Ruckus Wireless™ virtual SmartZone Data Plane (vSZ-D)

vSZ-D Configuration Guide for SmartZone 3.5

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Contents

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About this Guide

This *Configuration Guide* describes the features and configuration required for setting up the Ruckus Wireless Virtual SmartZone Data Plane (vSZ-D) on the network.

This guide is written for service operators and system administrators who are responsible for managing, configuring, and troubleshooting Ruckus Wireless devices. Consequently, it assumes a basic working knowledge of local area networks, wireless networking, and wireless devices.

NOTE: If release notes are shipped with your product and the information there differs from the information in this guide, follow the instructions in the release notes.

Most user guides and release notes are available in Adobe Acrobat Reader Portable Document Format (PDF) or HTML on the Ruckus Wireless Support Web site at https://support.ruckuswireless.com/contact-us.

Document Conventions

Table 1: Text conventions on page 6 and Table 2: Notice conventions on page 6 list the text and notice conventions that are used throughout this guide.

Table 1: Text conventions

Convention	Description	Example
`message phrase`	Represents information as it appears on screen	`[Device Name] >`
`user input`	Represents information that you enter	`[Device Name] > set ipaddr 10.0.0.12`
user interface controls	Keyboard keys, software buttons, and field names	Click **Start** > **All Programs**
screen or page names		Click **Advanced Settings**. The **Advanced Settings** page appears.

Table 2: Notice conventions

Notice type	Description
NOTE:	Information that describes important features or instructions
CAUTION:	Information that alerts you to potential loss of data or potential damage to an application, system, or device

Notice type	Description
WARNING:	Information that alerts you to potential personal injury

Related Documentation

For a complete list of documents that accompany this release, refer to the Release Notes.

Online Training Resources

To access a variety of online Ruckus Wireless training modules, including free introductory courses to wireless networking essentials, site surveys, and Ruckus Wireless products, visit the Ruckus Wireless Training Portal at:

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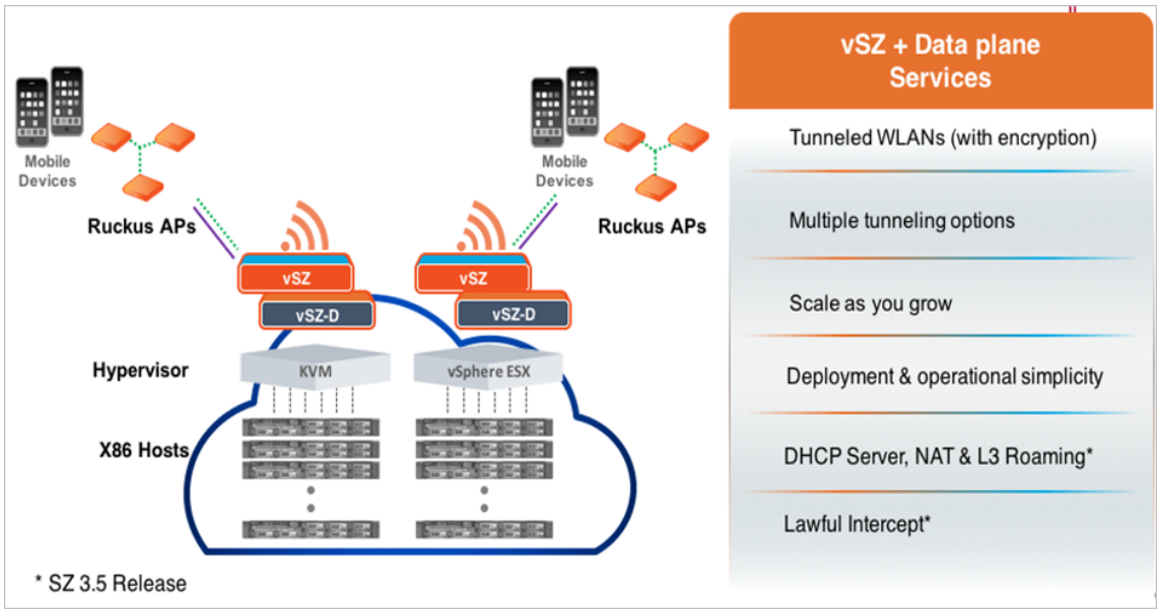
- Document part number (on the cover page)
- Page number (if appropriate)

Virtual SmartZone Data Plane Overview 1

The Ruckus Wireless 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, the Virtual SmartZone platform launched sophisticated data plane capabilities in a virtualized form factor. This is truly differentiated and distinguished offering that provides compelling business benefits for varied deployment scenarios.

Figure 1: vSZ-D services



Features and Benefits

2

In this chapter:

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

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

Figure 2: Use cases

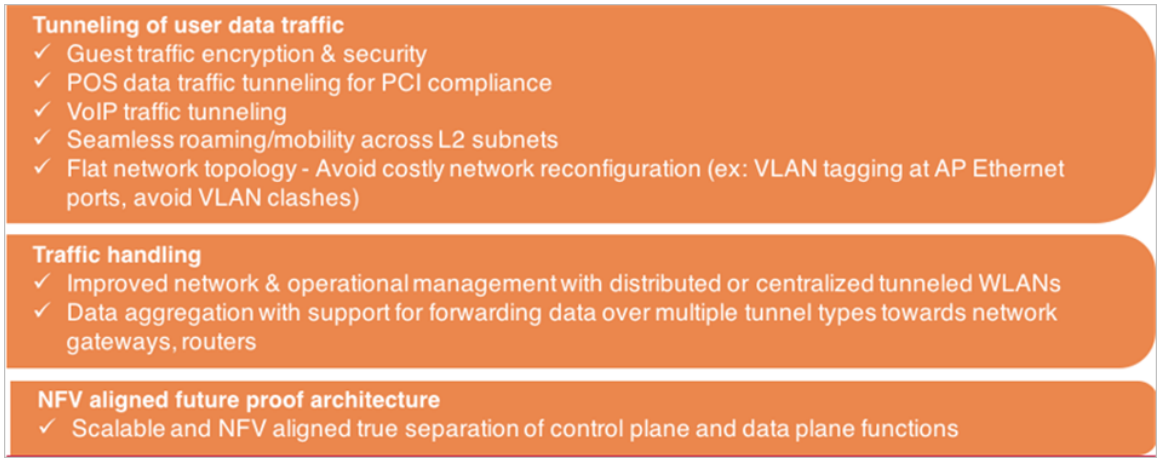


Table 3: Feature and Benefits

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
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

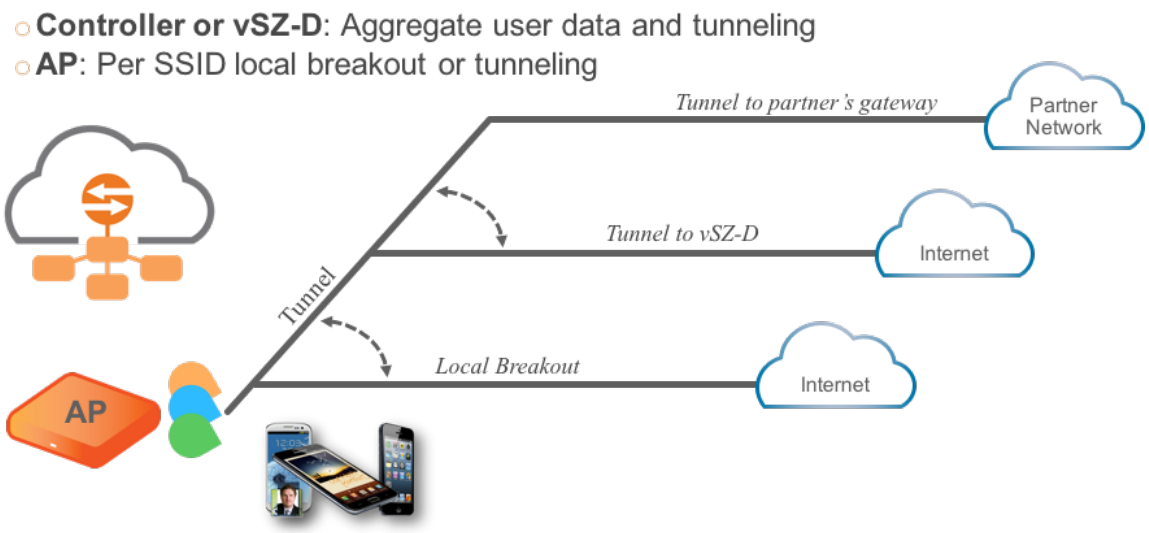
Feature	Benefit
Seamless integration with vSZ controller	• Simple integration and management with vSZ controller clustering architecture enables support for multiple vSZ-D instances • 10 vSZ-D instances per vSZ instance • 40 vSZ-D instances per vSZ cluster of 4 instances • The controller runs in Active/Active (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 Zone Affinity enabled, it is possible to support a distributed vSZ-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.
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, it is now possible to support tunneled WLANs on Ruckus Wireless APs that are managed by a vSZ controller. In addition, both the Ruckus Wireless AP and the vSZ-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.

Figure 3: Traffic redirection flexibility with the Virtual SmartZone platform

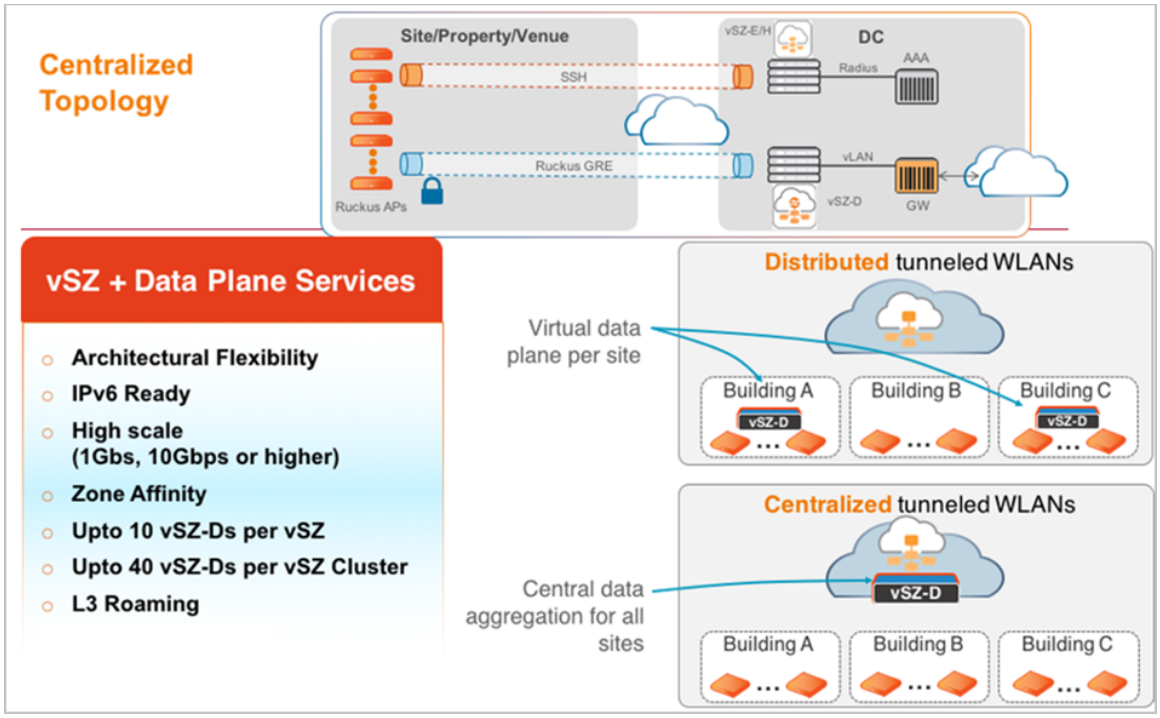


Architecture and Deployment Flexibility

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, 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 supports IPv6 addresses for the data and control/management plane interfaces. The vSZ-D also supports client IPv6 addressess for DHCP Relay only.

NOTE: vSZ-D does not support IPv6 addresses for northbound soft-GRE tunnels.

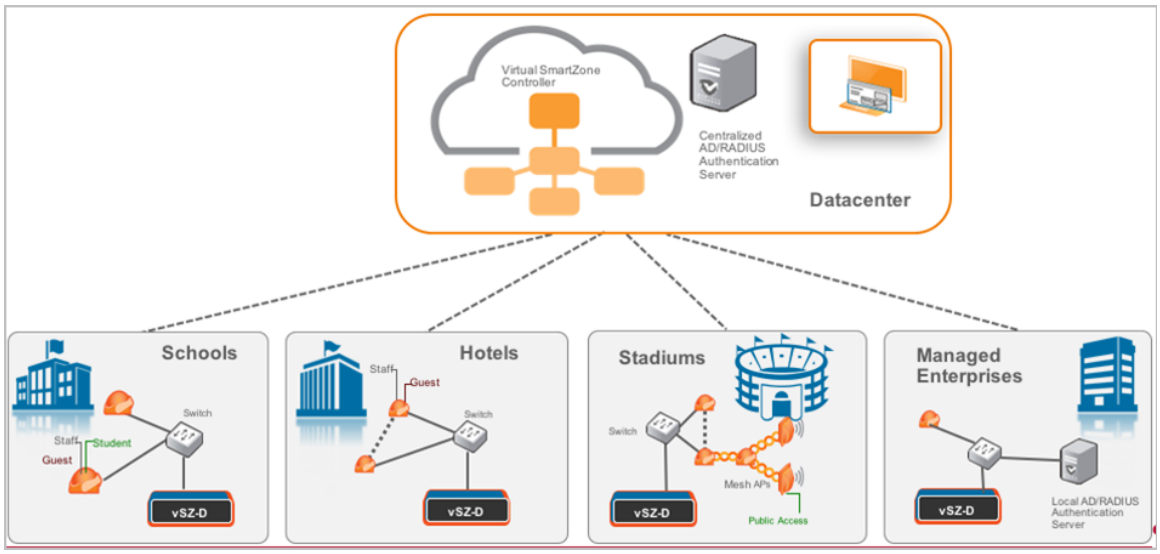
vSZ-D Zone Affinity

vSZ-D Zone Affinity is a new feature introduced in this release. It is now possible to dedicate vSZ-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 and bind those vSZ-Ds to that particular site so that all APs on that site shall tunnel traffic locally to the vSZ-D on that site.

Figure 5: vSZ-D Zone Affinity



DHCP Server and NAT Service on the vSZ-D

3.5 Release introduces a highly scalable and optimized DHCP Server on the vSZ-D that 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 only with CLI in 3.5 release.

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 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.

NAT Service

With NAT service enabled, all the WiFi client traffic is NATed by the vSZ-D before being forwarded to the core network. Each vSZ-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.

NOTE: Only single subnet is supported in 3.5 release.

L3 Roaming

Ruckus vSZ and vSZ-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.

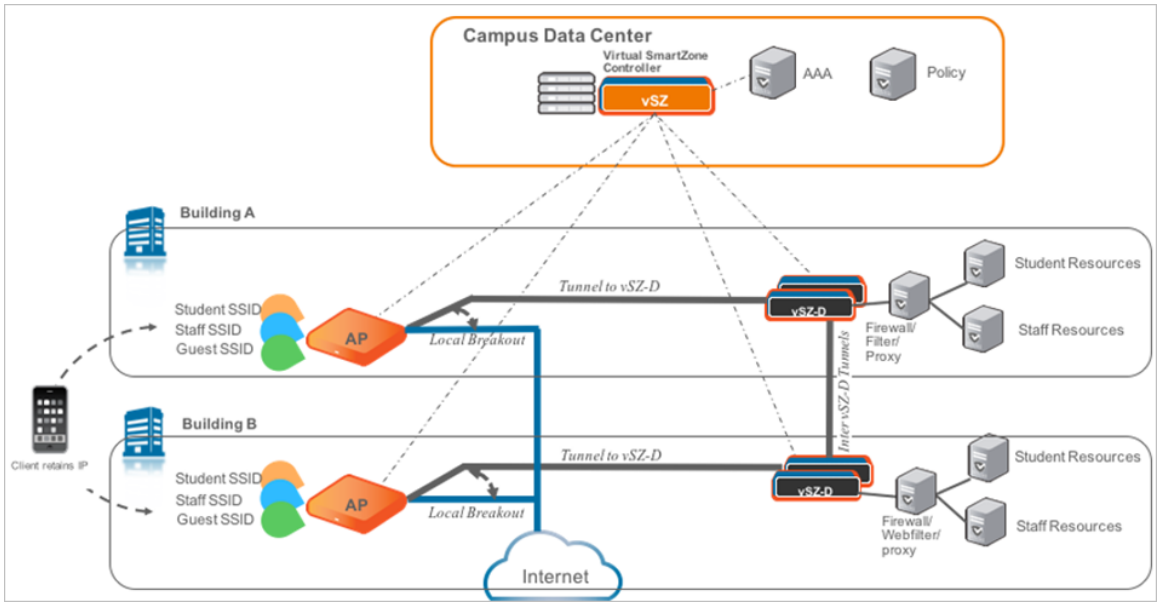
With the 3.5 release and on the vSZ-D, Ruckus Wi-Fi can now support L3 Roaming with IP Address preservation. Below is the high level use case that describes the feature functions. A large network that is broken up into various campuses and there is a need to support L3 Roaming. Below figure depicts 2 campuses, which are L2 separated but need L3 Roaming.

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

Each vSZ-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 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 or anchor vSZ-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).

Figure 6: Usage of L3 roaming



Lawful Intercept

An important carrier class feature that is being introduced on the vSZ-D with the 3.5 release 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.

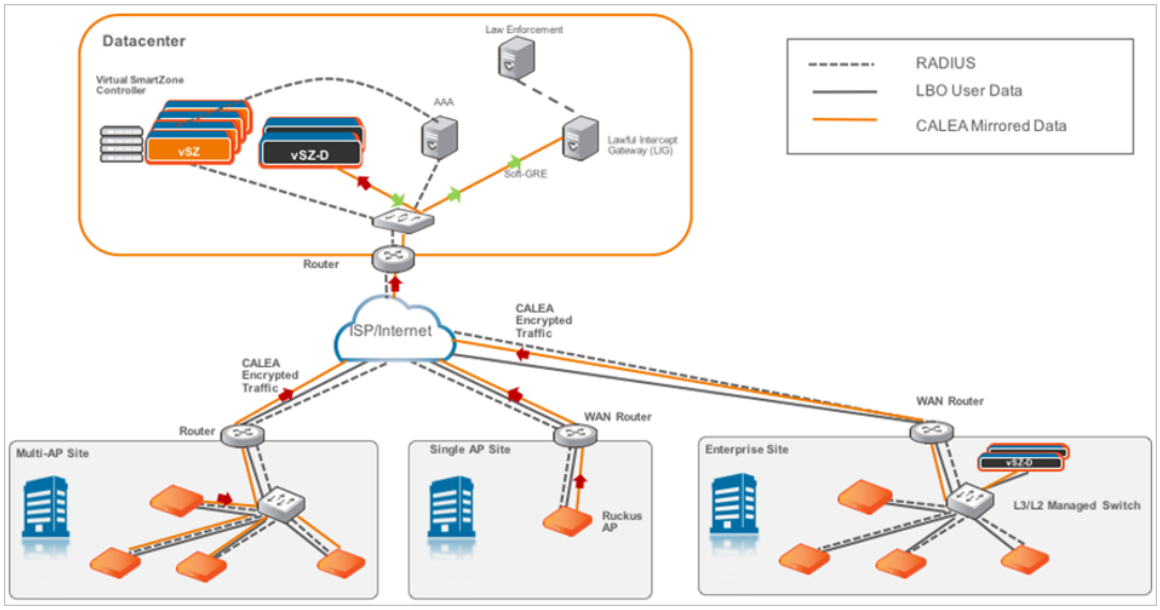
Ruckus vSZ-D now supports the ability to identify a device that has a LI warrant issued against it and mirror the client data traffic to a LIG (Lawful Intercept Gateway) that is hosted in the SP's data center over L2oGRE.

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 (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 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 only on premises where there is a need (typically larger venues) for tunneling.

The Ruckus architecture simply involves spinning up a vSZ-D instance at the central data center and designate that vSZ-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) 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 7: Usage of Lawful Intercept

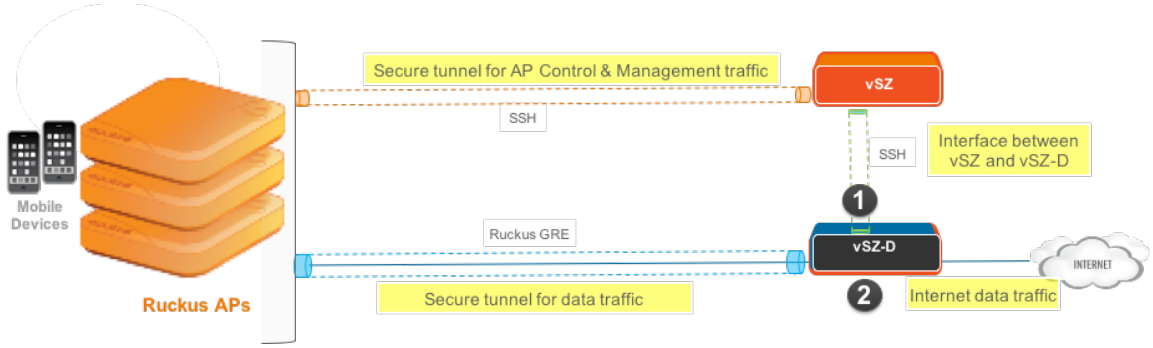


Network Architecture 3

vSZ-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 8: 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.

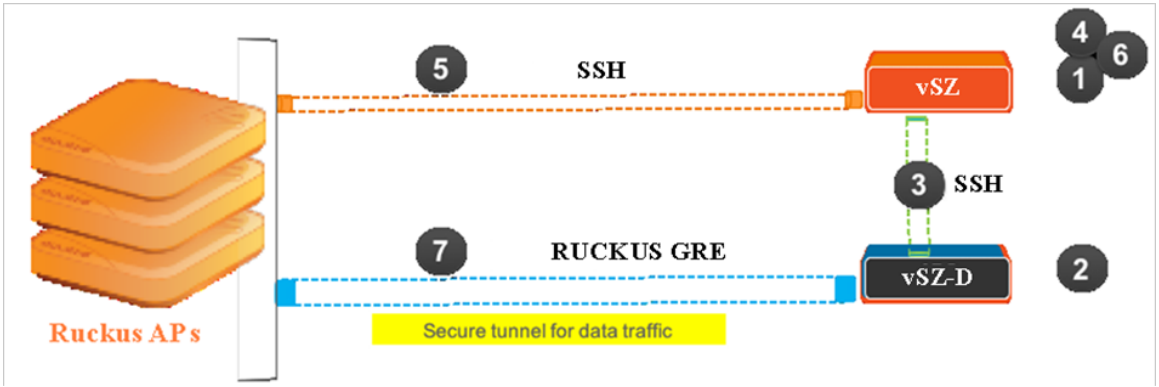
1. AP to and from vSZ-D: Data plane, secured by Ruckus GRE tunnel.
2. vSZ to and from vSZ-D: Control plane, for vSZ to manage vSZ-D
3. AP to and from vSZ: Control plane, for vSZ to manage the AP

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

Communication Workflow 4

The figure below captures a high level end-to-end communication flow between Ruckus Wireless APs, vSZ and vSZ-D.

Figure 9: Communication workflow between Ruckus Wireless APs, vSZ, and vSZ-D



The following are the steps seen in the above figure.

1. Update the vSZ controller to the latest 3.x 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, Ruckus Wireless recommends the update of vSZ controller before the update of vSZ-D

2. Install vSZ-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 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 connection request
5. The vSZ informs the AP of the vSZ-D data interface
6. The vSZ-D is displayed as active and managed on vSZ-E or vSZ-H
7. AP establishes a Ruckus GRE tunnel with the vSZ-D data interface when a tunnelling WLAN is configured

Figure 9: Communication workflow between Ruckus Wireless APs, vSZ, and vSZ-D on page 17 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 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 Wireless APs, vSZ and vSZ-D are designed to support NAT traversal so as to support such deployment topologies.

NAT Deployment Topologies 5

vSZ-D supports several deployment topologies.

AP Behind NAT and vSZ-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 in the public world through NAT. The AP obtains its private IP address and communicate with the vSZ-D through NAT. During communication with vSZ-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. vSZ-D, in this case, is insensitive to the NAT router's operation. When the packet comes back from vSZ-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 is behind NAT, it is assumed that vSZ-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 "setup" process. vSZ picks up this public address and the associated port number and informs the AP that this is the vSZ-D address/port (public-IP, port) pair to connect to.

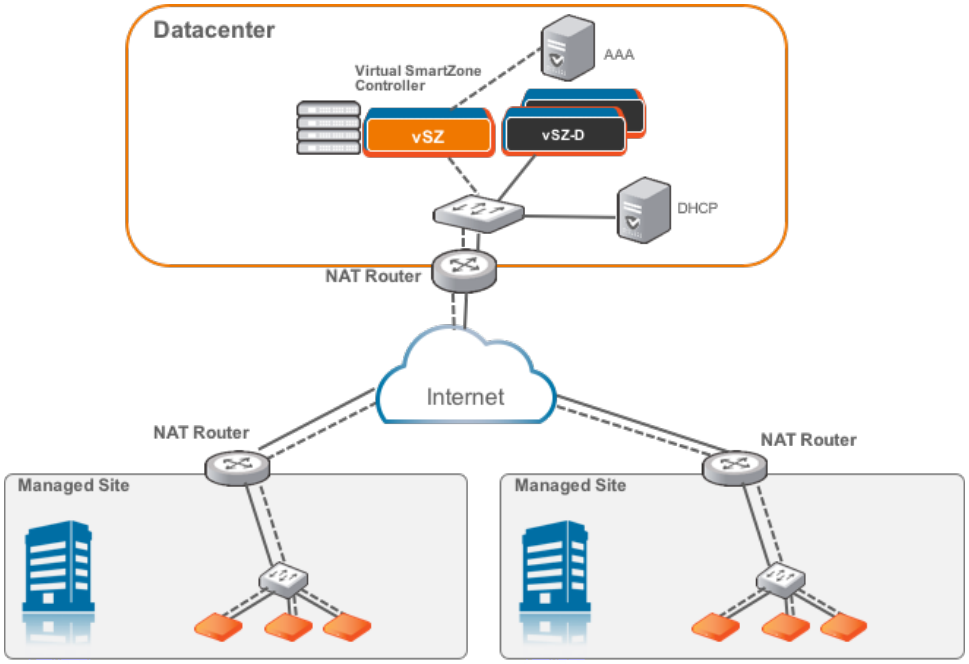
It is also needed to configure the NAT device and enter the port mapping, basically, (public-IP, port) <-> (private-IP, 23233) into NAT's rule table. Thus, when NAT receives the packet bound for vSZ-D (sent to public-IP/port) from the AP, it will translate it to (private-IP, 23233) based on the rule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

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

Figure 10: vSZ and vSZ-D at data center behind NAT



vSZ-D at Access Side with NAT

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

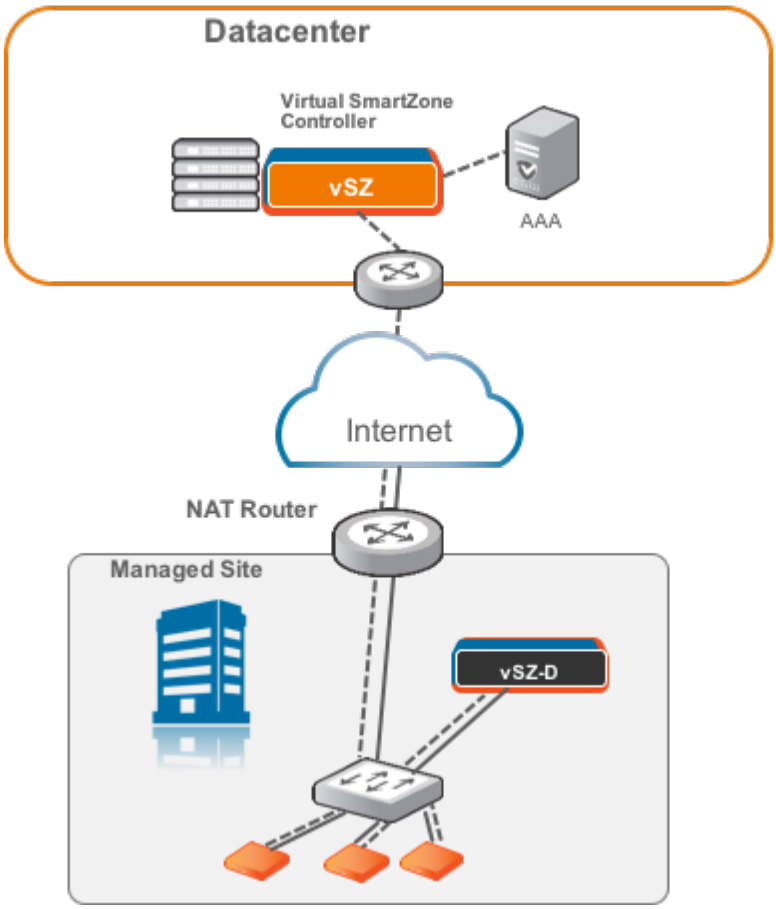
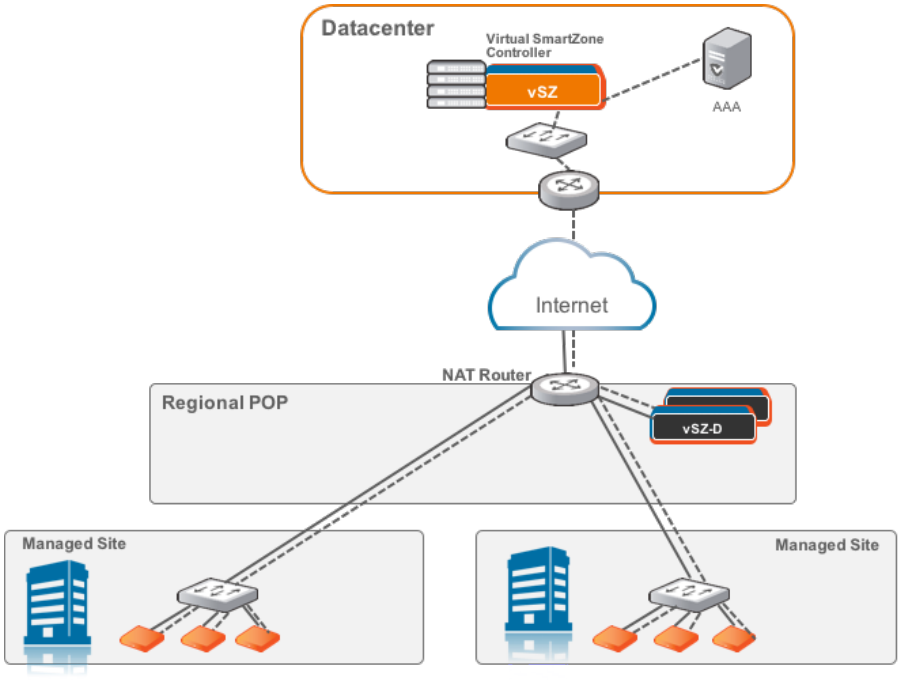


Figure 11: vSZ-D at access side with a NAT router

vSZ-D Behind NAT

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

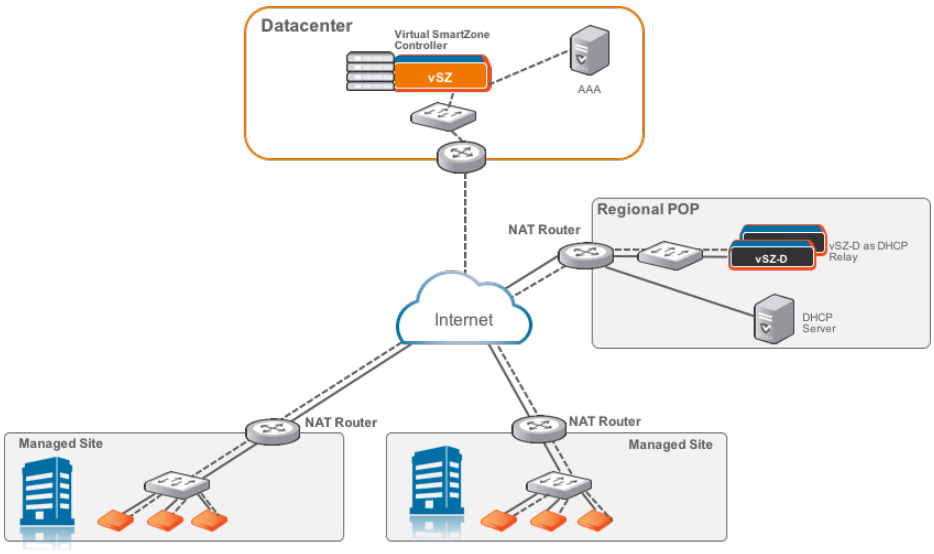
Figure 12: vSZ-D behind a NAT router



DHCP Relay with NAT

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

Figure 13: DHCP relay with a NAT router

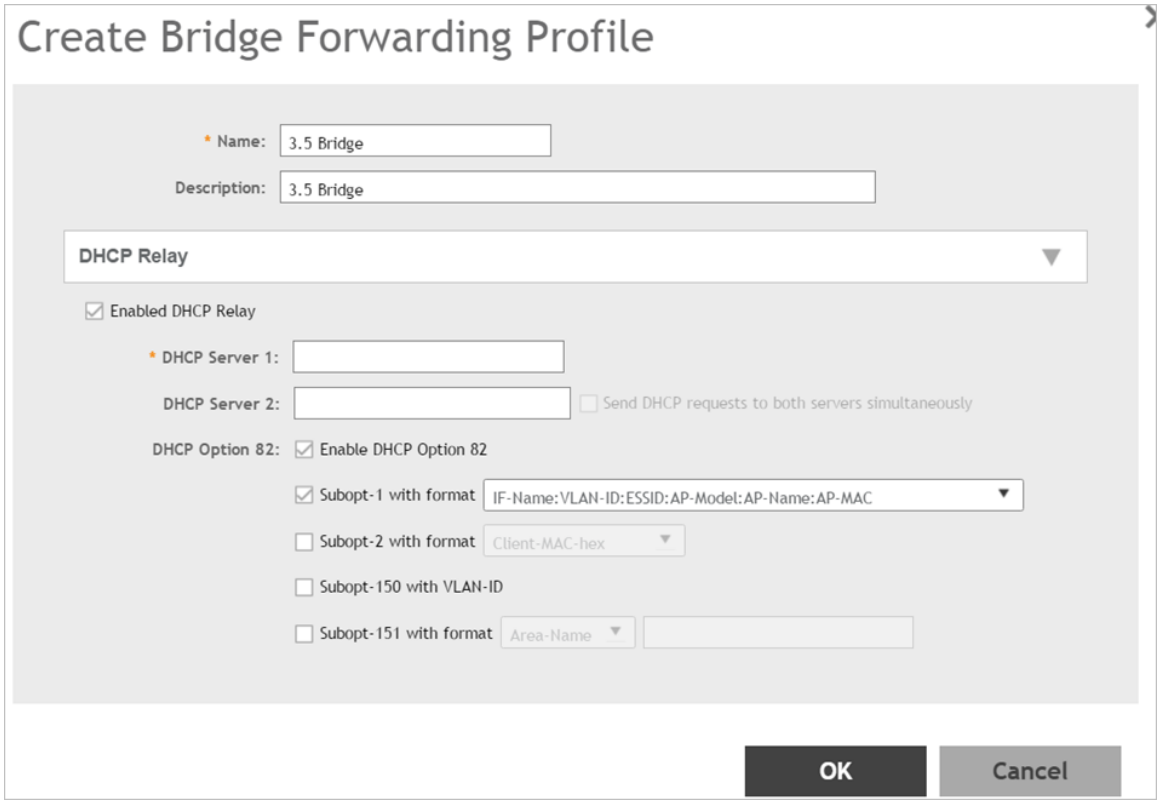


DHCP Option 82 and Bridge Profile

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. 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*.

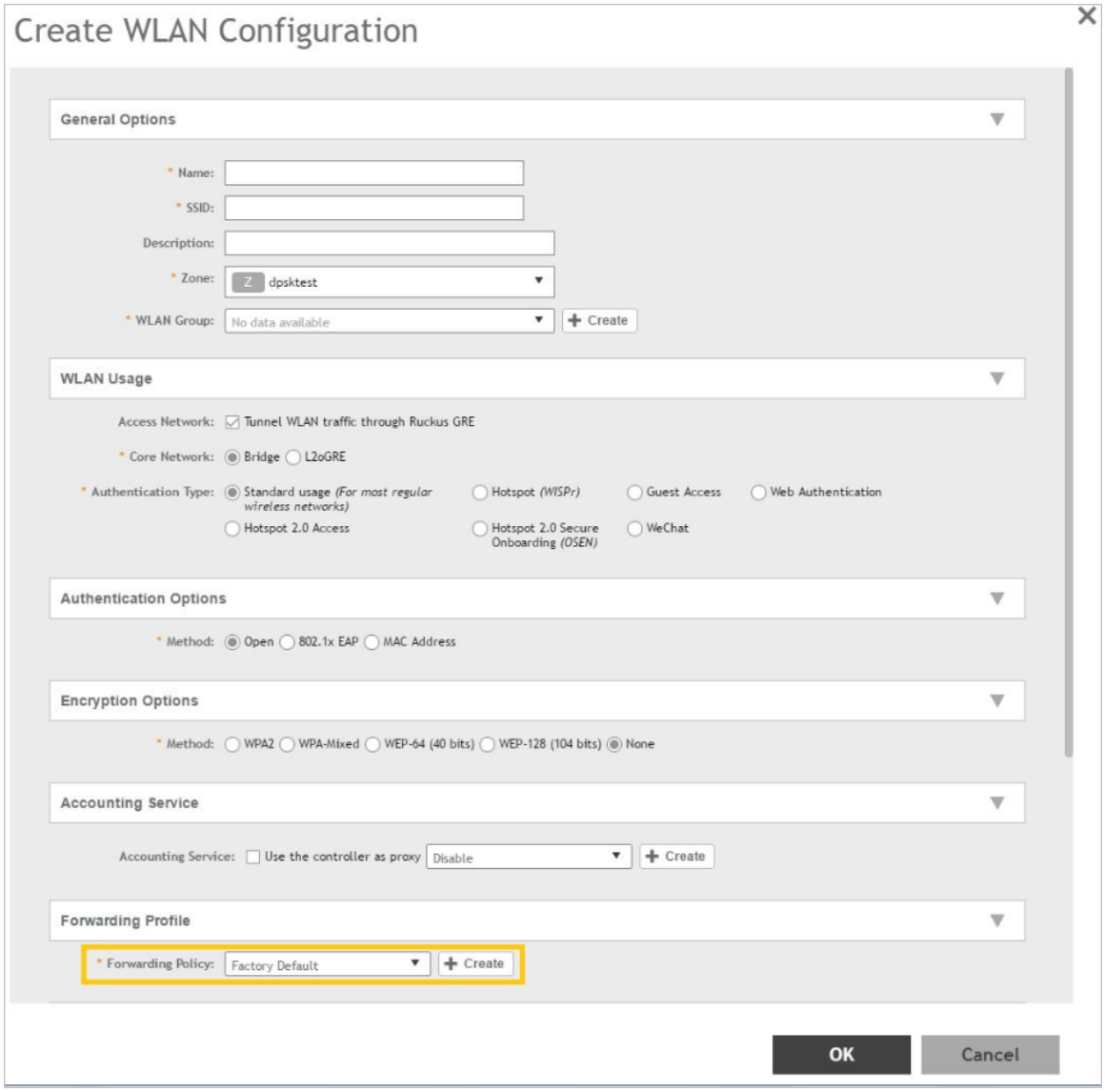
- Go to **vSZ controller web interface** > **Services & Profiles** > **Core Network Tunnel**
- Click on **Create** to add a **Bridge Forwarding Profile**
- Verify if the **DHCP Relay** is enabled.
- Add the **DHCP server** IP address
- Enable **DHCP Option 82** and choose the sub options based on your requirement or of the user. This will be taken care by vSZ-D during DHCP packet relay to the DHCP server.

Figure 14: Creating Bridge Profile



- Go to **vSZ controller web interface** > **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 15: Creating a WLAN Configuration


Create WLAN Configuration
General Options
* Name:
* SSID:
Description:
* Zone:
dpsktest
* WLAN Group:
No data available
Create
WLAN Usage
Access Network:
Tunnel WLAN traffic through Ruckus GRE
* Core Network:
Bridge
L2oGRE
* Authentication Type:
Standard usage (For most regular wireless networks)
Hotspot (WISPr)
Guest Access
Web Authentication
Hotspot 2.0 Access
Hotspot 2.0 Secure Onboarding (OSEN)
WeChat
Authentication Options
* Method:
Open
802.1x EAP
MAC Address
Encryption Options
* Method:
WPA2
WPA-Mixed
WEP-64 (40 bits)
WEP-128 (104 bits)
None
Accounting Service
Accounting Service:
Use the controller as proxy
Disable
Create
Forwarding Profile
* Forwarding Policy:
Factory Default
Create
OK
Cancel

System Requirements 6

In this chapter:

Hardware Requirements

vSZ-D supports auto scaling, which means the number of CPU cores can be expanded without needing a software update. Ruckus Wireless has tested from three to six CPU core allocations for the vSZ-D in release 3.2 and above.

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 5.5 and later OR KVM (CentOS 7.0 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 and service chaining
Memory	Minimum 6 Gb memory per instance
Disk space	10GB per instance
Ethernet interfaces	2

Hardware Component	Requirement
NICs that support Intel DPDK requiredby Data Interface	• Intel NICs iab, ixabe • 82576, I350 • 82599EB, 82599, X520

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 Wireless 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	10 Gbps	Tunnels are load-balanced

Number of vSZ Instances	Number of vSZ-D Instances	Number of Ruckus APs	Number of Tunnels on vSZ-D	Maximum Throughput (Unencrypted)	Notes
			case of failover)		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-D instance can handle 10K maximim 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

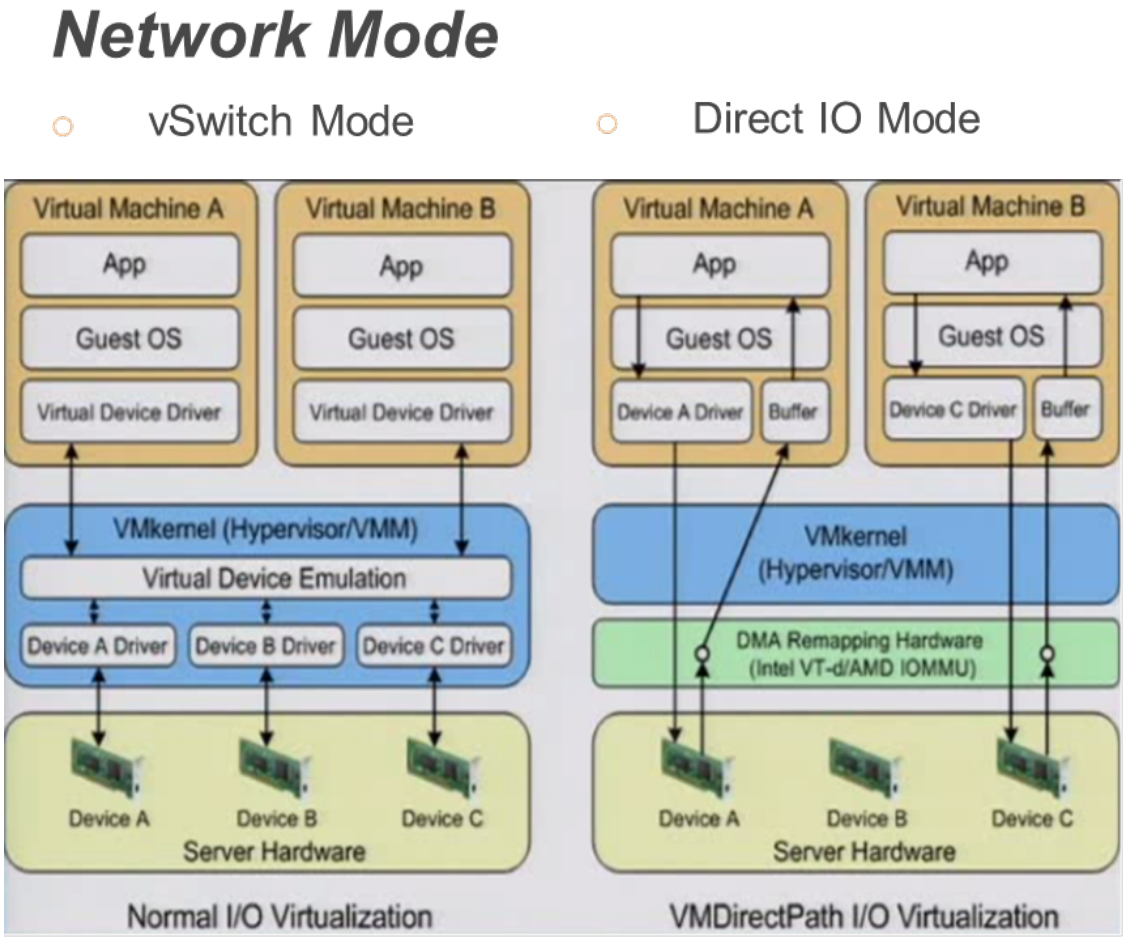
Number of vSZ Instances	Number of vSZ-D Instances	Number of Ruckus APs	Number of Tunnels on vSZ-D	Maximum Throughput (Unencrypted)	Notes
					maximim tunnels.
4	8	30000	3750 (10K maximum)	10 Gbps	Tunnels are load-balanced towards the vSZ-D by the vSZ. Each vSZ-D instance can handle 10K maximim tunnels.

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 vSZ-D Performance Recommendations on page 49 chapter for encryption and vSwitch impacts.

NOTE: * vDP 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



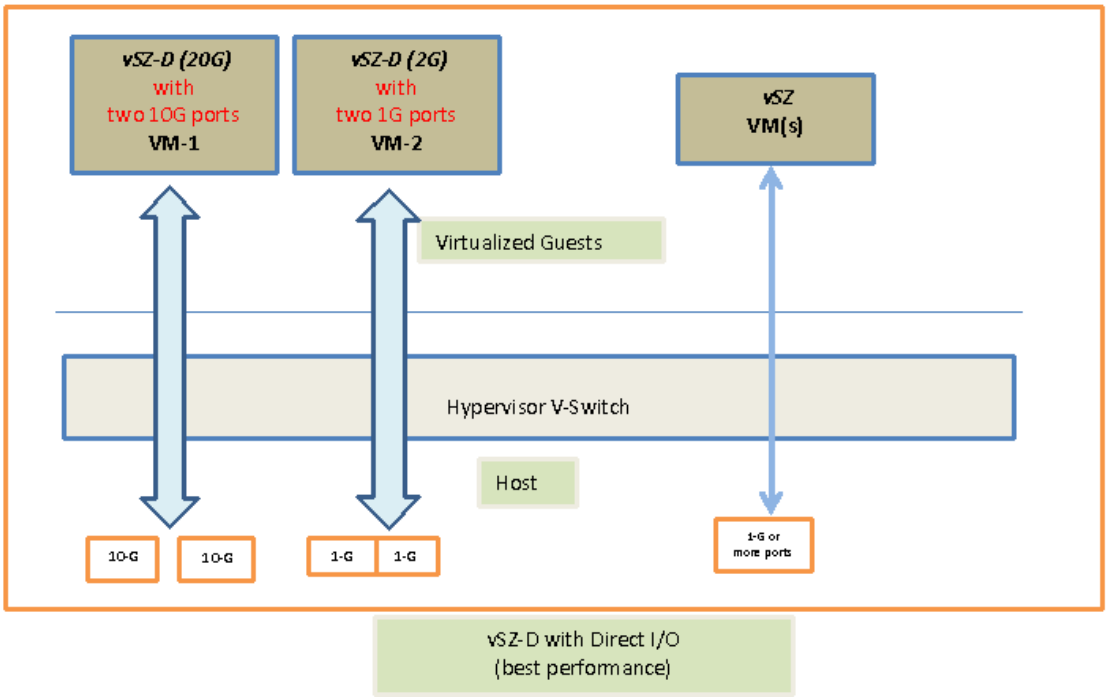
The figure below depicts a sample configuration in DirectIO mode. This is the recommended deployment model for the vSZ-D for best performance benefits. In this setup, cores as well as the NICs are dedicated to the vSZ-D VM only for best performance.

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.

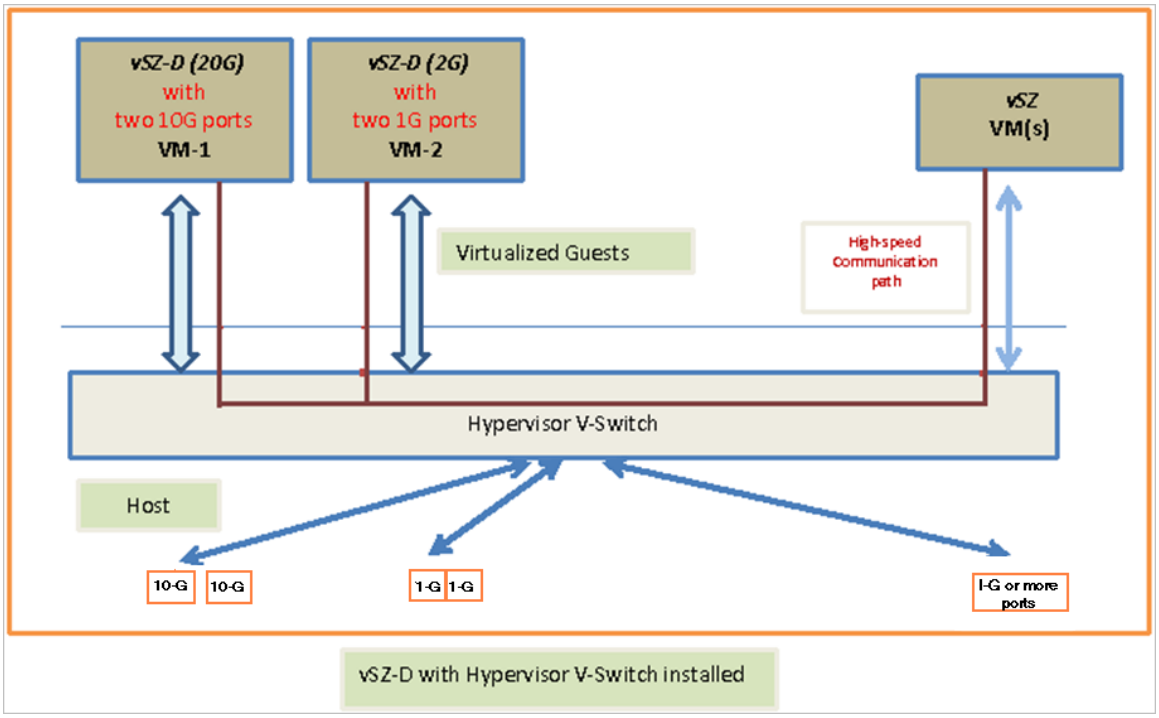
It also depicts a vSZ controller instance running as a separate VM. These VMs can be running on the same underlying host or potentially different hosts.



vSZ-D with Hypervisor vSwitch Installed

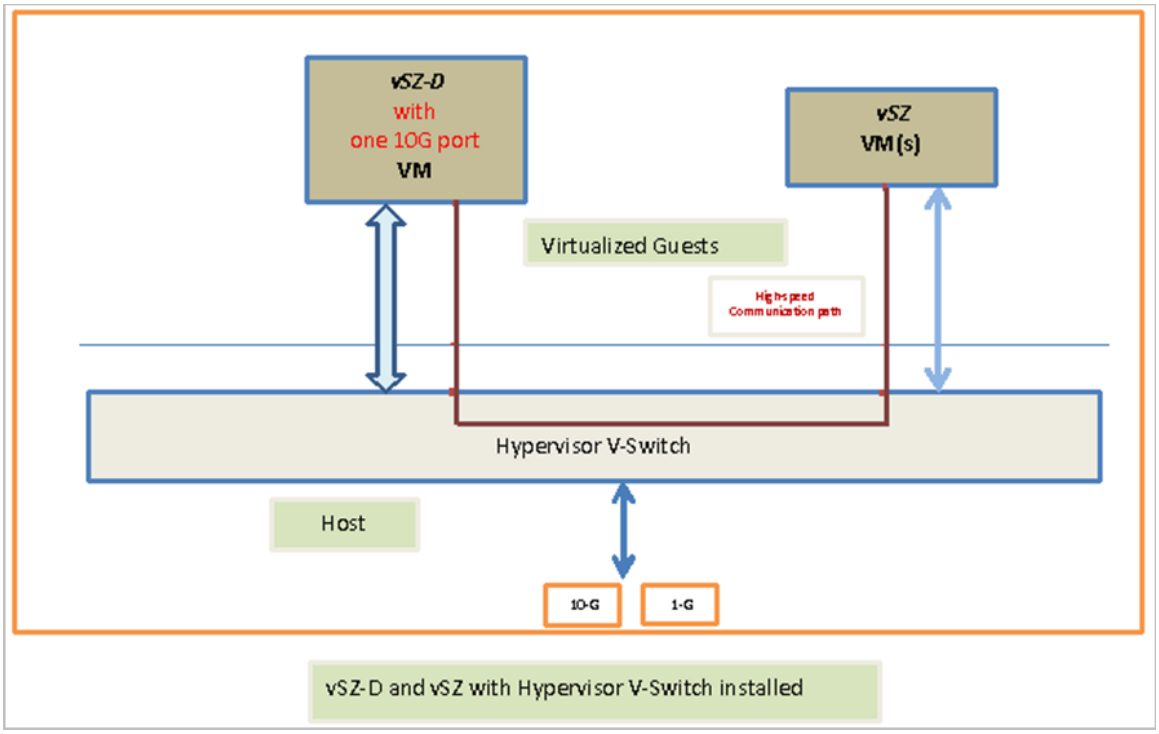
The figure below depicts a sample setup via the vSwitch.

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 Wireless. 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		82574
Data	Direct IO	1GB	igb	I350
				82576
				Intel 82571EB
				Broadcom BCM5720
		10GB	ixgbe	82599EB
				82598
				X540 (T1 and T2, for RJ-45 twist-pair)
				X520
	vSwitch	VMware	VMXNET3	--
		KVM	Virtio	--

Hypervisor Configuration 7

In this chapter:

This section covers hypervisor-specific configurations that Ruckus Wireless 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 Wireless offers the following general configuration recommendations.

Table 9: General vSZ-D configuration recommendations

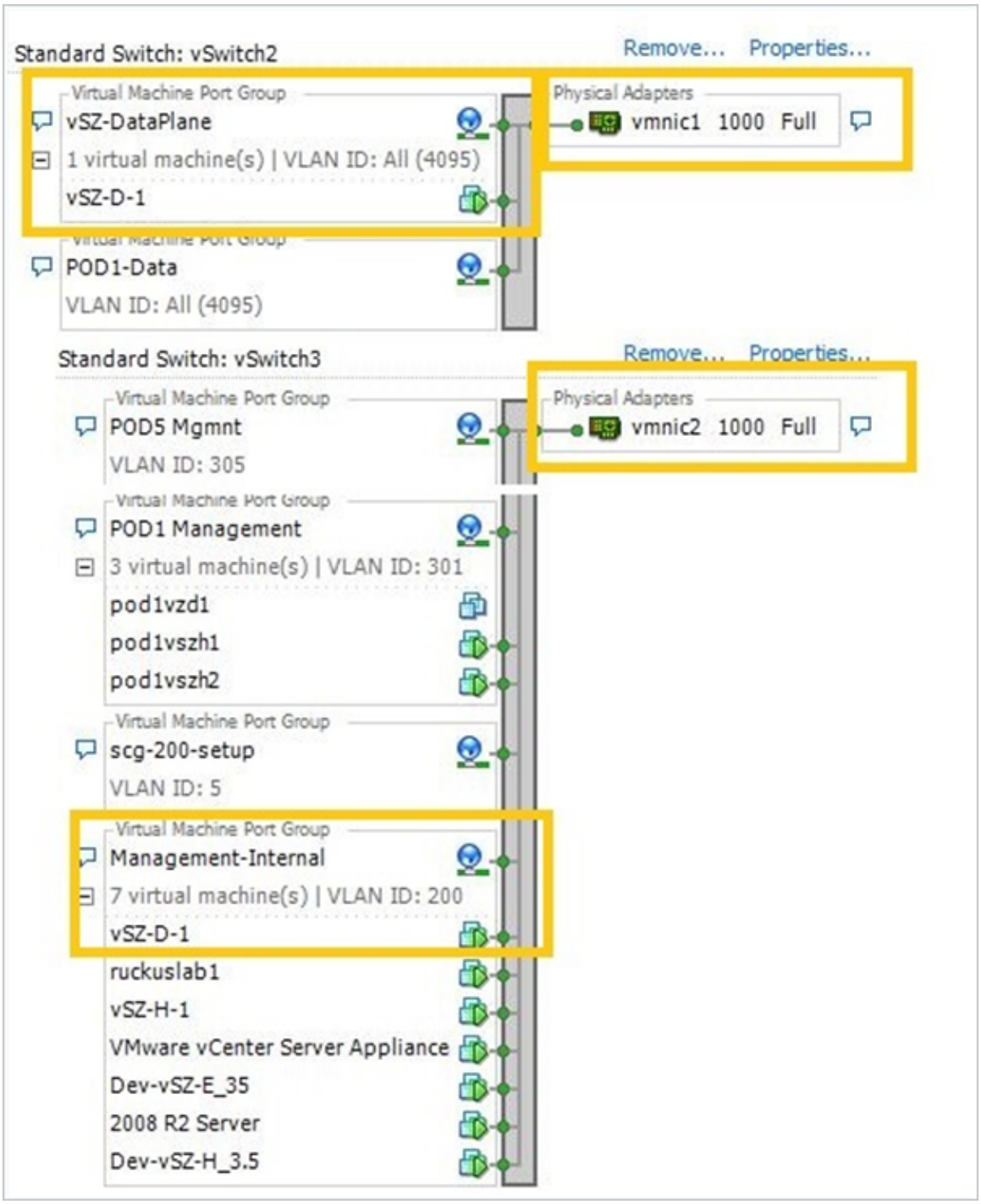
Component	Minimum Recommendation
Recommended reserved memory	Minimum 6144MB

Component	Minimum Recommendation
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**.

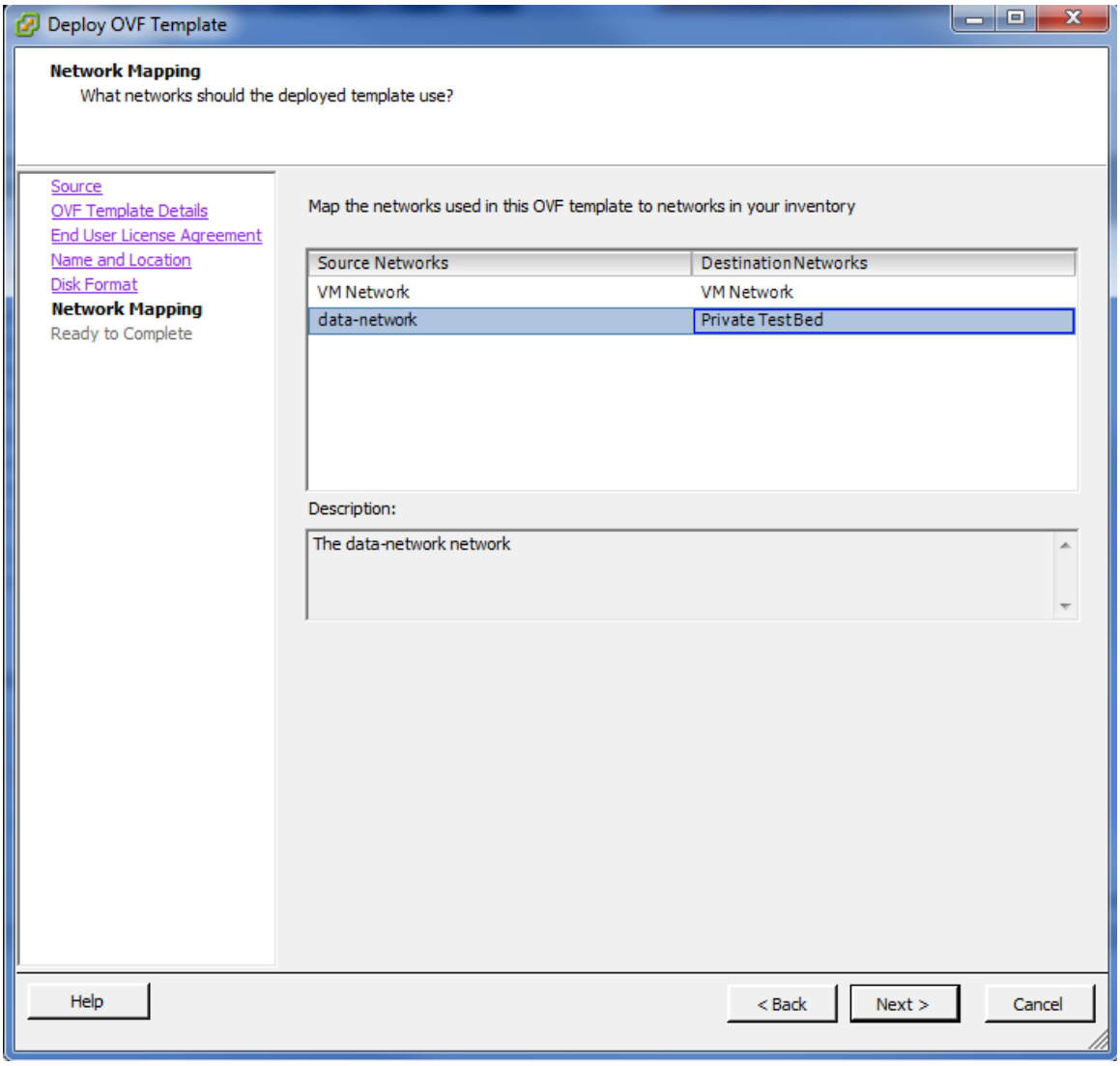
VMware Specific Configuration

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

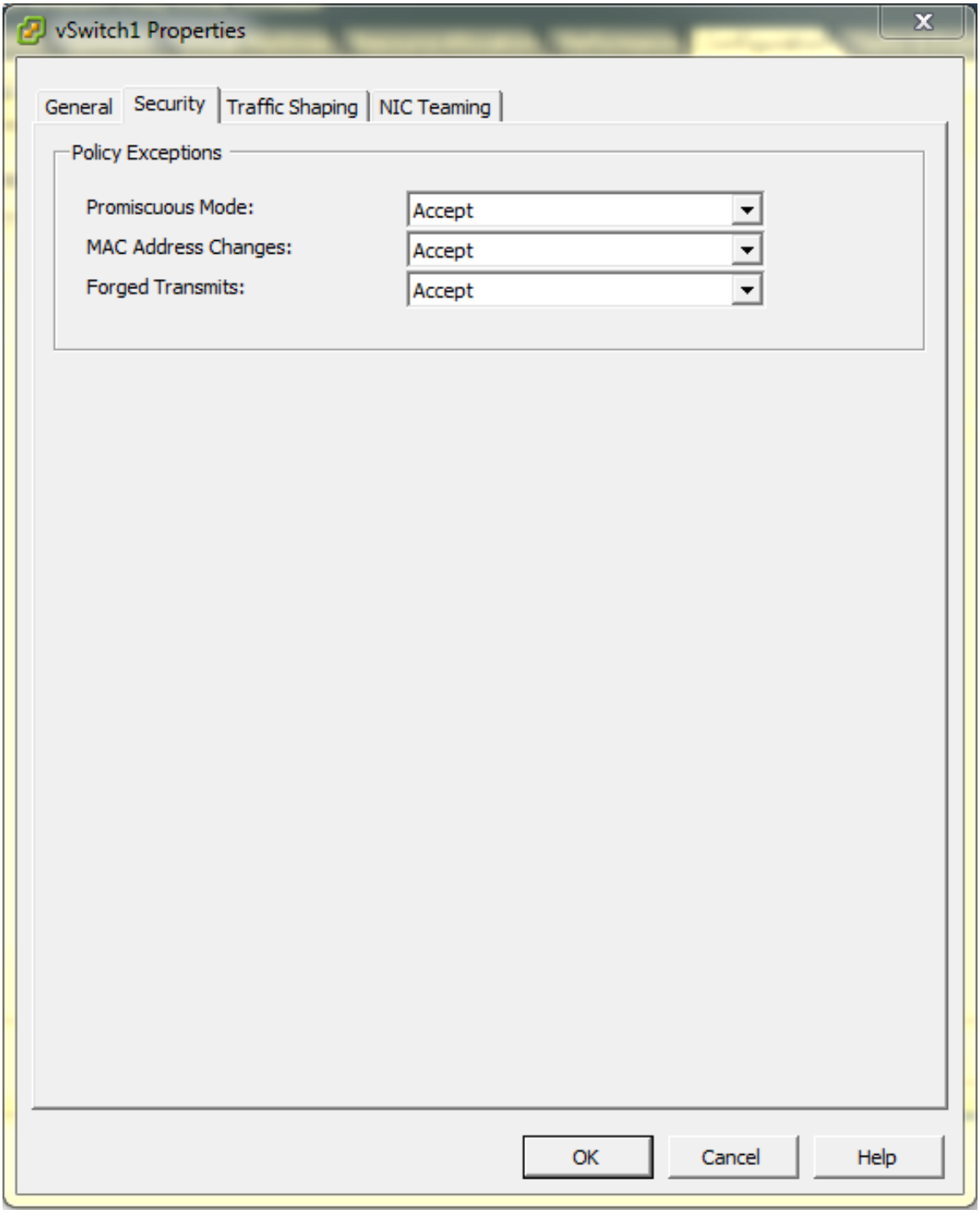
- Deploy vSZ-D on a machine that has at least two physical NICs. Alternatively, deploy to two vSwitch instances with dedicated physical NICs.



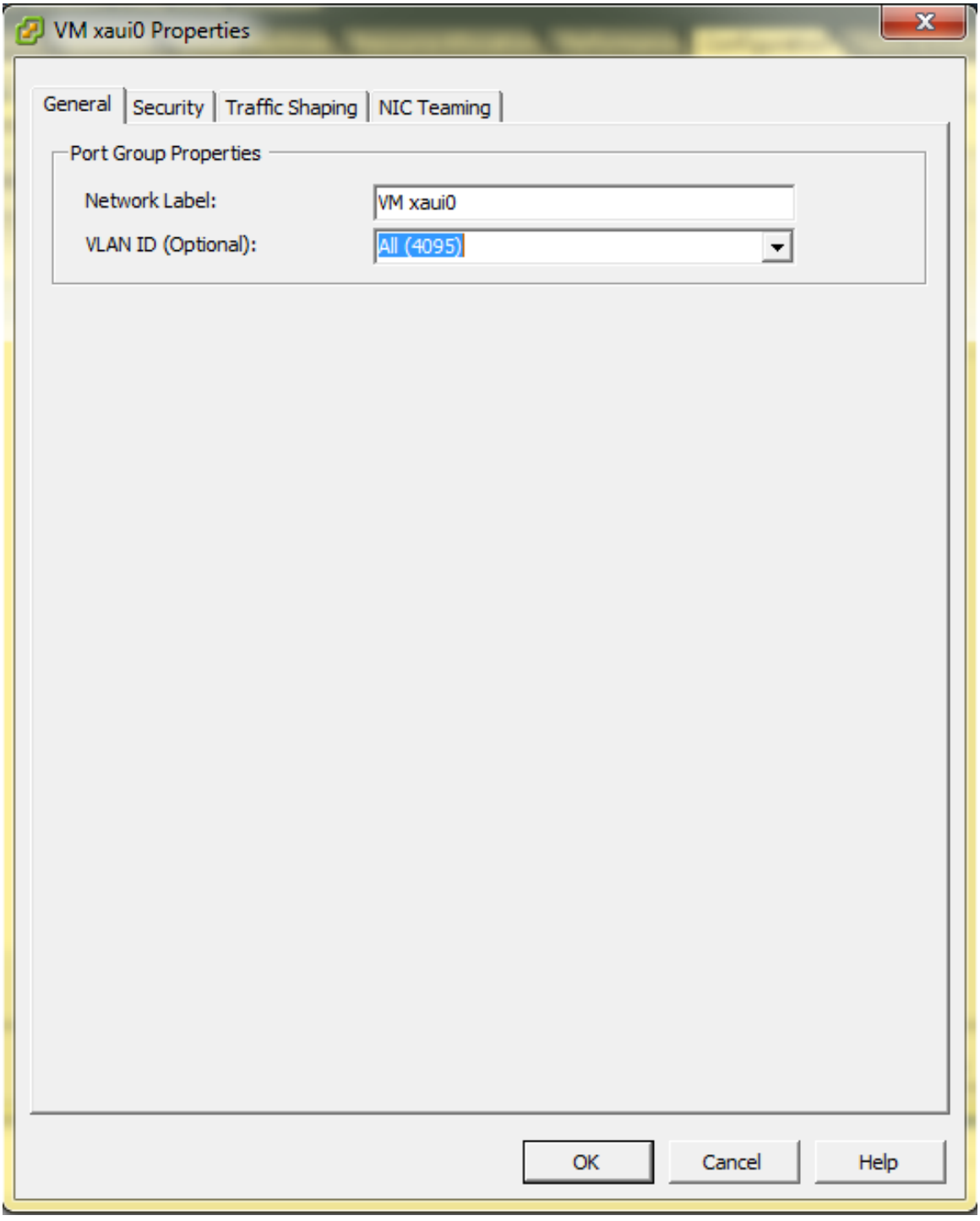
- When deploying an instance of vSZ-D using an OVA file, you must assign the management and data interfaces to two different network groups (vSwitch) on different subnets.



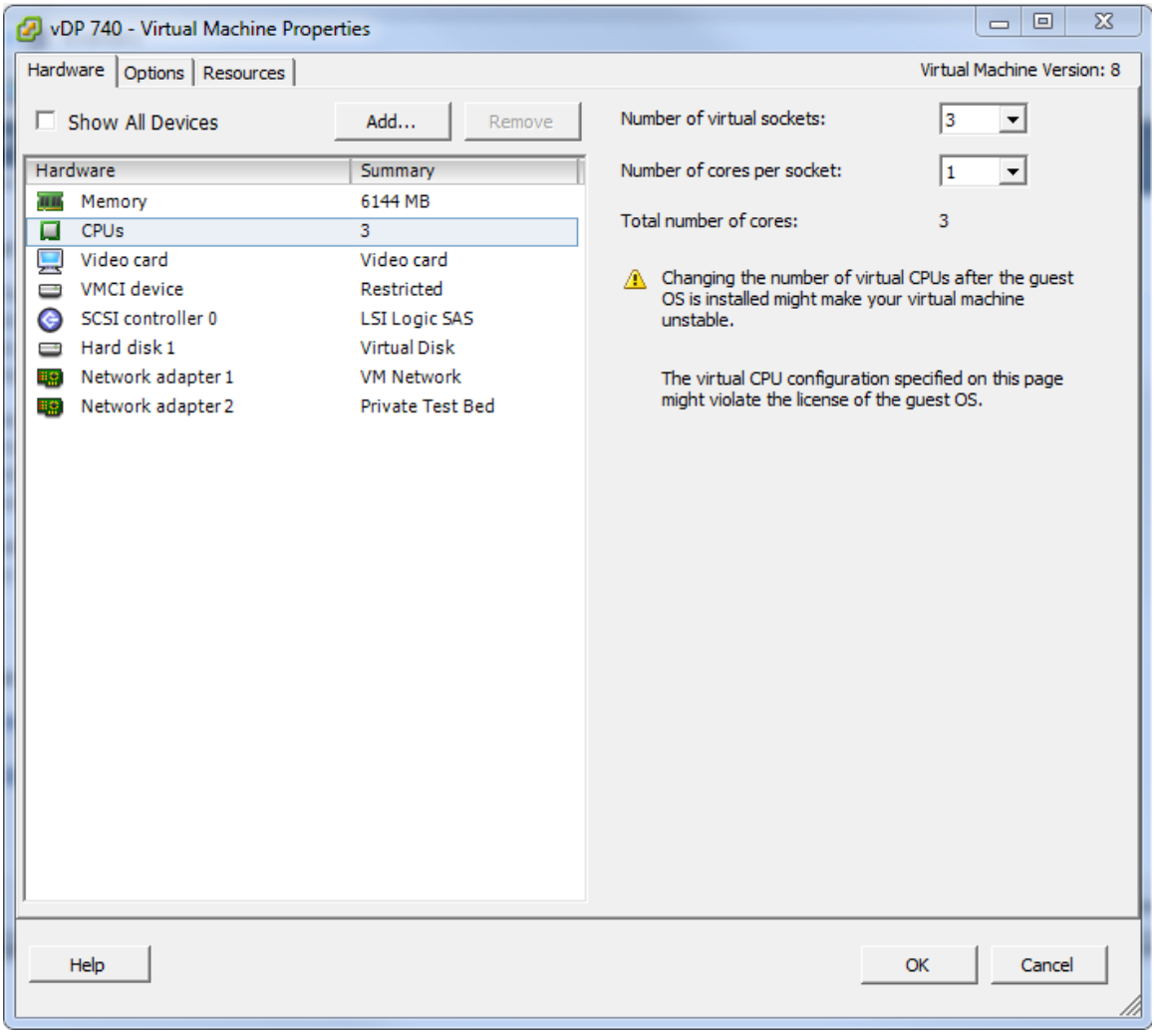
- Enable **Promiscuous** mode in vSwitch Config.



- 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.



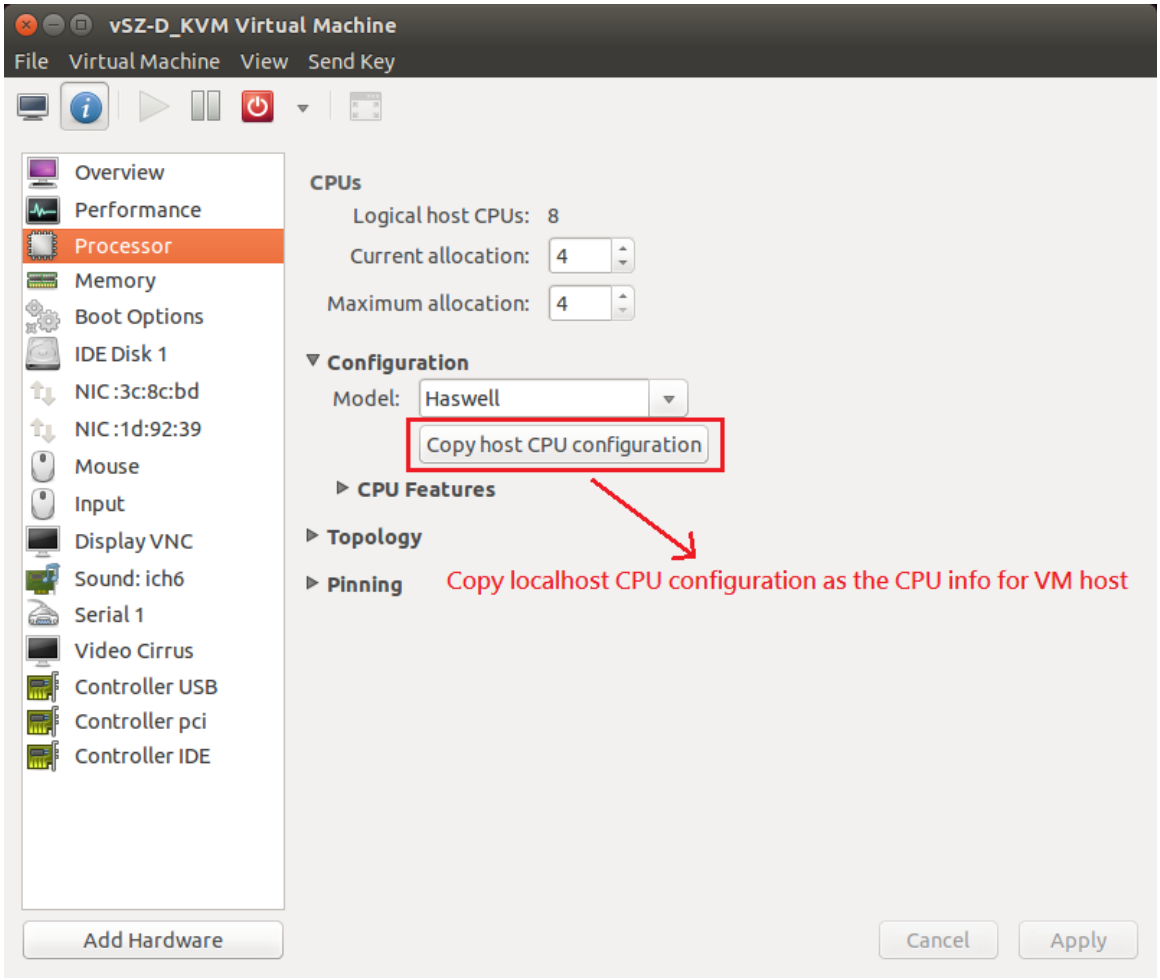
- For advanced CPU and memory resource configuration recommendations, refer to the *vSphere Resource Management Guide*, which is available on the VMware website.

KVM Specific Configuration

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

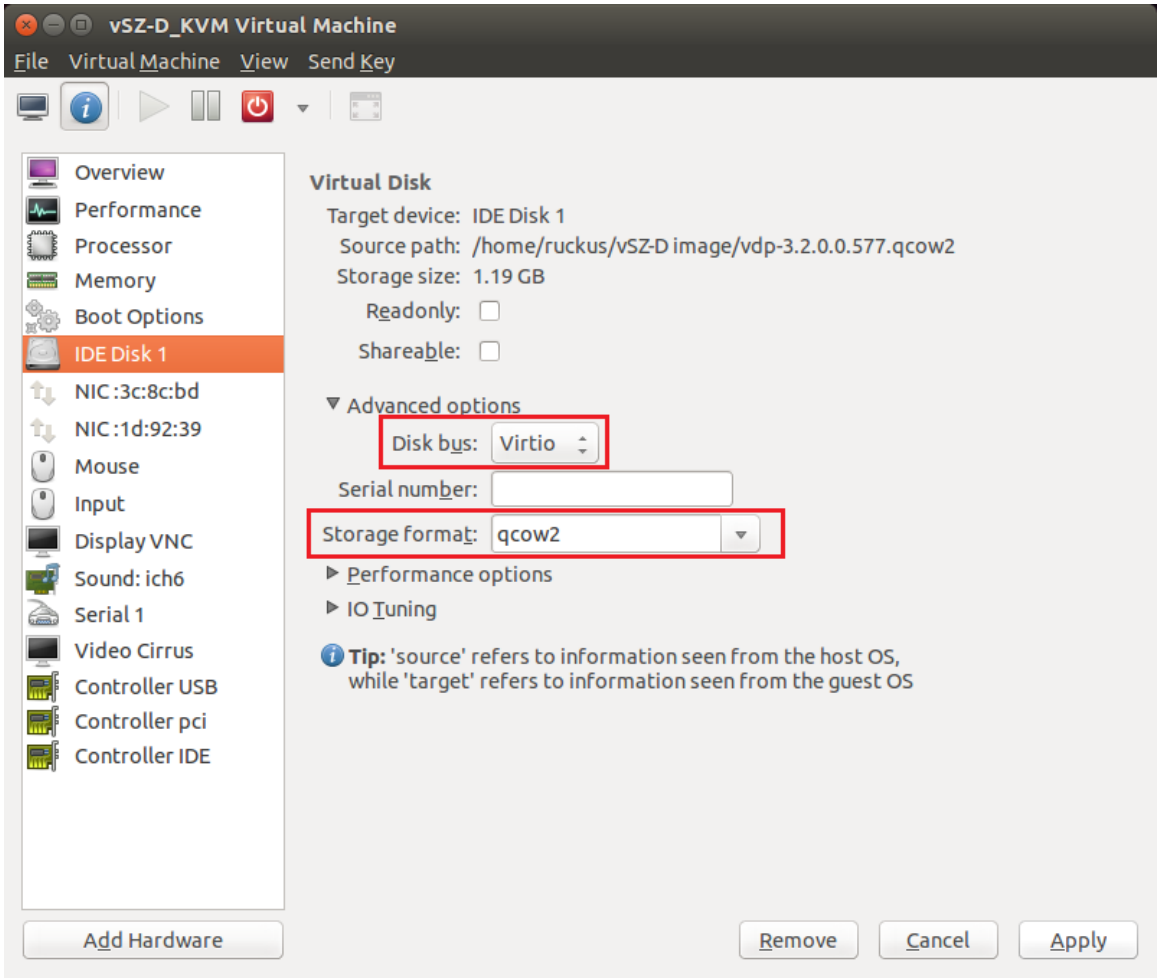
CPU Type

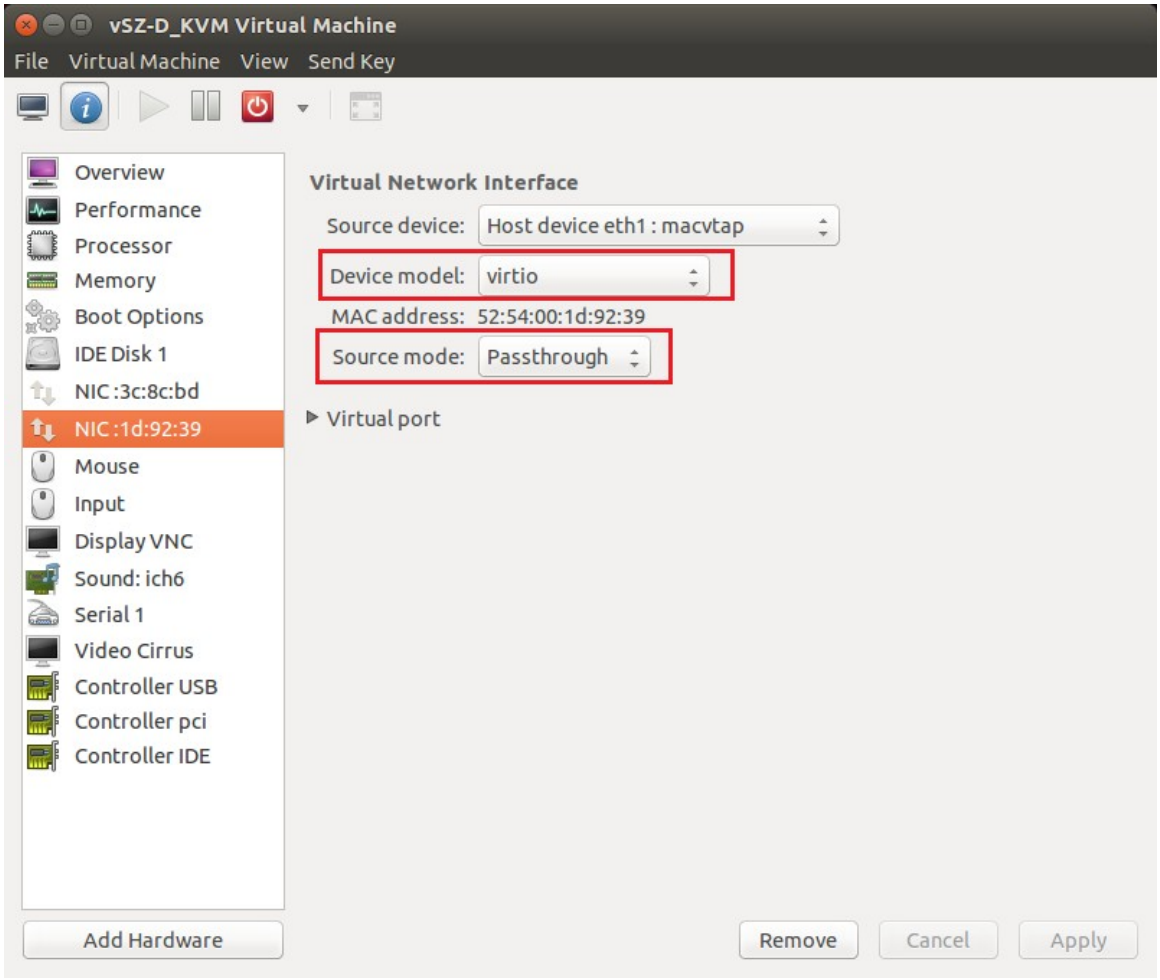
When selecting the CPU model, make sure you select one that is higher than Intel Core 2 Duo. On Linux, you can this information in `/proc/cpuinfo`.



Disk Configuration

Ruckus Wireless 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



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:

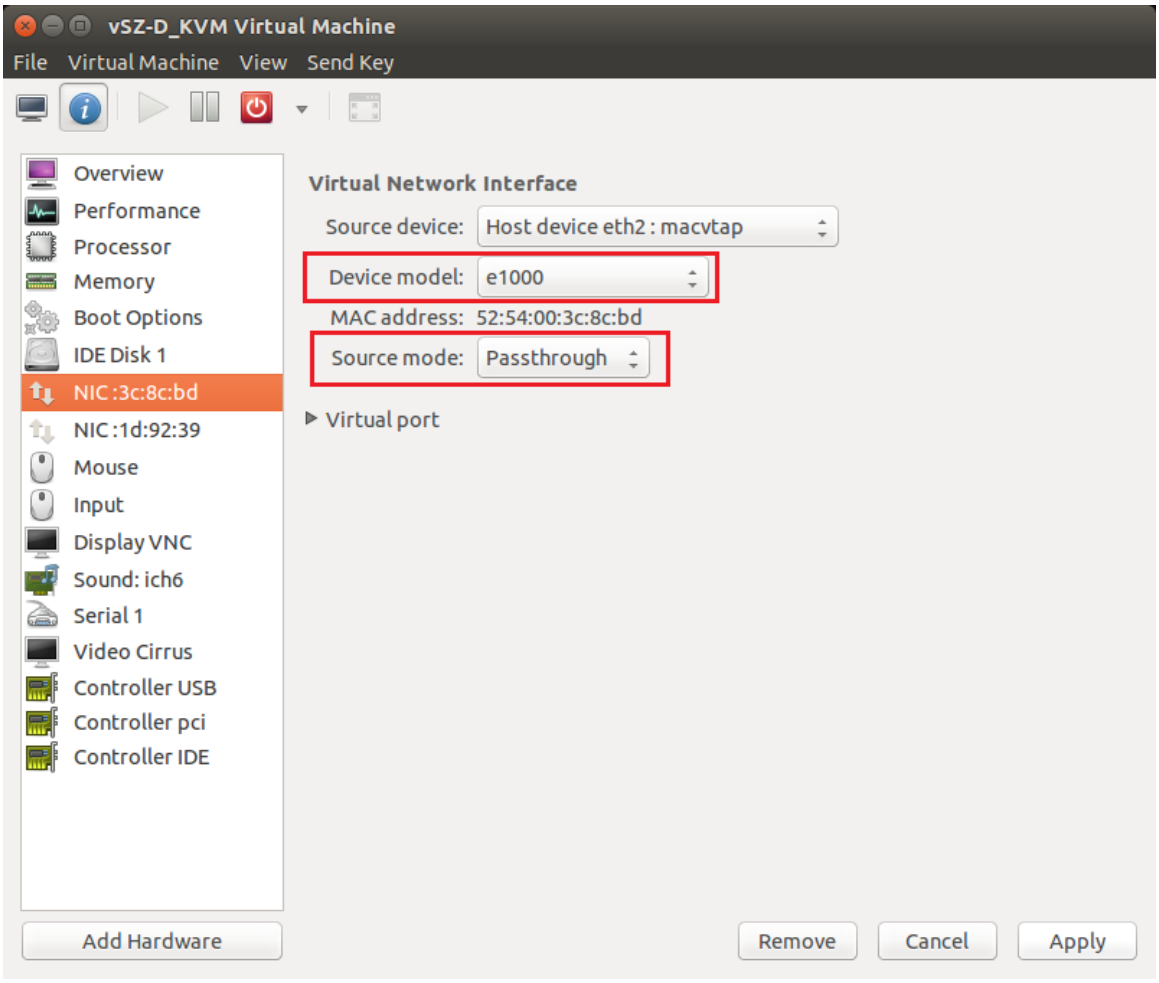
1. Enable VT-d (for Intel processors) in the motherboard BIOS. Intel's VT-d ("Intel Virtualization Technology for Directed I/O") is available on most i7 family processors.
2. Add kernel boot parameters via GRUB to enable IOMMU (see figure below). To enable IOMMU in the kernel of Intel processors, pass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

NIC Configuration in vSwitch Mode

NOTE: Configure only two ports for vSZ-D.

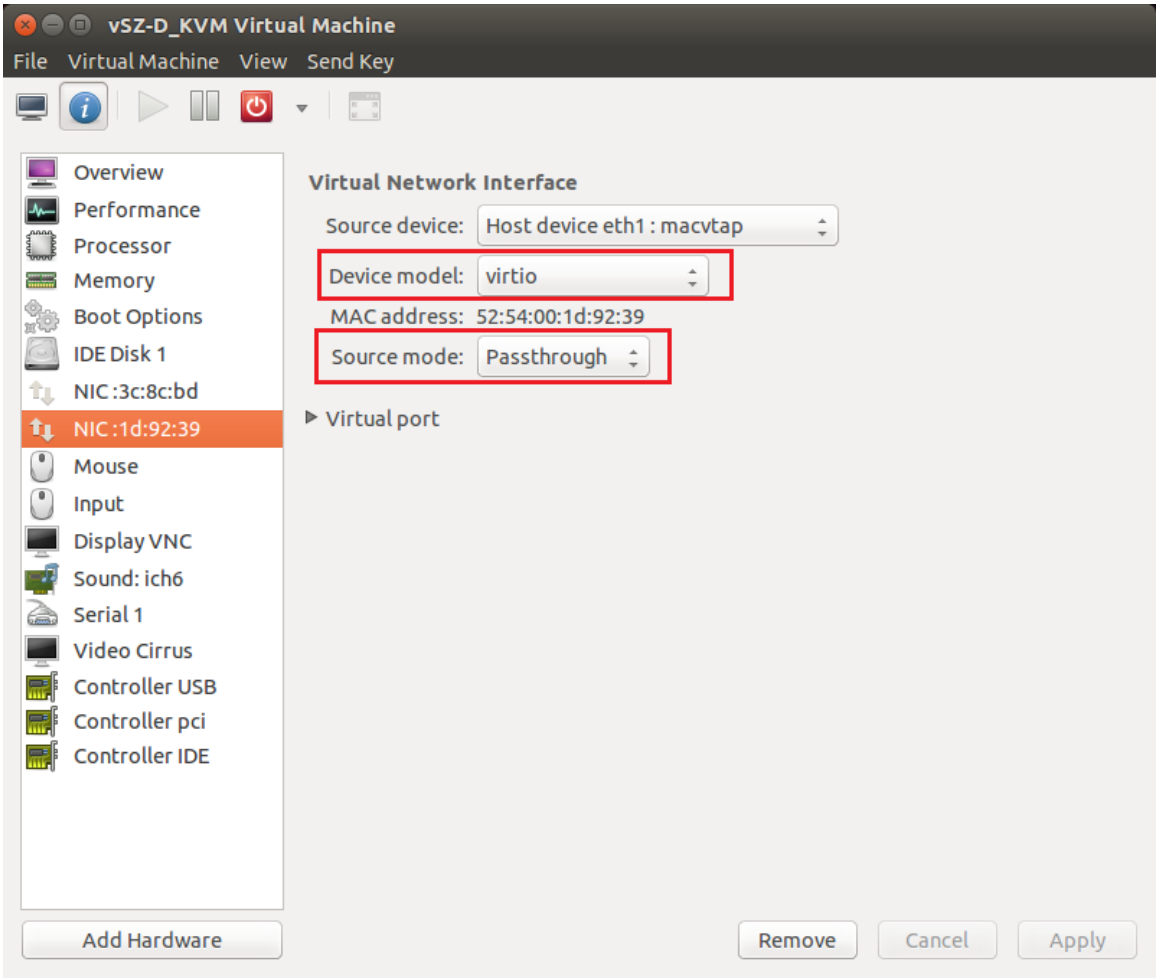
For the management interface, use the following settings:

- **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.


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

Upgrade Procedure 8

Procedure for upgrading to a new vSZ-D version.

Controller and vSZ-D Firmware Compatibility Matrix

The below table indicates the compatibiliy matrix. In general, Ruckus Wireless supports N-2 vSZ-D releases with vSZ.

Table 10: Controller and vSZ-D Firmware Compatibility Matrix

vSZ Release	vSZ-D Release		
	3.5	3.4	3.2
3.5	Yes	Yes	Yes
3.4	No	Yes	Yes
3.2	No	No	Yes

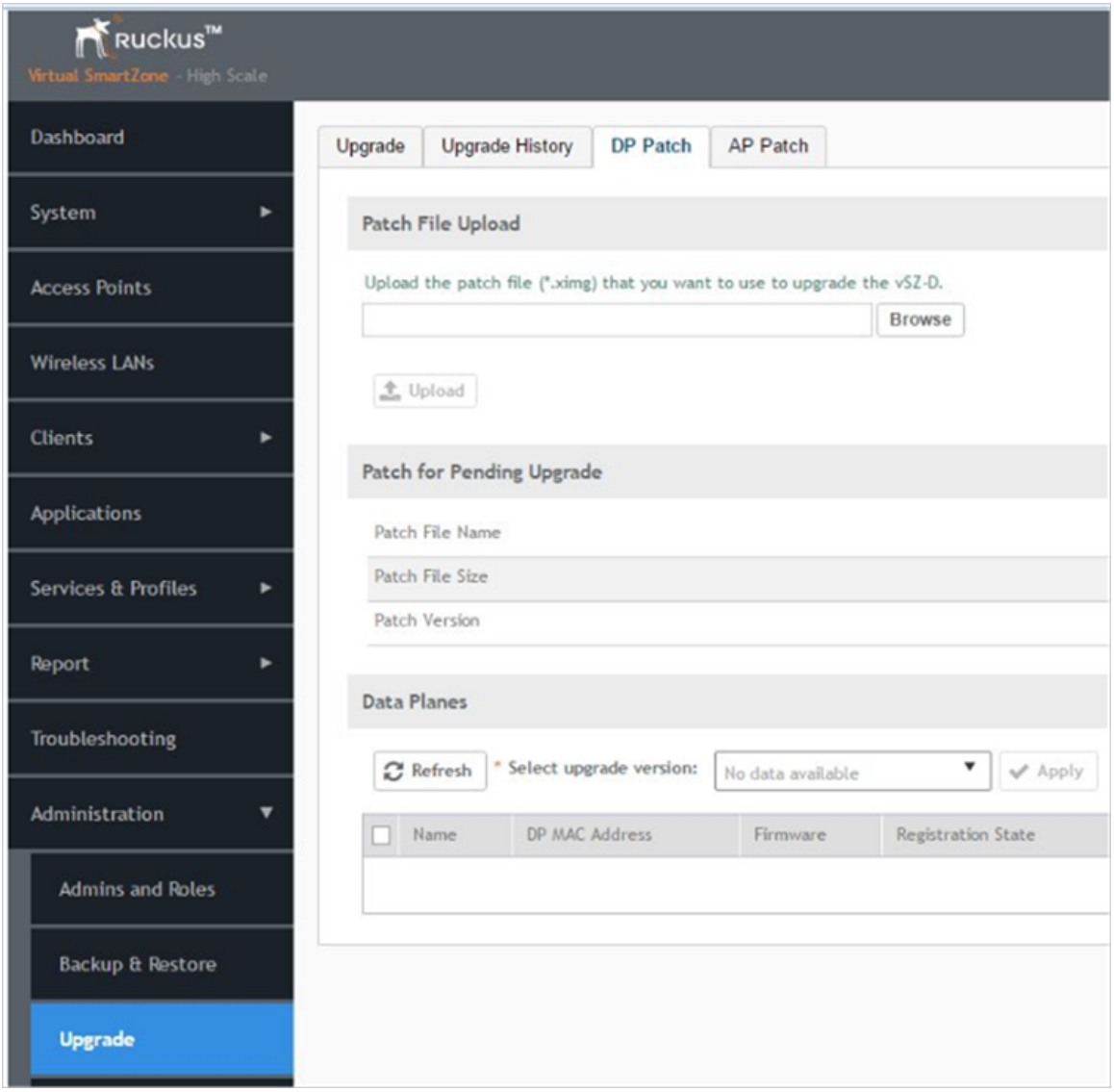
Follow these steps to upgrade the vSZ-D version.

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

NOTE: If you are upgrading both vSZ and vSZ-D, Ruckus Wireless® recommends upgrading vSZ first before vSZ-D.

1. Copy the software upgrade file that you received from Ruckus Wireless® 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 16: Upgrade Section



3. 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 is `vSZ-D-installer_{version}.ximg`.

4. Click **Upload** to upload the software upgrade file.
5. The **Patch Information** displays the new vSZ-D file details.
6. Select the vSZ-D instance that you want to upgrade from the **Data Plane** table and click **Apply**.

   The controller fetches the new vSZ-D version on a reboot.

7. To verify if the upgrade is successful after a reboot:
   - Go to **Controller web interface** > **Administration** > **Upgrade** to view a confirmation message that the data plane firmware upgrade is complete.

- Go to **Controller web interface** > **Configuration** > **System** > **Cluster Planes** to view a confirmation message that the data plane is managed with an upgrade firmware version.

vSZ-D Performance Recommendations 9

vSZ-D has been designed to induce minimal latency in user data aggregation and forwarding. The unique design of the vSZ-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 is engineered to scale to the underlying NIC capacity profiles whether be it 1G or 10G speeds. vSZ-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 performance:

- To obtain the best throughput, Ruckus Wireless 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 Wireless R&D Labs.
- There is an expected performance impact when enabling encryption (AES 128 bit) on the Ruckus GRE Tunnels. This is due to the overhead induced by the crypto processing on Ruckus Wireless AP and vSZ-D due to the associated overheads of encryption and decryption on a per packet basis. The vSZ-D software is designed to introduce minimal latency and overheads associated in packet processing. vSZ-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 Wireless.

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