Introduction to Cisco vWAAS

This chapter provides an overview of the Cisco Virtual Wide Area Applications Services (Cisco vWAAS) solution and describes the main features that enable Cisco vWAAS to overcome the most common challenges in transporting data over a wide area network.

This chapter contains the following sections:

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- Cisco vWAAS and WAAS Interoperability, on page 3
- OVA Package Files for Cisco vWAAS and vCM Models, on page 4
- Cisco vWAAS Models: CPUs, Memory, and Disk Storage, on page 4
- VMware VMFS Block Size and vWAAS Disk Size, on page 5
- Cisco vCM Models: Managed Nodes, vCPUs, Memory, and Disk Storage, on page 6
- Cisco vWAAS and vCM Sizing Guidelines for Cisco WAAS Version 6.4.3x and Later, on page 6
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- Cisco Hardware Platforms Supported for Cisco vWAAS, on page 22
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About Cisco vWAAS

Cisco vWAAS is a virtual appliance, for both enterprises and service providers, which accelerates business applications delivered from private and virtual private cloud infrastructure. Cisco vWAAS enables you to rapidly create WAN optimization services with minimal network configuration or disruption. Cisco vWAAS can be deployed in the physical data center and in private clouds and virtual private clouds offered by service providers.

Cisco vWAAS service is associated with application server virtual machines as they are instantiated or moved. This approach helps enable cloud providers to offer rapid delivery of WAN optimization services with little network configuration or disruption in cloud-based environments

Cisco vWAAS enables migration of business applications to the cloud, reducing the negative effect on the performance of cloud-based application delivery to end users. It enables service providers to offer an excellent application experience over the WAN as a value-added service in their catalogs of cloud services.

Cisco Integrated Services Router-Cisco Wide Area Application Services (Cisco ISR-Cisco WAAS) is the specific implementation of vWAAS running in a Cisco IOS-XE software container on a Cisco ISR 4000 Series

router (ISR-4321, ISR-4331, ISR-4351, ISR-4431, ISR-4451, or ISR-4461). In this context, **container** refers to the hypervisor that runs virtualized applications on a Cisco ISR 4000 Series router.

Note Cisco ISR-4461 is supported for Cisco vWAAS in Cisco WAAS 6.4.1b and later.

The following table shows the hypervisors supported for Cisco vWAAS. For more information on each of these hypervisors, see Hypervisors Supported for Cisco vWAAS and vCM, on page 34 in this chapter, and in the chapters listed in the following table.

Table 1: Hypervisors Supported for Cisco vWAAS

Hypervisor	For More Information:
Cisco ISR-WAAS	See the chapter "Cisco vWAAS on Cisco ISR-WAAS."
VMware vSphere ESXi	See the chapter "Cisco vWAAS on VMware ESXi."
Microsoft HyperV	See the chapter "Cisco vWAAS on Microsoft Hyper-V."
RHEL KVM	See the chapter "Cisco vWAAS on RHEL KVM, KVM on CentOS, and KVM in SUSE Linux."
KVM on CentOS	See the chapter "Cisco vWAAS on RHEL KVM, KVM on CentOS, and KVM in SUSE Linux."
KVM in SUSE Linux	See the chapter "Cisco vWAAS on RHEL KVM, KVM on CentOS, and KVM in SUSE Linux."
Cisco Enterprise NFVIS	See the chapter "Cisco vWAAS with Cisco Enterprise NFVIS."

Cisco vWAAS supports WAN optimization in a cloud environment where Cisco physical WAN Automation Engine (Cisco WAE) devices cannot usually be deployed. Virtualization also provides various benefits such as elasticity, ease of maintenance, and a reduction of branch office and data center footprint.

The following hardware and cloud platforms are supported for Cisco vWAAS. For more information on each of these supported platforms, see Cisco Hardware Platforms Supported for Cisco vWAAS.

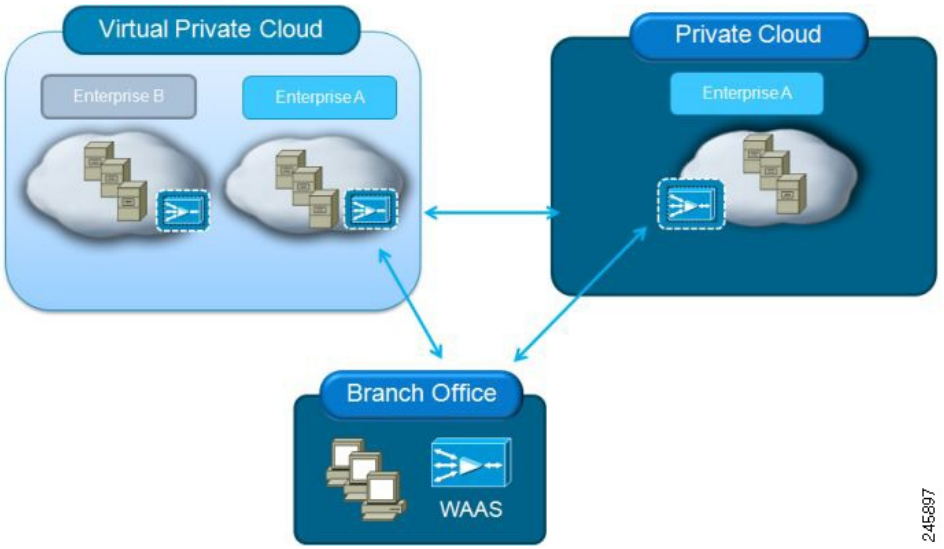
- Cisco Unified Computing System (UCS)
- Cisco UCS E-Series Servers
- Cisco UCS E-Series Network Compute Engines (NCEs)
- Cisco ISR-4000 Series
- Cisco ENCS 5400 Series
- Microsoft Azure Cloud

For details on the interoperability of the hypervisors and platforms supported for vWAAS, see Platforms Supported for Cisco vWAAS, by Hypervisor Type.

As shown in the following figure, you can enable vWAAS at the branch and/or the data center:

- At the branch: With Cisco ENCS 5400-W Series, Cisco Unified Computing System (UCS) E-Series servers and E-Series Network Compute Engines (NCEs), on either the Cisco 4000 Series Integrated Services Routers (ISRs) or Cisco ISR G2 branch router.
- At the data center: With a Cisco UCS server.

Figure 1: Cisco vWAAS in Virtual Private Cloud at WAN Edge, in Branch Office and Data Center



Cisco vWAAS supports on-demand provisioning and teardown, which reduces the branch office and data center footprint. Cisco vWAAS software follows the VMware ESXi standard as the preferred platform to deploy data center applications and services.

Cisco vWAAS and WAAS Interoperability

Consider the following guidelines when using Cisco vWAAS with WAAS:

- **For Cisco vWAAS in Cisco WAAS Version 6.1.x and later**: The Cisco vWAAS and Cisco vCM devices require both virtual (network) interfaces to be present, but both need not be active. If only one virtual interface is active, the Cisco vWAAS and Cisco vCM devices will not be operational after power up.
- **Cisco WAAS Central Manager interoperability**: In a mixed-version Cisco WAAS network, the Cisco WAAS Central Manager must be running the latest version of the Cisco WAAS software, and associated Cisco WAAS devices must be running Version 5.1.x or later.
- **Cisco WAAS system interoperability**: Cisco WAAS Version 5.2.1 is not supported running in a mixed version Cisco WAAS network in which another Cisco WAAS device is running a software version earlier than Version 5.1.x. Directly upgrading a device from a version earlier than Version 5.5.3 to 5.2.1 is not supported.

OVA Package Files for Cisco vWAAS and vCM Models

The following table shows the OVA and NPE OVA file for each Cisco vWAAS model:

Table 2: OVA Package Files for Cisco vWAAS Models

vWAAS Model	OVA Filename	NPE OVA Filename
vWAAS-150	vWAAS-150.ova	Cisco-WAAS-vWAAS-150-npe.ova
vWAAS-200	vWAAS-200.ova	Cisco-WAAS-vWAAS-200-npe.ova
vWAAS-750	vWAAS-750.ova	Cisco-WAAS-vWAAS-750-npe.ova
vWAAS-1300	vWAAS-1300.ova	Cisco-WAAS-vWAAS-1300-npe.ova
vWAAS-2500	vWAAS-2500.ova	Cisco-WAAS-vWAAS-2500-npe.ova
vWAAS-6000	vWAAS-6000.ova	Cisco-WAAS-vWAAS-6000-npe.ova
vWAAS-12000	vWAAS-12000.ova	Cisco-WAAS-vWAAS-12000-npe.ova
vWAAS-50000	vWAAS-50000.ova	Cisco-WAAS-vWAAS-50000-npe.ova

The following table shows the OVA and NPE OVA file for each Cisco vCM model (all models are available with Cisco WAAS Version 4.3.1 and later, except as noted):

Table 3: OVA Package Files for Cisco vCM Models

vCM Model	OVA Filename	NPE OVA Filename
vCM-100N	vCM-100N.ova	Cisco-WAAS-vCM-100N-npe.ova
vCM-500N	vCM-500N.ova	Cisco-WAAS-vCM-500N-npe.ova
vCM-1000N	vCM-1000N.ova	Cisco-WAAS-vCM-1000N-npe.ova
vCM-2000N	vCM-2000N.ova	Cisco-WAAS-vCM-2000N-npe.ova

Cisco vWAAS Models: CPUs, Memory, and Disk Storage

For the following Cisco vWAAS models, follow these operating guidelines for CPU, memory, and disk storage:

- When using Cisco vWAAS in Cisco WAAS Version 6.4.x or later, we recommend that you select **vWAAS Re-sized** during installation.
- When Cisco vWAAS-6000, vWAAS-1300, vWAAS-12000, or vWAAS-50000 are used with Akamai Connect and when connections are more than 70 percent of Transport Flow Optimization (TFO), the response time will be on the higher side. Adding CPUs to these models when used with Akamai Connect may improve response time.

- The following table shows where to find additional memory and disk storage information for Akamai Connect and Cisco ENCS 5400-W, by Cisco vWAAS model.

Table 4: Cisco vWAAS Memory and Disk Storage, Akamai Connect and Cisco ENCS 5400-W

Cisco vWAAS Model	For more information
vWAAS-150	• See Cisco vWAAS-150 with Akamai Connect in the chapter "Cisco vWAAS with Akamai Connect."
vWAAS-6000R	• See the chapter "Cisco vWAAS on Cisco ENCS 5400-W Series." • See *Cisco vWAAS Bundled Image Upgrade for ENCS 5400 Series, with RMA Process for Cisco EOS/EOL WAVE Devices*.
vWAAS-12000 and vWAAS-50000	• See Akamai Connect Cache Engine on Cisco Mid-End and High-End Platforms in the chapter "Cisco vWAAS with Akamai Connect."
vWAAS models with Akamai Connect	• See Cisco vWAAS with Akamai Connect Hardware Requirements in the chapter "Cisco vWAAS with Akamai Connect."
vWAAS models on Cisco ENCS 5400 Series	• See the chapter "Cisco vWAAS on Cisco ENCS 5400-W Series." • See *Cisco vWAAS Bundled Image Upgrade for ENCS 5400 Series, with RMA Process for Cisco EOS/EOL WAVE Devices*.

VMware VMFS Block Size and vWAAS Disk Size

The following table shows the VMware Virtual Machine File System (VMware VMFS) block size and associated Cisco vWAAS maximum disk file size.

Table 5: VMware VMFS Block Size and Cisco vWAAS Maximum File Size

VMFS Block Size	vWAAS Maximum Disk File Size
1 MB	256 GB
2 MB	512 GB
4 MB	1024 GB
8 MB	2046 GB

Note For Cisco vWAAS models that have a disk size that is larger than 256 GB, a VMFS block size that is larger than 1 MB is required.

Cisco vCM Models: Managed Nodes, vCPUs, Memory, and Disk Storage

The following table shows the number of managed nodes and disk storage for each Cisco vCM model, as well as the required and recommended number of vCPUs and the required and recommended memory capacity.

Note Cisco vCM installation packages are configured with the minimal required amounts of CPU and memory resources to accommodate the various hypervisor setups. These minimal requirements are sufficient for initial setup and a limited number of nodes.

However, as the number of managed devices on your system increases, the Cisco WAAS Central Manager service can experience intermittent restarts or flapping: device states when under resource shortage. To remedy this, configure the recommended values for number of CPUs and memory, as shown in the following table.

Table 6: Cisco vCM Models: Managed Nodes, vCPUs, Memory, and Disk Storage

vCM Model	Managed Nodes	Required vCPUs	Recommended vCPUs	Required Memory	Recommended Memory	Disk Storage
vCM-100	100	2	2	2 GB	2 GB	250 GB
vCM-500	500	2	4	2 GB	5 GB	300 GB
vCM-1000	1000	2	6	4 GB	8 GB	400 GB
vCM-2000	2000	4	8	8 GB	16 GB	600 GB

Cisco vWAAS and vCM Sizing Guidelines for Cisco WAAS Version 6.4.3x and Later

Note Cisco vWAAS installation packages are configured with the minimal required amounts of CPU and memory resources to accommodate the various hypervisor setups. These minimal requirements are sufficient for initial setup and a limited number of nodes.

However, as the number of managed devices on your system increases, the Central Manager service can experience intermittent restarts or flapping: device states when under resource shortage. To remedy this, please configure the recommended values for number of CPUs and memory shown in this section.

Cisco vCM on VMware ESXi Sizing Guidelines

This section contains the following Cisco vCM on VMware ESXi sizing guidelines tables:

The following table shows Cisco vCM on VMware ESXi sizing guidelines for Central Manager Mode.

Note In the **Number of Nodes (Cisco WAAS and Other Devices)** column in the following table: In cases when the Cisco WAAS Central Manager manages Cisco WAAS devices, the total number of managed devices can be reduced by 20% compared to management of only Cisco WAAS devices.

Table 7: Cisco vCM on VMware ESXI Sizing Guidelines: Central Manager Mode

Cisco vCM Model	Number of Nodes (Cisco WAAS Devices Only)	Number of Nodes (Cisco WAAS and Other Devices)	Number of Managed Appnav Clusters
vCM-100	100	80	25
vCM-500N	500	500	125
vCM-1000N	1000	1000	250
vCM-2000N	2000	2000	300

The following table shows Cisco vCM on VMware ESXi sizing guidelines for virtual hardware requirements.

Table 8: Cisco vCM on VMware ESXi: Virtual Hardware Requirements

Cisco vCM Model	Required Number of vCPUs	Recommended Number of vCPUs	Required Virtual Memory	Recommended Virtual Memory	Number of Virtual Disks	Virtual Disk Datastore
vCM-100	2	2	2	3	2	254
vCM-500N	2	4	2	5	2	304
vCM-1000N	2	6	4	8	2	404
vCM-2000N	4	8	8	16	2	604

The following table shows Cisco vCM on VMware ESXi sizing guidelines for hardware requirements.

Table 9: Cisco vCM on VMware ESXi: Hardware Requirements

Cisco vCM Model	Cisco Hardware	CPU Clock Speed	Disk
vCM-100	UCS C210 M2	2.6 GHz	HDD-7.2K RPM
vCM-500N	UCS C210 M2	2.6 GHz	HDD-7.2K RPM
vCM-1000N	UCS C210 M2	2.6 GHz	HDD-7.2K RPM
vCM-2000N	UCS C210 M2	2.6 GHz	HDD-7.2K RPM

Cisco vWAAS on Microsoft Hyper-V Sizing Guidelines

This section contains the following Cisco vWAAS on Microsoft Hyper-V sizing guidelines tables:

The following table shows Cisco vWAAS on Microsoft Hyper-V sizing guidelines for connections.

Table 10: Cisco vWAAS on Microsoft Hyper-V: Connections Sizing Guidelines

Cisco vWAAS Model	Optimized TCP Connections	Optimized CIFS/SMB Connections	Optimized SSL Connections	Optimized MAPI Connections	Optimized EMAPI Connections	Akamai Connect Optimized TCP Connections
vWAAS-150	150	150	150	45	45	150
vWAAS-200	200	200	200	60	60	200
vWAAS-750	750	750	750	225	225	750
vWAAS-1300	1,300	1,300	1,300	390	390	1,300
vWAAS-2500	2,500	2,500	2,500	750	750	2,500
vWAAS-6000	6,000	6,000	6,000	1,800	1,800	6,000
vWAAS-12000	12,000	12,000	12,000	3,600	3,600	12,000
vWAAS-50000	50,000	50,000	50,000	15,500	15,500	50,000

Consider the following guidelines for connections sizing for Cisco vWAAS on Microsoft Hyper-V, as shown in the above table.

- For the **Optimized TCP Connections** column: Any system will optimize up to the maximum of its capacity until overload conditions arise. During overload conditions, new connections will not be optimized. Existing connections will be optimized to the greatest degree possible by the system. Should you need scalability beyond the capacity of a single device, multiple devices can be deployed.
- For the **Optimized SSL Connections** column: These connections, when used, are part of the overall connection limit for the device.
- For the **Optimized MAPI Connections** and **Optimized EMAPI Connections** columns: MAPI/EMAPI numbers represent the number of concurrent clients.
- For the **Akamai Connect Optimized TCP Connections** column:
  - Any system will optimize up to the maximum of its capacity until overload conditions arise. During overload conditions, new connections will not be optimized.Existing connections will be optimized to the greatest degree possible by the system. Should you need scalability beyond the capacity of a single device, multiple devices can be deployed.
  - Connections per second (CPS) is approximately 20% of the TFO limit. If the CPS exceeds this some traffic will end up in pass through and not optimized.

The following table shows Cisco vWAAS on Microsoft Hyper-V sizing guidelines for bandwidth, throughput, disk, and cache sizing.

Table 11: Cisco vWAAS on Microsoft Hyper-V: Bandwidth, Throughput, Disk, and Cache Sizing Guidelines

Cisco vWAAS Model	Target WAN Bandwidth	Optimized LAN Throughput	DRE Disk Capacity	Default SMB AO Object Cache Capacity	Default Akamai Connect Cache Capacity	Akamai Connect Target WAN Bandwidth
vWAAS-150	15 Mbps	75 Mbps	52 GB	–-	80 GB	–-
vWAAS-200	20 Mbps	300 Mbps	50 GB	72 GB	100 GB	–-
vWAAS-750	50 Mbps	500 Mbps	95 GB	108 GB	250 GB	–-
vWAAS-1300	80 Mbps	500 Mbps	140 GB	108 GB	300 GB	–-
vWAAS-2500	150 Mbps	750 Mbps	230 GB	108 GB	350 GB	–-
vWAAS-6000	150 Mbps	800 Mbps	320 GB	108 GB	350 GB	–-
vWAAS-12000	310 Mbps	1,600 Mbps	450 GB	202 GB	750 GB	–-
vWAAS-50000	380 Mbps	2,000 Mbps	1,000 GB	203 GB	850 GB	–-

Consider the following guidelines for bandwidth, throughput, DRE disk, object cache, and Akamai Connect sizing for Cisco vWAAS on Microsoft Hyper-V, as shown in the above table.

- For the **Target WAN Bandwidth** column: Target WAN bandwidth is not limited in software or by any other system limit, but is rather provided as guidance for deployment sizing purposes. Target WAN bandwidth is a measure of the optimized/compressed throughput WAAS can support, this value is taken at approximately 50 to 70% compression.
- For the Optimized LAN Throughput column: Maximum LAN Throughput is the theoretical maximum throughput the WAAS device can deliver on the LAN side. This number is measured at 99% compression in a dual-sided scenario with TFO, DRE, or LZ and no WAN condition between the WAAS devices.

Note Your specific results are highly dependent on the type of traffic, compression values, WAN conditions, and how much and the type of "work" the WAAS device is doing (such as TFO, DRE, LZ, AO).

Also, if you are using an appliance with a 2- or 4-port port-channel, or a 10 G port, it is possible to scale beyond 1 Gbps of throughput. The same is true for Cisco vWAAS if you have a 10 G NIC in your ESXi or Hyper-V host, you can scale beyond 1 Gbps. Actual results depend on the use case.

- For the **Default SMB AO Object Cache Capacity** column: SMB Object cache is not available on the Cisco vWAAS-150 and 200 models in Cisco WAAS Version 6.2.1. However the space is there to be reallocated toward Akamai Connect if desired.

- For the **Default Akamai Connect Cache Capacity** column: The SMB Object Cache and Akamai Connect Cache can be modified to skew toward SMB, Akamai, or a 50/50 split. For more information, see the Cisco WAAS information on resizing Cisco vWAAS on NFVIS, see the *Cisco Wide Area Application Services Configuration Guide*.
- For the **Akamai Connect Target WAN Bandwidth** column:
  - Target WAN bandwidth is not limited in software or by any other system limit, but is rather provided as guidance for deployment sizing purposes. Target WAN bandwidth is a measure of the optimized/compressed throughput WAAS can support, this value is taken at approximately 50 - 70% compression.
  - Akamai Connect for Cisco vWAAS-1300:

    - **Hardware**: Cisco UCS-EN120S-M2/K9

    - **CPU Clock Speed**: 1.799 GHz

    - **Disk Type**: SATA and selected platform test coverage

The following table shows Cisco vWAAS on Microsoft Hyper-V sizing guidelines for virtual hardware requirements.

Table 12: Cisco vWAAS on Microsoft Hyper-V: Virtual Hardware Requirements

Cisco vWAAS Model	Number of vCPUs	Virtual Memory	Number of Virtual Disks	Virtual Disk Datastore
vWAAS-150	1	3 GB	3	168 GB
vWAAS-200	1	3 GB	4	267.2 GB
vWAAS-750	2	4 GB	4	508.2 GB
vWAAS-1300	2	6 GB	4	610.2 GB
vWAAS-2500	4	8 GB	4	762.2 GB
vWAAS-6000	4	11 GB	4	915 GB
vWAAS-12000	4	12 GB	3	766.2 GB
vWAAS-50000	8	48 GB	3	1,552 GB

The following table shows Cisco vWAAS on Microsoft Hyper-V sizing guidelines for hardware requirements.

Table 13: Cisco vWAAS on Microsoft Hyper-V: Hardware Requirements

Cisco vWAAS Model	Cisco Hardware	CPU Clock Speed	Disk	Interface
vWAAS-150	ISR-4321 and UCS-EN140N-M2/K9	1.7 GHz	SSD	1 GE
vWAAS-200	ISR-3945E and UCS-E140S-M2/K9	1.8 GHz	HDD -7.2K RPM	1 GE

Cisco vWAAS Model	Cisco Hardware	CPU Clock Speed	Disk	Interface
vWAAS-750	ISR-3945E and UCS-E140S-M2/K9	1.8 GHz	HDD -7.2K RPM	1 GE
vWAAS-1300	ISR-3945E and UCS-E140S-M2/K9	1.8 GHz	HDD -7.2K RPM	1 GE
vWAAS-2500	ISR-4451 and UCS-E140S-M2/K9	1.8 GHz	HDD -7.2K RPM	1 GE
vWAAS-6000	ISR-4451 and UCS-E140S-M2/K9	1.8 GHz	HDD -7.2K RPM	1 GE
vWAAS-12000	UCSC-C240-M3S	3.5 GHz	HDD -7.2K RPM	10 GE
vWAAS-50000	UCSC-C240-M3S	3.5 GHz	HDD -7.2K RPM	10 GE

Cisco vCM on RHEL KVM Sizing Guidelines

This section contains the following tables:

- Cisco vCM on RHEL KVM Sizing Guidelines: Central Manager Mode
- Cisco vCM on RHEL KVM Sizing Guidelines: Virtual Hardware Requirements
- Cisco vCM on RHEL KVM Sizing Guidelines: Hardware Requirements

The following table show sizing guidelines for Cisco vCM in Central Manager Mode.

Table 14: Cisco vCM on RHEL KVM Sizing Guidelines: Central Manager Mode

Cisco vCM Model	Number of Nodes (Cisco WAAS Devices Only)	Number of Nodes (Cisco WAAS and Other Devices)	Number of Managed Cisco AppNav Clusters
vCM-100	100	80	25
vCM-500N	500	500	125
vCM-1000N	1000	1000	250
vCM-2000N	2000	2000	300

Note In the above table, the **Number of Nodes (WAAS and Other Devices)** column: In cases when the Cisco WAAS Central Manager manages Cisco WAAS devices the total number of managed devices can be reduced by 20% compared to management of only Cisco WAAS devices.

The following table shows virtual hardware requirements sizing guidelines for Cisco vCM on ESXi.

Table 15: Cisco vCM on RHEL KVM Sizing Guidelines: Virtual Hardware Requirements

Cisco vCM Model	Required Number of vCPUs	Recommended Number of vCPUs	Required Virtual Memory	Recommended Virtual Memory	Number of Virtual Disks	Virtual Disk Datastore
vCM-100	2	2	2 GB	3 GB	3	250 GB
vCM-500N	2	4	2 GB	5 GB	3	300 GB
vCM-1000N	2	6	4 GB	8 GB	3	400 GB
vCM-2000N	4	8	8 GB	16 GB	3	600 GB

Table 16: Cisco vCM on RHEL KVM Sizing Guidelines: Hardware Requirements

Cisco vCM Model	Cisco Hardware	CPU Clock Speed	Disk
vCM-100	UCS C210 M2	2.6 GHz	HDD-7.2K RPM
vCM-500N	UCS C210 M2	2.6 GHz	HDD-7.2K RPM
vCM-1000N	UCS C210 M2	2.6 GHz	HDD-7.2K RPM
vCM-2000N	UCS C210 M2	2.6 GHz	HDD-7.2K RPM

Resizing for Cisco vWAAS in WAAS Version 6.4.1a to 6.4.1x

This section contains the following topics:

Cisco vWAAS Resizing Guidelines

Cisco vWAAS in Cisco WAAS Version 6.4.1a and later requires additional resources. Resizing Cisco vWAAS on the recommended platforms enables Cisco vWAAS to scale to optimized TCP connections for the associated device, and to reduce CPU and RAM utilization.

Consider the following guidelines and recommendations for Cisco vWAAS resizing:

- Only vWAAS models can be resized. Cisco ISR-WAAS and Cisco vCM cannot be resized.
- Although optional, we highly recommend that you resize CPU and memory resources for Cisco vWAAS models on all hypervisors. For Cisco vWAAS in Cisco WAAS 6.4.1b and later, options are provided during Cisco vWAAS deployment for you to select either original or resized resources.
- For Cisco vWAAS in Cisco WAAS Version 6.4.1b: You cannot deploy Cisco vWAAS-12000 or Cisco vWAAS-50000 in Microsoft Hyper-V with the original resources. For a successful deployment of Cisco vWAAS 12000 or Cisco vWAAS-50000 in Microsoft Hyper-V with original resources, do a new deployment with WAAS Version 6.4.1 or earlier, and then perform the bin upgrade to Cisco WAAS Version 6.4.1b.
- We recommend the following actions:

- Resize CPU and memory resources, as shown in the table "Resized Cisco vWAAS Specifications for Cisco WAAS Version 6.4.1a and Later" in this section.
- Resize the DRE object cache and Akamai Connect Cache, as shown in the two tables in the section DRE Disk, Object Cache, and Akamai Connect Cache Capacity, on page 20.
- For optimum performance, use the SSD disk with the UCS models listed in the table "Resized Cisco vWAAS Specifications for Cisco WAAS Version 6.4.1a and Later" in this section.

The following table shows original and resized specifications for CPU and memory, by vWAAS model, as well as the tested CPU clock speed and minimum Cisco platform model recommended for each vWAAS model. For default and resized DRE disk capacity, object cache capacity, and Akamai Connect cache capacity, by Cisco vWAAS model, see .

Table 17: Resized Cisco vWAAS Specifications for Cisco WAAS Version 6.4.1a and Later

Cisco vWAAS Model	Original CPU	Resized CPU	Tested CPU Clock Speed	Original Memory	Resized Memory	Minimum Cisco Platform
vWAAS-150 (earliest supported version: WAAS 6.1.x)	1 CPU	2 CPUs	1.7 GHz	3 GB	4 GB	UCS-E140N-M2
vWAAS-200	1 CPU	2 CPUs	1.8 GHz	3 GB	4 GB	UCS-E140S-M2
vWAAS-750	2 CPUs	4 CPUs	1.8 GHz	4 GB	8 GB	UCS-E140S-M2
vWAAS-1300	2 CPUs	4 CPUs	1.9 GHz	6 GB	12 GB	UCS-E160S-M3
vWAAS-2500	4 CPUs	6 GB	1.9 GHz	8 GB	16 GB	UCS-E160S-M3
vWAAS-6000	4 CPUs	8 GB	2.0 GHz	11 GB	24 GB	UCS-E180D-M3
vWAAS-6000R (earliest supported version: WAAS 6.4.x)	4 CPUs	8 GB	2.0 GHz	11 GB	24 GB	UCS-E180D-M3
vWAAS-12000	4 CPUs	12 CPUs	2.6 GHz	12 GB	48 GB	UCS-C220 or UCS-C240
vWAAS-50000	8 CPUs	16 CPUs	2.6 GHz	48 GB	72 GB	UCS-C220 or UCS-C240

Cisco vWAAS Model	Original CPU	Resized CPU	Tested CPU Clock Speed	Original Memory	Resized Memory	Minimum Cisco Platform
vWAAS-150000 (earliest supported version: WAAS 6.4.1a)	24 CPUs	—	3.0 GHz	96 GB	—	UCS C220 M5 For more information, see the Cisco UCS C220 M5 Rack Server Data Sheet.

Upgrading to vWAAS in WAAS Version 6.4.1a or Later with Existing CPU and Memory

You can use the CLI or the Central Manager to upgrade to WAAS Version 6.4.1a or later, with existing CPU and memory:

- **Using the Cisco WAAS CLI to Perform an Upgrade with Existing CPU Memory**:

  During the upgrade, if the vCPU and memory resources are undersized, you will be prompted to resize these Cisco vWAAS parameters before the upgrade.

  You can continue the upgrade procedure and retain the existing vWAAS resources.

  Note For Cisco vWAAS in Cisco WAAS 6.4.1a only: After the upgrade, undersized-resource alarms are displayed for vCPU and memory for the vWAAS device. Use the show alarms command to display information about these undersized alarms for the vWAAS model.

- **Using the Cisco WAAS Central Manager to Perform an Upgrade with Existing CPU and Memory**:

  During the upgrade, if the vCPU and memory resources are undersized, informational note is displayed in the Upgrade window, but there will not be a prompt to resize these Cisco vWAAS parameters before the upgrade.

  You can continue the upgrade procedure and retain the existing Cisco vWAAS resources.

  Note For Cisco vWAAS in Cisco WAAS 6.4.1a only: After the upgrade, undersized-resource alarms are listed for vCPU and memory for the Cisco vWAAS device. Use the show alarms command to display information about these undersized alarms for the Cisco vWAAS model.

Upgrading to vWAAS in WAAS Version 6.4.1a or Later with Resized CPU and Memory

You can use the Cisco WAAS CLI or the Cisco WAAS Central Manager to upgrade to WAAS Version 6.4.1a or later, with resized CPU and memory:

- **Using the Cisco WAAS CLI to perform an upgrade with resized CPU and memory**:

  During the upgrade, if the vCPU and memory resources are undersized, you will be prompted to resize these Cisco vWAAS parameters *before* the upgrade. You can then cancel the upgrade procedure, resize the specific resources, and restart the upgrade procedure.

  1. After shutting down the vWAAS instance, manually increase the vCPU and memory, from the hypervisor, to meet your specifications.
     - To change settings in VMware ESXi: Choose **Edit Settings... > Hardware**.
     - To change settings in Microsoft Hyper-V: Choose **Virtual Machine > Settings... > Hardware**.
     - To change settings in RHEL KVM/CentOS:
       a. Open **Virtual Manager**.
       b. Choose **Virtual Machine > CPUs**.
       c. Choose **Virtual Machine > Memory**.
     - To change settings in Cisco NFVIS, for the Cisco vBranch solution:
       a. Choose **VM Life Cycle > Image Repository > Profiles** and add another profile with: resized CPU, memory, and same disk size.
       b. Choose **VM Life Cycle > Deploy > VM Details** and select the resized profile created.
       c. Click **Deploy**.

     Note If you use the **Route Manager Debugging (RMD) process with vBranch**: To ensure that the RMD process will start successfully in vBranch deployment, you must manually connect both the interfaces before starting the vWAAS.

     - To change settings for Microsoft Azure:
       a. Choose **Deployments > Microsoft Template Overview > Custom Deployment**.
       b. Choose **Home > Virtual Machines > vWAAS Instance > Size**.
  2. Restart the device. With the resized vCPU and memory, the host should have sufficient resources for a successful upgrade.

Note The resources will not change automatically in subsequent upgrades and downgrades of the system change; you must manually change resources as needed for your system.

- **Using the Cisco WAAS Central Manager to perform the upgrade with resized CPU and memory**:

  Consider these guidelines as you perform an upgrade with resized CPU and memory using the Cisco WAAS Central Manager:

  - During the upgrade, if the vCPU and memory resources are undersized, an informational note is displayed on the Upgrade window, but there will not be a prompt to resize these Cisco vWAAS parameters before the upgrade.
  - You cannot cancel the upgrade procedure, in process, from the Cisco WAAS Central Manager. In this scenario, wait until the is complete, change resources as needed, and perform the upgrade.

Note The resources will not change automatically in subsequent upgrades and downgrades of the system change; you must manually change resources as needed for your system.

Resizing Guidelines by Hypervisor for vWAAS in WAAS 6.4.1b and Later

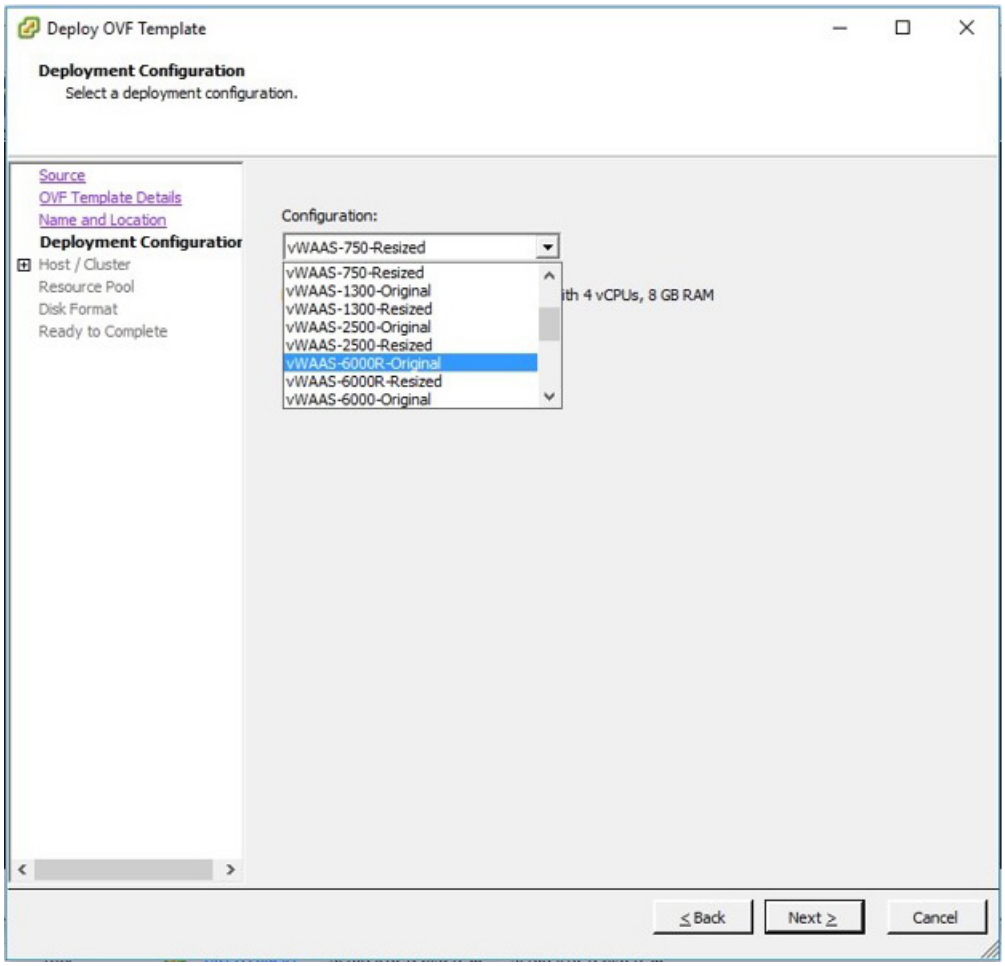
This section contains the following topics:

Resizing for Cisco vWAAS on VMware ESXi

Procedure

Step 1 From the vSphere Client, choose **Deploy OVF Template** > **Deployment Configuration**.

Figure 2: vSphere Client Deployment Configuration Window



Step 2 From the **Configuration** drop-down list, choose the Cisco vWAAS model for this hypervisor.

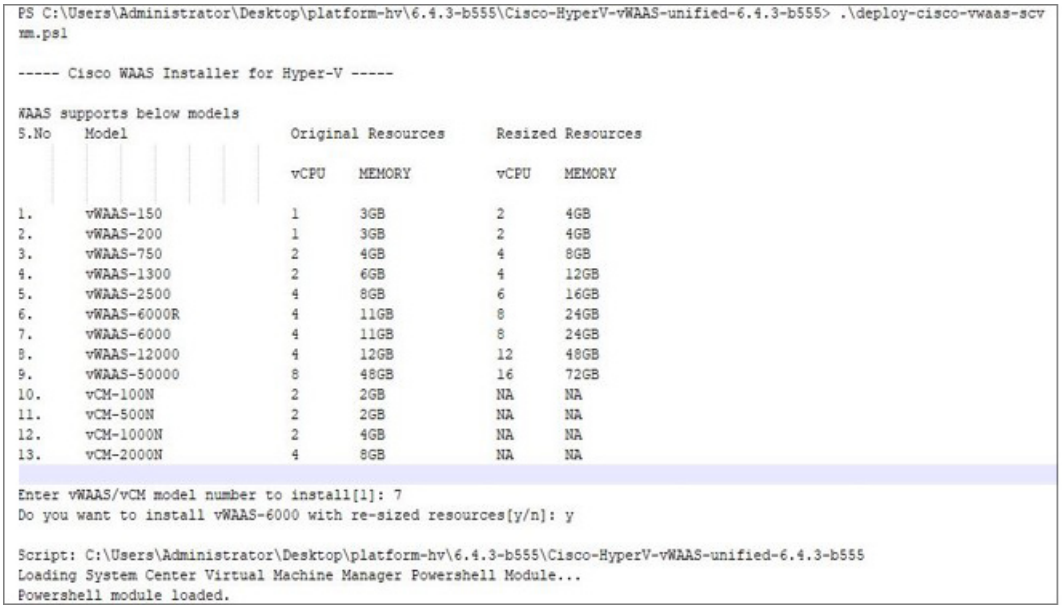
For example, if the model you want to choose is **Cisco vWAAS-6000**, you can either choose **vWAAS-6000-Original** or **vWAAS-6000-Resized**.

Resizing for Cisco vWAAS on Microsoft Hyper-V

Procedure

Step 1 Log in to the Cisco WAAS Installer for Microsoft Hyper-V, which displays a list of supported Cisco WAAS models.

Figure 3: Cisco vWAAS and Cisco vCM Resources for Cisco vWAAS on Hyper-V



Step 2 At the **Enter vWAAS/vCM model to install** prompt, enter the line number for the model that you want to install. For example, from the listing shown in the above figure, if you enter **7**, you will select **vWAAS-6000**.

Step 3 At the **Do you want to install vWAAS-6000 with resized resources [y/n]** prompt, enter **Y** to select resized resources.

Step 4 After you select **Y**, the system displays the associated script, for example:

```
Script:
C:\Users\Administrator\Desktop]platform-hv\6.4.3-b55\Cisco-HyperV-vWAAS-unified-6.4.3-b55
Loading System Center Virtual Machine Manager Powershell Module...
Powershell module loaded.
```

Resizing for Cisco vWAAS on RHEL CentOS or SUSE Linux

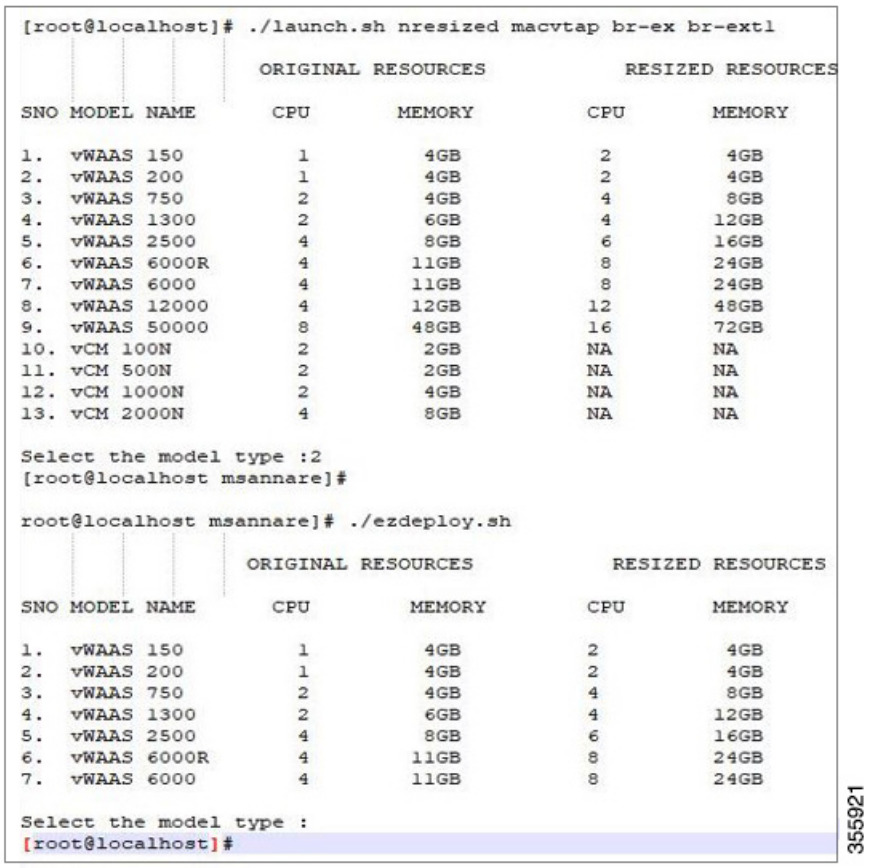
Procedure

Step 1 In the **root@localhost** window, enter the resizing launch script:

```
[root@localhost]# ./launch.sh nresized macvtap br-ex br-extl
```

Step 2 The system displays original and resized resources for each Cisco vWAAS model.

Figure 4: Cisco vWAAS and Cisco vCM Resources on CentOS or SUSE Linux



Step 3 At the **Select the model type** prompt, enter the line number of the model type for your system. For example, if you click **7**, you will select **vWAAS-6000**.

The system displays the following message:

```
Do you want to install vWAAS-6000 with resized resources [y/n]
Enter Y to select resized resources.
```

Step 4 Launch the EzDeploy script:

```
[root@localhost]# ./ezdeploy.sh
```

The **EzDeploy** script also displays both the original and resized resources, as shown in the above figure.

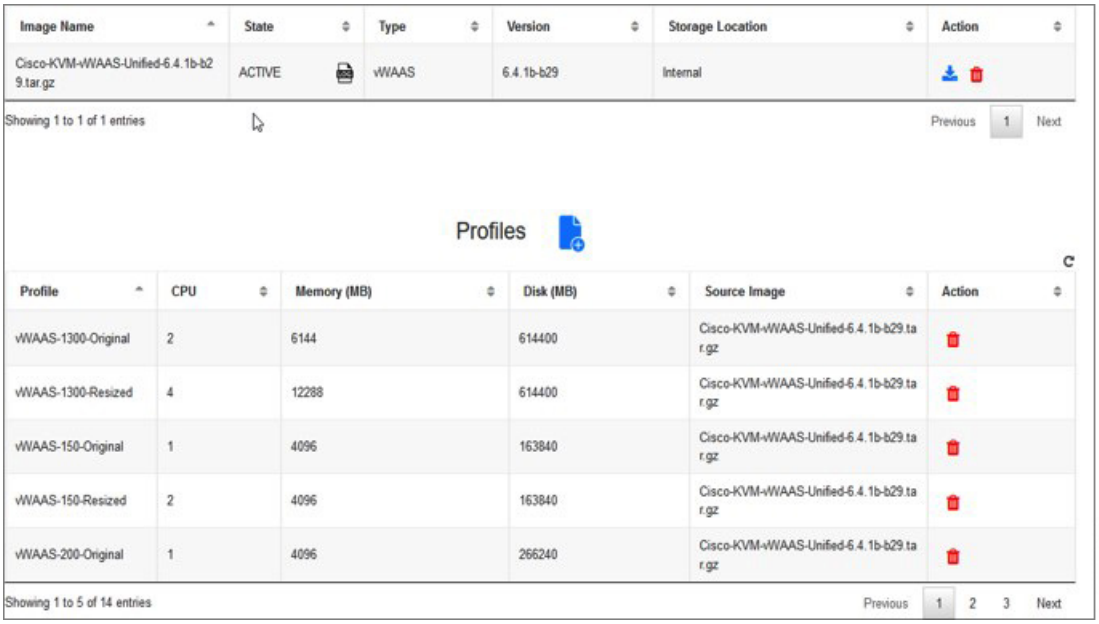
Step 5 The system deploys the selected model, with resized resources.

Resizing for Cisco vWAAS on NFVIS

Procedure

Step 1 To resize Cisco vWAAS on Cisco NFVIS, install the Cisco vWAAS OVA with Cisco WAAS Version 6.4.1b or later. The following figure shows the NFVIS profiles listing for original and resized Cisco vWAAS resources.

Figure 5: Cisco vWAAS Profiles Listing on Cisco vWAAS on NFVIS



Step 2 For more information on resizing Cisco vWAAS on NFVIS, see the *Cisco Enterprise Network Function Virtualization Infrastructure Configuration Guide*.

DRE Disk, Object Cache, and Akamai Connect Cache Capacity

The two tables in this section describe:

- The first table shows default specifications for DRE disk, object cache, and Akamai Connect cache capacity for Cisco WAVE models.
- The second table shows default and resized specifications for DRE disk, object cache, and Akamai Connect cache capacity for Cisco vWAAS models.

Table 18: DRE Disk, Default OC, and Default Akamai Connect Cache by Cisco WAVE Model

Cisco WAVE Model	DRE Disk Capacity	Default Object Cache Capacity	Default Akamai Connect Cache Capacity
WAVE 294-4G	40 GB	102 GB	59 GB

Cisco WAVE Model	DRE Disk Capacity	Default Object Cache Capacity	Default Akamai Connect Cache Capacity
WAVE 294-4G-SSD	40 GB	57 GB	55 GB
WAVE 294-8G	55 GB	77 GB	65 GB
WAVE 294-8G-SSD	55 GB	46 GB	47 GB
WAVE 594-8G	80 GB	143 GB	200 GB
WAVE 594-8G-SSD	80 GB	125 GB	125 GB

Table 19: Default and Resized DRE, OC, and Akamai Connect Cache, by Cisco vWAAS Model

Cisco vWAAS Model	DRE Disk Capacity	Default Object Cache Capacity	Default Akamai Connect Cache Capacity
vWAAS-150	52.3 GB	52 GB	30 GB
vWAAS-150 Resized	51.25 GB	52 GB	30 GB
vWAAS-200	52.23 GB	82 GB	100 GB
vWAAS-200 Resized	51.25 GB	82 GB	100 GB
vWAAS-750	96.75 GB	122 GB	250 GB
vWAAS-750 Resized	92.75 GB	122 GB	250 GB
vWAAS-1300	140 GB	122 GB	300 GB
vWAAS-1300 Resized	136.25 GB	122 GB	300 GB
vWAAS-2500	238 GB	122 GB	350 GB
vWAAS-2500 Resized	223.25 GB	122 GB	350 GB
vWAAS-6000	320 GB	122 GB	400 GB
vWAAS-6000 Resized	302.05 GB	122 GB	400 GB
vWAAS-6000R	320 GB	122 GB	350 GB
vWAAS-6000R Resized	302.05 GB	122 GB	350 GB
vWAAS-12000	450 GB	226 GB	750 GB
vWAAS-12000 Resized	407.25 GB	226 GB	750 GB
vWAAS-50000	1000 GB	227 GB	850 GB
vWAAS-50000 Resized	1000 GB	227 GB	850 GB
vWAAS-150000	1.95 T	700 GB	1500 GB

Cisco Hardware Platforms Supported for Cisco vWAAS

This section contains the following topics:

Platforms Supported for Cisco vWAAS, by Hypervisor Type

For each hypervisor used with Cisco vWAAS, the following table shows the types of platforms supported for Cisco vWAAS, including minimum Cisco WAAS version, host platform, and disk type.

Note Cisco ISR-4321 with IOS-XE 16.9.x is supported for Cisco vWAAS in Cisco WAAS Version 6.4.1b and later.

Table 20: Platforms Supported for Cisco vWAAS, by Hypervisor Type

Earliest Supported Cisco WAAS Version	Host Platforms	Earliest Supported Host Version	Disk Type
Hypervisor: **Cisco ISR-WAAS** PID: **OE-VWAAS-KVM** and Device Type: **ISR-WAAS**			
• 6.4.1b (ISR-4461) • 5.4.1 • 5.2.1 (ISR-4451)	• ISR-4461 (vWAAS-750, vWAAS-1300, vWAAS-2500) • ISR-4451 (vWAAS-750, vWAAS-1300, vWAAS-2500) • ISR-4431 (vWAAS-750, vWAAS-1300) • ISR-4351 (vWAAS-750) • ISR-4331 (vWAAS-750) • ISR-4321 (vWAAS-200)	• IOS-XE 3.9	• ISR-SSD • NIM-SSD
Hypervisor: **Cisco NFVIS** PID: **OE-VWAAS-KVM** and Device Type: **OE-VWAAS-KVM**			

Earliest Supported Cisco WAAS Version	Host Platforms	Earliest Supported Host Version	Disk Type
• 6.2.x (Cisco UCS-E Series) • 6.4.1 (Cisco ENCS 5400 Series and Cisco)	• Cisco ENCS 5400-W Series • Cisco UCS-E Series	• NFV FC2	• virtio
Hypervisor: **VMware vSphere ESXi** PID: **OE-VWAAS-ESX** and Device Type: **OE-VWAAS-ESX**			
• 5.0.3g	• Cisco UCS • Cisco UCS-E Series	• ESXi 5.0	• VMDK
Hypervisor: **Microsoft Hyper-V** PID: **OE-VWAAS-HYPERV** and Device Type: **OE-VWAAS-HYPERV**			
• 6.1.x	• Cisco UCS • Cisco UCS-E Series	• Microsoft Windows 2008 R2	• VHD
Hypervisor: **RHEL KVM** PID: **OE-VWAAS-KVM** and Device Type: **OE-VWAAS-KVM**			
• 6.2.x	• Cisco UCS • Cisco UCS-E Series	RHEL CentOS 7.1	virtio
Hypervisor: **SUSE Linux** PID: **OE-VWAAS-GEN-LINUX** and Device Type: **OE-VWAAS-GEN-LINUX**			
• 6.4.1b	• Cisco UCS • Cisco UCS-E Series	SUSE Linux Enterprise Server (SLES) 12	virtio
Hypervisor: **Microsoft Azure** PID: **OE-VWAAS-AZURE** and Device Type: **OE-VWAAS-AZURE**			
• 6.2.x	• Microsoft Azure cloud	• N/A	• VHD
Hypervisor: **OpenStack** PID: **OE-VWAAS-OPENSTACK** and Device Type: **OE-VWAAS-OPENSTACK**			
• 6.4.1b	• OpenStack cloud	• OpenStack Mitaka	• virtio

Components for Deploying Cisco vWAAS, by Hypervisor Type

For each hypervisor used with Cisco vWAAS, the following table shows the components used to deploy Cisco vWAAS, including package format, deployment tool, preconfiguration tool (if needed), and network driver.

Table 21: Components for Deploying Cisco vWAAS, by Hypervisor Type

Hypervisor	Package Format	Deployment Tool	Pre-Configuration	Network Driver
Cisco ISR-WAAS	• OVA	• Ezconfig	• onep	• virtio_net
Cisco NFVIS	• TAR	• NFVIS	• Bootstrap Day0 config	• virtio_net
VMware vSphere ESXi	• OVA	• ---	• ---	• vmxnet3
Microsoft HyperV	• Zip	• Powershell script	• ---	• netvsc
RHEL KVM	• TAR	• EZdeploy • launch.sh	• ---	• virtio_net
Microsoft Azure	• JSON template	• ---	• ---	• netvsc

Note Cisco Virtual Interface Cards (VICs) are not qualified for Cisco vWAAS.

Components for Managing Cisco vWAAS, by Hypervisor Type

For each hypervisor used with Cisco vWAAS, the following table shows the components used to manage Cisco vWAAS, including Cisco vCM model, Cisco vWAAS model, number of instances supported, and traffic interception method used.

Table 22: Components for Managing Cisco vWAAS, by Hypervisor Type

Hypervisor	vCM Models Supported	vWAAS Models Supported	Number of Instances Supported	Traffic Interception Method
Cisco ISR-WAAS	• N/A	• vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS- 2500	• 1	• AppNav-XE

Hypervisor	vCM Models Supported	vWAAS Models Supported	Number of Instances Supported	Traffic Interception Method
Cisco NFVIS	• N/A	• vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS-2500 • vWAAS-6000	• 1	• WCCP • APPNav-XE • Inline (with Cisco WAAS v6.2.1 and later)
VMware vSphere ESXi	• vCM-100 • vCM-500 • vCM-1000 • vCM-2000	• vWAAS-150 • vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS-2500 • vWAAS-6000 • vWAAS-12000 • vWAAS-50000	• many	• WCCP • APPNav-XE
Microsoft HyperV	• vCM-100 • vCM-500 • vCM-1000 • vCM-2000	• vWAAS-150 • vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS-2500 • vWAAS-6000 • vWAAS-12000 • vWAAS-50000	• many	• WCCP • APPNav-XE

Hypervisor	vCM Models Supported	vWAAS Models Supported	Number of Instances Supported	Traffic Interception Method
RHEL KVM	• vCM-100 • vCM-500 • vCM-1000 • vCM-2000	• vWAAS-150 • vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS-2500 • vWAAS-6000 • vWAAS-12000 • vWAAS-50000	• many	• WCCP • APPNav-XE • Inline (with WAAS v6.2.1 and later)
SUSE Linux	• vCM-100 • vCM-500 • vCM-1000 • vCM-2000	• vWAAS-150 • vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS-2500 • vWAAS-6000 • vWAAS-12000 • vWAAS-50000	• many	• WCCP • APPNav-XE
Microsoft Azure	• N/A	• vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS-2500 • vWAAS-6000 • vWAAS-12000	• 1	• Routed mode (with Cisco WAAS v6.2.1 and later)

Hypervisor	vCM Models Supported	vWAAS Models Supported	Number of Instances Supported	Traffic Interception Method
OpenStack	• vCM-100 • vCM-500 • vCM-1000 • vCM-2000	• vWAAS-150 • vWAAS-200 • vWAAS-750 • vWAAS-1300 • vWAAS-2500 • vWAAS-6000 • vWAAS-12000 • vWAAS-50000	• many	• WCCP • APPNav-XE

Cisco UCS E-Series Servers and NCEs

This section contains the following topics:

Cisco vWAAS and Cisco UCS E-Series Interoperability

Cisco UCS E-Series servers and Cisco UCS E-Series Network Compute Engines (NCEs) provide platforms for Cisco vWAAS and Cisco ISR routers. The following table shows the supported operating systems, hypervisors, Cisco ISR routers, and the minimum version of Cisco IOS-XE used.

Table 23: Cisco vWAAS and UCS E-Series Interoperability

Supported Operating Systems for Cisco vWAAS	Supported Hypervisors for Cisco vWAAS	Supported Cisco ISR Routers for Cisco vWAAS	Minimum Cisco IOS -XE Version
Cisco UCS E-Series Servers			

Supported Operating Systems for Cisco vWAAS	Supported Hypervisors for Cisco vWAAS	Supported Cisco ISR Routers for Cisco vWAAS	Minimum Cisco IOS -XE Version
• Microsoft Windows Server 2008 R2, 2012, and 2012 R2 • Red Hat Enterprise Linux (RHEL) 7.1 and later • Linux (Community Enterprise Operating System) CentOS 7.1 and later	• Microsoft Hyper-V 2008 R2, 2012, and 2012 R2 • VMware vSphere ESXi 5.5 and 6.0 (vWAAS in WAAS Versions 6.4.3b and earlier) • VMware vSphere ESXi 6.7 (vWAAS in WAAS Version 6.4.3c and later) • RHEL KVM or CentOS 7.1 (vWAAS in WAAS Version 6.4.3b and earlier) • RHEL KVM or CentOS 7.2 (vWAAS in WAAS Version 6.4.3c and later)	• ISR-4331 • ISR-4351 • ISR-4451 • ISR-4461	• 3.10
Cisco UCS E-Series NCEs			

Supported Operating Systems for Cisco vWAAS	Supported Hypervisors for Cisco vWAAS	Supported Cisco ISR Routers for Cisco vWAAS	Minimum Cisco IOS -XE Version
• Microsoft Windows Server 2012 R2	• Microsoft Hyper-V 2012 R2 • VMware vSphere ESXi 5.5 and 6.0 (vWAAS in WAAS Versions 6.4.3b and earlier) • VMware vSphere ESXi 6.7 (vWAAS in WAAS Version 6.4.3c and later) • RHEL KVM or CentOS 7.1 (vWAAS in WAAS Version 6.4.3b and earlier • RHEL KVM or CentOS 7.2 (vWAAS in WAAS Version 6.4.3c and later)	• ISR-4331 • ISR-4351 • ISR-4451 • ISR-4461	• 3.10 (UCS-EN120S) • 3.15.1 (UCS-EN140N)

Cisco vWAAS and Cisco UCS E-Series Memory Guidelines and Requirements

When calculating memory requirements for your vWAAS system, include the following parameters:

- A minimum of 2 GB of memory is needed for VMware v5.0, v5.1, or v6.0.
- A minimum of 4 GB of memory is needed for VMware v5.5.
- You must also allocate memory overhead for vCPU memory. The amount is dependent on the number of vCPUs for your system: 1, 2, 4, or 8 vCPUs.

For information on vCPUs, ESXi server datastore memory, and disk space by Cisco vWAAS model and vCM model, see the chapter "Cisco vWAAS on VMware ESXi."

Example 1:

A deployment of vWAAS-750 on the UCS-E140S, using VMware v6.0: Cisco UCS-E140S has a default value of 8 GB memory (which can be expanded to 48 GB).

- Cisco vWAAS-750 requires 6 GB memory + VMware v6.0 requires 2 GB memory = 6 GB memory, which is below the default memory capacity of the UCS-E140S.
- You can deploy Cisco vWAAS-750 on the Cisco UCS-E140S without adding additional memory to the Cisco UCS-E140S DRAM.

Example 2:

A deployment of vWAAS-1300 on the UCS-E140S, using VMware v6.0: Cisco UCS-E140S has a default value of 8 GB DRAM, (which can be expanded to 48 GB).

- Cisco vWAAS-1300 requires 6 GB memory + VMware v6.0 requires 2 GB DRAM = 8 GB memory, which equals the memory capacity of UCS-E140S.
- To deploy Cisco vWAAS-1300 on the Cisco UCS-E140S, you must add additional memory to the Cisco UCS-E140S memory.

Note For Cisco vWAAS datastore, you can use either SAN storage or local storage on the VMware ESXi server. NAC Appliance Server (NAS) should only be used in nonproduction scenarios, such as test purposes.

The following table shows memory and disk storage capacity for Cisco UCS E-Servers NCEs.

Table 24: Memory and Disk Storage for Cisco UCS E-Servers NCEs

Cisco UCS E-Series Server (E) or NCE (EN)	Memory	Disk Storage
UCS-E140S (single-wide blade)	Default: 8 GB Maximum: 16 GB	Up to two of the following: • 7200-RPM SATA: 1 TB • 10,000-RPM SAS: 900 GB • 10,000-RPM SAS SED: 600 GB • SAS SSD SLC: 200 GB • SAS SSD eMLC: 200 or 400 GB
UCS-EN120S (single-wide blade)	Default: 4 GB Maximum: 16 GB	Up to one of the following: • 7200-RPM SATA: 500 GB • 7200-RPM SATA: 1 TB • 10,000-RPM SAS: 900 GB
UCS-E140DP (double-wide blade with PCIe cards)	Default: 8 GB Maximum: 48 GB	Up to one of the following: • 7200-RPM SATA: 1 TB • 10,000-RPM SAS: 900 GB • 10,000-RPM SAS SED: 600 GB • SAS SSD SLC: 200 GB • SAS SSD eMLC: 200 or 400 GB

Cisco UCS E-Series Server (E) or NCE (EN)	Memory	Disk Storage
UCS-E140D (double-wide blade)	Default: 8 GB Maximum: 48 GB	Up to three of the following: • 7200-RPM SATA: 1 TB • 10,000-RPM SAS: 900 GB • 10,000-RPM SAS SED: 600 GB • SAS SSD SLC: 200 GB • SAS SSD eMLC: 200 or 400 GB
UCS-EN40N (Network Interface Module)	N/A	One of the following mSATA SSD drives: • mSATA SSD drive: 50 GB • mSATA SSD drive: 100 GB • mSATA SSD drive: 200 GB
UCS-E160DP (double-wide blade with PCIe cards)	Default: 8 GB Maximum: 48 GB	Up to two of the following: • 7200-RPM SATA: 1 TB • 10,000-RPM SAS: 900 GB • 10,000-RPM SAS SED: 600 GB • SAS SSD SLC: 200 GB • SAS SSD eMLC: 200 or 400 GB
UCS-E160D (double-wide blade)	Default: 8 GB Maximum: 96 GB	Up to three of the following: • 7200-RPM SATA: 1 TB • 10,000-RPM SAS: 900 GB • 10,000-RPM SAS SED: 600 GB • SAS SSD SLC: 200 GB • SAS SSD eMLC: 200 or 400 GB
UCS-E180D (double-wide blade)	Default: 8 GB Maximum: 96 GB	Up to three of the following: • 7200-RPM SATA: 1 TB • 10,000-RPM SAS: 1.8 TB • 10,000-RPM SAS: 900 GB • 10,000-RPM SAS SED: 600 GB • SAS SSD SLC: 200 GB • SAS SSD eMLC: 200 or 400 GB

Cisco ENCS 5400-W Series

This section contains the following topics:

About the Cisco ENCS 5400 Series

The Cisco Enterprise Network Compute System (ENCS) 5400-W Series is designed for the Cisco Enterprise Network Functions Virtualization (NFV) solution, and is available for Cisco vWAAS in Cisco WAAS Version 6.4.1 and later.

The Cisco ENCS 5400-W Series: ENCS 5406-W, 5408-W, and 5412-W, is an x86 hybrid platform is designed for the Cisco Enterprise NFV solution, for branch deployment and for hosting WAAS applications. These high-performance units achieves this goal by providing the infrastructure to deploy virtualized network functions while acting as a server that addresses processing, workload, and storage challenges.

Note Cisco vWAAS is designed to run in appliance mode or as a Virtualized Network Function (VNF) in three Cisco ENCS 5400-W series models: Cisco ENCS 5406-W, Cisco ENCS 5408-W, Cisco ENCS 5412-W, and three Cisco PIDs: ENCS 5406-K9, ENCS 5408-K9, ENCS 5412-K9.

For more information on the Cisco ENCS 5400 series, see the Cisco 5400 Enterprise Network Compute System Data Sheet .

For information on Cisco vWAAS with NFVIS on the ENCS 5400 Series, see the chapter "Cisco vWAAS with Cisco Enterprise NFVIS."

Cisco ENCS 5400-W Series Hardware Features and Specifications

The following table shows specifications that apply to all three Cisco ENCS 5400-W series models. For more information, see the Cisco 5400 Enterprise Network Compute System Data Sheet .

Table 25: Cisco ENCS 5400 Series Features and Specifications

Cisco ENCS 5400-W Feature/Specification	Description
Cisco vWAAS models supported	One of the following configurations: • Cisco ENCS-5406/K9 supports vWAAS 200 and vWAAS-750 • Cisco ENCS-5408/K9 supports vWAAS-1300 • Cisco ENCS-5412/K9 supports vWAAS-2500 and vWAAS-6000-R

Cisco ENCS 5400-W Feature/Specification	Description
CPU	One of the following specifications: • Cisco ENCS-5406/K9: Intel Xeon Processor D-1528 (6 core, 1.9 GHz, and 9 MB cache) • Cisco ENCS-5408/K9: Intel Xeon Processor D-1548 (8 core, 2.0 GHz, and 12 MB cache) • Cisco ENCS-5412/K9: Intel Xeon Processor D-1557 (12 core, 1.5 GHz, and 18 MB cache)
BIOS	Version 2.4
Cisco NFVIS on KVM hypervisor	KVM hypervisor Version 3.10.0-327.el7.x86_64
CIMC	Version 3.2
Network Controller	Intel FTX710-AM2
WAN Ethernet port	Intel i350 dual port
DIMM	Two DDR4 dual in-line memory module (DIMM) slots, for ENCS models with the following capacities: • Cisco ENCS 5406-W: 16 GB • Cisco ENCS-5408-W: 16 GB • Cisco ENCS-5412-W: 32 GB
Gigabit Ethernet ports	Two Gigabit Ethernet ports: For each RJ45 port, there is a corresponding fiber optic port. At a given time, you can use either the RJ45 connection or the corresponding fiber optic port.
NIM	One Network Interface Module (NIM) expansion slot: You can install a NIM in the NIM slot, or if the slot is not needed, you can remove the NIM from the NIM module. Each ENCS 5400 model supports one NIM slot, for a Cisco 4-port 1G fail-to-wire NIM card.
Management Controller	Ethernet management port for Cisco Integrated Management Controller (CIMC), which monitors the health of the entire system.
HDD Storage	lthough there are two hot-swappable HDD slots, we do not recommend HDD storage for the Cisco ENCS 5400-W Series.
SSD Storage	• No RAID and one 960 GB SSD • RAID-1 and two SSDs (960 GB SSD)

Cisco ENCS 5400-W Feature/Specification	Description
Offload Capabilities	Optional crypto module to provide offload capabilities to optimize CPU resources like VM-toVM traffic and to maintain open software support.

Hypervisors Supported for Cisco vWAAS and vCM

Here is an overview of hypervisors are supported for Cisco vWAAS and vCM.

- **Cisco ISR-WAAS**

  Cisco ISR-WAAS is the implementation of vWAAS running in a Cisco IOS-XE software container on a Cisco ISR4400 Series router. In this context, **container** refers to a KVM hypervisor that runs virtualized applications on the Cisco ISR-4400 Series router.

  Cisco ISR-4461 is supported for Cisco vWAAS in Cisco WAAS 6.4.1b and later.

- **VMware ESXi**

  Cisco vWAAS for VMware ESXi provides cloud-based application delivery service over the WAN in ESX/ESXi-based environments. Cisco vWAAS on VMware vSphere ESXi is delivered an OVA file. The vSphere client takes the OVA file for a specified vWAAS model, and deploys an instance of that vWAAS model.

- **Microsoft Hyper-V**

  Microsoft Hyper-V, available for vWAAS with WAAS Version 6.1.x and later, provides virtualization services through hypervisor-based emulations.

  Cisco vWAAS on Microsoft Hyper-V extends Cisco networking benefits to Microsoft Windows Server Hyper-V deployments.

- **RHEL KVM and KVM CentOS**

  Cisco vWAAS on RHEL KVM (Red Hat Enterprise Linux Kernel-based Virtual Machine) is a virtual WAAS appliance that runs on a RHEL KVM hypervisor. Cisco vWAAS on RHEL KVM extends the capabilities of ISR-WAAS and vWAAS running on the Cisco UCS E-Series Servers.

  - Cisco vWAAS on RHEL KVM is available for vWAAS in WAAS Version 6.2.1 and later.
  - Cisco vWAAS on KVM on CentOS (Linux Community Enterprise Operating System) is available for vWAAS in WAAS Version 6.2.3x and later.

  Note Cisco vWAAS on RHEL KVM can also be deployed as a tar archive (tar.gz) to deploy Cisco vWAAS on Cisco Network Functions Virtualization Infrastructure Software (NFVIS). The NFVIS portal is used to select the tar.gz file to deploy vWAAS.

- **Cisco Enterprise NFVIS**

Cisco Enterprise NFV Infrastructure Software (NFVIS) offers flexibility and choice in deployment and platform options for the Cisco Enterprise NFV solution. By virtualizing and abstracting the network services from the underlying hardware, NFVIS allows virtual network functions (VNFs) to be managed independently and to be provisioned dynamically.

- For vWAAS on WAAS Version 5.x to 6.2.x, Cisco NFVIS is available for vWAAS running on Cisco UCS E-Series Servers.
- For vWAAS on WAAS Version 6.4.1 and later, Cisco NFVIS is available for vWAAS running on Cisco UCS E-Series Servers and the Cisco ENCS 5400 Series.

Cloud Platforms Supported for Cisco vWAAS

Cisco vWAAS supports the following cloud computing platforms:

- **Microsoft Azure**: Used with Cisco vCM and Cisco vWAAS models supported on Microsoft Hyper-V. Cisco vWAAS in Azure is supported for Cisco vWAAS in Cisco WAAS Version 6.2.1x and later.
- **OpenStack**: Used with Cisco vCM and Cisco vWAAS models supported on Linux KVM on CentOS, Cisco vWAAS in OpenStack is supported for Cisco vWAAS in Cisco WAAS Version 6.4.1b and later.

For more information, see the chapter "Cisco vWAAS in Cloud Computing Platforms."