

Cisco Catalyst SD-WAN Control Components Compatibility Matrix and Recommended Computing Resources

First Published: 2020-08-01

Last Modified: 2026-09-25

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

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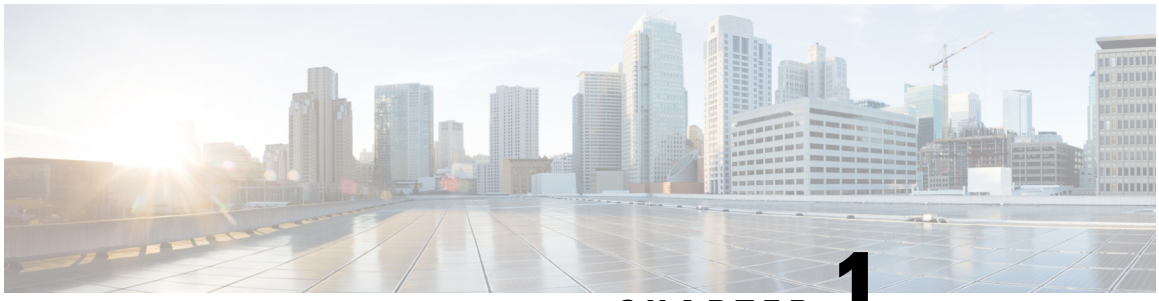
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PART I

Compatibility Matrix for SD-WAN Control Components

- Compatibility Matrix, on page 1



CHAPTER 1

Compatibility Matrix

What's changing

We have transitioned compatibility information to a new Compatibility Matrix Tool.

Why the new tool

The tool is aimed at improving the way we manage, access, and update compatibility information. The tool delivers a more streamlined, user-friendly experience with real-time updates and better searchability.

What the tool offers

The Compatibility Matrix Tool provides up-to-date information on Cisco Catalyst SD-WAN Control Components and device compatibility, enabling users to quickly determine which devices are supported by specific control components.

For additional release information, see Cisco SD-WAN Release Notes.

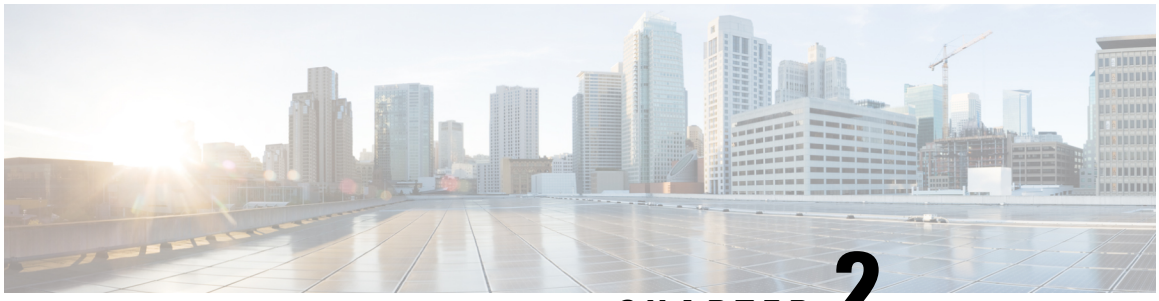


PART II

Hypervisor Compatibility Matrix

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- Hypervisor Compatibility Matrix for Cisco Catalyst SD-WAN Control Components and vEdgeCloud, on page 5
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Hypervisor Compatibility Matrix



CHAPTER 2

Hypervisor Compatibility Matrix for Cisco Catalyst SD-WAN Control Components and vEdgeCloud

Note For information on the hypervisor compatibility matrix for Cloud Routers (Cisco Catalyst 8000V) , see Hypervisor Compatibility Matrix for Cloud Routers.

For information on compatibility matrix for Cisco Catalyst SD-WAN Control Components, see Cisco Catalyst SD-WAN Compatibility Matrix

Table 1: Hypervisor Compatibility Matrix for Cisco SD-WAN Control Components

Control Component Version	Cisco SD-WAN Control Components- Hypervisor Version		
	ESXi	KVM	Nutanix*
20.6	6.5/6.7/7.0	Ubuntu 20.04 (QEMU 4.2.1)	Not supported
20.9	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1)	Not supported
20.12	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1)	AOS 7.3 AHV v.10.3 pc.7.3.0.5
20.13	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1)	AOS 7.3 AHV v.10.3 pc.7.3.0.5
20.14	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1)	AOS 7.3 AHV v.10.3 pc.7.3.0.5

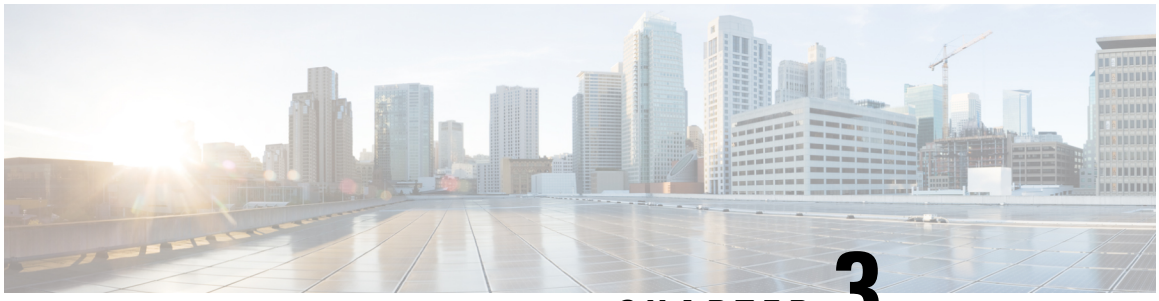
Control Component Version	Cisco SD-WAN Control Components- Hypervisor Version		
	ESXi	KVM	Nutanix*
20.15	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1) Ubuntu 22.04 (QEMU 6.2.0) RHEL 9.4 (QEMU 8.2.0)	AOS 7.3 AHV v.10.3 pc.7.3.0.5
20.16	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1) Ubuntu 22.04 (QEMU 6.2.0) RHEL 9.4 (QEMU 8.2.0)	AOS 7.3 AHV v.10.3 pc.7.3.0.5
20.18	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1) Ubuntu 22.04 (QEMU 6.2.0) RHEL 9.4 (QEMU 8.2.0)	AOS 7.3 AHV v.10.3 pc.7.3.0.5
26.1.1	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1) Ubuntu 22.04 (QEMU 6.2.0) RHEL 9.4 (QEMU 8.2.0)	AOS 7.3 AHV v.10.3 pc.7.3.0.5
26.2.1	6.5/6.7/7.0/8.0	Ubuntu 20.04 (QEMU 4.2.1) Ubuntu 22.04 (QEMU 6.2.0) RHEL 9.4 (QEMU 8.2.0)	AOS 7.3 AHV v.10.3 pc.7.3.0.5

Note * See this guide for information about intalling Nutanix.

Table 2: Hypervisor Compatibility Matrix for vEdgeCloud

Control Component Version	vEdgeCloud-Device Version	vEdgeCloud-Hypervisor Version		
		ESXi	KVM	NFVIS
20.6	20.6	6.5/6.7/7.0	RHEL 7.5/7.7	4.6.1 FC2
20.9	20.9	6.7/7.0	RHEL7.5/7.7	4.9.4 FC2

Control Component Version	vEdgeCloud-Device Version	vEdgeCloud-Hypervisor Version		
		ESXi	KVM	NFVIS
20.12	20.9	6.7/7.0	RHEL 7.7/8.4	4.12.1 FC1
20.13	20.9	6.7/7.0	RHEL 7.7/8.4	4.13.1 FC1
20.14	20.9	6.7/7.0	RHEL 7.7/8.4	4.14.1 FC1
20.15	20.9	6.7/7.0	RHEL 7.7/8.4	4.14.1 FC1



CHAPTER 3

Hypervisor Compatibility Matrix for Cloud Routers

Note For information on Control Components and vEdgeCloud, see Hypervisor Compatibility Matrix for Cisco Catalyst SD-WAN Control Components and vEdgeCloud.

For information on compatibility matrix for Cisco Catalyst SD-WAN Control Components, see Cisco Catalyst SD-WAN Compatibility Matrix

Table 3: Hypervisor Compatibility Matrix for CSR1000v, ISRv and C8000v

Control Component Version	C8000v-Device version	C8000v-Hypervisor Version				
		ESXi	KVM	NFVIS	Nutanix	Hyper-V on Azure Local
20.12	17.12	6.7/7.0/8.0	RHEL 7.7/8.4/9.2, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.12.1 FC1	NA	NA
20.13	17.13	6.7/7.0	RHEL 7.7/8.4, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.13.1 FC1	NA	NA

Control Component Version	C8000v-Device version	C8000v-Hypervisor Version				
		ESXi	KVM	NFVIS	Nutanix	Hyper-V on Azure Local
20.14	17.14	6.7/7.0	RHEL 7.7/8.4, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.14.1 FC1	NA	NA
20.15	17.15	7.0/7.7/8.0	RHEL 8.4/8.10/9.2, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.14.1 FC1	AOS 7.3	Microsoft HCI OS version 23H2
20.16	17.16	7.7/8.0	RHEL 8.10/9.2, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.14.1 FC1	NA	NA
20.18	17.18	7.7/8.0	RHEL 8.10/9.2, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.14.1 FC1	AOS 7.3	Microsoft HCI OS version 23H2
26.1.1	26.1.1	7.7/8.0	RHEL 8.10/9.2, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.14.1 FC1	AOS 7.3	Microsoft HCI OS version 23H2
26.2.1	26.2.1	7.7/8.0	RHEL 8.10/9.2, Openstack RH-OSP 16.1, and Openstack CVIM 4.2	4.14.1 FC1	AOS 7.3	Microsoft HCI OS version 23H2

Note Starting from Cisco IOS XE Catalyst SD-WAN Release 17.4.1a, the Cisco Catalyst 8000V is newly endorsed virtual router platform, supplanting the Cisco CSR1000V and Cisco ISRv. To integrate the Cisco Catalyst 8000V into a Cisco Catalyst SD-WAN setup, you must have Cisco vManage Release 20.4.1 or a more recent version. It's important to note that as of Cisco IOS XE Catalyst SD-WAN Release 17.4.1a, there are no longer any installable images available for Cisco CSR1000V or Cisco ISRv.

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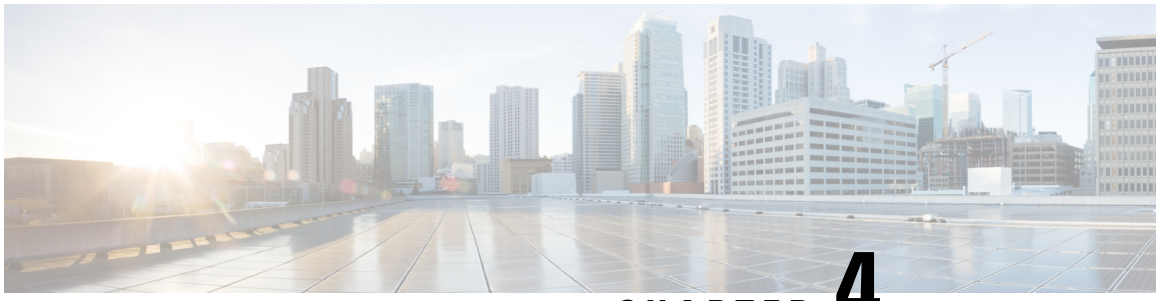


PART III

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- Recommended Computing Resources for Cisco SD-WAN Controller Release 20.1.x and earlier releases, on page 237



CHAPTER 4

Recommended Computing Resources

This topic provides the hardware recommendations for the Cisco SD-WAN Validator server, vEdge Cloud router server, Cisco SD-WAN Manager server, and Cisco SD-WAN Controller server. The resources required to run the Cisco SD-WAN Validator, Cisco SD-WAN Controller, and Cisco SD-WAN Manager server on the VMware vSphere ESXi or the Kernel-based Virtual Machine (KVM) server vary depending on the number of devices you deploy in the overlay network.

Note Cisco SD-WAN Manager server, Cisco SD-WAN Validator, and Cisco SD-WAN Controller have been tested on Intel server platforms.

- Catalyst SD-WAN Recommended Computing Resources Matrix, on page 15
- Points to Consider, on page 16

Catalyst SD-WAN Recommended Computing Resources Matrix

What's new

We have introduced the Recommended Computing Resources Tool to streamline the process of identifying recommended computing resources for Cisco Catalyst SD-WAN deployments. Enter your deployment requirements to receive recommendations in seconds.

Why use the Recommended Computing Resources Tool

The tool eliminates manual analysis of recommendation tables and deployment scenarios by generating computing resource recommendations based on your deployment requirements.

Transition

To provide a smooth transition, this guide and the Recommended Computing Resources Tool will both remain available for the next two releases after Cisco Catalyst SD-WAN Manager Release 26.1.x. After this transition period, the Recommended Computing Resources Tool will become the primary source for recommended computing resource information.

Points to Consider

Note

- We perform scale testing with server configuration detailed in this document. You must deploy servers that fulfil the technical parameters requirements which are specified in this document. You can choose to use servers from third party vendors, which are technically equivalent to the specifications detailed in this document. However, third party servers are not qualified by Cisco. In the event of any issue, Cisco TAC can triage but Cisco will not take liability for issues arising from hardware belonging to a third party vendor.
- The performance factor varies based on your network design and configuration. Consult your Cisco Accounts team for any design-related questions.
- Cisco Catalyst SD-WAN supports the following Elastic Block Store (EBS) volume types:
  - General Purpose SSD (gp2)
  - EBS volume type (gp3) by Amazon Web Services (AWS)
  - The IOPS (Input/Output Operations Per Second) for EBS volume types is generally dictated by the cloud provider. We recommend you select the appropriate EBS volume type that aligns with the performance requirements of your Cisco Catalyst SD-WAN deployment.
- Migrating Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller VMs using tools like vMotion or deploying them using distributed storage solutions like VSAN can have specific restrictions and hence not supported.
- Ensure that you assign the resource reservations that are specified in the VMware virtual machine requirements section in the CPU/Memory Reservation field to ensure proper health and functioning of the Cisco SD-WAN Control Components deployment.

Cisco Catalyst SD-WAN Manager Single Tenant

- The system that you select to run Cisco SD-WAN Manager must satisfy the storage throughput requirement to match the above performance results.
- We recommend that you use Raid 0 for best performance, since application redundancy is built into the solution
- The OS volume must be on a solid-state drive (SSD).
- An oversubscription of 2:1 on vCPU to pCPU (physical CPU) can be supported on Cisco SD-WAN Manager when the overlay has fewer than 250 devices.
- An oversubscription of 2:1 on vCPU to pCPU (physical CPU) is supported for Cisco SD-WAN Controller and Cisco SD-WAN Validator in all of the above deployments.
- We recommend that you use a 10-Gbps interface for production.
- For 3-node and 6-node clusters, we recommend that you use three network interfaces —one for tunnel, one for management, and one for the Cisco SD-WAN Manager cluster communication.

- Co-hosting of Cisco SD-WAN Manager instances on single server is not supported. However, Cisco SD-WAN Manager can be co-hosted with Cisco SD-WAN Controller and Cisco SD-WAN Validator instances on same server.
- If SAIE is enabled:
  - Beyond 50 GB per day up to 100 GB per day, the configuration needs a 3-node cluster. For more that 100 GB per day, configure a 6-node cluster (all sizes are per-day sizes).
- If SAIE is disabled
  - Depending on network sensitivity and deployment type, we recommend using a cluster of three Cisco SD-WAN Manager instances if you want to configure intra-cluster high availability.



Note

- The use of encrypted hard drives is not supported for on-premises deployments of Cisco Catalyst SD-WAN due to the potential impact on software performance.
- Starting from Cisco vManage Release 20.9.1, **DPI** and **Aggregated DPI** are called as **SAIE** and **Aggregated SAIE** respectively.
- Starting from Cisco vManage Release 20.6.1, you can disable Aggregated DPI statistics collection, in Cisco SD-WAN Manager select **Administration** > **Settings** > **Statistics Setting** . Click **Edit**. Scroll to find Aggregated DPI and choose **Disable All**.
- To disable DPI statistics collection, in Cisco SD-WAN Manager select **Administration** > **Settings** > **Statistics Setting** . Click **Edit**. Scroll to find DPI and choose **Disable All**.

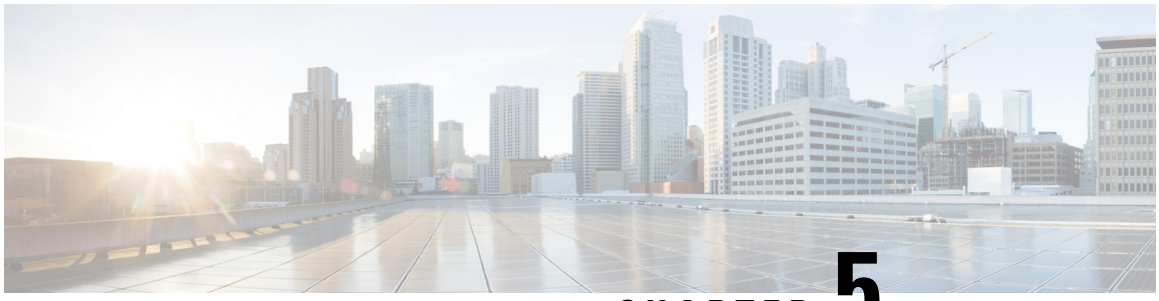
Cisco Catalyst SD-WAN Validator Single Tenant

- The OS volume must be on a solid-state drive (SSD).
- The maximum number of DTLS session supported is 4000 per Cisco SD-WAN Validator.

Cisco Catalyst SD-WAN Controller Single Tenant

- The OS volume must be on a solid-state drive (SSD).

For information about latency requirements, see Cisco Catalyst SD-WAN Design Guide.



CHAPTER 5

Recommended Computing Resources for SD-WAN Control Components Release 26.2.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 19
- Multitenant (MT), on page 31

Single Tenant (ST)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Note The control components and the device software versions should be the same, to achieve the following scale.

Table 4: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge and c6i.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge and c6i.8xlarge
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	m6i.8xlarge, c6i.16xlarge, and c5.18xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This deployment supports the m6i.8xlarge, c6i.16xlarge, and c5.18xlarge AWS instance types. Cisco recommends using m6i.8xlarge.

Table 5: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled									
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	No	Yes
<1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	No	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	No	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	No	Yes
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled									
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA	NA
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes	Yes
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	No	Yes
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	Yes	Yes	Yes	No	Yes
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	Yes	Yes	Yes	No	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- ****Nutanix:
  - We recommended operating each UCS server as an independent, single-node Nutanix cluster with dedicated compute, storage, and management.
  - If using a Nutanix cluster deployment, you must pin VMs must to specific UCS servers using strictly enforced VM affinity policies to ensure each VM consumes only the compute and storage resources of its assigned host.
- For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

Table 6: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node and cluster deployments: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.
- Starting with Cisco Catalyst SD-WAN Manager Release 20.15.x, the statistics database requires less storage than in previous releases. After the statistics migration completes, adjust the sizing value based on your deployment:
  - 3-node or 6-node cluster: Divide the previous sizing value by 30.
  - Single-node deployment: Divide the previous sizing value by 10.

  For example, if a 3-node or 6-node cluster previously required 30 GB, the new database requires 1 GB.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 7: Supported scale on Nutanix Hyperconverged Infrastructure (HCI) platform

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored	Maximum daily processing volume	DR support
Up to 1000	One node large SD-WAN Manager	50 GB/day	30 days	50 GB/day	Yes
1000-2500	Three node large SD-WAN Manager cluster (all services)	100 GB/day	14 days	300 GB/day	Yes

Note To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Table 8: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
0-50	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	t3.medium

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
51-1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large and c6i.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge

Table 9: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge and c6i.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are eight, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 10: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth generation and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 11: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Table 12: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	m6i.8xlarge, c6i.16xlarge, and c5.18xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This deployment supports the m6i.8xlarge, c6i.16xlarge, and c5.18xlarge AWS instance types. Cisco recommends using m6i.8xlarge.

Table 13: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
24 (T) and 1000(D)*	One Node Large Cisco SD-WAN Manager	50 GB/Day	14 Days	Yes	Yes	Yes	Yes
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes

Note For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

***** indicates that a pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 14: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large and c6i.large	Standard_F2s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2

Table 15: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

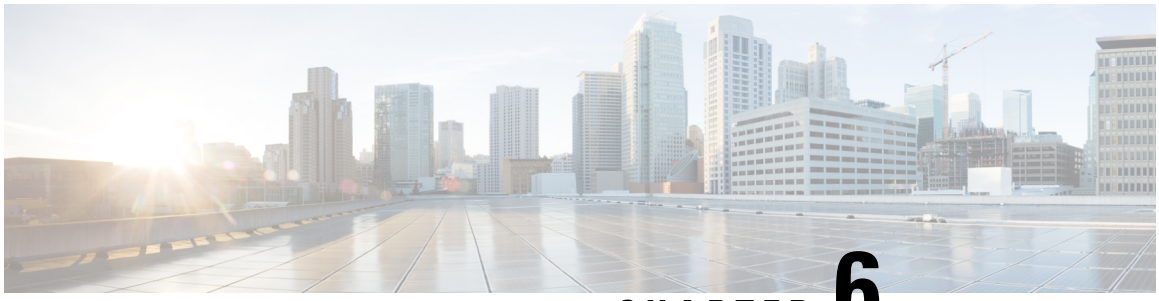
Table 16: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
24 Tenants or 1000 Devices	2	A pair for every 24 tenants
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco SD-WAN Controllers, 50 tenants require 6 Cisco SD-WAN Controllers, and 150 tenants require 14 Cisco SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco SD-WAN Manager node up to 10 TB.
- A pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco SD-WAN Manager fabric is eight.



CHAPTER 6

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 26.1.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 35
- Multitenant (MT), on page 47

Single Tenant (ST)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Note The control components and the device software versions should be the same, to achieve the following scale.

Table 17: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge and c6i.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge and c6i.8xlarge

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	m6i.8xlarge, c6i.16xlarge, and c5.18xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This deployment supports the m6i.8xlarge, c6i.16xlarge, and c5.18xlarge AWS instance types. Cisco recommends using m6i.8xlarge.

Table 18: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled									
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	No	Yes
<1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	No	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled									
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA	NA

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes	Yes
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	No	Yes
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	Yes	Yes	Yes	No	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- ****Nutanix:
  - We recommended operating each UCS server as an independent, single-node Nutanix cluster with dedicated compute, storage, and management.
  - If using a Nutanix cluster deployment, you must pin VMs must to specific UCS servers using strictly enforced VM affinity policies to ensure each VM consumes only the compute and storage resources of its assigned host.
- For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

Table 19: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node and cluster deployments: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.
- Starting with Cisco Catalyst SD-WAN Manager Release 20.15.x, the statistics database requires less storage than in previous releases. After the statistics migration completes, adjust the sizing value based on your deployment:
  - 3-node or 6-node cluster: Divide the previous sizing value by 30.
  - Single-node deployment: Divide the previous sizing value by 10.

  For example, if a 3-node or 6-node cluster previously required 30 GB, the new database requires 1 GB.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 20: Supported scale on Nutanix Hyperconverged Infrastructure (HCI) platform

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored	Maximum daily processing volume	DR support
Up to 1000	One node large SD-WAN Manager	50 GB/day	30 days	50 GB/day	Yes
1000-2500	Three node large SD-WAN Manager cluster (all services)	100 GB/day	14 days	300 GB/day	Yes

Note To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Table 21: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
0-50	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	t3.medium
51-1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large and c6i.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge

Table 22: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge and c6i.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are eight, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 23: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth generation and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 24: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Table 25: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	m6i.8xlarge, c6i.16xlarge, and c5.18xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This deployment supports the m6i.8xlarge, c6i.16xlarge, and c5.18xlarge AWS instance types. Cisco recommends using m6i.8xlarge.

Table 26: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
24 (T) and 1000(D)*	One Node Large Cisco SD-WAN Manager	50 GB/Day	14 Days	Yes	Yes	Yes	Yes
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes

Note For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

***** indicates that a pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 27: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large and c6i.large	Standard_F2s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2

Table 28: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

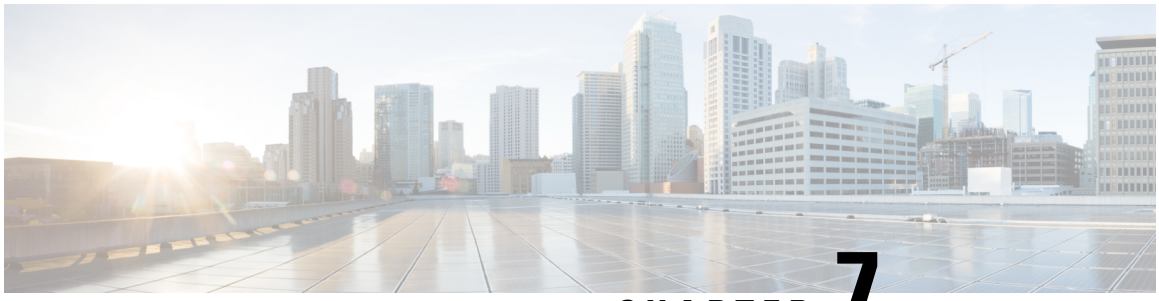
Table 29: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
24 Tenants or 1000 Devices	2	A pair for every 24 tenants
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco SD-WAN Controllers, 50 tenants require 6 Cisco SD-WAN Controllers, and 150 tenants require 14 Cisco SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco SD-WAN Manager node up to 10 TB.
- A pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco SD-WAN Manager fabric is eight.



CHAPTER 7

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.18.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 51
- Multitenant (MT), on page 63

Single Tenant (ST)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Note The control components and the device software versions should be the same, to achieve the following scale.

Table 30: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge and c6i.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge and c6i.8xlarge

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	m6i.8xlarge, c6i.16xlarge, and c5.18xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This deployment supports the m6i.8xlarge, c6i.16xlarge, and c5.18xlarge AWS instance types. Cisco recommends using m6i.8xlarge.

Table 31: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled									
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	No	Yes
<1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	No	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	No	Yes	Yes	No	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled									
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA	NA

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes	Yes
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	No	Yes
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	Yes	Yes	Yes	No	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- ****Nutanix:
  - We recommended operating each UCS server as an independent, single-node Nutanix cluster with dedicated compute, storage, and management.
  - If using a Nutanix cluster deployment, you must pin VMs must to specific UCS servers using strictly enforced VM affinity policies to ensure each VM consumes only the compute and storage resources of its assigned host.
- For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

Table 32: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node and cluster deployments: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.
- Starting with Cisco Catalyst SD-WAN Manager Release 20.15.x, the statistics database requires less storage than in previous releases. After the statistics migration completes, adjust the sizing value based on your deployment:
  - 3-node or 6-node cluster: Divide the previous sizing value by 30.
  - Single-node deployment: Divide the previous sizing value by 10.

  For example, if a 3-node or 6-node cluster previously required 30 GB, the new database requires 1 GB.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 33: Supported scale on Nutanix Hyperconverged Infrastructure (HCI) platform

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored	Maximum daily processing volume	DR support
Up to 1000	One node large SD-WAN Manager	50 GB/day	30 days	50 GB/day	Yes
1000-2500	Three node large SD-WAN Manager cluster (all services)	100 GB/day	14 days	300 GB/day	Yes

Note To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Table 34: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
0-50	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	t3.medium
51-1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large and c6i.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge

Table 35: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge and c6i.xlarge

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge and c6i.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge and c6i.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are eight, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 36: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth generation and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 37: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Table 38: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	m6i.8xlarge, c6i.16xlarge, and c5.18xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This deployment supports the m6i.8xlarge, c6i.16xlarge, and c5.18xlarge AWS instance types. Cisco recommends using m6i.8xlarge.

Table 39: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
24 (T) and 1000(D)*	One Node Large Cisco SD-WAN Manager	50 GB/Day	14 Days	Yes	Yes	Yes	Yes
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes

Note For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

***** indicates that a pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 40: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large and c6i.large	Standard_F2s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2

Table 41: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge and c6i.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge and c6i.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

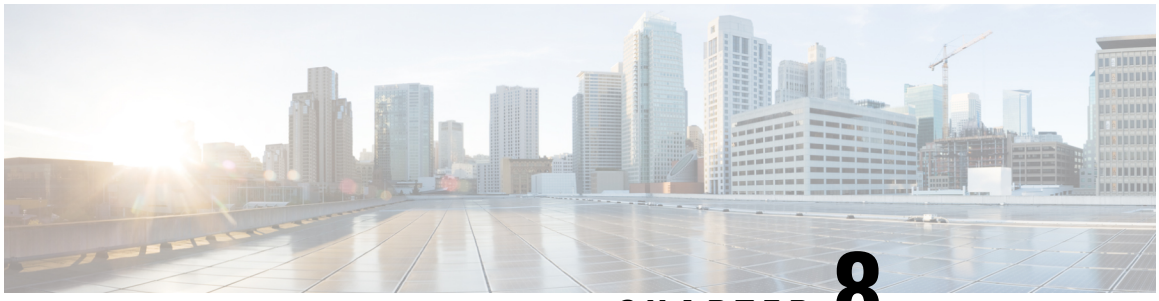
Table 42: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
24 Tenants or 1000 Devices	2	A pair for every 24 tenants
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco SD-WAN Controllers, 50 tenants require 6 Cisco SD-WAN Controllers, and 150 tenants require 14 Cisco SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco SD-WAN Manager node up to 10 TB.
- A pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco SD-WAN Manager fabric is eight.



CHAPTER 8

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.16.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 67
- Multitenant (MT), on page 77

Single Tenant (ST)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Note
- The control components and the device software versions should be the same, to achieve the following scale.

Table 43: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 44: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled								
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
250-1000	One Node Medium Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	Yes
1000-2000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	Yes
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	No	Yes	Yes	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled								
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	No	Yes	Yes	Yes
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	Yes
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	No	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	No	Yes	Yes	Yes



Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

Table 45: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.



Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node and cluster deployments: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.
- Starting with Cisco Catalyst SD-WAN Manager Release 20.15.x, the statistics database requires less storage than in previous releases. After the statistics migration completes, adjust the sizing value based on your deployment:
  - 3-node or 6-node cluster: Divide the previous sizing value by 30.
  - Single-node deployment: Divide the previous sizing value by 10.

  For example, if a 3-node or 6-node cluster previously required 30 GB, the new database requires 1 GB.



Note Maximum tested disk size for On-prem is 10 TB per instance.



Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 46: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 47: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are eight, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 48: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth generation and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 49: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Table 50: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 51: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
24 (T) and 1000(D)*	One Node Large Cisco SD-WAN Manager	50 GB/Day	14 Days	Yes	Yes	Yes	Yes
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	No	No	Yes	Yes

Note For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

***** indicates that a pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 52: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large	Standard_F2s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Table 53: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

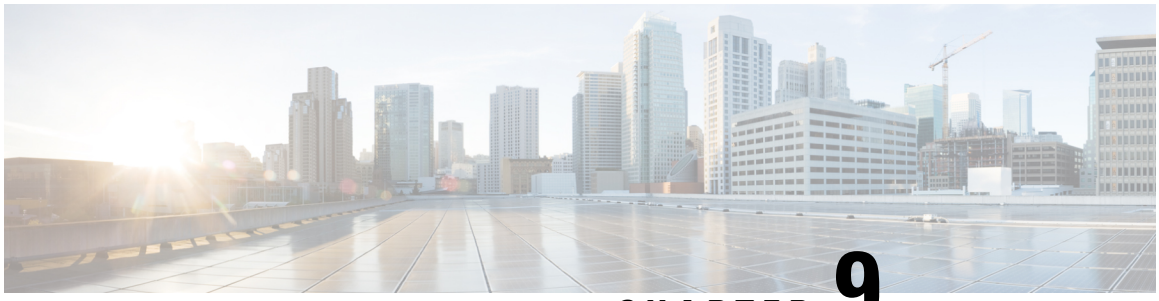
Table 54: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
24 Tenants or 1000 Devices	2	A pair for every 24 tenants
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco SD-WAN Controllers, 50 tenants require 6 Cisco SD-WAN Controllers, and 150 tenants require 14 Cisco SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco SD-WAN Manager node up to 10 TB.
- A pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco SD-WAN Manager fabric is eight.



CHAPTER 9

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.15.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 81
- Multitenant (MT), on page 92

Single Tenant (ST)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Note
- The control components and the device software versions should be the same, to achieve the following scale.

Table 55: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 56: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported ***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**									
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	No	Yes
<1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported ***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**									
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	No	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported ***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**									
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled									
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA	NA

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported ***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**									
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes	Yes
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported ***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**									
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	No	Yes
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported ***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**									
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	Yes	Yes	Yes	No	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- ****Nutanix:
  - We recommended operating each UCS server as an independent, single-node Nutanix cluster with dedicated compute, storage, and management.
  - If using a Nutanix cluster deployment, you must pin VMs must to specific UCS servers using strictly enforced VM affinity policies to ensure each VM consumes only the compute and storage resources of its assigned host.

Table 57: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node and cluster deployments: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.
- Starting with Cisco Catalyst SD-WAN Manager Release 20.15.x, the statistics database requires less storage than in previous releases. After the statistics migration completes, adjust the sizing value based on your deployment:
  - 3-node or 6-node cluster: Divide the previous sizing value by 30.
  - Single-node deployment: Divide the previous sizing value by 10.

  For example, if a 3-node or 6-node cluster previously required 30 GB, the new database requires 1 GB.
- Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 58: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 59: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are eight, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 60: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth generation and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 61: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Table 62: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 63: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
24 (T) and 1000(D)*	One Node Large Cisco SD-WAN Manager	50 GB/Day	14 Days	Yes	Yes	Yes	Yes
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes

Table 64: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large	Standard_F2s_v2
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Table 65: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

Table 66: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

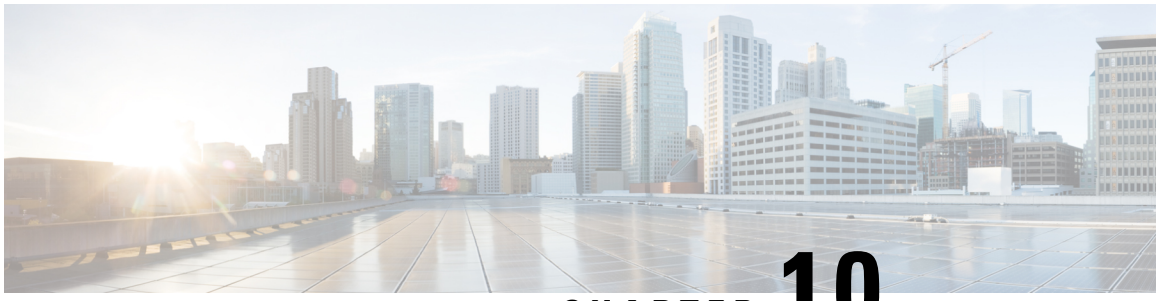
Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
24 Tenants or 1000 Devices	2	A pair for every 24 tenants
75 Tenants or 2500 Devices	2	A pair for every 24 tenants

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco SD-WAN Controllers, 50 tenants require 6 Cisco SD-WAN Controllers, and 150 tenants require 14 Cisco SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco SD-WAN Manager node up to 10 TB.
- A pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco SD-WAN Manager fabric is eight.



CHAPTER 10

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.14.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 97
- Multitenant (MT), on page 107

Single Tenant (ST)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Note The control components and the device software versions should be the same, to achieve the following scale.

Table 67: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 68: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled								
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
250-1000	One Node Medium Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
1000-2000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	Yes
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	No	Yes	Yes	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled								
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	No	Yes	Yes	Yes
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	Yes
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	No	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	No	Yes	Yes	Yes



Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

Table 69: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node and cluster deployments: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 70: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 71: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are eight, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 72: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth generation and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 73: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Table 74: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 75: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
24 (T) and 1000(D)*	One Node Large Cisco SD-WAN Manager	50 GB/Day	14 Days	Yes	Yes	Yes	Yes
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	No	No	Yes	Yes

Note For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

***** indicates that a pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 76: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large	Standard_F2s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Table 77: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

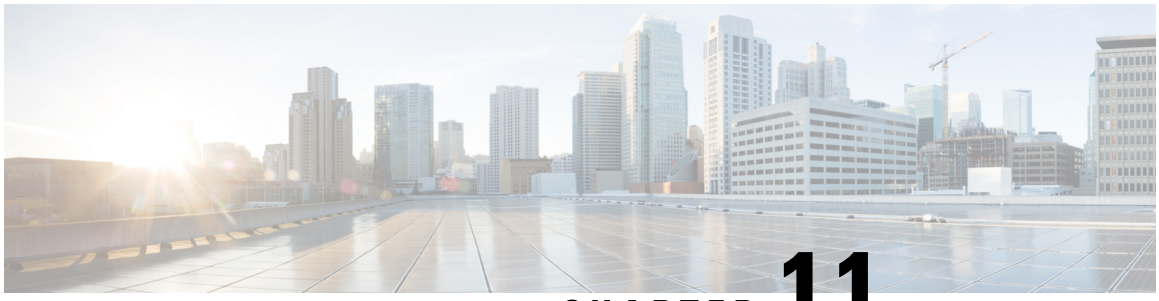
Table 78: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
24 Tenants or 1000 Devices	2	A pair for every 24 tenants
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco SD-WAN Controllers, 50 tenants require 6 Cisco SD-WAN Controllers, and 150 tenants require 14 Cisco SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco SD-WAN Manager node up to 10 TB.
- A pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco SD-WAN Manager fabric is eight.



CHAPTER 11

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.13.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 111
- Multitenant (MT), on page 121

Single Tenant (ST)

The supported instance specifications for the Cisco Catalyst SD-WAN Manager, Cisco Catalyst SD-WAN Validator, and Cisco Catalyst SD-WAN Controller are as follows:

Note
- The controller and the device software versions should be the same, to achieve the following scale.

Table 79: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 80: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled								
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
250-1000	One Node Medium Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	Yes
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
1000-2000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	Yes
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	No	Yes	Yes	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled								
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	No	Yes	Yes	Yes
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	Yes
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	No	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS)	Customer Cloud
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	No	Yes	Yes	Yes



Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

Table 81: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node and cluster deployments: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 82: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 83: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are eight, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 84: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 85: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD



Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco Catalyst SD-WAN Manager, Cisco Catalyst SD-WAN Validator, and Cisco Catalyst SD-WAN Controller are as follows:

Table 86: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 87: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
24 (T) and 1000(D)*	Single Node Large Cisco SD-WAN Manager	50 GB/Day	14 Days	Yes	Yes	Yes	Yes
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	No	No	Yes	Yes

Note For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

***** indicates that a pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 88: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large	Standard_F2s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Table 89: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

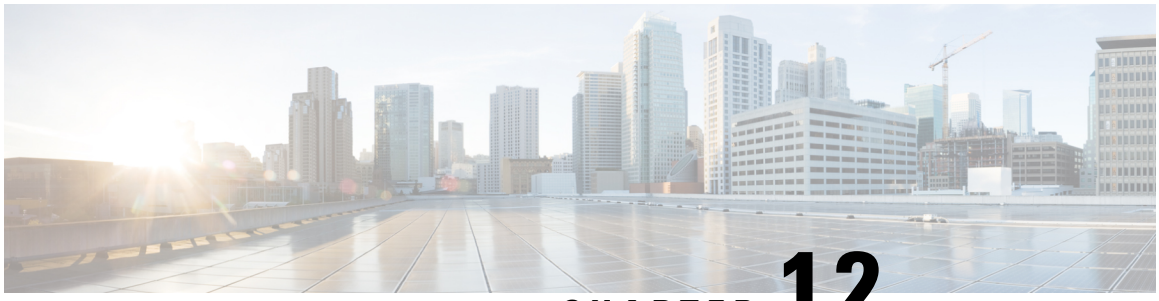
Table 90: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
24 Tenants or 1000 Devices	2	A pair for every 24 tenants
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco Catalyst SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco Catalyst SD-WAN Controllers, 50 tenants require 6 Cisco Catalyst SD-WAN Controllers, and 150 tenants require 14 Cisco Catalyst SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco Catalyst SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco Catalyst SD-WAN Manager node up to 10 TB.
- A pair of Cisco Catalyst SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN Manager overlay is eight.



CHAPTER 12

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.12.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 125
- Multitenant (MT), on page 136

Single Tenant (ST)

The supported instance specifications for the Cisco Catalyst SD-WAN Manager, Cisco Catalyst SD-WAN Validator, and Cisco Catalyst SD-WAN Controller are as follows:

Note
- The controller and the device software versions should be the same, to achieve the following scale.

Table 91: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 92: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled									
<250	One Node Small Cisco Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	No	Yes
<1000	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	No	Yes	Yes	No	Yes
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes	Yes	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	No	Yes	Yes	No	Yes
2000-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
5000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	No	Yes	Yes	No	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE**) Enabled									
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	No	Yes	NA	NA	NA
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	NA	Yes	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
1000-2500	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes	Yes	Yes
2500-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	No	Yes	Yes	No	Yes
2500-5000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	500 GB/Day	Yes	Yes	Yes	No	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	DR Supported***	Cisco Cloud	On-Prem (UCS - ESXi/KVM)	On-Prem (UCS - Nutanix)****	Customer Cloud
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	No	Yes	Yes	No	Yes
7000-12500	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	No	Yes	Yes	No	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor
- *** Consider the following points when choosing deployment models for Disaster Recovery:
  - Ensure the data center to disaster recovery (DC-DR) link has a minimum bandwidth of 1 Gigabit.
  - The latency between data centers should be 50 milliseconds (ms) or lower to ensure optimal performance.
- For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.
- ****Nutanix:
  - We recommended operating each UCS server as an independent, single-node Nutanix cluster with dedicated compute, storage, and management.
  - If using a Nutanix cluster deployment, you must pin VMs must to specific UCS servers using strictly enforced VM affinity policies to ensure each VM consumes only the compute and storage resources of its assigned host.

Table 93: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco Catalyst SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco Catalyst SD-WAN Manager disk size:
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for single node deployment: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 1.5 Terabytes.
- Formula to calculate the Cisco Catalyst SD-WAN Manager disk size required for cluster deployment: (Data per day × number of days × 3) + 500 GB buffer. For example, if the data per day is 100 Gigabytes, the number of days the data must be stored is 10, then the required Cisco Catalyst SD-WAN Manager disk size is 3.5 Terabytes.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 94: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-12500	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 95: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
10000-12500	10	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are twelve, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller devices for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco Catalyst SD-WAN controllers in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco Catalyst SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco Catalyst SD-WAN Controller and Cisco Catalyst SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco Catalyst SD-WAN Controller controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 96: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco Catalyst SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 97: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco Catalyst SD-WAN Manager, Cisco Catalyst SD-WAN Validator, and Cisco Catalyst SD-WAN Controller are as follows:

Table 98: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco Catalyst SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 99: Cisco Catalyst SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	DR Supported	Cisco Cloud	On-Prem (UCS)	Customer Cloud
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes	Yes
150(T) and 5000(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	Yes	No	Yes	Yes
150(T) and 7500D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	No	No	Yes	Yes



Note For DR deployments beyond the supported scale, please contact a Cisco representative for further assistance.

***** indicates that a pair of Cisco SD-WAN Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 100: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large	Standard_F2s_v2

Devices	Number of Cisco Catalyst SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Table 101: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

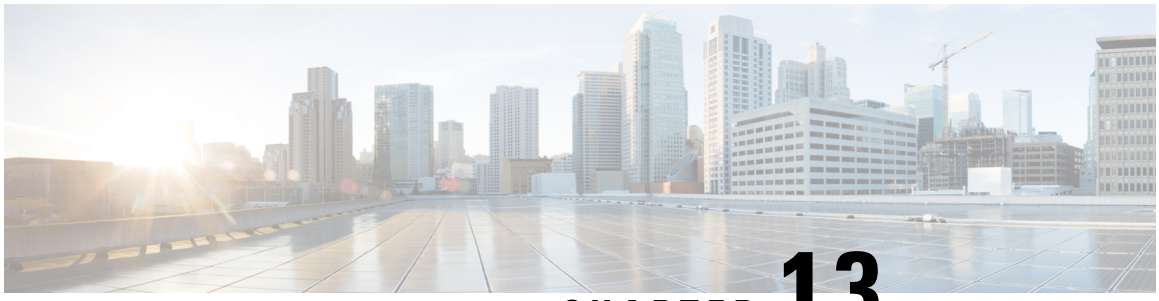
Table 102: Cisco Catalyst SD-WAN Validator and Cisco Catalyst SD-WAN Controller Specifications

Devices	Number of Cisco Catalyst SD-WAN Validator Required	Number of Cisco Catalyst SD-WAN Controller Required
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco Catalyst SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco Catalyst SD-WAN Controllers, 50 tenants require 6 Cisco Catalyst SD-WAN Controllers, and 150 tenants require 14 Cisco Catalyst SD-WAN Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco Catalyst SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco Catalyst SD-WAN Manager node up to 10 TB.
- A pair of Cisco Catalyst SD-WAN Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco Catalyst SD-WAN Validator instances in a single Cisco Catalyst SD-WAN Manager overlay is eight.



CHAPTER 13

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.11.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 141
- Multitenant (MT), on page 148

Single Tenant (ST)

The supported instance specifications for the Cisco vManage, Cisco vBond Orchestrators, and Cisco vSmart Controllers are as follows:

Note The controller and the device software versions should be the same, to achieve the following scale.

Table 103: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco vManage basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 104: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco SD-WAN Application Intelligence Engine (SAIE) Disabled							
<250	One Node Small Cisco vManage	NA	NA	NA	Yes	Yes	Yes
250-1000	One Node Medium vManage	NA	NA	NA	Yes	Yes	Yes
1000-1500	One Node Large vManage	NA	NA	NA	Yes	Yes	Yes
1500-2000	Three Node Medium vManage Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes
2000-5000	Three Node Large vManage Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes
5000-10000	Six Node Large vManage Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco SD-WAN Application Intelligence Engine (SAIE) Enabled							
<250	One Node Medium vManage	25 GB/Day	20 Days	25 GB/Day	Yes	NA	NA
<250	One Node Large vManage	50 GB/Day	30 Days	50 GB/Day	NA	Yes	Yes
250-1000	One Node Large vManage	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes
1000-4000	Three Node Large vManage Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes
4000-7000	Six Node Large vManage Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	Yes	Yes	Yes
7000-10000	Six Node Large vManage Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	Yes	Yes	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor

Table 105: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco vManage Cluster
2000-5000	Three Node Large Cisco vManage Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco SD-WAN Manager disk size:
- Formula to calculate the Cisco SD-WAN Manager disk size required for single node deployment: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 1.5 Terabytes.
- Formula to calculate the Cisco SD-WAN Manager disk size required for cluster deployment: (Data per day × number of days × 3) + 500 GB buffer. For example, if the data per day is 100 Gigabytes, the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 3.5 Terabytes.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the **Cisco SD-WAN Manager** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco SD-WAN Manager** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 106: Cisco SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco vBond	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Devices	Number of Cisco vBond	vCPU	RAM	OS Volume	vNICs	Azure	AWS
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-10000	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 107: Cisco Cisco SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco vSmart	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Devices	Number of Cisco vSmart	vCPU	RAM	OS Volume	vNICs	Azure	AWS
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are twelve, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco SD-WAN Validator and Cisco SD-WAN Controller for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco SD-WAN Validator and Cisco SD-WAN Controller instances recommended in the table above assumes a deployment with Cisco SD-WAN Control Components in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco SD-WAN Validator and Cisco SD-WAN Controller instances recommended to be deployed across the two data centers – without considering any Cisco vSmart controller group/affinity configuration.

  If you are deploying Cisco SD-WAN Validator and Cisco SD-WAN Controller instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco SD-WAN Validator groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 108: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 109: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco vManage, Cisco vBond Orchestrators, and Cisco vSmart Controllers are as follows:

Table 110: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco vManage Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 111: Cisco vManage Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	Cisco Cloud	On-Prem (UCS)	Customer Cloud
75(T) and 2500(D)*	Three Node Large vManage	100 GB/Day	14 Days	Yes	Yes	Yes
150(T) and 7500(D)*	Six Node Large vManage (64 vCPUs required)	100 GB/Day	14 Days	No	Yes	Yes

Note * indicates that a pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 112: Cisco vBond Orchestrators Recommended Computing Resources

Devices	Number of Cisco vBond	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large	Standard_F2s_v2
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Table 113: Cisco vSmart Controllers Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2

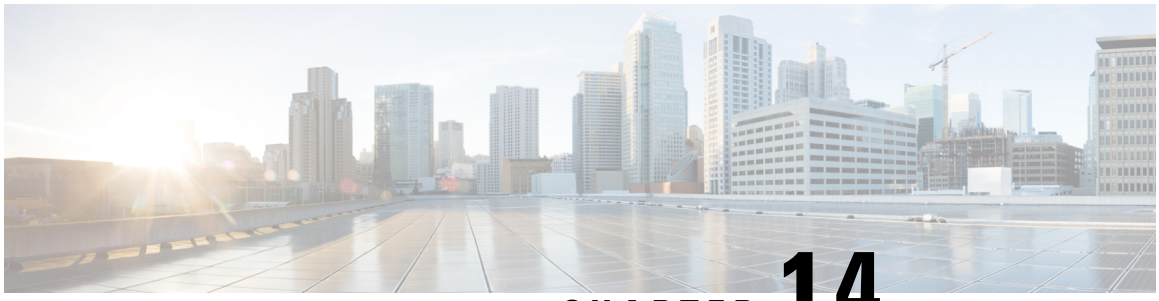
Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

Table 114: Cisco vBond and vSmart Specifications

Devices	Number of Cisco vBond Orchestrators Required	Number of Cisco vSmart Controllers Required
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants

Note

- A pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 vSmart Controllers, 50 tenants require 6 vSmart Controllers, and 150 tenants require 14 vSmart Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco vManage nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco vManage node up to 10 TB.
- A pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco vBond Orchestrator instances in a single Cisco SD-WAN overlay is eight.



CHAPTER 14

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.10.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 153
- Multitenant (MT), on page 160

Single Tenant (ST)

The supported instance specifications for the Cisco vManage, Cisco vBond Orchestrators, and Cisco vSmart Controllers are as follows:

Note The controller and the device software versions should be the same, to achieve the following scale.

Table 115: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco vManage basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 116: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco SD-WAN Application Intelligence Engine (SAIE) Disabled							
<250	One Node Small Cisco vManage	NA	NA	NA	Yes	Yes	Yes
250-1000	One Node Medium vManage	NA	NA	NA	Yes	Yes	Yes
1000-1500	One Node Large vManage	NA	NA	NA	Yes	Yes	Yes
1500-2000	Three Node Medium vManage Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes
2000-5000	Three Node Large vManage Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes
5000-10000	Six Node Large vManage Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco SD-WAN Application Intelligence Engine (SAIE) Enabled							
<250	One Node Medium vManage	25 GB/Day	20 Days	25 GB/Day	Yes	NA	NA
<250	One Node Large vManage	50 GB/Day	30 Days	50 GB/Day	NA	Yes	Yes
250-1000	One Node Large vManage	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes
1000-4000	Three Node Large vManage Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes
4000-7000	Six Node Large vManage Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	Yes	Yes	Yes
7000-10000	Six Node Large vManage Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	Yes	Yes	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the following statistics are also considered in the recommendations:
  - Approute
  - Performance Monitor

Table 117: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco vManage Cluster
2000-5000	Three Node Large Cisco vManage Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco SD-WAN Manager disk size:
- Formula to calculate the Cisco SD-WAN Manager disk size required for single node deployment: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 1.5 Terabytes.
- Formula to calculate the Cisco SD-WAN Manager disk size required for cluster deployment: (Data per day × number of days × 3) + 500 GB buffer. For example, if the data per day is 100 Gigabytes, the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 3.5 Terabytes.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the **Cisco SD-WAN Manager** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco SD-WAN Manager** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 118: Cisco SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Devices	Number of Cisco SD-WAN Validators	vCPU	RAM	OS Volume	vNICs	Azure	AWS
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-10000	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 119: Cisco Catalyst SD-WAN Controllers Recommended Computing Resources

Devices	Number of Cisco Catalyst SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Devices	Number of Cisco Catalyst SD-WAN Controllers	vCPU	RAM	OS Volume	vNICs	Azure	AWS
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are twelve, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco SD-WAN Validator and Cisco SD-WAN Controller for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco SD-WAN Validator and Cisco SD-WAN Controller instances recommended in the table above assumes a deployment with Cisco SD-WAN Control Components in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco SD-WAN Validator and Cisco SD-WAN Controller instances recommended to be deployed across the two data centers – without considering any Cisco vSmart controller group/affinity configuration.

  If you are deploying Cisco SD-WAN Validator and Cisco SD-WAN Controller instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco SD-WAN Validator groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 120: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v

Hardware SKU	Specifications
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)



Note

- Any UCS Platform (Fifth and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco SD-WAN Controllers with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 121: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD



Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco vManage, Cisco vBond Orchestrators, and Cisco vSmart Controllers are as follows:

Table 122: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs	RAM	Storage Size	Azure	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	Standard_F64s_v2	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco vManage Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 123: Cisco vManage Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	Cisco Cloud	On-Prem (UCS)	Customer Cloud
75(T) and 2500(D)*	Three Node Large vManage	100 GB/Day	14 Days	Yes	Yes	Yes
150(T) and 7500(D)*	Six Node Large vManage (64 vCPUs required)	100 GB/Day	14 Days	No	Yes	Yes

Note * indicates that a pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all the tenants.

Table 124: Cisco vBond Orchestrators Recommended Computing Resources

Devices	Number of Cisco vBond	vCPU	RAM	OS Volume	vNICs	AWS	Azure
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large	Standard_F2s_v2

Devices	Number of Cisco vBond	vCPU	RAM	OS Volume	vNICs	AWS	Azure
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2

Table 125: Cisco vSmart Controllers Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS	Azure
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge	Standard_F4s_v2
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge	Standard_F8s_v2

Note This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.

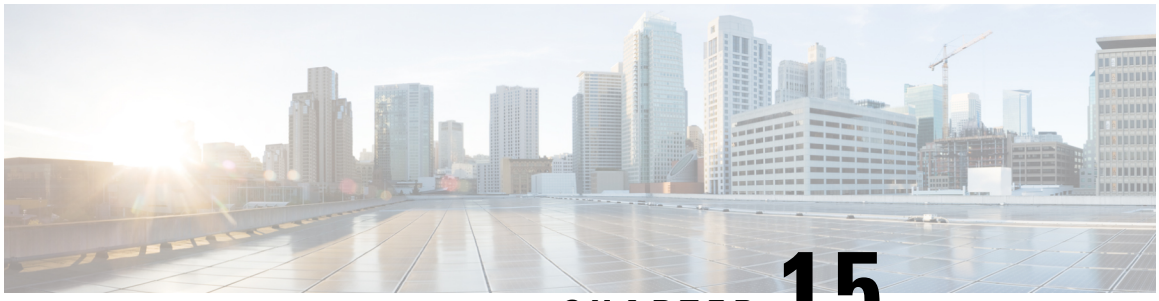
Table 126: Cisco vBond and vSmart Specifications

Devices	Number of Cisco vBond Orchestrators Required	Number of Cisco vSmart Controllers Required
75 Tenants or 2500 Devices	2	A pair for every 24 tenants
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 vSmart Controllers, 50 tenants require 6 vSmart Controllers, and 150 tenants require 14 vSmart Controllers.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco vManage nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco vManage node up to 10 TB.
- A pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco vBond Orchestrator instances in a single Cisco SD-WAN overlay is eight.



CHAPTER 15

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.9.x

Note Starting from Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources are specified for single tenant and multitenants according to the instance type definitions. Prior to Cisco Catalyst SD-WAN Control Components Release 20.9.x, the recommended computing resources were specified based the deployment modes.

- Single Tenant (ST), on page 165
- Multitenant (MT), on page 173

Single Tenant (ST)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Note The control components and the device software versions should be the same, to achieve the following scale.

Table 127: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type	
	vCPUs*	RAM*	Storage Size*	Azure	AWS
Small	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2	c5.4xlarge
Medium	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2	c5.9xlarge
Large	32 vCPUs	128 GB RAM	5 TB	Standard_D32ds_v5	c5.18xlarge and m6i.8xlarge**

* vCPU, RAM, and Storage Size numbers are on per Cisco SD-WAN Manager basis. The Storage Size numbers can be sized up to 10 TB for on-prem and customer cloud hosted.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 128: Instance Types with Number of Devices, Nodes and Deployment Models

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	Cisco Cloud	On-Prem (UCS)	Customer Cloud
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled							
<250	One Node Small Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes
250-1000	One Node Medium Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA	NA	Yes	Yes	Yes
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	NA	NA	NA	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	Cisco Cloud	On-Prem (UCS)	Customer Cloud
5000-10000	Six Node Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats and AppServer	NA	NA	NA	Yes	Yes	Yes
** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled							
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days	25 GB/Day	Yes	NA	NA
<250	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	NA	Yes	Yes
250-1000	One Node Large Cisco SD-WAN Manager	50 GB/Day	30 Days	50 GB/Day	Yes	Yes	Yes
1000-4000	Three Node Large Cisco SD-WAN Manager Cluster (All Services)	100 GB/Day	14 Days	300 GB/Day	Yes	Yes	Yes

Devices	Nodes and Deployment Models with Instance Type	Data Processing Factor	Number of days the data can be stored	Max Daily Processing Volume	Cisco Cloud	On-Prem (UCS)	Customer Cloud
4000-7000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	2 TB/Day*	Yes	Yes	Yes
7000-10000	Six Node Large Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server, stats, and AppServer	100 GB/Day	14 Days	1 TB/Day*	Yes	Yes	Yes

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.

Table 129: Supported Scale on Cisco HyperFlex (HX), SAIE Disabled

Devices	Nodes and Deployment Models with Instance Types
0-2000	Three Node Medium Cisco SD-WAN Manager Cluster
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster

To achieve scale beyond the numbers mentioned in the tables above, deploy multiple overlays.

Note

- The number of days the data can be stored in Cisco SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco SD-WAN Manager disk size:
- Formula to calculate the Cisco SD-WAN Manager disk size required for single node deployment: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 1.5 Terabytes.
- Formula to calculate the Cisco SD-WAN Manager disk size required for cluster deployment: (Data per day × number of days × 3) + 500 GB buffer. For example, if the data per day is 100 Gigabytes, the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 3.5 Terabytes.

Note Maximum tested disk size for On-prem is 10 TB per instance.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated SAIE size. The aggregated SAIE size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated SAIE also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the SAIE and aggregated SAIE index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated SAIE value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated SAIE** size to the desired value based on your SAIE traffic, the default disk size allocation is 5 GB.

Note When SAIE is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your SAIE traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 130: Cisco SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
4000-8000	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
8000-10000	6	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge

Table 131: Cisco SD-WAN Controller Recommended Computing Resources

Devices	Number of Cisco vSmart	vCPU	RAM	OS Volume	vNICs	Azure	AWS
<250	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2	c5.xlarge
250-1000	2	4	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_D4ds_v5	c5.2xlarge

Devices	Number of Cisco vSmart	vCPU	RAM	OS Volume	vNICs	Azure	AWS
1000-2500	2	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
2500-5000	4	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
5000-7500	6	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge
7500-10000	8	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2	c5.2xlarge

Note

- This image can be deployed on standard F8_v2; however, standard F8s_v2 is the recommended instance type.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay are twelve, similarly the maximum number of tested Cisco SD-WAN Controller instances is twelve.
- The required number of vCPUs and RAM for Cisco SD-WAN Validator and Cisco SD-WAN Controller for Cisco Cloud Hosted overlays are determined by the Cisco Cloud Ops and provisioned accordingly.
- The number of Cisco SD-WAN Controller and Cisco SD-WAN Validator instances recommended in the table above assumes a deployment with Cisco SD-WAN Control Components in two locations (i.e. data centers) designed for redundancy – with half the controllers in one data center and half the controllers in another data center. In other words, the table above already considers the 1:1 redundancy in the number of Cisco SD-WAN Controller and Cisco SD-WAN Validator instances recommended to be deployed across the two data centers – without considering any Cisco SD-WAN Controller group/affinity configuration.

  If you are deploying Cisco SD-WAN Controller and Cisco SD-WAN Validator instances with a different set of assumptions, for example, across three data centers, or if you are using Cisco SD-WAN Controller groups/affinity within your deployment, refer to the Points to Consider chapter for additional guidance.

Table 132: Testbed Specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, and PS.
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz Intel(R) Xeon(R) Gold 6330N CPU @ 2.20GHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note

- Any UCS Platform (Fifth and sixth generation above) with the same or higher hardware specifications mentioned in the above table supports Cisco SD-WAN Control Components with similar scale numbers mentioned in this document.
- The CPU specifications are not tied to any brand, both AMD and Intel brands with specifications above are supported.

Table 133: Testbed Specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Note

- The tested replication factor is three.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant (MT)

The supported instance specifications for the Cisco SD-WAN Manager, Cisco SD-WAN Validator, and Cisco SD-WAN Controller are as follows:

Table 134: Instance Type Definitions

Instance Type	Specifications (Approximation)			Qualified Instance Type
	vCPUs	RAM	Storage Size	AWS
Large	32 vCPUs*	128 GB RAM	5 TB	c5.18xlarge and m6i.8xlarge**

* requires 64 vCPU for multi-tenant deployment in the Cisco SD-WAN Manager Specifications table for deploying beyond 2500 devices.

** This instance can be deployed on c5.18xlarge and m6i.8xlarge. However, we recommend using the m6i.8xlarge instance type for this deployment.

Table 135: Cisco SD-WAN Manager Specifications

Max Tenants (T) and Devices (D)	Nodes and Deployment Models with Instances Type	Data Processing Factor	Number of Days the Data Can be Stored	Cisco Cloud	On-Prem (UCS)	Customer Cloud
75(T) and 2500(D)*	Three Node Large Cisco SD-WAN Manager	100 GB/Day	14 Days	Yes	Yes	Yes
150(T) and 7500(D)*	Six Node Large Cisco SD-WAN Manager (64 vCPUs required)	100 GB/Day	14 Days	No	Yes	Yes

Note * indicates that a pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants.

Table 136: Cisco SD-WAN Validator Recommended Computing Resources

Devices	Number of Cisco SD-WAN Validator	vCPU	RAM	OS Volume	vNICs	AWS
<1000	2	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	c5.large
1000-4000	2	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge
4000-7500	4	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge

Table 137: Cisco SD-WAN Controller Recommended Computing Resources

Devices	vCPU	RAM	OS Volume	vNICs	AWS
< 250	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	c5.xlarge
250-2500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge
2500-5000	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge
5000-7500	8	16 GB	10 GB	2 (one for tunnel interface, one for management)	c5.2xlarge

Table 138: Cisco SD-WAN Validator and Cisco SD-WAN Controller Specifications

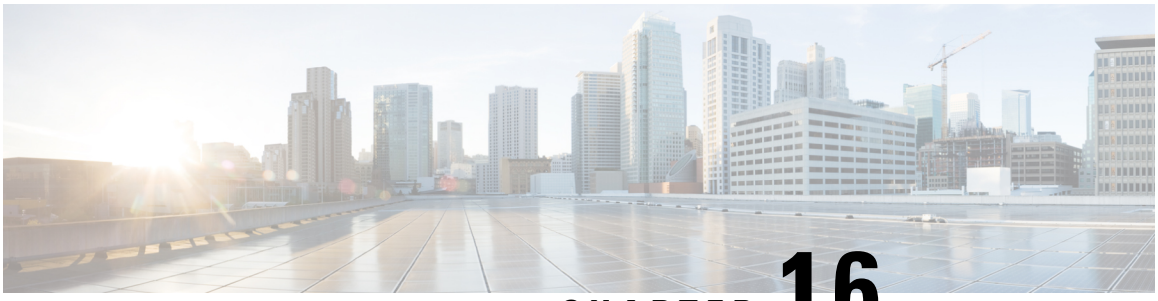
Devices	Number of Cisco SD-WAN Validator Required	Number of Cisco SD-WAN Controller Required
75 Tenants or 2500 Devices	2	A pair for every 24 tenants

Devices	Number of Cisco SD-WAN Validator Required	Number of Cisco SD-WAN Controller Required
150 Tenants or 7500 Devices	2 (additional 2 if deployment goes beyond 4000 devices)	A pair for every 24 tenants



Note

- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all the tenants. For example, 24 tenants require 2 Cisco SD-WAN Controller, 50 tenants require 6 Cisco SD-WAN Controller, and 150 tenants require 14 Cisco SD-WAN Controller.
- The SAIE numbers are for the entire multi-tenant (cluster) deployment and there is no per tenant SAIE limitation.
- If SAIE is enabled, we recommend that the aggregated SAIE data (across all Cisco SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the SAIE data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco SD-WAN Manager node up to 10 TB.
- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay is eight.



CHAPTER 16

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.8.x (Cisco Hosted Cloud Deployment)

Starting from Cisco SD-WAN Manager Release 20.6.x, new cloud controller instances are introduced. There are three types of these instances- Small, Medium, and Large, based on computing resources. The following table shows the specifications associated with each instance type.

Instance Type	Specifications (Approximation)		
	vCPUs	RAM	Storage Size
Small	16 vCPUs	32 GB RAM	500 GB
Medium	32 vCPUs	64 GB RAM	1 TB
Large	32 vCPUs	128 GB RAM	5 TB

Table 139: Instance Types With Number of Devices and Nodes and Deployment Models

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Disabled**			
<250	One Node Small vManage	NA	NA
250-1000	One Node Medium vManage	NA	NA
1000-1500	One Node Large vManage	NA	NA
1500-2000	Three Node Medium vManage Cluster	NA	NA
2000-5000	Three Node Large vManage Cluster	NA	NA
5000-7000	Six Node Large vManage Cluster	NA	NA

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Enabled**			
<250	One Node Medium vManage	25 GB/Day	20 Days
250-1000	One Node Large vManage (All Services)	50 GB/Day	30 Days
1000-2000	Three Node Large vManage Cluster	100 GB/Day	14 Days
2000-7000	Six Node Large vManage Cluster	100 GB/Day	14 Days

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.

Note The number of days the data can be stored in Cisco SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco SD-WAN Manager disk size:

Formula to calculate the Cisco SD-WAN Manager disk size required for single node deployment: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 1.5 Terabytes.

Formula to calculate the Cisco SD-WAN Manager disk size required for cluster deployment: (Data per day × number of days × 3) + 500 GB buffer. For example, if the data per day is 100 Gigabytes, the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 3.5 Terabytes.

Table 140: Number of Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers Required for Respective Device Ranges

Devices	Number of Cisco Catalyst SD-WAN Validators required	Number of Cisco Catalyst SD-WAN Controllers required
<250	2	2
250-1000	2	2
1000-1500	2	2
1500-2000	4	4
2000-5000	6	6
5000-7000	8	8

Note The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers, is determined by the Cloud Ops and is provisioned accordingly.

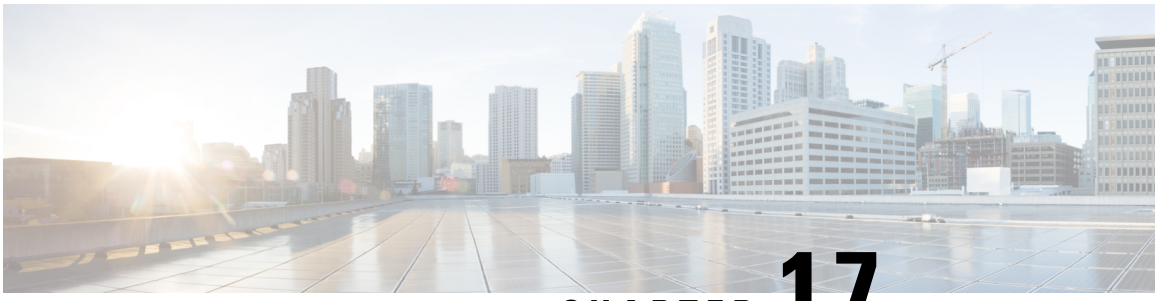
Multitenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controllers are as follows:

Table 141: Hardware Specifications to Support 50 Tenants and 1000 Devices

Server	Cisco vManage	Cisco vBond Orchestrator	Cisco vSmart Controller
Deployment Model	Cloud hosted	Cloud hosted	Cloud hosted
Number of Instances	3 instances	2 instances	6 instances
Instance Type	Large	NA	NA

Note The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers, is determined by the Cloud Ops and is provisioned accordingly.



CHAPTER 17

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.8.x (Customer Cloud Hosted on Azure Deployment)

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller for Azure are as follows:

Note The controller and the device version should be the same, to achieve the below scale.

Table 142: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Azure Instance Sizing
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Disabled**						
<250	Disabled	One Node vManage (All Services)	16 vCPUs	32 GB RAM	500 GB	Standard_F16s_v2
250-1000	Disabled	One Node vManage (All Services)	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2
1000-1500	Disabled	One Node vManage (All Services)	32 vCPUs	128 GB RAM	1 TB	Standard_F64s_v2
1500-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	Standard_F32s_v2
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	Standard_F64s_v2

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Azure Instance Sizing
5000-7000	Disabled	Six Node vManage Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats, and AppServer	32 vCPUs	128 GB RAM	1 TB	Standard_F64s_v2
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Enabled**						
<500	50 GB/Day	One Node vManage (All Services)	32 vCPUs	128 GB RAM	10 TB	Standard_F64s_v2
500-2000	100 GB/Day	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	Standard_F64s_v2
2000-7000	2.0 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	10 TB	Standard_F64s_v2

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.
- * vCPU, RAM, and Storage Size numbers are on per Cisco SD-WAN Manager basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

** For a larger dataset per day, have Stats running on all servers.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Note In Cisco vManage Release 20.5.1 and earlier releases, You can modify the **DPI** size to the desired value to achieve the above mentioned storage size numbers.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated DPI size. The aggregated DPI size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated DPI also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the DPI and aggregated DPI index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated DPI value,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated DPI** size to the desired value based on your DPI traffic, the default disk size allocation is 5 GB.

Note When DPI is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your DPI traffic, the default collection interval is 30 minutes.
4. Click **Save**.

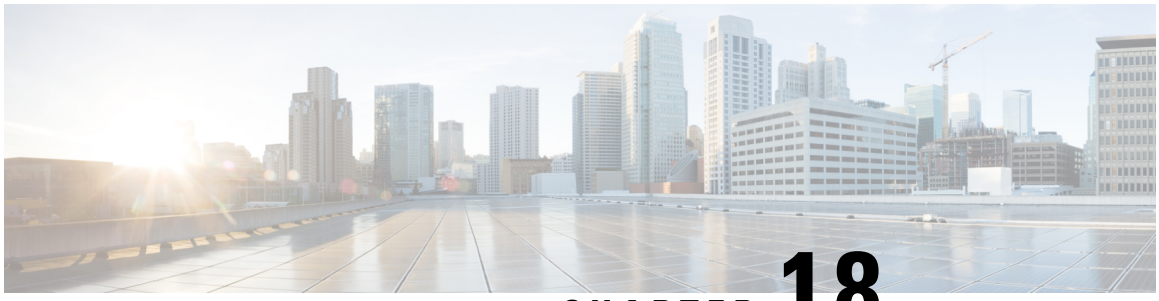
Table 143: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	vCPUs	RAM	OS Volume	vNICs	Azure Instance Sizing
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
1001 -1500	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2

Table 144: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPUs	RAM	OS Volume	vNICs	Azure Instance Sizing

1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2
1001 -1500	8	16 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2



CHAPTER 18

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.8.x (On-Prem Deployment)

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Note For cloud deployments, the Cisco operation teams actively monitor the customer deployment and add resource in collaboration with the customer. This topic does not include recommendations for Cisco cloud deployments.

Note The controller and the device version should be the same, to achieve the below scale.

Table 145: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
On-Prem						
**** SD-WAN Application Intelligence Engine (SAIE) Disabled**						
<250	Disabled	One Node vManage (All Services)	16 vCPUs	32 GB RAM	500 GB	UCS
250-1000	Disabled	One Node vManage (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
1000-1500	Disabled	One Node vManage (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
1500-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
5000-7000	Disabled	Six Node vManage Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	1 TB	UCS
0-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	HX
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	HX
**** SD-WAN Application Intelligence Engine (SAIE) Enabled**						
<500	50 GB/Day	One Node vManage (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
500-2000	100 GB/Day	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
2000-7000	2.0 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	10 TB	UCS

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.
- * vCPU, RAM, and Storage Size numbers are on per Cisco SD-WAN Manager basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

** For a larger dataset per day, have Stats running on all servers.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Note In Cisco vManage Release 20.5.1 and earlier releases, You can modify the **DPI** size to the desired value to achieve the above mentioned storage size numbers.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated DPI size. The aggregated DPI size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated DPI also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the DPI and aggregated DPI index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated DPI value,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated DPI** size to the desired value based on your DPI traffic, the default disk size allocation is 5 GB.

Note When DPI is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your DPI traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 146: Cisco Catalyst SD-WAN Validator Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
1001 or more	4	8 GB	10 GB	2 (one for tunnel interface, one for management)

Note The tested and recommended limit of supported Cisco vBond Orchestrator instances in a single Cisco SD-WAN overlay is eight.

Table 147: Cisco Catalyst SD-WAN Controller Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)
1001 or more	8	16 GB	16 GB	2 (one for tunnel interface, one for management)

Testbed Specifications

Table 148: Testbed specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, PS
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)



Note Any UCS Platform (Fifth generation and above) with the same or higher hardware specifications mentioned in the above table supports Cisco SD-WAN Controllers with similar scale numbers mentioned in this document.

Drive specifications:

- Interface Speed— 12.0 Gbit per second
- Read speed (64KB) —1800 MB per second
- Write speed (64KB)—850 MB per second

Note

- The recommended numbers are based on the test setup specifications. Systems below these requirements may have challenges processing high volume of statistics data like SAIE.
- Tested with 10 TB Volume (8 X 1.6 TB SSD Drives Raid 0).
- Default hyperthreading is enabled.
- Slower disks can impact processing speed.

Table 149: Testbed specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Drive specifications:

- The tested replication factor is 3.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controllers are as follows:

Table 150: Hardware Specifications to Support 50 Tenants and 1000 Devices

Server	Cisco vManage	Cisco vBond Orchestrator	Cisco vSmart Controller
Deployment Model	On-premises Cluster	On-premises deployment	On-premises deployment

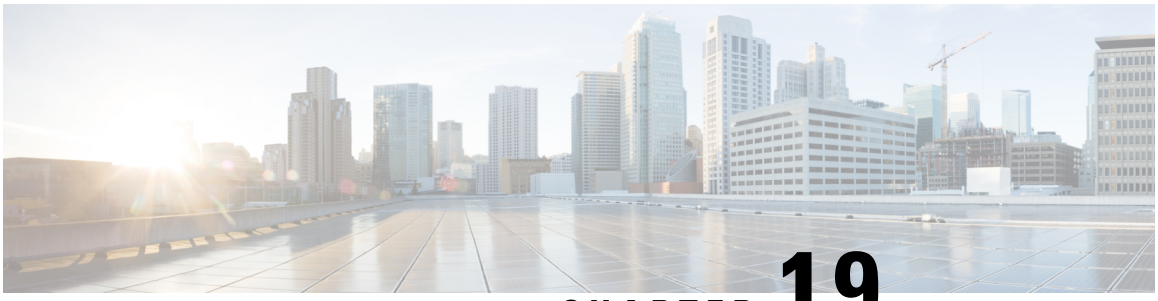
Number of Instances	3 Compute+Data nodes	2 instances	2 instances per 24 tenants To support 50 tenants and 1000 devices across all tenants, deploy 6 Cisco vSmart Controller instances.
CPU	32 vCPU	4 vCPU	8 vCPU
DRAM	128 GB	4 GB	16 GB
Hard Disk	Minimum: 1 TB; Recommended: 10 TB	10 GB	10 GB
Bandwidth	1 Gbps	10 Mbps	100 Mbps

Table 151: Hardware Specifications to Support 100 Tenants and 5000 Devices

Server	**Cisco vManage**	**Cisco vBond Orchestrator**	**Cisco vSmart Controller**
Deployment Model	On-premises Cluster	On-premises deployment	On-premises deployment
Number of Instances	6 nodes: 3 Compute+Data nodes and 3 Data nodes	2 instances	2 instances per 24 tenants To support 100 tenants and 5000 devices across all tenants, deploy 10 Cisco vSmart Controllers.
CPU	64 vCPU	4 vCPU	8 vCPU
DRAM	128 GB	4 GB	16 GB
Hard Disk	Minimum: 2 TB; Recommended: 10 TB	10 GB	10 GB
Bandwidth	1 Gbps	10 Mbps	100 Mbps

Note

- If DPI is enabled, we recommend that the aggregated DPI data (across all Cisco vManage nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the DPI data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco vManage node up to 10 TB.
- A pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco vBond Orchestrator instances in a single Cisco SD-WAN overlay is eight.



CHAPTER 19

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.7.x (Cisco Hosted Cloud Deployment)

Starting from Cisco SD-WAN Manager Release 20.6.x, new cloud controller instances are introduced. There are three types of these instances- Small, Medium, and Large, based on computing resources. The following table shows the specifications associated with each instance type.

Instance Type	Specifications (Approximation)		
	vCPUs	RAM	Storage Size
Small	16 vCPUs	32 GB RAM	500 GB
Medium	32 vCPUs	64 GB RAM	1 TB
Large	32 vCPUs	128 GB RAM	5 TB

Table 152: Instance Types With Number of Devices and Nodes and Deployment Models

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Disabled**			
<250	One Node Small vManage	NA	NA
250-1000	One Node Medium vManage	NA	NA
1000-1500	One Node Large vManage	NA	NA
1500-2000	Three Node Medium vManage Cluster	NA	NA
2000-5000	Three Node Large vManage Cluster	NA	NA
5000-7000	Six Node Large vManage Cluster	NA	NA

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Enabled**			
<250	One Node Medium vManage	25 GB/Day	20 Days
250-1000	One Node Large vManage (All Services)	50 GB/Day	30 Days
1000-2000	Three Node Large vManage Cluster	100 GB/Day	14 Days
2000-7000	Six Node Large vManage Cluster	100 GB/Day	14 Days

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.

Note The number of days the data can be stored in Cisco SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco SD-WAN Manager disk size:

Formula to calculate the Cisco SD-WAN Manager disk size required for single node deployment: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 1.5 Terabytes.

Formula to calculate the Cisco SD-WAN Manager disk size required for cluster deployment: (Data per day × number of days × 3) + 500 GB buffer. For example, if the data per day is 100 Gigabytes, the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 3.5 Terabytes.

Table 153: Number of Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers Required for Respective Device Ranges

Devices	Number of Cisco Catalyst SD-WAN Validators required	Number of Cisco Catalyst SD-WAN Controllers required
<250	2	2
250-1000	2	2
1000-1500	2	2
1500-2000	4	4
2000-5000	6	6
5000-7000	8	8

Note The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers, is determined by the Cloud Ops and is provisioned accordingly.

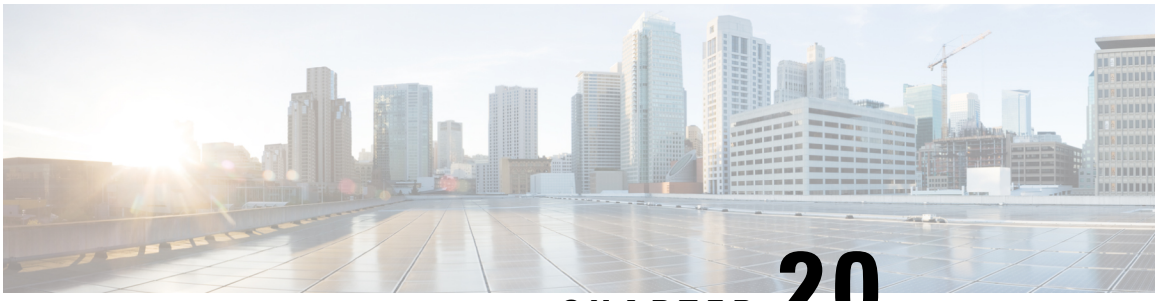
Multitenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controllers are as follows:

Table 154: Hardware Specifications to Support 50 Tenants and 1000 Devices

Server	Cisco vManage	Cisco vBond Orchestrator	Cisco vSmart Controller
Deployment Model	Cloud hosted	Cloud hosted	Cloud hosted
Number of Instances	3 instances	2 instances	6 instances
Instance Type	Large	NA	NA

Note The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers, is determined by the Cloud Ops and is provisioned accordingly.



CHAPTER 20

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.7.x (Customer Cloud Hosted on Azure Deployment)

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller for Azure are as follows:

Note The controller and the device version should be the same, to achieve the below scale.

Table 155: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Azure Instance Sizing
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Disabled**						
<250	Disabled	One Node vManage (All Services)	16 vCPUs	32 GB RAM	500 GB	[illegible]
250-1000	Disabled	One Node vManage (All Services)	32 vCPUs	64 GB RAM	1 TB	[illegible]
1000-1500	Disabled	One Node vManage (All Services)	32 vCPUs	128 GB RAM	1 TB	[illegible]
1500-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	[illegible]
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	[illegible]

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Azure Instance Sizing
5000-7000	Disabled	Six Node vManage Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats, and AppServer	32 vCPUs	128 GB RAM	1 TB	
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Enabled**						
<500	50 GB/Day	One Node vManage (All Services)	32 vCPUs	128 GB RAM	10 TB	
500-2000	100 GB/Day	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	
2000-7000	2.0 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	10 TB	

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.

* vCPU, RAM, and Storage Size numbers are on per Cisco vManage basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Note In Cisco vManage Release 20.5.1 and earlier releases, You can modify the **DPI** size to the desired value to achieve the above mentioned storage size numbers.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated DPI size. The aggregated DPI size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated DPI also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the DPI and aggregated DPI index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated DPI value,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated DPI** size to the desired value based on your DPI traffic, the default disk size allocation is 5 GB.

Note When DPI is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your DPI traffic, the default collection interval is 30 minutes.
4. Click **Save**.

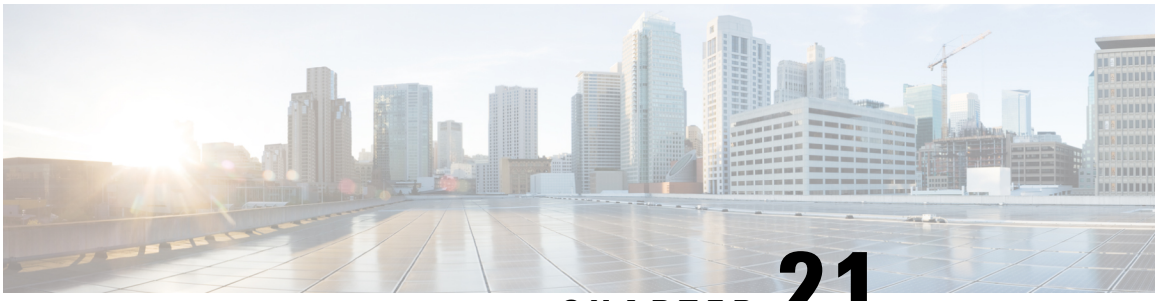
Table 156: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	vCPUs	RAM	OS Volume	vNICs	Azure Instance Sizing
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
1001 -1500	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2

Table 157: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPUs	RAM	OS Volume	vNICs	Azure Instance Sizing

1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2
1001 -1500	8	16 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2



CHAPTER 21

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.7.x (On-Prem Deployment)

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Note For cloud deployments, the Cisco operation teams actively monitor the customer deployment and add resource in collaboration with the customer. This topic does not include recommendations for Cisco cloud deployments.

Note The controller and the device version should be the same, to achieve the below scale.

Table 158: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
On-Prem						
**** SD-WAN Application Intelligence Engine (SAIE) Disabled**						
<250	Disabled	One Node vManage (All Services)	16 vCPUs	32 GB RAM	500 GB	UCS
250-1000	Disabled	One Node vManage (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
1000-1500	Disabled	One Node vManage (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
1500-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
5000-7000	Disabled	Six Node vManage Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	1 TB	UCS
0-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	HX
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	HX
**** SD-WAN Application Intelligence Engine (SAIE) Enabled**						
<500	50 GB/Day	One Node vManage (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
500-2000	100 GB/Day	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
2000-7000	2.0 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	10 TB	UCS

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.
- * vCPU, RAM, and Storage Size numbers are on per Cisco vManage basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Note In Cisco vManage Release 20.5.1 and earlier releases, You can modify the **DPI** size to the desired value to achieve the above mentioned storage size numbers.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated DPI size. The aggregated DPI size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated DPI also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the DPI and aggregated DPI index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated DPI value,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated DPI** size to the desired value based on your DPI traffic, the default disk size allocation is 5 GB.

Note When DPI is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your DPI traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 159: Cisco Catalyst SD-WAN Validator Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
1001 or more	4	8 GB	10 GB	2 (one for tunnel interface, one for management)

Note The tested and recommended limit of supported Cisco vBond Orchestrator instances in a single Cisco SD-WAN overlay is eight.

Table 160: Cisco Catalyst SD-WAN Controller Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)
1001 or more	8	16 GB	16 GB	2 (one for tunnel interface, one for management)

Testbed Specifications

Table 161: Testbed specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, PS
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)



Note Any UCS Platform (Fifth generation and above) with the same or higher hardware specifications mentioned in the above table supports Cisco SD-WAN Controllers with similar scale numbers mentioned in this document.

Drive specifications:

- Interface Speed— 12.0 Gbit per second
- Read speed (64KB) —1800 MB per second
- Write speed (64KB)—850 MB per second

Note

- The recommended numbers are based on the test setup specifications. Systems below these requirements may have challenges processing high volume of statistics data like SAIE.
- Tested with 10 TB Volume (8 X 1.6 TB SSD Drives Raid 0).
- Default hyperthreading is enabled.
- Slower disks can impact processing speed.

Table 162: Testbed specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Drive specifications:

- The tested replication factor is 3.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controllers are as follows:

Table 163: Hardware Specifications to Support 50 Tenants and 1000 Devices

Server	Cisco vManage	Cisco vBond Orchestrator	Cisco vSmart Controller
Deployment Model	On-premises Cluster	On-premises deployment	On-premises deployment

Number of Instances	3 Compute+Data nodes	2 instances	2 instances per 24 tenants To support 50 tenants and 1000 devices across all tenants, deploy 6 Cisco vSmart Controller instances.
CPU **DRAM** **Hard Disk**	32 vCPU 128 GB Minimum: 1 TB; Recommended: 10 TB	4 vCPU 4 GB 10 GB	8 vCPU 16 GB 10 GB
Bandwidth	1 Gbps	10 Mbps	100 Mbps

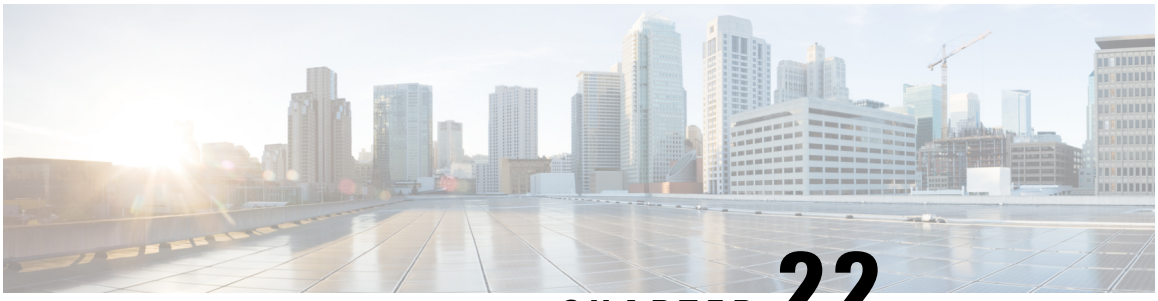
Table 164: Hardware Specifications to Support 100 Tenants and 5000 Devices

Server	Cisco vManage	Cisco vBond Orchestrator	Cisco vSmart Controller
Deployment Model	On-premises Cluster	On-premises deployment	On-premises deployment
Number of Instances	6 nodes: 3 Compute+Data nodes and 3 Data nodes	2 instances	2 instances per 24 tenants To support 100 tenants and 5000 devices across all tenants, deploy 10 Cisco vSmart Controllers.
CPU **DRAM** **Hard Disk**	64 vCPU 128 GB Minimum: 2 TB; Recommended: 10 TB	4 vCPU 4 GB 10 GB	8 vCPU 16 GB 10 GB
Bandwidth	1 Gbps	10 Mbps	100 Mbps



Note

- If DPI is enabled, we recommend that the aggregated DPI data (across all Cisco vManage nodes and all tenants in the multitenant system) does not exceed 350 GB per day. If the DPI data exceeds 350 GB per day, increase the Hard Disk capacity of each Cisco vManage node up to 10 TB.
- A pair of Cisco vSmart Controllers supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco vBond Orchestrator instances in a single Cisco SD-WAN overlay is eight.



CHAPTER 22

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.6.x (Cisco Hosted Cloud Deployment)

Starting from Cisco vManage Release 20.6.x, new cloud controller instances are introduced. There are three types of these instances- Small, Medium, and Large, based on computing resources. The following table shows the specifications associated with each instance type.

Instance Type	Specifications (Approximation)		
	vCPUs	RAM	Storage Size
Small	16 vCPUs	32 GB RAM	500 GB
Medium	32 vCPUs	64 GB RAM	1 TB
Large	32 vCPUs	128 GB RAM	5 TB

Table 165: Instance Types With Number of Devices and Nodes and Deployment Models

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**			
<250	One Node Small Cisco SD-WAN Manager	NA	NA
250-1000	One Node Medium Cisco SD-WAN Manager	NA	NA
1000-1500	One Node Large Cisco SD-WAN Manager	NA	NA
1500-2000	Three Node Medium Cisco SD-WAN Manager Cluster	NA	NA

Devices	Nodes and deployment models with instance type	Data processing factor	Number of days the data can be stored
2000-5000	Three Node Large Cisco SD-WAN Manager Cluster	NA	NA
5000-7000	Six Node Large Cisco SD-WAN Manager Cluster	NA	NA
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled**			
<250	One Node Medium Cisco SD-WAN Manager	25 GB/Day	20 Days
250-1000	One Node Large Cisco SD-WAN Manager (All Services)	50 GB/Day	30 Days
1000-2000	Three Node Large Cisco SD-WAN Manager Cluster	100 GB/Day	14 Days
2000-7000	Six Node Large Cisco SD-WAN Manager Cluster	100 GB/Day	14 Days

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.

Note The number of days the data can be stored in Cisco SD-WAN Manager, depends on per-day processing volume of the device nodes. To store the data for a longer time or to accommodate the increase in per-day processing volume, use the following formulas to calculate the required Cisco SD-WAN Manager disk size:

Formula to calculate the Cisco SD-WAN Manager disk size required for single node deployment: (Data per day × number of days) + 500 GB buffer. For example, if the data per day is 100 Gigabytes and the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 1.5 Terabytes.

Formula to calculate the Cisco SD-WAN Manager disk size required for cluster deployment: (Data per day × number of days × 3) + 500 GB buffer. For example, if the data per day is 100 Gigabytes, the number of days the data must be stored is 10, then the required Cisco SD-WAN Manager disk size is 3.5 Terabytes.

Table 166: Number of Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers Required for Respective Device Ranges

Devices	Number of Cisco Catalyst SD-WAN Validators required	Number of Cisco Catalyst SD-WAN Controllers required
<250	2	2
250-1000	2	2
1000-1500	2	2
1500-2000	4	4
2000-5000	6	6
5000-7000	8	8



Note The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers, is determined by the Cloud Ops and is provisioned accordingly.

Multitenant

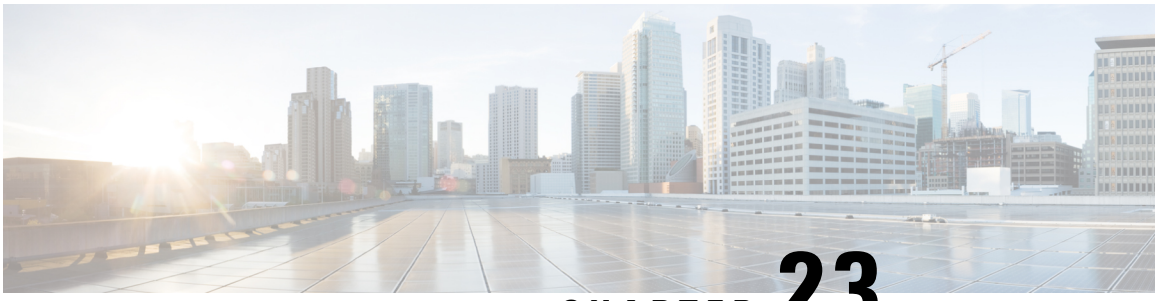
The supported hardware specifications for the Cisco Catalyst SD-WAN Validator, Cisco SD-WAN Manager, and the Cisco Catalyst SD-WAN Controller are as follows:

Table 167: Hardware Specifications to Support 50 Tenants and 1000 Devices

Server	Cisco SD-WAN Manager	Cisco Catalyst SD-WAN Validator	Cisco SD-WAN Controller
Deployment Model	Cloud hosted	Cloud hosted	Cloud hosted
Number of Instances	3 instances	2 instances	6 instances
Instance Type	Large	NA	NA



Note The required number of vCPUs and RAM for Cisco Catalyst SD-WAN Validators and Cisco Catalyst SD-WAN Controllers, is determined by the Cloud Ops and is provisioned accordingly.



CHAPTER 23

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.6.x (Customer Cloud Hosted on Azure Deployment)

Single Tenant

The supported hardware specifications for the Cisco SD-WAN Validator, Cisco SD-WAN Manager, and the Cisco SD-WAN Controller for Azure are as follows:

Note The controller and the device version should be the same, to achieve the below scale.

Table 168: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Azure Instance Sizing
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**						
<250	Disabled	One Node Cisco SD-WAN Manager (All Services)	16 vCPUs	32 GB RAM	500 GB	[illegible]
250-1000	Disabled	One Node Cisco SD-WAN Manager (All Services)	32 vCPUs	64 GB RAM	1 TB	[illegible]
1000-1500	Disabled	One Node Cisco SD-WAN Manager (All Services)	32 vCPUs	128 GB RAM	1 TB	[illegible]
1500-2000	Disabled	Three Node Cisco SD-WAN Manager Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	[illegible]

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Azure Instance Sizing
2000-5000	Disabled	Three Node Cisco SD-WAN Manager Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	[illegible]
5000-7000	Disabled	Six Node Cisco SD-WAN Manager Cluster (3 Nodes with ConfigDB) and all nodes messaging server, stats, and AppServer	32 vCPUs	128 GB RAM	1 TB	[illegible]
**** Cisco SD-WAN Application Intelligence Engine (SAIE) Enabled**						
<500	50 GB/Day	One Node Cisco SD-WAN Manager (All Services)	32 vCPUs	128 GB RAM	10 TB	[illegible]
500-2000	100 GB/Day	Three Node Cisco SD-WAN Manager Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	[illegible]
2000-7000	2.0 TB/Day**	Six Node Cisco SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	10 TB	[illegible]

Note

- ** For a larger dataset per day, have Stats running on all servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.

* vCPU, RAM, and Storage Size numbers are on per Cisco SD-WAN Manager basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Note In Cisco vManage Release 20.5.1 and earlier releases, You can modify the **DPI** size to the desired value to achieve the above mentioned storage size numbers.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated DPI size. The aggregated DPI size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated DPI also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the DPI and aggregated DPI index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated DPI value,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated DPI** size to the desired value based on your DPI traffic, the default disk size allocation is 5 GB.

Note When DPI is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the Cisco SD-WAN Manager menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your DPI traffic, the default collection interval is 30 minutes.
4. Click **Save**.

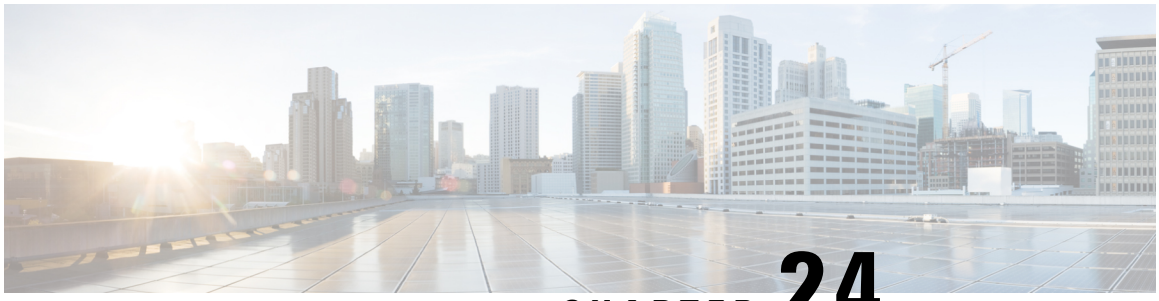
Table 169: Cisco Catalyst SD-WAN Validator Recommended Computing Resources

Devices	vCPUs	RAM	OS Volume	vNICs	Azure Instance Sizing
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
1001 -1500	4	8 GB	10 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2

Table 170: Cisco Catalyst SD-WAN Controller Recommended Computing Resources

Devices	vCPUs	RAM	OS Volume	vNICs	Azure Instance Sizing

1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F2s_v2
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F4s_v2
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2
1001 -1500	8	16 GB	16 GB	2 (one for tunnel interface, one for management)	Standard_F8s_v2



CHAPTER 24

Recommended Computing Resources for Cisco Catalyst SD-WAN Control Components Release 20.6.x (On-Prem Deployment)

Single Tenant

The supported hardware specifications for the Cisco SD-WAN Validator, Cisco SD-WAN Manager, and the Cisco SD-WAN Controller are as follows:

Note For cloud deployments, the Cisco operation teams actively monitor the customer deployment and add resource in collaboration with the customer. This topic does not include recommendations for Cisco cloud deployments.

Note The controller and the device version should be the same, to achieve the below scale.

Table 171: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
On-Prem						
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Disabled**						
<250	Disabled	One Node Cisco Catalyst SD-WAN Manager (All Services)	16 vCPUs	32 GB RAM	500 GB	UCS
250-1000	Disabled	One Node Cisco Catalyst SD-WAN Manager (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
1000-1500	Disabled	One Node Cisco Catalyst SD-WAN Manager (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
1500-2000	Disabled	Three Node Cisco Catalyst SD-WAN Manager Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
2000-5000	Disabled	Three Node Cisco Catalyst SD-WAN Manager Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
5000-7000	Disabled	Six Node Cisco Catalyst SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	1 TB	UCS
0-2000	Disabled	Three Node Cisco Catalyst SD-WAN Manager Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	HX
2000-5000	Disabled	Three Node Cisco Catalyst SD-WAN Manager Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	HX
**** Cisco Catalyst SD-WAN Application Intelligence Engine (SAIE) Enabled**						
<500	50 GB/Day	One Node Cisco Catalyst SD-WAN Manager (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
500-2000	100 GB/Day	Three Node Cisco Catalyst SD-WAN Manager Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
2000-7000	2.0 TB/Day**	Six Node Cisco Catalyst SD-WAN Manager Cluster (3 Node with ConfigDB) and all nodes messaging server,Stats, and AppServer	32 vCPUs	128 GB RAM	10 TB	UCS

Note

- *For a larger dataset per day, run Stats on all the servers.
- ** Along with the SAIE, the Approute statistics are also considered in the recommendations.
- * vCPU, RAM, and Storage Size numbers are on per Cisco Catalyst SD-WAN Manager basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Note In Cisco vManage Release 20.5.1 and earlier releases, You can modify the **DPI** size to the desired value to achieve the above mentioned storage size numbers.

Note Starting from Cisco vManage Release 20.6.1, you can achieve the above mentioned storage size numbers by modifying the aggregated DPI size. The aggregated DPI size is unidimensional and varies when the deployment includes edge devices that run on a mix of releases (Cisco SD-WAN Release 20.6.x and earlier releases). The aggregated DPI also varies when on-demand troubleshooting is enabled for the devices.

Ensure that both the DPI and aggregated DPI index sizes are configured to enable on-demand troubleshooting.

To modify the aggregated DPI value,

1. From the **Cisco Catalyst SD-WAN Manager** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Database Configuration**.
3. Modify the **Aggregated DPI** size to the desired value based on your DPI traffic, the default disk size allocation is 5 GB.

Note When DPI is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco Catalyst SD-WAN Manager** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your DPI traffic, the default collection interval is 30 minutes.
4. Click **Save**.

Table 172: Cisco Catalyst SD-WAN Validator Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs

1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
1001 or more	4	8 GB	10 GB	2 (one for tunnel interface, one for management)

Note The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay is eight.

Table 173: Cisco Catalyst SD-WAN Controller Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)
1001 or more	8	16 GB	16 GB	2 (one for tunnel interface, one for management)

Testbed Specifications

Table 174: Testbed specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, PS
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Note Any UCS Platform (Fifth Generation and above) with the same or higher hardware specifications mentioned in the above table supports Cisco SD-WAN Control Components with similar scale numbers mentioned in this document.

Drive specifications:

- Interface Speed— 12.0 Gbit per second
- Read speed (64KB) —1800 MB per second
- Write speed (64KB)—850 MB per second

Note

- The recommended numbers are based on the test setup specifications. Systems below these requirements may have challenges processing high volume of statistics data like SAIE.
- Tested with 10 TB Volume (8 X 1.6 TB SSD Drives Raid 0).
- Default hyperthreading is enabled.
- Slower disks can impact processing speed.

Table 175: Testbed specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Drive specifications:

- The tested replication factor is 3.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant

The supported hardware specifications for the Cisco SD-WAN Validator, Cisco SD-WAN Manager, and the Cisco SD-WAN Controller are as follows:

Table 176: Hardware Specifications to Support 50 Tenants and 1000 Devices

Server	Cisco SD-WAN Manager	Cisco SD-WAN Validator	Cisco SD-WAN Controller
Deployment Model	On-premises Cluster	On-premises deployment	On-premises deployment
Number of Instances	3 Compute+Data nodes	2 instances	2 instances per 24 tenants To support 50 tenants and 1000 devices across all tenants, deploy 6 Cisco vSmart Controller instances.
CPU **DRAM** **Hard Disk**	32 vCPU 128 GB Minimum: 1 TB; Recommended: 10 TB	4 vCPU 4 GB 10 GB	8 vCPU 16 GB 10 GB
Bandwidth	1 Gbps	10 Mbps	100 Mbps

Table 177: Hardware Specifications to Support 100 Tenants and 5000 Devices

Server	Cisco SD-WAN Manager	Cisco SD-WAN Validator	Cisco SD-WAN Controller
Deployment Model	On-premises Cluster	On-premises deployment	On-premises deployment
Number of Instances	6 nodes: 3 Compute+Data nodes and 3 Data nodes	2 instances	2 instances per 24 tenants To support 100 tenants and 5000 devices across all tenants, deploy 10 Cisco vSmart Controllers.
CPU **DRAM** **Hard Disk**	64 vCPU 128 GB Minimum: 2 TB; Recommended: 10 TB	4 vCPU 4 GB 10 GB	8 vCPU 16 GB 10 GB
Bandwidth	1 Gbps	10 Mbps	100 Mbps

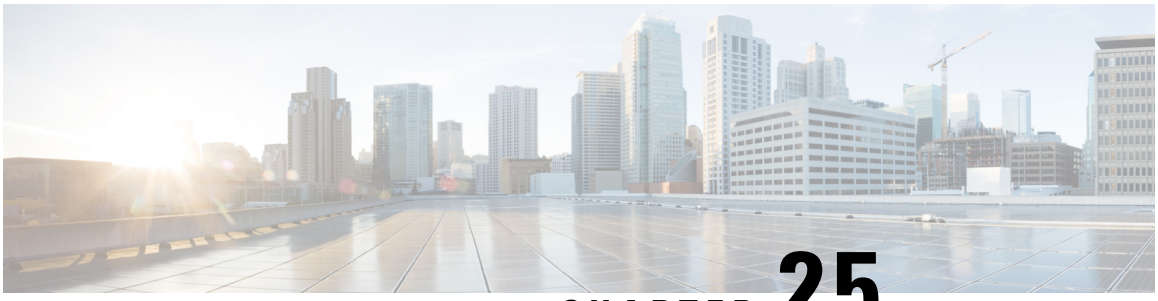
Table 178: Hardware Specifications to Support 150 Tenants and 7500 Devices

Server	Cisco SD-WAN Manager	Cisco SD-WAN Validator	Cisco SD-WAN Controller

Deployment Model	On-premises cluster	On-premises deployment	On-premises deployment
Number of Instances	6 nodes: 3 Compute+Data nodes and 3 Data nodes	4 instances	2 instances per 24 tenants/1000 devices To support 150 tenants and 7500 devices across all tenants, deploy 16 Cisco SD-WAN Controller.
CPU	64 vCPU	4 vCPU	8 vCPU
DRAM	128 GB	4 GB	16 GB
Hard Disk	Minimum: 2 TB; Recommended: 10 TB	10 GB	10 GB
Bandwidth	1 Gbps	10 Mbps	100 Mbps

Note

- A deployment with up to 150 tenants and 7500 devices across tenants is supported from Cisco IOS XE Catalyst SD-WAN Release 17.6.3a, Cisco SD-WAN Release 20.6.3, and Cisco vManage Release 20.6.3.
- If DPI is enabled, we recommend that the aggregated DPI data (across all Cisco Catalyst SD-WAN Manager nodes and all tenants in the multitenant system) does not exceed 350 GB per day.
- A pair of Cisco SD-WAN Controller supports 24 tenants and 1000 devices across all tenants.
- A tenant can add a maximum of 1000 devices.
- The tested and recommended limit of supported Cisco SD-WAN Validator instances in a single Cisco Catalyst SD-WAN overlay is eight.



CHAPTER 25

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.5.x (On-Prem Deployment)

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Note For cloud deployments, the Cisco operation teams actively monitor the customer deployment and add resource in collaboration with the customer. This topic does not include recommendations for Cisco cloud deployments.

Table 179: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
On-Prem						
DPI Disabled						
<250	Disabled	One Node vManage (All Services)	16 vCPUs	32 GB RAM	500 GB	UCS
250-1000	Disabled	One Node vManage (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
1000-1500	Disabled	One Node vManage (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
1500-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
0-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	HX
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	HX
DPI Enabled						
<250	50 GB/Day	One Node vManage (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
250-1000	100 GB/Day	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
1000-2000	1.2 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB, AppServer), 3 Nodes (Stats, AppServer) all nodes messaging server	32 vCPUs	128 GB RAM	10 TB	UCS
2000-5000	1.8 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB), All Nodes messaging server, Stats, AppServer	32 vCPUs	128 GB RAM	10 TB	UCS

* vCPU, RAM, and Storage Size numbers are on per Cisco vManage basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

** For a larger dataset per day, have Stats running on all servers.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Table 180: Cisco Catalyst SD-WAN Validator Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
1001 or more	4	8 GB	10 GB	2 (one for tunnel interface, one for management)

Table 181: Cisco Catalyst SD-WAN Controller Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs

1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)
1001 or more	8	16 GB	16 GB	2 (one for tunnel interface, one for management)

Testbed Specifications

Table 182: Testbed specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, PS
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Drive specifications:

- Interface Speed— 12.0 Gbit per second
- Read speed (64KB) —1800 MB per second
- Write speed (64KB)—850 MB per second



Note

- The recommended numbers are based on the test setup specifications. Systems below these requirements may have challenges processing high volume of statistics data like DPI.
- Tested with 10 TB Volume (8 X 1.6 TB SSD Drives Raid 0).
- Default hyperthreading is enabled.
- Slower disks can impact processing speed.

Table 183: Testbed specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Drive specifications:

- The tested replication factor is 3.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant

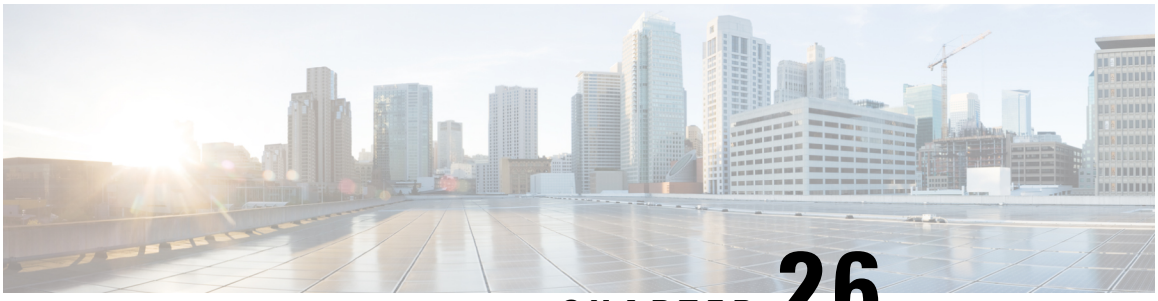
The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Table 184: On-prem Deployment

Server	Cisco SD-WAN Manager	Cisco Catalyst SD-WAN Validator	Cisco Catalyst SD-WAN Controller
Deployment Model	Cluster	N/A	Non-containerized
Number of Instances	3	2	2 per 24 tenants
CPU **DRAM** **Hard Disk**	32 vCPU 128 GB 1 TB	4 vCPU 4 GB 10 GB	8 vCPU 16 GB 16 GB
NMS Service Distribution	Some services run on all three Cisco vManage instances in the cluster, while some services run on only one of the three instances in the cluster. Therefore, the CPU load may vary among the instances.	N/A	N/A



Note If DPI is enabled, we recommend that the aggregated DPI data across all Cisco vManage instances and all tenants in the multi-tenant system not exceed 350 GB per day.



CHAPTER 26

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.4.x (On-Prem Deployment)

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Note For cloud deployments, the Cisco operation teams actively monitor the customer deployment and add resource in collaboration with the customer. This topic does not include recommendations for Cisco cloud deployments.

Table 185: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
On-Prem						
DPI Disabled						
<250	N/A	One Node vManage (All Services)	16 vCPUs	32 GB RAM	500 GB	UCS
250-1000	N/A	One Node vManage (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
1000-1500	N/A	One Node vManage (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
1500-2000	N/A	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
2000-5000	N/A	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
0-2000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	HX
2000-5000	Disabled	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	HX
DPI Enabled						
<250	50 GB/Day	One Node vManage (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
250-1000	100 GB/Day	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	10 TB	UCS
1000-2000	1.2 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB, AppServer), 3 Nodes (Stats, AppServer) all nodes messaging server	32 vCPUs	128 GB RAM	10 TB	UCS
1000-4000	1.8 TB/Day**	Six Node vManage Cluster (3 Node with ConfigDB), All Nodes messaging server, Stats, AppServer	32 vCPUs	128 GB RAM	10 TB	UCS

* vCPU, RAM, and Storage Size numbers are on per Cisco vManage basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

** For a larger dataset per day and a larger number of device support, have Stats running on all servers.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Note If DPI is enabled, we recommend to have Stats Service running on all Cisco vManage nodes, to achieve a larger dataset and better performance.

Table 186: Cisco Catalyst SD-WAN Validator Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
1001 or more	4	8 GB	10 GB	2 (one for tunnel interface, one for management)

Table 187: Cisco Catalyst SD-WAN Controller Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)
1001 or more	8	16 GB	16 GB	2 (one for tunnel interface, one for management)

Testbed Specifications

Table 188: Testbed specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, PS
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Drive specifications:

- Interface Speed— 12.0 Gbit per second
- Read speed (64KB) —1800 MB per second
- Write speed (64KB)—850 MB per second



Note

- The recommended numbers are based on the test setup specifications. Systems below these requirements may have challenges processing high volume of statistics data like DPI.
- Tested with 10 TB Volume (8 X 1.6 TB SSD Drives Raid 0).
- Default hyperthreading is enabled.
- Slower disks can impact processing speed.

Table 189: Testbed specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Drive specifications:

- The tested replication factor is 3.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.

Multitenant

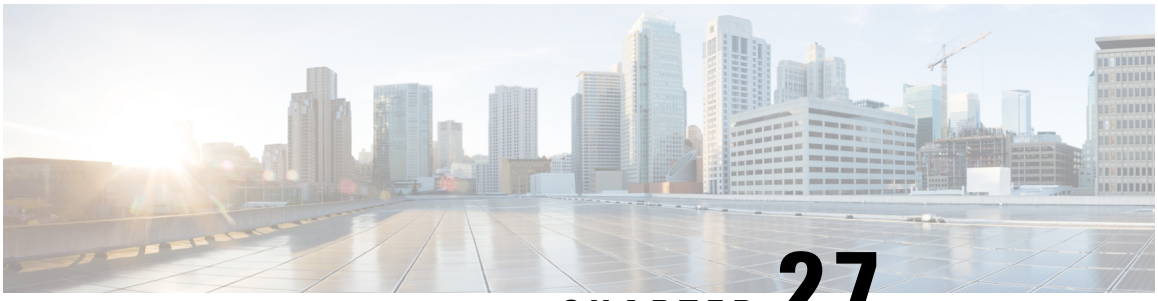
The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Table 190: On-prem Deployment

Server	Cisco SD-WAN Manager	Cisco Catalyst SD-WAN Validator	Cisco Catalyst SD-WAN Controller
Deployment Model	Cluster	N/A	Non-containerized
Number of Instances	3	2	2 per 24 tenants
CPU **DRAM** **Hard Disk**	32 vCPU 72 GB 1 TB	4 vCPU 4 GB 10 GB	8 vCPU 16 GB 16 GB
NMS Service Distribution	Some services run on all three Cisco vManage instances in the cluster, while some services run on only one of the three instances in the cluster. Therefore, the CPU load may vary among the instances.	N/A	N/A



Note If DPI is enabled, we recommend that the aggregated DPI data across all Cisco vManage instances and all tenants in the multi-tenant system not exceed 350 GB per day.



CHAPTER 27

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.3.x (On-Prem Deployment)

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Note For cloud deployments, the Cisco operation teams actively monitor the customer deployment and add resource in collaboration with the customer. This topic does not include recommendations for Cisco cloud deployments.

Table 191: Cisco SD-WAN Manager Recommended Computing Resources

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
On-Prem						
DPI Disabled						
<250	N/A	One Node vManage (All Services)	16 vCPUs	32 GB RAM	500 GB	UCS
250-1000	N/A	One Node vManage (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
1000-1500	N/A	One Node vManage (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS
1500-2000	N/A	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	UCS
2000-5000	N/A	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	UCS

Devices	Aggregated Statistics from Edge Devices	Nodes and Deployment Models	vCPUs *	RAM*	Storage Size*	Deployment Type
0-2000	N/A	Three Node vManage Cluster (All Services)	32 vCPUs	64 GB RAM	1 TB	HX
2000-5000	N/A	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB RAM	1 TB	HX
DPI Enabled						
<250	50 GB/Day	One Node vManage (All Services)	32 vCPUs	128 GB	10 TB	UCS
250-1000	100 GB/Day	Three Node vManage Cluster (All Services)	32 vCPUs	128 GB	10 TB	UCS
1000-2000	1.2 TB/Day	Six Node vManage Cluster (3 Node with ConfigDB, AppServer), 3 Nodes (Stats, AppServer) all nodes messaging server	32 vCPUs	128 GB	10 TB	UCS

Note When DPI is enabled, you must set the Statistics Collection timer to 30 minutes or higher.

To set the Statistics Collection timer,

1. From the **Cisco vManage** menu, choose **Administration** > **Settings**.
2. Click **Edit** next to **Statistics Configuration**.
3. Modify the **Collection Interval** minutes to the desired value based on your DPI traffic, the default collection interval is 30 minutes.
4. Click **Save**.

* vCPU, RAM, and Storage Size numbers are on per Cisco vManage basis. The Storage Size numbers are the maximum tested values by Cisco, you can allocate smaller storage sizes.

To achieve scale beyond the above mentioned numbers, deploy multiple overlays.

Table 192: Cisco Catalyst SD-WAN Validator Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
51-250	2	4 GB	10 GB	2 (one for tunnel interface, one for management)
251-1000	2	4 GB	10 GB	2 (one for tunnel interface, one for management)

1001 or more	4	8 GB	10 GB	2 (one for tunnel interface, one for management)

Table 193: Cisco Catalyst SD-WAN Controller Recommended Computing Resources for HX/UCS

Devices	vCPUs	RAM	OS Volume	vNICs
1-50	2	4 GB	16 GB	2 (one for tunnel interface, one for management)
51-250	4	8 GB	16 GB	2 (one for tunnel interface, one for management)
251-1000	4	16 GB	16 GB	2 (one for tunnel interface, one for management)
1001 or more	8	16 GB	16 GB	2 (one for tunnel interface, one for management)

Testbed Specifications

Table 194: Testbed specifications for UCS Platforms

Hardware SKU	Specifications
UCSC-C240-M5SX	UCS C240 M5 24 SFF + 2 rear drives without CPU, memory cards, hard disk, PCIe, PS
UCS-MR-X16G1RT-H	16GB DDR4-2933-MHz RDIMM/1Rx4/1.2v
UCS-CPU-I6248R	Intel 6248R 3GHz/205W 24C/35.75MB DDR4 2933MHz
UCS-SD16T123X-EP	1.6TB 2.5in Enterprise Performance 12G SAS SSD (3X endurance)

Drive specifications:

- Interface Speed— 12.0 Gbit per second
- Read speed (64KB) —1800 MB per second
- Write speed (64KB)—850 MB per second

Note

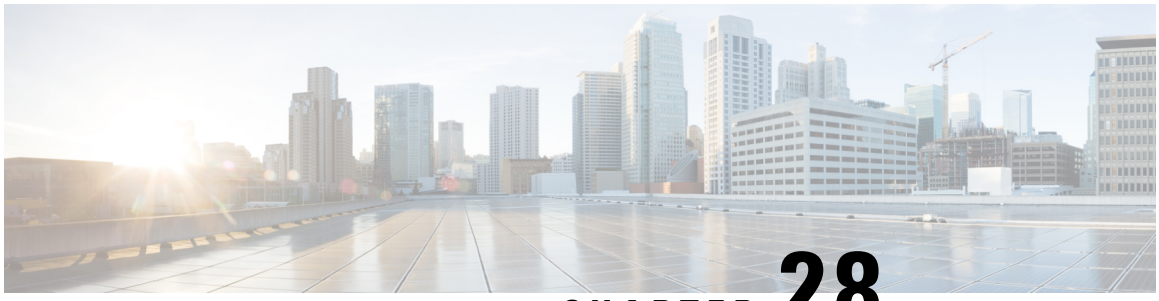
- The recommended numbers are based on the test setup specifications. Systems below these requirements may have challenges processing high volume of statistics data like DPI.
- Tested with 10 TB Volume (8 X 1.6 TB SSD Drives Raid 0).
- Default hyperthreading is enabled.
- Slower disks can impact processing speed.

Table 195: Testbed specifications for HX Platforms

Hardware SKU	Specifications
HXAF240-M5SX	Cisco HyperFlex HX240c M5 All Flash Node
HX-MR-X32G2RT-H	32GB DDR4-2933-MHz RDIMM/2Rx4/1.2v
HX-CPU-I6248	Intel 6248 2.5GHz/150W 20C/24.75MB 3DX DDR4 2933 MHz
HX-SD38T61X-EV	3.8TB 2.5 inch Enterprise Value 6G SATA SSD
HX-NVMEXPB-I375	375GB 2.5 inch Intel Optane NVMe Extreme Performance SSD

Drive specifications:

- The tested replication factor is 3.
- The default compression on the HX system is applicable to all cases. This compression is automatically determined by the system and cannot be configured.



CHAPTER 28

Recommended Computing Resources for Cisco SD-WAN Controller Release 20.1.x and earlier releases

Single Tenant

The supported hardware specifications for the Cisco vBond Orchestrator, Cisco vManage, and the Cisco vSmart Controller are as follows:

Note For cloud deployments, the Cisco operation teams actively monitor the customer deployment and add resource in collaboration with the customer. This topic does not include recommendations for Cisco cloud deployments.

Table 196: Cisco SD-WAN Manager Computing Resources

Devices	vCPUs	RAM	OS Volume	Storage Size	Bandwidth	vNICs
1-250	16	32 GB	25 GB for Cisco vManage Release 20.3.1 and later, or 20 GB for earlier Cisco SD-WAN Manager releases	500 GB, 1500 IOPS	25 Mbps	3 (one for tunnel interface, one for management, one for the Cisco SD-WAN Manager cluster message bus)
251-1000	32	64 GB	25 GB for Cisco vManage Release 20.3.1 and later, or 20 GB for earlier Cisco SD-WAN Manager releases	1 TB, 3072 IOPS	100 Mbps	3 (one for tunnel interface, one for management, one for the Cisco SD-WAN Manager cluster message bus)
1001 -1500	32	64 GB	25 GB for Cisco vManage Release 20.3.1 and later, or 20 GB for earlier Cisco SD-WAN Manager releases	1 TB, 3072 IOPS	150 Mbps	3 (one for tunnel interface, one for management, one for the Cisco SD-WAN Manager cluster message bus)

Points to consider:

- The system selected to run Cisco vManage must satisfy the storage throughput requirement.
- The operating system and the database volumes must be on a drive that supports Transactions per second (TPS) throughput based on the above-mentioned vCPU values.
- Don't oversubscribe vCPU and memory. However, an oversubscription of 2:1 on vCPU to pCPU (physical CPU) can be supported when your overlay has fewer than 250 devices.
- We recommend a 10-Gbps interface for production.
- We recommend three network interfaces —one for tunnel, one for management, and one for the Cisco vManage cluster message bus.
- With hyperthreading enabled on CPU, an oversubscription of 4:1 on pCPUs to total number of threads is supported for fewer than 250 devices. For example, a Cisco UCS-C220-M4S server with two sockets, each with eight cores for a total of 16 physical cores can have hyperthreading enabled. Each processor has 16 logical CPUs for a total of 32 logical CPUs on both logical and physical processors (cores).
- If your overlay network has few devices, but if they generate large amounts of DPI or cflowd data, we recommend that you use the server recommendations given for 251-1000 devices or for 1001 or more devices.
- If DPI is enabled:



Note To disable DPI statistics collection, in Cisco vManage select **Administration** > **Settings** > **Statistics Setting** . Click **Edit**. Scroll to find DPI and choose **Disable All**.

  - In a three node Cisco SD-WAN Manager cluster, we recommend that each Cisco SD-WAN Manager have a minimum of 32 vCPUs, 64 GB of memory, and a 1 TB disk, and that aggregated DPI data across all Cisco SD-WAN Manager instances not exceed 100 GB per day.
  - In a six node Cisco SD-WAN Manager cluster, we recommend that each Cisco SD-WAN Manager have a minimum of 32 vCPUs, 64 GB of memory, and a 1 TB disk, and that aggregated DPI data across all Cisco SD-WAN Manager instances not exceed 750 GB per day.

- If DPI is disabled:
  - For a deployment of fewer than 1,500 nodes, a single Cisco SD-WAN Manager is required, although we recommend a cluster of three Cisco SD-WAN Manager instances for high availability. For a deployment of between 1,500 nodes and 4,499 nodes, a cluster of three Cisco SD-WAN Manager instances are required. Each Cisco SD-WAN Manager instance requires a minimum of 32 vCPUs, 64 GB of memory, and a 1 TB disk.

Table 197: Cisco Catalyst SD-WAN Validator Computing Resources

Devices	vCPUs	RAM	OS Volume	Bandwidth	vNICs
1-50	2	4 GB	10 GB	1 Mbps	2 (one for tunnel interface, one for management)
51-250	2	4 GB	10 GB	2 Mbps	2 (one for tunnel interface, one for management)

251-1000	2	4 GB	10 GB	5 Mbps	2 (one for tunnel interface, one for management)
1001 or more	4	8 GB	10 GB	10 Mbps	2 (one for tunnel interface, one for management)

Table 198: Cisco Catalyst SD-WAN Controller Computing Resources

Devices	vCPUs	RAM	OS Volume	Bandwidth	vNICs
1-50	2	4 GB	16 GB	2 Mbps	2 (one for tunnel interface, one for management)
51-250	4	8 GB	16 GB	5 Mbps	2 (one for tunnel interface, one for management)
251-1000	4	16 GB	16 GB	7 Mbps	2 (one for tunnel interface, one for management)
1001 or more	8	16 GB	16 GB	10 Mbps	2 (one for tunnel interface, one for management)

Points to Consider:

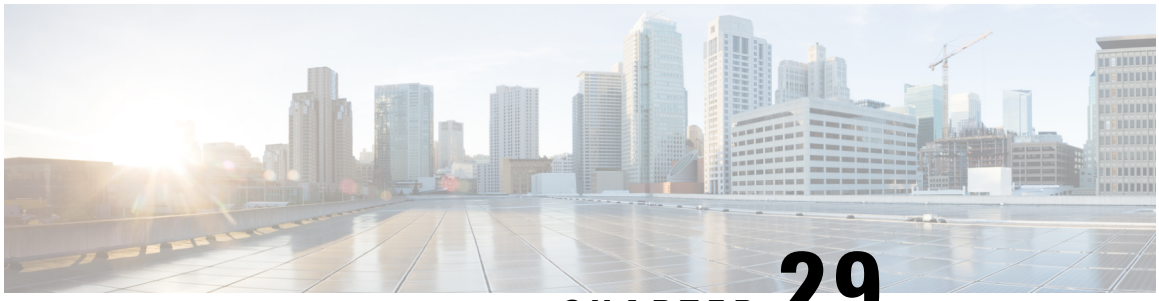
- The OS volume must be on a solid-state drive (SSD).
- If more than 1001 devices are present, the deployment of devices should not exceed 1500 OMP sessions per Cisco vSmart Controller.



PART IV

Related Documents

- Related Documents, on page 243



CHAPTER 29

Related Documents

User Documentation

- User Documentation for Cisco IOS XE Catalyst SD-WAN Release 17
- User Documentation for Cisco SD-WAN Release 20

Release and Compatibility

For more Cisco IOS XE SD-WAN and Cisco SD-WAN release information, see Cisco Catalyst SD-WAN Release and Compatibility.

Cisco vEdge

For information about Cisco vEdge Cloud Routers, refer to Cisco vEdge Cloud Data Sheet