

# NVMe Storage for Cisco UCS C-Series Rack and B-Series Blade Servers

## Product Overview

The Cisco Unified Computing System™ (Cisco UCS®) is a next-generation data center platform that unites computing, networking, storage, and virtualization resources in a cohesive system designed to reduce total cost of ownership (TCO) and increase business agility.

As storage moves closer to the server, new opportunities for data center efficiency are arising. When applications that need greater storage performance achieve high availability by using cluster-capable file systems and other means for replicating data, major efficiencies can be gained.

Ultra-low latency nonvolatile memory express (NVMe) storage fully integrated into the Cisco UCS architecture enables servers to provide increased storage reliability and performance compared to spinning media. Organizations also gain the benefits of lower total cost of acquisition and lower TCO through reduced data center power and cooling needs, as well as lower cost per I/O operations per second (IOPS) and lower wattage requirements per IOPS. Bringing storage inside the server on a high-performance NVMe tier can also reduce application licensing costs, making local flash storage a powerful solution for delivering more capabilities on a smaller budget. And all these benefits are more fully optimized on Cisco UCS than on any other server platform.

Cisco UCS implements local storage differently for a uniquely powerful experience. The Cisco UCS platform uses an advanced cooling methodology and zero-oversubscription CPU mapping to provide the highest levels of efficiency as well as best-in-class, consistent performance. Teams can manage hundreds of devices as easily as one with the Cisco® Integrated Management Controller (IMC) or Cisco UCS Manager. Customers can also choose the amount of storage necessary to meet their application needs: from 400 GB all the way up to 30 TB (for example, for a 2-rack-unit [2RU] server).

## NVMe Storage Solutions

NVMe storage solutions offer the following main benefits:

- **Reduced TCO:** NVMe storage can be used to eliminate the need for SANs and network-attached storage (NAS) or to augment existing shared-array infrastructure. With significant performance improvements available in both cases, Cisco customers can reduce the amount of physical infrastructure they need to deploy, increase the number of virtual machines they can place on a single physical server, and improve overall system efficiency. These improvements provide savings in capital expenditures (CapEx) and operating expenses (OpEx), including reduced application licensing fees and savings related to space, cooling, and energy use.
- **Strategic partnerships:** Cisco tests a broad set of NVMe storage technologies and focuses on three major partners: HGST, Intel, and SanDisk. With each partnership, devices are built exclusively in conjunction with Cisco engineering, so customers have the flexibility of a variety of endurance and capacity levels and the most relevant form factors, as well as the powerful management features and robust quality benefits that are unique to Cisco.

## Overview

Cisco UCS NVMe storage offers the following main advantages:

- Manageability
  - Complete Cisco UCS Manager inventory, service-profile mapping, and firmware updates are supported for one or many Cisco NVMe storage devices.
  - Significantly reduce complexity compared to most competing solutions, which require manual command-line interface (CLI) processes for each PCIe-connected device.
- Performance
  - Get what you pay for with full CPU-to-PCIe lane connectivity to each storage device (zero oversubscription). For example, a Cisco server with 8 NVMe devices has  $8 \times 4 = 32$  lanes of Generation 3 PCIe connectivity directly to the CPU. Not all server platforms provide this level of integration and thus offer lower performance than Cisco UCS rack servers
  - Gain peace of mind with endurance and performance-state tracking, displayed in Cisco UCS Manager or Cisco IMC.
  - Power and cooling algorithms based on device System Management Bus (SMBus) integration provide exceptional power consumption efficiency and consistent performance in any data center with server inlet temperatures of less than 35°C.
- Flexibility
  - Gain best-in-class capacity flexibility with the capability to choose from as little as 400 GB to as much as 30 TB of capacity in a 2RU server, with multiple NVMe device endurance level options, to meet the needs of any application.
  - Gain block storage that integrates transparently with Cisco UCS servers to immediately improve performance and relieve I/O bottlenecks.

## Product Specifications

Table 1 provides general specifications for Cisco UCS NVMe storage, and Table 2 provides performance specifications. Table 3 summarizes server compatibility, and Table 4 summarizes NVMe connectivity features.

**Table 1.** General Product Specifications

	Size in GB					
Cisco UCS NVMe Storage Specifications: General	400	800	800	800	800	1200
Mean time between failure (MTBF; in hours)	2 million					
Cisco warranty (in years)	3					

	Size in GB					
<b>Endurance: Physical drive write operations per day (DWPD)*</b>	10	3	3	10	10	3
<b>Endurance: Total petabytes written (PBW)*</b>	7.3	4.4	4.4	14.6	14.6	6.6
<b>Server connectivity</b>	Gen 3 PCIe x4					
<b>NVMe version</b>	1.0c	1.0c	1.1a	1.0c	1.0c	1.0c
<b>Power consumption (active/idle)</b>	25/4	25/4	25/8	25/4	25/4	25/4
<b>Cisco part number</b>	<b>UCS-PCI25-40010</b>	<b>UCS-PCI25-8003</b>	<b>UCS-SDHPCIE800GB</b>	<b>UCS-PCI25-80010</b>	<b>UCSC-F-180010</b>	<b>UCSC-F-112003</b>
<b>Device partner</b>	Intel	Intel	HGST	Intel	Intel	Intel
<b>Form Factor</b>	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Half Height Half Length PCIe Add in Card (HHHL)	Half Height Half Length PCIe Add in Card (HHHL)

\* Drive write operations per day and total petabytes written are based on a 5-year manufacturer's warranty.

	Size in GB						
<b>Cisco UCS NVMe Storage Specifications: General</b>	1600	1600	1600	1900	2000	3800	3800
<b>Mean time between failure (MTBF; in hours)</b>	2 million						
<b>Cisco warranty (in years)</b>	3						
<b>Endurance: Physical drive write operations per day (DWPD)*</b>	3	3	10	1	3	1	1
<b>Endurance: Total petabytes written (PBW)*</b>	8.8	8.8	29.2	3.5	11.0	6.9	6.9
<b>Server connectivity</b>	Gen 3 PCIe x4						
<b>NVMe version</b>	1.1a	1.0c	1.0c	1.1a	1.0c	1.1a	1.1a
<b>Power consumption (active/idle)</b>	25/8	25/4	25/4	25/8	25/4	25/8	25/8

	Size in GB						
<b>Cisco part number</b>	<b>UCS-SDHPCIE16TB</b>	<b>UCS-PCI25-16003</b>	<b>UCSC-F-I160010</b>	<b>UCSC-F-H19001</b>	<b>UCSC-F-I20003</b>	<b>UCS-PCI25-38001</b>	<b>UCSC-F-H38001</b>
<b>Device partner</b>	HGST	Intel	Intel	HGST	Intel	HGST	HGST
<b>Form Factor</b>	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Half Height Half Length PCIe Add in Card (HHHL)	Half Height Half Length PCIe Add in Card (HHHL)	Half Height Half Length PCIe Add in Card (HHHL)	Small Form Factor (SFF) 2.5"	Half Height Half Length PCIe Add in Card (HHHL)

\* Drive write operations per day and total petabytes written are based on a 5-year manufacturer's warranty.

**Table 2.** Performance Specifications

	Size in GB					
<b>Cisco UCS NVMe Storage Specifications: Performance (up to) at 25 Watts (W)</b>	400	800	800	800	800	1200
<b>Read throughput (maximum MBps, sequential 128 KB)</b>	2700	2600	2600	2800	2800	2600
<b>Write throughput (maximum MBps, sequential 128 KB)</b>	1080	1000	1400	1900	1900	1250
<b>Random read operations at 4-KB block size (IOPS)</b>	450,000	430,000	634,000	460,000	460,000	450,000
<b>Random write operations at 4-KB block size (IOPS)</b>	75,000	50,000	80,000	90,000	90,000	50,000
<b>Random mixed IOPS (70% read and 30% write, 4 KB)</b>	150,000	110,000	190,000	200,000	200,000	130,000
<b>Read IOPS (maximum, random 8 KB)</b>	275,000	250,000	330,000	285,000	285,000	260,000
<b>Write IOPS (maximum, random 8 KB)</b>	32,000	26,000	42,000	45,000	45,000	27,000
<b>Approximate read latency (microseconds)</b>	80	80	80	80	80	80
<b>Approximate write latency (microseconds)</b>	20	20	20	20	20	20
<b>Cisco part number</b>	<b>UCS-PCI25-40010</b>	<b>UCS-PCI25-8003</b>	<b>UCS-SDHPCIE800GB</b>	<b>UCS-PCI25-80010</b>	<b>UCSC-F-I80010</b>	<b>UCSC-F-I12003</b>
<b>Device partner</b>	Intel	Intel	HGST	Intel	Intel	Intel

	Size in GB						
<b>Cisco UCS NVMe Storage Specifications: Performance (up to) at 25 Watts (W)</b>	1600	1600	1600	1900	2000	3800	3800
<b>Read throughput (maximum MBps, sequential 128 KB)</b>	3000	2600	2800	3000	2800	3000	3000
<b>Write throughput (maximum MBps, sequential 128 KB)</b>	1600	1600	1900	1600	2000	1600	1600

	Size in GB						
Random read operations at 4-KB block size (IOPS)	743,000	450,000	450,000	743,000	450,000	743,000	743,000
Random write operations at 4-KB block size (IOPS)	140,000	56,000	150,000	140,000	175,000	38,000	38,000
Random mixed IOPS (70% read and 30% write, 4 KB)	310,000	160,000	240,000	310,000	265,000	310,000	310,000
Read IOPS (maximum, random 8 KB)	385,000	270,000	290,000	385,000	295,000	385,000	385,000
Write IOPS (maximum, random 8 KB)	75,000	33,000	75,000	75,000	90,000	75,000	75,000
Approximate read latency (microseconds)	80	80	80	80	80	80	80
Approximate write latency (microseconds)	20	20	20	20	20	20	20
Cisco part number	UCS-SDHPCIE16TB	UCS-PCI25-16003	UCSC-F-I160010	UCSC-F-H19001	UCSC-F-I20003	UCS-PCI25-38001	UCSC-F-H38001
Device partner	HGST	Intel	Intel	HGST	Intel	HGST	HGST

**Table 3.** Server Compatibility

			Size in GB					
		<b>Cisco UCS NVMe Storage Specifications: Cisco Server Quantity Supported</b>	400	800	800	800	800	1200
<b>Cisco UCS rack servers</b>	C220 M4	Up to	2	2	2	2	2	2
	C240 M4	Up to	2	2	2	2	6	6
	C460 M4	Up to	2	2	2	2	10	10
	C3260	Up to	0	0	1	0	0	0
<b>Cisco UCS blade servers</b>	B200 M4	Up to	2	2	2	2	0	0
	B420 M4	Up to	0	0	0	0	0	0
	B260 M4	Up to	0	0	0	0	0	0
	B460 M4	Up to	0	0	0	0	0	0
		Storage Device Form Factor (Half Height Half Length or Small Form Factor 2.5")	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"	HHHL	HHHL
		Cisco Product ID (PID)	UCS-PCI25-40010	UCS-PCI25-8003	UCS-SDHPCIE800GB	UCS-PCI25-80010	UCSC-F-I80010	UCSC-F-I12003
		Device Partner	Intel	Intel	HGST	Intel	Intel	Intel

			Size in GB						
		<b>Cisco UCS NVMe Storage Specifications: Cisco Server Quantity Supported</b>	1600	1600	1600	1900	2000	3800	3800
<b>Cisco UCS rack servers</b>	C220 M4	Up to	2	2	2	2	2	2	2
	C240 M4	Up to	2	2	6	6	6	2	6
	C460 M4	Up to	2	2	10	10	10	2	10
	C3260	Up to	1	0	0	0	0	0	0
<b>Cisco UCS blade servers</b>	B200 M4	Up to	2	2	0	0	0	2	0
	B420 M4	Up to	0	0	0	0	0	0	0
	B260 M4	Up to	0	0	0	0	0	0	0
	B460 M4	Up to	0	0	0	0	0	0	0
		Storage Device Form Factor (Half Height Half Length or Small Form Factor 2.5")	SFF 2.5"	SFF 2.5"	HHHL	HHHL	HHHL	SFF 2.5"	HHHL
		Cisco Product ID (PID)	<b>UCS-SDHPCI E16TB</b>	<b>UCS-PCI25-16003</b>	<b>UCSC-F-I160010</b>	<b>UCSC-F-H19001</b>	<b>UCSC-F-I20003</b>	<b>UCS-PCI25-38001</b>	<b>UCSC-F-H38001</b>
		Device Partner	HGST	Intel	Intel	HGST	Intel	HGST	HGST

**Note:** Small-form-factor (SFF) 2.5-inch and half-height, half-length (HHHL) devices can be combined as long as the same partner brand is being used. For example, 2 SFF Intel and 10 HGST HHHL devices in a Cisco UCS C460 M4 Rack Server is an **invalid** configuration. A **valid** configuration would be 2 SFF HGST and 10 HHHL HGST devices. If the same brand is used, the OS sees all the devices as local storage.

**Table 4.** NVMe Connectivity Features

Cisco UCS NVMe Storage - Feature support			Size in GB					
		Feature	400	800	800	800	800	1200
<b>Rack Servers</b>	C220M4	Hot Insert/Pluggable	no	no	no	no	n/a	n/a
		OS Surprise Removal	no	no	no	no	n/a	n/a
		OS Informed Removal	yes	yes	yes	yes	n/a	n/a
	C240M4, C460M4	Hot Insert/Pluggable	yes	yes	yes	yes	n/a	n/a
		OS Surprise Removal	no	no	no	no	n/a	n/a
		OS Informed Removal	yes	yes	yes	yes	n/a	n/a

Cisco UCS NVMe Storage - Feature support			Size in GB					
Blade Servers	B200M4, B420M4, B260M4, B460M4	Hot Insert/Pluggable	n/a					
		OS Surprise Removal						
		OS Informed Removal						
		Cisco Product ID (PID)	UCS-PCI25-40010	UCS-PCI25-8003	UCS-SDHPCIE800GB	UCS-PCI25-80010	UCSC-F-I80010	UCSC-F-I12003
		Device Partner	Intel	Intel	HGST	Intel	Intel	Intel

Cisco UCS NVMe Storage - Feature support									
		Feature	1600	1600	1600	1900	2000	3800	3800
Rack Servers	C220M4	Hot Insert/Pluggable	no	n/a	n/a	n/a	n/a	no	n/a
		OS Surprise Removal	no	no	n/a	n/a	n/a	no	n/a
		OS Informed Removal	yes	yes	n/a	n/a	n/a	yes	n/a
	C240M4, C460M4	Hot Insert/Pluggable	yes	n/a	n/a	n/a	n/a	yes	n/a
		OS Surprise Removal	no	no	n/a	n/a	n/a	no	n/a
		OS Informed Removal	yes	yes	n/a	n/a	n/a	yes	n/a
Blade Servers	B200M4, B420M4, B260M4, B460M4	Hot Insert/Pluggable	n/a						
		OS Surprise Removal							
		OS Informed Removal							
		Cisco Product ID (PID)	UCS-SDHPCIE16TB	UCS-PCI25-16003	UCSC-F-I160010	UCSC-F-H19001	UCSC-F-I20003	UCS-PCI25-38001	UCSC-F-H38001
		Device Partner	HGST	Intel	Intel	HGST	Intel	HGST	HGST

**Note:** Hot insertion and OS informed removal are supported only with Cisco IMC Release 2.0(13) and later and depend on the OS version; there is no support under Cisco UCS Manager as of this writing.

Please see individual server specification sheets or the Cisco Commerce Workspace (CCW) for current support of capacities and available PCIe slots because the information may change. Note that the supported number of devices shown in the table assumes that one PCIe slot is being used for I/O or management of the server; in some cases, a modular LAN-on-motherboard (mLOM) slot can be used for primary server I/O.

## Operating System Support

To meet the needs of our customers, Cisco UCS supports a broad set of operating systems. For the most up-to-date list, please visit the [Cisco UCS hardware and software interoperability matrixes](#).

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## Cisco UCS Manager Integration Features

### Cisco UCS Rack and Blade Servers

Cisco UCS NVMe storage products are supported as either managed by Cisco UCS Manager or in a standalone Cisco IMC environment. IMC standalone and Cisco UCS Manager support are available for rack servers, and Cisco UCS Manager support is available for blade servers. The minimum IMC version for NVMe support in standalone mode is Release 2.0(13). The minimum version for Cisco UCS Manager support is Release 3.1(2).

## Cisco Capital

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