

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

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## 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 of 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 375 GB all the way up to 76 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 two major partners: Western Digital (previously HGST [Hitachi Global Storage Technologies]) and Intel. 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 UCS rack server with six NVMe devices has  $6 \times 8 = 48$  lanes of Generation 3 PCIe (PCIe 3.0) connectivity directly to the CPU. Not all server platforms provide this level of integration; thus, they 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 800 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	800	1000	1600	1600	3200	3200
Mean Time Between Failures (MTBF; in hours)	2 million					
Cisco warranty (in years)	3					
Endurance: physical drive-write operations per day (DWPD)*	3	1	3	3	3	3
Server connectivity	Gen 3 PCIe x4					
NVMe version	1.2a	1.2	1.2a	1.2	1.2a	1.2
Power consumption	25/4	25/4	25/8	25/4	25/4	25/4

	Size in GB					
(active/idle)						
Cisco Product ID (PID) – rack	UCSC-NVMEHW-H800	UCSC-NVMEHW-I1000	UCSC-NVMEHW-H1600	UCSC-NVMEHW-I1600	UCSC-NVMEHW-H3200	UCSC-NVMEHW-I3200
Cisco Product ID (PID) – blade	UCSB-NVMEHW-H800	UCSB-NVMEHW-I1000	UCSB-NVMEHW-H1600	UCSB-NVMEHW-I1600	UCSB-NVMEHW-H3200	UCSB-NVMEHW-I3200
Device partner	Western Digital	Intel	Western Digital	Intel	Western Digital	Intel
Form factor	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"

\* Drive-write operations per day are based on a five-year manufacturer's warranty.

	Size in GB						
Cisco UCS NVMe storage specifications: general	2000	4000	6400	7680	3200	6400	7680
Mean Time Between Failures (MTBF; in hours)	2 million						
Cisco warranty (in years)	3						
Endurance: physical drive-write operations per day (DWPD)*	1	1	3	1	30	30	3
Server connectivity	Gen 3 PCIe x4						
NVMe version	1.2	1.2	1.2a	1.2	1.2	1.2	1.2a
Power consumption (active/idle)	25/8	25/4	25/4	25/8	25/4	25/8	25/8
Cisco Product ID (PID) – rack	UCSC-NVMEHW-I2TBV	UCSC-NVMEHW-I4000	UCSC-NVMEHW-H6400	UCSC-NVMEHW-H7680	UCSC-NVMEXPB-I375	UCSC-NVMEXP-I750	UCSC-NVME-H76801
Cisco Product ID (PID) – blade	UCSB-NVMEHW-I2TBV	UCSB-NVMEHW-I4000	UCSB-NVMEHW-H6400	UCSB-NVMEHW-H7680	UCSB-NVMEXPB-I375	UCSB-NVMEXP-I750	UCSB-NVME-H76801
Device partner	Intel	Intel	Western Digital	Western Digital	Intel	Intel	Western Digital
Form factor	Small Form Factor (SFF) 2.5"	Small Form Factor (SFF) 2.5"	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 (HHHL) PCIe add- on card

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

Table 2. Performance specifications

	Size in GB					
Cisco UCS NVMe storage specifications: performance (up to) at 25 Watts (W)	800	1000	1600	1600	3200	3200
Read throughput (maximum MBps, sequential 64 KB)	3270	3210	3320	3200	3320	3200
Write throughput (maximum MBps, sequential 128 KB)	1520	600	2100	1325	2120	3050
Random read operations at 4-KB block size (IOPS)	755K	309K	818K	559K	821K	636K
Random write operations at 4-KB block size (IOPS)	127K	32K	173K	223K	187K	223K
Random mixed IOPS (70% read and 30% write, 4 KB)	258K	12K	346K		386K	
Approximate read latency (microseconds)	-	85	-	85	-	85
Approximate write latency (microseconds)	20	20	20	15	20	15
Cisco Product ID (PID) – rack	UCSC-NVMEHW-H800	UCSC-NVMEHW-I1000	UCSC-NVMEHW-H1600	UCSC-NVMEHW-I1600	UCSC-NVMEHW-H3200	UCSC-NVMEHW-I3200
Cisco Product ID (PID) – blade	UCSB-NVMEHW-H800	UCSB-NVMEHW-I1000	UCSB-NVMEHW-H1600	UCSB-NVMEHW-I1600	UCSB-NVMEHW-H3200	UCSB-NVMEHW-I3200
Device partner	Western Digital	Intel	Western Digital	Intel	Western Digital	Intel

	Size in GB						
Cisco UCS NVMe storage specifications: performance (up to) at 25 Watts (W)	2000	4000	6400	7680	375	750	7680
Read throughput (maximum MBps, sequential 64 KB)	3270	3270	3360	3360	2500	2500	6100
Write throughput (maximum MBps, sequential 64 KB)	1170	1940	2230	2230	2200	2200	2230
Random read operations	543K	681K	835K	835K	550K	550K	1240K

	Size in GB						
at 4-KB block size (IOPS)							
Random write operations at 4-KB block size (IOPS)	36K	45K	534K	238K	550K	550K	73.2K
Random mixed IOPS (70% read and 30% write, 4 KB)	-	-	534K	238K	500K	500K	239K
Approximate read latency (microseconds)	85	85	-	-	10	10	-
Approximate write latency (microseconds)	15	15	20	20	10	10	20
Cisco product ID (PID) number – rack	UCSC-NVMEHW-I2TBV	UCSC-NVMEHW-I4000	UCSC-NVMEHW-H6400	UCSC-NVMEHW-H7680	UCSC-NVMEXPB-I375	UCSC-NVMEXP-I750	UCSC-NVME-H76801
Cisco product ID (PID) – blade	UCSB-NVMEHW-I2TBV	UCSB-NVMEHW-I4000	UCSB-NVMEHW-H6400	UCSB-NVMEHW-H7680	UCSB-NVMEXPB-I375	UCSB-NVMEXP-I750	UCSB-NVME-H76801
Device partner	Intel	Intel	Western Digital	Western Digital	Intel	Intel	Western Digital

Table 3. Server compatibility

		Size in GB						
		Cisco UCS NVMe storage specifications: Cisco server quantity supported	800	1000	1600	1600	3200	3200
Cisco UCS C-Series Rack Servers	C220 M5	Up to	10	10	10	10	10	10
	C240 M5	Up to	10	10	10	10	10	10
	C480 M5	Up to	32	32	32	32	32	32
	S3260 M4	Up to	0	0	1	0	1	0
	C125	Up to	2	2	2	2	2	2
Cisco UCS B-Series Blade Servers	B200 M5	Up to	2	2	2	2	2	2
	B480 M5	Up to	4	4	4	4	4	4
		Storage device form Factor (HHHL or small form factor 2.5")	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"
		Cisco Product ID (PID) – rack	UCSC-NVMEHW-H800	UCSC-NVMEHW-I1000	UCSC-NVMEHW-H1600	UCSC-NVMEHW-I1600	UCSC-NVMEHW-H3200	UCSC-NVMEHW-I3200

		Size in GB						
	Cisco Product ID (PID) – blade	UCSB-NVMEHW-H800	UCSB-NVMEH-W-1000	UCSB-NVMEHW-H1600	UCSB-NVMEHW-1600	UCSB-NVMEHW-H3200	UCSB-NVMEHW-13200	
	Device partner	Western Digital	Intel	Western Digital	Intel	Western Digital	Intel	

		Size in GB							
	Cisco UCS NVMe storage specifications: Cisco server quantity supported	2000	4000	6400	7680	375	750	7680	
Cisco UCS C-Series Rack Servers	C220 M5	Up to	10	10	10	10	10	10	10
	C240 M5	Up to	10	10	10	10	10	10	10
	C480 M5	Up to	32	32	32	32	32	32	32
	S3260 M4	Up to	0	0	1	0	0	0	0
	C125	Up to	2	2	2	2	2	2	2
Cisco UCS B-Series Blade Servers	B200 M5	Up to	2	2	2	2	2	2	2
	B480 M5	Up to	4	4	4	4	4	4	0
	Storage device form factor (HHHL or small form factor 2.5")	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"	SFF 2.5"	HHHL
	Cisco Product ID (PID) – rack	UCSC-NVMEHW-12TBV	UCSC-NVMEH-W-14000	UCSC-NVMEHW-H6400	UCSC-NVMEHW-H7680	UCSC-NVMEEXP-B-1375	UCSC-NVMEEXP-1750	UCSC-NVME-H76801	
	Cisco Product ID (PID) – blade	UCSB-NVMEHW-12TBV	UCSB-NVMEH-W-14000	UCSB-NVMEHW-H6400	UCSB-NVMEHW-H7680	UCSB-NVMEEXP-B-1375	UCSB-NVMEEXP-1750	UCSB-NVME-H76801	
	Device partner	Intel	Intel	Western Digital	Western Digital	Intel	Intel	Western Digital	

**Note:** Mixing of Western Digital and Intel NVMe drives is not supported. 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.

**Table 4.** NVMe connectivity features

Cisco UCS NVMe storage – feature support		Size in GB						
	Feature	800	1000	1600	1600	3200	3200	
Cisco UCS C-Series	C220M5 Hot insert/pluggable	no	no	no	no	no	no	

Cisco UCS NVMe storage – feature support			Size in GB						
Rack Servers		OS surprise removal	no	no	no	no	no	no	no
		OS informed removal	yes	yes	yes	yes	yes	yes	yes
	C240M5, C480M5, C125	Hot insert/pluggable	no	no	no	no	no	no	no
		OS surprise removal	no	no	no	no	no	no	no
		OS informed removal	yes	yes	yes	yes	yes	yes	yes
Cisco UCS B-Series Blade Servers	B200M5, B480M5	Hot insert/pluggable	n/a						
		OS surprise removal							
		OS informed removal							
		Cisco Product ID (PID) – rack	UCSC-NVMEHW-H800	UCSC-NVMEHW-I1000	UCSC-NVMEHW-H1600	UCSC-NVMEHW-I1600	UCSC-NVMEHW-H3200	UCSC-NVMEHW-I3200	
		Cisco Product ID (PID) – blade	UCSB-NVMEHW-H800	UCSB-NVMEHW-I1000	UCSB-NVMEHW-H1600	UCSB-NVMEHW-I1600	UCSB-NVMEHW-H3200	UCSB-NVMEHW-I3200	
		Device partner	Western Digital	Intel	Western Digital	Intel	Western Digital	Intel	

Cisco UCS NVMe storage – feature support									
		Feature	2000	4000	6400	7680	375	750	7680
Cisco UCS C-Series Rack Servers	C220M5	Hot insert/pluggable	no	no	no	no	no	no	n/a
		OS surprise removal	no	no	no	no	no	no	n/a
		OS informed removal	yes	yes	yes	yes	yes	yes	n/a
	C240M5, C480M5, C125	Hot insert/pluggable	yes	yes	yes	yes	yes	yes	n/a
		OS surprise removal	no	no	no	no	no	no	n/a
		OS informed removal	yes	yes	yes	yes	yes	yes	n/a
Cisco UCS B-	B200M5, B480M5	Hot insert/pluggable	n/a						

Cisco UCS NVMe storage – feature support									
Series Blade Servers		OS surprise removal							
		OS informed removal							
		Cisco Product ID (PID) – rack	UCSC-NVMEHW-I2TBV	UCSC-NVMEHW-I4000	UCSC-NVMEHW-H6400	UCSC-NVMEHW-H7680	UCSC-NVMEXPB-I375	UCSC-NVMEXPB-I750	UCSC-NVME-H76801
		Cisco Product ID (PID) – blade	UCSB-NVMEHW-I2TBV	UCSB-NVMEHW-I4000	UCSB-NVMEHW-H6400	UCSB-NVMEHW-H7680	UCSB-NVMEXPB-I375	UCSB-NVMEXPB-I750	UCSB-NVME-H76801
		Device partner	Intel	Intel	Western Digital	Intel	Intel	Intel	Western Digital

**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 for current support of capacities and available PCIe slots because the information may change. Note that the supported number of devices shown in the tables 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 C-Series Rack and B-Series 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). Use Cisco UCS Manager or Cisco IMC release notes to verify software support for the above listed NVMe drives.

## Cisco Capital

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## For more information

<https://www.cisco.com/c/en/us/products/servers-unified-computing/product-listing.html>.

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