System configurations and diagrams

System block diagram and hardware configurations

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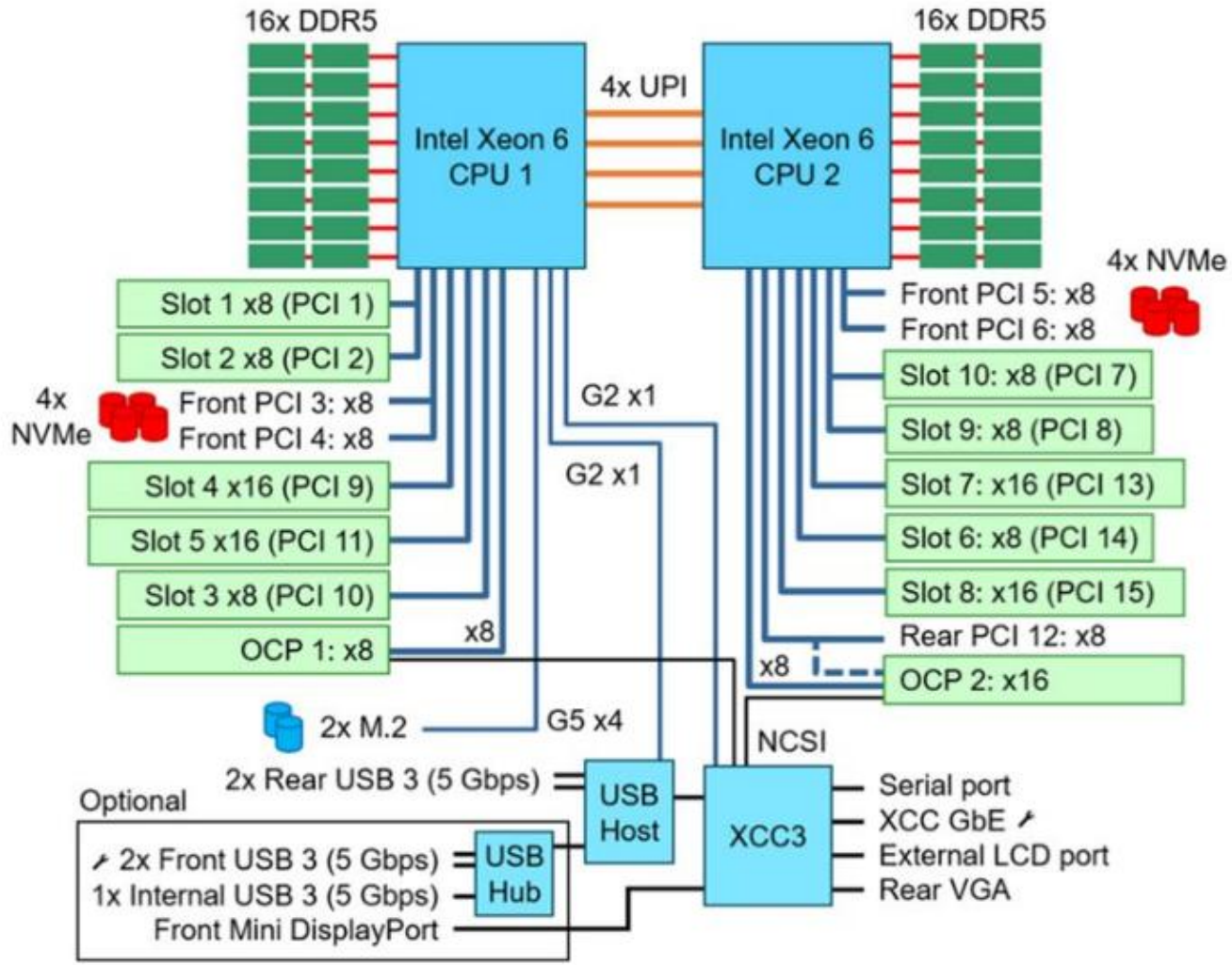
SR650 V4 system block diagram

The block diagram shows how a configuration with 10 rear slots is connected.
Most of the PCIe connections are implemented using cables, which maximizes the flexibility in how the server can be configured.



SR650 V4 front drive configurations

The front of the server supports 2.5-inch hot-swap drives (eight, 16, or 24 drive bays), 3.5-inch hot-swap drives (eight or 12 bays), or E3.S drives (up to 32 1T hot-swap drive bays, up to 12 E3.S 2T bays for CXL memory, or a combination of 1T and 2T bays).
Note: The E3.S 2T bays for CXL memory are non-hot-swap.

Up to 24 2.5-inch drive bays (combination of SAS/SATA, NVMe and AnyBay)

Up to 32 E3.S 1T NVMe drive bays (hot-swap)

Up to 12 3.5-inch drive bays (combination of SAS/SATA, NVMe and AnyBay)

Up to 12 E3.S 2T CXL memory bays and 8 E3.S 1T drive bays (non-hot-swap)

SR650 V4 front 3.5-inch drive configurations

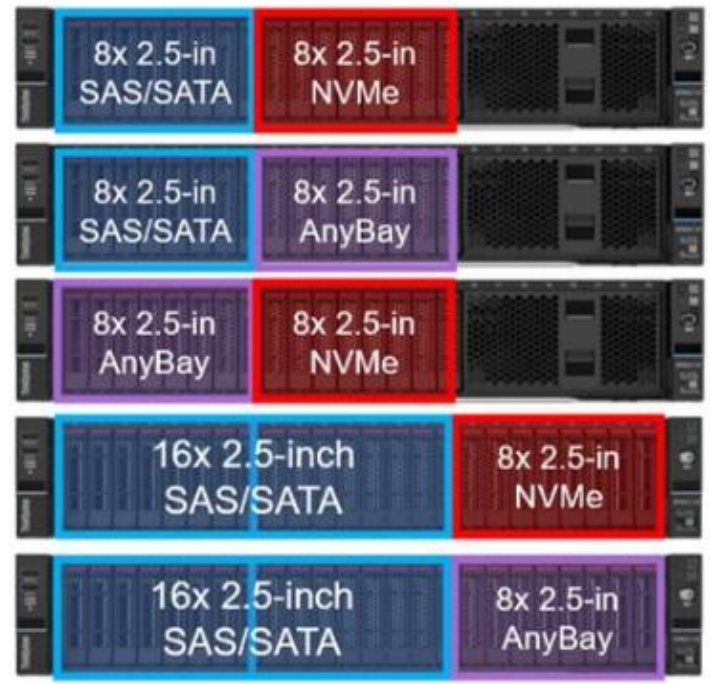
Each configuration requires a different backplane. Check the SR650 V4 product guide on Lenovo Press for more details.

Table 21. Backplanes for front drive bays

Feature	Description	Bays	PCIe Gen	SAS Gen	Max qty
Front 3.5-inch drive backplanes					
C4DB	ThinkSystem 2U V4 8x3.5" SAS/SATA Backplane	8	-	12Gb	1
C3RW	ThinkSystem 2U V4 12x3.5" SAS/SATA Backplane	12	-	12Gb	1
C3R	ThinkSystem 2U V4 8x3.5" SAS/SATA+4x 3.5" AnyBay Backplane	12	Gen5	24Gb	1
C48N	ThinkSystem 2U V4 8x3.5" SAS/SATA+4x 3.5" NVMe Backplane	12	Gen5	24Gb	1

SR650 V4 front 2.5-inch drive configurations

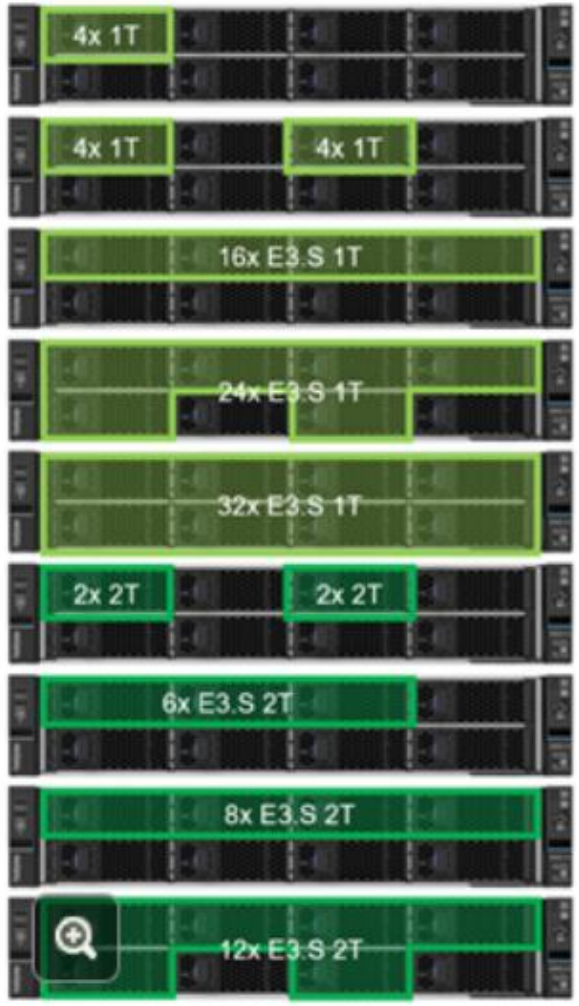
All the same drive type



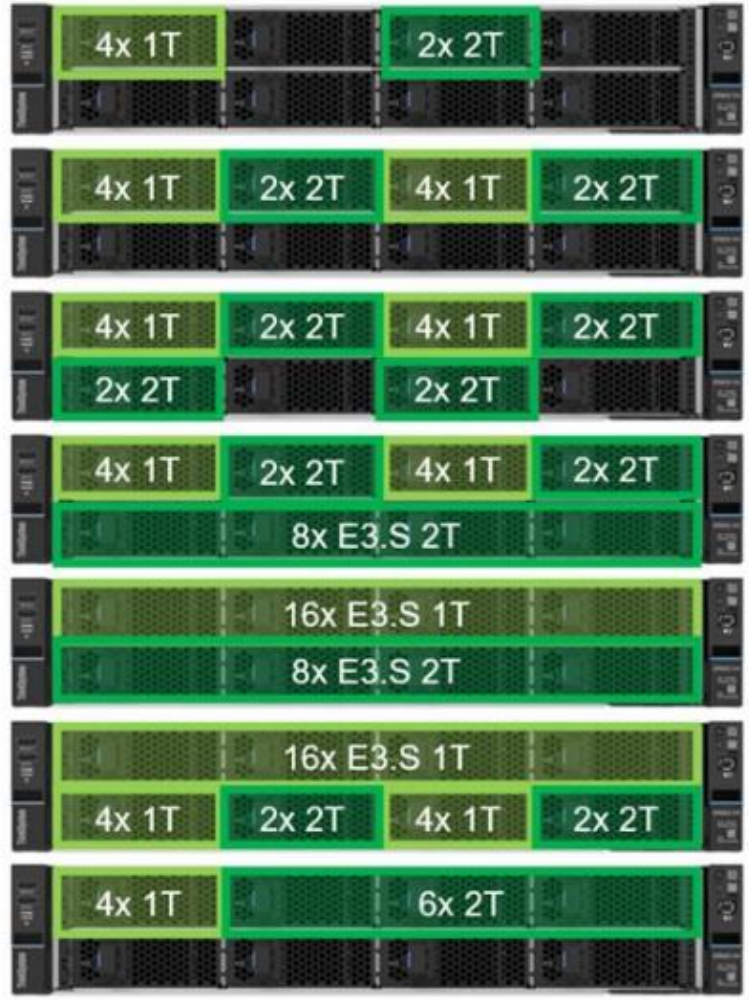
Combination

SR650 V4 front E3.S drive configurations

All the same drive type



Combination



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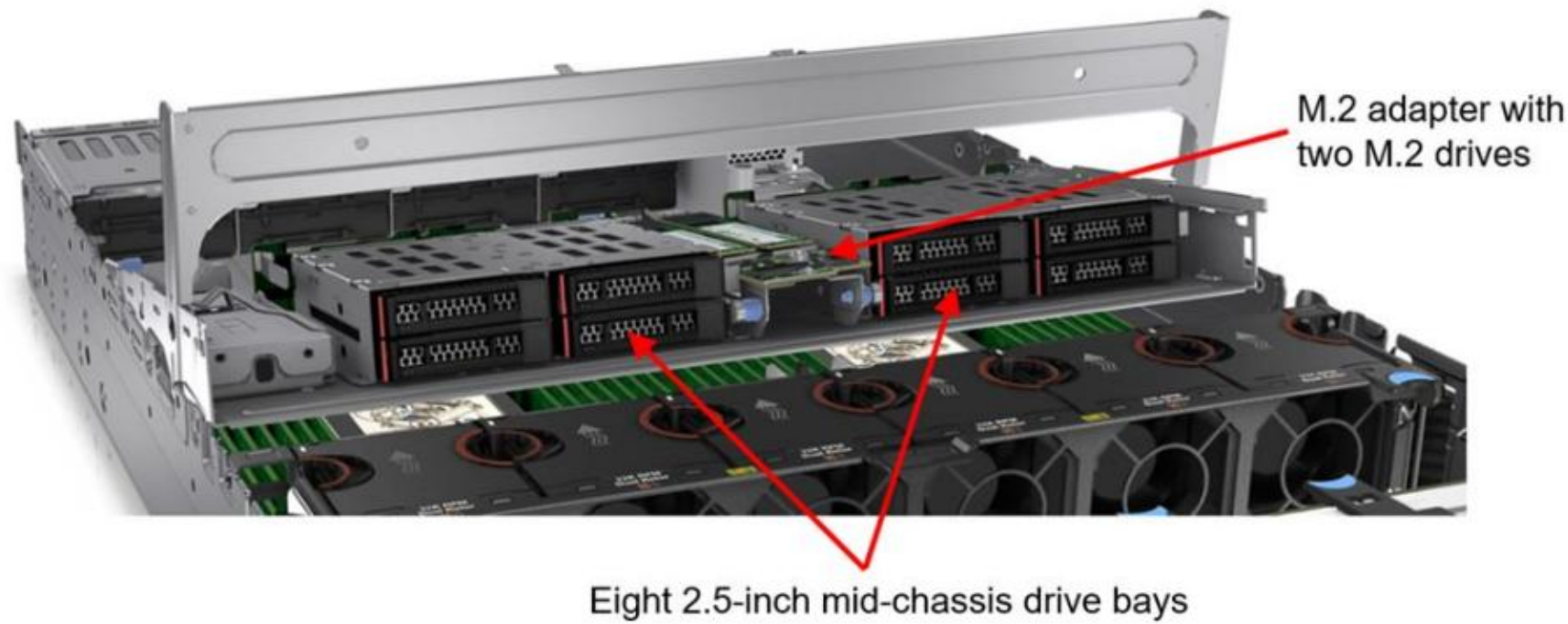
SR650 V4 mid drive configurations

The SR650 V4 supports simple-swap drives installed in the middle of the server chassis. The drive bays are accessible by removing the top lid of the server and levering the mid drive chassis up at the front.

The following configurations are supported:

- Eight 2.5-inch simple-swap SAS/SATA drive bays
- Eight 2.5-inch simple-swap NVMe drive bays



SR650 V4 rear drive configurations

Slots can be used in conjunction with rear 2.5-inch or 3.5-inch drive bays. Slot 8 can also be configured for a pair of hot-swap M.2 drives.
With most configurations, slots 1 and 2 (riser 1) are low profile (LP) slots; however, with the eight 2.5-inch drive configuration, the slots in riser 1 are full height (FH) slots.
Four 3.5-inch drive bays support SAS/SATA drive bays.
Four 2.5-inch drive bays support SAS/SATA, NVMe Gen 5, or AnyBay Gen 5 drive bays.
Eight 2.5-inch drive bays support SAS/SATA drive bays.
Possible combinations are shown below.

Rear four 2.5-inch drives and two hot-swap M.2 drives

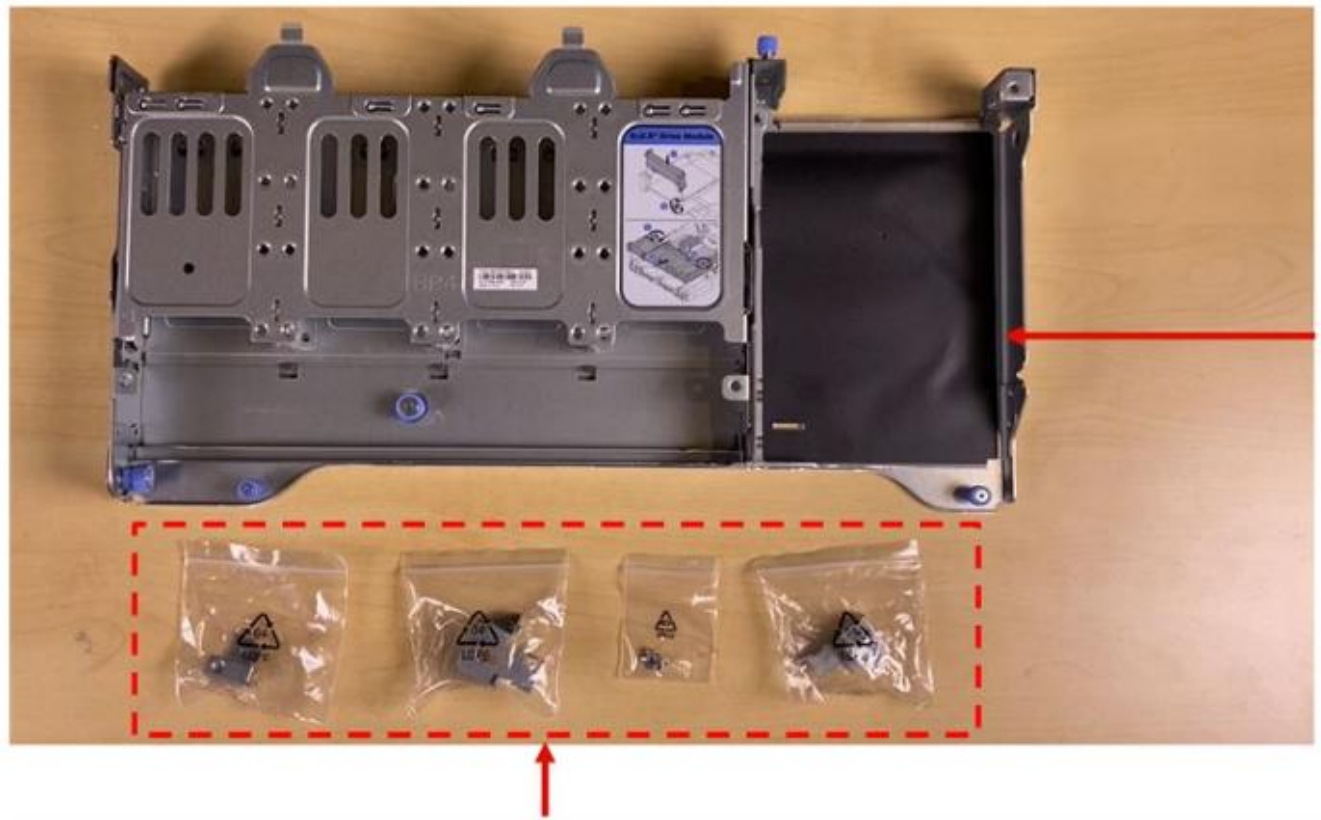
Rear eight 2.5-inch drives

Rear four 3.5-inch drives

Rear two hot-swap M.2 drives

SR650 V4 rear drive cage

The following figure shows the rear eight 2.5-inch drive cage. To install the rear drive cage, the original rearwall bracket in the chassis should be replaced with the rearwall bracket shipped with the new cage.



SR650 V4 internal M.2 drives

The internal M.2 drives (non-hot-swap) are installed on the M.2 backplane and mounted horizontally in the server. Depending on the M.2 backplane selected, RAID is either integrated or implemented with the use of VROC.

Internal M.2 module locations are as follows:

- In servers without mid-chassis drives, the M.2 module is mounted on the air baffle
- With a mid-chassis drive cage, the M.2 module is mounted on the mid drive cage

M.2 module is mounted on the air baffle

M.2 module is mounted on mid drive cage

SR650 V4 hot-swap M.2 drives

The SR650 V4 supports one or two M.2 form-factor SATA or NVMe drives for use as an operating system boot solution or as additional storage. Locations are as follows:

- Rear-mounted hot-swap M.2 drives with integrated RAID.
- Front-mounted hot-swap M.2 drives with integrated RAID. Only supported with E3.S and 2.5-inch front drive configurations.

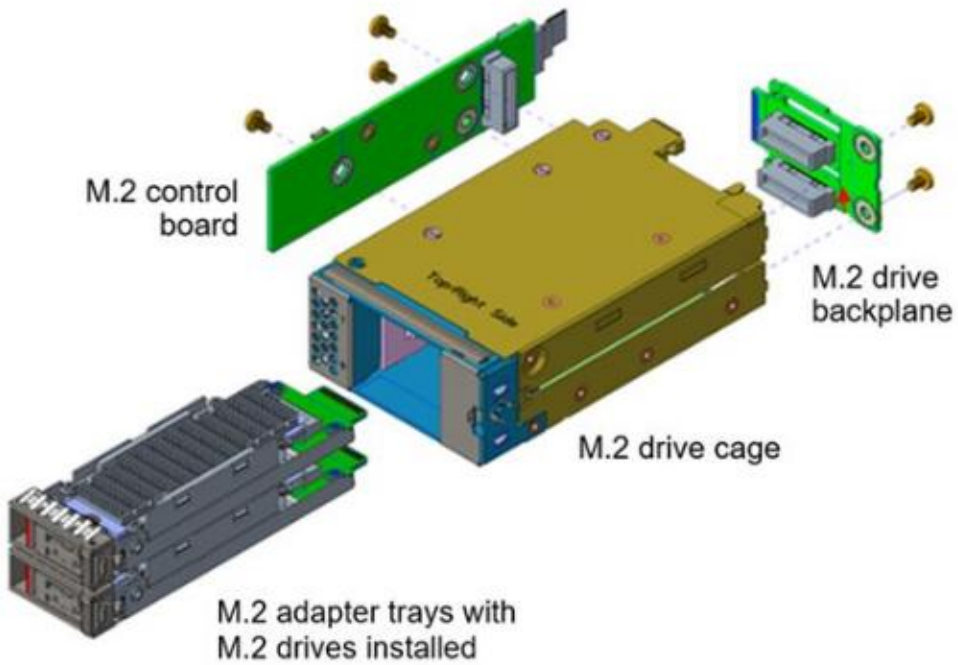
Front hot-swap M.2 with 8 or 16 2.5-inch drive bays

Front hot-swap M.2 with E3.S drive bays

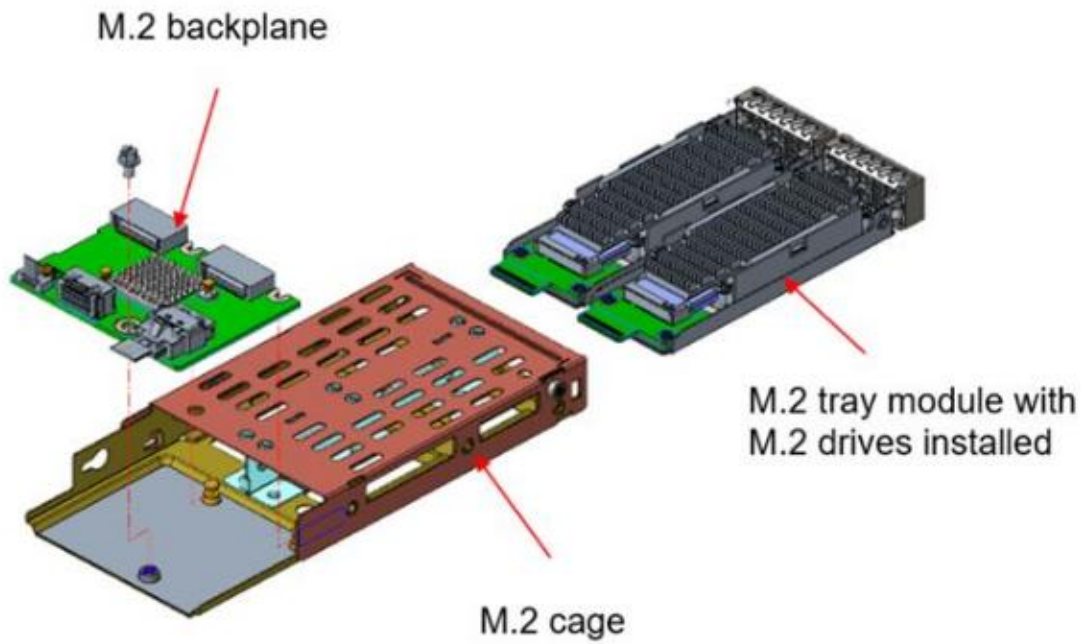
Rear hot-swap M.2 in slot 8
(can also be used with rear 2.5-inch or 3.5-inch drive bays)

Hot-swap M.2 drive assemblies

Hot-swap M.2 drive assemblies can be installed at the front or rear of the server.



Front M.2 drive assembly



Rear M.2 drive assembly

SR650 V4 memory options

The SR650 V4 supports 16 DIMMs per processor. Each processor has eight memory channels with two DIMMs per channel (2DPC). The server also supports up to 12 CXL memory DIMMs (6 per CPU) which are installed in E3.S 2T drive bays

Memory module type:

- TruDDR5 6400 MHz x8 RDIMM: 16 GB (1Rx8), 32 GB (2Rx8), 48 GB (2Rx8)
- TruDDR5 6400 MHz 10x4 RDIMM: 32 GB (1Rx4), 64 GB (2Rx4), 96 GB (2Rx4), 128 GB (2Rx4)
- TruDDR5 6400 MHz 3DS RDIMM: 256 GB (4Rx4)
- TruDDR5 8800 MHz MRDIMM: 32 GB (2Rx8), 64 GB (2Rx4)
- CXL memory module (CMM): 96 GB, 128 GB

Speed: Operating speed depends on processor model and UEFI settings

- 6400 MHz RDIMMs:
  - 6400 MT/s for 1 DIMM per channel
  - 5200 MT/s for 2 DIMMs per channel
- 8800 MHZ MRDIMMs
  - 8800 MT/s for 1 DIMM per channel

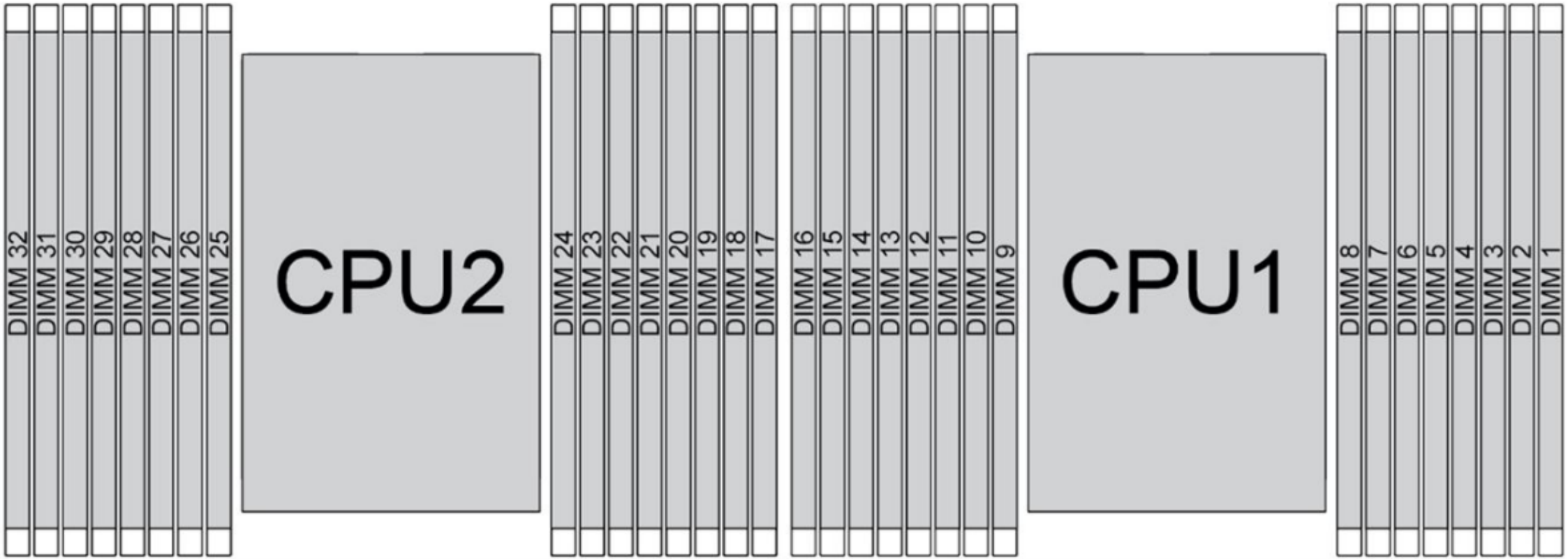
Minimum memory: 16 GB

Maximum memory: 8 TB: 32 256 GB 3DS RDIMMs (2 processors)

Note: For detailed memory configuration and installation rules, refer to the Memory module installation rules and order section of the SR650 V4 Hardware Maintenance Guide.

Memory slot and channel identification

The following figure shows the layout of the memory modules and processors. Click HERE to see the memory slot and channel identification.

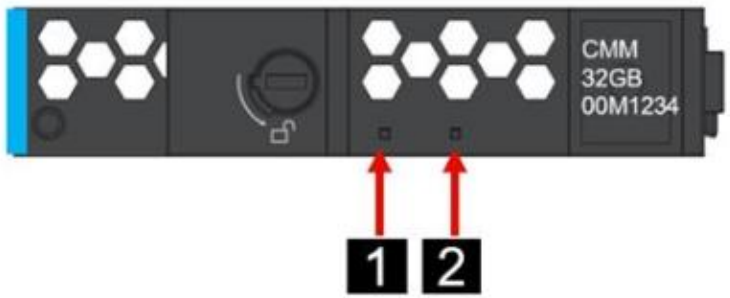


Memory slot and channel identification

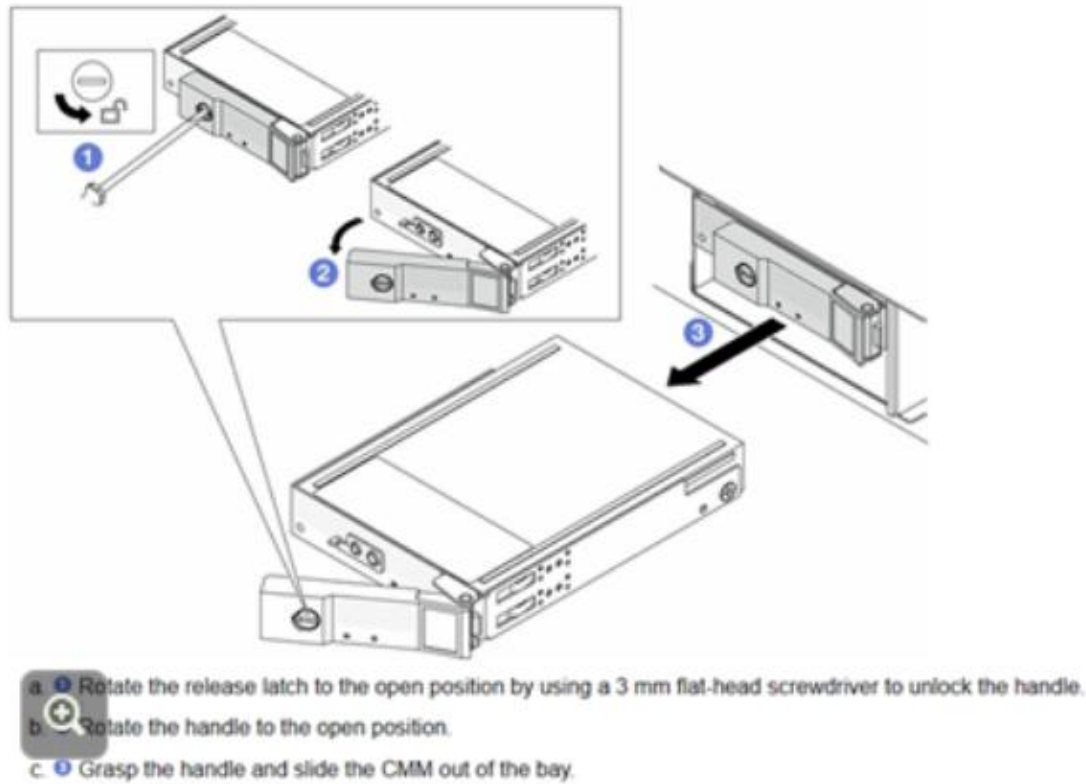
Processor	CPU 1															
Controller	iMC7		iMC6		iMC5		iMC4		iMC0		iMC1		iMC2		iMC3	
Channel	CH7		CH6		CH5		CH4		CH0		CH1		CH2		CH3	
Slot No.	0	1	0	1	0	1	0	1	1	0	1	0	1	0	1	0
DIMM No.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Processor	CPU 2															
Controller	iMC7		iMC6		iMC5		iMC4		iMC0		iMC1		iMC2		iMC3	
Channel	CH7		CH6		CH5		CH4		CH0		CH1		CH2		CH3	

Replacing E3.S CXL memory modules

E3.S CXL memory modules (CMM) are not hot-swappable. Before removing an E3.S CMM, power off the server and peripheral devices and also disconnect the power cords and external cables.



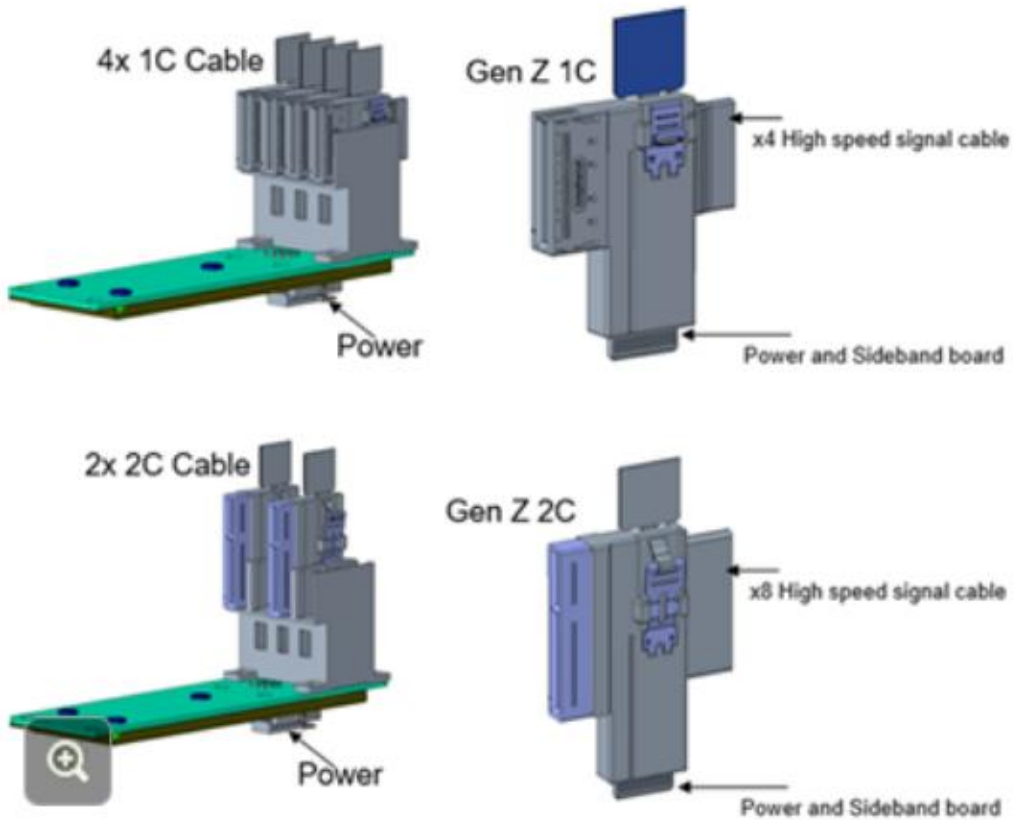
LED	Status	Description
1 Fault LED	Off	The CMM is healthy.
	Solid amber	The CMM is faulty.
2 Health LED	Solid white	The CMM is powered but not active. Removal is not permitted.
	Blinking white	The CMM is active. Removal is not permitted.
	Off	The CMM is not powered. Removal is permitted.



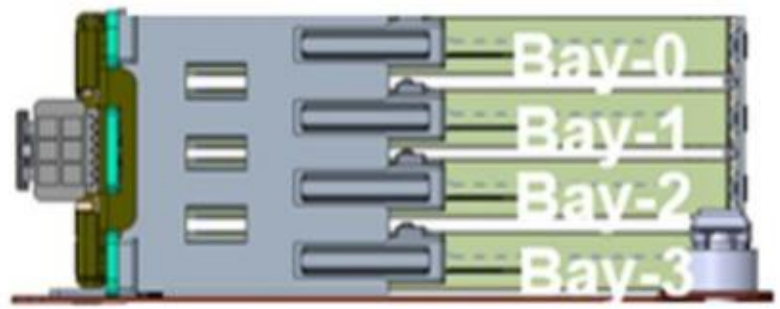
Note: The SR650a V4 does not support CMMs.

Replacing E3.S hot-swap or E3.S CMM cages

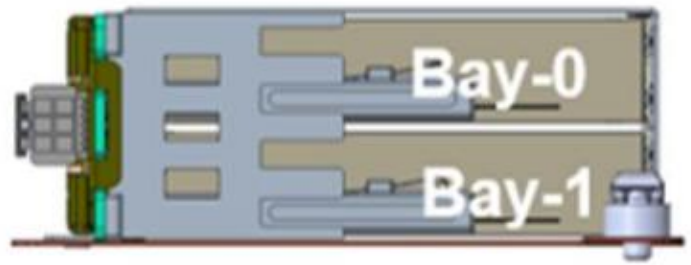
The SR650 V4 supports two types of E3.S cages, which have different replacement procedures. For more information, refer to the SR650 V4 Hardware Maintenance Menu or to the replacement videos on the course landing page or YouTube.



Rear view (four E3.S 1T)

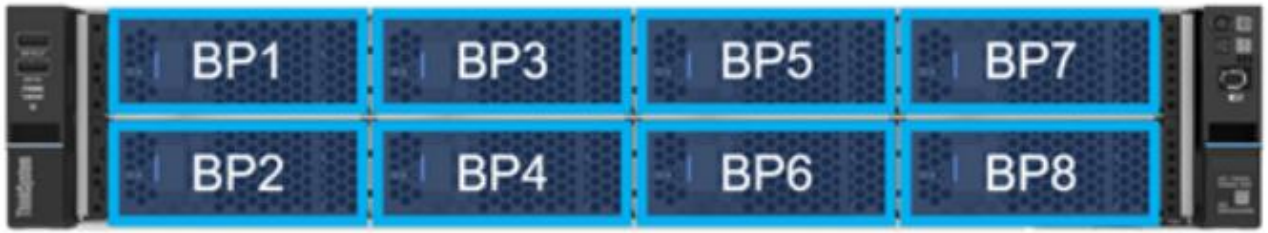


Rear view (two E3.S CMM)



E3.S backplane information on the chassis

The SR650 V4 with front E3.S drive bay configuration has chassis markings showing backplane numbering. There is also a sticker to indicate the E3.S cable connections from the system board to the E3.S backplane.



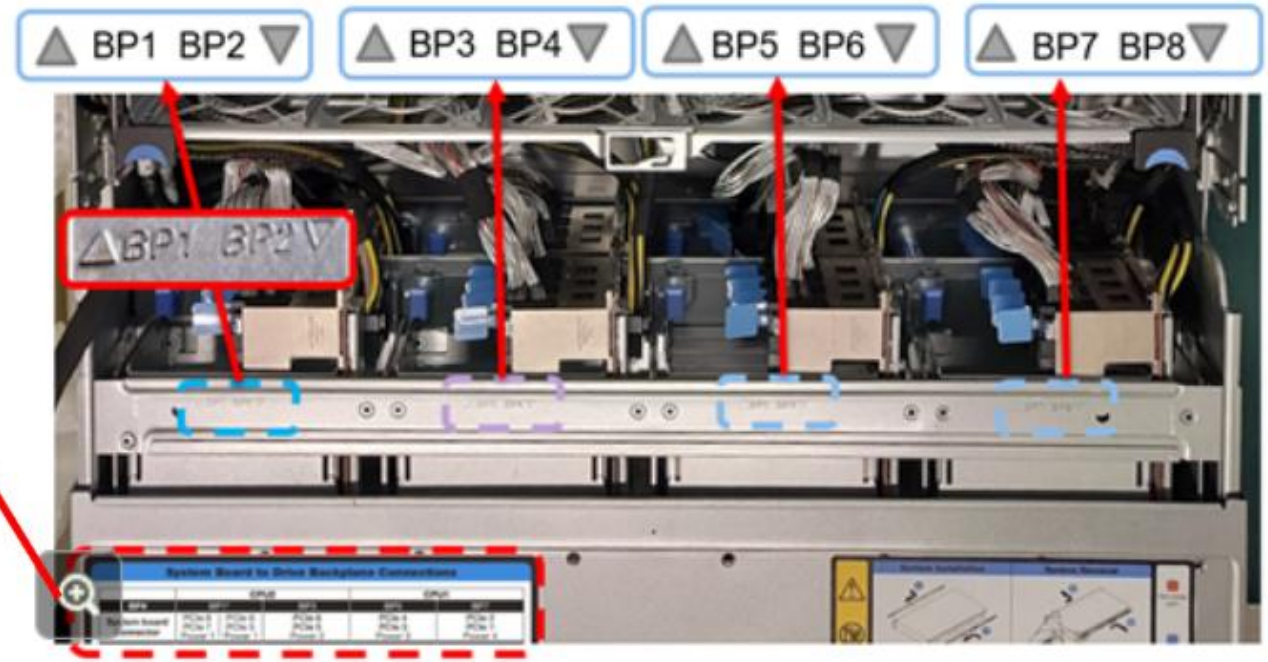
SR650 V4 E3.S backplane numbering

System Board to Drive Backplane Connections

	CPU2			CPU1	
BP#	BP1*		BP3	BP5	BP7
System board connector	PCIe 8 PCIe 7 Power 1	PCIe 6 PCIe 5 Power 1	PCIe 6 PCIe 5 Power 2	PCIe 4 PCIe 3 Power 3	PCIe 2 PCIe 1 Power 4
BP#	BP2		BP4	BP6	BP8
System board connector	PCIe 13A PCIe 13B Power 12		PCIe 15A PCIe 15B Power 23	PCIe 9A PCIe 9B Power 20	PCIe 11A PCIe 11B Power 21

* = If only BP1 & BP5 installed, BP1 should be connected to PCIe 6, PCIe 5, Power 1.
Backplane installation order: BP1, BP5, BP3, BP7, BP2, BP6, BP4, BP8.

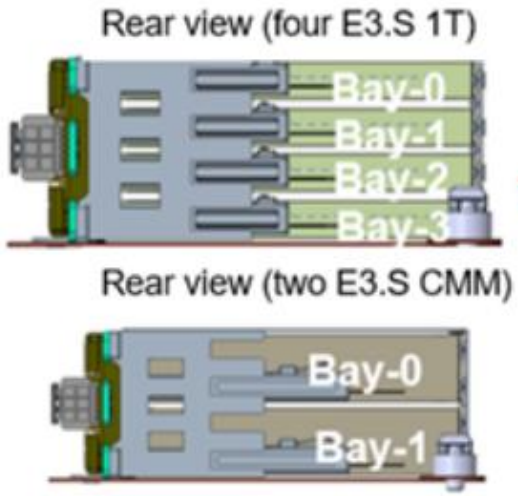
SR650 V4 E3.S cable connection sticker



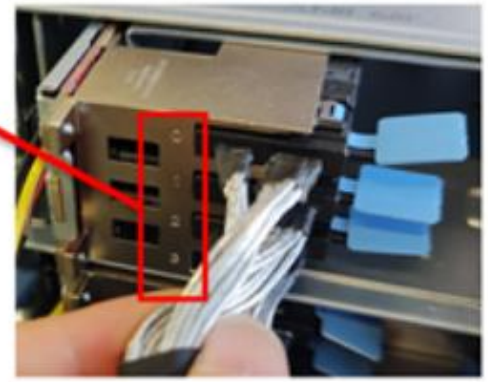
Backplane number marked on the chassis

Slot information on the E3.S backplane and E3.S cable

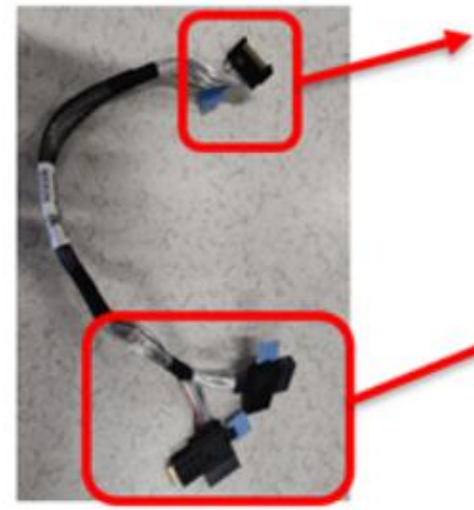
To prevent incorrect connection, slot numbers are marked on the E3.S drive cage and E3.S cables. The E3.S cable connector marked **0/2 (BP)** should be connected to slot 0 or 2 on the E3.S backplane, and the connector marked **1/3 (BP)** should be connected to slot 1 or 3 on the E3.S backplane. The E3.S cable connector marked **MB** should be connected to the system board.



E3.S backplane slot number on the drive cage (1T and CMM)



E3.S backplane slot number on the drive cage (1T)



E3.S 1T Y cable

E3.S 1T Y cable labeling

Lenovo

E3.S cable connection example

In this example scenario, an SR650 V4 is configured with two backplanes (BP1 and BP5) and four E3.S 1T drives in each backplane. The following slides will show you how to connect BP1 to the system.

System Board to Drive Backplane Connections

	CPU2		CPU1	
BP#	**BP1***	**BP3**	**BP5**	**BP7**
System board connector	PCIe 8 PCIe 7 Power 1 PCIe 6 PCIe 5 Power 1	PCIe 6 PCIe 5 Power 2	PCIe 4 PCIe 3 Power 3	PCIe 2 PCIe 1 Power 4
BP#	**BP2**	**BP4**	**BP6**	**BP8**
System board connector	PCIe 13A PCIe 13B Power 12	PCIe 15A PCIe 15B Power 23	PCIe 9A PCIe 9B Power 20	PCIe 11A PCIe 11B Power 21

* If only BP1 & BP5 installed, BP1 should be connected to PCIe 6, PCIe 5, Power 1.

backplane installation order: BP1, BP5, BP3, BP7, BP2, BP6, BP4, BP8.

SR650 V4 E3.S cable connection sticker on the chassis

Click each number in turn to see the procedure.

Step 1 2 3

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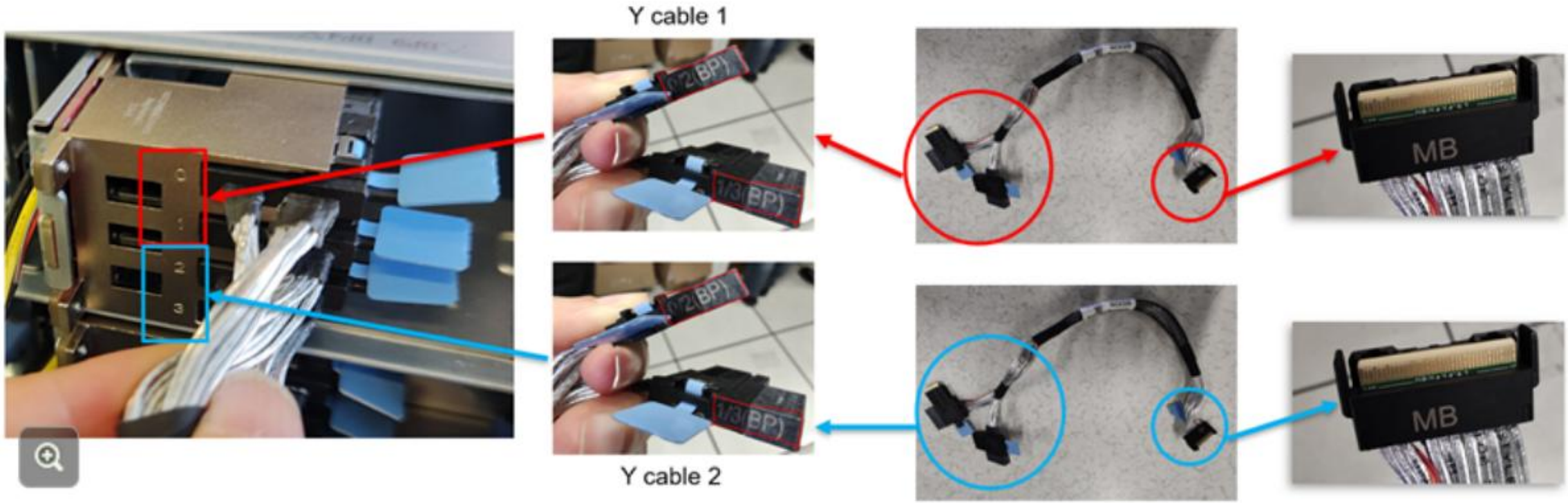
E3.S cable connection example

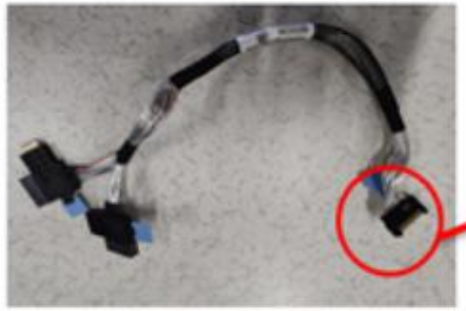
- Connect the **0/2 (BP)** connector on Y cable 1 to slot 0 and the **1/3 (BP)** connector to slot 1 on E3.S BP1
- Connect the **0/2 (BP)** connector on Y cable 2 to slot 2 and the **1/3 (BP)** connector to slot 3 on E3.S BP1

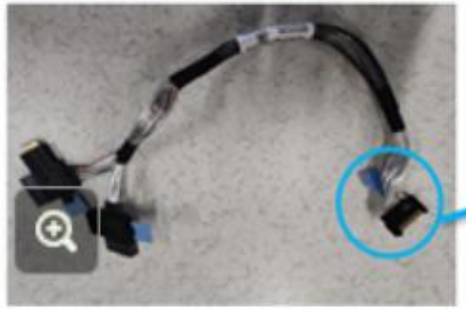


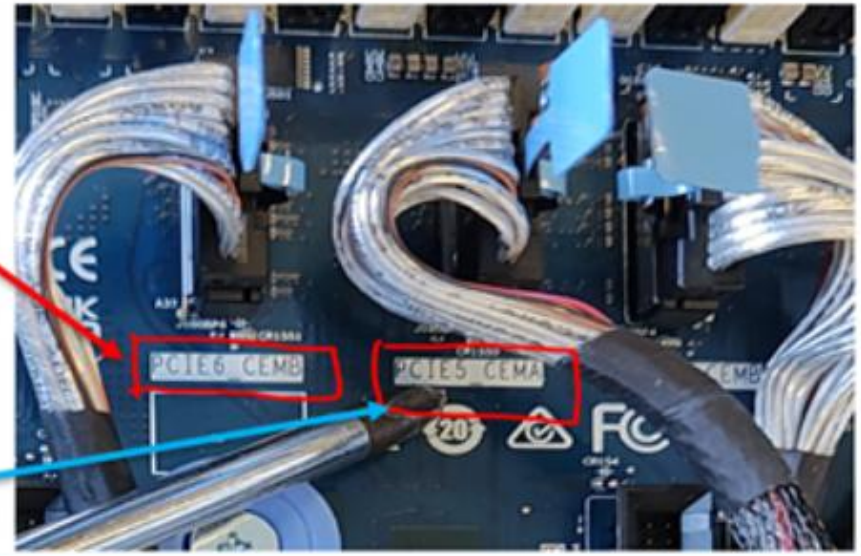
Step 1 2 3

E3.S cable connection example

- Connect the **MB** connector on Y cable 1 to the **PCIE6_CEMB** connector on the system board
- Connect the **MB** connector on Y cable 2 to the **PCIE5_CEMA** connector on the system board







System Board to Drive Backplane Connections

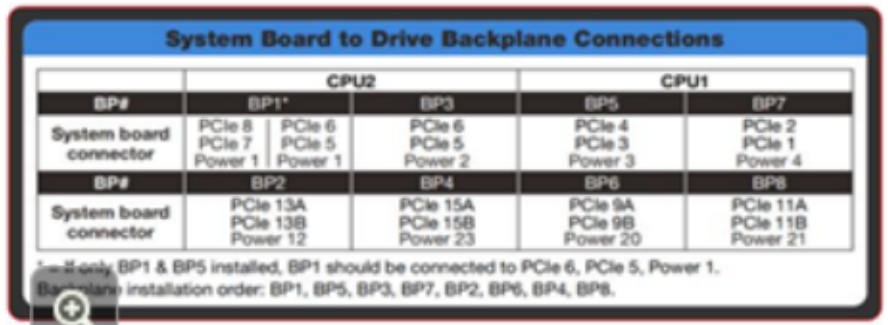
	CPU2			CPU1	
BP#	**BP1***		**BP3**	**BP5**	**BP7**
System board connector	PCIe 8 PCIe 7 Power 1	PCIe 6 PCIe 5 Power 1	PCIe 6 PCIe 5 Power 2	PCIe 4 PCIe 3 Power 3	PCIe 2 PCIe 1 Power 4
BP#	**BP2**		**BP4**	**BP6**	**BP8**
System board connector	PCIe 13A PCIe 13B Power 12		PCIe 15A PCIe 15B Power 23	PCIe 9A PCIe 9B Power 20	PCIe 11A PCIe 11B Power 21

* If only BP1 & BP5 installed, BP1 should be connected to PCIe 6, PCIe 5, Power 1.
Backplane installation order: BP1, BP5, BP3, BP7, BP2, BP6, BP4, BP8.

Step 1 2 3

E3.S cable connection example

Always check the E3.S cable connection sticker before installation. Different stickers are used with the SR650 V4, SR650 V4 with Neptune DWC, and SR650a V4.

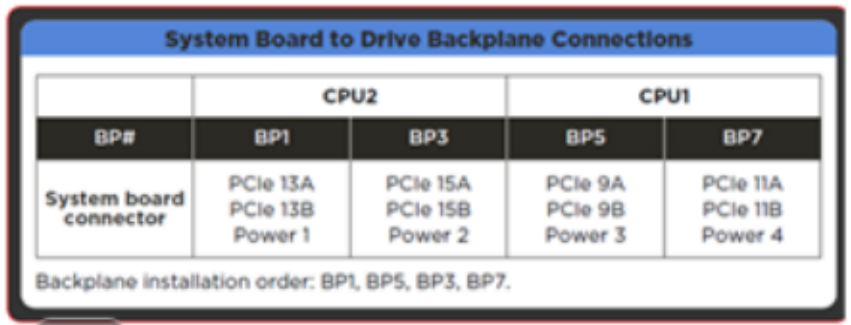


System Board to Drive Backplane Connections

BP#	CPU2		CPU1	
	BP1*	BP3	BP5	BP7
System board connector	PCIe 8 PCIe 7 Power 1 | PCIe 6 PCIe 5 Power 1	PCIe 6 PCIe 5 Power 2	PCIe 4 PCIe 3 Power 3	PCIe 2 PCIe 1 Power 4
BP#	BP2	BP4	BP6	BP8
System board connector	PCIe 13A PCIe 13B Power 12	PCIe 15A PCIe 15B Power 23	PCIe 9A PCIe 9B Power 20	PCIe 11A PCIe 11B Power 21

* If only BP1 & BP5 installed, BP1 should be connected to PCIe 6, PCIe 5, Power 1.
Backplane installation order: BP1, BP5, BP3, BP7, BP2, BP6, BP4, BP8.

SR650 V4 E3.S cable connection sticker

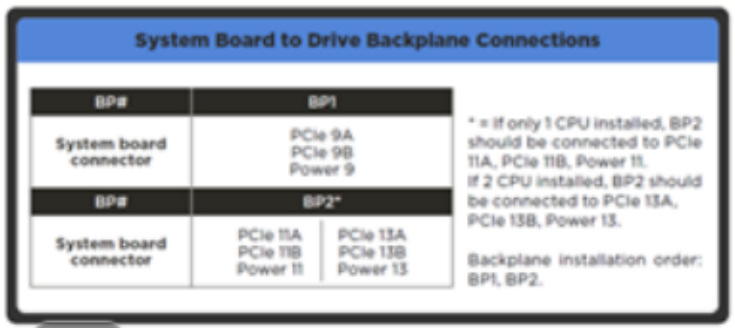


System Board to Drive Backplane Connections

BP#	CPU2		CPU1	
	BP1	BP3	BP5	BP7
System board connector	PCIe 13A PCIe 13B Power 1	PCIe 15A PCIe 15B Power 2	PCIe 9A PCIe 9B Power 3	PCIe 11A PCIe 11B Power 4

Backplane installation order: BP1, BP5, BP3, BP7.

SR650 V4 Neptune DWC E3.S cable connection sticker



System Board to Drive Backplane Connections

BP#	BP1	
System board connector	PCIe 9A PCIe 9B Power 9	
BP#	BP2*	
System board connector	PCIe 11A PCIe 11B Power 11	PCIe 13A PCIe 13B Power 13

* = If only 1 CPU installed, BP2 should be connected to PCIe 11A, PCIe 11B, Power 11.
If 2 CPU installed, BP2 should be connected to PCIe 13A, PCIe 13B, Power 13.

Backplane installation order: BP1, BP2.

SR650a V4 E3.S cable connection sticker

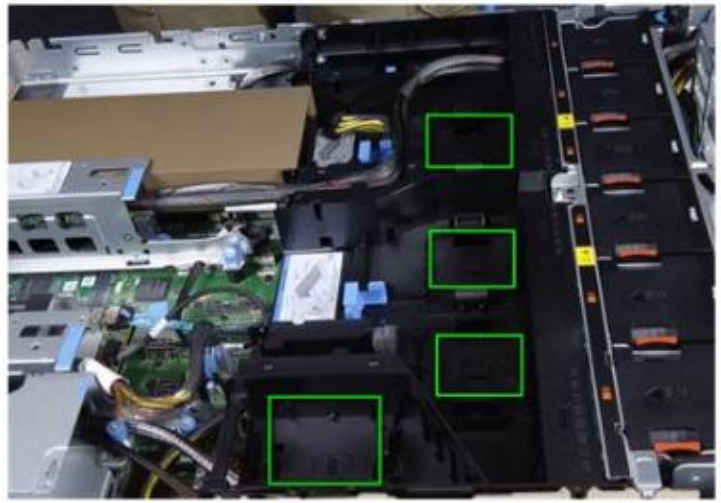
For more information, refer to the *E3.S backplane cable routing* section of the ThinkSystem SR650 V4 Internal Cable Routing Guide or ThinkSystem SR650a V4 Internal Cable Routing Guide.

Step 1 2 3

RAID flash power module location

The SR650 V4 supports up to four RAID flash power modules (supercaps). The location of the RAID flash power modules will vary depending on the hardware configuration.

On the standard air baffle

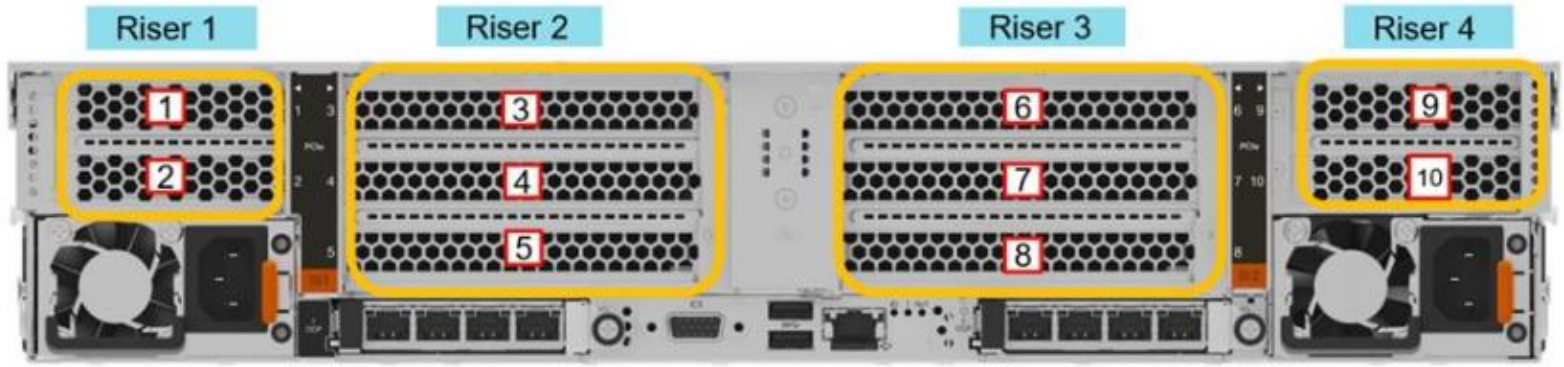


On the GPU air baffle

On the 2.5-inch mid drive cage

SR650 V4 riser card combination

The SR650 V4 supports up to 10 PCIe slots and two OCP slots, all at the rear of the server. Slot availability is based on riser selection and the configuration of drive bays.



Riser 1: Slots 1 and 2 (connect to CPU 1), low-profile slots (full height when configured with eight 2.5-inch rear drive bays)
- Choice 1: x8, x8
- Choice 2: x16, x16

Riser 2: Slots 3, 4, and 5 (connect to CPU 1), full-height slots
- Choice 1: x8, x16, x16
- Choice 2: Empty, x16, x16 (use with a double-width GPU in slot 4)
- Choice 3: x16, x16, Empty
- Choice 4: Empty, Empty, x16 (use with four 3.5-inch or eight 2.5-inch rear drive bays)

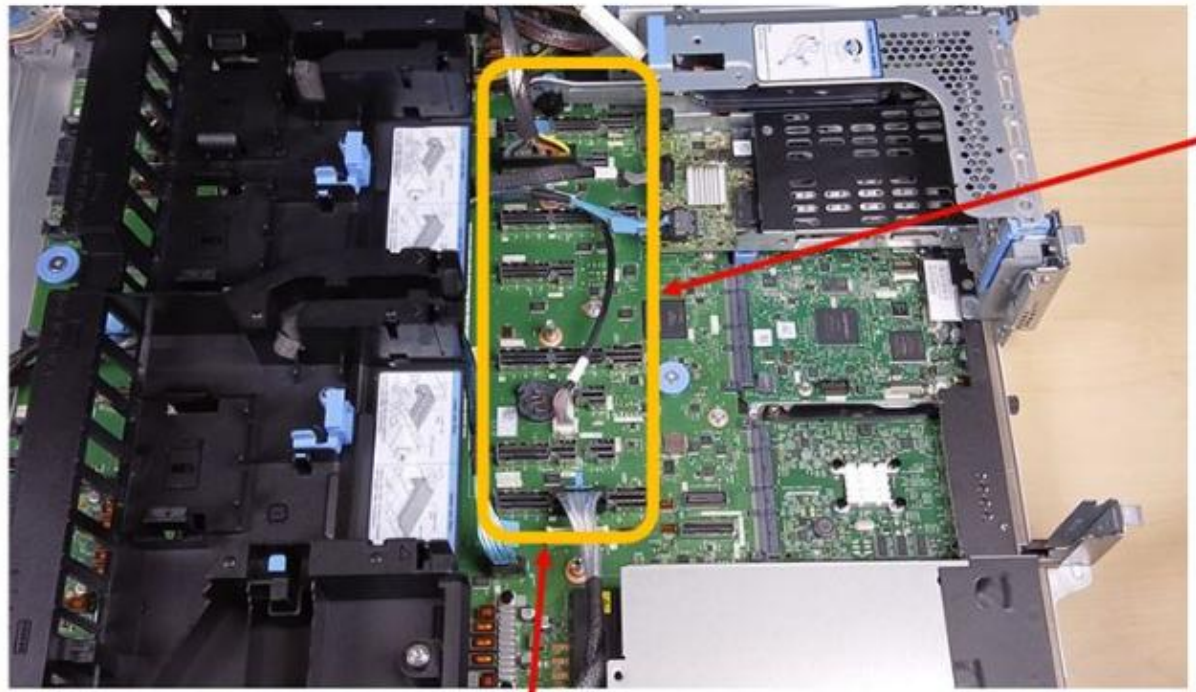
Riser 3: Slots 6, 7, and 8 (connect to CPU 2), full-height slots
- Choice 1: x8, x16, x16
- Choice 2: Empty, x16, x16 (use with a double-width GPU in slot 7)
- Choice 3: x16, x16, Empty
- Choice 4: Empty, Empty, x16 (use with any 2.5-inch or 3.5-inch rear drive bays)

Riser 4: Slots 9 and 10 (connect to CPU 2), low-profile slots
- Choice 1: x8, x8
- Choice 2: x16, x16

Configuration notes: All x8 slots are open-ended slots, which means they can physically support x16 adapters even though only 8 lanes (x8) will be connected.

Cable riser

The riser card used on the SR650 V4 and SR650a V4 does not have a gold finger on the PCB. A cable is used to connect it to the PCIe connector on the system board.



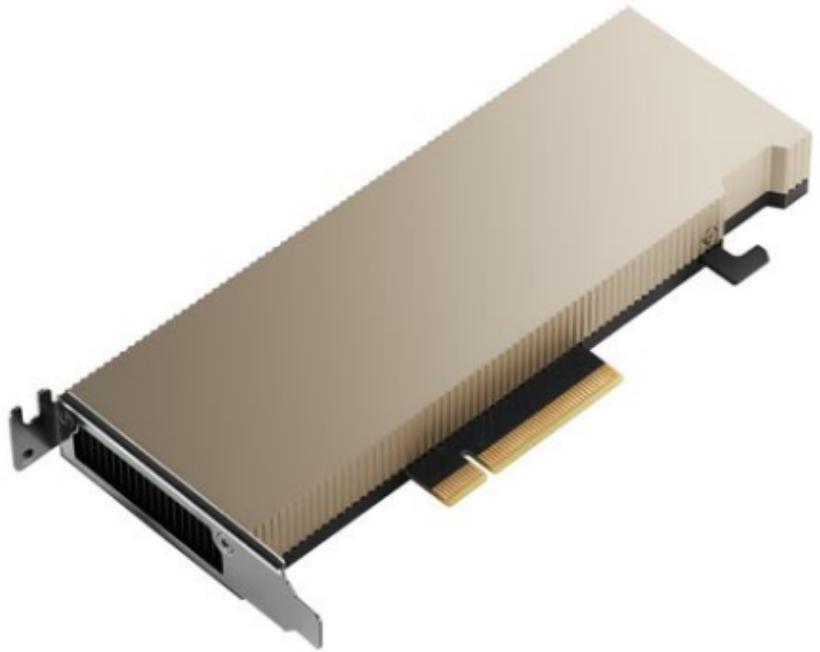
Gold finger

SR650 V4 GPU configuration rules

The following configuration requirements must be met when installing GPUs:

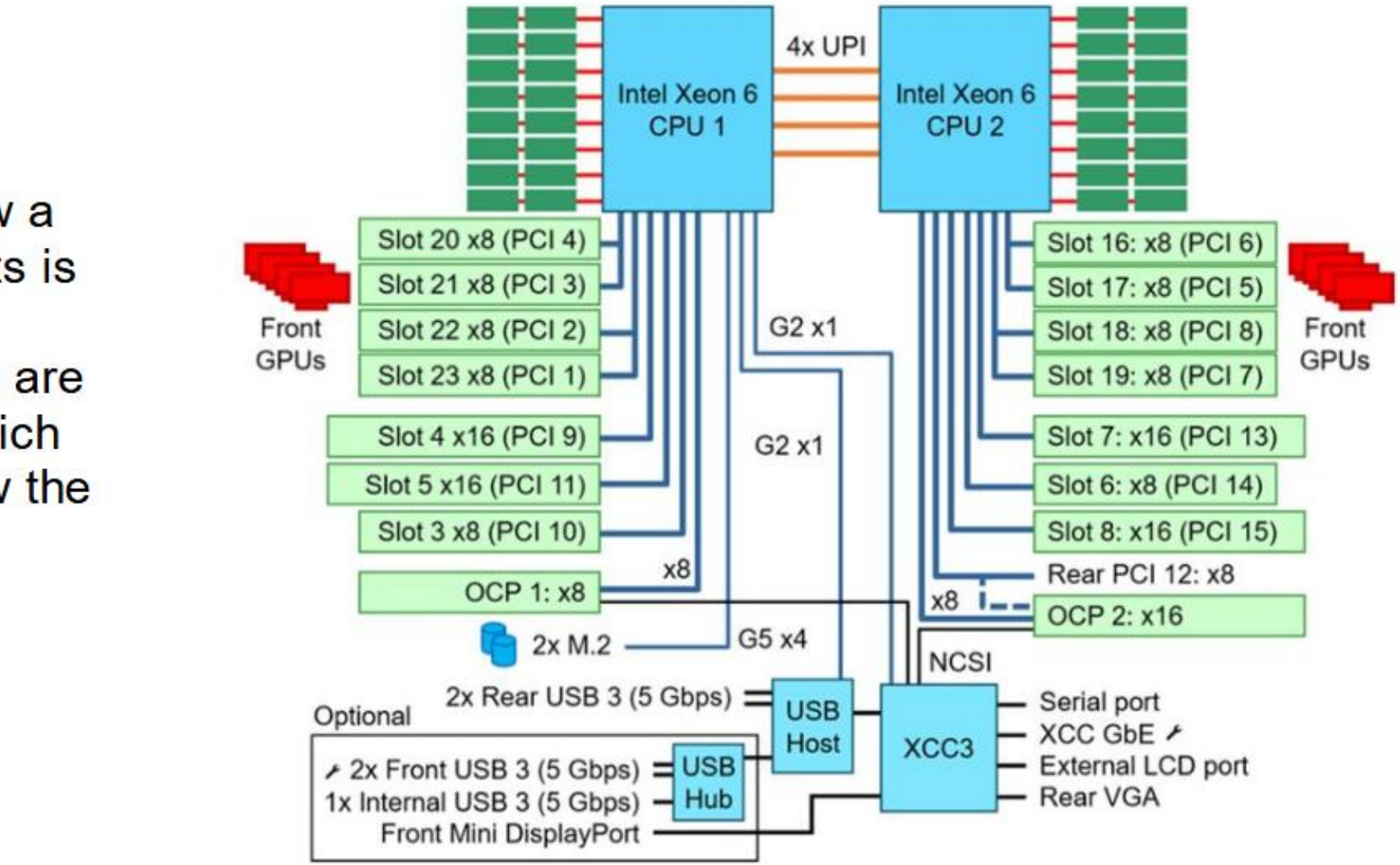
- All the GPUs must be identical
- When a double-width GPU is installed in slot 4 or 7, the adjacent slot (3 or 6 respectively) will not be available
- Middle and rear drive bays will not be supported when a GPU is installed
- The 3.5-inch model does not support GPUs
- GPUs are not supported with the ThinkSystem V4 1U/2U Compute Complex Neptune Core Module (machine type 7DK2)

Note: If a GPU is listed as “Controlled”, it means the US Government has prohibited its use in certain markets. If a GPU is listed as “No”, it means the GPU is not controlled and is available in all markets.



SR650a V4 system block diagram

This block diagram shows how a configuration with six rear slots is connected.
Most of the PCIe connections are implemented using cables, which maximizes the flexibility in how the server can be configured.



SR650a V4 front configurations

The front of the server supports eight 2.5-inch hot-swap drives, eight E3.S 1T hot-swap drives, or four E3.S 1T hot-swap drives. All three options support two M.2 form-factor SATA or NVMe drives for use as an operating system boot solution or as additional storage.

Note: Unlike the SR650 V4, the SR650a V4 does not support the following drive bays:

- Front 3.5-inch drive bays
- Front E3.S 2T drives bays, including support for CXL memory
- Mid-chassis drive bays
- Rear drive bays

Eight 2.5-inch hot-swap drives

Eight E3.S 1T drive bays

SR650a V4 hot-swap M.2 drives

The SR650a V4 supports one or two M.2 form-factor SATA or NVMe drives for use as an operating system boot solution or as additional storage. Possible locations are as follows:

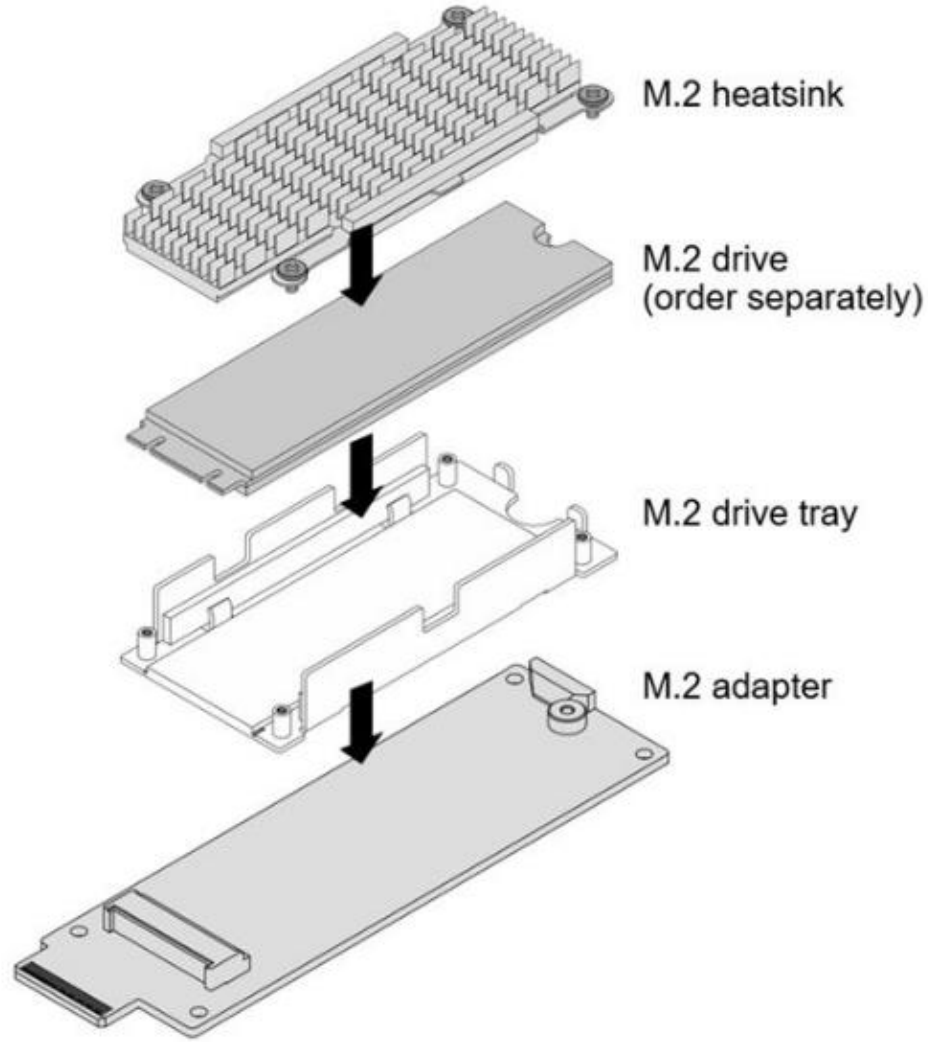
- Rear-mounted hot-swap M.2 drives with integrated RAID
- Front-mounted hot-swap M.2 drives with integrated RAID – only supported with E3.S drive configurations

Four E3.S 1T drive bays and two hot-swap M.2 drives

Five PCIe slots and two hot-swap M.2 drives

Hot-swap M.2 drive assembly components

The figure on the right shows the components of the hot-swap M.2 SATA/NVMe Drive Assembly Kit (PN:4XH7A96837), which can be used for hot-swap M.2 drives in front and rear drive bays – not for internal M.2 drives.
This kit can be used in all ThinkSystem V4 1U/2U servers.



SR650a V4 memory options

The SR650a V4 supports 16 DIMMs per processor. Each processor has eight memory channels with two DIMMs per channel (2DPC).

Memory module type:

- TruDDR5 6400 MHz x8 RDIMM: 16 GB (1Rx8), 32 GB (2Rx8), 48 GB (2Rx8)
- TruDDR5 6400 MHz 10x4 RDIMM: 32 GB (1Rx4), 64 GB (2Rx4), 96 GB (2Rx4), 128 GB (2Rx4)
- TruDDR5 6400 MHz 3DS RDIMM: 256 GB (4Rx4)
- TruDDR5 8800 MHz MRDIMM: 32 GB (2Rx8), 64 GB (2Rx4)

Speed: Operating speeds depend on the processor model and UEFI settings

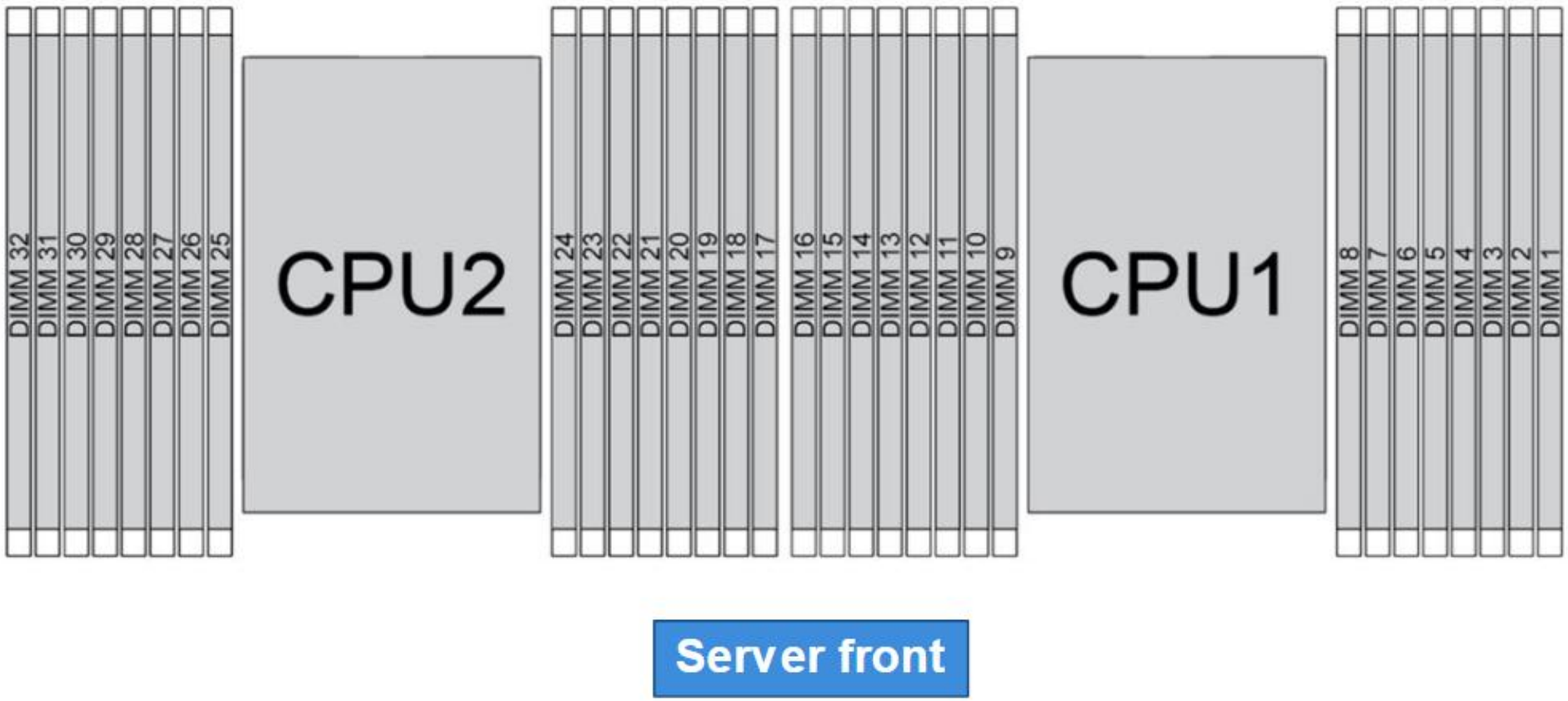
- 6400 MHz RDIMMs:
  - 6400 MT/s for 1 DIMM per channel
  - 5200 MT/s for 2 DIMMs per channel
- 8800 MHZ MRDIMMs
  - 8800 MT/s for 1 DIMM per channel

Minimum memory: 16 GB

Maximum memory: 8 TB, thirty-two 256 GB 3DS RDIMMs (two processors)

Memory slot and channel identification

The following figure shows the layout of the memory modules and processors. It is the same layout as the SR650 V4. Click HERE to see the memory slot and channel identification.



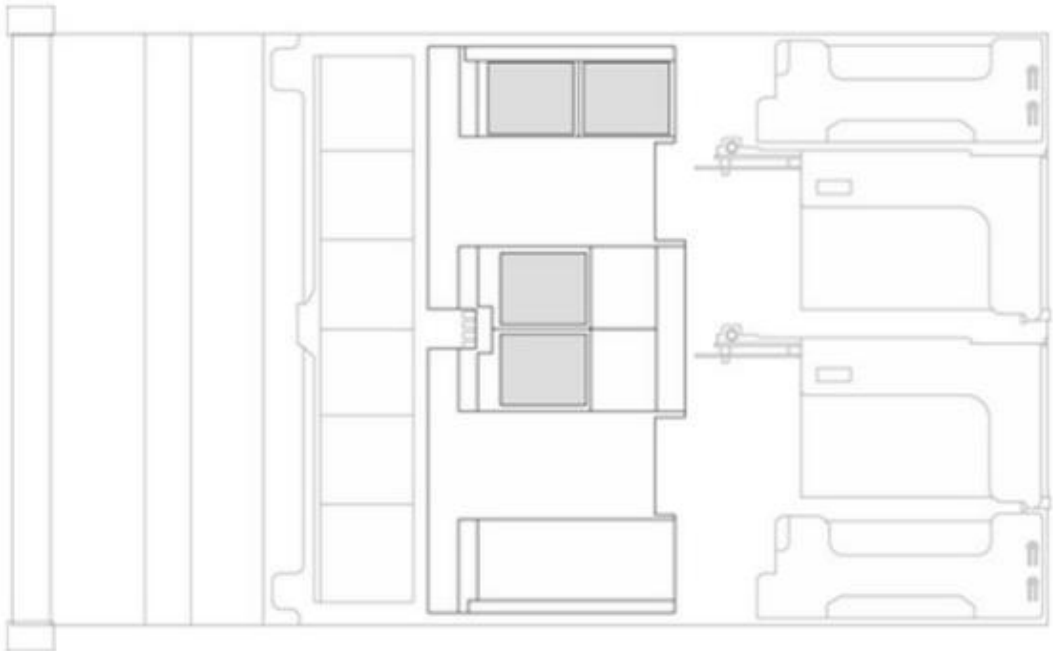
Memory slot and channel identification

Processor	CPU 1															
Controller	iMC7		iMC6		iMC5		iMC4		iMC0		iMC1		iMC2		iMC3	
Channel	CH7		CH6		CH5		CH4		CH0		CH1		CH2		CH3	
Slot No.	0	1	0	1	0	1	0	1	1	0	1	0	1	0	1	0
DIMM No.	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Processor	CPU 2															
Controller	iMC7		iMC6		iMC5		iMC4		iMC0		iMC1		iMC2		iMC3	
Channel	CH7		CH6		CH5		CH4		CH0		CH1		CH2		CH3	

RAID flash power module location

The SR650a V4 supports up to four RAID flash power modules (supercaps) installed on the standard air baffle.

Front



SR650a V4 front riser card combination

The SR650a V4 has front slots for GPUs, either four double-width GPUs or up to eight single-width GPUs. The following figure shows the locations of the front-accessible slots.

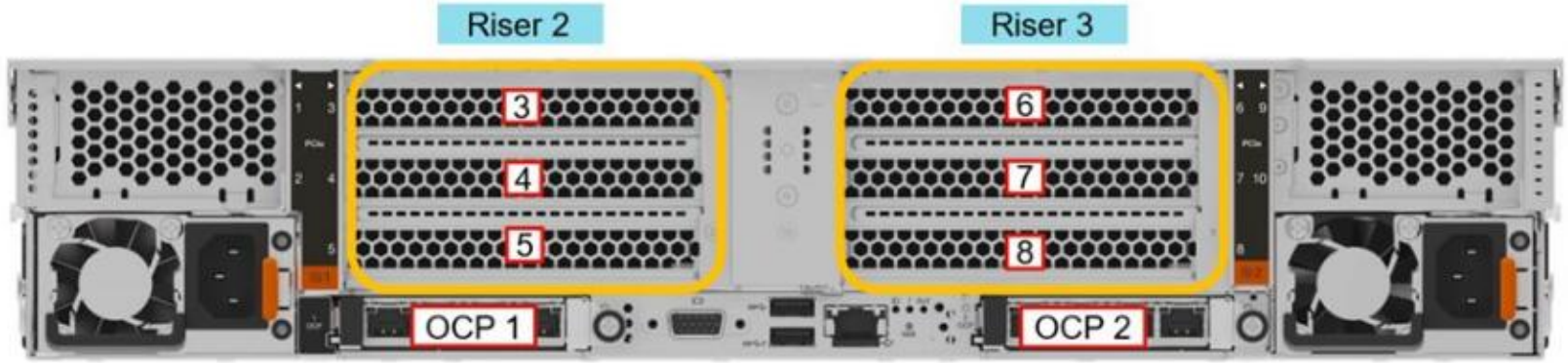
With 1 CPU installed:
- Two x16 slots in Riser 7 (slots 21, 23)
- Four x8 slots in Riser 7 only (slots 20, 21, 22, 23)

With 2 CPUs installed:
- Four x16 slots in Riser 6 (slots 17, 19) and Riser 7 (slots 21, 23)
- Eight x8 slots in Riser 6 and Riser 7 (all slots)
- Four x8 slots in Riser 6 (slots 16, 18) and Riser 7 (slots 20, 22)

Configuration notes: Both Riser 6 and Riser 7 must have slots configured, even in one-processor configurations where only Riser 7 is used.

SR650a V4 rear riser card combination

The SR650a V4 supports up to six PCIe slots and two OCP slots at the rear of the server. Slot availability is based on riser selection and drives. Riser 1 and Riser 4 are not available for use in the SR650a V4.



Riser 2: Slots 3, 4, and 5 (connect to CPU 1), full-height slots
- Choice 1: x8, x16, x16
- Choice 2: Empty, x16, x16
- Choice 3: x16, x16, Empty
- Choice 4: Empty, Empty, x16

Riser 3: Slots 6, 7, and 8 (connect to CPU 2), full-height slots
- Choice 1: x8, x16, x16
- Choice 2: Empty, x16, x16
- Choice 3: x16, x16, Empty
- Choice 4: Empty, Empty, x16

Configuration notes:
- All x8 slots are open-ended slots, which means they can physically support x16 adapters even though only eight lanes (x8) will be connected.
- Slot 8 can instead be configured for a pair of hot-swap M.2 drives.

SR650a V4 GPU configuration rules

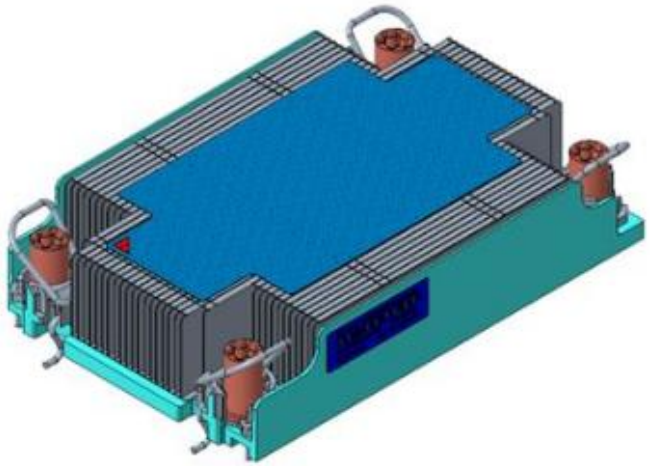
The following configuration requirements must be met when installing GPUs:

- All the GPUs must be identical
- GPUs are only supported in the front slots
- When a double-width GPU is installed, the adjacent slot will not be available
- For configurations with H100 GPUs, the server has optional support for NVLink bridges (PN:4X67A71309) to connect two adjacent GPUs. Each pair of GPUs supports three NVLink bridges. NVLink bridges are optional, but if they are used, then three must be installed for each pair of GPUs:
  - GPUs in slots 17 & 19: Three NVLink bridges
  - GPUs in slots 21 & 23: Three NVLink bridges

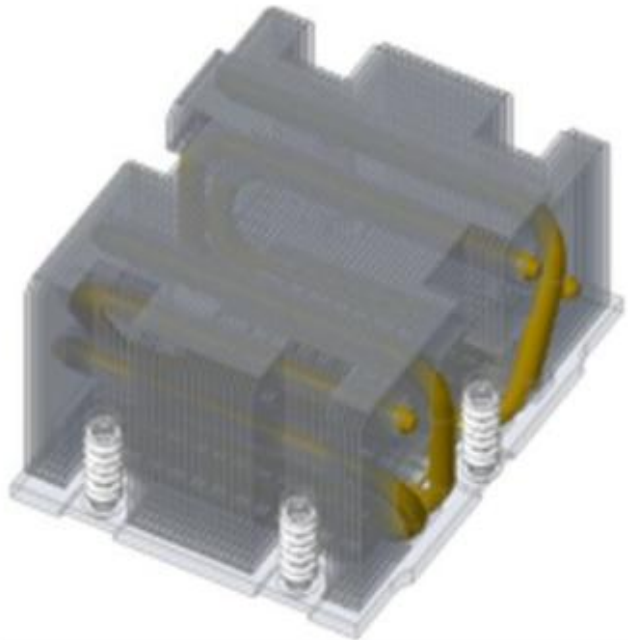
Note: If a GPU is listed as “Controlled”, it means the US Government has prohibited its use in certain markets. If a GPU is listed as “No”, it means the GPU is not controlled and is available in all markets.

SR650 V4 / SR650a V4 heat sink

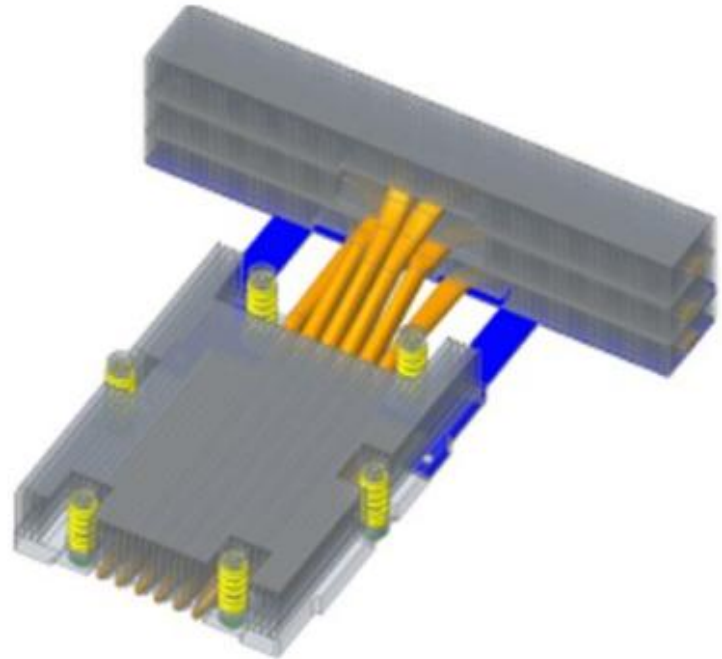
The SR650 V4 and SR650a V4 support standard and high-performance heat sinks for processors with different TDPs.



Entry heat sink
For processors with a TDP of 205 W or less



V4 2U standard heat sink
For processors with a TDP of less than 330 W



V4 2U performance heat sink with separate radiator connected heat pipes, suitable for most configurations