Smarter technology for all

Servicing the ThinkSystem SR650 V4 and SR650a V4

ES72642

March 2025

Lenovo

Prerequisites

- ES42692 – Intel Xeon processor architecture for ThinkSystem V4 servers

- ES52678 – ThinkSystem tools for the ThinkSystem V4 platform

- ES41759C –ThinkSystem problem determination

- ES51757B – Introducing ThinkSystem tools

- ES52374 – ThinkSystem tools for the ThinkSystem V3 platform

- ES51780C – Servicing ThinkSystem storage controllers

Objectives

After completing the course, you will be able to:

- Describe the features and specifications of the ThinkSystem SR650 V4 and SR650a V4

- Identify the components of the SR650 V4 and SR650a V4

- Describe the configurations of the SR650 V4 and SR650a V4

- Describe the SR650 V4 and SR650a V4 management tools

- Describe the specific problem determination steps and explain how to troubleshoot issues with the SR650 V4 and SR650a V4

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Product overview

Product description and front, rear, and inside views

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ThinkSystem SR650 V4 product overview

The SR650 V4 is a 2U two-socket (2U2S) rack server that features two Intel Xeon 6700-series or 6500-series processors (code name: Granite Rapids). The chassis supports 2.5-inch, 3.5-inch, or E3.S drives at the front. Hot-swap M.2 drives can also be used at the front with E3.S or 2.5-inch drives. There is also support for 2.5-inch drives in the middle and 2.5-inch, 3.5-inch, and M.2 drives at the rear. Up to 10 single-width or two double-width GPUs are supported with limitations.
Support for advanced direct-water cooling (DWC) capabilities with the Lenovo Processor Neptune Core Module is scheduled for June 2025.

The following SR650 V4 machine types and warranties are available:
7DGC – One-year warranty
7DGD – Three-year warranty
7DK2 – Three-year warranty - SR650 V4 with Compute Complex Neptune Core liquid cooling
7DLN – Three-year warranty - SR650 V4 with SAP HANA
7DGA – One-year warranty - SR650 V4 for vSAN
7DGB – Three-year warranty - SR650 V4 for vSAN

SR650 V4 with security bezel

SR650 V4 specifications

Attribute	Specifications
Form factor	2U rack server
Processors	Up to two Intel Xeon 6700- or 6500-series processors with Performance cores (P-cores) Support for processors with up to 86 cores and 172 threads, core speeds of up to 4.0 GHz, and TDP ratings of up to 350 W
Memory	• Up to 8 TB by using thirty-two 256 GB 3DS RDIMMs • 32 DIMM slots with two processors (16 DIMM slots per processor) – each processor has eight memory channels with 2 DIMMs per channel (DPC) • 16 DIMM slots with two processors when the Compute Complex Neptune Core liquid cooling is used (machine type: 7DK2) • Lenovo TruDDR5 RDIMMs and MRDIMMs are supported – RDIMMs operate at up to 6400 MHz at 1 DPC and up to 5200 MHz at 2 DPC, MRDIMMs are supported up to 8000 MHz CXL 2.0 memory is also supported • Up to 12 DIMMs (six per processor) installed in E3.S 2T drive bays
Disk drive bays	Up to 16 3.5-inch or 40 2.5-inch or 32 E3.S hot-swap drive bays: • Front bays can be 3.5-inch (eight or 12 bays), or 2.5-inch (eight, 16, or 24 bays), or E3.S (32

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SR650 V4 specifications

Attribute	Specifications
Disk drive bays	Up to 16 3.5-inch or 40 2.5-inch or 32 E3.S hot-swap drive bays: • Front bays can be 3.5-inch (eight or 12 bays), or 2.5-inch (eight, 16, or 24 bays), or E3.S (32 bays) • Middle bays are 2.5-inch (eight bays) simple-swap • Rear bays can be 3.5-inch (four bays) or 2.5-inch (four or eight bays) • Combinations of SAS/SATA, NVMe, or AnyBay (supporting SAS, SATA or NVMe) are available M.2 support, for OS boot and drive storage support: • Two front or rear hot-swap M.2 drive bays, or • Internal M.2 module supporting up to two M.2 drives
Network interface	Two dedicated OCP 3.0 SFF slots with a PCIe Gen 5 host interface, either x8 or x16 Support for a variety of two-port and four-port adapters with up to 400 GbE network connectivity One port of each installed OCP adapter can optionally be shared with the XCC management processor for Wake-on-LAN and NC-SI support
PCIe expansion slots	Up to 10 PCIe Gen 5 slots, all at the rear, plus two OCP slots The use of Riser 3 and Riser 4 requires two processors • Riser 1: Two low-profile slots, x8 or x16 (CPU 1)

Note: For the latest specifications, refer to the product guide on Lenovo Press.

SR650 V4 specifications

Attribute	Specifications
PCIe expansion slots	Up to 10 PCIe Gen 5 slots, all at the rear, plus two OCP slots The use of Riser 3 and Riser 4 requires two processors • Riser 1: Two low-profile slots, x8 or x16 (CPU 1) • Riser 2: Three full-height slots, two x16 and one x8 (CPU 1) • Riser 3: Three full-height slots, two x16 and one x8 (CPU 2) • Riser 4: Two low-profile slots, x8 or x16 (CPU 2)
GPU support	Support for up to 10 single-width GPUs or two double-width GPUs
Cooling	Six (with two processors installed) or five (with one processor installed) single-rotor or dual-rotor hot-swap 60 mm fans, configuration dependent Fans are N+1 redundant, tolerating a single-rotor failure One fan integrated in each power supply For customers with water infrastructure in their data center, the server also supports open-loop water cooling for efficient heat removal
Power supplies	Two hot-swap redundant power supplies, 80 PLUS Platinum or 80 PLUS Titanium certification – 800 W, 1300 W, 2000 W, 2700 W, and 3200 W AC options

Note: For the latest specifications, refer to the product guide on Lenovo Press.

SR650 V4 specifications

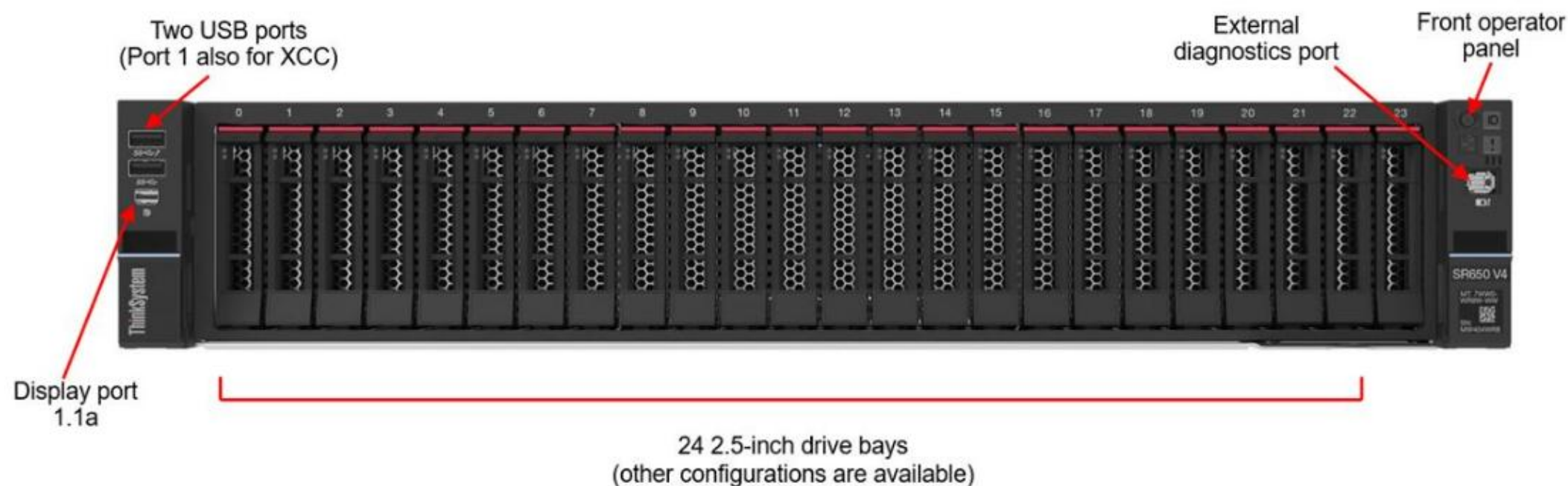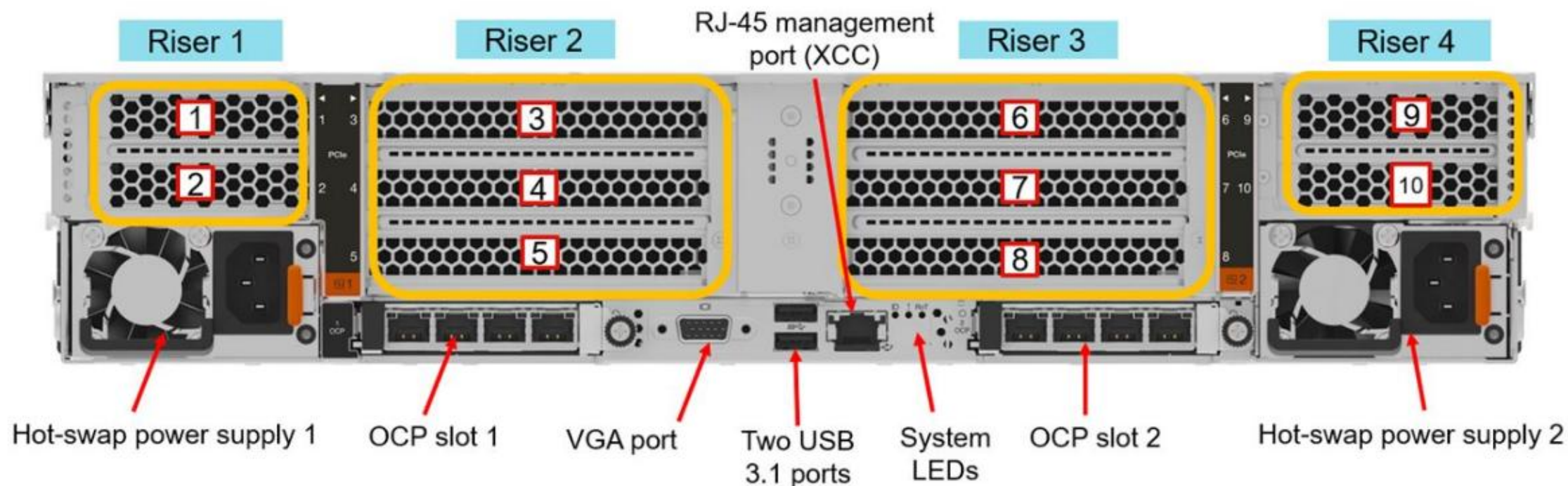| Attribute	Specifications
Cooling	Six (with two processors installed) or five (with one processor installed) single-rotor or dual-rotor hot-swap 60 mm fans, configuration dependent Fans are N+1 redundant, tolerating a single-rotor failure One fan integrated in each power supply For customers with water infrastructure in their data center, the server also supports open-loop water cooling for efficient heat removal
Power supplies	Two hot-swap redundant power supplies, 80 PLUS Platinum or 80 PLUS Titanium certification – 800 W, 1300 W, 2000 W, 2700 W, and 3200 W AC options All AC power supplies support 230 V power, some also support 115 V input supply In China only, all power supply options support 240 V DC, there is also support for HVDC and -48V DC power supply options
Storage controllers	• Up to 36 onboard NVMe ports (RAID support using Intel VROC, or with the use of a Tri-mode RAID adapter) • 12 Gb SAS/SATA RAID adapters, PCIe Gen 4 or PCIe Gen 3 host interface • 12 Gb SAS/SATA HBA (non-RAID), PCIe Gen 4 or PCIe Gen 3 host interface

Note: For the latest specifications, refer to the product guide on Lenovo Press.

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SR650 V4 front view – 2.5-inch drive system

Two USB ports
(Port 1 also for XCC)

External
diagnostics port

Front operator
panel

Display port
1.1a

24 2.5-inch drive bays
(other configurations are available)

SR650 V4 rear view – 10 PCIe slots

This figure shows the configuration with four riser cards and 10 PCIe Gen 5 slots.
The use of risers 3 and 4 requires two processors.

Riser 1   Riser 2   RJ-45 management port (XCC)   Riser 3   Riser 4

Hot-swap power supply 1   OCP slot 1   VGA port   Two USB 3.1 ports   System LEDs   OCP slot 2   Hot-swap power supply 2

Note: For additional rear hot-swap drive and PCIe slot configuration information, refer to the SR650 V4 rear drive configuration page.

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SR650 V4 inside view

Location for Internal RAID adapter (cabled)

Hot-swap fans

CPU 2 + 16 DIMMs

Rear PCIe connectors

Four 2.5-inch drive bays

Location for SAS Expander (cabled)

M.2 module (mounted on air baffle or drive cage)

CPU 1 + 16 DIMMs

OCP slot 1

Riser 2 (slots 3-5)

Riser 1 (slots 1-2)

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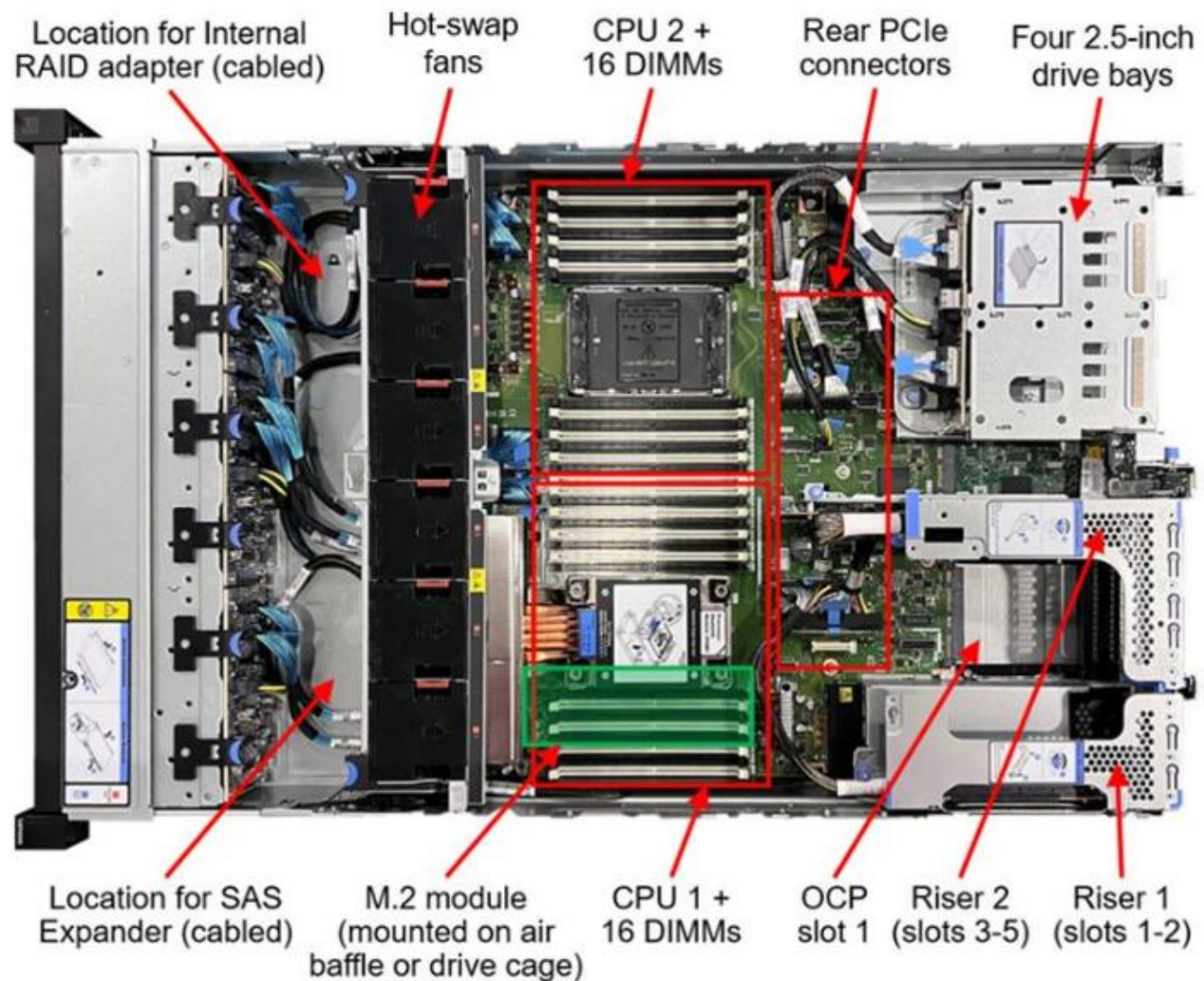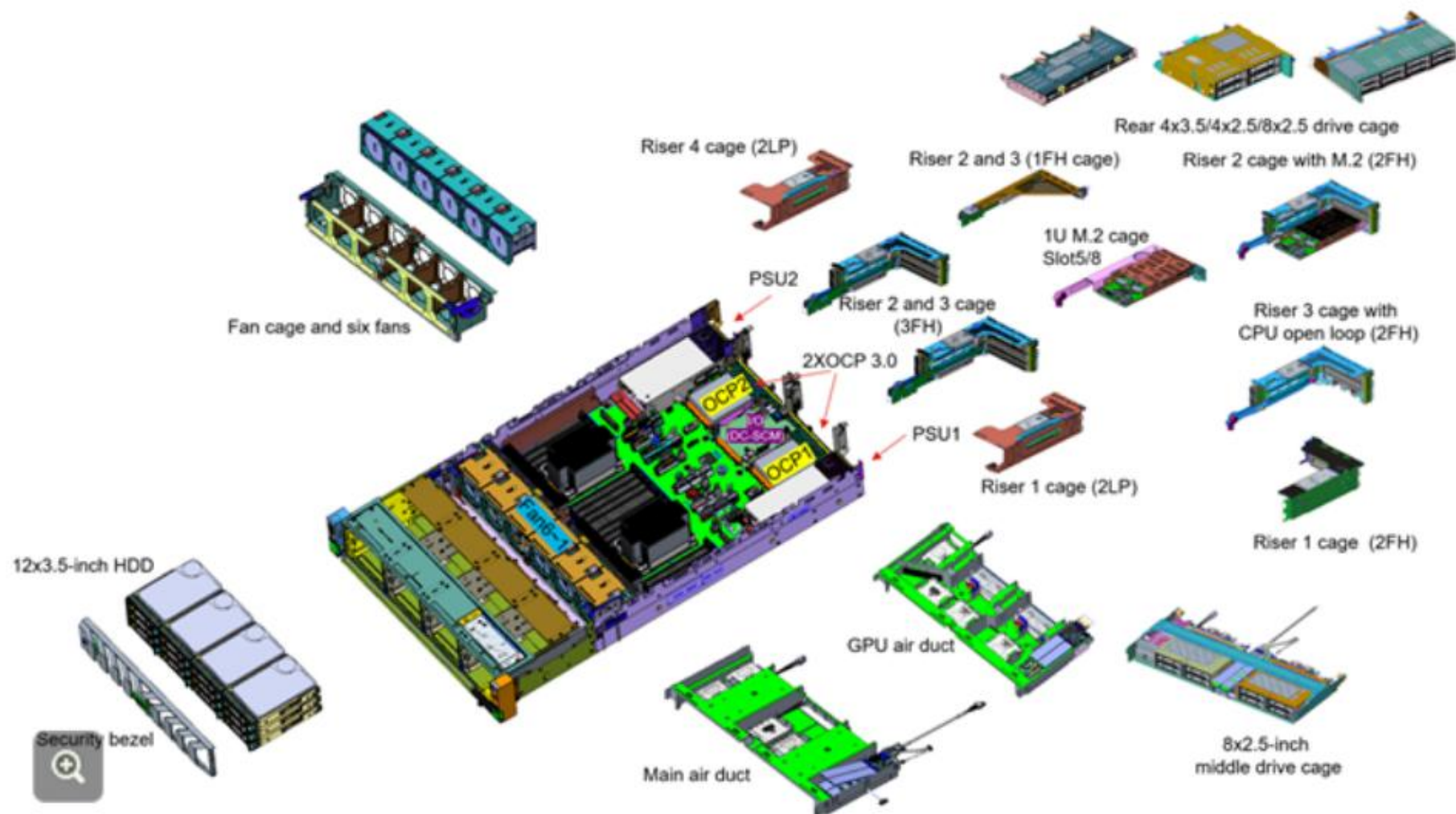
SR650 V4 exploded view – 3.5-inch drive system

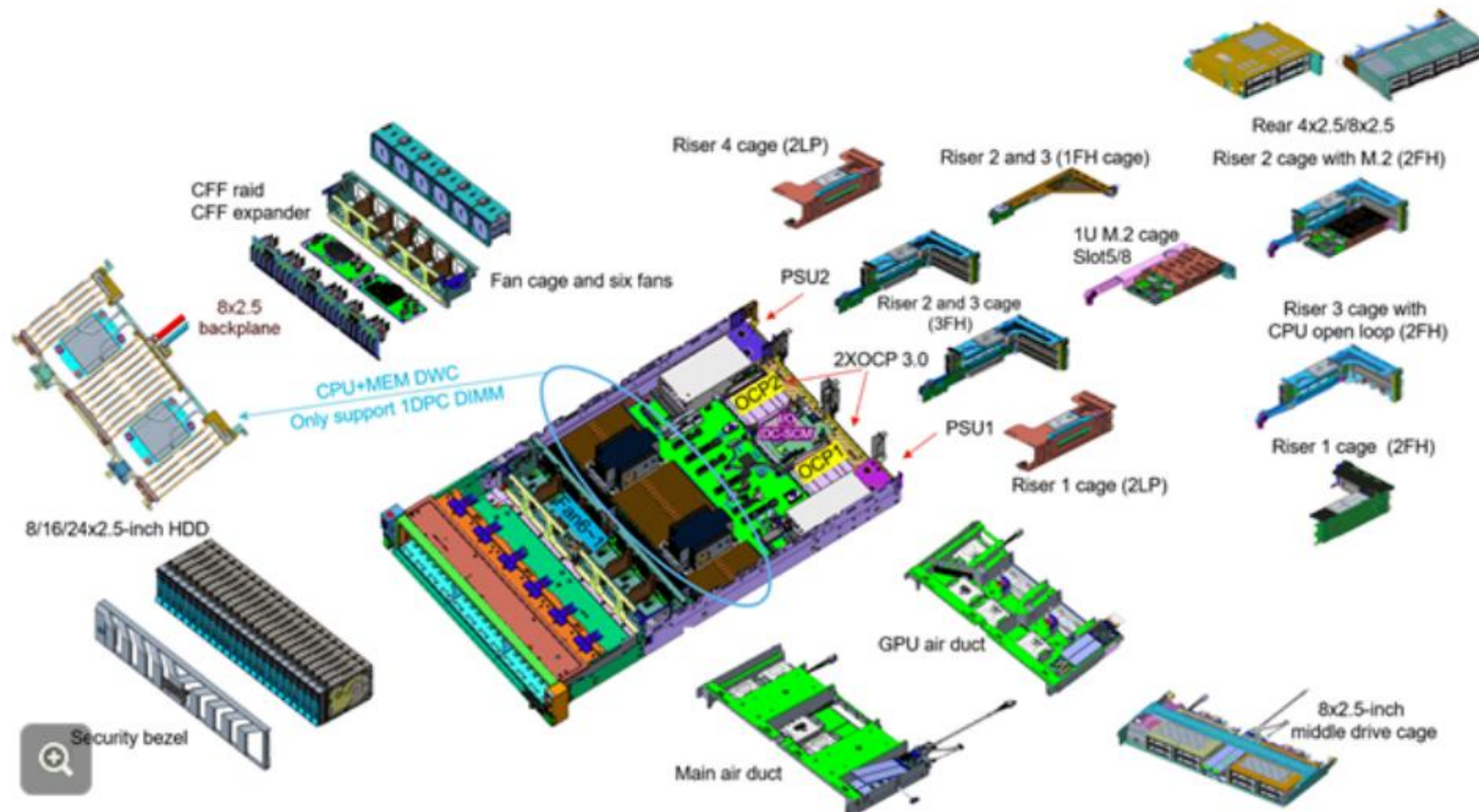Configuration rules and limitations:

- Due to insufficient space, the internal CFF card is not supported in the 3.5-inch chassis
- A GPU is only supported in the configuration with eight 3.5-inch drives – a 12x3.5 backplane must be installed with a fixed filler on the top layer
- With the CPU open loop configuration, the rear M.2 drive cannot be installed in slot 8

Fan cage and six fans

Riser 4 cage (2LP)

Rear 4x3.5/4x2.5/8x2.5 drive cage

Riser 2 and 3 (1FH cage)

Riser 2 cage with M.2 (2FH)

PSU2

1U M.2 cage Slot5/8

Riser 2 and 3 cage (3FH)

2XOCP 3.0

OCP2

DC-SCM

OCP1

PSU1

Riser 3 cage with CPU open loop (2FH)

Riser 1 cage (2LP)

Riser 1 cage (2FH)

12x3.5-inch HDD

GPU air duct

Security bezel

Main air duct

8x2.5-inch middle drive cage

SR650 V4 exploded view – 2.5-inch drive system

Configuration rules and limitations:
- 2.5-inch NVMe configurations do not need a retimer card
- With the CPU open loop configuration, the rear M.2 drive cannot be installed in slot 8

CFF raid
CFF expander

Fan cage and six fans

8x2.5 backplane

Riser 4 cage (2LP)

Riser 2 and 3 (1FH cage)

Rear 4x2.5/8x2.5

Riser 2 cage with M.2 (2FH)

1U M.2 cage Slot5/8

PSU2

Riser 2 and 3 cage (3FH)

Riser 3 cage with CPU open loop (2FH)

CPU+MEM DWC
Only support 1DPC DIMM

2XOCP 3.0

OCP2

DC-SCM

OCP1

PSU1

Riser 1 cage (2FH)

8/16/24x2.5-inch HDD

Riser 1 cage (2LP)

Security bezel

GPU air duct

Main air duct

8x2.5-inch middle drive cage

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ThinkSystem SR650a V4 product overview

The SR650a V4 is a 2U two-socket (2U2S) rack server based on the SR650 V4 with added support for four double-width GPUs, including the NVIDIA H100 NVL 94GB, or eight single-width GPUs. It features two Intel Xeon 6700-series or 6500-series processors (code name: Granite Rapids). The chassis supports up to eight 2.5-inch SAS/SATA, NVMe, or AnyBay hot-swap drive bays or eight E3.S 1T NVMe hot-swap drives for local storage at the front.

The following SR650a V4 machine types and warranties are available :

7DGC – One-year warranty

7DGD – Three-year warranty

SR650a V4 specifications

Attribute	Specifications
Form factor	2U rack server
Processors	Up to two Intel Xeon 6700- or 6500-series processors with Performance cores (P-cores) Support for processors with up to 86 cores and 172 threads, core speeds of up to 4.0 GHz, and TDP ratings of up to 350 W
Memory	• Up to 8 TB by using thirty-two 256 GB 3DS RDIMMs • 32 DIMM slots with two processors (16 DIMM slots per processor) – each processor has eight memory channels with 2 DIMMs per channel (DPC) • Lenovo TruDDR5 RDIMMs and MRDIMMs are supported – RDIMMs operate at up to 6400 MHz at 1 DPC and up to 5200 MHz at 2 DPC, MRDIMMs are supported up to 8000 MHz
Disk drive bays	Up to eight 2.5-inch or eight E3.S hot-swap drive bays, all front accessible • 2.5-inch drives can be SAS, SATA, or NVMe • E3.S drives are NVMe M.2 support, for OS boot and drive storage support: • Two front or rear hot-swap M.2 drive bays, or • Internal M.2 module supporting up to two M.2 drives

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SR650a V4 specifications

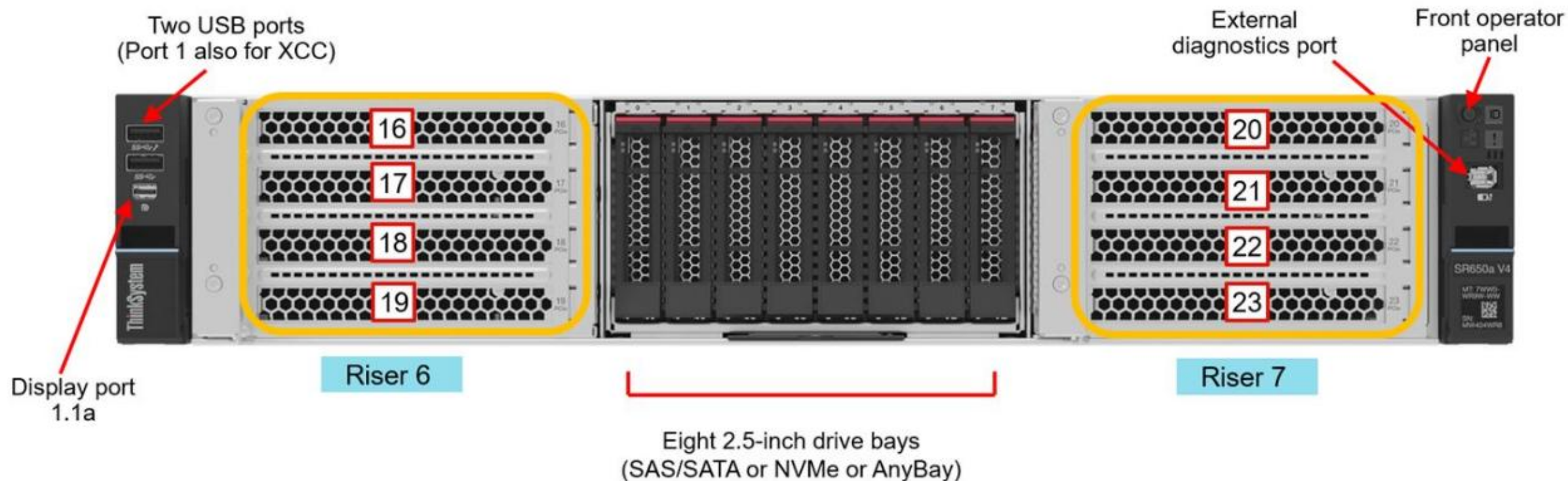| Attribute	Specifications
Network interface	Two dedicated OCP 3.0 SFF slots with a PCIe Gen 5 host interface, either x8 or x16 Support for a variety of two-port and four-port adapters with up to 400 GbE network connectivity One port of each installed OCP adapter can optionally be shared with the XCC management processor for Wake-on-LAN and NC-SI support
PCIe expansion slots	Up to eight slots at the front for GPUs, up to six slots at the rear, plus two OCP slots – all slots are PCIe Gen 5 The use of Riser 3 and Riser 6 requires two processors • Riser 2 (Rear): three full-height slots, two x16 and one x8 (CPU 1) • Riser 3 (Rear): three full-height slots, two x16 and one x8 (CPU 2) • Riser 6 (Front): four full-height slots (CPU 2) • Riser 7 (Front): four full-height slots (CPU 1) The server also supports rear hot-swap M.2 drives instead of slot 8. All configurations include two OCP slots with PCIe Gen 5 x16 or x8 connections at the rear of the server For 2.5-inch front drive configurations, the server supports the installation of a CFF RAID adapter or HBA in a dedicated area that does not consume any of the rear PCIe slots.
GPU support	Support for up to four double-width GPUs or eight single-width GPUs in the front slots

Note: For the latest specifications, refer to the product guide on Lenovo Press.

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SR650a V4 specifications

Attribute	Specifications
GPU support	Support for up to four double-width GPUs or eight single-width GPUs in the front slots
Cooling	Six (with two processors installed) or five (with one processor installed) single-rotor or dual-rotor hot-swap 60 mm fans, configuration dependent Fans are N+1 redundant, tolerating a single-rotor failure One fan integrated in each power supply For customers with water infrastructure in their data center, the server also supports open-loop water cooling for efficient heat removal
Power supplies	Two hot-swap redundant power supplies, 80 PLUS Platinum or 80 PLUS Titanium certification – 800 W, 1300 W, 2000 W, 2700 W, and 3200 W AC options All AC power supplies support 230 V power, some also support 115 V input supply In China only, all power supply options support 240 V DC, there is also support for HVDC and -48V DC power supply options
Storage controllers	• Up to 36 onboard NVMe ports (RAID support using Intel VROC, or with the use of a Tri-mode RAID adapter) • 12 Gb SAS/SATA RAID adapters, PCIe Gen 4 or PCIe Gen 3 host interface • 12 Gb SAS/SATA HBA (non-RAID), PCIe Gen 4 or PCIe Gen 3 host interface

Note: For the latest specifications, refer to the product guide on Lenovo Press.

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SR650a V4 front view – 2.5-inch drive system

Two USB ports
(Port 1 also for XCC)

Display port
1.1a

Riser 6

Eight 2.5-inch drive bays
(SAS/SATA or NVMe or AnyBay)

External
diagnostics port

Front operator
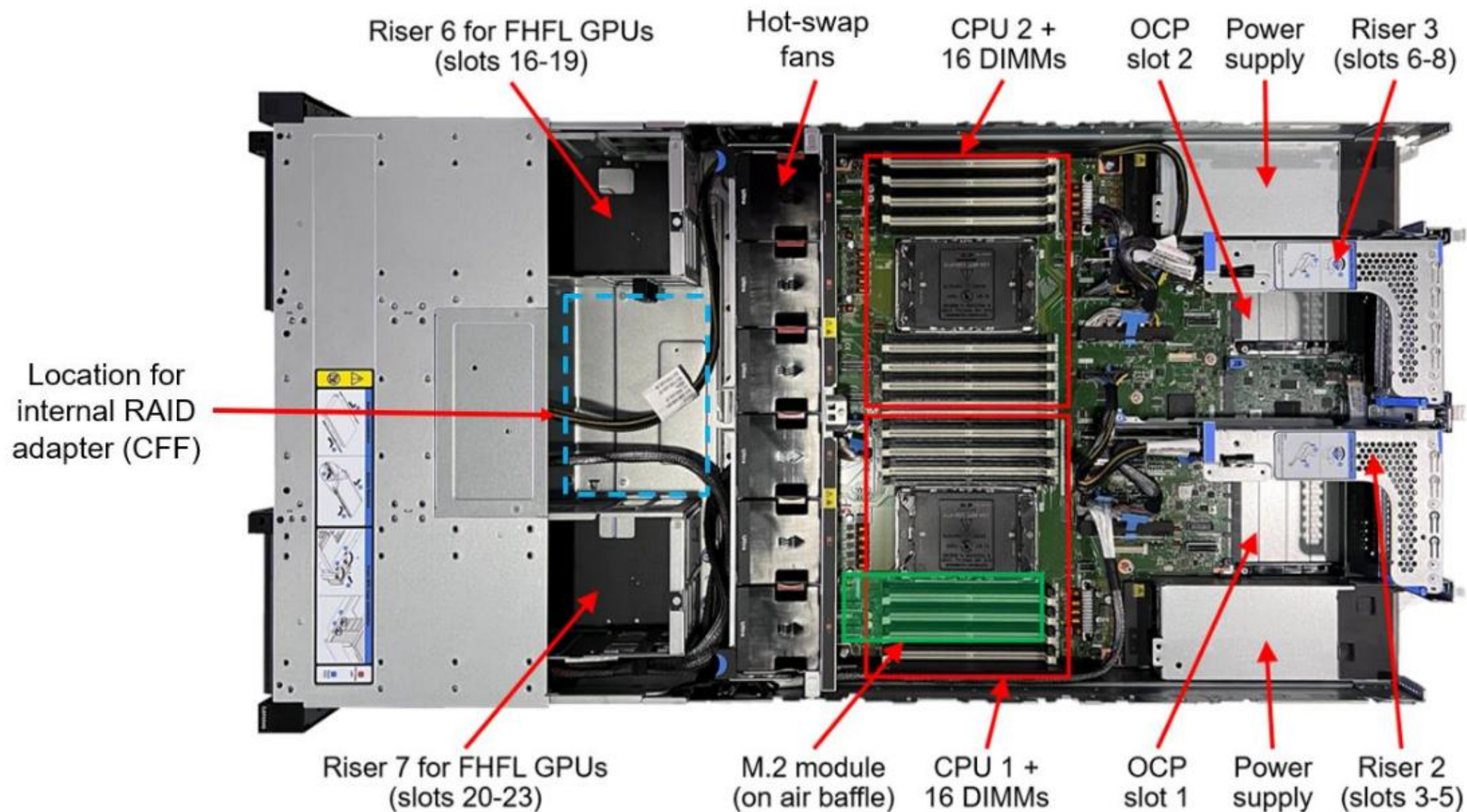panel

Riser 7

16

17

18

19

20

21

22

23

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SR650a V4 rear view

This figure shows the configuration with two riser cards and six PCIe Gen 5 slots
Slot 8 can also be configured for a pair of hot-swap M.2 drives.

Note: Riser 1 and Riser 4 are not available for use in the SR650a V4.

SR650a V4 inside view

Riser 6 for FHFL GPUs (slots 16-19)

Hot-swap fans

CPU 2 + 16 DIMMs

OCP slot 2

Power supply

Riser 3 (slots 6-8)

Location for internal RAID adapter (CFF)

Riser 7 for FHFL GPUs (slots 20-23)

M.2 module (on air baffle)

CPU 1 + 16 DIMMs

OCP slot 1

Power supply

Riser 2 (slots 3-5)

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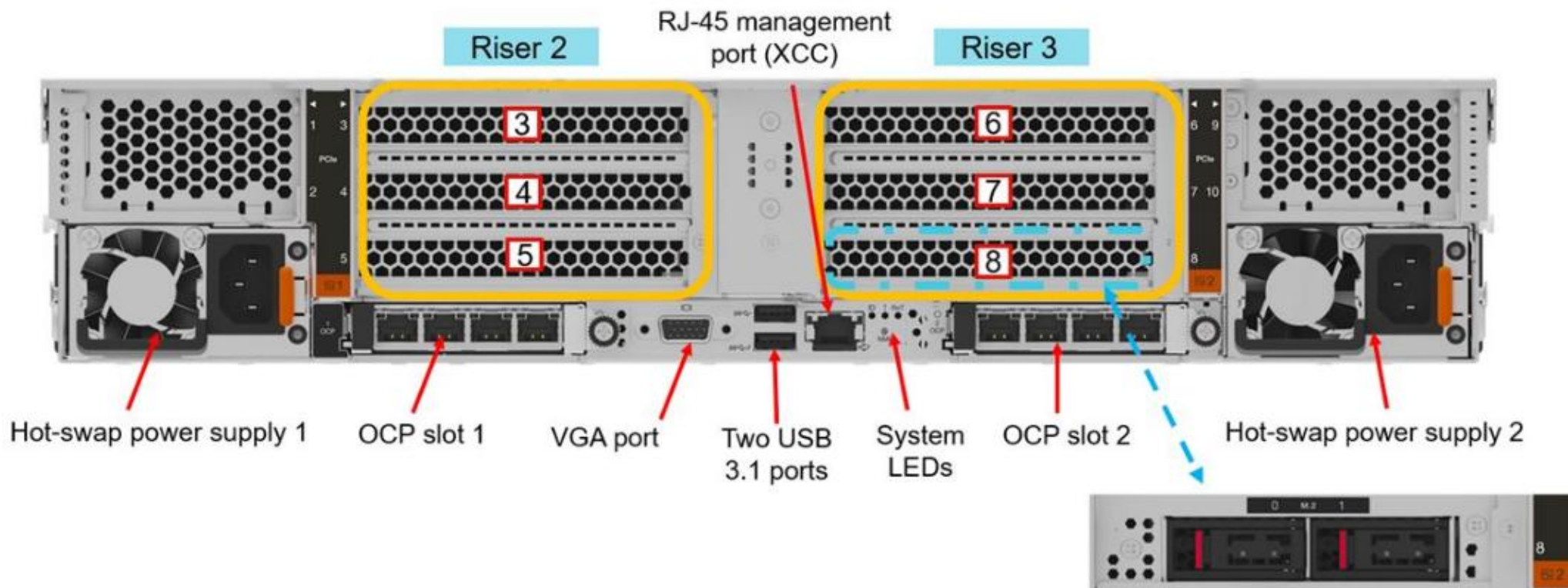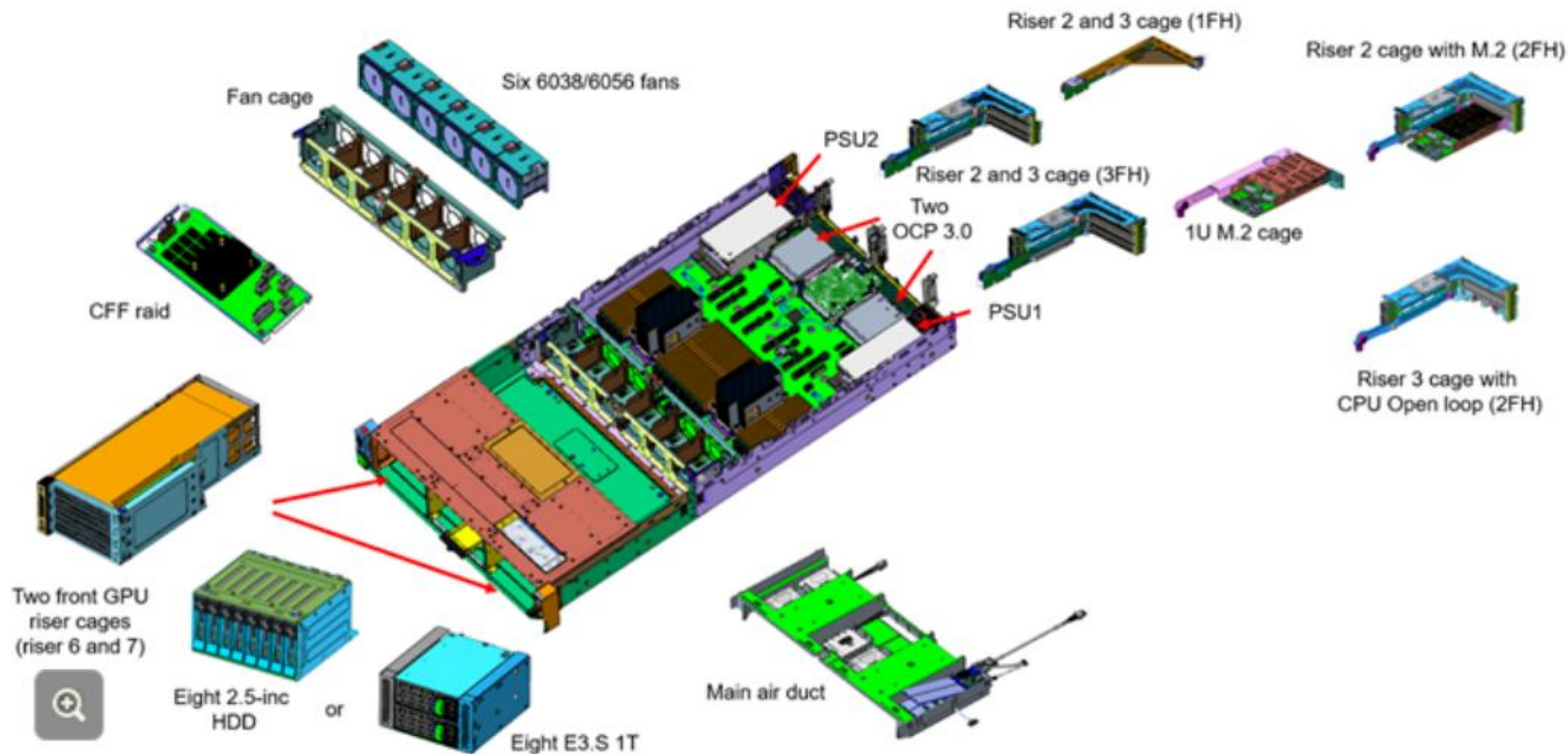
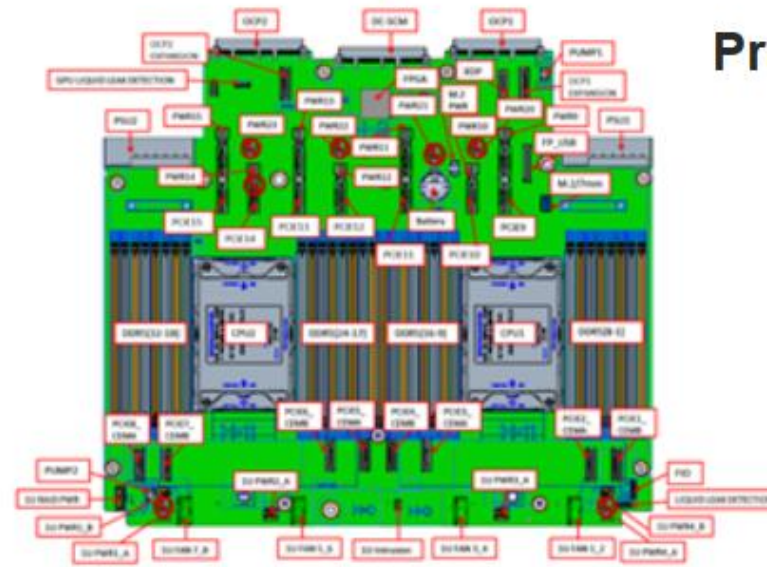# SR650a V4 exploded view

Configuration rules and limitations:
• With the CPU open loop configuration, the rear M.2 drive cannot be installed in slot 8
• GPUs are only supported in the front slots

Riser 2 and 3 cage (1FH)

Riser 2 cage with M.2 (2FH)

Six 6038/6056 fans

Fan cage

PSU2

Riser 2 and 3 cage (3FH)

Two OCP 3.0

1U M.2 cage

CFF raid

PSU1

Riser 3 cage with CPU Open loop (2FH)

Two front GPU riser cages (riser 6 and 7)

Eight 2.5-inc HDD   or

Eight E3.S 1T

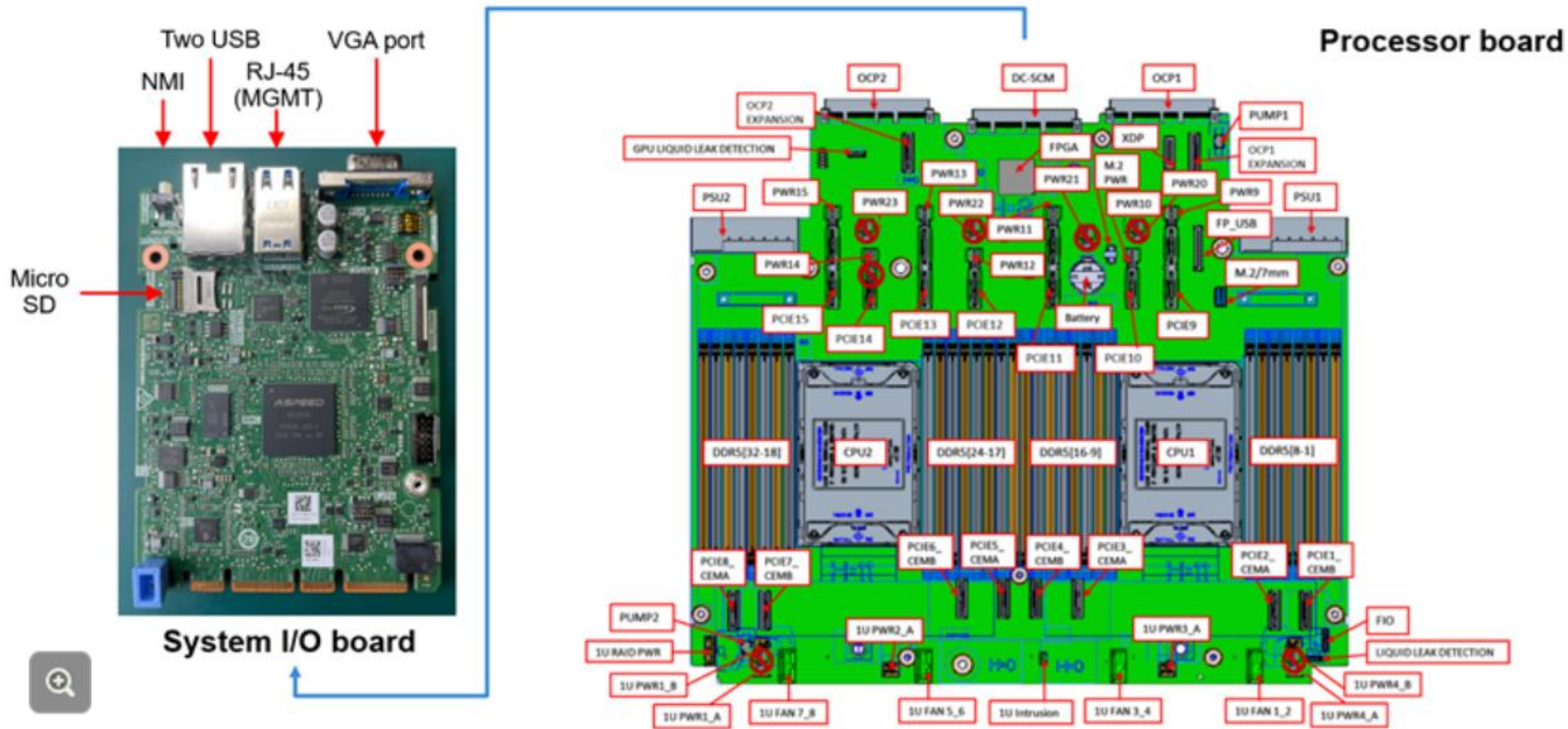Main air duct

System I/O board and processor board

The SR650 V4 and SR650a V4 use the same system board assembly. The system board assembly has two components:
- Processor board
    - A board containing CPU sockets, PCIe slots, memory slots, and other server component connectors
- System I/O board, as known as DC-SCM (Data Center Secure Control Module)
    - A board containing the system BMC (XCC3) management port, USB ports, and a VGA connector
    - A Micro SD card slot to extend XCC3 storage space for the backup of firmware and for remote console virtual media

System I/O board

Processor board

Processor and I/O board connectors

Processor board

System I/O board labels: NMI, Two USB, RJ-45 (MGMT), VGA port, Micro SD, System I/O board

Processor board labels: OCP2, DC-SCM, OCP1, OCP2 EXPANSION, PUMP1, GPU LIQUID LEAK DETECTION, FPGA, XDP, OCP1 EXPANSION, PWR13, M.2 PWR, PWR21, PSU2, PWR15, PWR23, PWR22, PWR20, PWR9, PSU1, PWR11, PWR10, FP_USB, PWR14, PWR12, M.2/7mm, PCIE15, PCIE13, PCIE12, Battery, PCIE9, PCIE14, PCIE11, PCIE10, DDR5[32-18], CPU2, DDR5[24-17], DDR5[16-9], CPU1, DDR5[8-1], PCIE8_CEMA, PCIE7_CEMB, PCIE6_CEMB, PCIE5_CEMA, PCIE4_CEMB, PCIE3_CEMA, PCIE2_CEMA, PCIE1_CEMB, PUMP2, FIO, 1U RAID PWR, 1U PWR2_A, 1U PWR3_A, LIQUID LEAK DETECTION, 1U PWR1_B, 1U PWR4_B, 1U PWR1_A, 1U FAN 7_8, 1U FAN 5_6, 1U Intrusion, 1U FAN 3_4, 1U FAN 1_2, 1U PWR4_A

External diagnostics handset

The SR650 V4 and SR650a V4 support the external LCD diagnostic panel. The panel can be used to quickly access system information, such as active errors, system health status, firmware version, network connection status, and health information.

External diagnostic port (pong)

Tri-Mode storage support

If installed with a RAID 940-8i or RAID 940-16i adapter, the SR650 V4 and SR650a V4 also support NVMe through a feature called Tri-Mode support (or Trimode support). This feature enables the use of NVMe U.3 drives at the same time as SAS and SATA drives.

The following hardware components are required for Tri-Mode support:

• AnyBay backplane
• RAID 940 series adapter
• U.3 drives: Only NVMe drives with a U.3 interface are supported – U.2 drives are not supported

ThinkSystem 2.5-inch U.3 NVMe PCIe Gen 4 x4 HS SSD

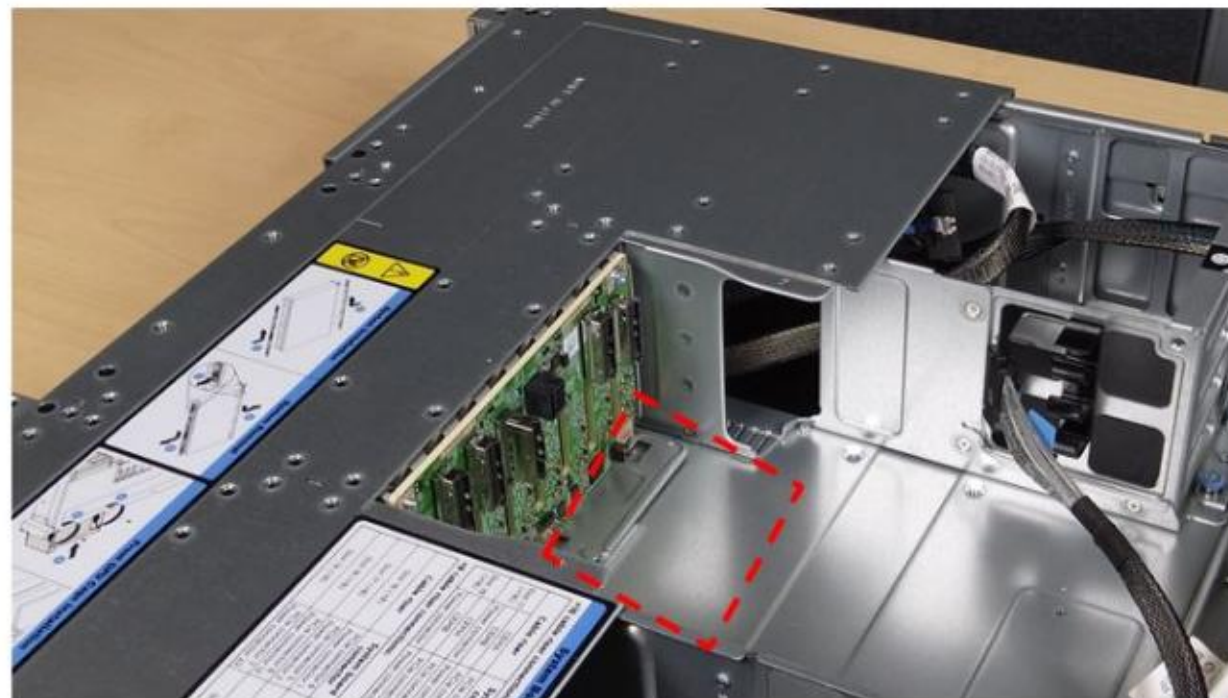ThinkSystem RAID 940-16i Flash PCIe Gen4 12 Gb Adapter

Internal RAID adapter/HBA

For configurations with 2.5-inch front drive bays, an internal RAID adapter or HBA (also known as CFF or custom form factor) can be installed in a dedicated space and cabled to a PCIe Gen 4 x8 connector, thereby freeing up a slot for other purposes. There is insufficient space for an internal CFF card in the 3.5-inch front drive bay chassis.

Note: E3.S configurations do not support a RAID adapter.
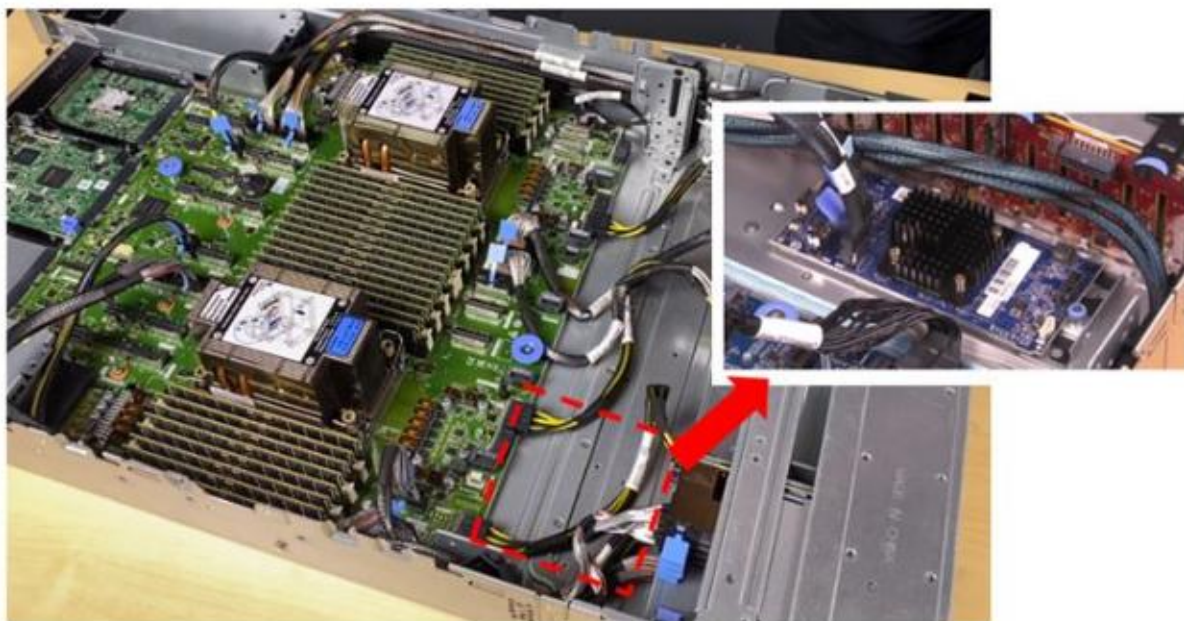
CFF card location in the SR650 V4

CFF card location in the SR650a V4