IBM SAN Volume Controller SV3

Hardware guide

IBM

Note

Before using this information and the product it supports, read the information in Chapter 2, "Notices ," on page 3.

Contents

Figures

Tables

Chapter 1. SAN Volume Controller SV3

Welcome to the SAN Volume Controller SV3 documentation, where you can find information about how to install, maintain, and use the IBM Storage SAN Volume Controller SV3 .

Chapter 2. Notices

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Product support statement

If you have an operating system, Hypervisor, platform or host attachment card in your environment, check the IBM System Storage Interoperation Center (SSIC) to confirm the support status for this product.

SSIC can be found at http://www-03.ibm.com/systems/support/storage/ssic/interoperability.wss.

Homologation statement

This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Contact an IBM representative or reseller for any questions.

Safety and environmental notices

Review all safety notices, environmental notices, and electronic emission notices before you install and use the product.

Suitability for telecommunication environment: This product is not intended to connect directly or indirectly by any means whatsoever to interfaces of public telecommunications networks.

To find the converted text for a caution or danger notice, complete the following steps.

1. Look for the identification number at the end of each caution notice or each danger notice. In the following examples, the numbers (C001) and (D002) are the identification numbers.

   CAUTION: A caution notice indicates the presence of a hazard that has the potential of causing moderate or minor personal injury. (C001)

   DANGER: A danger notice indicates the presence of a hazard that has the potential of causing death or serious personal injury. (D002)

2. Locate the *IBM Systems Safety Notices* document with the user publications that were provided with your system hardware.
3. Find the matching identification number in *IBM Systems Safety Notices*. Then, review the topics about the safety notices to ensure that you are in compliance.
4. (Optional) Read the multilingual safety instructions on the system website.

   a. Go to www.ibm.com/support
   b. Enter the name of your system in the Search field (for example, "IBM Storage FlashSystem 5300").
   c. Click the documentation link.

For more information on Safety and environmental notices, see Environmental and safety notices.

For more details on different notices, see the following pages:

Safety notices and labels

Review the safety notices and safety information labels before you use this product.

To view a PDF file, you need Adobe Acrobat Reader. You can download it at no charge from the Adobe website:

www.adobe.com/support/downloads/main.html

IBM Systems Safety Notices

This publication contains the safety notices for the IBM Systems products in English and other languages. Anyone who plans, installs, operates, or services the system must be familiar with and understand the safety notices. Read the related safety notices before you begin work.

Note: The *IBM System Safety Notices* document is organized into two sections. The danger and caution notices without labels are organized alphabetically by language in the "Danger and caution notices by language" section. The danger and caution notices that are accompanied with a label are organized by label reference number in the "Labels" section. You can download the most current version of *IBM System Safety Notices* at the following site: *Environmental and safety notices*.

The following notices and statements are used in IBM documents. They are listed in order of decreasing severity of potential hazards.

Danger notice definition
A special note that emphasizes a situation that is potentially lethal or extremely hazardous to people.

Caution notice definition
A special note that emphasizes a situation that is potentially hazardous to people because of some existing condition, or to a potentially dangerous situation that might develop because of some unsafe practice.

Note: In addition to these notices, labels might be attached to the product to warn of potential hazards.

Finding translated notices

Each safety notice contains an identification number. You can use this identification number to check the safety notice in each language.

To find the translated text for a caution or danger notice:

1. In the product documentation, look for the identification number at the end of each caution notice or each danger notice. In the following examples, the numbers (D002) and (C001) are the identification numbers.

   DANGER: A danger notice indicates the presence of a hazard that has the potential of causing death or serious personal injury. (D002)

   CAUTION: A caution notice indicates the presence of a hazard that has the potential of causing moderate or minor personal injury. (C001)

2. After you download the *IBM System Safety Notices* document, open it.

3. Under the language, find the matching identification number. Review the topics about the safety notices to ensure that you are in compliance.

Caution notices for the system

Ensure that you understand the caution notices for the system.

Use the reference numbers in parentheses at the end of each notice (for example, D005) to find the matching translated notice in *IBM Systems Safety Notices*.

CAUTION: The battery contains lithium. To avoid possible explosion, do not burn or charge the battery.

Do not throw or immerse into water, heat to more than 100°C (212°F), repair or disassemble. (C003)

CAUTION:

≥ 18 kg (39.7 lb)   ≥ 33.6 kg (74 lb)   ≥ 46.3 kg (102 lb)

The weight of this part or unit is between 32 and 55 kg (70.5 and 121.2 lb). It takes three persons to safely lift this part or unit. (C010)

CAUTION: To avoid personal injury, before lifting this unit, remove all appropriate subassemblies per instructions to reduce the system weight. (C012)

CAUTION: CAUTION regarding IBM provided VENDOR LIFT TOOL:

- Operation of LIFT TOOL by authorized personnel only
- LIFT TOOL intended for use to assist, lift, install, remove units (load) up into rack elevations. It is not to be used loaded transporting over major ramps nor as a replacement for such designated tools like pallet jacks, walkies, fork trucks and such related relocation practices. When this is not practicable, specially trained persons or services must be used (for instance, riggers or movers). Read and completely understand the contents of LIFT TOOL operator's manual before using.
- Read and completely understand the contents of LIFT TOOL operator's manual before using. Failure to read, understand, obey safety rules, and follow instructions may result in property damage and/or personal injury. If there are questions, contact the vendor's service and support. Local paper manual must remain with machine in provided storage sleeve area. Latest revision manual available on vendor's website.
- Test verify stabilizer brake function before each use. Do not over-force moving or rolling the LIFT TOOL with stabilizer brake engaged.
- Do not raise, lower or slide platform load shelf unless stabilizer (brake pedal jack) is fully engaged. Keep stabilizer brake engaged when not in use or motion.
- Do not move LIFT TOOL while platform is raised, except for minor positioning.
- Do not exceed rated load capacity. See LOAD CAPACITY CHART regarding maximum loads at center versus edge of extended platform.
- Only raise load if properly centered on platform. Do not place more than 200 lb (91 kg) on edge of sliding platform shelf also considering the load's center of mass/gravity (CoG).
- Do not corner load the platform tilt riser accessory option. Secure platform riser tilt option to main shelf in all four (4x) locations with provided hardware only, prior to use. Load objects are designed to slide on/off smooth platforms without appreciable force, so take care not to push or lean. Keep riser tilt option flat at all times except for final minor adjustment when needed.
- Do not stand under overhanging load.
- Do not use on uneven surface, incline or decline (major ramps).
- Do not stack loads.
- Do not operate while under the influence of drugs or alcohol.
- Do not support ladder against LIFT TOOL.
- Tipping hazard. Do not push or lean against load with raised platform.
- Do not use as a personnel lifting platform or step. No riders.
- Do not stand on any part of lift. Not a step.
- Do not climb on mast.
- Do not operate a damaged or malfunctioning LIFT TOOL machine.
- Crush and pinch point hazard below platform. Only lower load in areas clear of personnel and obstructions. Keep hands and feet clear during operation.
- No Forks. Never lift or move bare LIFT TOOL MACHINE with pallet truck, jack or fork lift.

- Mast extends higher than platform. Be aware of ceiling height, cable trays, sprinklers, lights, and other overhead objects.
- Do not leave LIFT TOOL machine unattended with an elevated load.
- Watch and keep hands, fingers, and clothing clear when equipment is in motion.
- Turn Winch with hand power only. If winch handle cannot be cranked easily with one hand, it is probably over-loaded. Do not continue to turn winch past top or bottom of platform travel. Excessive unwinding will detach handle and damage cable. Always hold handle when lowering, unwinding. Always assure self that winch is holding load before releasing winch handle.
- A winch accident could cause serious injury. Not for moving humans. Make certain clicking sound is heard as the equipment is being raised. Be sure winch is locked in position before releasing handle. Read instruction page before operating this winch. Never allow winch to unwind freely. Freewheeling will cause uneven cable wrapping around winch drum, damage cable, and may cause serious injury. (C048)

CAUTION: Removing components from the upper positions in the rack cabinet improves rack stability during a relocation. Follow these general guidelines whenever you relocate a populated rack cabinet within a room or building.

- Reduce the weight of the rack cabinet by removing equipment starting at the top of the rack cabinet. When possible, restore the rack cabinet to the configuration of the rack cabinet as you received it. If this configuration is not known, you must observe the following precautions.
  - Remove all devices in the 32U position and above.
  - Ensure that the heaviest devices are installed in the bottom of the rack cabinet.
  - Ensure that there are no empty U-levels between devices installed in the rack cabinet below the 32U level.
- If the rack cabinet you are relocating is part of a suite of rack cabinets, detach the rack cabinet from the suite.
- If the rack cabinet you are relocating was supplied with removable outriggers they must be reinstalled before the cabinet is relocated.
- Inspect the route that you plan to take to eliminate potential hazards.
- Verify that the route that you choose can support the weight of the loaded rack cabinet. Refer to the documentation that comes with your rack cabinet for the weight of a loaded rack cabinet.
- Verify that all door openings are at least 760 x 230 mm (30 x 80 in.).
- Ensure that all devices, shelves, drawers, doors, and cables are secure.
- Ensure that the four leveling pads are raised to their highest position.
- Ensure that there is no stabilizer bracket installed on the rack cabinet during movement.
- Do not use a ramp inclined at more than 10 degrees.
- When the rack cabinet is in the new location, complete the following steps:
  - Lower the four leveling pads.
  - Install stabilizer brackets on the rack cabinet.
  - If you removed any devices from the rack cabinet, repopulate the rack cabinet from the lowest position to the highest position.
- If a long-distance relocation is required, restore the rack cabinet to the configuration of the rack cabinet as you received it. Pack the rack cabinet in the original packaging material, or equivalent. Also lower the leveling pads to raise the casters off the pallet and bolt the rack cabinet to the pallet. (R002)

Danger notices for the system

Ensure that you are familiar with the danger notices for your system.

Use the reference numbers in parentheses at the end of each notice (for example, D005) to find the matching translated notice in *IBM Systems Safety Notices*.

DANGER: When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard: If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product. Do not open or service any power supply assembly. Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.

- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords. For AC power, disconnect all power cords from their AC power source. For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.

- When connecting power to the product ensure all power cables are properly connected. For racks with AC power, connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate. For racks with a DC power distribution panel (PDP), connect the customer's DC power source to the PDP. Ensure that the proper polarity is used when attaching the DC power and DC power return wiring.

- Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.

- Connect any equipment that will be attached to this product to properly wired outlets.

- When possible, use one hand only to connect or disconnect signal cables.

- Never turn on any equipment when there is evidence of fire, water, or structural damage.

- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.

- When performing a machine inspection: Assume that an electrical safety hazard is present. Perform all ontinuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements. Do not attempt to switch power to the machine until all possible unsafe conditions are corrected. Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached AC power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.

- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.

- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

  To disconnect:

  1. Turn off everything (unless instructed otherwise).
  2. Remove the power cords from the outlets.
  3. Remove the signal cables from the connectors.
  4. Remove all cables from the devices.

  To connect:

  1. Turn off everything (unless instructed otherwise).

2. Attach all cables to the devices.

3. Attach the signal cables to the connectors.

4. Attach the power cords to the outlets.

5. Turn on the devices.

- Sharp edges, corners and joints might be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

DANGER: Heavy equipment–personal injury or equipment damage might result if mishandled. (D006)

DANGER: Serious injury or death can occur if loaded lift tool falls over or if a heavy load falls off the lift tool. Always completely lower the lift tool load plate and properly secure the load on the lift tool before moving or using the lift tool to lift or move an object. (D010)

DANGER: Racks with a total weight of > 227 kg (500 lb.), Use Only Professional Movers! (R003)

DANGER: Do not transport the rack via fork truck unless it is properly packaged, secured on top of the supplied pallet. (R004)

DANGER:

Main Protective Earth (Ground):

This symbol is marked on the frame of the rack.

The PROTECTIVE EARTHING CONDUCTORS should be terminated at that point. A recognized or certified closed loop connector (ring terminal) should be used and secured to the frame with a lock washer using a bolt or stud. The connector should be properly sized to be suitable for the bolt or stud, the locking washer, the rating for the conducting wire used, and the considered rating of the breaker. The intent is to ensure the frame is electrically bonded to the PROTECTIVE EARTHING CONDUCTORS. The hole that the bolt or stud goes into where the terminal conductor and the lock washer contact should be free of any non-conductive material to allow for metal to metal contact. All PROTECTIVE EARTHING CONDUCTORS should terminate at this main protective earthing terminal or at points marked with ⏚ . (R010)

Special caution and safety notices

This information describes special safety notices that apply to the system.

These notices are in addition to the standard safety notices that are supplied; they address specific issues that are relevant to the equipment provided.

General safety

When you service the IBM Storage FlashSystem 5300, follow general safety guidelines.

CAUTION: The weight of the enclosure exceeds 18kgs, lift the enclosure after referring label

≥ 18 kg (39.7 lb) ≥ 33.6 kg (74 lb) ≥ 46.3 kg (102 lb)

Use the following general rules to ensure safety to yourself and others.

- Observe good housekeeping in the area where the devices are kept during and after maintenance.
- Follow the guidelines when lifting any heavy object:

1. Ensure that you can stand safely without slipping.
2. Distribute the weight of the object equally between your feet.
3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.
4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 18 kg (40 lb) or objects that you think are too heavy for you.*

- Do not perform any action that causes a hazard or makes the equipment unsafe.
- Before you start the device, ensure that other personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the unit.
- Keep your tool case away from walk areas so that other people cannot trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a device. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.
- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconducting clip, approximately 8 cm (3 in.) from the end.
- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

    Remember: Metal objects are good electrical conductors.

- Wear safety glasses when you are hammering, drilling, soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.
- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.
- Reinstall all covers correctly after you have finished servicing the unit.

Inspecting the system for unsafe conditions

Use caution when you are working in any potential safety hazardous situation that is not covered in the safety checks. If unsafe conditions are present, determine how serious the hazards are and whether you can continue before you correct the problem.

Before you begin

Before you start the safety inspection, make sure that the power is off, and that the power cord is disconnected.

About this task

Each device has the required safety items that are installed to protect users and support personnel from injury. Only those items are addressed.

Important: Good judgment must also be used to identify potential safety hazards due to the attachment of non-IBM features or options that are not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard might be and whether you can continue without first correcting the problem. For example, consider the following conditions and their potential safety hazards:

Electrical hazards (especially primary power)
    Primary voltage on the frame can cause serious or lethal electrical shock.

Explosive hazards
    A damaged CRT face or a bulging capacitor can cause serious injury.

Mechanical hazards
    Loose or missing items (for example, nuts and screws) can cause serious injury.

To inspect each node for unsafe conditions, use the following steps. If necessary, see any suitable safety publications.

Procedure

1. Turn off the system and disconnect the power cord.
2. Check the frame for damage (loose, broken, or sharp edges).
3. Check the power cables by using the following steps:
   a) Ensure that the third-wire ground connector is in good condition. Use a meter to check that the third-wire ground continuity is 0.1 ohm or less between the external ground pin and the frame ground.
   b) Ensure that the power cord is the appropriate type, as specified in the parts listings.
   c) Ensure that the insulation is not worn or damaged.
4. Check for any obvious nonstandard changes, both inside and outside the unit. Use good judgment about the safety of any such changes.
5. Check inside the node for any obvious unsafe conditions, such as metal particles, contamination, water or other fluids, or marks of overheating, fire, or smoke damage.
6. Check for worn, damaged, or pinched cables.
7. Ensure that the voltage that is specified on the product-information label matches the specified voltage of the electrical power outlet. If necessary, verify the voltage.
8. Inspect the power-supply assemblies and check that the fasteners (screws or rivets) in the cover of the power-supply unit are not removed or disturbed.
9. Check the grounding of the network switch before you connect the system to the storage area network (SAN).

Checking external devices
Ensure that you complete an external device check before you install or service the system.

Procedure

To conduct an external device check, complete the following steps.
1. Verify that all external covers are present and are not damaged.
2. Ensure that all latches and hinges are in the correct operating condition.
3. Check the power cords for damage.
4. Check the external signal cables for damage.
5. Check the cover for sharp edges, damage, or alterations that expose the internal parts of the device.
6. Correct any problems that you find.

Checking internal devices
Ensure that you complete an internal device check before you install or service your system.

About this task

To conduct the internal device check, use the following steps.

Procedure

1. Check for any non-IBM changes that were made to the device.
2. Check the condition of the inside of the device for any metal or other contaminants, or any indications of water, other fluid, fire, or smoke damage.
3. Check for any obvious mechanical problems, such as loose components.
4. Check any exposed cables and connectors for wear, cracks, or pinching.

Handling static-sensitive devices

Ensure that you understand how to handle devices that are sensitive to static electricity.

⚠️ **Attention:** Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective bags until you are ready to install them.

To reduce the possibility of electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its antistatic bag, touch it to an unpainted metal part of the system unit for at least 2 seconds. (This action removes static electricity from the package and from your body).
- Remove the device from its package and install it directly into your system, without putting it down. If it is necessary to put the device down, place it onto its static-protective bag. (If your device is an adapter, place it component-side up.) Do not place the device onto the cover of the system or onto a metal table.
- Take additional care when you handle devices during cold weather. Indoor humidity tends to decrease in cold weather, causing an increase in static electricity.

Sound pressure

⚠️ **Attention:** Depending on local conditions, the sound pressure can exceed 85 dB(A) during service operations. In such cases, wear appropriate hearing protection.

Environmental notices

This information contains all the required environmental notices for IBM Systems products in English and other languages.

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When attaching a monitor to the equipment, you must use the designated monitor cable and any interference suppression devices that are supplied with the monitor.

Canada Notice

CAN ICES-3 (A)/NMB-3(A)

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This product may cause interference if used in residential areas. Such use must be avoided unless the user takes special measures to reduce electromagnetic emissions to prevent interference to the reception of radio and television broadcasts.

Warning: This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

Germany Notice

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Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55032 Klasse A.

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高調波電流規格 JIS C 61000-3-2 適合品

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CNS 13438

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電話：0800-016-888

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  New Orchard Road
  Armonk, NY 10504
  Contact for FCC compliance information only: fccinfo@us.ibm.com

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CAN ICES-3 (B)/NMB-3(B)

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Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:
International Business Machines Corp.

New Orchard Road
Armonk, New York 10504
Tel: 914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:
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Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 (0) 800 225 5426
email: HalloIBM@de.ibm.com

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┌────────────────────────────────────────────────┐
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• Reorient or relocate the receiving antenna.

• Increase the separation between the equipment and receiver.

• Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

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Chapter 3. System overview

IBM SAN Volume Controller is an enterprise-class storage virtualization solution. It helps organizations achieve better data economics by supporting the large scale workloads that are critical to success.

Built with IBM Storage Virtualize software - part of the IBM Spectrum Storage family, IBM SAN Volume Controller delivers the performance and scalability needed to gain insights from the latest analytics technologies.

IBM SAN Volume Controller operates as a clustered system of individual nodes, where a node is an individual hardware appliance. The nodes are always installed in pairs; a minimum of one pair and a maximum of four pairs of nodes constitute a system. Each pair of nodes is known as an I/O group.

I/O groups take the storage that is presented to the Storage Area Network (SAN) by the backend storage systems and transforms the storage into logical disks (volumes) that are used by applications on the hosts. A node is in only one I/O group and provides access to the volumes in that I/O group.

Figure 1. Rear view of the control enclosure

Table 1. IBM SAN Volume Controller SV3 Models		
Machine Type - Model	**Description**	**Minimum Software Level**
2145-SV3	IBM SAN Volume Controller model SV3 with one-year warranty	8.5.0
2147-SV3	IBM SAN Volume Controller model SV3 with three-year warranty	8.5.0

Figure 2. Front view of the control enclosure

IBM Storage Virtualize software

IBM SAN Volume Controller runs IBM Storage Virtualize which provides the following functions for the host systems that attach to the system:

- A single pool of storage
- Logical unit virtualization
- Management of logical volumes

The software also provides the following functions:

- Replication:
  - Simplify data management by automating configuration tasks.
  - Ensure seamless continuity while maintaining high throughput and low latency to applications.
- Data reduction:
  - Thin-provisioned logical volumes
  - Data reduction pool with deduplication and compression
- Ransomware threat detection
- Safeguarded snapshots
- Large scalable cache
- Easy to use management and automation that is consistent across the Storage Virtualize portfolio, including RestAPI, Ansible Playbooks, CSI integration, VMWare integration, and a modern Graphical User Interface (GUI).

For more information on IBM Storage Virtualize software, see the relevant IBM Documentation.

Control Enclosure

IBM SAN Volume Controller comprises a 2U Rack-Unit (2U) Control enclosure, which contains:

- One Node Canister
- Two Power Supplies.

Highly Available Architecture

IBM SAN Volume Controller implements an Active-Active architecture, with two independent nodes forming a redundant I/O Group. Because data volumes are served by both nodes, the volume remains available if one node fails or is taken offline.

Each node contains a removable Node canister which contains the systems CPUs, memory, backup batteries, and Network Attachment adapters.

Flexible Network Attachment

IBM SAN Volume Controller supports a range of Network Attachment adapter features.

The following adapter types are supported by the system:

Table 2. Adapter types			
Adapter Type	**Protocols supported**	**Minimum or maximum per node**	**Minimum software level**
Quad-port 64 Gbps Fibre Channel	SCSI, FC-NVMe	0 - 3	8.6.0
Quad-port 32 Gbps Fibre Channel	SCSI, FC-NVMe	0 - 6	8.5.0
Dual-port 100 Gbps Ethernet	iSCSI, RoCE, NVMe/TCP	0 - 3 (8.5.0) 0 - 6 (8.6.0)	8.5.0
Dual-port 25 Gbps Ethernet (iWARP)	iSCSI, iWARP (Replication/High availability)	0 - 5 (8.5.0) 0 - 6 (8.6.0)	8.5.0
Dual-port 25 Gbps Ethernet (RoCE)	iSCSI, RoCE, NVMe/TCP	0 - 5 (8.5.0) 0 - 6 (8.6.0)	8.5.0

In addition, each canister has two on-board 1 Gbps Ethernet ports that are used for system management.

Power Supplies and Battery Backup

IBM SAN Volume Controller has two redundant Power Supplies per node.

Each node contains a Battery that allows a canister to save its cache and metadata in an unscheduled power-down event.

For more details on different components of the SAN Volume Controller system, see the following pages:

Node canisters

A *node canister* provides host interfaces, management interfaces, and interfaces. Each IBM SAN Volume Controller enclosure contains a node canister.

A node canister has cache memory, internal drives to store software and logs, and the processing power to run the system's virtualizing and management software. A node canister also contains batteries that help to protect the system against data loss if a power outage occurs.

The nodes in a system combine to form a cluster, presenting as a single redundant system with a single point of control for system management and service. System management and error reporting are provided through an Ethernet interface to one of the nodes in the system, which is called the *configuration node*. The configuration node runs a web server and provides a command-line interface (CLI). The configuration node is a role that any node can take. If the current configuration node fails, a

new configuration node is selected from the remaining nodes. Each node also provides a command-line interface and web interface to enable some hardware service actions.

Figure 3. Rear view of the control enclosure

Information about the canister can be found in the management GUI.

Boot drive and TPM

Each node canister has two externally accessible boot drives, which hold the system software and associated logs and diagnostics. The boot drives are also used to save the system state and cache data if there is an unexpected power-loss to the system or canister.

The system supports hardware root of trust and secure boot operations, which protect against unauthorized physical access to the hardware and prevents malicious software from running on the system.

The system provides secure boot by pairing the boot drive with the Trusted Platform Module (TPM). The TPM provides a secure cryptographic processor that performs verification of hardware and prevents unauthorized access to hardware and the operating system. The TPM protects secure boot to ensure that the installed code images are signed, trusted, and unchanged.

As the system boots, the TPM acquires hash values from each part of the boot (software and configuration settings) in a process that is known as measuring. If a particular set of hash values reach the right values, TPM secures and locks this information into the TPM. This process is known as sealing information into the TPM. After the information is sealed within the TPM, it can only be unsealed if the boot arrives at the correct hash values. TPM verifies each of these hash values and unlocks the operating system only during a boot operation when these values are correct.

Batteries
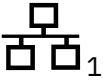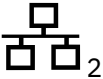
The node canister contains two redundant battery, which provide power to the canister if there is an unexpected power loss. This allows the canister to safely save system state and cached data.

Node indicators

A node has several LED indicators, which convey information about the current state of the node.

Node canister ports

Each node canister has the following on-board ports:

Table 3. Node canister ports

Port Marking	Logical port name	Connection and Speed	Function
🖧 1	Ethernet port 1	RJ45 copper, 1 Gbps	Primary Management IP Service IP
🖧 2	Ethernet port 2	RJ45 copper, 1 Gbps	Secondary Management IP (optional)
⚙	Technician port	RJ45 copper, 1 Gbps	DCHP port direct service management
⇌	USB port	USB type A	Encryption key storage, Diagnostics collection May be disabled

Technician port

The technician port is a designated 1 Gbps Ethernet port on the back panel of the node canister that is used to initialize a system or configure the node canister. The technician port can also access the management GUI and CLI if the other access methods are not available.

Adapter cards

The canister contains three removable adapter cages, each of which may contain up to two network adapter cards. These adapter cages connect with a single x16 PCIe connector on the main canister board, and have two connectors into which adapter cards can be inserted. If an adapter is present in the higher-numbered of the two slots in the cage, the x16 link is split into two x8 links. Otherwise, all 16 lanes are routed to the lower-numbered slot.

In the system software, adapter card slots are numbered left to right.

- Cage 1 holds adapters 1 and 2.
- Cage 2 holds adapters 5 and 6.
- Cage 3 holds adapters 7 and 8.

Adapter slots 3 and 4 are not in a removable cage, and are used for the Compression Accelerator card (fixed configuration).

Each node canister supports the following combinations of network adapters:

Table 4. Adapter Cage 1 combinations

Adapter Slot 1	Adapter Slot 2
Quad-port 64 Gbps Fibre Channel	Empty
Dual-port 25 Gbps Ethernet (iWARP)	Dual-port 25 Gbps Ethernet (iWARP)
Dual-port 25 Gbps Ethernet (RoCE)	Dual-port 25 Gbps Ethernet (RoCE)
Dual-port 100 Gbps Ethernet	Empty

Table 4. Adapter Cage 1 combinations (continued)	
Adapter Slot 1	**Adapter Slot 2**
Dual-port 100 Gbps Ethernet **Note:** This combination is supported with a minimum of 8.6.0 code.	Dual-port 100 Gbps Ethernet **Note:** This combination is supported with a minimum of 8.6.0 code.

Table 5. Adapter Cage 2 combinations	
Adapter Slot 5	**Adapter Slot 6**
Quad-port 64 Gbps Fibre Channel	Empty
Dual-port 25 Gbps Ethernet (iWARP)	Dual-port 25 Gbps Ethernet (iWARP)
Dual-port 25 Gbps Ethernet (RoCE)	Dual-port 25 Gbps Ethernet (RoCE)
Dual-port 100 Gbps Ethernet	Empty
Dual-port 100 Gbps Ethernet **Note:** This combination is supported with a minimum of 8.6.0 code.	Dual-port 100 Gbps Ethernet **Note:** This combination is supported with a minimum of 8.6.0 code.

Table 6. Adapter Cage 3 combinations	
Adapter Slot 7	**Adapter Slot 8**
Empty	Empty
Quad-port 64 Gbps Fibre Channel	Empty
Dual-port 25 Gbps Ethernet (iWARP)	Dual-port 25 Gbps Ethernet (iWARP)
Dual-port 25 Gbps Ethernet (RoCE)	Dual-port 25 Gbps Ethernet (RoCE)
Dual-port 100 Gbps Ethernet	Empty
Dual-port 100 Gbps Ethernet **Note:** This combination is supported with a minimum of 8.6.0 code.	Dual-port 100 Gbps Ethernet **Note:** This combination is supported with a minimum of 8.6.0 code.

Port Numbering

For each adapter card, ports are numbered downwards from top to bottom. Fibre Channel cards have a fixed relationship between port numbers and slot number.

Note: The cards are populated in order of slots 1, 2 followed by 7, 8 then 5, 6 to ensure best performance. The card in slots 7 and 8 will be numbered as shown even if there are not Fibre Channel adapters in slots 5 and 6.

Table 7. Port numberings						
Adapter slot numbers	**1**	**2**	**5**	**6**	**7**	**8**
Fibre channel port numbers	1	5	9	13	17	21
	2	6	10	14	18	22
	3	7	11	15	19	23
	4	8	12	16	20	24

Ethernet port numbering starts with the on-board ports (1, 2) and then progresses incrementally across any installed adapter cards, starting with the leftmost slot and numbering down each adapter in turn.

Memory configurations

IBM SAN Volume Controller supports up to twenty-four 64 GB DIMMs per node, with three memory configurations supported.

Table 8. Memory configuration

Configuration	Feature code	DIMMs per node	Memory per node	Best practice recommendation
Base	-	8	512 GB	Base config, ideal for < 16 drives and 1 network adapter with modest IOPS requirements
Upgrade 1	ACHA	16	1024 GB	This configuration is ideal for cache-heavy I/O Workloads and DRP or Deduplication workloads IOPs or latency and >16 drives with >1 adapter cage and/or DRP/Deduplication workloads
Upgrade 2	ACHC	24	1536 GB	This configuration is ideal for cache-heavy I/O Workloads and DRP or Deduplication workloads

For more details on the adapters, see the following pages:

Dual-port 100 Gbps Ethernet host interface adapter

The dual-port 100 Gbps Ethernet adapter provides two Ethernet port connections capable of running at 100 Gbps.

Figure 4. Dual-port 100 Gbps Ethernet host interface adapter

100 Gbps Ethernet ports can be used for:

• Host connections by using iSCSI, NVMe/TCP, or NVMe-RoCE

Connections can be made via a Ethernet switch, or as a direct connection to a host or other FlashSystem controller. Use of the NVMe-RoCE protocol requires RoCE-compatible Ethernet switches.

Ethernet ports are numbered from 1 to 2, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.
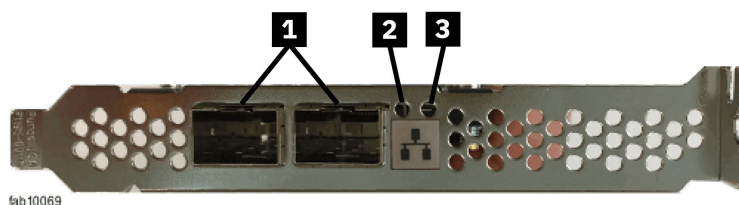
1 Ethernet port (2-port card)
2 Status LED (port 1)
3 Status LED (port 2)

Figure 5. 100 Gbps Ethernet card ports and indicators

Each port has a QSFP28 receptacle and a number of physical connection types supported:

Connection type	Supply method	Part number (examples for customer-supplied parts)
Optical Shortwave QSFP28 Module – 100 Gbps MPO (SR4)	IBM Orderable Feature	78P4988
100 Gbps DAC passive copper cable – up to 2M	Customer supplied	Mellanox MCP1600- C002E30N Cisco QSFP-100G-CU2M
Optical Shortwave QSFP28 Module – 100 Gbps LC (SRBD)	Customer supplied	Cisco SFBR-89BDDZ-CS4

Connection type	Supply method	Part number (examples for customer-supplied parts)
100 Gbps AOC active optical cable	Customer supplied	Cisco QSFP-100G-AOC5M

For more information, see "Dual-port 100 Gbps Ethernet host interface adapter ports and indicators" on page 118.

Quad-port 64 Gbps Fibre Channel adapter

The quad-port 64 Gb Fibre Channel adapter provides four Fibre Channel port connections capable of running at 64 Gbps.

The ports can also auto-negotiate to 32 Gb or 16 Gb for compatibility with slower networks.

Figure 6. Quad-port 64 Gbps Fibre Channel adapter

64 Gb Fibre Channel ports can be used for:

- Host connections by using standard Fibre Chanel (SCSI) or FC-NVMe
- Replication links
- Communications between control enclosures.

Connections can be made via a Fibre Channel switch, or as a direct connection to a host or other FlashSystem controller.

Fibre Channel ports are numbered from 1 to 4, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.

Each port has an Short-wave SFP transceiver that is installed as standard and can be connected with an LC-to-LC Fibre Channel cable. Long-wave SFP transceivers are not supported with the 64 Gbps Fibre Channel adapter.

The SFPs supported by the adapter are identified by the FRU part number that is displayed on the SFP.
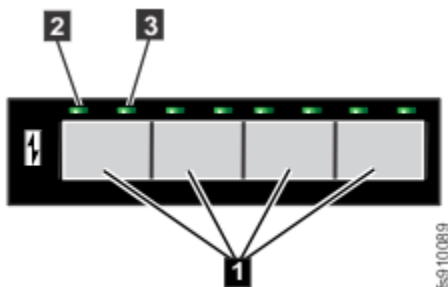
Figure 7. Fibre Channel ports and indicators

1 Fibre Channel port
2 Link-state LED (one for each port)
3 Speed-state LED (one for each port)

For more information, see "Fibre Channel port indicators" on page 116.

Quad-port 32 Gbps Fibre Channel adapter

The quad-port 32 Gbps Fibre Channel adapter provides four Fibre Channel port connections capable of running at 32 Gbps.

The ports can also auto-negotiate to 16 Gbps or 8 Gbps for compatibility with slower networks.
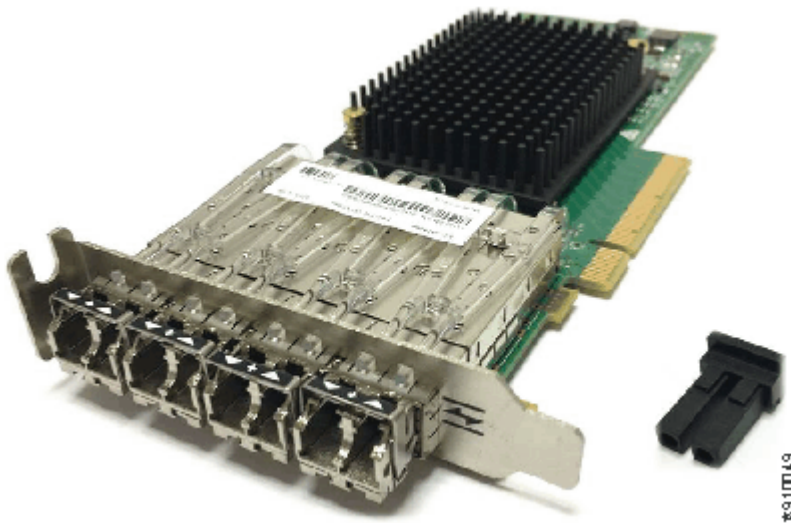
Figure 8. Quad-port 32 Gbps Fibre Channel adapter

32 Gbps Fibre Channel ports can be used for:

- Host connections by using standard Fibre Chanel (SCSI) or FC-NVMe
- Replication links
- Communications between control enclosures.

Connections can be made via a Fibre Channel switch, or as a direct connection to a host or other FlashSystem controller.

Fibre Channel ports are numbered from 1 to 4, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.

Each port has a Short-wave SFP transceiver that is installed as standard and can be connected with an LC-to-LC Fibre Channel cable. Long-wave SFP transceivers are available as an option for implementation of long-distance links.
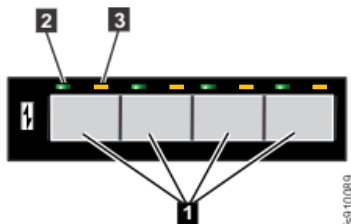
Figure 9. Fibre Channel ports and indicators

1 Fibre Channel port (4-port card)
2 Link-state LED (one for each port)
3 Speed-state LED (one for each port)

For more information, see "Fibre Channel port indicators" on page 116.

Dual-port 25 Gbps Ethernet (RoCE) host interface adapter

The dual-port 25 Gbps Ethernet (RoCE) adapter provides two Ethernet port connections capable of running at 25 Gbps.

The ports can also work at 10 Gbps when a 10 Gbps transceiver module is fitted. The ports can auto-negotiate to 10 Gbps only when non-optical transceiver modules are used.
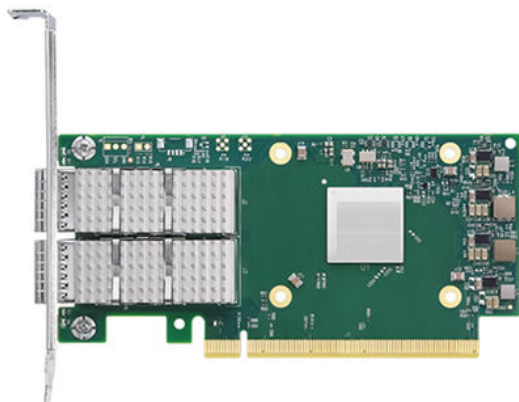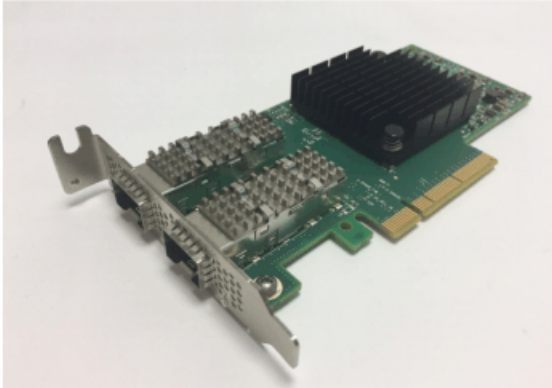

Figure 10. Dual-port 25 Gbps Ethernet (RoCE) host interface adapter

25 Gbps Ethernet ports can be used for:

- Host connections by using iSCSI, NVMe/TCP, or NVMe-RoCE
- IP Replication links

Connections can be made via a Ethernet switch, or as a direct connection to a host or other FlashSystem controller. Use of the NVMe-RoCE protocol requires RoCE-compatible Ethernet switches.

Ethernet ports are numbered from 1 to 4, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.
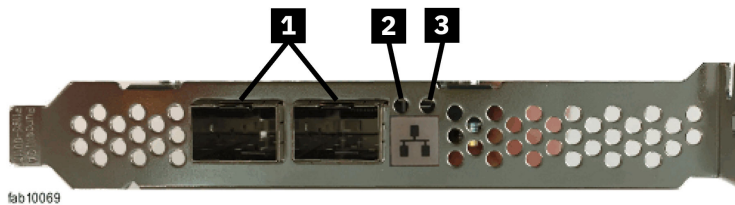
1 Ethernet port (2-port card)
2 Status LED (port 1)
3 Status LED (port 2)

Figure 11. Ethernet ports and indicators

Each port has an SFP+ receptacle, and a number of physical connection types supported:

Connection type	Supply method	Part number (examples for customer-supplied parts)
Optical Shortwave SFP28 Module - 25 Gb	IBM Orderable Feature	78P5153
Optical Shortwave SFP+ Module – 10 Gb	IBM Orderable Feature	78P1661
Copper 10BASE-T RJ45 Module - 10 Gb	IBM Orderable Feature	45W2412
25 Gbps DAC passive copper cable	Customer supplied	Mellanox MCP2M00-A003
QSFP28 to SFP28 passive Twinax copper cable (100 Gbps to 25 Gb)	Customer supplied	Cisco QSFP-4SFP25G-CU3MMellanox - MCP7F00-A002R
10 Gbps DAC passive copper cable	Customer supplied	Cisco SFP-H10GB-CU3m
QSFP+ to SFP+ splitter cable (40 Gbps to 10 Gb)	Customer supplied	Mellanox MC2609125-005

For more information, see "Dual-port 25 Gbps Ethernet host interface adapter ports and indicators" on page 117.

Dual-port 25 Gbps Ethernet (iWARP) host interface adapter

The dual-port 25 Gb Ethernet (iWARP) adapter provides two Ethernet port connections capable of running at 25 Gbps.

The ports can also work at 10 Gbps when a 10 Gbps transceiver module is fitted. The ports can auto-negotiate to 10 Gbps only when non-optical transceiver modules are used.
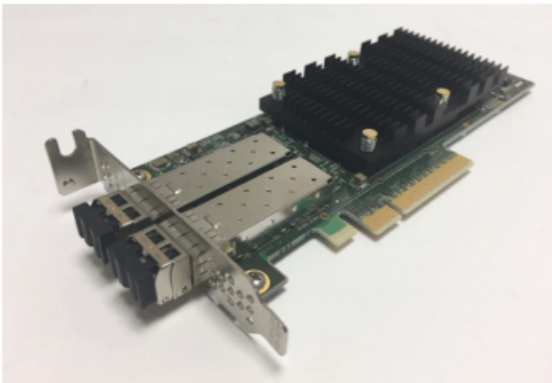
Figure 12. Dual-port 25 Gb Ethernet (iWARP) host interface adapter

25 Gb Ethernet ports can be used for:

- Host connections by using iSCSI
- IP Replication links
- Communications between control enclosures.

Connections can be made via a Ethernet switch, or as a direct connection to a host or other FlashSystem controller.

Ethernet ports are numbered from 1 to 2, starting from the left (horizontal placement) or top (vertical placement). Figure 2 shows ports and their indicators.
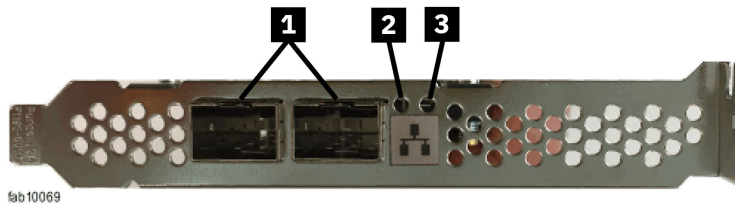
1 Ethernet port (2-port card)
2 Status LED (port 1)
3 Status LED (port 2)

Figure 13. Ethernet ports and indicators

Each port has an SFP+ receptacle, and a number of physical connection types supported:

Connection type	Supply method	Part number (examples for customer-supplied parts)
Optical Shortwave SFP28 Module - 25 Gb	IBM Orderable Feature	78P5153
Optical Shortwave SFP+ Module – 10 Gb	IBM Orderable Feature	78P1661
Copper 10BASE-T RJ45 Module - 10 Gb	IBM Orderable Feature	45W2412
25 Gb DAC passive copper cable	Customer supplied	Mellanox MCP2M00-A003
QSFP28 to SFP28 passive Twinax copper cable (100 Gb to 25 Gb)	Customer supplied	Cisco QSFP-4SFP25G-CU3MMellanox - MCP7F00-A002R
10 Gb DAC passive copper cable	Customer supplied	Cisco SFP-H10GB-CU3m
QSFP+ to SFP+ splitter cable (40 Gb to 10 Gb)	Customer supplied	Mellanox MC2609125-005

For more information, see "Dual-port 25 Gbps Ethernet host interface adapter ports and indicators" on page 117.

Batteries

Each node caches critical data and holds state information in volatile memory.

If power to a node fails, the node canister uses battery power to write cache and state data to its boot drives, before performing an orderly shutdown.

Each node canister contains a redundant pair of batteries. A single battery can power the node long enough to write the configuration state and cache to the internal boot drive. Both batteries together provide enough charge capacity to handle two back-to-back power failures. This means that normally the node can restart I/O operations immediately after repowering without waiting to recharge the battery, or requiring any operator intervention. If several power events occur in close succession, such as battery does not have enough charge for node to save its internal state, the node remains in service until the batteries are charged sufficiently.

The battery subsystem supports a five-second ride-through capability to handle a brief AC power outage. During this time, the batteries power the node that continues to run normally servicing host I/O requests. If AC power is restored within the ride-through period, the node continues to run and does not shut

down. If AC power does not return within the ride-through period, then the node stops servicing I/O and proceeds to save state data and shut down. When started, the shutdown operations run to completion even if the system power is restored during this time.

Note: Expansion canisters do not cache volume data or store state information in volatile memory. Therefore, expansion canisters do not require battery power. If AC power to both power supplies in an expansion enclosure fails, the enclosure powers off. When AC power is restored to at least one power supply, the enclosure restarts without operator intervention.

Important: Although the system is resilient to power failures and brown outs, always install the enclosures in an environment that has reliable, consistent, and required AC power. Consider uninterruptible power supply units to avoid extended interruptions to data access.

Battery management

As a battery ages, it loses capacity. The battery in the node canister lasts at least five years before it cannot hold enough charge to support a successful node shutdown.

The batteries automatically perform conditioning cycles approximately every three months to ensure accurate determination of their state of health.

When the battery capacity starts to degrade, the system posts an "EOL Warning" event for software level 8.6.3 and later. At this point, the battery subsystem still has enough capacity to be able to support an unscheduled system power-down. If a battery reports an "EOL Warning" event, replace it within approximately six months post the event.

When a battery no longer has capacity to protect against a power loss event, it reports the "EOL Fatal" event. If a battery reports an "EOL Fatal" event, the node goes offline and the battery needs replacing to allow the node to exit from Service state and come online.

If a node canister's battery fails, that canister goes offline and reports a node error. The remaining node in the I/O group destages its cache and runs the I/O group in "write-through" mode until its partner node is repaired and online.

Batteries can be installed or removed from the rear of the node canister without shutting down or removing the node.

The node canister has a battery status LED, which is described in Node canister indicators.

To access information about the battery in the management GUI, select **Monitoring** > **System**. On the **System - Overview** page, click the directional arrow next to the enclosure that contains the battery module. Select **Battery Module** under **Internal Components** to display information about the battery module. To display information about the battery in the command-line interface, use the **lsnodebattery** command.

Power supply units

Power supply units (PSUs) are subcomponents of enclosures. A PSU takes electrical power from the rack Power Distribution Units (PDUs) and provides the power to the components in the enclosure.

For redundancy, the IBM SAN Volume Controller enclosure has two 1010 W PSUs that provide power to the system. If any two PSUs fail, the system can still run without any interruptions. The PSUs must be connected to a 240 VAC (high-line) AC supplies.

Power supplies in the IBM SAN Volume Controller enclosure are 80Plus certified as "Titanium" efficiency.

For optimum power redundancy, connect each power supply to a different power source.

The information about the health of the PSUs can be found in the management GUI.

Figure 14 on page 35 shows the rear view of a control enclosure and identifies the location of a power supply unit and its indicators. The power supply has no power switch. A power supply is active when the power cord is connected to the power connector and power source.
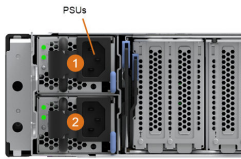
1 Power supply 1
2 Power supply 2

Figure 14. Locate node PSUs

When viewed from the rear, both PSUs are on the left side of the node enclosure, with PSU 1 above PSU 2.
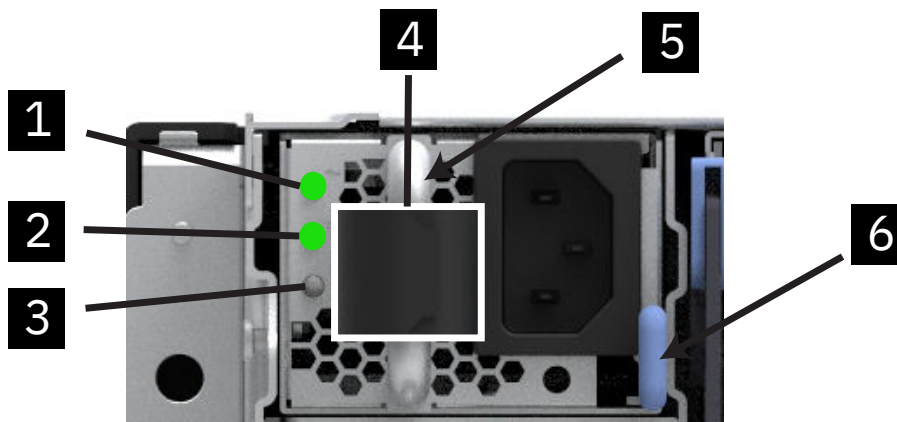
1 AC good indicator
2 DC good indicator
3 Fault indicator
4 Velcro strap clip
5 Power supply handle
6 Power supply release tab

Figure 15. Power supply details

The power supply indicators provide a summary of the status of the power supply.

Software feature limits

IBM SAN Volume Controller runs the IBM Storage Virtualize software stack to provide its rich storage functionality. There are no software feature limits on this product.

Chapter 4. Planning for hardware

This information is intended to help prepare the physical site for the installation of a SAN Volume Controller .

About this task

Certain physical site specifications must be met before the system can be set up. This activity includes verifying that adequate space is available, and that requirements for power and environmental conditions are met.

Procedure

1. Review all the guidelines in the planning topics to understand where the system can be installed and identify all prerequisites, such as building structure, equipment rack, environmental controls, power supply, and accessibility.
2. Complete the "Planning worksheets" on page 46 to record the information for the initial system creation.

What to do next

For more details on the planning for hardware, see the following pages:

SAN Volume Controller node environment requirements

Before the node is installed, the physical environment must meet certain requirements. These requirements include verifying that adequate space is available and power and environmental conditions are met.

Input-voltage requirements

Ensure that your environment meets the voltage requirements that are shown in Table 9 on page 37.

Table 9. Input-voltage requirements

Voltage	Frequency
200-240 V AC	50 Hz or 60 Hz

Power requirements for each node

Ensure that your environment meets the typical power requirement as shown in Table 10 on page 37.

Table 10. Power consumption

Component	Power requirements
IBM SAN Volume Controller 2145-SV3	~ 450 W in typical configuration, 806 W in maximum configuration (200 - 240V AC, 50/60 Hz)

Environment requirements without redundant AC power

Ensure that your environment falls within the following ranges if you are not using redundant AC power.

If you are not using redundant ac power, ensure that your environment falls within the ranges that are shown in Table 11 on page 38.

Table 11. Physical specifications				
Environment	**Temperature**	**Altitude**	**Relative humidity**	**Maximum dew point**
Operating in lower altitudes	5°C to 35°C (41°F to 95°F)	0 - 950 m (0 ft to 3,117 ft)	8% to 80%	24°C (75°F)
Operating in higher altitudes	5°C to 28°C (41°F to 82°F)	951 m to 3,050 m (3,118 ft to 10,000 ft)		
Turned off (with standby power)	5°C to 45°C (41°F to 113°F)	0 m to 3,050 m (0 ft to 10,000 ft)	8% to 80%	27°C (80.6°F)
Storing	1°C to 60°C (33.8°F to 140.0°F)	0 m to 3,050 m (0 ft to 10,000 ft)	5% to 80%	29°C (84.2°F)
Shipping	-40°C to 60°C (-40°F to 140.0°F)	0 m to 10,700 m (0 ft to 34,991 ft)	5% to 100%	29°C (84.2°F)

Note: Decrease the maximum system temperature by 1°C for every 175 m increase in altitude. For above 950 m, decrease in maximum air temperature by 1°C for every 300 m.

Preparing your environment

The following tables list the physical characteristics of a SAN Volume Controller node.

Dimensions and weight

Use the parameters that are shown in to ensure that space is available in a rack capable of supporting the node.

Table 12. Dimensions and weight			
Height	**Width**	**Depth**	**Maximum weight**
87 mm (3.4 in.)	446 mm (17.6 in)	826 mm (32.5 in)	25 kg (55 lb) to 30 kg (65 lb) depending on configuration

Additional space requirements

Ensure that space is available in the rack for the additional space requirements around the node, as shown in .

Table 13. Additional space requirements		
Location	**Additional space requirements**	**Reason**
Left side and right side	Minimum: 50 mm (2 in.)	Cooling air flow
Back	Minimum: 100 mm (4 in.) If the cable-management arm is used, allow 177 mm (7 in.)	Cable exit

Maximum heat output of each SAN Volume Controller node

The node dissipates the maximum heat output that is given in .

Table 14. Maximum heat output	
Model	**Heat output per node**
IBM SAN Volume Controller 2145-SV3	Maximum configuration: 2760 BTU per hour (806 watts)

Acoustical declaration with noise hazard notice

CAUTION:

High levels of acoustical noise are (or could be under certain circumstances) present.

Use approved hearing protection and/or provide mitigation or limit. (L018)

Table 15. Declared noise emission values in accordance with ISO 9296										
Declared noise emission values in accordance with ISO 9296										
Product Description: SAN Volume Controller MTs 2145, 2147 Model SV3 RMID: FSIV-4U48	Mean A-weighted sound power level, $L_{WA,m}$ (B)		Mean A-weighted emission sound pressure level, $L_{PA,m}$(dB)[1-7]							Statistical adder for verification, K_v (B)	
	Oper ating	Idle	Front			Rear			Bysta nder, with door and cover s	Opera ting	Idle
			1.0m Heigh t	1.18 m Heigh t (Syste m Level)	1.5m Heigh t	1.0m Heigh t	1.18 m Heigh t (Syste m Level)	1.5m Heigh t			
Typical configuration, 25°C 0.25 meter test stand	6.6	6.6	-	-	-	-	-	-	-	0.3	0.3
Typical configuration, 25°C Centered in Rack	6.2	6.2	57	57	56	56	56	55	52	0.3	0.3

Table 15. Declared noise emission values in accordance with ISO 9296 (continued)											
Declared noise emission values in accordance with ISO 9296											
0.3Maximum configuration, 25°C Centered in Rack	6.3	6.3	58	57	56	57	57	55	53	0.3	0.3
Maximum configuration, 27°C Centered in Rack	6.4	6.4	60	59	58	59	58	57	55	0.3	0.3
Maximum configuration, 35°C Centered in Rack	7.2	7.2	70	69	68	69	68	68	65	0.3	0.3
0.3Maximum configuration, 100% System and PSU Fan Speed Centered in Rack	7.8	7.8	78	78	76	73	73	73	72	0.3	0.3

Table 15. Declared noise emission values in accordance with ISO 9296 (continued)
Declared noise emission values in accordance with ISO 9296
1. Declared level $L_{WA,m}$ is the upper-limit A-weighted sound power level.
2. Declared level $L_{WA,m}$ is the mean A-weighted emission sound pressure level that is measured either at the 0.5-meter operator positions with doors open or 1-meter bystander positions with doors closed.
3. The statistical adder for verification, K_v, is a quantity to be added to the declared mean A-weighted sound power level, $L_{WA,m}$ such that there is a 95% probability of acceptance, when using the verification procedures of ISO 9296, if no more than 6.5% of the batch of new equipment has A-weighted sound power levels greater than ($L_{WA,m}$ K_v).
4. The quantity $L_{WA,c}$(formerly called $L_{WA,d}$), can be computed from the sum of $L_{WA,m}$and K_v.
5. All declared data for systems that are obtained through a combination of measurements made in accordance with ISO 7779 and modeled results. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.
6. 10 dB (decibel) equals 1 B (bel).
7. Under certain environments, configurations, system settings, or workloads, there is an increase in fan speeds that results in higher noise levels.
Notice: Government regulations (such as those prescribed by OSHA or European Community Directives) might govern noise level exposure in the workplace and might apply to you and your server installation. The actual sound pressure levels in your installation depend upon various factors, including the number of racks in the installation; the size, materials, and configuration of the room where you designate the racks to be installed; the noise levels from other equipment; the room ambient temperature, and employees' location in relation to the equipment. Further, compliance with such government regulations also depends upon various extra factors, including the duration of employees' exposure and whether employees wear hearing protection. IBM recommends that you consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

Enclosure location guidelines

Use these guidelines to plan the location of a control enclosure and any expansion enclosures that attach to it.

Each control enclosure contains two node canisters, forming an I/O group. The guidelines apply on an I/O group by I/O group basis.

Note: A mounting rail kit is provided with each control enclosure and expansion enclosure. Each rail can expand to accommodate a range of rack depths, which are measured between the front and rear mounting posts of the rack. However, because there are differences between some types of mounting rails, be sure to use the specific rail kit that is supplied with each control or expansion enclosure.

Plan for one of the following types of installation.

- Control enclosure only
- Control enclosure and one or more expansion enclosures
  - Position the control enclosure in the center of the rack to have shorter cabling runs. Balance the number of expansion enclosures above and below the control enclosure.
  - Position the enclosures together. Avoid adding other equipment between enclosures.
  - Position the enclosures in the rack so that you can easily view them and access them for servicing. This action also allows the rack to remain stable and allows two or more people to install and remove the enclosures.

Planning management connections

The cable-connection tables provide an easy to read method of recording the locations of current and planned cable connections for each control enclosure in the system.

Management Ethernet connections

Each node canister in a control enclosure connects over an Ethernet cable from Ethernet port 1 of the canister to an enabled port on your Ethernet switch or router. Ethernet port 1 is for accessing the management GUI, the service assistant GUI for the node canister, and iSCSI host attachment. For IBM SAN Volume Controller 2145-SV3 and 2147-SV3, iSCSI host attachment on any on board Ethernet ports is not supported.

Note:

- For 100 Gbps Ethernet connectivity, you may use third-party 100GBASE-BIDI QSFP optical transceiver that meets the minimum standards specifications. However, during troubleshooting, IBM support may ask customers to install IBM approved transceivers if the third-party transceivers are determined to cause the issue.

IP address allocation and usage

As you plan your installation, you must consider IP address requirements and service access for the system.

Use Table 16 on page 42 to consider the TCP/IP address requirements of the system and the requirements to access other services. You must also plan for the IP address allocation, and for the configuration of the Ethernet router, gateway and firewall.

Table 16. Summary of TCP/IP ports and services

Service	Traffic direction	Protocol	Port	Service type
Email (SMTP) notification and inventory reports	Outbound	TCP	25	Optional
SNMP event notification	Outbound	UDP	162	Optional
Syslog event notification	Outbound	TCP UDP	6514 (TCP) 514 (UDP)	Optional
IPv4 DHCP (Node service address)	Outbound	UDP	68	Optional
IPv6 DHCP (Node service address)	Outbound	UDP	547	Optional
Network time server (NTP)	Outbound	UDP	123	Optional
SSH for command line interface (CLI) access	Inbound	TCP	22	Mandatory
Remote support assistance	Outbound	TCP	22	Optional
HTTPS for GUI access	Inbound	TCP	443	Mandatory
Uploading support packages to IBM	Outbound	TCP	443	Optional
Remote support assistance for HTTPS GUI access	Outbound	TCP	443	Optional
Remote user authentication service - HTTP	Outbound	TCP	16310	Optional
Remote user authentication service - HTTPS	Outbound	TCP	16311	Optional
Remote user authentication service - Lightweight Directory Access Protocol (LDAP)	Outbound	TCP	389	Optional

Table 16. Summary of TCP/IP ports and services (continued)				
Service	**Traffic direction**	**Protocol**	**Port**	**Service type**
iSCSI	Inbound	TCP	3260	Optional
iSCSI iSNS	Outbound	TCP	3260	Optional
IP-based RDMA replication/high availability	Inbound and Outbound	TCP	4791, 21451, 21452, and 21455	Optional
IP-based RDMA replication/high availability	Inbound and Outbound	UDP	4791, 21451, 21452, and 21455	Optional
IP Partnership management IP communication	Inbound and Outbound	TCP	3260	Optional
IP Partnership data path connections[1]	Inbound and Outbound	TCP	3265	Optional
REST API access and replication management	Inbound	TCP	7443	Optional
NVMe over RDMA	Inbound and Outbound	UDP over RoCEv2	4420	Optional
NVMe over TCP	Inbound and Outbound	TCP	4420	Optional
IP quorum application	Inbound and Outbound	TCP	1260	Optional
[1]Ports must be open for IP addresses that are configured for replication and not the system IP address.				

For configuration and management, you must allocate an IP address to the system; this IP address is referred to as the *management IP address*. For extra fault tolerance, you can also configure a second IP address for the second Ethernet port on the node. The addresses must be fixed addresses. If IPv4 and IPv6 are operating concurrently, you must provide an address for each protocol.

⚠️ **Attention:** The address for a management IP cannot be the same address that is used for the service IP. Using the same IP address causes communication problems.

Name servers are not used to locate other devices. You must supply the numeric IP address of the device. To locate a device, the device must have a fixed IP address.

Planning for I/O connections

Plan to install the appropriate adapters for your FlashSystem control enclosure so that it is compatible with your networking topology and provides the appropriate connection capability.

The control enclosure contains two node canisters. Each node canister has eight PCIe interface slots, where 6 are used for host adapter cards. The SAS adapters are supported in adapter slot 6. On the SAN Volume Controller SV3 there are dedicated on-board ports and cannot be used for host I/O or replication.

Important: Both nodes in the same I/O group must be configured with the same adapters.

provides examples of the connection types and the alternative connection methods if alternative connection methods are available.

Table 17. Communications types					
Functionality	**Network speeds supported**	**On-board or Adapter**	**Host I/O**	**System to system**	**Storage virtualization**
Fibre Channel SAN (SCSI)	64 Gb, 32 Gb, 16 Gb	Adapter: 4-port	yes	yes	yes
Fibre Channel SAN (FC-NVMe)	64 Gb, 32 Gb, 16 Gb	Adapter: 4-port	yes	no	no
Ethernet (iSCSI)	100 Gb	Adapter: 2-port	yes	no	no
	25 Gb	Adapter: 2-port	yes	yes	yes
Ethernet (NVMe/TCP and NVMe/RDMA)	100 Gb	Adapter: 2-port	yes	no	no
	25 Gb	Adapter: 2-port	yes	yes	no

Note: 2 port adapter with port speed 25 Gb or 10 Gb depends on transceiver installation. For more information on the adapter, see "Cable reference" on page 44.

Cable reference

The cable standard tables specify cable types and standards for customer-supplied cables for use with the system.

Table 18 on page 44 provides a list of Ethernet cable standards. Ethernet cables are not supplied as part of your order. Ensure the cables that are used meet the minimum standards for the Ethernet port type.

Table 18. Ethernet cable standards					
Ethernet adapter type	**Ethernet port type**	**Connector**	**Cable type**	**Minimum standard**	**Remark**
On-board Ethernet ports	1 Gbps Ethernet port	RJ45	Unshielded twisted pair (UTP)	Cat 5e or Cat 6 (up to 100 meters)	
On-board Ethernet ports	10 Gbps Ethernet port	RJ45	Unshielded twisted pair (UTP)	Cat 6a or Cat 7 (up to 100 meters)	
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	25 Gbps Ethernet port	LC-SFP28 Transceiver (IBM feature)	Optical fibre	• OM3 (up to 70 m) • OM4 (up to 100 m)	

Table 18. Ethernet cable standards (continued)					
Ethernet adapter type	**Ethernet port type**	**Connector**	**Cable type**	**Minimum standard**	**Remark**
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	25 Gbps Ethernet port	QSFP28 to SFP28	Passive Twinax DAC Cable (up to 2 m)	• SFF-8432 transceiver specification • IEC60825-1 product safety specification • Operational temperature should be 0 deg C - 70 deg C. However, in some cases the temperature can reach to 85 deg C.	
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	10 Gbps Ethernet port	RJ45 SFP+ connector (IBM feature)	Unshielded twisted pair (UTP)	• Cat 6a or Cat 7 (up to 100 meters	The 25 Gbps Adapter card runs as a 10 Gbps port when using the RJ45 SFP+ connector.
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	10 Gbps Ethernet port	LC - SFP+ Transceiver (IBM feature)	Optical fiber	• OM2 (up to 60 meters) or OM3 (60 - 150 meters)	The 25 Gbps Adapter card runs as a 10 Gbps port when using the LC - SFP+ Transceiver connector.
2 Port 25 Gbps RoCE Adapter Card or 2 Port 25 Gbps iWARP Adapter Card	25 Gbps Ethernet port	DAC (Direct Attached Copper)	DAC: Twin-ax copper cable (up to 2 m)	• SFF-8432 transceiver specification • IEC60825-1 product safety specification • Operational temperature should be 0 deg C - 70 deg C. However, in some cases the temperature can reach 85 deg C.	The 25 Gbps adapter ports can work with 10 Gbps and 25 Gbps DAC cables.
2 Port 100 Gbps RoCEv2 Adapter Card	100 Gbps Ethernet	QSFP28 (SR4) – Transceiver (IBM feature)	MPO fabric	• OM3 (up to 70 m) • OM4 (up to 100 m)	

Table 18. Ethernet cable standards (continued)					
Ethernet adapter type	**Ethernet port type**	**Connector**	**Cable type**	**Minimum standard**	**Remark**
2 Port 100 Gbps RoCEv2 Adapter Card	100 Gbps Ethernet	QSFP28 (SRBD) – Transceiver	LC fabric Optical: OM3/OM4	• SFF-8436 transceiver specification • IEC60825-1 product safety specification • Operational temperature should be 0 deg C - 70 deg C. However, in some cases the temperature can reach to 85 deg C.	
2 Port 100 Gbps RoCEv2 Adapter Card	100 Gbps Ethernet	AOC (Active Optical Cable)	AOC: Ribbon optical fiber cable		
2 Port 100 Gbps RoCEv2 Adapter Card	100 Gbps Ethernet	DAC (Direct Attached Copper)	DAC: Twin-ax copper cable (up to 2 m)		

Planning worksheets

Planning worksheets can help identify important information that is needed when the system is installed and configured. Complete the relevant sections to help with installation planning.

The planning worksheet is available for download in the following languages:

- English
- Brazilian Portuguese
- French
- Italian
- German
- Spanish
- Simplified Chinese
- Japanese
- Korean

Chapter 5. Installing

This information covers the system hardware installation and initial setup.

After you verify that the power and environmental requirements of the system are met, and planning the location of the enclosure, you are ready to begin installing the hardware components. The installation activity follows the plan that is used in the planning section.

For more details on the installation, see the following pages:

Unpacking the node

Before you unpack the node, ensure that you review and follow all related instructions.

Before you begin
The node and related parts are shipped in a single box, containing the following:

- Node with the following components preinstalled:

  - Node canister with adapters, SFPs, and memory feature codes preinstalled
  - Two power supplies and two power interposers
  - Bezel
- Rail kit including left and right rails, securing screws, and locating pins
- Two power cables
- Optional OM3 fiber cables
- Fibre Channel cables

Note: You will need a box knife to unpack the node.

About this task

⚠️ **CAUTION:** Lifting the enclosure requires two persons or a suitable mechanical lift. If there are less than two persons or a lifting equipment is not available, reduce the weight of the enclosure temporarily by removing the two PSUs and the node canister.

Procedure

1. Cut the box tape and open the lid of the shipping carton.
2. Remove the rail kit box and set it aside in a safe location.
3. Lift the front and rear foam packing pieces from the carton.
4. Remove the four corner reinforcement pieces from the carton.
5. Using the box knife, carefully cut the four corners of the carton from top to bottom.
6. Fold the sides and back of the carton down to uncover the rear of the node.

   If necessary, carefully cut along the lower fold line of the sides and remove them.
7. Carefully cut the raised section of the foam packing away from the rear of the enclosure.
8. Lift the enclosure from the shipping carton.
9. Carefully cut open the bag covering the rear of the enclosure.
10. If you do not have two persons or mechanical lift available, then remove the power supply units (PSU) from the enclosure
11. Record the last six digits of the serial number on the back of the each power supply, and then set the power supply aside.

12. Remove the node canister from the enclosure only if you do not have two persons or mechanical lift available.

13. Record the serial number on the canister release handle, and then set the canister aside.

Installing support rails for the node

Before you install the node, you must first install the support rails for it.

Procedure

To install the support rails for the node, complete the following steps.

1. Locate the node rails.

    The rail assembly consists of two rails that must be installed in the rack cabinet.
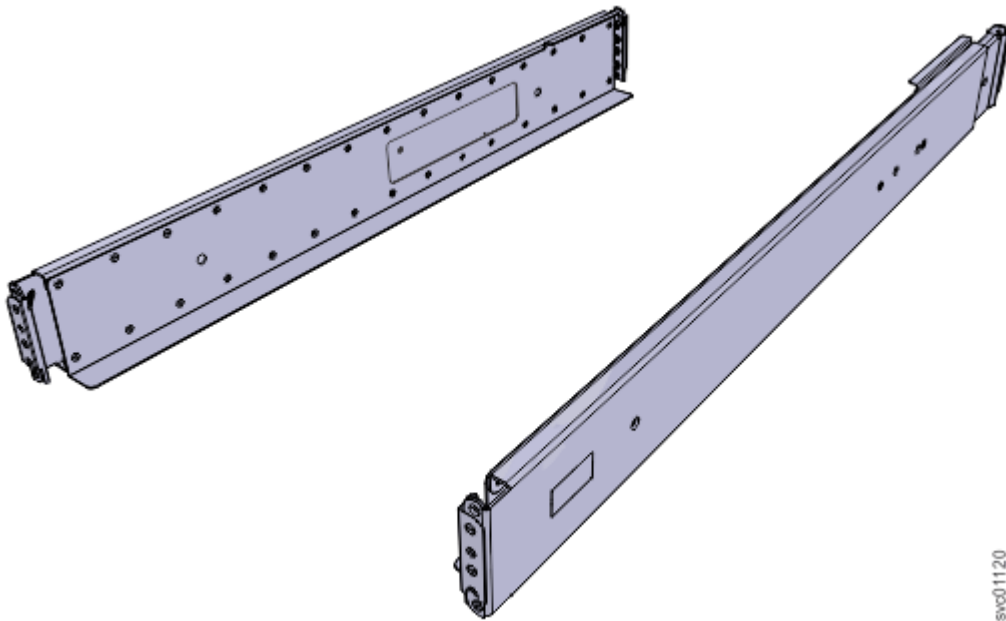
Figure 16. Node support rails

2. Working at the front of the rack cabinet, identify the two standard rack units (2U) of space in the rack into which you want to install the support rails.

    The following figure shows two rack units with the front mounting holes identified.
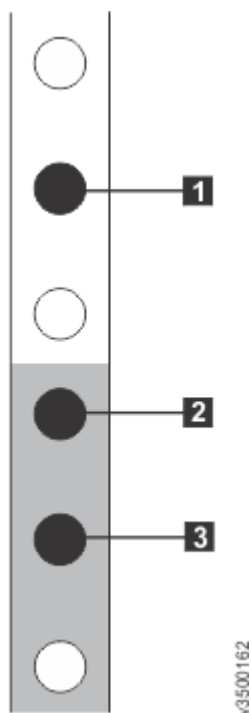
Figure 17. Hole locations in the front of the rack

- **1** Upper rail-mounting bracket pin
- **2** Lower rail-mounting bracket pin
- **3** Rack mounting screw hole

3. Ensure that the appropriate bracket pins are installed in the front and rear bracket of each rail.

   Each rail comes with four medium pins preinstalled (two in the front bracket and two in the rear bracket). Large pins are provided separately. Use the pins that are appropriate for the mounting holes in your rack (see the following table).

Table 19. Selecting bracket pins for your rack

Mounting holes	Bracket pins
Round, unthreaded	Use the preinstalled medium pins.
Square	Unscrew the medium pins and replace with the large pins that are supplied with the rails.

4. At each end of the rail, grasp the tab **1** and pull *firmly* to open the hinge bracket.
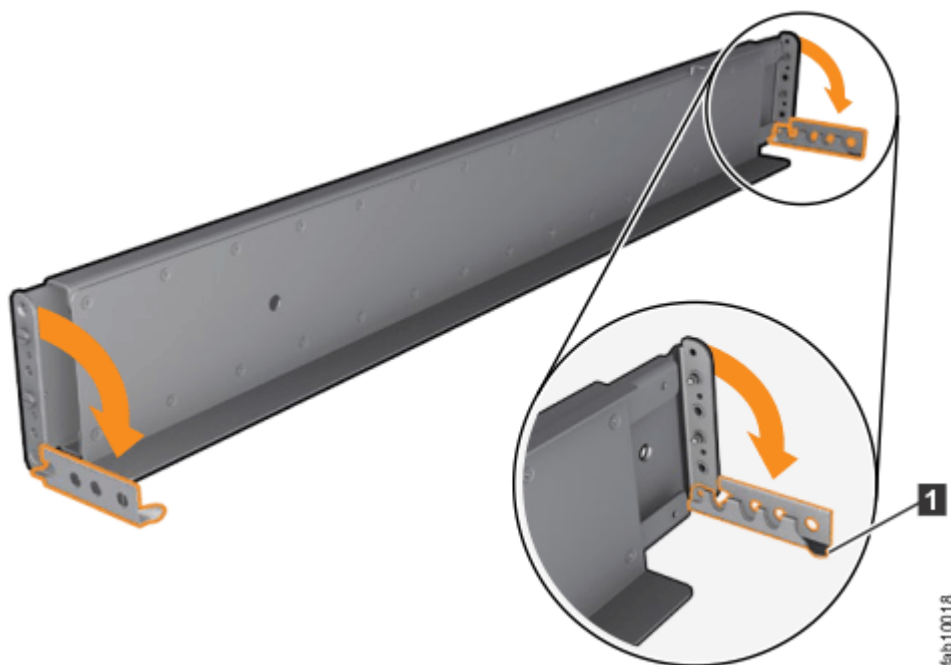
Figure 18. Opening the hinge brackets

5. Align the holes in the rail bracket with the holes on the front and rear rack cabinet flanges. Ensure that the rails are aligned on the inside of the rack cabinet.
6. On the rear of the rail, press the two bracket pins into the holes in the rack flanges.
7. Close the rear hinge bracket to secure the rail to the rack cabinet flange.
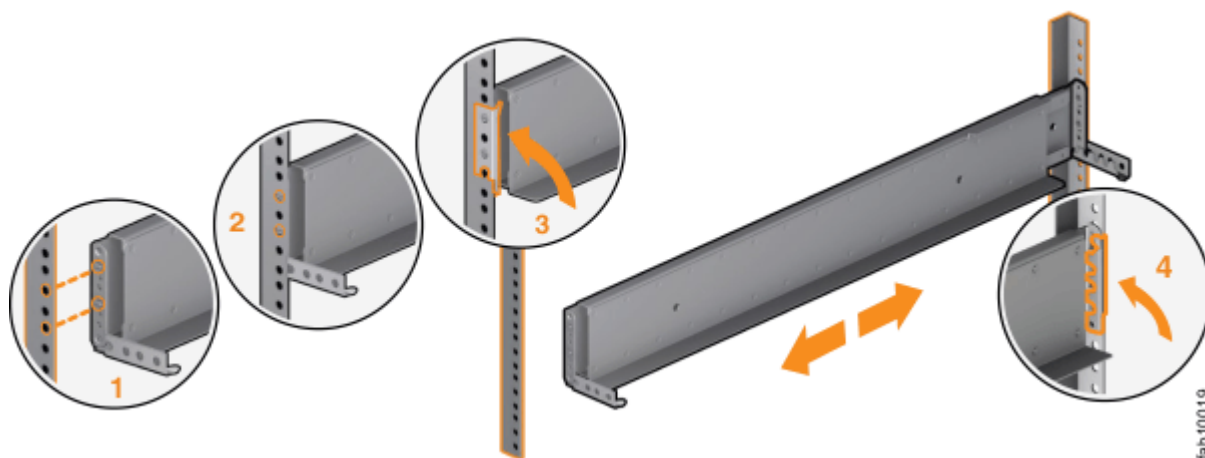
Figure 19. Closing the hinge brackets

8. On the front of the rail, press the two bracket pins into the holes in the rack flanges.
9. Close the front hinge bracket to secure the rail to the rack cabinet flange.
10. Secure the rear of the rail to the rear rack flange with two black M5 screws.
11. Repeat the steps to secure the opposite rail to the rack cabinet.

Installing the node

Following your node location plan, install the node.

About this task

⚠️ **CAUTION:**

- To lift a node requires at least two people.
- Install a node only onto the rails supplied with the node.
- Load the rack from the bottom up to ensure rack stability. Empty the rack from the top down.

Procedure

To install an node, complete the following steps.

1. To remove the fascia from the node, grasp the fascia by the left and right blue touch points.
2. Pull the fascia straight out from the node, so that the left and the right ends of the fascia release at the same time.
3. Align the node with the front of the rack cabinet.
4. Slide the node into the rack along the rails until the node is fully inserted, as shown in the following figure.

   Note: The rails are not designed to hold an node that is partially inserted. The node must always be in a fully inserted position.
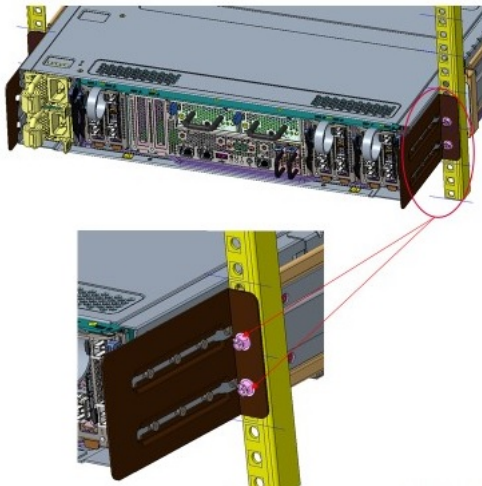
Figure 20. Inserting the node

5. Secure the node with four M5 screws in the holes in the rack mounting flanges on either side of the enclosure.
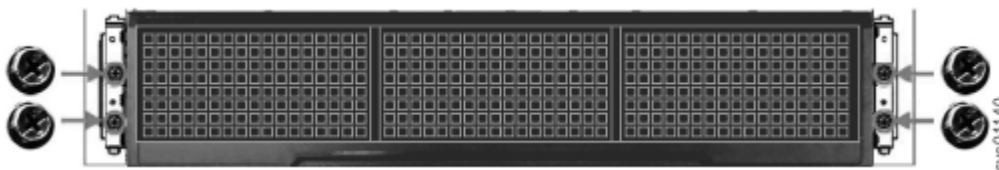
Figure 21. Securing the front of the node

6. To replace the fascia, complete the following steps:

   a) Hold the fascia by the blue touch points on each end and align the fascia with the front of the node so the clips on the rear of the fascia align with the four mounting posts on the node flanges.
   b) Press the ends of the fascia so that the clips engage with the mounting posts and the back of the fascia is flush against the front panel of the node.

What to do next

If you removed components from the node to lift it, reinstall the components into their original locations in the node.

Connecting Ethernet cables to the node

To provide system management connectivity for your system, you must connect an Ethernet cables to Ethernet port 1 of the node canister in the node.

Procedure

To install the Ethernet cable, complete the following steps.

1. Connect Ethernet port 1 of the node to the IP network that provides connection to the system management interfaces, as shown in the following figure.

   This port can also be used for iSCSI connectivity to the system by hosts on the network. Where more than one node is present in the system, ensure port 1 of every node is connected to the same network to provide access if the configuration node fails.

Figure 22. Ethernet ports on the node

2. Optionally, connect Ethernet port 2 of the node to a second IP network that provides redundant connection to the system management interfaces.

   If there is more than one node in the system, ensure that port 2 of every node is connected to the same network to provide access if the configuration node fails.

Connecting Fibre Channel cables to a Fibre Channel adapter in the node

Your system may have one or more 4-port Fibre Channel adapters installed. You must use Fibre Channel cables to connect the node to the switches in the Fibre Channel SAN.

Before you begin

Obtain the "Planning worksheets" on page 46 completed by the customer to determine the number of required cables and their intended port locations.

Procedure

To install the cables, complete the following steps.

1. Review the "Planning worksheets" on page 46.

2. Connect the required number of Fibre Channel cables to the node, and the switches in the Fibre Channel SAN.

   The following figure shows the location and port numbers of the Fibre Channel adapter in adapter slot 1 of the node. (The system might also have an optional Fibre Channel adapter installed in slot 2 and slot 3 of the node.)

Figure 23. Fibre Channel adapter in adapter slot 1

Powering on the system

After you install all hardware components, you must power on the system and check its status.

About this task

Note: Each power supply unit includes a cable retainer to secure the power cable.

Use the cable retainers to secure the power cables from being accidentally pulled out of the node. The cable retainer, which is on the back of each PSU, has a curved opening that faces the rear of the PSU. After you plug the power cables in to the PSU, slip the power cable behind the retainer. Then, pull the cable back into the retainer opening to secure the cable.

Each cable must be routed through the retainer, as shown in the following figure. For PSU 1, hook the power cable underneath the cable retainer so the cable can extend to the left. For PSU 2, make a loop to secure the cable under the retainer and extend the power cable to the right side of the node.

To remove the power cable, push the cable forward to unhook it from the cable retainer. Then, unplug the cable from the PSU.

Procedure

To power on the system, complete the following steps.

1. Power on the node. Use the supplied power cords to connect both power supply units of the node to their power sources.

   If the power sources have circuit breakers or switches, ensure that they are turned on. The enclosure does not have power switches.

   Notes:

   - Each node has two power supply units. To provide power failure redundancy, connect the two power cords to separate power circuits.
   - Ensure that each power cable is secured to each PSU on the back of the node.

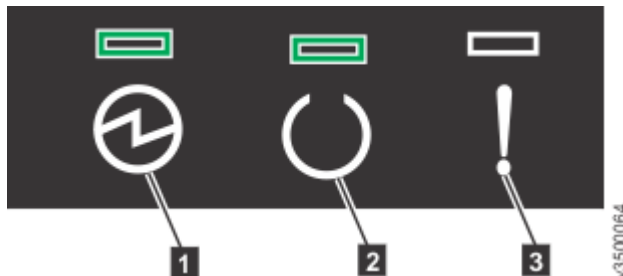2. From the rear of the node, check the LEDs on the node canister.

Figure 24. Node canister LEDs

1 Power
2 Status
3 Fault

The canister is ready for initialization with no critical errors when **Power** is illuminated, **Status** is flashing, and **Fault** is off.

What to do next

Next, you will connect an Ethernet cable to the technician port on the node, and initialize the system.

Installing optional features

Optional hardware features can be installed in an enclosure. For example, drives, network adapters, and more memory modules.

The optional features that an enclosure supports are shown in the sales manual within the IBM Documentation. To find the relevant IBM Sales Manual, search "in all of IBM Sales manuals" for the machine type or the product name of the enclosure.

If an optional feature was ordered with the enclosure order, it is fitted at IBM manufacturing.

Drives can be added to a control enclosure or an expansion enclosure without powering off the enclosure. The IBM Storage Virtualize software discovers the drives. Use the management GUI to add the drives to an existing array or use them to make a new array.

Pluggable network port modules (for example SFP) can be added or changed without powering off the node canister.

A node canister must be logically removed from the system (by using the **rmnode** command) and power off before adding memory modules to it. When putting the node canister back in to the enclosure, it is automatically added back into the system if there are no unrecoverable node errors. Ensure that hosts can access volumes via this node canister before logically removing the other node canister from the system (by using the **rmnode** command) and power it off to add memory modules to it.

A node canister must be logically removed from the system (by using the **rmnode** command) and powered off before adding or changing any network adapter to it.

When a node canister comes online with new adapters in it, the addresses of the ports might move. Some reconfiguration might be needed to restore all communication links before proceeding to update the next node canister. If portmasks or portsets are being used, they might need to be changed.

Always check that hosts, other Storage Virtualize nodes, and any back-end storage controllers can access the partner node canister before powering off a node canister.

Note: Wait for the power LED to start flashing (standby mode) before removing the node canister from the enclosure.

Use the management GUI to check that access to volumes is not lost if a node is offline. Host administrators can check that there are still paths to volumes if a node is offline.

If there are partnerships with other IBM Storage Virtualize systems, use the management GUI to check that communication with the partner system is not lost when a node is offline.

Use the management GUI to power off or remove a node canister from the system. However, if the node is logically removed from the system, use the service assistant tool or CLI to power it off.

Use the management GUI to make any port configuration changes that might be needed to a node with new or different network adapters.

See the "Removing and replacing a network adapter" on page 69 page appropriate to the product for the specific information about how and where to fit adapters in the node canister type.

Related concepts
"Removing and replacing control enclosure parts" on page 58
Parts can be removed and replaced in the control enclosures to perform service procedures or during the initial installation process.

Related information
Troubleshooting

Adding a node to a system

You can add a node to the system by using the CLI or management GUI. A node can be added to the system if the node previously failed and is being replaced with a new node or if a repair action causes the node to be unrecognizable by the system. When you add nodes, ensure that they are added in pairs to

create a full I/O group. Adding a node to the system typically increases the capacity of the entire system. Adding spare nodes to a system does not increase the capacity of the system.

You can use either the management GUI or the command-line interface to add a node to the system. Some models might require you to use the front panel to verify that the new node was added correctly.

Before you add a node to a system, you must make sure that the switch zoning is configured such that the node that is being added is in the same zone as all other nodes in the system. If you are replacing a node and the switch is zoned by worldwide port name (WWPN) rather than by switch port, make sure that the switch is configured such that the node that is being added is in the same VSAN or zone.

Note: Use a consistent method (either only the management GUI, or only the CLI) when you add, remove, and re-add nodes. If a node is added by using the CLI and later re-added by using the GUI, it might get a different node name than it originally had.

You can use either the **addnode** command or the **Add Node** wizard in the management GUI. To access the **Add Node** wizard, select **Monitoring** > **System**. On the **System -- Overview** page, select **Add Node** to start the wizard. Complete the wizard and verify the new node. If **Add Node** is not displayed, it indicates a potential cabling issue. Check the installation information to ensure that your node was cabled correctly.

To add a node to a system by using the command-line interface, complete these steps:

1. Enter this command to verify that the node is detected on the network:

   ```
   svcinfo lsnodecandidate
   ```

   If the node is detected on the system the results display information identifying the new node in the system, like the serial number and machine signature. The **id** parameter displays the WWNN for the node. If the node is not detected, verify cabling to the node.

2. Enter this command to determine the I/O group where the node must be added:

   ```
   lsiogrp
   ```

3. Record the name or ID of the first I/O group that has a node count of zero. You need the name or ID for the next step.

   Note: You must do this step for the first node that is added. Do not perform this step for the second node of the pair because it uses the same I/O group number.

4. Enter this command to add the node to the system:

   ```
   addnode -wwnodename WWNN -iogrp iogrp_name -name new_name_arg -site site_name
   ```

   Where **WWNN** is the WWNN of the node, **iogrp_name** is the name of the I/O group that you want to add the node to and new_name_arg is the name that you want to assign to the node. If you do not specify a new node name, a default name is assigned. Typically, you specify a meaningful node name. The site_name specifies the name of the site location of the new node. This parameter is only required if the topology is a HyperSwap or stretched system.

   Note: Adding the node might take a considerable amount of time.

5. Record this information for future reference:

   - Serial number.
   - Worldwide node name.
   - All of the worldwide port names.
   - The name or ID of the I/O group

Chapter 6. Hardware Servicing

The following topics contain information about service procedures for control and expansion enclosures.

This section describes removing and replacing field-replaceable units (FRUs) from the nodes and expansion enclosures.

Each part has its own removal procedure. Sometimes a step within a procedure refers you to a different remove or replace procedure. Complete the new procedure before you continue with the first procedure that you started.

Note: Do not use FRUs from containers with broken seals or try to transfer FRUs between systems. If you open a FRU container but do not use the part, do not re-seal the container; instead, send the FRU back for reconditioning per the Certified Service Parts (CSP) process.

For more details on the service procedures, see the following pages:

Resolving a problem with failure to boot: 2145-SV3

An IBM Service Support Representative (SSR) can use this procedure if a IBM SAN Volume Controller 2145-SV3 node canister fails to boot when powered on.

Before you begin

If the Storage Virtualize software is not running, then the node canister status LED is off. The service interfaces such as the service IP, technician port, and satask.txt on a USB flash drive do not work.

About this task

Complete the following steps if the SAN Volume Controller software is not running.

Procedure

1. If secure boot has failed then the boot drive Fault LEDs might be on (in this case replace boot drives and TPM). If you inserts a USB flash drive into a node that has failed the secure boot debug data will be copied onto it (in the format bootsnap.<timestamp>.tgz).
2. If the microprocessors could not be started or the POST has failed, then it will set the canister fault LED on with the node canister status LED off (in this case replace the node canister). If the Storage Virtualize software is running, then the node canister fault LED might be on, and the node canister status LED might flash. The node canister error code and error data can be seen in the Service Assistant GUI, by connecting to the technician port, or by using the other service interfaces. Look up the error code in the IBM Documentation for your product.
3. If the Power On Self Test (POST) on the microprocessor has failed then run the fix procedure given in step <u>"4" on page 57</u> for assistance with recovery. You might be directed to try removing all adapters and DIMMs except for the DIMM in memory channel 0, DIMM slot 0.
4. If there is no error event for the missing node, complete the following steps.
   a) Power® off the node by pulling out the AC power cords.
   b) Wait for 1 minute.
   c) Reinsert the AC power cords to restore the power.
      The node attempts to power on.
   d) If the power LED comes on green, then watch the node canister status indicator.
   e) If the node canister status LED remains off, replace the node canister.

Removing and replacing control enclosure parts

Parts can be removed and replaced in the control enclosures to perform service procedures or during the initial installation process.

Important: Read the safety precautions in the IBM Systems Safety Notices. These guidelines help you safely work with the system.

Procedure: Identifying which enclosure or canister to service

Use this procedure to identify which enclosure or canister must be serviced.

About this task

To prevent data access loss or data loss when servicing the system, identify the correct enclosure or canister when you complete a service action.

- Labels on the enclosure front and rear indicate the enclosure model and serial number.
- The node canister can be identified by the enclosure it is in, and the serial number of the node canister. The label on the release handles of the canister displays the serial number.

A canister can also be located by the enclosure that contains it and its slot location. This ID is shown as *E-C* or *E/C*, where *E* is the enclosure ID and *C* is the canister slot location. On the service assistant, the ID is known as the Panel.

Note: When a node canister is added to a system as a node, it is given a node name and a node ID. The default node name is *nodeN*, where *N* is the node ID. The node ID does not represent the slot location of the node.

To display the node name and canister location in the management GUI, complete the following steps:

1. Select **Monitoring** > **System Hardware**.
2. On the **System Hardware - Overview** page, select the directional arrow next to the enclosure that contains the node canister that you want to display.
3. On the **Enclosure Details** page, click **Node Canister** to highlight the node canister in the graphic and display details for the node canister.

The service assistant home-page also shows both the node name and the canister location. If you have only the node name, use these panels to determine the node canister location. Use this procedure to identify which enclosure or canister must be serviced, as completing a service action on the wrong canister can lead to data access loss or data loss.

To control the identify LED of an enclosure or online canister, use the management GUI:

1. Select **Monitoring** > **System Hardware** .
2. On the **System Hardware - Overview** page, select the directional arrow next to the enclosure that contains the node canister that you want to identify.
3. On the **Enclosure Details** page, right-click the node canister in the graphic and select **Identify** from the **Actions** menu.

Alternatively, if a node canister is not online to the system, use the service assistant to control the identified LED.

1. Log in to the service assistant of the node canister to be identified.
2. Click **Identify** at the upper left of the page to control the identified LEDs.

Procedure: Understanding system volume dependencies

If one component in a redundant pair is offline or powered off, host access to volumes can be disrupted. Before you remove or power off a node canister or enclosure, verify whether any volumes depend on those components.

The following examples describe scenarios where the system or node status can impact if a volume is available to a host.

- If a control enclosure has only one node canister online, access to a volume depends on the online node canister. For example, a host might lose access to a volume that is stored partially or wholly on an array that uses drives in the offline node or its expansion enclosures.
- If one expansion canister in an expansion enclosure is powered off, further expansion canisters to that down side chain get isolated from the control canister of the side chain. In this case, host access to volumes depends on the online canister if the volume uses drives in an isolated enclosure or the enclosure with the offline canister.
- If an entire expansion enclosure is powered off, both sides of the SAS chain are broken. In this case, host access to some volumes can be considered to depend on the entire expansion enclosure.

The impact that a service procedure might have on host access to data can be understood by using the management GUI. To do so, use the following procedure:

1. In the management GUI, select **Monitoring** > **System** .
2. On the **System -- Overview** page, use the directional arrow near the enclosure that contains the node canister to open the **Enclosure Details** page.
3. Under **Rear View** of the system, right-click the canister and select **Dependent Volumes** from the **Actions** menu to display all volumes that become disabled to hosts if the canister is powered off.

During a maintenance procedure, if the **Dependent Volumes** action identifies dependent volumes, you may choose to stop the procedure. Then, investigate whether it is possible to reinstate the redundancy in the system to carry out the procedure without loss of access to data. For example, first complete procedures to ensure that both canisters in the enclosure are online. Then, complete any procedure that powers off the only online canister in the enclosure.

Procedure: Powering off the system

Sometimes, it is necessary to power down all node canisters in a system. For example, you might need to shut down the system before you do the maintenance actions in your data center.

Before you begin

Notes:

- It is not necessary to shut down the entire system (all node canisters) when you complete service actions.
- Service actions upon a node canister require only one node canister in the control enclosure to be shut down. If one node canister of an I/O group is online and communicating with hosts and other nodes, volumes that depend on resources of the I/O group can remain online.
- Service actions upon a control enclosure might require the control enclosure to be shut down. In this case, the I/O group that is provided by the control enclosure goes offline. All volumes that depend on that I/O group become disabled. However, other I/O groups in the system can continue to operate.

Procedure

1. Stop all host I/O to volumes on the system.
2. Shut down the system by using the management GUI. Click **Monitoring** > **System**. From the **System Actions** menu, select **Power Off System**.
3. Disconnect the power cords.

a) If you are servicing the control enclosure only, disconnect the power cords from both power supply units (PSUs) in the control enclosure.

   Note: You do not need to power off the expansion enclosures.

b) If you are preparing for site maintenance, disconnect the power cords from both power supplies in each expansion enclosure in the control enclosure's SAS chains.

   Note: The 2U and 5U expansion enclosures do not have a power button. Each expansion enclosure has two PSUs.

4. When you are ready to restore power to the control enclosure and any expansion enclosures, follow the Powering on the control enclosures procedure for system configuration.

Procedure: Powering off a node

To complete some service tasks, you must ensure that the node canister is powered off safely.

About this task

⚠️ **Attention:** If your system is powered on and doing I/O operations, the system must power off correctly to ensure that no data is lost. If possible, always use the fix procedures that are presented by the management GUI to manage and maintain your system. The fix procedures ensure that the canister is powered off safely.

While a node canister is powered off, some volumes can become inaccessible. Refer to "Procedure: Understanding system volume dependencies" on page 59 to determine whether it is appropriate to continue this procedure.

Procedure

To power off a node canister, complete the following steps:

1. Determine the volume dependencies for the node canister that you are shutting down. For more information, see "Procedure: Understanding system volume dependencies" on page 59.
2. Go to the service assistant for the node with the canister to shut down.
3. On the home page, select the node canister to shut down.
4. If you are working on a maintenance procedure, complete the following steps to ensure that the correct node canister is identified.

   a) Go to the **Node Details** panel in the service assistant.
   b) Select the **Node** tab. Then, make a note of the last 6 digits that appear in the **Part Identity** field.
   c) Select the **Hardware** tab. Then, take note of the values in the **Canister Location** (slot), **Machine Type and Model**, and **Serial Number** fields.

      Table 20 on page 60 summarizes the information that can help you identify the correct node canister.

Table 20. Information to identify a node canister

Tab	Field name	Node canister value
Node	Part Identify	
Hardware	Canister Location (slot)	
	Machine Type and Model	
	Serial Number	

   d) To activate the identified indication on the node canister, you can also click the **Identify** button. The fault LED indicator on the node canister blinks so that you can confirm its location.

5. Use the **Power off** action to power off the canister.

6. After the node is powered off, the service assistant shows that the node status is offline. The status LED indicators on the canister show that the node is powered off.

Removing and replacing the enclosure end caps

You can remove and replace the enclosure end caps during some service procedures.

About this task

shows the end caps on the front of the control enclosure. Each end cap provides information to identify the enclosure (machine type and model and serial number). LED indicators also provide information about the status of the enclosure.

Notes:

- The information on the end cap must always match the information that is printed on the rear of the enclosure. It must also match the information that is stored on the enclosure midplane.
- No tools are required to complete this task. Do not remove or loosen any screws.

Procedure

1. If the enclosure is on a table or other flat surface, elevate the enclosure front slightly or carefully extend the front over the table edge.
2. Grasp the end cap by the blue touch point and pull it until the bottom edge of the end cap is clear of the bottom tab on the chassis flange.

   shows an example of the left end cap. The touch point is located below the LED indicators.
3. Lift the end cap off the chassis flange.

   shows how to lift the end cap of chassis flange.
4. Fit the slot on the top of the new end cap over the tab on the top of the chassis flange.
5. Rotate the end cap down until it snaps into place.

Removing and replacing the node support rails

You can replace faulty support rails with new rails that are received from stock.

About this task

As part of this procedure, the control enclosure must be removed from the rack. . Follow all safety precautions when you complete this procedure.

Procedure

1. Identify the enclosure that is mounted on the rails that are being replaced.

   Follow the steps in "Procedure: Identifying which enclosure or canister to service" on page 58 to ensure that you identify the correct enclosure.
2. Shut down the control enclosure by following the steps in "Procedure: Powering off the system " on page 59.
3. Remove power from the enclosure by unplugging both power cables from the electrical outlets.
4. Remove all cables from the back of the enclosure that has faulty support rails; ensure that you identify the port to which each cable connects.
5. Remove the end caps from the front flanges of the enclosure, as described in topic "Removing and replacing the enclosure end caps" on page 61.
6. Unscrew the four M5 screws that secure the left and right end caps of the control enclosure to the rack, as shown in Figure 25 on page 62.
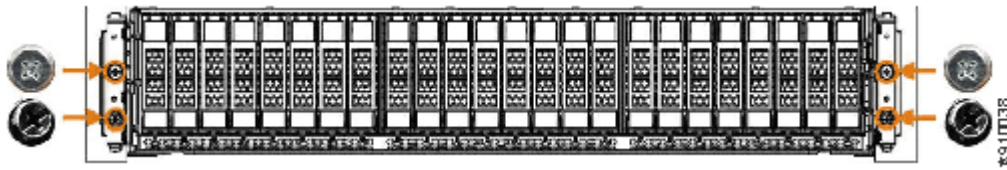
Figure 25. Four screws at the front of the enclosure

Some installations might have two black, removable M5 screws and two silver screws that remain attached to the control enclosure after they are loosened. shows an example of an silver alternative rail pin for square holes and an M5 screw.

Figure 26. Example of a silver screw and M5 screw

7. Slide the enclosure from the rack.

   • If components were not removed from the control enclosure, .

   • can remove several internal components to decrease the weight of the control enclosure. Be sure to note the serial numbers and slots (for drives) for each component and follow the procedures that are listed in .

Table 21. Summary of internal components that can be removed and replaced	
Component	**Procedure**
Node canister 1	"Removing and reseating a node" on page 76
Node canister 2	
Power supply unit 1	"Removing and replacing a power supply unit:2145-SV3" on page 65
Power supply unit 2	
Power supply unit 3	
Power supply unit 4	
Power interposer 1	"Removing and replacing a power interposer" on page 86
Drives (1 - 24 drives). Record the slot from which each drive was removed.	
Drives (1 - 48 drives). Record the slot from which each drive was removed.	

8. Locate the left support rail.

   Record the shelf number of the support rail so that the replacement rails can be installed into the same position.

9. At the rear of the rack, remove the black M5 screws from the rear bracket of the rail. Two screws are attached to each bracket. Then, open the rear hinge bracket, as show in .
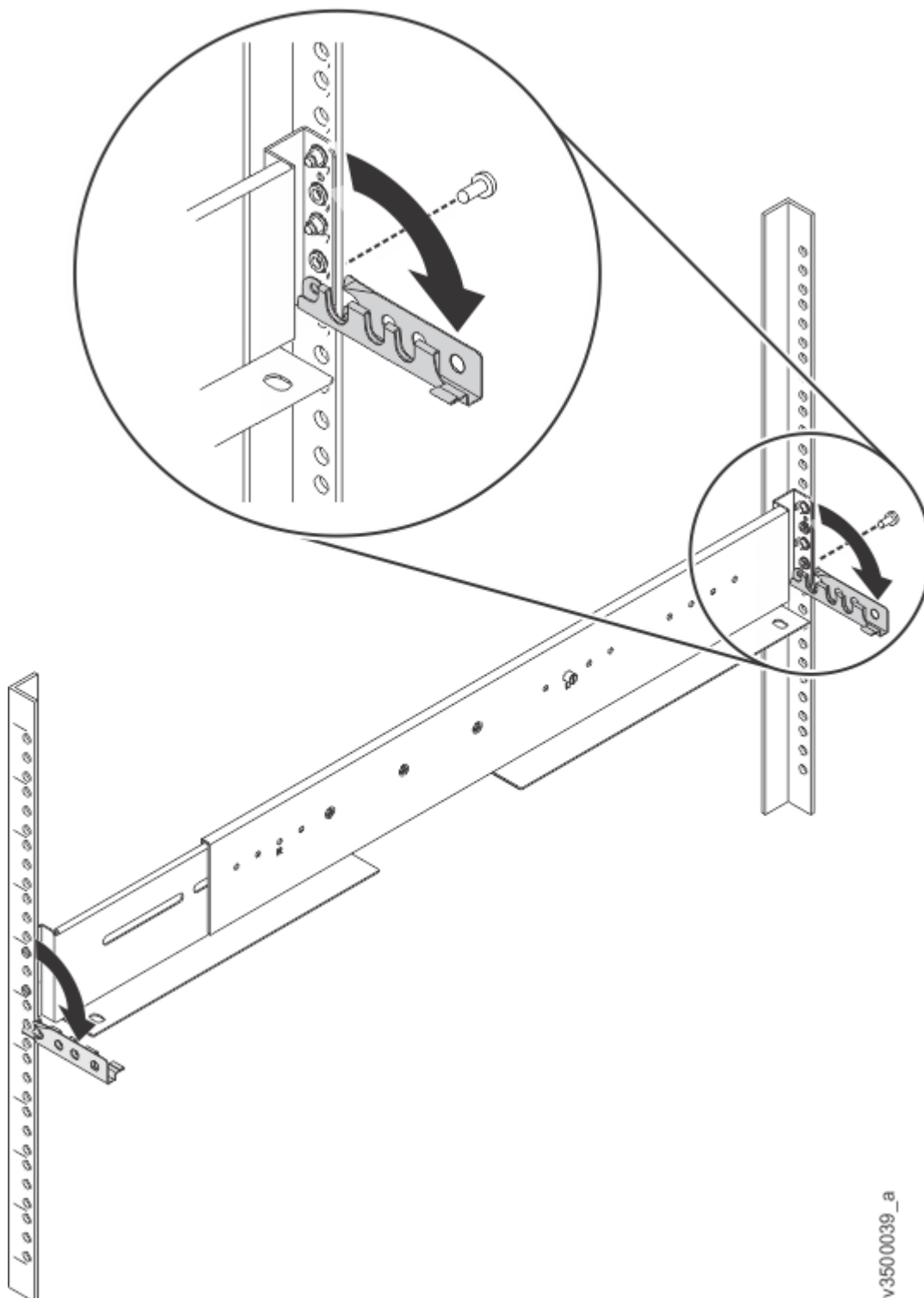
Figure 27. Opening the rear hinge bracket of the mounting rail

10. At the front of the rack, hold on to the rail and open the front hinge bracket.
11. Compress the rail to shorten it, then, remove it from inside the rack, as Figure 28 on page 64 shows.
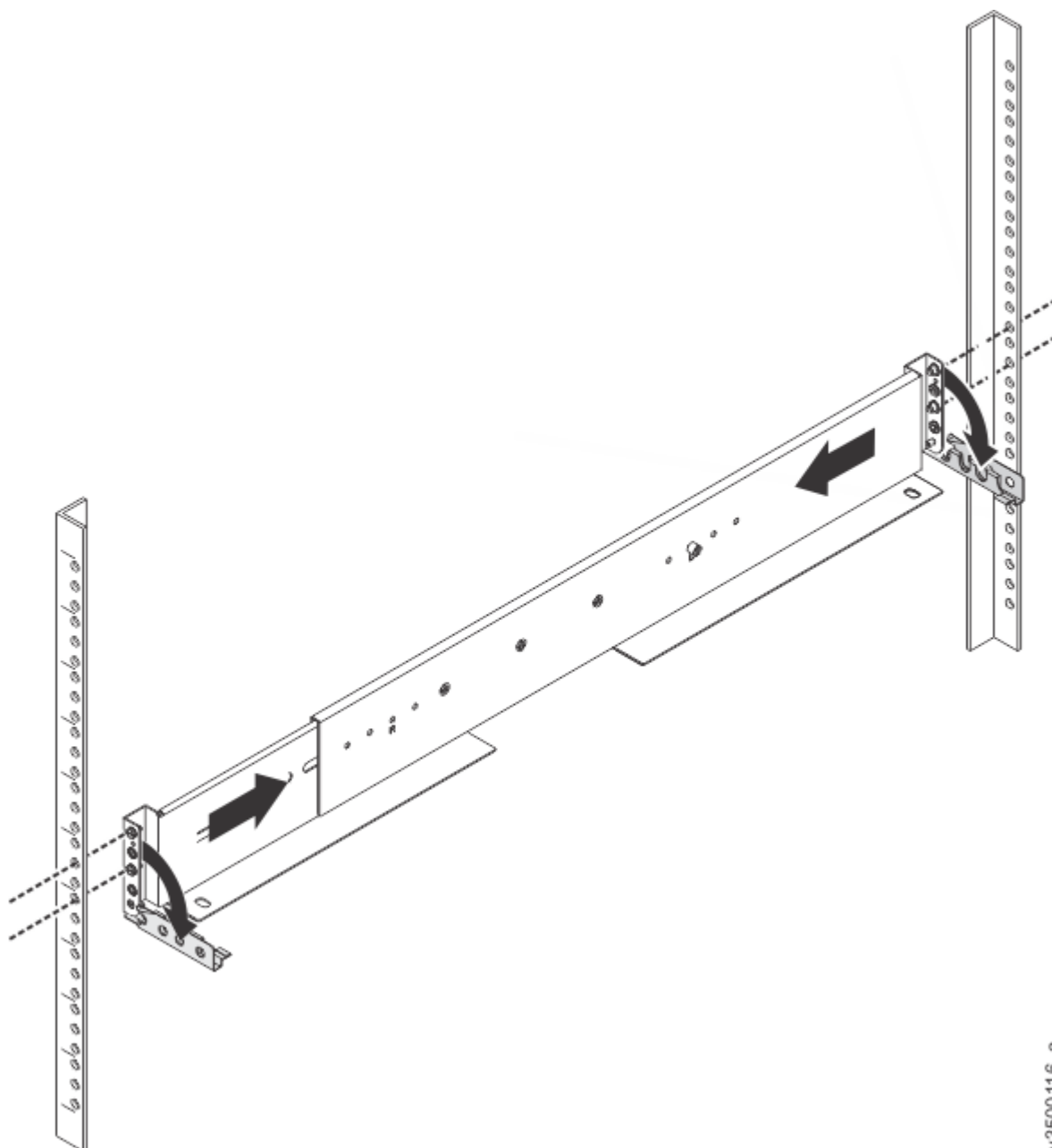
Figure 28. Compressing the rail for removal from rack

12. Repeat steps "9" on page 62 to "11" on page 63 on the right support rail.

13. Install the new support rails at the rack position that is recorded at step "8" on page 62. Follow the procedure, as described in "Installing support rails for the node" on page 48.

14. Return the control enclosure that was removed at step "7" on page 62 to the rack.

    - If no components were removed from the control enclosure, ensure that three persons are available to support the weight.

    - If components were removed, return the control enclosure to the rack position from which it was removed. Then, follow the procedures that are listed in Table 21 on page 62 to reinstall each component into the control enclosure.

15. Secure the control enclosure to the rail with the four black M5 screws that were removed at step "6" on page 61.

Note: Some installations might have two black, removable M5 screws and two silver screws that are built into the control enclosure. In this case, first secure the silver screws and then secure the M5 screws.

16. Reinstall the end caps (removed at step "5" on page 61) by following the instructions in "Removing and replacing the enclosure end caps" on page 61.
17. Reconnect the cables, ensuring that they are connected to their original ports.
18. Reconnect the power supply cables to their original power supply and electrical outlet.

    The system starts.
19. After the system is online, use the management GUI to verify that the system is functioning correctly.

Removing and replacing a power supply unit:2145-SV3

You can remove and replace either of the two hot-swap redundant power supply units (PSUs) in the enclosure. These redundant power supplies operate in parallel, one continuing to power the enclosure if the other fails.

About this task

Notes:

- Do not insert a PSU if the PSU slot does not contain a power interposer.
- Do not operate an enclosure without a power interposer and PSU in a PSU slot for longer than **5 minutes**. Operating for longer than this period might cause the enclosure to shut down due to overheating.
- Remove the replacement PSU from its packaging and have it available before carrying out this procedure.
- No tools are required to complete this task. Do not remove or loosen any screws.
- Although many components are hot-swappable, their intended use is only when your system is not active (no I/O operations). If your system is powered on and processing I/O operations, go to the management GUI and follow the fix procedures. Initiating the replacement actions without the assistance of the fix procedures can result in loss of data or loss of access to data.
- Be careful when you are replacing the hardware components that are located in the back of the system. Do not inadvertently disturb or remove any cables that you are not instructed to remove.

- When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices.

Procedure

1. Identify the location of the control enclosure that requires service. The Event Log contains the enclosure MTM and serial number.

Figure 29. Locate Power Supply Units

2. Identify the PSU that requires service; the Event Log contains the ID of the PSU that failed.

Removing the PSU

3. Release the cable retention clip and disconnect the power cord from the power supply unit that you are replacing.

   This figure shows the location of the cable LED indicator **1**, retention clip **2**, PSU release tab **3**, and the PSU handle **4**.
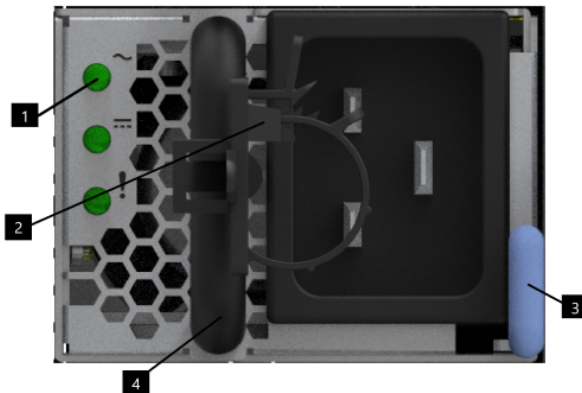
Figure 30. Features of a power supply unit

4. While holding the PSU handle, press and hold the PSU release tab and steadily pull the handle horizontally to slide the PSU from the node, as shown in this figure.

   Support the PSU with your other hand as it is released from the node.

Figure 31. Removing the power supply unit

Important: Insert the replacement PSU within 5 minutes; otherwise, the system may overheat and shut down.

Replacing the PSU

5. While supporting the PSU, slide the power supply into the enclosure until the release tab engages with a "click".

6. Connect the power cord to the power supply and to a properly grounded electrical outlet. Secure the cable with the cable retention clip on the rear of the power supply unit.

   Note: After the power cord is connected to the electrical outlet, make sure that the PSU LED indicator **1** shown in <u>Figure 30 on page 66</u>, is lit.

Removing and replacing an SFP transceiver

When a failure occurs on an optical link in a control enclosure, the SFP transceiver in the port that provides the link might need to be removed and replaced.

About this task

No tools are required to complete this task. Do not remove or loosen any screws.

Although many components are hot-swappable, their intended use is only when your system is not active (no I/O operations). If your system is powered on and processing I/O operations, go to the management GUI and follow the fix procedures. Initiating the replacement actions without the assistance of the fix procedures can result in loss of data or loss of access to data.

Be careful when you are replacing the hardware components that are located in the back of the system. Do not inadvertently disturb or remove any cables that you are not instructed to remove.

⚠ **CAUTION:** Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following information: laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam. (C030)

When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices

Procedure

1. Carefully determine the failing physical port connection. In the Event Log, its location is identified by the following information:
   - Enclosure (MTM and serial number)
   - Canister (serial number)
   - Adapter (slot number) - if applicable
   - Port (port number).

   Important:
   - For correct operation, use the correct replacement SFP transceivers with each adapter. See <u>Replaceable units</u> for the applicable information for your system.
     – Use only the appropriate 25 Gbps SFP transceiver in the 25 Gbps Ethernet adapters.
     – Use only the appropriate 32 Gbps SFP transceivers in the 32 Gbps Fibre Channel adapter.
     – Use only the appropriate 64 Gbps SFP transceiver in the 64 Gbps Fibre Channel adapters.
   - Removing the wrong SFP transceiver might result in loss of data access.
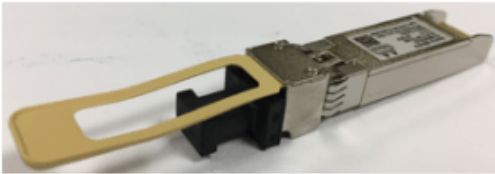
   Replacing the SFP

2. Locate the faulty SFP device. The enclosure MTM and serial number are at the rear of the enclosure. The canister serial number is at the rear of the canister. Adapter slots and canister Ethernet ports are numbered on the canister, from left to right. Ports on each adapter are numbered from left to right.

3. Record or mark the cable that is to be removed.
4. Unlatch and remove the cable from the faulty SFP device.

   As Table 22 on page 68 shows, the SFP transceiver and latching mechanism can vary per each type of host interface adapter.

Table 22. SFP transceiver example	
Host interface adapter	**SFP transceiver example**
Quad-port 64 Gbps Fibre Channel	
Dual-port 25 Gbps Ethernet (RoCE)	
Dual-port 25 Gbps Ethernet (iWARP)	
Dual-port 100 Gbps Ethernet	

5. Remove the faulty SFP transceiver from its aperture.

   a) Unclip the handle of the SFP transceiver.

   b) Pull on the handle of the SFP transceiver to slide it out of the slot.

Replacing the SFP

6. Install the replacement SFP transceiver into the aperture that is vacated in step "5" on page 68.

   a) Open the latch on the replacement SFP transceiver.

   b) Push the new SFP transceiver into the aperture until it stops.

   c) Close the release latch.

   d) Gently pull the SFP transceiver. If it is installed correctly, it does not move from its aperture.

7. Reconnect the optical cable.

8. Check the Event Log to confirm that the error is cleared. Mark the error as fixed or restart the node, depending on the failure indication originally noted.

Removing and replacing a network adapter

Use this procedure to remove and replace a network adapter, such as a host interface adapter or SAS adapter, in a system with a new one received from stock.

About this task

Notes: No tools are required to complete this task. Do not remove or loosen any screws when you remove or replace an adapter.

Procedure

1. Identify the node with the faulty adapter.

   a) Identify any dependencies on the node canister by using the management GUI. Understand the impact of any dependencies and resolve them if necessary.

   b) Locate the control enclosure that requires servicing by its MTM and serial number (S/N), which are labeled on the enclosure front left cover and also on the enclosure rear. At the rear of the enclosure, locate the node canister by finding its serial number on the bottom lip of the canister.

   c) Use the Event Log to identify the location of the adapter that requires replacement. Location information includes the enclosure MTM and S/N, node canister (slot number/serial number), and the adapter slot number.

2. Before you can remove the faulty adapter, power down the node canister, as described in "Procedure: Powering off a node" on page 60.

3. At the rear of the enclosure, the adapter is located in a cage. There may be another adapter in the same cage. Label each network cable connection or record all cables that are connected to each adapter in the cage, using a table such as shown in Table 23 on page 69

Table 23. Cable identification for adapters in the cage being serviced

Slot numbers contained in cage	
Adapter in slot 1 of the cage	**Adapter in slot 2 of the cage**
Port 1 cable:	Port 1 cable:
Port 2 cable:	Port 2 cable:
Port 3 cable:	Port 3 cable:
Port 4 cable:	Port 4 cable:

4. Use the management GUI to shut down the node canister containing the adapter that requires replacement.

5. Wait for the node to shut down. Refer to the status LEDs to determine that the node has shut down before proceeding to replace the adapter.

Note: If you are using NVMe over RDMA for host attachment with 100 Gbps adapters in the node canister, ensure that 100 Gbps adapter ports must be set with 1500 MTU value. If the MTU value for 100 Gbps

adapter changes to a value other than 1500 on adding or removing any adapter in the system, use the chportethernet command to change MTU value.

Removing the host interface adapter

6. If applicable, remove each SFP from each port of the failed adapter , as described in "Removing and replacing an SFP transceiver" on page 67. Record the serial number of each SFP device as you remove them from the adapter ports, to ensure they can be returned to the same port in the replacement adapter.

7. Locate the eject handle on the left side of the cage containing the failed adapter. Release the cage from the canister by pulling the blue end of the cage release lever downwards.

8. Slide the adapter cage from the canister. Ensure other cables allow for removal of the adapter cage containing the adapter.

9. Press the adapter out of the PCIe socket of the adapter cage.

Important: Adapters with a large SFP cage, such as the 4-port Fibre Channel adapter, might have limited clearance between the external edge of the SFP cage and the slot of the PCIe riser. When you remove or insert an adapter, you might need to start the removal at the bracket end of the adapter, so that the adapter is removed at a slight angle.

Replacing the host interface adapter

10. Review Table 24 on page 70 to ensure that you are using the correct replacement adapter.
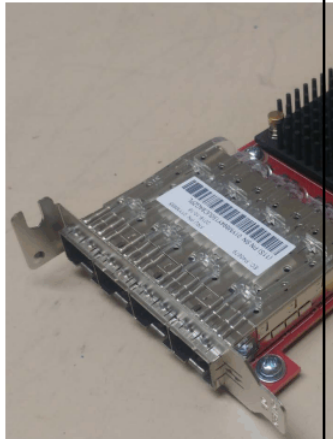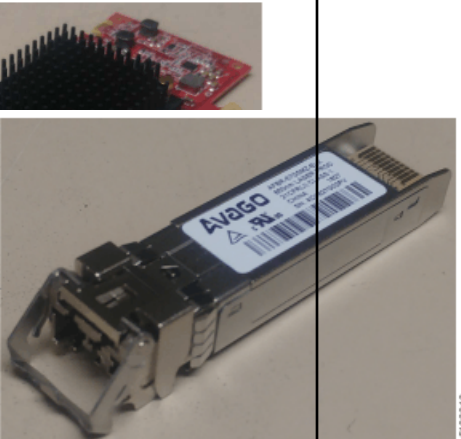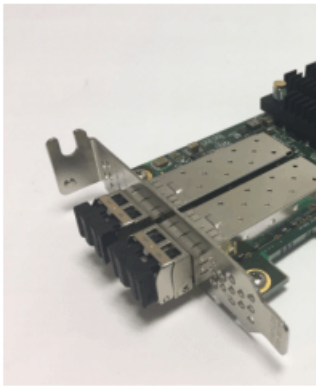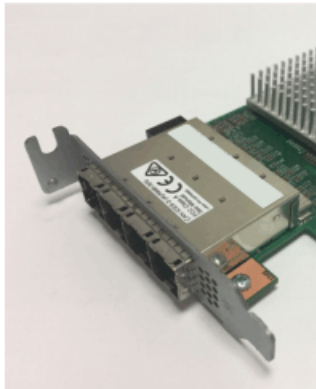
Table 24. Summary of network adapters and SFP devices		
Type	**Adapter**	**SFP device**
Quad-port 64 Gbps Fibre Channel		
Quad-port 32 Gbps Fibre Channel		

Table 24. Summary of network adapters and SFP devices (continued)

Type	Adapter	SFP device
Dual-port 25 Gbps Ethernet (iWARP)		
Quad-port 12 Gbps SAS		Not applicable
Dual-port 100 Gbps Ethernet		

11. Align the replacement adapter with the PCIe socket of the adapter cage and press the adapter into place. Ensure that the adapter is fully seated in the riser, as shown in .
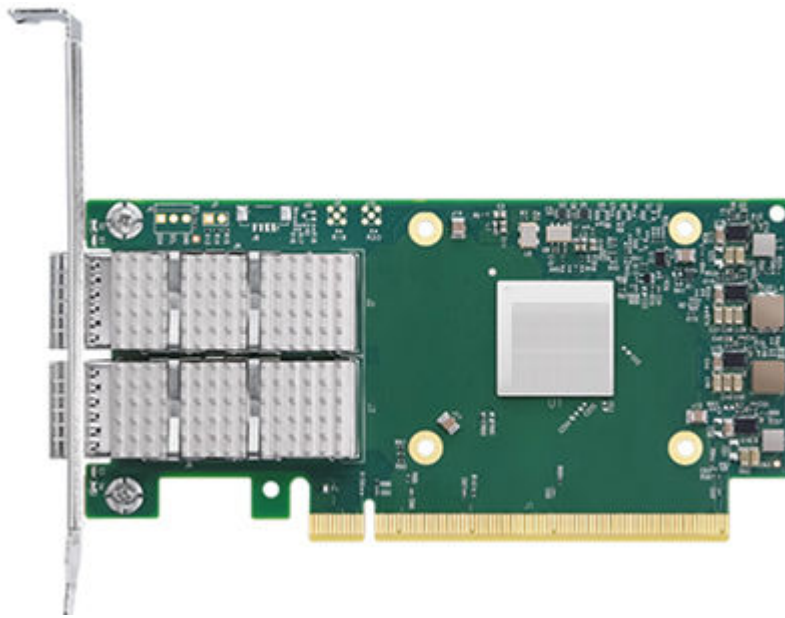
Figure 32. Alignment of the network adapter

12. Ensure the both adapters or PCIe card filler are well seated.

13. Insert any SFP devices that were removed into the adapter.

14. Align the adapter cage so that the adapter SFPs face out of the canister and the adapter cage lever is fully open.

15. Push the adapter cage into the proper slot until the lever begins to move, the press the handle up and in until it clicks into place.

16. Reconnect the network cables to the rear of the canister, by using the information that you collected at step "3" on page 69.

17. Verify that the error is cleared from the Event Log.

Removing and replacing the cover of a node

To complete a service procedure, you may need to remove and replace the cover of a node canister.

About this task

- No tools are required to complete this task. Do not remove or loosen any screws.
- The cover of a node canister can be removed only after the canister is removed from the control enclosure.

Procedure

1. Remove the node canister from the control enclosure, as described in "Removing and reseating a node" on page 76.

Removing the cover

2. Place the node canister on a flat, level work surface. The release levers should be facing you and the cover should be facing upwards.

   Note: The node canister in the upper slot (node canister 1) of the control enclosure is upside-down. To access the cover, you must turn it over after you have removed it from the control enclosure.

3. Open the cover of the node canister by depressing the recessed, blue touch points on the lid (**1**) and sliding the lid away from you (**2**), as shown in Figure 33 on page 73.
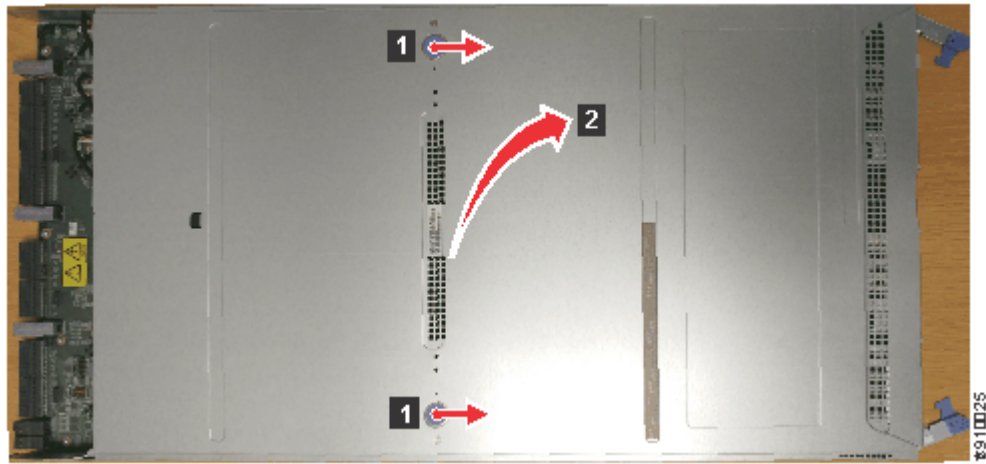
Figure 33. Removing the node canister cover

Replacing the cover

4. Slide the cover onto the node canister until the catch clicks and the lid edges are flush with the canister. shows an example.

Figure 34. Replacing the node canister cover

Note: Inserting the node canister into the upper slot of the enclosure requires the node canister to be inverted, so that the lid faces downwards.

Removing and replacing the node battery

To remove and replace a faulty battery with a new one received from stock, use this procedure.

About this task

No tools are required to complete this task. Do not remove or loosen any screws.

There are redundant batteries in each canister. The batteries can be hot swapped without removing the canister or powering the canister down.

⚠️ **CAUTION:** The battery is a lithium ion battery. To avoid possible explosions, do not burn. Exchange only with the approved part. Recycle or discard the battery as instructed by local regulations. (C007a)

Procedure

1. Refer to the Event Log to identify the enclosure and node canister where battery replacement is required. Alternately, follow the procedure .

Removing the battery

2. Identify the canister and battery to be removed. The battery fault LED will usually be on or flashing.
3. Hold the battery handle (3) and press the battery latch (1) towards the handle and slide the battery out as shown in Figure 1. The battery LEDs (2) are displayed in Figure 1.

Figure 35. Removing the battery

Replacing the battery

4. Align the battery so that the blue latch is on the left side of the battery.
5. Place the replacement battery in the battery slot.
6. Push the battery until the latch clicks.

Figure 36. Replacing the battery
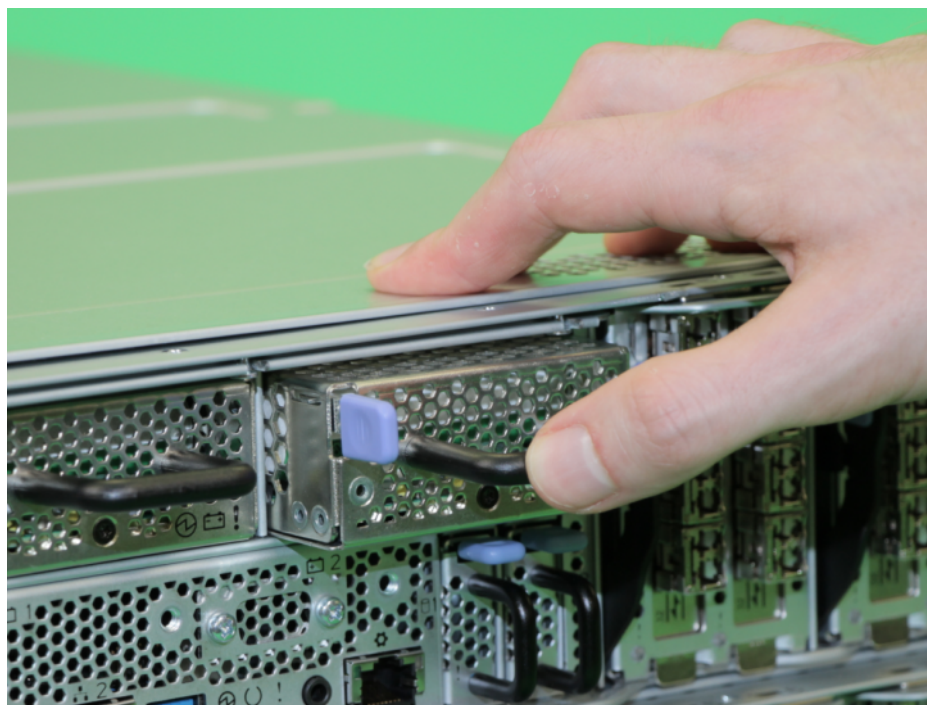
Removing and replacing a CMOS battery

The complementary metal-oxide semiconductor (CMOS) battery is a coin-shaped power cell that is mounted inside the node canister. It is used to keep the system time when there is no power to the node canister.

About this task

- Use this procedure to remove and replace a CMOS battery in a node canister.
- The node canister must be shutdown and removed to perform this task.
- A Philips screw driver is needed to remove the canister cover.

- Recycle or discard the battery as instructed by local regulations.

Procedure

1. Remove the node canister, as described in "Removing and reseating a node" on page 76.
2. Remove the node canister cover, as described in "Removing and replacing the cover of a node" on page 72.

Removing the CMOS battery

3. Locate the CMOS battery inside the node canister.
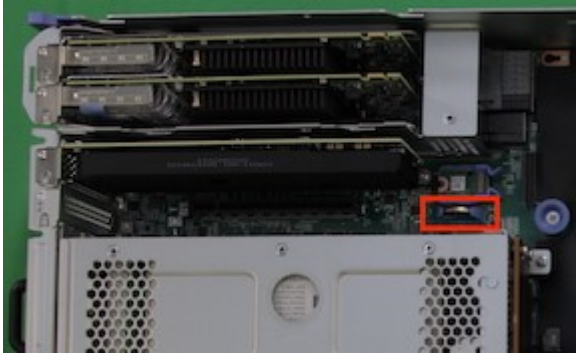
Figure 37. Locating a CMOS battery

4. Gently pop the CMOS battery out of the battery holder, as shown in Figure 38 on page 75.

Figure 38. Replacing a CMOS battery

Replacing the CMOS battery

5. Orient the replacement coin cell with positive toward the right (away from adapter cage 1).
6. Gently push the new coin cell down into the battery holder.
7. Install the node canister cover, as described in "Removing and replacing the cover of a node" on page 72.
8. Reinsert the node canister, as described in "Removing and reseating a node" on page 76.

   If the canister does not begin to power-up, check that it is fully inserted into the enclosure.
9. Reconnect all cables.
10. Use the management GUI to check that the time and date settings of the system are correct.

a) If a CMOS battery error is present in the Event Log, run the fix procedure.

Removing and reseating a node

To access or replace some components during service procedures, a canister might need to be temporarily removed from, and reinserted into, the enclosure.

Before you begin

Note: This topic provides instructions for temporarily removing and replacing a canister and should be used only when instructed to do so by other service procedures. To replace a faulty node canister with one from FRU stock, follow the procedure that is described in "Removing and replacing a faulty node" on page 77.

Make a note of the following points before replacing a canister:

- No tools are required to complete this task. Do not remove or loosen any screws.
- Before removing a canister, it must be powered off or be in service state. Otherwise, it can result in loss of data or loss of access to data.
- If a canister was recently removed from the system, and then added again, ensure that the canister is online for at least 25 minutes before you remove its partner canister. This delay allows multipath drivers to fail over to the online canister when the partner canister is removed.
- Use care when you remove a canister from the enclosure. Have a flat surface ready to receive the canister after removal.
- Use care when you lift and insert the canister.

Before you start the removal procedure, make sure to transfer the following components from the faulty canister to the replacement canister:

- DIMMs
- PCIe adapters
- Backup battery

To remove and reinsert a canister in the enclosure, complete the following steps.

Procedure

1. Shut down the canister by using the service assistant. Follow the steps in "Procedure: Powering off a node" on page 60.
2. Use the LED indicators on the canister to confirm that it is safe to remove it from the enclosure, as described in "Node front and rear panel indicators: 2147-SV3 and 2145-SV3" on page 110.
3. Record which data cables are plugged into the specific ports on the rear of the canister. The cables must be inserted back into the same ports after the replacement is complete; otherwise, the system cannot function properly.
4. Disconnect the data cables that are connected to the canister.
5. If you are reinserting the canister while the enclosure is installed in the rack, disconnect the CMA arm from the adjacent side of the enclosure to allow room to slide the canister out of the enclosure.
6. Locate the left and right release levers for the canister, marked by blue touchpoints on the ends of the levers.
7. Holding the canister release levers by the blue touch points, open the two levers horizontally 90 degrees, then slide the canister out of the enclosure and place it onto an antistatic mat.
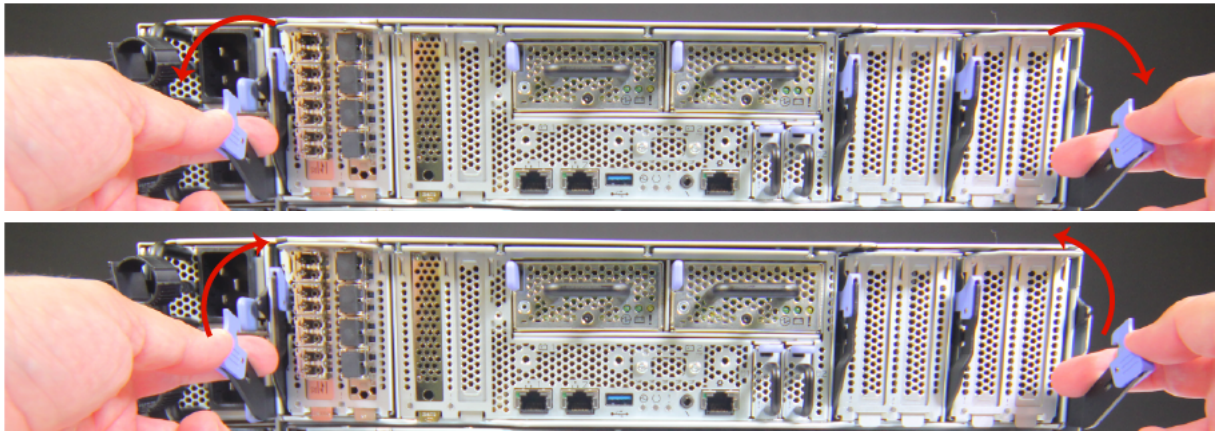
Figure 39. Removing and replacing the node

8. To reinstall the canister, ensure that both of the canister release levers are fully open (90 degrees relative to the canister), and then slide the canister into the enclosure, ensuring that both release levers engage with the canister and begin to close.

9. Press the release levers closed to lock the canister into the enclosure. Press the latch ends to ensure that the latches are engaged with the canister.

10. Reconnect the CMA to the enclosure and rack.

11. Reconnect all cables that were removed from the back of the canister.

12. If the canister does not begin to power up, check that it is fully inserted into the enclosure. If necessary, remove the power and cables; then, repeat steps "8" on page 77 through "12" on page 77.

Removing and replacing a faulty node

You can use this procedure to remove a faulty node and replace it with a new node. You can remove the parts from the faulty node and reinstall them into the new node. You can also use this procedure to allow for replacement of parts inside the node.

About this task

Notes:

- Ensure the FRU part number (P/N) of the replacement part matches that of the failed node, or is an approved substitute. The FRU P/N is identified on the label of the and on the FRU packaging.

- Do not operate the control enclosure with one node that is removed for longer than **16** minutes. Operating for longer than this period might cause the enclosure to shut down due to overheating.

- A Phillips screw driver is required to remove the node cover. Do not remove or loosen any other screws.

- Use care when you remove a node from the control enclosure. The node is long and its center of gravity is far forward. It can be helpful to have a lift or other sturdy, flat surface ready to receive the node during removal.

Procedure

1. Review the Event Log to identify the faulty node.

2. Review "Procedure: Understanding system volume dependencies" on page 59 to identify any volume dependencies on the node .

3. Follow Procedure: Powering off a node canister to verify that the hosts do not lose access to data in volumes.

4. From the rear of the control enclosure, label each cable and remove it from the node.

Removing the faulty node

5. Remove the node, as described in "Removing and reseating a node" on page 76, and place it on a flat, level surface.
6. Remove the new node from its packaging.

   Ensure that the FRU P/N of the replacement node matches that of the failed node or that the new P/N is an approved substitute. See "Replaceable units" on page 118 for more information.
7. Remove the covers from the faulty and replacement nodes and set them aside, as described in "Removing and replacing the cover of a node" on page 72.
8. Remove the air baffles from the faulty and replacement nodes and set them aside, as described in "Removing and replacing the air baffle of a node" on page 100.
9. Complete the following procedures to remove parts from the faulty node and install them in the replacement node.

   - "Removing and replacing a memory module" on page 79
   - Removing and replacing a fan module
   - "Removing and replacing the Trusted Platform Module" on page 93
   - "Removing and replacing the node battery" on page 73
   - "Removing and replacing an adapter cage" on page 91

     Notes:

     – You do not need to remove each adapter from its adapter cage. Each assembled riser and adapter are transferred to the replacement node.
     – When you install each PCIe risers and adapter assembly into the replacement node , use the same numbered slot that was used in the faulty node.

   - "Removing and replacing a boot drive" on page 95

     Note: Transfer each boot drive one at a time. Ensure that you install the drive into the same slot in the replacement node .

   - "Removing and replacing a compression card" on page 101

Replacing the new node

10. Replace the air baffle in the new node canister, as described in "Removing and replacing the air baffle of a node" on page 100.
11. Replace the cover on the new node, as described in, as described in "Removing and replacing the cover of a node" on page 72.
12. Install the new node into the control enclosure, as described in "Removing and reseating a node" on page 76.
13. Reconnect the cables that were removed in step "4" on page 77 to the appropriate ports in the replacement node.
14. If the node was communicating with other nodes using RDMA over Ethernet, then use the Service Assistant Tool or the `sainfo lsnodeip` command to check if the node IP configuration has been lost. Use the Service Assistant Tool or the `satask chnodeip` command to set the node IP if needed.

    Note: Step "14" on page 78 is only needed for a new node.
15. Use the management GUI or service assistant GUI to check that the node is online (or is Active) in the system.
16. Enter the service assistant command `satask chbootdrive -replacecanister` to update the drives to match the serial number of the new node.

    Note: Node error code 545 is expected. For more information, see 545.

    To help identify the node, the inside of the release levers are labeled with the serial number.
17. Review the management GUI to determine that all errors are resolved.

Removing and replacing a memory module

You can remove and replace a faulty dual inline memory module (DIMM) from a control enclosure. You can also use this procedure to add DIMMs to increase the memory capacity of the node canister.

About this task

Notes:

- ![ESD warning symbol] The memory modules are sensitive to electrostatic-discharge (ESD). Take precautions to avoid damage from static electricity. When you remove or replace this part, you must follow recommended procedures for handling ESD-sensitive devices.
- A screwdriver is required to open the node canister cover.
- The hardware (for example labels on the printed circuit board) identifies the processors as CPU0 and CPU1, but the Storage Virtualize error messages identify them as CPU1 and CPU2.
- All DIMMs are 64 GB, and supported configurations can have 8, 16 or 24 installed DIMMs in specific slots.

As Figure 40 on page 79 shows, each node canister contains:

- Five fans across the top
- Two processors, which are identified as CPU 1 and CPU 2
- 24 DIMM slots numbered 1 through 24.
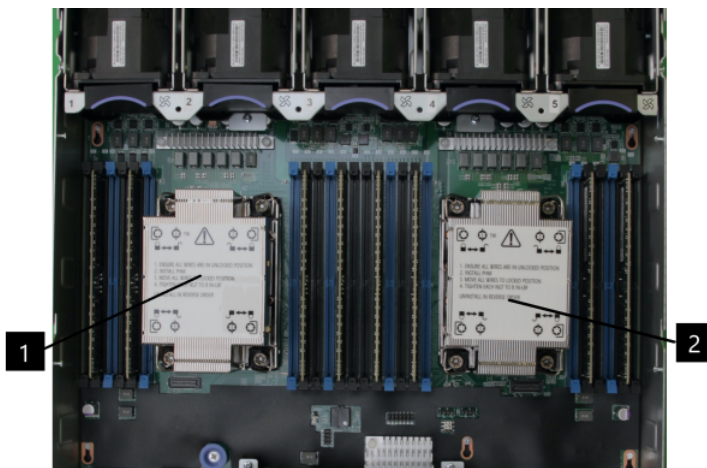
Figure 40. Location of CPUs and DIMM slots

1 CPU1 to the Storage Virtualize Software and CPU 0 to the hardware. **2** CPU 2 to the Storage Virtualize Software and CPU 1 to the hardware.

- A CPU processor can have 4, 8 or 12 DIMMs installed.
- On the system board, the DIMM slots are labeled according to their memory channel and slot. They are associated with the CPU nearest to their DIMM slots.
- You do not have to replace all memory modules at the same time. However, when you install memory modules, be sure that you follow the configurations that are described in the following table:

Total Memory per Control Enclosure	512 GB	1024 GB	1536 GB	Slot label
Features	**ACGM**	**ACGM + ACGN**	**ACGM + ACGN + ACGP**	
CH1-DIMM0	Blank	64 GB	64 GB	**1**
CH0-DIMM0	64 GB	64 GB	64 GB	**2**
CH0-DIMM1	Blank	Blank	64 GB	**3**
CH3-DIMM0	Blank	64 GB	64 GB	**4**
CH2-DIMM0	64 GB	64 GB	64 GB	**5**
CH3-DIMM1	Blank	Blank	64 GB	**6**
CPU 1				
CH6-DIMM1	Blank	Blank	64 GB	**7**
CH6-DIMM0	64 GB	64 GB	64 GB	**8**
CH7-DIMM0	Blank	64 GB	64 GB	**9**
CH4-DIMM1	Blank	Blank	64 GB	**10**
CH4-DIMM0	64 GB	64 GB	64 GB	**11**
CH5-DIMM0	Blank	64 GB	64 GB	**12**
CH1-DIMM0	Blank	64 GB	64 GB	**13**
CH0-DIMM0	64 GB	64 GB	64 GB	**14**
CH0-DIMM1	Blank	Blank	64 GB	**15**
CH3-DIMM0	Blank	64 GB	64 GB	**16**
CH2-DIMM0	64 GB	64 GB	64 GB	**17**
CH3-DIMM1	Blank	Blank	64 GB	**18**
CPU 2				
CH6-DIMM1	Blank	Blank	64 GB	**19**
CH6-DIMM0	64 GB	64 GB	64 GB	**20**
CH7-DIMM0	Blank	64 GB	64 GB	**21**
CH4-DIMM1	Blank	Blank	64 GB	**22**
CH4-DIMM0	64 GB	64 GB	64 GB	**23**
CH5-DIMM0	Blank	64 GB	64 GB	**24**

Table 25. Available memory configurations for a control enclosure

If a node error 510 is logged (error code 1022 in the system log), the sense data includes the following information, that you can use to determine which DIMMs need to be replaced.

- Detected memory size in MB.
- Expected memory size in MB.
- A list with one entry per DIMM slot, show the size of the DIMM in GB for each slot.

Procedure

Identifying failed DIMMs

1. If you are replacing failed DIMMs, use the service assistant or the **System Event Log** in the management GUI to obtain the sense data. This data shows the detected and expected memory sizes and the size of the DIMM in each slot.
2. Identify the column in the memory configuration table that contains the expected configuration. To do so, match the expected memory size from the error sense data to the column that has the same node canister total memory.
3. Compare the size of DIMM reported in each slot in the error data with the expected DIMM size for the slot index and node canister total memory size that is shown in the memory configuration table. For each mismatch, the DIMM must be replaced with the size of DIMM that is indicated in the table. See the Replaceable units topic for the correct FRU part number for each size of DIMM.

Removing the node canister

4. Follow "Procedure: Powering off a node" on page 60 to verify that the hosts do not lose access to data in volumes.
5. Remove the node canister, as described in "Removing and reseating a node" on page 76, and place it on a flat, level surface.
6. Remove the cover, as described in "Removing and replacing the cover of a node" on page 72.

Removing the DIMM

Important: Do not start service status on the node. Power off the node to replace a DIMM or run the rmnode command to add DIMMs.

If you are upgrading memory of a node canister as a part of an enclosure upgrade, you must remove that node from the system configuration before you start the following procedure. To do so, you can use the management GUI or the CLI.

- To use the management GUI, right-click the node canister and select **Remove**.
- To use the CLI, enter the following command, where *object_id* | *object_name* identifies the node canister that receives the additional memory:

```
rmnode object_id | object_name
```

If you are replacing a faulty DIMM with a new one from FRU stock, you do not need to remove the node canister from the system configuration.

7. Remove the air baffle. For details, see "Removing and replacing the air baffle of a node" on page 100.
8. Locate the appropriate DIMM slot.

   As Figure 41 on page 82, Figure 42 on page 82, Figure 43 on page 83, and Figure 44 on page 83 shows that the DIMM locations are identified on the system board.
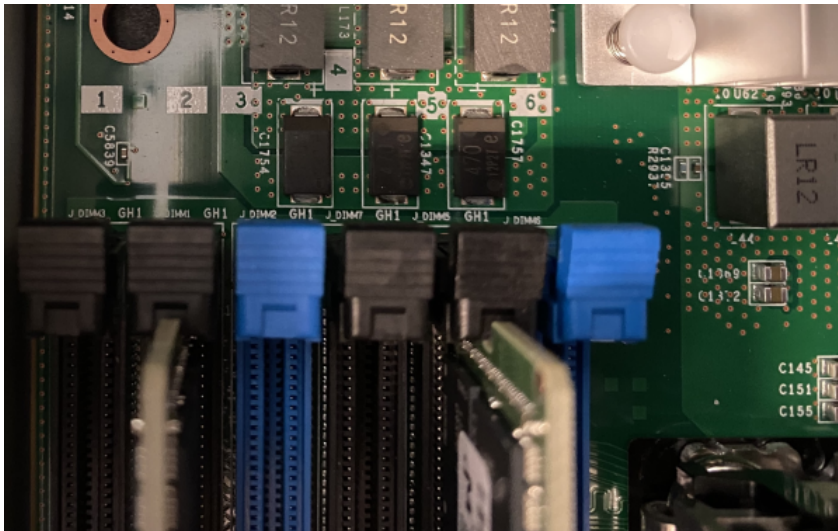
Figure 41. Identifying DIMM locations 1-6
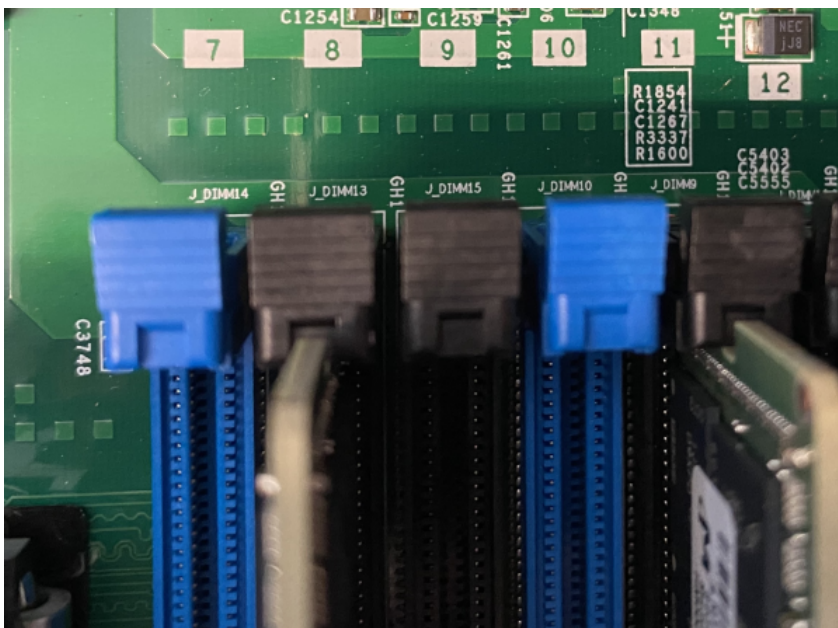
Figure 42. Identifying DIMM locations 7-12

Figure 43. Identifying DIMM locations 13-18
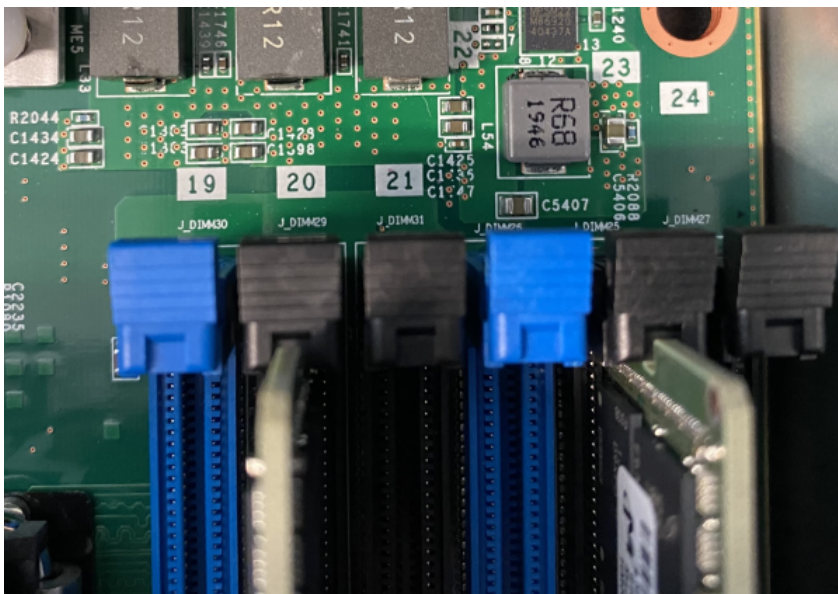
Figure 44. Identifying DIMM locations 19-24

9. Press the locking tabs on the side of the DIMM to eject it.
10. Lift the DIMM up and out of the slot.
11. If you have other tasks to complete inside the control enclosure, do those tasks now.

Replacing or adding the DIMM

Important: If you are adding memory to a node canister, you must remove that node from the system configuration before you start the following procedure. To do so, you can use the management GUI or the CLI.

- To use the management GUI, right-click the node canister and select **Remove**.
- To use the CLI, enter the following command, where *object_id | object_name* identifies the node canister that receives the additional memory:

```
rmnodecanister object_id | object_name
```

If you are replacing a faulty DIMM with a new one from FRU stock, you do not need to remove the node canister from the system configuration.

12. Touch the static-protective package that contains the new DIMM to any unpainted metal surface on the node canister. Remove the DIMM from the package.
13. Turn the DIMM so that the DIMM keys align correctly with the connector on the main board.
14. Insert the DIMM into the connector by aligning the edges of the DIMM with the slots at the ends of the DIMM connector.

> ⚠️ **Attention:** If there is a gap between the DIMM and the retaining clips, the DIMM is not correctly inserted; open the retaining clips, remove the DIMM, and then reinsert it.

15. Apply pressure on both ends of the DIMM simultaneously and firmly press the DIMM straight down into the connector. The retaining clips snap into the locked position when the DIMM is firmly seated in the connector.
16. Repeat steps "12" on page 84 through "15" on page 84 until all the new or replacement DIMMs are installed.
17. Replace the air baffle. For details, see "Removing and replacing the air baffle of a node" on page 100.
18. Install the cover, as described in "Removing and replacing the cover of a node" on page 72.
19. Reinsert the node canister, as described in "Removing and reseating a node" on page 76.

    If the canister does not begin to power-up, check that the canister is fully inserted into the enclosure.
20. When the node is active again, go to the management GUI and look for any unfixed events that are related to the DIMMs.

Removing and replacing a fan module:2145-SV3

Use this procedure to replace a faulty fan module in an SAN Volume Controller node canister with a new one received from stock.

About this task

Each node canister contains five fan modules, which are accessible when the node canister is removed from the control enclosure.

> ⚠️ **Attention:**
> - Do not remove the node canister and faulty fan module before the replacement fan is available. After a fan module is removed, this replacement procedure must be completed within **16 minutes** to ensure that the components do not shut down due to excessive temperatures.
> - When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices.
> - A Phillips screw driver is required to remove the canister cover.

Procedure

1. Follow "Procedure: Powering off a node" on page 60 to verify that the hosts will not lose access to data in volumes.
2. Remove the node canister, as described in "Removing and reseating a node" on page 76.
3. Remove the cover, as described in "Removing and replacing the cover of a node" on page 72.

Removing the fan module

4. Remove the replacement fan module from its packaging.
5. Identify the faulty fan module.

   The Event Log indicates the fan and node that are causing the error. The fix procedure in the management GUI provides the location of the node canister. As Figure 45 on page 85 shows, the fan

modules are numbered 1 to 5 within the node canister. Note that shows the fans with the air baffle removed. The air baffle does not need to be removed to remove or replace a fan
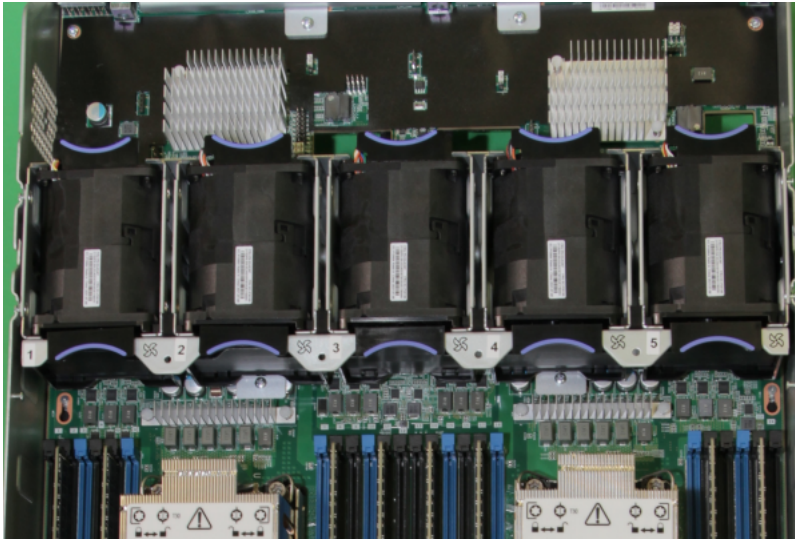
Figure 45. Location of the fans within the node canister

6. Hold the fan module between your finger and thumb at the blue touch points. Squeeze gently and lift the fan module out of the node canister, as shows.
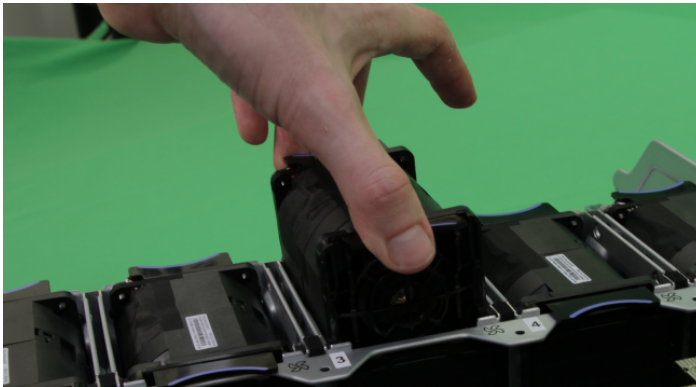
Figure 46. Removing the fan module

Replacing the fan module

7. Install the replacement fan module into the vacant fan slot. The cable must face toward the canister front. Be careful to ensure the connecting cable passes over the air dam at the V-shaped indent, as shown in . Ensure that the cable is not caught under the fan module.
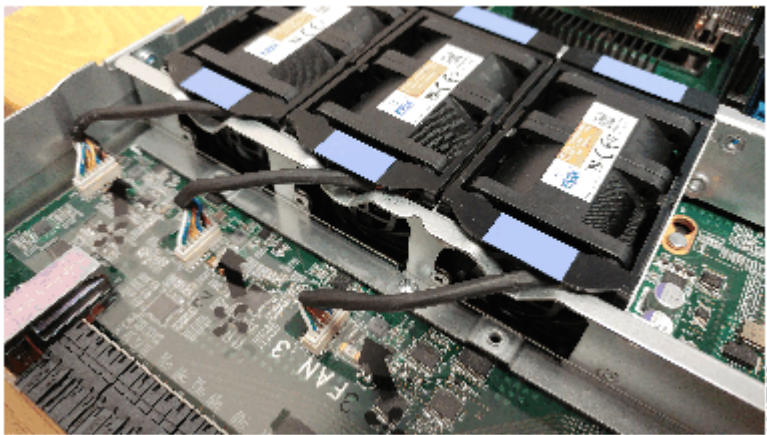
Figure 47. Aligning the cable connector

   a) Check the orientation of the connector and plug the cable end into the numbered fan connector on the system board.

   b) If you are installing fan module 5, carefully pass the cable through the gap in the metal divider of the battery compartment to reach the connector on the main board.
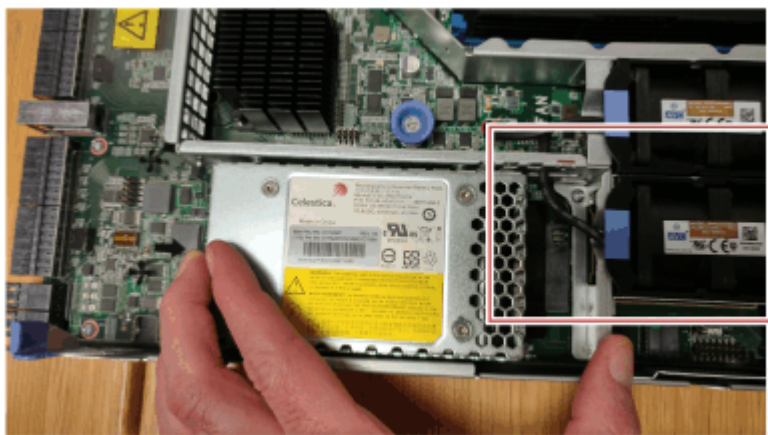
Figure 48. Aligning the cable connector for fan 5

8. Install the canister cover, as described in "Removing and replacing the cover of a node" on page 72.

9. Reinsert the node canister, as described in "Removing and reseating a node" on page 76.

10. Reconnect the power and data cables into the ports from which they were removed.

11. If the control enclosure is powered and the node canister is correctly installed, the node canister starts automatically.

   a) If the node canister is not correctly installed, remove it and repeat the installation procedure.

12. When the node canister is back online, check the Event Log for any new events that might indicate a problem with the reassembly.

Removing and replacing a power interposer

A faulty power interposer can be removed and replaced with an identical or equivalent replacement part from stock.

About this task

A power interposer fills the space between the PSU and the midplane. This is a disruptive procedure, and the enclosure must be shutdown and removed from the rack to service the power interposer. The PSUs

must be removed from the rear of the enclosure before the power interposer can be removed. Before you remove or replace a power interposer, review the following guidelines for this procedure:

- Ensure that you identify the correct PSUs and power interposer for removal.
- Do not insert a PSU into the slot while the power interposer is removed.
- A screwdriver is required to remove the power interposer.

⚠️ **DANGER:** When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard: If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product. Do not open or service any power supply assembly. Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.

- The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords. For AC power, disconnect all power cords from their AC power source. For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.

- Sharp edges, corners and joints might be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

Procedure

1. Before you start identify which power interposer assembly will be replaced. The 4U enclosure contains 2 power interposer assemblies. The upper power inteposer connects to PSU 1 and PSU 2, while the lower connects to PSU3 and PSU4.
2. Complete "Procedure: Powering off a node" on page 60 for both node canisters in the enclosure.

Disconnecting cables from the enclosure

3. Label and disconnect the four (4) power cables from the rear of the control enclosure.
4. Write down the port and cable connections before you disconnect all cables from the ports rear of the control enclosure. Use the following tables to record the information for each node canister. Depending on your system configuration, some PCIe adapter ports and Ethernet ports might not be connected.

   Possible connections on Node Canister 1 summarizes the possible PCIe slot and port configuration of node canister 1.

Table 26. Summary of node canister 1 PCIe slots and port connections

Location	Port	Label or empty
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	1	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	2	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	3	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	4	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	1	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	2	

Table 26. Summary of node canister 1 PCIe slots and port connections (continued)

Location	Port	Label or empty
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	3	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	4	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	1	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	2	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	3	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	4	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	1	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	2	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	3	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	4	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	1	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	2	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	3	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	4	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	1	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	2	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	3	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	4	
Management Ethernet port	1	
Management Ethernet port	2	
Technician Port	T	
USB Port		

Possible connections on Node Canister 2 summarizes the possible PCIe slot and port configuration of node canister 2.

Location	Port	Label or empty
Table 27. Summary of node canister 2 PCIe slots and port connections		
Location	**Port**	**Label or empty**
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	1	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	2	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	3	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	4	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	1	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	2	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	3	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	4	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	1	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	2	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	3	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	4	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	1	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	2	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	3	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	4	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	1	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	2	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	3	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	4	

Table 27. Summary of node canister 2 PCIe slots and port connections (continued)

Location	Port	Label or empty
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	1	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	2	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	3	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	4	
Management Ethernet port	1	
Management Ethernet port	2	
Technician Port	T	
USB Port		

5. Remove the cables from the rear of the enclosure.

Removing the enclosure

6. Remove the end caps from the front flanges of the enclosure, as described in topic "Removing and replacing the enclosure end caps" on page 61

   a) Unscrew the four M5 screws that secure the left and right end caps of the control enclosure to the rack. Eight screws at the front of the enclosure

7. Remove the enclosure from the rack.

   a) Slide the enclosure from the rack. If components were not removed from the control enclosure. Ensure that four persons are available to support the weight of the enclosure when it is removed from the rack.

   b) If fewer people are available, you can remove several internal components to decrease the weight of the control enclosure. Be sure to note the serial numbers and slots for each component (drives and canisters).

8. Remove the power supply unit, as described in "Removing and replacing a power supply unit:2145-SV3" on page 65.

9. Place the enclosure on a flat surface.

Removing the power interposer

10. Facing the front of the enclosure the power interposer cover is on the right side of the top of the enclosure. Remove the three screws, and slide forward then lift the cover off of the top of the enclosure. Under the cover there are two power interposer assemblies.

11. Remove the screw holding the power interposer board latch in place.

12. Remove the upper power interposer by pressing down and away from the midplane on the top power interposer latch to disengage it from the backplane power connector, and lift the upper power interposer from the enclosure.

13. The lower power interposer is removed the same way. Remove the screw retaining the latch. Press down and away from the midplane on the bottom power interposer to disengage it from the backplane power connectors and lift the lower power interposer from the enclosure.

Replacing the power interposer

14. Lower the power interposer into the enclosure from the top.

15. Move the latch up and towards the midplane to secure it to the power connector backplane.

16. Fasten the latch in place using a screw.

17. Repeat these steps for the upper PIB.

18. Lower the power interposer into the enclosure from the top.

19. Move the latch up and towards the midplane to secure it to the power connector backplane.

20. Fasten the latch in place using a screw.

21. Replace the PIB cover using 3 screws.

22. Replace the enclosure in the rack per "Removing and replacing an enclosure or midplane assembly" on page 102

23. Secure the ears to the rack and install left and right ear covers per "Removing and replacing the enclosure end caps" on page 61.

24. Replace the drive if they were removed.

25. Replace the canisters if they were removed, per "Removing and reseating a node" on page 76.

26. Replace the cables to the canister per the above Table 1 and Table 2.

27. Replace the PSUs.

28. Plug in the line cords per their labeling, per "Removing and replacing a power supply unit:2145-SV3" on page 65.

29. Reconnect all cables.

Removing and replacing an adapter cage

Use this procedure to remove and replace a network adapter in a node canister with a new one received from stock. The adapter cage is replaced when replacing a single adapter does not work or both adapters in the cage are having problems.

About this task

Note:

- No tools are required to complete this task. Do not remove or loosen any screws.

- This procedure requires that the node canister is powered down. The adapter cages are not hot swappable.

Procedure

1. Identify the node canister with the faulty adapter. Identify any dependencies on the node canister by using the management GUI. Understand the impact of any dependencies and resolve them, if necessary.

2. Before you can remove the faulty adapter, power down the node canister, as described in "Procedure: Powering off a node" on page 60.

3. Identify the location of the network adapter cage that requires replacement. The Event Log contains the enclosure MTM and serial number, node canister (slot number and serial number), and adapter slot number. Note that release lever for adapter cage 1 is to the right of the left canister release lever.
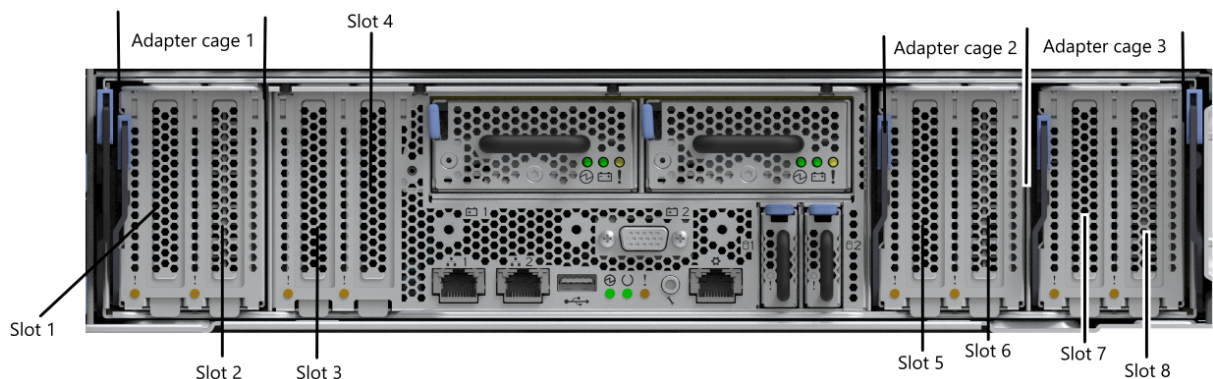
Figure 49. Removing an adapter cage

4. Locate the enclosure that requires servicing by its MTM and S/N, which are labeled on the enclosure front left cover and the enclosure rear. At the rear of the enclosure, locate the node canister by finding its serial number on the bottom lip of the canister.

5. Label each cable connection or record all cables that are connected to the node canister adapter cage. This information is used to reconnect the cables later. If adjacent cables are preventing the removal of the adapter cage, they may need to be labeled and removed.

   Possible connections on an adapter cage summarizes the network adapter slot and port configuration of node canister.

Table 28. Summary of adapter cage slots and port connections

Location	Port	Label or empty	SFP Serial
Adapter slot 1 (left)	1		
Adapter slot 1 (left)	2		
Adapter slot 1 (left)	3		
Adapter slot 1 (left)	4		
Adapter slot 2 (right)	1		
Adapter slot 2 (right)	2		
Adapter slot 2 (right)	3		
Adapter slot 2 (right)	4		

6. Remove the cables from the node canister adapter cage.

7. Record the serial of each SFP device as you remove them from the adapter ports. You need to put them back in the same ports later.

Removing the network adapter cage

8. Remove the node canister adapter cage, by lowering the pressing down on the lever on the upper left side of the adapter cage. Use the lever to pull the adapter cage out of the enclosure.

Figure 50. Removing an adapter cage

9. Migrate the network adapter cards to the replacement adapter cage using "Removing and replacing a network adapter" on page 69.

10. Remove the network adapter cards from the adapter cage. With the adapter cage on a static-protective flat surface lift each adapter from the cage. The Adapter slots are not screwed in. Move the cards one at a time to keep them in the same slot order.

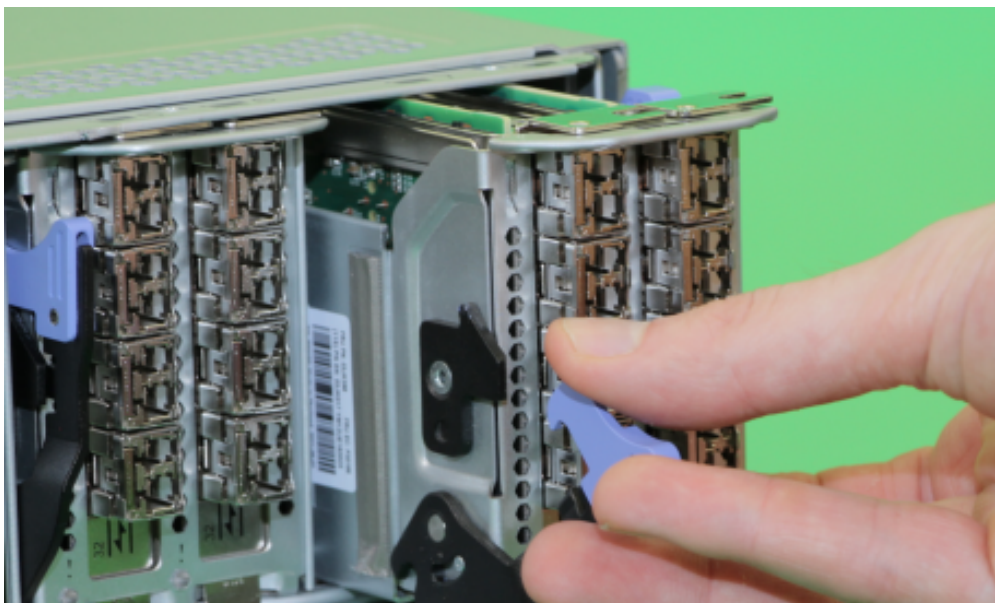   **Important:** Adapters with a large SFP cage, such as the 4-port Fibre Channel adapter, have limited clearance between the external edge of the SFP cage and the slot of the network adapter riser. When you remove or insert an adapter, it may be necessary to start the removal at the bracket end of the adapter, so that the adapter is removed at a slight angle, rather than square to the adapter slot.

Replacing the network adapter cage

11. Ensure that the adapter is fully seated in the riser; the bracket of the adapter must be aligned correctly with the tab on the adapter cage.

12. Orient the adapter cage so that the lever is fully extended on the left side of the cage. Press the adapter cage into the proper adapter cage slot until the lever moves up.

13. Press the lever until a click to seat the cage. Note if both adapter cage slots 2 and 3 are empty use the adjacent wall for alignment.

14. Insert any SFP devices that were removed into one or more adapters as per .

15. Reconnect the cables to the rear of the node canister. Use the information that you collected to identify the correct ports.

16. If a fix procedure is being run in the management GUI to direct this procedure, then it powers the node canister back on. Otherwise, you can reseat the node canister to make it power back on.

17. Verify that the error is cleared from the Event Log.

Removing and replacing the Trusted Platform Module

Use this procedure to remove and replace a faulty Trusted Platform Module (TPM) with a new one received from stock.

About this task

Do not remove or loosen any screws.

 When you replace this part, you must follow recommended procedures for handling electrostatic discharge (ESD)-sensitive devices.

Important: If the node canister is part of a system and is the last online node, do not proceed to change the TPM in the node. Doing so prevents the node from accessing encryption keys that are stored on the node canister boot drive. Instead, complete repairs to bring another node (ideally the partner node) online in the system. The node with the replacement TPM can then obtain required encryption keys from the online node.

Note: You will need two FRU kits. One FRU kit has the TPM with a matched boot drive, the other FRU kit is a blank boot drive. It does not matter which of the two boot drive slots the blank drive is put in.

Procedure

1. Identify the node canister that contains the faulty TPM. Use the management GUI to identify any dependencies on the node canister. Understand the impact of any dependencies and resolve them, if necessary.

   The Event Log contains the TPM failure error. You can also locate the enclosure MTM and serial number, and the node canister serial number.

2. Label each power and cable connection or record all cables that are connected to the node canister. This information is used to reconnect the canister later.

3. Remove the cables from the node canister.

4. Follow "Removing and reseating a node" on page 76 to disconnect and remove the node canister with the faulty TPM.

5. Remove the cover of the node canister, as described in "Removing and replacing the cover of a node" on page 72.

Removing the boot drives

6. Locate the boot drives on the rear of the node canister.
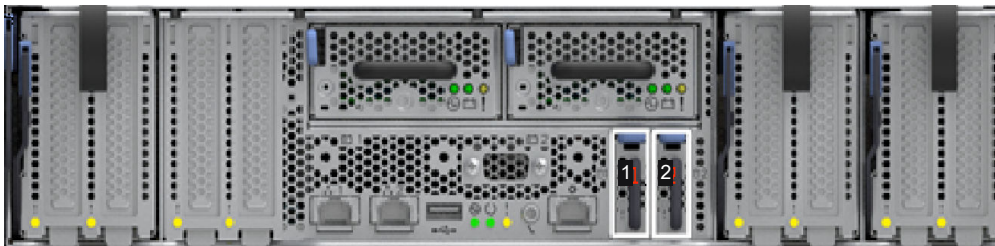
Figure 51. Location of boot drives

7. Hold the boot drive handle (3) and press down on the release latch (1) towards the handle and pull to remove the boot drive. In Figure 52 on page 94, the faulty LED (2) location on the boot drive is shown.

Figure 52. Removing the boot drive

8. When the latch is released, the boot drive can be slide out of slot.

Figure 53. Released boot drive

Removing the TPM

9. Locate the TPM, which is between the boot drive and CMOS battery, as shown in Figure 54 on page 95.
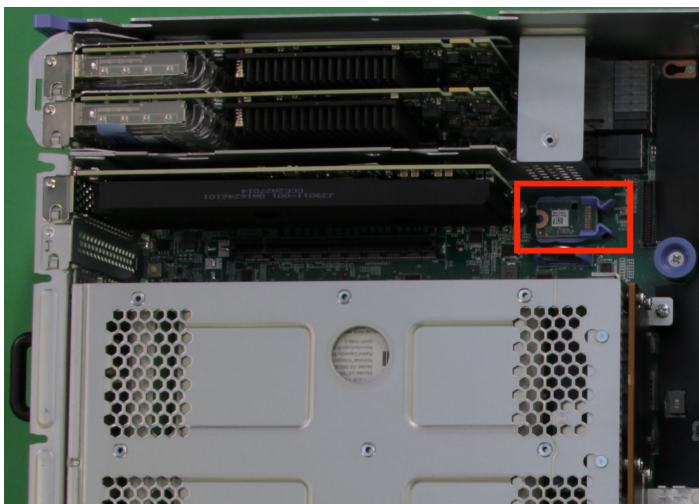
Figure 54. Locating the TPM

10. Insert your finger tip between the latches and hold the TPM between your thumb and finger, as shown in Figure 55 on page 95.

Figure 55. Removing the TPM

11. Remove the TPM by pulling it upwards from its socket.

Replacing the TPM and boot drives

12. Touch the replacement TPM packaging onto a metal area of the case; then, remove the replacement TPM from its package.

13. Align the replacement TPM over the socket and firmly press it straight down into the socket.

14. Replace the paired boot drive that came with the TPM.

15. Replace the blank boot drive.

16. Install the node canister lid, as described in "Removing and replacing the cover of a node" on page 72.

17. Reinstall the node canister, as described in "Removing and reseating a node" on page 76.

18. Reconnect the power and networking cables to the node canister, ensuring the cables go into the same ports from which they were removed in step "4" on page 94.

19. When the node canister is back online, check the Event Log for new events, particularly events that relate to TPM and encryption failures.

Removing and replacing a boot drive

Use this procedure to remove and replace a faulty boot drive from a node canister.

About this task

IBM Storage FlashSystem node canisters have dual boot drives. The canister can run if one boot drive failed. See "Procedure: Understanding system volume dependencies" on page 59 to check for dependencies before you put the node in service state.

Notes:

- Install the boot drive in drive bay 1 or 2 in the rear of the enclosure.

- Do not change both boot drives at the same time. You can only replace a single boot drive. If you replace the TPM then you will be required to replace both boot drives.
- Do not use a drive that was already used in another node.
- Do not swap the two boot drives between slots or canisters.
- Do not replace both boot drives and the node canister all at the same time. If you do, then all Vital Product Data on the node is lost and the whole node needs to be replaced.
- If all boot drives in a node canister are replaced with new drives, then some Ethernet configuration of the node will be lost, such as the service IP and node IP. Use the Service Assistant Tool to reset the service IP and node IP if needed. (A node IP is only needed if the node must communicate with other nodes by using RDMA over Ethernet). If the boot drives are replaced at the same time, then replace the Trusted Platform Module (TPM) too. See "Removing and replacing the Trusted Platform Module" on page 93 for more information.
- No tools are required to complete this task. Do not remove or loosen any screws while you are completing this procedure.
- The boot drives are hot swappable and require a command to sync the new drive. Until drives comes online, sync command will take the node offline.

Procedure

1. Read the safety information.
2. Review the Event Log to identify the faulty boot drive and the node canister in which it resides.
3. Log in to the management GUI to check for dependent volumes.
4. Log in to the service GUI or CLI for the impacted node.
5. Check the hardware panel or command **lsbootdrive** to ensure the drive that failed in the Active column, if it says active, the node should be rebooted to prevent removing an active drive and causing the node OS to crash.

Removing the boot drive

6. Locate the boot drive on the rear of the canister.
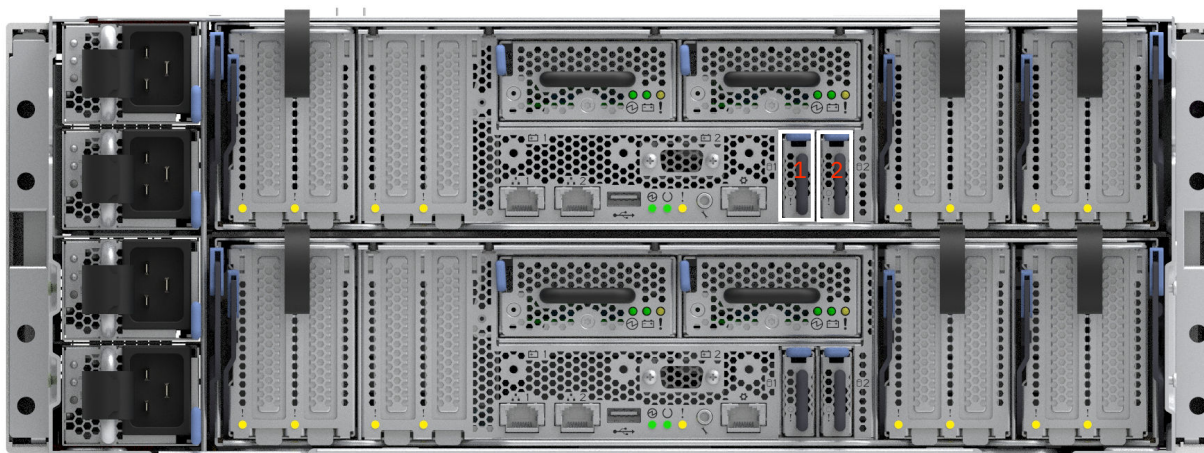
Figure 56. Location of the boot drives

7. Hold the boot drive handle (3) and press down on the release latch (1) towards the handle and pull to remove the boot drive. In , the faulty LED (2) location on the boot drive is shown.
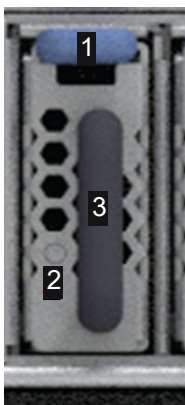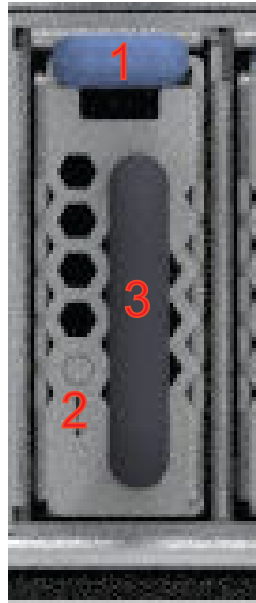
Figure 57. Removing the boot drive

8. When the latch is released, the boot drive can be slide out of slot.

Figure 58. Released boot drive

Replacing the boot drive

9. Touch the static-protective package that contains the drive to any unpainted metal surface on the node; then, remove the drive from the package and place it on a static-protective surface. Orient the boot drive so that the latch is on the up.

10. Physically replace the boot drive that is broken (the fault LED will indicate the specific drive).

11. Slide the boot drive into the boot drive slot, and press in until the latch clicks in
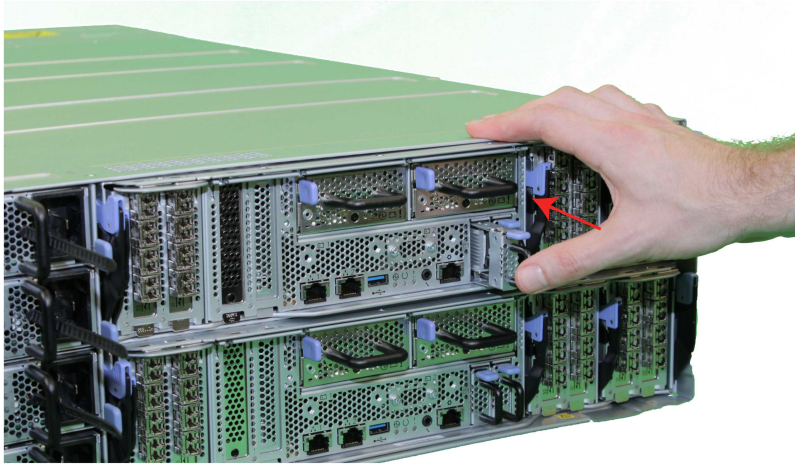
Figure 59. Inserting the boot drive

12. Log into the service assistant GUI or use management GUI or service CLI to place the node in service state.

13. From the service GUI, issue the boot drive sync operation or log into the CLI to run the sync command. Then, issue the following command:

```
satask chbootdrive -sync panel_name
```

14. Wait for the node to restart. It should leave the service mode automatically if it does not log into the service GUI or CLI.

15. The node canister should automatically rejoin the cluster. Wait for the node to complete sync. After the completion of sync, the status of the node changes from out_of _sync to online.

    The following example displays the status of the node before completing sync.

```
sainfo lsbootdrive
```

The resulting output:

```
panel_name node_id node_name can_sync slot_id booted status      actual_drive_sn
configured_drive_sn actual_node_sn identify  FRU_part_number FRU_identity
bfbfbf1    1       bfn1      yes      1       no     out_of_sync
1234567         1234567               bfbfbf1         off       90Y8879
11S49Y7427YXXX6XK
bfbfbf2    1       bfn2      no       2       yes     online
1234568                                               off
```

The following example displays the status of the node after completing sync.

```
sainfo lsbootdrive
```

The resulting output:

```
panel_name node_id node_name can_sync slot_id booted status      actual_drive_sn
configured_drive_sn actual_node_sn identify  FRU_part_number FRU_identity
bfbfbf1    1       bfn1      no       1       no     online
1234567         1234567               bfbfbf1         off       90Y8879
```

```
11S49Y7427YXXX6XK
bfbfbf2    1        bfn2      no        2         yes     online
1234568                                                    off
```

Removing and replacing the air baffle of a node

To service parts under the air baffle such as memory, you may need to remove and replace the air baffle of a node .

About this task

- A Phillips screwdriver required to complete this task to remove the cover. No other tools are needed.
- The air baffle can be removed after the node is removed from the control enclosure and the canister cover is removed.

Procedure

1. Remove the node from the control enclosure, as described in "Removing and reseating a node" on page 76.
2. Remove the cover from the node, as described in "Removing and replacing the cover of a node" on page 72.

Removing the air baffle

Note: If the node was not powered off properly there may still be power running in the system running on the batteries.

3. With the node on a level surface, lift the air baffle out of the inner section of the node. There are no latches or screws holding it in place.
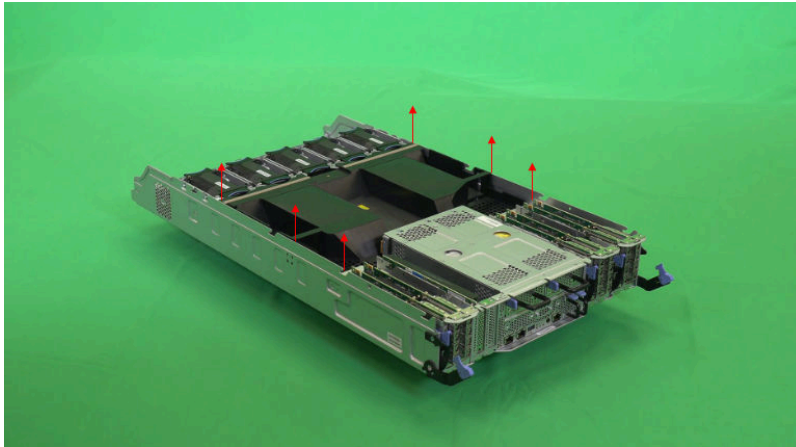
Figure 60. Removing the air baffle

Replacing the air baffle

4. Align the baffle to the edges of node, fan edge and adapter cages, then lower the air baffle into the node until it is level and flush.
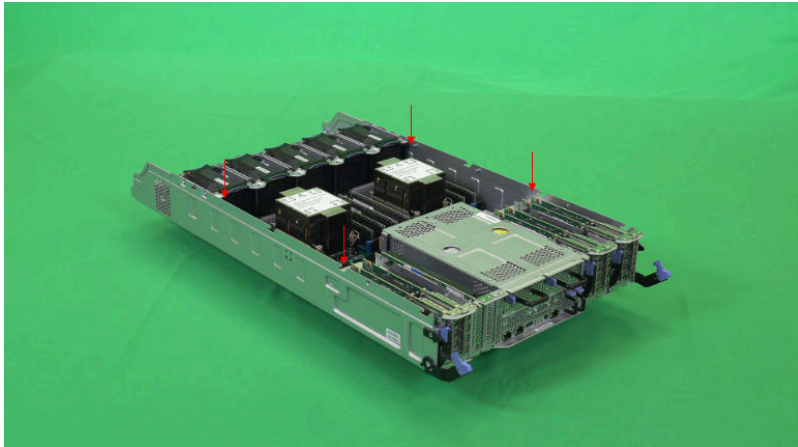
Figure 61. Replacing the air baffle

5. Install the cover on the node, as described in "Removing and replacing the cover of a node" on page 72.

6. Install the node on the control enclosure, as described in "Removing and reseating a node" on page 76.

Removing and replacing a compression card

Use this procedure to remove and replace a compression card in an IBM Storage FlashSystem system with a new one received from stock.

About this task

Note: When a node canister is removed, do not operate the system for more than **16 minutes**. Operating the system for longer than this period might cause the control enclosure to shut down due to overheating.

- A screw driver is required to remove the node canister cover.
- The adapter is not attached to the node canister by screws.
- ESD wrist strap is required.

Procedure

1. Label each network cable connection or record all cables that are connected to the node canister. This information is used to reconnect the cables to the node canister.

2. The compression card is not contained in an adapter cage. Shut down and remove the canister to replace the card.

Removing the compression card

3. Remove the node canister, as described in Removing and replacing a node.

4. Remove the cover and set it aside, as described in "Removing and replacing the cover of a node" on page 72.

5. The compression card is located in adapter slot 3 located closest to adapter cage 1, as shown in Figure 62 on page 102.
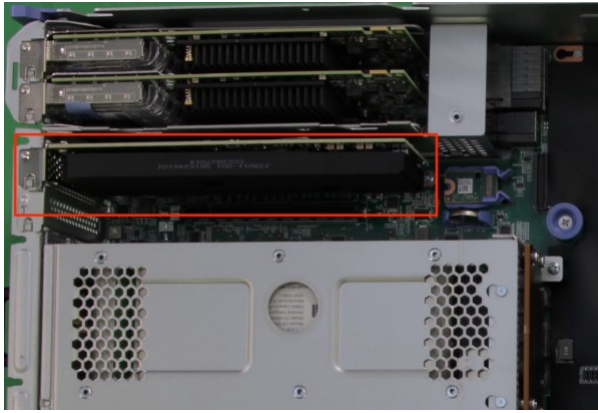
Figure 62. Locating the compression card

6. Lift the PCIe adapter from the canister, similar to standard PCIe cards.

Replacing the host interface adapter

7. Align the replacement card with the PCIe socket and press the adapter into place. Ensure that the adapter is fully seated in the connector.

8. Ensure that the bracket of the compression card is aligned with the metal tab of the enclosure.

Figure 63. Locating the compression card

9. Install the canister lid, as described in "Removing and replacing the cover of a node" on page 72.

10. Insert the node canister, as described in Removing and replacing a node.

11. If the node canister does not start, check that the canister is fully inserted into the enclosure.

12. Reconnect the network cables to the rear of the canister, by using the information that you collected at the start.

Removing and replacing an enclosure or midplane assembly

A trained service provider does not replace a midplane. Instead, they replace the enclosure with a new enclosure, which contains the midplane assembly and PIBs. The midplane includes a VPD chip that contains the Machine Type, Model, and Serial number of the enclosure. These need to be recorded along with worldwide node names.

About this task

⚠ **Attention:** This procedure causes a loss of excess data, as the enclosure is removed from the rack.

⚠ **CAUTION:**

33.6-46.3 kg (74-102 lbs) | 46.3-61.7 kg (102-136 lbs) | ≥61.7-100 kg (136-220 lbs)

The weight of this part or unit is more than 55 kg (121.2 lb). It takes specially trained persons, a lifting device, or both to safely lift this part or unit. (C011)

⚠️ **CAUTION:** To avoid personal injury, before lifting this unit, remove all appropriate subassemblies per instructions to reduce the system weight. (C012)

Ensure that a suitably rated mechanical lift is available to support the weight of the enclosure when it is inserted into the rack for installation. If you do not have mechanical lifting equipment, then dis-assemble the removable components from the enclosure so that it becomes safe for 2 persons to lift the empty chassis from the pallet and into the rack.

To enable two people to lift the enclosure to and from the rack, you can remove the components from the control enclosure before you remove it from the rack. Record the serial number of the component in each location so that the components can be returned to the same location at the end of the procedure. Then, remove the components and place them in a safe location. Also, all cables need to be labeled.

Refer to the Environmental requirements and note the weight considerations before you install the enclosure.

⚠️ **DANGER:** When working on or around the system, observe the following precautions:

Electrical voltage and current from power, telephone, and communication cables are hazardous. To avoid a shock hazard: If IBM supplied the power cord(s), connect power to this unit only with the IBM provided power cord. Do not use the IBM provided power cord for any other product. Do not open or service any power supply assembly. Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.

- ⚠️🔌 The product might be equipped with multiple power cords. To remove all hazardous voltages, disconnect all power cords. For AC power, disconnect all power cords from their AC power source. For racks with a DC power distribution panel (PDP), disconnect the customer's DC power source to the PDP.
- When connecting power to the product ensure all power cables are properly connected. For racks with AC power, connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate. For racks with a DC power distribution panel (PDP), connect the customer's DC power source to the PDP. Ensure that the proper polarity is used when attaching the DC power and DC power return wiring.
- Connect all power cords to a properly wired and grounded electrical outlet. Ensure that the outlet supplies proper voltage and phase rotation according to the system rating plate.
- Connect any equipment that will be attached to this product to properly wired outlets.
- When possible, use one hand only to connect or disconnect signal cables.
- Never turn on any equipment when there is evidence of fire, water, or structural damage.
- Do not attempt to switch on power to the machine until all possible unsafe conditions are corrected.
- When performing a machine inspection: Assume that an electrical safety hazard is present. Perform all ontinuity, grounding, and power checks specified during the subsystem installation procedures to ensure that the machine meets safety requirements. Do not attempt to switch power to the machine until all possible unsafe conditions are corrected. Before you open the device covers, unless instructed otherwise in the installation and configuration procedures: Disconnect the attached AC power cords, turn off the applicable circuit breakers located in the rack power distribution panel (PDP), and disconnect any telecommunications systems, networks, and modems.
- Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.
- Connect and disconnect cables as described in the following procedures when installing, moving, or opening covers on this product or attached devices.

To disconnect:

1. Turn off everything (unless instructed otherwise).
2. Remove the power cords from the outlets.
3. Remove the signal cables from the connectors.
4. Remove all cables from the devices.

To connect:

1. Turn off everything (unless instructed otherwise).
2. Attach all cables to the devices.
3. Attach the signal cables to the connectors.
4. Attach the power cords to the outlets.
5. Turn on the devices.

- ⚠️ Sharp edges, corners and joints might be present in and around the system. Use care when handling equipment to avoid cuts, scrapes and pinching. (D005)

⚠️ **Attention:**

- The control enclosure midplane assembly must be replaced only by a trained service provider. Complete this procedure only if instructed to do so by a service action or the IBM Support center.
- If you have a single control enclosure, this procedure requires that you shut down your system to replace the control enclosure midplane assembly. If you have more than one control enclosure, part of the system can continue to run. However, you lose access to the volumes that are on the affected I/O group. You also lose access to any volumes that are in other I/O groups that depend on the drives that are in the affected I/O group. If the system is still doing I/O requests in all the I/O groups, schedule the replacement during a maintenance period or other time when the I/O can be stopped.
- When you replace hardware components in the back of the enclosure, ensure that you do not inadvertently disturb or remove cables that you are not instructed to remove.
- Ensure that you are aware of procedures for handling static-sensitive devices before you remove the enclosure.

Procedure

1. Log in to the service assistant on one of the node canisters in the control enclosure. In the **Node Details** panel, select the **Location** tab. Note the following values for the enclosure in Table 29 on page 104. This information might be needed later.

Table 29. Recording control enclosure information

Item	Value
WWNN 1	
WWNN 2	
Machine type and model	
Serial number	

2. If the control enclosure is still active, stop host I/O or FlashCopy®, FlashCopy, Global Mirror, or Metro Mirror activities on all the volumes that depend on the control enclosure.

   This step applies to all I/O group volumes that are managed by this control enclosure. It also applies to any volumes in other I/O groups that depend on the drives in the affected I/O group.

3. Complete "Procedure: Powering off a node" on page 60 for the node canister that requires the midplane assembly replacement.

Removing the enclosure

4. Disconnect label and remove the four power cables from the rear of the control enclosure.

5. Write down the port and cable connections before you disconnect all cables from the ports rear of the control enclosure. Use the following tables to record the information for each node canister. Depending on your system configuration, some PCIe adapter ports and Ethernet ports might not be connected. Ports are numbered top to bottom, and left to right.

   Possible connections on Node Canister 1 summarizes the possible PCIe slot and port configuration of node canister 1.

Table 30. Summary of node canister 1 PCIe slots and port connections

Location	Port	Label or empty
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	1	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	2	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	3	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	4	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	1	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	2	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	3	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	4	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	1	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	2	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	3	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	4	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	1	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	2	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	3	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	4	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	1	

Table 30. Summary of node canister 1 PCIe slots and port connections (continued)		
Location	**Port**	**Label or empty**
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	2	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	3	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	4	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	1	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	2	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	3	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	4	
Management Ethernet port	1	
Management Ethernet port	2	
Technician Port	T	
USB Port		

summarizes the possible PCIe slot and port configuration of node canister 2.

Table 31. Summary of node canister 2 PCIe slots and port connections		
Location	**Port**	**Label or empty**
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	1	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	2	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	3	
Adapter Cage 1 - PCIe Card 1 (left) - Slot 1	4	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	1	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	2	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	3	
Adapter Cage 1 - PCIe Card 2 (right) - Slot 2	4	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	1	

Table 31. Summary of node canister 2 PCIe slots and port connections (continued)		
Location	**Port**	**Label or empty**
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	2	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	3	
Adapter Cage 2 - PCIe Card 1 (left) - Slot 5	4	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	1	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	2	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	3	
Adapter Cage 2 - PCIe Card 2 (right) - Slot 6	4	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	1	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	2	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	3	
Adapter Cage 3 - PCIe Card 1 (left) - Slot 7	4	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	1	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	2	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	3	
Adapter Cage 3 - PCIe Card 2 (right) - Slot 8	4	
Management Ethernet port	1	
Management Ethernet port	2	
Technician Port	T	
USB Port		

6. Remove the four power supplies from the control enclosure, as described in "Removing and replacing a power supply unit:2145-SV3" on page 65.

7. Remove the node canisters from the control enclosure, as described in "Removing and reseating a node" on page 76. Label them to indicate what canister came from each canister slot. The top canister is in slot 1, and the bottom canister is in slot 2.

8. Remove the end caps from the control enclosure, as described in "Removing and replacing the enclosure end caps" on page 61.

9. Remove the screws from the front of the control enclosure to free the enclosure from the rack.

10. Carefully slide the control enclosure from the rack.

Replacing the enclosure

11. Unpack the replacement enclosure.
12. Visually inspect the enclosure to ensure the power inter-poser boards are installed in the replacement enclosure. If not move the old power inter-poser boards from the old enclosure using the "Removing and replacing a power interposer" on page 86.
13. Record the machine type and model serial number of the enclosure on the blank agency sticker at the top of the enclosure.
14. Reinstall the control enclosure in the rack cabinet, securing it with the screws that were removed.
15. Reinstall the end caps at the front of the enclosure, as described in "Removing and replacing the enclosure end caps" on page 61.
16. Reinstall the node canisters into the same canister slots from which they were removed, as described in "Removing and reseating a node" on page 76.
17. Reinstall the power interposers, as described in "Removing and replacing a power interposer" on page 86.
18. Reinstall the four power supplies, as described in "Removing and replacing a power supply unit:2145-SV3" on page 65.
19. Reconnect the data cables to the same connectors at the rear of the control enclosure. Use the data that you collected in step "5" on page 105.
20. Reconnect power to the control enclosure.

    The node canisters restart. The yellow fault LED indicators are on because the new enclosure was not set with the identity of the old enclosure. The node canisters log node error 504 to report that they are in the wrong location. In the system Event log, the error code is 1192. It is good to verify that the line cords are connected to at least two different power distribution units.

21. Use an **ssh** client to log in as the superuser to the service IP address of either node canister. Then, access the service assistant CLI.

    Important:

    • Do not reset the system ID.
    • After the replacement midplane is modified, it cannot be used as a replacement part for a different enclosure. Do **not** return a modified midplane assembly to FRU stock.

    Note: If you replaced a node canister, log in to the node canister that was not replaced. Enter the **satask chvpd -replacemidplane** command. If the command is successful, the node canister modifies the VPD data. You are disconnected from the CLI as both node canisters reboot.

22. If the **satask chvpd -replacemidplane** command fails, complete the following steps:

    a) Connect to the Service Assistant Tool of the node canister. Go to http://*service_ip*/service or connect to the technician port of the node canister.

       If you replaced a node canister at the same time as the midplane assembly, connect to the node canister that was not replaced.

    b) If you cannot access the service assistant, see Problem: Cannot connect to the service assistant.

    c) In the Service Assistant tool, use the **Configure Enclosure** panel.

    d) Select to use the node copy of the data that you recorded in step "1" on page 104 (WWNN 1, WWNN 2, machine type and model, and serial number).

       If the node copy for any of the values is not available, select the **Specify** option for each missing value. Then, enter the value that you recorded at step "1" on page 104.

    e) After you specify all values in the **Enclosure Information** panel, click **Modify**.

       The node canisters restart. When the restart finishes, the system comes online with both node canisters online.

23. Wait for the green status LED of both node canisters to light and indicate that the node canisters are active in the system.

Note: Customers can complete the following tasks after the new enclosure is installed and the control enclosure is operating again.

24. Use the management GUI to check the status of all volumes and physical storage to ensure that the system is operating normally.
25. Go to **Monitoring** > **Events** to check the Event Log for other events or errors.
26. Restart the host application and any FlashCopy, Global Mirror, or Metro Mirror activities that were stopped.

System indicators summary

An system contains several control and expansion enclosures, each of which has LED indicators for identification and fault diagnosis. The details of these indicators are covered in the following topics.

Note: For optimal usage, configure call home and event notifications rather than using the LED indicators as the primary means of fault diagnosis. As a best practice, configure call home and event notifications to precisely detect the fault and failure of the system.

Power supply indicators

IBM Storage FlashSystem power supplies have three LED indicators to convey information about the state of the supply.
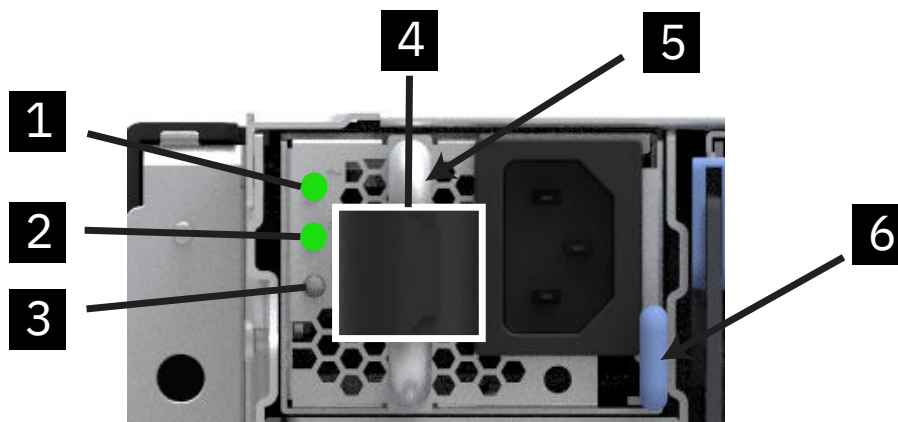
1. AC good indicator
2. DC good indicator
3. Fault indicator
4. Velcro strap clip
5. Power supply handle
6. Power supply release tab

Figure 64. Power supply details

Table 32 on page 110 describes the meaning of each indicator.

Table 32. Summary of LED indicators for the PSUs		
LED Name	**Color**	**Meaning**
AC Good	Green	• **Off** - There is no AC input to the power supply, or the power supply is in a fault state that will not allow AC input. • **On** - The power supply is receiving AC power cord and is operating normally.
DC Good	Green	• **Off** - There is no DC output from the power supply to the node. • **On** - The power supply is outputting DC power to the node.
Fault	Amber	• **Off** - There are no isolated FRU failures on the power supply. • **Flash** - The power supply is being identified using an `identify` command. • **On** - The associated power supply has been isolated and is requiring service or replacement.

Node front and rear panel indicators: 2147-SV3 and 2145-SV3

Each node canister within the control enclosure has indicators that are visible from the back of the enclosure..

Figure 65 on page 110 shows the indicators a control enclosure. Each node canister has its own set of indicators that identify the status of the node canister.

Figure 65. Node canister status LEDs

Node front panel indicators

Labels and indicators on the left end cap of the node provide information about the node status. When multiple nodes are in a rack, the serial number is used to identify the node that is being referenced.

Figure 66. Left node end cap

Table 33 on page 111 summarizes the possible meanings of each indicator.

Table 33. Summary of LED indicators

LED Name	Color	Symbol	Meaning
Power	Green	⏻	• **Off** - There is no external power to the Node. • **Slow flash** - The node is in a standby state. • **On** - There is AC power to the node and the node is not in standby.
Identify	Blue	📡	• **Off** - The node is not being identified. • **On** - The node has been set to Identify.
Fault	Amber	!	• **Off** - There are no isolated FRU failures on the node. • **On** - There are one or more isolated FRU failures in the node requiring service or replacement.

Node canister status LED indicators

shows the location of the LED indicators:
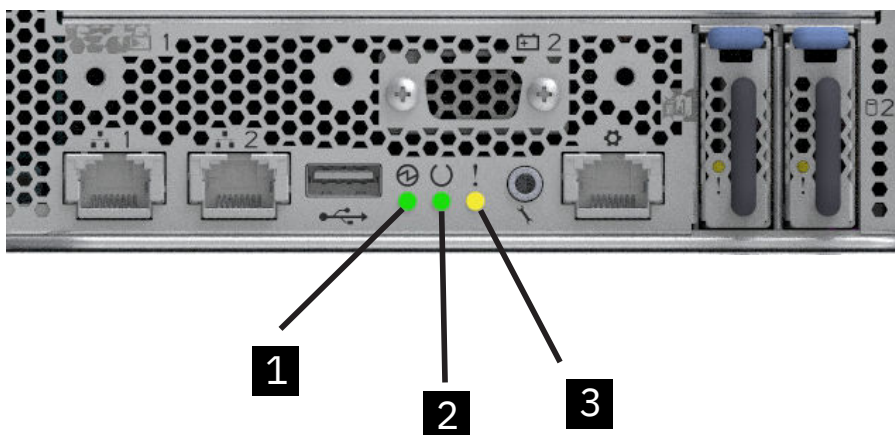
1 Node canister power LED
2 Node canister status LED
3 Node canister fault LED

Figure 67. Node canister LEDs

Table 34 on page 112 summarizes the meaning and values of each indicator.

Table 34. Node canister status LEDs indicator			
LED Name	**Color**	**State**	**Meaning**
Power	Green	Off	There is no external power to the node.
		Slow flash	The node is in a stand by state.
		Fast flash	During POST, the Power LED on the node will fast blink to indicate the BIOS is in POST.
		On	The node is in a power on state. **Note:** During ride through and FHD, the LED remains in Solid.

Table 34. Node canister status LEDs indicator (continued)			
LED Name	**Color**	**State**	**Meaning**
Status	Green	Off	The controller RAID stack is not operational.
		Slow flash	The node is in candidate or service state. For example, if it is not able to perform I/O in a cluster, it is safe to remove the node.
		Fast flash	is performing destage activity or running on battery.
		On	The controller is active and joined a cluster. The node has state data that must be preserved on shutdown. This normally means it is active in the cluster, handling I/O, but there is a transient starting state that is also covered (it is possible to get held in starting state if a quorum cannot be established, the alert then lights).
Fault	Amber	Off	There are no isolated FRU failures on the node.
		Flash	The node is being identified using an **identify** command.
		On	There are one or more isolated FRU failures in the node requiring service or replacement.

Battery status LED indicators

Each node canister also has a battery and three LED indicators for the battery status. If an AC power failure occurs, the battery provides power to the node canister as it stores cache and system data to an internal drive. This process is known as a *fire hose dump*. The following image shows the location of the battery indicators and describes the function and possible values for each indicator.
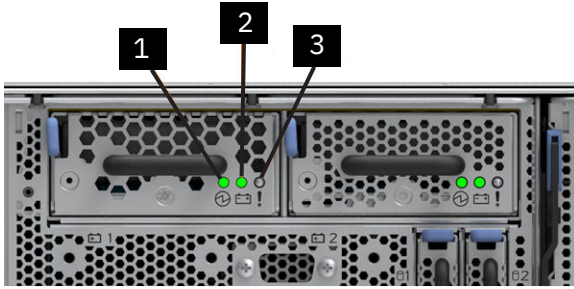
Figure 68. Battery LEDs

1 Battery power LED
2 Battery status LED
3 Battery fault LED

Table 35. Battery status LED indicators			
LED Name	**Color**	**State**	**Meaning**
Power	Green	Off	The battery power protection is not being provided. This LED is per battery. If both batteries are failing to indicate battery power, the node does not have AC Loss protection. Replace the batteries or canister.
		On	The Battery Module has DC input power or is providing power to the system.
Status	Green	Off	Output is off or out of tolerance, unable to supply power to volatile cache memory, and potentially de-staging function.
		Flash	Battery is charging.
		On	The battery is fully charged. No action necessary.

Table 35. Battery status LED indicators (continued)			
LED Name	**Color**	**State**	**Meaning**
Fault	Amber	Off	There have been NO isolated faults or conditions detected by the battery module that can be serviced using service indicators.
		Flash	The APD has been identified and the battery is charging. **Note:** It is possible the battery might also have a fault.
		On	There has been a fault condition detected with the battery that can be serviced using service indicators. The battery is in a condition that permits repair or replacement activity if removable.

Adapter slot fault LED indicators

Fault LEDs on the adapter is used to identify the adapters with any faults which might require any replacement or servicing. Table 36 on page 115 describes the function and possible values for each indicator.

Table 36. Adapter slot fault LED indicator		
Fault	Off	There are no isolated FRU failures on this adapter.
	Flash	The adapter is being identified using an identify command .
	On	There is an isolated FRU failures in the adapter that requires service or replacement.

Boot drive fault LED indicators

Boot drive LEDs are used to identify any failed or missing boot drive. Table 37 on page 116 describes the function and possible values for each indicator.

Table 37. Boot drive fault LED indicator		
Fault	Off	There are no isolated FRU failures on this boot drive.
	Flash	This boot drive is being identified using an identify command.
	On	There is an isolated FRU failure in this boot drive that requires service or replacement.

Node port indicators

Each Node canister Ethernet port has a pair of green LEDs with the following meanings. Table 38 on page 116 describes the LED indicators.

Table 38. Onboard Ethernet port LEDs				
Name	**Symbol**	**Color**	**State**	**Meaning**
Link speed	None	Green	OFF	No link connection or the link is connected at less than 1 Gbps.
			ON	There is a 1 Gbps link connection to a remote device.
Activity	None	Green	OFF	No activity.
			FLASHING	Activity on link.

Network adapter port indicators

A control enclosure can support several types of optional host interface adapters. Each host interface adapter has its own Light-Emitting Diode (LED) indicators to help with status and fault diagnosis, as documented in the following sections:

Fibre Channel port indicators

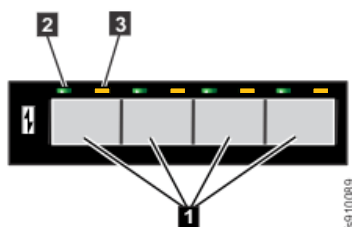The system supports dual-port and quad-port fibre channel adapters and the status is shown by the indicators.

Figure 69. Fibre Channel ports and indicators

1 Fibre Channel port (4-port card)
2 Link-state LED (one for each port)
3 Speed-state LED (one for each port)

The following table lists the possible link status values for the Fibre Channel LEDs.

Table 39. Link status values for Fibre Channel adapter LEDs		
Green LED	**Amber LED**	**Meaning**
Off	Off	One of the following situations is in effect: • The port is not configured. • The port is not active.
Off	On	The port is configured, but the link is not detected at the transport layer. This situation is the result of the port not being connected or of a failed link negotiation with the switch.
On	Off	The link is up and running at the expected port speed. This display does not imply logical connectivity, that is completion of FLOGI or FIP.
On	On	The link is up but running at a degraded speed.

Dual-port 25 Gbps Ethernet host interface adapter ports and indicators

Each port on the dual-port 25 Gbps Ethernet host interface adapter has one bi-color LED that indicates the status of the link and port. The location of the LEDs varies depending on the type of adapter.

Figure 70 on page 117 shows the front of a dual-port 25 Gbps Ethernet (RoCE) host interface adapter.

Figure 70. Dual-port 25 Gbps Ethernet host interface adapter ports and LEDs (RoCE)

The LED states and their descriptions are explained in Table 40 on page 117.

Table 40. LED indicators for dual-port 25 Gbps Ethernet host interface adapter (RoCE)		
Color	**State**	**Description**
None	Off	The port is not active.
Green	Solid	The port has a valid link with no active traffic.
Green	Blinking	The port has a valid link with active traffic.
Yellow	Blinking	The link has a problem.

Figure 71 on page 117 shows the 25 Gbps Ethernet (iWARP) host interface adapter. Each port has a single LED that indicates the status of the port and link.

Figure 71. Dual-port 25 Gbps Ethernet host interface adapter ports and LEDs (iWARP)

Table 41 on page 118 summarizes the possible values of the LEDs on the 25 Gbps Ethernet host interface adapter (iWARP).

Table 41. Table 2. LED indicators for dual-port 25 Gbps Ethernet host interface adapter (iWARP)

Color	State	Description
Off	Off	The ports and links are not active.
Green	Solid	The ports have a valid link.

Dual-port 100 Gbps Ethernet host interface adapter ports and indicators

Each port on the dual-port 100 Gbps Ethernet host interface adapter has one bi-color LED that indicates the status of the link and port. The location of the LEDs varies depending on the type of adapter.

Figure 72 on page 118 shows the dual-port 100 Gbps Ethernet (RoCE) network adapter.

Figure 72. Dual-port 100 Gbps Ethernet adapter host interface adapter ports and LEDs (RoCE)

Table 42 on page 118 shows LED states and their descriptions. The Dual-port 100 Gbps Ethernet (RoCE) network adapter has a single bi-colour LED per port.

Table 42. LED indicators for dual-port 100 Gbps Ethernet host interface adapter (RoCE)

Color	State	Description
None	Off	The port is not active.
Green	Solid	The port has a valid link with no active traffic.
Green	Blinking	The port has a valid link with active traffic.
Yellow	Blinking	The link has a problem.

Replaceable units

Each system consists of several replaceable units, such as cables, SFP transceivers, canisters, power supply units, batteries, drives, and enclosure chassis. The part numbers vary depending on the model of the control enclosure or expansion enclosure.

Node replaceable units

All IBM SAN Volume Controller 2145-SV3 and IBM SAN Volume Controller 2147-SV3 parts are field-replaceable units (FRUs), which must be replaced by IBM® trained service technicians. There are no customer-replaceable parts (CRUs).

SAN Volume Controller 2145-SV3 replaceable units

Part Number	Description
Table 43. SAN Volume Controller 2147-SV3 and 2145-SV3 replaceable unit	
Part Number	**Description**
Part Number	Description
01FT706	100 GbE QSFP28 SR4

Part Number	Description
01KV680	Power cord India C13-E/C14 2 m
01PP689	Power cord India C13-I/C20 2.8 m
01YM283	25 GbE RoCE adapter
01YM285	25 GbE iWARP adapter
02YC309	EMC Filler
02YC310	Front Bezel
02YJ555	FAB3/4 generic bezel FRU
03JK915	Quad-port 32 Gbps and 64 Gbps FC adapter
03JK911	Quad-port 64 Gbps FC-NVMe adapter
03GH231	Quad-port 16 or 32 Gbps FC-NVMe adapter
03GH960	Compression adapter
03GU966	M.2SSD+TPM kit
03JK030	PSU FRU 1KW
03JK032	Rail Kit FRU
03JK082	SV3 node canister
03JK125	Battery
03JK398	Adapter Cage
03JK399	Power interposer
03JK530	Enclosure FRU
03JK533	Fan 6038
03JK535	64 Gb DIMM
03JK732	RJ45 module for 25 GbE adapters
15R8848	25 m OM3 Fiber Cable (LC)
39M5068	Power Cord - Argentina
39M5102	Power Cord - Australia/NZ
39M5123	Power Cord - Europe/Africa
39M5130	Power Cord - Denmark
39M5144	Power Cord - South Africa
39M5151	Power Cord - UK/EMEA
39M5158	Power Cord - Switzerland
39M5165	Power Cord - Chile/Italy
39M5172	Power Cord - Israel
39M5206	Power Cord - China
39M5219	Power Cord - Korea

Table 43. SAN Volume Controller 2147-SV3 and 2145-SV3 replaceable unit (continued)

Part Number	Description
Table 43. SAN Volume Controller 2147-SV3 and 2145-SV3 replaceable unit (continued)	
Part Number	**Description**
39M5226	Power Cord - India
39M5240	Power Cord - Brazil
39M5392	Power Cord - C13-I/C20
39M5508	Power Cord - C13-E/C14
41V2120	10m OM3 Fiber Cable (LC)
45D4773	1 m OM3 Fiber Cable (LC)
45D4774	5 m OM3 Fiber Cable (LC)
03GU827	10 GbE SFP for use in 25GbE adapters
03GH278	25 Gbps SFP28 for mellanox
03GH316	25 Gbps SFP28 for any 25 GbE adapter
78P5240	32 Gbps FC short-wave (SW) SFP Transceiver
78P5241	32 Gbps long-wave (LW) SFP
78P7742	64 Gbps SW SFP
78P7709	64 Gbps FC SW SFP
01LL634	100 GbE RoCEv2 adapter
03JK978	M.2SSD
03JK177	Quad-port 32 Gbps FC-NVMe adapter
00RY543	CR2032 coin battery

Note: The IBM Storage Virtualize software calls out the FRU part number of the type of 32 Gbps or 64 Gbps FC adapter that is fitted. It is best to replace it with the same type of adapter but it can also be replaced with the other type of 32 Gbps or 64 Gbps adapter.