

IBM Elastic Storage System 3000
Version 6.0.0

*Hardware Planning and Installation
Guide*



Note

Before using this information and the product it supports, read the information in [“Notices” on page 81.](#)

This edition applies to version 6 release 0 modification 0 of the following product and to all subsequent releases and modifications until otherwise indicated in new editions:

- IBM Spectrum® Scale Data Management Edition for IBM® ESS (product number 5765-DME)
- IBM Spectrum Scale Data Access Edition for IBM ESS (product number 5765-DAE)

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About this information

This information is intended as a guide for administering IBM Elastic Storage® System (ESS) 3000.

Who should read this information

This information is intended for administrators of IBM Elastic Storage System (ESS) 3000 systems that include IBM Spectrum Scale RAID.

Related information

Related information

For information about:

- IBM Spectrum Scale, see:
http://www.ibm.com/support/knowledgecenter/STXKQY/ibmspectrumscale_welcome.html
- mmvdisk command, see [mmvdisk documentation](#).

Conventions used in this information

Table 1 on page xi describes the typographic conventions used in this information. UNIX file name conventions are used throughout this information.

Table 1. Conventions

Convention	Usage
bold	Bo l d words or characters represent system elements that you must use literally, such as commands, flags, values, and selected menu options. Depending on the context, bold typeface sometimes represents path names, directories, or file names.
<u>bold underlined</u>	<u>bold <u>underlined</u></u> keywords are defaults. These take effect if you do not specify a different keyword.
constant width	Examples and information that the system displays appear in constant-width typeface. Depending on the context, constant-width typeface sometimes represents path names, directories, or file names.
<i>italic</i>	<i>Italic</i> words or characters represent variable values that you must supply. <i>Italics</i> are also used for information unit titles, for the first use of a glossary term, and for general emphasis in text.
<key>	Angle brackets (less-than and greater-than) enclose the name of a key on the keyboard. For example, <Enter> refers to the key on your terminal or workstation that is labeled with the word <i>Enter</i> .

Table 1. Conventions (continued)

Convention	Usage
\	In command examples, a backslash indicates that the command or coding example continues on the next line. For example: <pre>mkcondition -r IBM.FileSystem -e "PercentTotUsed > 90" \ -E "PercentTotUsed < 85" -m p "FileSystem space used"</pre>
{ <i>item</i> }	Braces enclose a list from which you must choose an item in format and syntax descriptions.
[<i>item</i>]	Brackets enclose optional items in format and syntax descriptions.
<Ctrl- <i>x</i> >	The notation <Ctrl- <i>x</i> > indicates a control character sequence. For example, <Ctrl-c> means that you hold down the control key while pressing <c>.
<i>item</i> ...	Ellipses indicate that you can repeat the preceding item one or more times.
	In <i>synopsis</i> statements, vertical lines separate a list of choices. In other words, a vertical line means <i>Or</i> . In the left margin of the document, vertical lines indicate technical changes to the information.

How to submit your comments

To contact the IBM Spectrum Scale development organization, send your comments to the following email address:

scale@us.ibm.com

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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 translated 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* with the user publications that were provided with your system hardware.
3. Find the matching identification number in the *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. Search for " Elastic Storage System 3000 "
 - c. Click the documentation link.

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.

Note: You can find and download the current *IBM System Safety Notices* by searching for Publication number **G229-9054** in the [IBM Publications Center](#).

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.

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 a 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.
- 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.
- 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)

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:**

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

swc01053

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)

**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. (C048, part 1 of 2)

- 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, part 2 of 2)



CAUTION:

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

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



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.

- In ESS application a rack cannot be moved with disks in place. Remove all disks from the attached enclosure before moving the rack.
- 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. After the rack is installed, you can install 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)

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 Elastic Storage System 3000 , follow general safety guidelines.

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

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.

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.

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 for loose or broken feet when the system is not installed in a rack cabinet.
4. Check the power cords for damage.
5. Check the external signal cables for damage.
6. Check the cover for sharp edges, damage, or alterations that expose the internal parts of the device.
7. Check the bottom of the external cover for any loose or broken feet.
8. Correct any problems that you find.

Checking internal devices

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

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

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.

The [*IBM Systems Environmental Notices*](#) includes statements on limitations, product information, product recycling and disposal, battery information, flat panel display, refrigeration and water-cooling systems, external power supplies, and safety data sheets.

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

European Community and Morocco Notice

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

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Deutschsprachiger EU Hinweis: Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

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Dieses Produkt entspricht dem "Gesetz über die elektromagnetische Verträglichkeit von Geräten (EMVG)." Dies ist die Umsetzung der EU-Richtlinie 2014/30/EU in der Bundesrepublik Deutschland.

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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:

IBM Deutschland GmbH
Technical Relations Europe, Abteilung M456
IBM-Allee 1, 71139 Ehningen, Germany
Tel: +49 800 225 5426
e-mail: Halloibm@de.ibm.com

Generelle Informationen:

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

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(一社) 電子情報技術産業協会 高調波電流抑制対策実施
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This statement applies to products less than or equal to 20 A per phase.

高調波電流規格 JIS C 61000-3-2 適合品

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- 回路分類 : 5 (3相、P F C回路付)
- 換算係数 : 0

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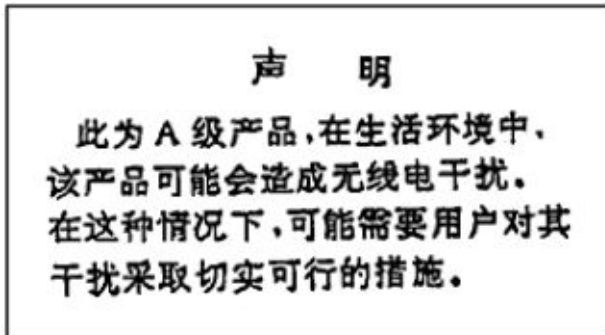
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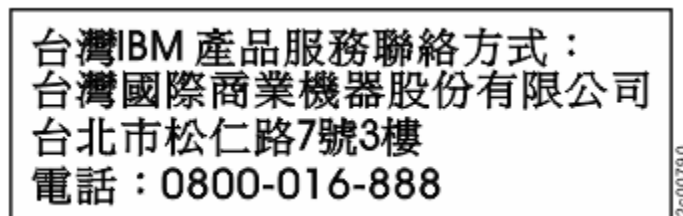
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Responsible Party:

International Business Machines Corporation

New Orchard Road

Armonk, NY 10504

Contact for FCC compliance information only: fccinfo@us.ibm.com

Chapter 2. Technical overview

The technical overview topics provide information about the major concepts of the IBM Elastic Storage System 3000.

This chapter is for both customers and IBM Service Support Representative (SSR).

System overview

IBM Elastic Storage System 3000 is an all-Flash array platform. This storage platform uses NVMe-attached drives in ESS 3000 to provide significant performance improvements as compared to SAS-attached flash drives.

Elastic Storage System 3000 can contain up to 24 NVMe-attached SSD drives, 12 drives (half populated) or 24 drives (fully populated). The drives are accessible from the front of ESS 3000, as shown in [Figure 1](#) on [page 15](#).

Note: The minimum number of drives is 12. In a 12-drive configuration, drives must be plugged into slots 1 - 6 and then 13 - 18.

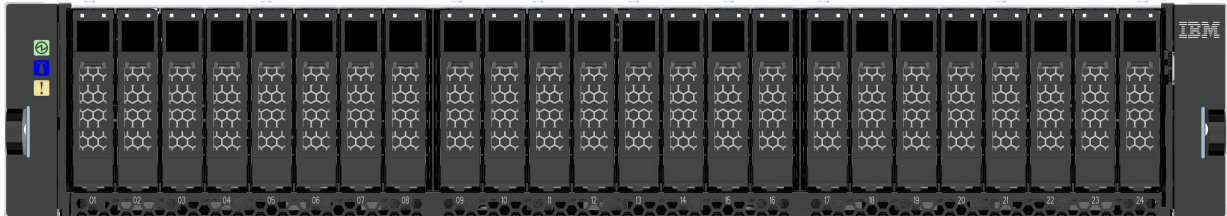


Figure 1. Front view of ESS 3000

Each Elastic Storage System 3000 contains two identical I/O server canisters. As [Figure 2](#) on [page 15](#) shows, the top I/O server canister is inverted above the bottom one; each server canister is connected to power supply units mounted on either side of the canister.



Figure 2. Rear view of ESS 3000

Table 2. Overview of Elastic Storage System 3000 systems

Product	Cores per CPU	Number of DIMMs per server canister	Total memory per server canister	Total memory per ESS 3000	Specific features	Warranty
Elastic Storage System 3000	14	12 or 24 (32 GB DIMM only)	384 GB or 768 GB	768 GB or 1536 GB	Dual 14-core Intel Skylake 64-bit CPUs at 2.2 GHz per each of the two server canisters Dual SSD boot drives	Service offerings 1 year plus 2 years extended support (total of 3 years) Installed by IBM SSRs Enterprise Class Support

The major characteristics of the ESS system are as follows:

- IBM Spectrum Scale software with enclosure-based, all-inclusive software feature licensing
- NVMe transport protocol for high performance of 2.5-inch (SFF) NVMe-attached flash drives:
 - Support for industry-standard 2.5-inch NVMe-attached SSD drive options with the following storage capacities: 1.92 TB, 3.84 TB, 7.68 TB, and 15.36 TB.
- Onboard ports:
 - Four 1 GbE/10 GbE Ethernet ports:
 - First port is reserved for system management
 - The other three ports are not used
 - Two USB ports (disabled by software)
 - One 1 Gb Ethernet SSR access port
- Three PCIe HBA slots are available that support the following adapter options:
 - EC64: PCIe4 x16 2-Port EDR 100GB InfiniBand Adapter
 - EC67: PCIe4 x16 2-Port 100GbE RoCE Adapter

Networking details

The networking details of ESS 3000 are shown in the following figure:

ESS 3000 Networking

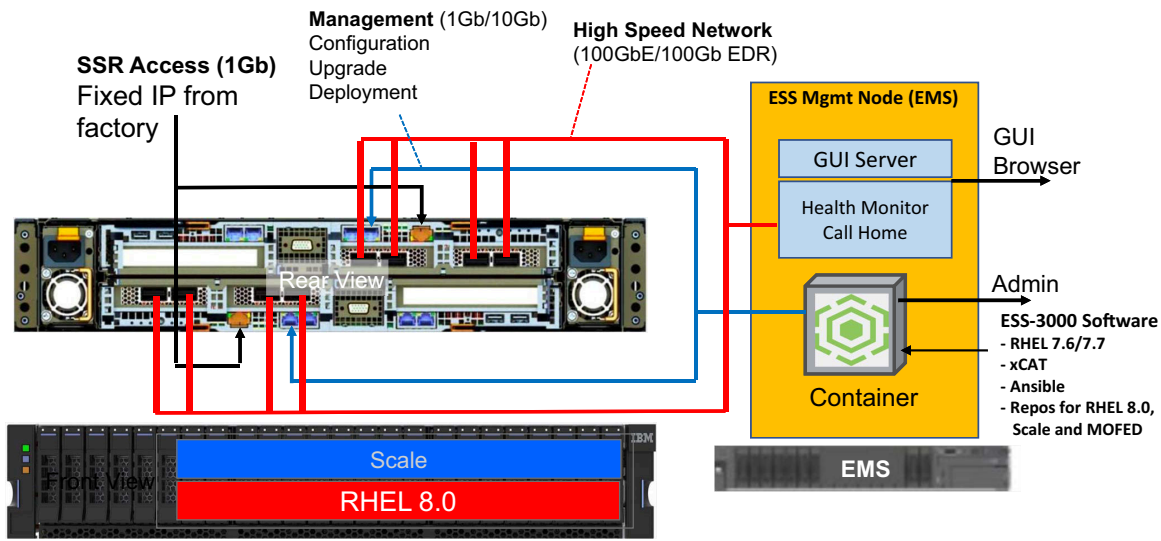


Figure 3. ESS 3000 Networking

ESS 3000 Sharing Existing Networks

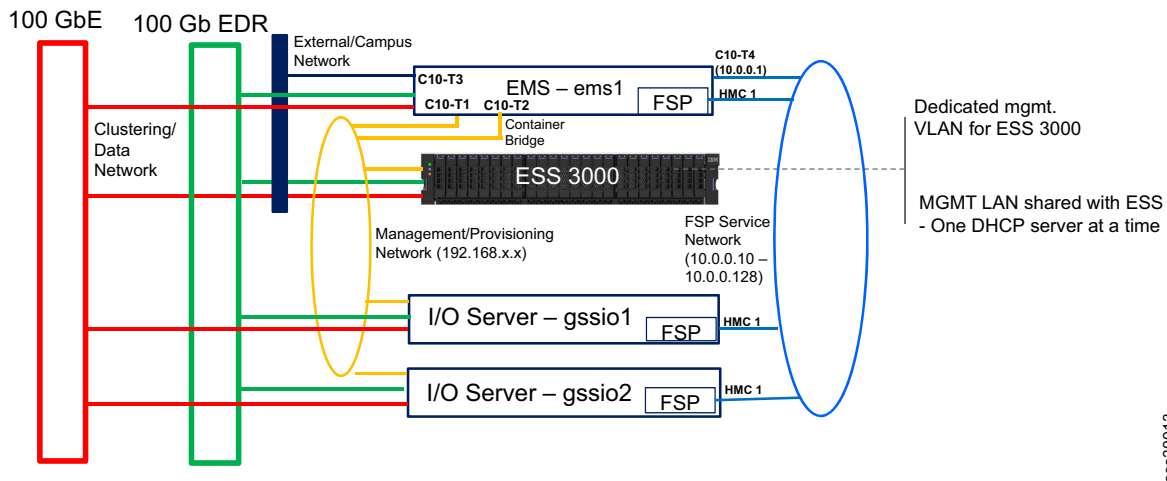


Figure 4. ESS 3000 Sharing Existing Networks

NVMe transport protocol in Elastic Storage System 3000

The Elastic Storage System 3000 systems uses the Non-Volatile Memory express (NVMe) drive transport protocol.

- NVMe is designed specifically for flash technologies. It is a faster, less complicated storage drive transport protocol than SAS.
- The NVMe-attached drives support multiple queues so that each CPU core can communicate directly with the drive. This avoids the latency and overhead of core-to-core communication, to give the best performance.
- NVMe offers better performance and lower latencies exclusively for solid-state drives through multiple I/O queues and other enhancements.

- High performance IBM Spectrum Scale RAID supports the following RAID code options: 3WayReplication, 4WayReplication, 8+2p, and 8+3p.
- The NVMe transport protocol supports industry standard NVMe flash drives.

Enterprise level software and support

ESS 3000 consists of two I/O server canisters that run the IBM Spectrum Scale software, which is a part of the IBM Spectrum Storage family. For more information on the IBM Spectrum Scale capabilities, see [IBM Spectrum Scale](#).

Enterprise level software and support is available based on the IBM Spectrum Scale software stack.

System hardware

An ESS 3000 enclosure contains NVMe flash drives and a pair of server canisters.

System topology

Figure 5 on page 18 shows hardware high-level architecture and topology.

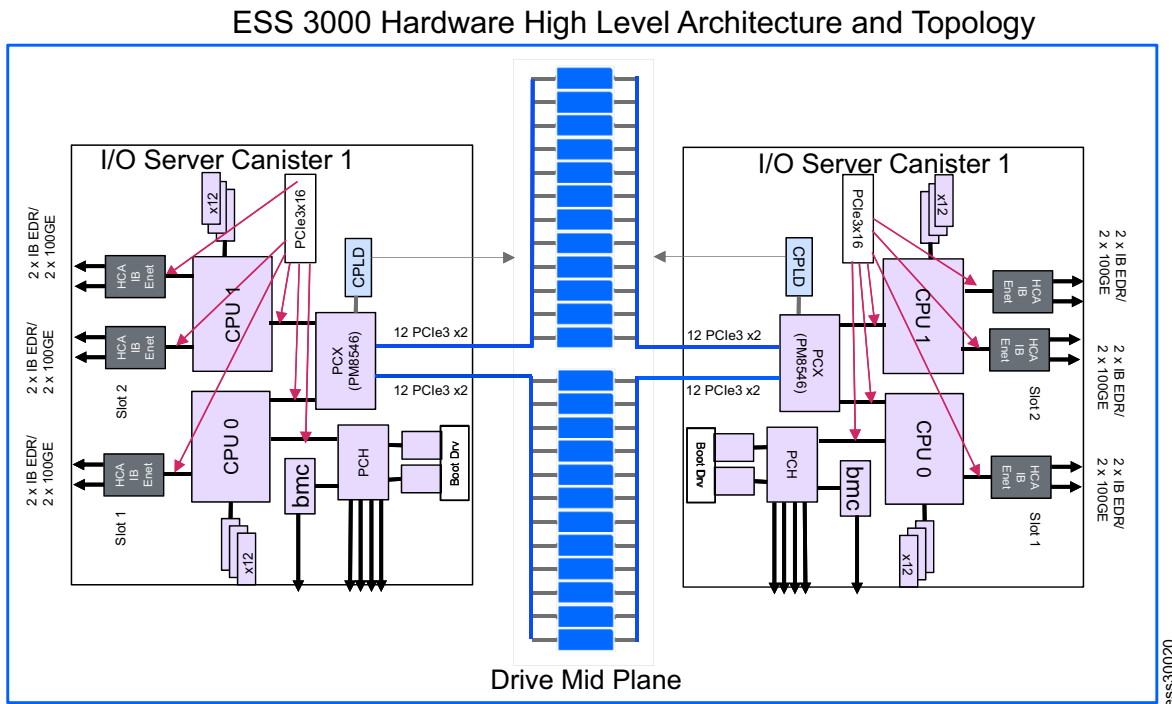


Figure 5. ESS 3000 High-level architecture and topology

EMS node

An EMS node is a management server that is required for each ESS system of one or more building blocks.

You need an EMS node as a part of your ESS system. The EMS node is ordered with the initial building block although you can use an existing customer system. The additional building blocks that are added to an existing building block do not require an additional EMS node. A single EMS node can support multiple building blocks in the same IBM ESS 3000 cluster.

You need a minimum of one EMS node (5148-21L) as a part of your ESS cluster. The EMS node can be ordered as a part of ESS 3000. When ESS 3000 is added to an existing ESS cluster that has a 5148-21L EMS node, the same EMS node can also be used to manage ESS 3000. In such a configuration, the existing EMS node must be upgraded to ESS 5.3.5 or later versions before an ESS 3000 building block can be added. For a new ESS 3000 customer, the EMS node is shipped with an already installed ESS 5.3.5. An

EMS node can manage many ESS building blocks that are part of the same ESS cluster. For more information on the EMS node, see [Model 5148-21L and 5148-22L server specifications](#).

The EMS node also serves as a third GPFS quorum node in a configuration with one building block.

System management

An EMS node in an ESS 3000 cluster provides system management functions. ESS 3000 GUI runs on the EMS nodes and provides management and health monitoring capabilities. The EMS node also runs a container with Ansible playbook that can provide orchestration of complex tasks, such as cluster configuration, file system creation, and code update. [Figure 6 on page 19](#) shows high-level view of system management topology.

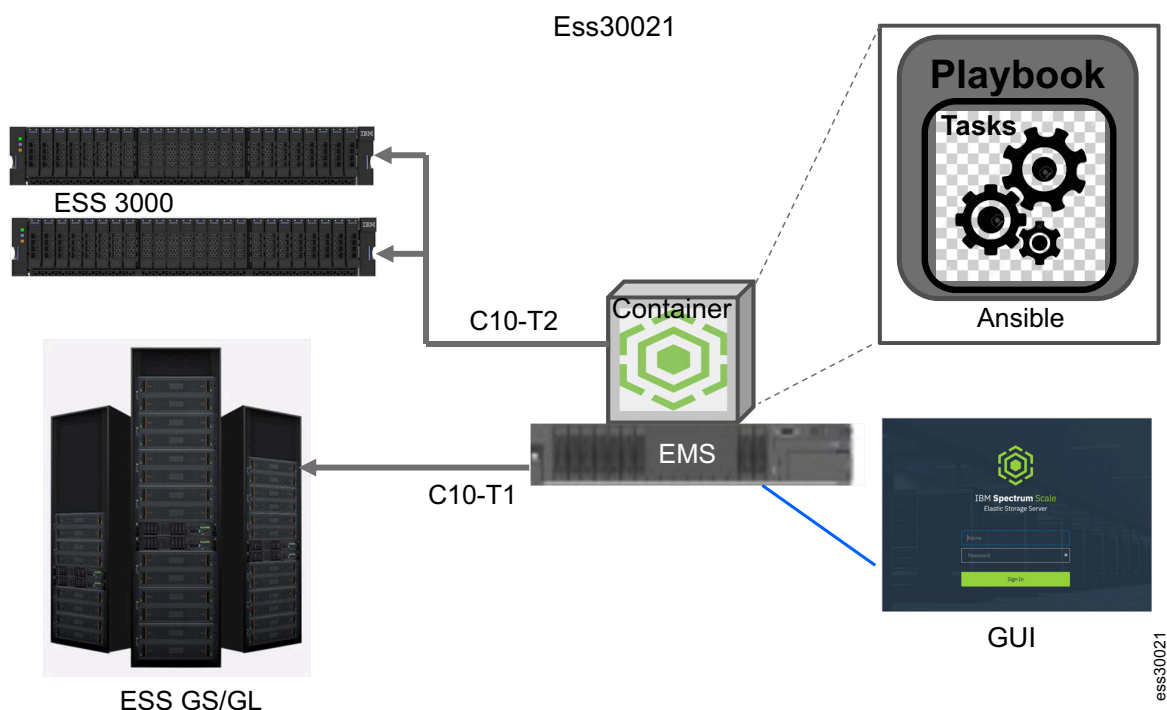


Figure 6. High-level view of system management

Drives

ESS 3000 supports industry-standard 2.5-inch NVMe-attached SSD drive options.

The following storage capacities are supported: 1.92 TB, 3.84 TB, 7.68 TB, and 15.36 TB.

Drives are hot swappable from front of the enclosure.

Drive slots

A drive slot represents the location in an enclosure into which a drive can be inserted.

Each drive slot must contain either a drive or an empty carrier. The empty carriers do not have drive indicators. The numbering scheme for the drive slots is indicated on the enclosure.

The following table graphically displays enclosures that have 24 drives, with 2.5-inch drive slots. The drive slots are arranged in one row of vertically mounted drive assemblies.

ESS 3000 supports 12 and 24 drive configurations. All drives must be identical in an ESS 3000 enclosure. In a 12 drive configuration, drives must be installed in slots 1- 6 and 13-18.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Power supply units

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

For redundancy, two PSUs are installed in the enclosure.

SSR access port

The SSR access port is a designated Ethernet port on the back panel of the canister that a service personnel can use to initialize a system.

You can use the SSR access port to do the following tasks:

- Check the hardware
- Set the IP address of the management interface

Each of the canisters in the Elastic Storage System 3000 has a 1 Gb Ethernet SSR access port, as shown in Figure 7 on page 20. Because canister 2 is inverted, the plug of the Ethernet cable also needs to be inverted to connect to the SSR access port.

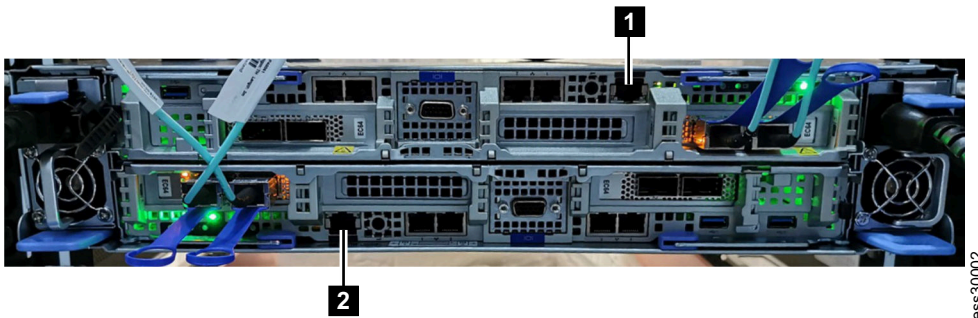


Figure 7. SSR access port

Hardware specification sheets

EMS node specifications

The ESS 3000 system uses one EMS node in the basic configuration. The EMS node acts as the management server and provides infrastructure for hardware monitoring and hosts GUI.

The EMS server has the following roles:

- Quorum node
- GUI server
- Call home (ESA) server

For more information on the EMS node, see [Model 5148-21L and 5148-22L server specifications](#).

Chapter 3. Planning for hardware

Before the IBM Service Support Representative (SSR) installs the system hardware, the customer must provide a plan that explains where and how the hardware will be installed, configured, and connected in the customer's storage area network. Ensure that the system's physical configuration records are easily accessible to be used as a reference as needed.

The customers have to work with the IBM technical team to plan for installation and deployment of ESS 3000.

Planning for site preparation

This information is intended to help you prepare your physical site for the installation of Elastic Storage System 3000. Marketing and installation planning representatives are also available to help you plan your installation. Proper planning for your new system facilitates a smooth installation and a fast system startup.

The use of the terms, “server”, “processor”, “system” and “all models” in the following information refer to the Elastic Storage System 3000.

Site preparation and physical planning

For detailed guidelines about site preparation and physical planning, see the [Site preparation and physical planning](#) document.

Planning for hardware installation

Before the IBM SSR installs the system, you must plan the physical configuration and the initial data configuration.

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

Important: The IBM SSR refers to these system configuration details when they perform the system installation, so it is important that these records are complete and accurate.

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.

If there are dependencies identified, you will need to resolve them before the IBM SSR installs your system hardware.

2. Use the [Table 21 on page 68](#) to identify the rack locations where the IBM SSR will install each enclosure.

Planning for racks

For detailed rack specification information on the 7965-S42 rack, see: [Planning for the 7965-S42 rack](#).

If you do not have a 7965-S42 rack and want to install the system into a non-IBM rack, see the [ESS 3000 requirements](#) topic. Ensure that the physical environment meet the specified requirements, such as rack space, power, and environmental conditions.

Reviewing Elastic Storage System 3000 location guidelines

Consult these guidelines when you plan the location of Elastic Storage System 3000 and any existing Elastic Storage System in your environment, including any IBM Spectrum Scale client or protocol node.

ESS 3000 contains two I/O server canister. Each ESS 3000 cluster consists of the following components:

- One or more ESS 3000 systems – each system requires 2U (standard rack units) in a rack
- One EMS node - requires 2U space in a rack
- 1 GbE or 10 GbE Network switch for management network - requires 1U in rack
- 100Gb High Speed IB or Ethernet network for internode communication – requires 1U space in rack

ESS 3000 model

The model contains two removable server canisters that have two CPUs.

- 5141-AF8 IBM Elastic Storage System 3000 that comes with a 3-year warranty.

Memory options for a new ESS 3000

Elastic Storage System 3000 uses the same memory features that control the initial amount of memory and subsequent memory upgrades.

Each CPU has twelve DIMM slots, for a total of 24 DIMM slots per server canister, which means 48 DIMM slots per enclosure. You can install two distinct memory configurations in those 48 DIMM slots.

Initially, every ESS 3000 ships with the ACG1 feature:

Feature	Memory per enclosure	Maximum per enclosure
ACG1	768 GB base cache memory (twenty-four 32GB DIMMs - 6 per CPU)	1

Memory upgrade options

You can order the following ACGB feature to upgrade to more memory at any time. ACGB can be ordered as either an MFI (factory install) or by post-sale MES upgrade (field install).

Table 3. Memory upgrade features		
Feature	Description	Maximum per enclosure
ACGB	768 GB memory upgrade (twenty-four 32GB DIMMs)	1

One upgrade feature ACGB can be added to an existing ACG1 feature to fully populate all memory DIMM slots.

Only one of the configurations has a DIMM in every available DIMM slot.

Valid locations to install each DIMM are shown in [Table 4 on page 23](#).

Memory configurations for each server canister

The following table shows the available memory configuration for each server canister. To ensure proper cooling and steady flow of air from the five fan modules in each server canister, "dummy" DIMMs must be inserted in any slot that does not contain a memory module.

<i>Table 4. Available memory configurations for a server canister</i>		
Total Memory per ESS 3000	768 GB	1,536 GB
Features	ACG1	ACG1 +ACGB
Slots for CPU1	Content of each DIMM slot	
A0	32 GB	32 GB
A1	dummy	32 GB
B0	32 GB	32 GB
B1	dummy	32 GB
C0	32 GB	32 GB
C1	dummy	32 GB
D0	32 GB	32 GB
D1	dummy	32 GB
E0	32 GB	32 GB
E1	dummy	32 GB
F0	32 GB	32 GB
F1	dummy	32 GB
Slots for CPU2	Content of each DIMM slot	
A0	32 GB	32 GB
A1	dummy	32 GB
B0	32 GB	32 GB
B1	dummy	32 GB
C0	32 GB	32 GB
C1	dummy	32 GB
D0	32 GB	32 GB
D1	dummy	32 GB
E0	32 GB	32 GB
E1	dummy	32 GB
F0	32 GB	32 GB
F1	dummy	32 GB

Dummy DIMMs are inserted for cooling purposes, to ensure a steady flow of air from the five fan modules in each server canister.

Note: When you start with base feature ACG1, there is only one available upgrade feature allowed. That is, upgrade feature kit ACGB.

Server canister orientation for inserting or removing DIMMs

The following Figure 8 on page 24 shows the CPU and the location of the DIMM slots. It shows one of the two server canisters for an IBM Elastic Storage System 3000 (5141-AF8), which is open and oriented for DIMM removal and replacement.

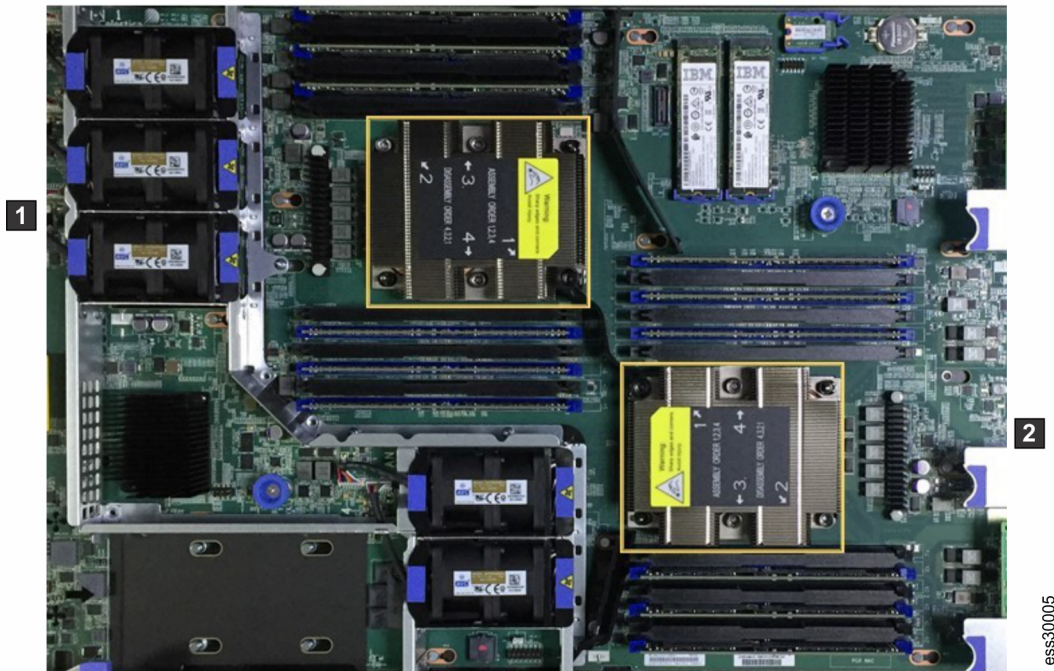


Figure 8. Location of CPUs and DIMM slots within the server canister

In the Figure 8 on page 24 figure, the server canister chassis is oriented with the three PCIe HBAs in card risers to the right (rear). Three fan modules to the left sit atop the NVMe-attached Flash drives at the front of the server canister.

In the Figure 8 on page 24, **1** indicates the front of the I/O server canister and **2** indicates the rear of the I/O server canister.

The following figure shows a proper orientation for the server canister that an IBM SSR would use to remove or replace a DIMM because it shows the labels in a way they are easily read.

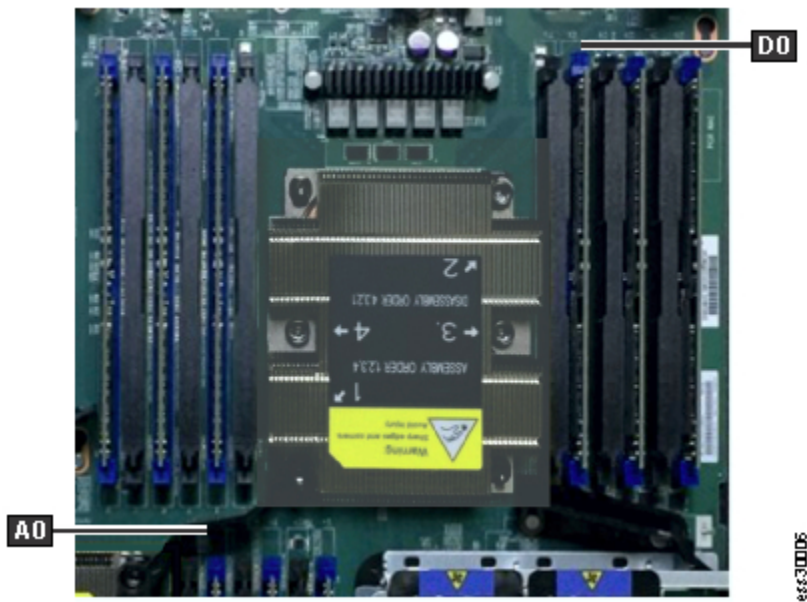


Figure 9. DIMM slots

Closeup view of DIMM slot labeling

White-lettered labeling on the printed circuit board identifies the DIMM slots. In [Figure 10 on page 25](#), slots C0, C1, and B0 are shown.

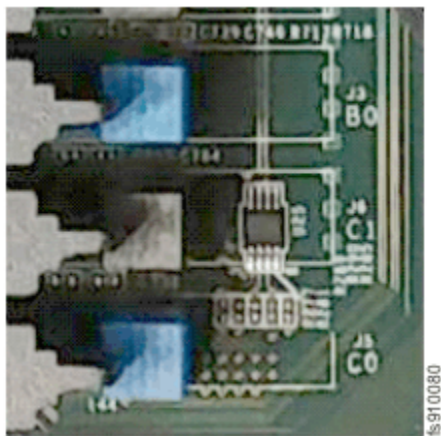


Figure 10. DIMM slot labels printed in white on the circuit board of the server canister

Planning for power for server canister

Each enclosure is provided power through two power supplies. Either of the power supply unit can power the enclosure independently if there is a loss of input power to the other power supply in the enclosure.

Plan to connect the power cords of the power supplies on the left side of the enclosures (when viewed from the rear) to one power source, and connect the power cords of the power supplies on the right side of the enclosures to another power source.



Attention: The power cord is the main power disconnect. Ensure that the socket outlets are located near the equipment and are easily accessible.

[Figure 11 on page 26](#) shows the back of a Elastic Storage System 3000. Each PSU is located on the sides of ESS 3000.



Figure 11. Rear view of an Elastic Storage System 3000

Planning for cable connections to PDUs

Each enclosure must be connected to a pair of power outlets by selecting appropriate feature codes while ordering the system. The following table lists the feature codes of the power cords:

Table 5. Power cord feature codes	
Feature codes	Description
6458	Power Cord 4.3m (14-ft), Drawer to IBM PDU, (250V/10A) with C13/C14 connectors
6671	Power Cord 2.7m (9-ft), Drawer to IBM PDU (250V/10A) with C13/C14 connectors
6672	Power Cord 2m (6.5-ft), Drawer to IBM PDU (250V/10A) with C13/C14 connectors
6665	Power Cord 2.8m (9.2-ft), Drawer to IBM PDU (250V/10A) with C19/C20 connectors



Attention: Ensure that sufficient power supply circuits are available to provide the total power requirements of the equipment that is connected to each power supply circuit.

Planning for power for EMS node (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_rpower_51x.htm)

Determining your power requirements (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_power.htm?view=kc)

Server Information Form 3A (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_form3a.htm?view=kc)

Workstation Information Form 3B (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_form3b.htm?view=kc)

Plugs and receptacles (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_plugs.htm?view=kc)

Supported PDU power cords (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_pdupowercords.htm?view=kc)

Modification of IBM-provided power cords (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_cordmod.htm?view=kc)

Uninterruptible power supply (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_ups.htm?view=kc)

Power distribution unit and power cord options for 0551, 0553, 0555, 7014, 7953, and 7965 racks (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_specsheetpdu.htm?view=kc)

Calculating the power load for 7188 or 9188 power distribution units (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_pdloadcalculator.htm?view=kc)

Planning for cables (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_cables_51x.htm)

EMS node

Cable management

Power cord routing and retention (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_cordretention.htm?view=kc)

2U canister

System calculators (https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_systemcalculators_51x.htm)

Physical installation planning

Before you set up your system environment, you must verify that the prerequisite conditions for the system are met.

This information applies to the supported hardware components. Answer the following questions before you start the installation process.

- Does your physical site meet the environment requirements for your system?
- Do you have adequate rack space for your hardware?

The system requires two Electronic Industries Alliance (EIA) units for each ESS 3000.

- Do the power circuits you are planning to use have sufficient capacity and the correct sockets for your installation?

- A clearly visible and accessible emergency power off switch is required.
- For redundancy, two independent power circuits are required. One circuit connects to each power supply in each enclosure.
- Have you provided appropriate connectivity by preparing your environment?

Operating environment

To use the system, you must meet the minimum hardware and software requirements and ensure that the other operating environment criterias are met.

Supported hosts

IBM Spectrum Scale needs to be installed on the host server before it is connected to ESS 3000. IBM Spectrum Scale provides the high-performance scale-out clustering capabilities. For a list of supported host type and OS, see the [IBM Spectrum Scale Frequently Asked Questions](#).

User interfaces

The system provides the following user interfaces:

- The management GUI, which is a web-accessible graphical user interface (GUI) that supports flexible and rapid access to storage management information. The ESS 3000 GUI also provides a Directed Maintenance Procedure (DMP) for drive replacement.
- A command-line interface (CLI) that uses Secure Shell (SSH).

ESS 3000 requirements

Before you install a system, your physical environment must meet certain requirements. This includes verifying that adequate space is available and that requirements for power and environmental conditions are met.

Safety notices

Use the following general safety information for all rack-mounted devices:

DANGER:

Observe the following precautions when working on or around your IT rack system:

- **Heavy equipment–personal injury or equipment damage might result if mishandled.**
- **Always lower the leveling pads on the rack cabinet.**
- **Always install stabilizer brackets on the rack cabinet.**
- **To avoid hazardous conditions due to uneven mechanical loading, always install the heaviest devices in the bottom of the rack cabinet. Always install servers and optional devices starting from the bottom of the rack cabinet.**
- **Rack-mounted devices are not to be used as shelves or work spaces. Do not place objects on top of rack-mounted devices.**



- **Each rack cabinet might have more than one power cord. Be sure to disconnect all power cords in the rack cabinet when directed to disconnect power during servicing.**
- **Connect all devices installed in a rack cabinet to power devices installed in the same rack cabinet. Do not plug a power cord from a device installed in one rack cabinet into a power device installed in a different rack cabinet.**
- **An electrical outlet that is not correctly wired could place hazardous voltage on the metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. (R001 part 1 of 2)**



CAUTION:

- Do not install a unit in a rack where the internal rack ambient temperatures will exceed the manufacturer's recommended ambient temperature for all your rack-mounted devices.
- Do not install a unit in a rack where the air flow is compromised. Ensure that air flow is not blocked or reduced on any side, front, or back of a unit used for air flow through the unit.
- Consideration should be given to the connection of the equipment to the supply circuit so that overloading of the circuits does not compromise the supply wiring or overcurrent protection. To provide the correct power connection to a rack, refer to the rating labels located on the equipment in the rack to determine the total power requirement of the supply circuit.
- (For sliding drawers) Do not pull out or install any drawer or feature if the rack stabilizer brackets are not attached to the rack. Do not pull out more than one drawer at a time. The rack might become unstable if you pull out more than one drawer at a time.
- (For fixed drawers) This drawer is a fixed drawer and must not be moved for servicing unless specified by the manufacturer. Attempting to move the drawer partially or completely out of the rack might cause the rack to become unstable or cause the drawer to fall out of the rack. (R001 part 2 of 2)

Important: In addition, remember:

- The rack design must support the total weight of the installed enclosures and incorporate stabilizing features suitable to prevent the rack from tipping or being pushed over during installation or normal use.
- The rack must not exceed the maximum enclosure operating ambient temperature of 32-degrees C, using any optical cable or discrete optical transceiver, including all Ethernet (100 Gb) cables and InfiniBand (100Gb EDR) that are ≥ 3 meter in length. However, when you are using the copper cable, the maximum ambient operating temperature can be 35-degrees C, including all Ethernet and InfiniBand cables < 3 meter in length.

In particular, the rack front and rear doors must be at least 60% perforated to enable sufficient airflow through the enclosure. If there is less airflow, additional mechanisms are required to cool the enclosure. An appropriate IBM rack configuration would be the 7014-T42 IBM Rack Model T42, with standard rear door and feature code 6069 Front Door For 2.0 Meter Rack (High Perforation).

- The rack must have a safe electrical distribution system. It must provide overcurrent protection for the enclosure and must not be overloaded by the total number of enclosures installed. The electrical power consumption rating that is shown on the nameplate should be observed.
- The electrical distribution system must provide a reliable ground for each enclosure in the rack.

Power requirements for each power supply (two per enclosure)

Ensure that your environment meets the following power requirements.

Table 6. System power specifications				
Product	Power Supplies	Inlet	Watts	
5141-AF8	2	C14	1300	

To aid in power and cooling requirements planning, [Table 7 on page 30](#) lists the rating of each power supply unit (PSU) by enclosure.

The power that is used by the system depends on various factors, including the number of enclosures and drives in the system and the ambient temperature.

Table 7. Power specifications per power supply				
Model and type	PSU	Input power requirements	Maximum input current	Maximum power output
Elastic Storage System 3000	2000 W (2)	200 V to 240 V single phase AC At a frequency of 50 Hz or 60 Hz IEC C14 standardized	10A (x2)	2000 W

The power and thermal measurements that are shown in [Table 8 on page 30](#) were obtained in the specific operating environment.

Table 8. Power consumption examples per enclosure			
Model and type	Configuration	Total power consumption	Caloric value (BTU/hr)
Elastic Storage System 3000 5141-AF8	1 enclosure with up to 24 dual port NVMe drives, 3 host adapters	1632 W	5570

Note: These measurements are presented as an example. Measurements that are obtained in other operating environments might vary. Conduct your own testing to determine specific measurements for your environment.

Each Elastic Storage System 3000 enclosure contains two PSUs for redundancy. The total power consumption values represent the total power that is drawn by both PSUs.

Environmental requirements

System airflow is from the front to the rear of each enclosure:

- Airflow passes between drive carriers and through each enclosure.
- The combined power and cooling module exhausts air from the rear of each canister.

Ensure that your environment falls within the ranges that are listed in the [Table 9 on page 31](#).

Environment	Ambient temperature	Altitude	Relative humidity
Operating	5°C to 32°C ¹ (41°F to 90°F)	0 - 3048 m ^{2, 3} (0 - 10000 ft)	8% to 80% non-condensing
Non-operating	1°C to 50°C (34°F to 122°F)	-305 to 12192 m (-1000 to 40000 ft)	8% to 80% non-condensing
Storage	1°C to 60°C (34°F to 140°F)		5% to 80% non-condensing
Shipping	-40°C to 60°C (-40°F to 140°F)		5% to 100% condensing, but not precipitating

Note:

- – Max Ambient Temperature Environment = 32C / 950 m
- – Max Altitude Environment = 25C / 3,050 m
- – Decrease the maximum air temperature by 1 degree C per 300 m above 950 m.
- The maximum ambient operating temperature when using an optical cable or discrete optical transceiver is 32C, which includes all Ethernet (100Gb) cables and InfiniBand (100Gb EDR) that are greater than or equal to 3 meter in length. The maximum ambient operating temperature when using only copper cable is 35C, which includes all Ethernet and InfiniBand cables less than 3 meter in length.

Dimensions and weight requirements for rack installation

Ensure that space is available in a standard 19" rack that is capable of supporting the enclosure. The rack rail kit supports racks with threaded round and square rail mounting holes. The following table lists the dimensions and weights of the enclosures:

Enclosure	Height	Width	Depth	Maximum weight	
				Drive ready (without drive modules)	Fully configured (with drive modules)
Elastic Storage System 3000 with 24 drive slots	87 mm (3.46 in.)	483 mm (19.0 in.)	850 mm (33.5 in.)	44.85 kg (98.87 lb)	49.65 kg (109.46 lb)

CAUTION:



or



or



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)

The following table shows the rack space requirements for ESS 3000 in tabular form:

Table 11. Rack space requirements for the Elastic Storage System 3000	
Minimum rail length	Maximum rail depth
670 mm (26.38 in.)	870 mm (34.25 in.)

Service clearance for Elastic Storage System 3000

The service clearance area is the area around the rack which is needed for the authorized service representatives to service the enclosure as shown in the sample illustration in the [Figure 12 on page 32](#).

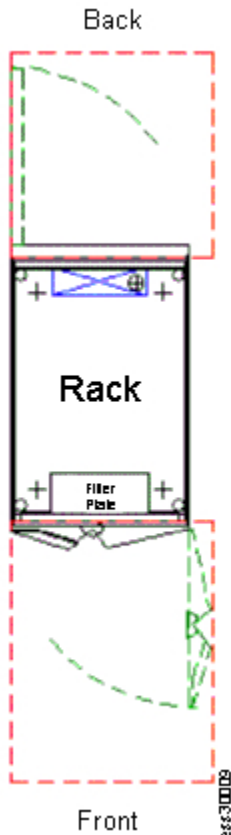


Figure 12. Sample illustration to show space around the rack

For Elastic Storage System 3000, use the recommended measurements that are given in the [Table 12 on page 32](#).

Table 12. Service clearance requirements	
Front ¹	Back
1200 mm (47 in.)	1000 mm (39 in.)

Table 12. Service clearance requirements (continued)	
Front ¹	Back
¹ Storage racks require larger service clearances in the front of the rack.	

For more information on the layout of the room, see [Computer room layout](#)

See the [Site preparation and physical planning](#) section to help you prepare your physical site for the installation of Elastic Storage System 3000.

Additional space requirements

Ensure that these additional space requirements, as shown in [Table 13 on page 33](#), are available around the enclosures.

Table 13. Clearances		
Location	Additional space requirements	Reason
Left and right sides	50 mm (2 in.)	Cooling air flow
Back	Minimum: 100 mm (4 in.)	Cable exit

Supported drives

[Table 14 on page 33](#) provides drive specifications for your Elastic Storage System 3000 system.

Table 14. Drive specifications	
Model and type	2.5-inch drives
Elastic Storage System 3000 with 24 2.5-inch drive slots	24 dual port NVMe drives (1.92 TB, 3.84 TB, 7.68 TB, 15.36 TB)

Acoustical declaration with noise hazard notice

[Figure 13 on page 34](#) indicates the declared noise emissions values in accordance with ISO 9296.

SSRs must be enrolled in a hearing conservation program and use hearing protection when servicing the system.

Declared noise emission values in accordance with ISO 9296 ⁽¹⁻⁵⁾						
Product description 5141-AF8	Declared A-weighted sound power level, $L_{WA,m}$ (B)		Declared A-weighted emission sound pressure level, $L_{pA,m}$ (dB)		Statistical adder for verification, K_v (B)	
	Operating	Idling	Operating	Idling	Operating	Idling
Principal configuration: Single 2U ESS 3000 enclosure in a rack 25 degrees C, 500m	7.8 ⁽⁶⁾	7.8 ⁽⁶⁾	74	74	0.3	0.3
Maximum configuration: Single 2U ESS 3000 enclosure in a rack 27 degrees C, 500m	8.0 ⁽⁶⁾	8.0 ⁽⁶⁾	77	77	0.3	0.3
Maximum configuration: Single 2U ESS 3000 enclosure in a rack Maximum fan speeds, Worst-case ambient	8.6 ⁽⁶⁾	8.6 ⁽⁶⁾	83	83	0.3	0.3
Notes:						
1. Declared level $L_{WA,m}$ is the upper-limit A-weighted sound power level; Declared level $L_{pA,m}$ is the mean A-weighted sound pressure level measured at the 1-meter bystander positions.						
2. 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 will be 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 $(L_{WA,m} + K_v)$.						
3. The quantity $L_{WA,c}$ (formerly called $L_{WA,d}$), can be computed from the sum of $L_{WA,m}$ and K_v .						
4. All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.						
5. B, dB, abbreviations for bels and decibels, respectively. 1 B = 10 dB.						
6. Notice: Government regulations (such as those prescribed by OSHA or European Community Directives) may govern noise level exposure in the workplace and may apply to you and your server installation. The actual sound pressure levels in your installation depend upon a variety of 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 a variety of additional 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.						

ess30007

Figure 13. Acoustical Declaration with Noise Hazard Notice

Shock and vibration specifications for Elastic Storage System 3000 enclosures

Table 15 on page 35 and Table 16 on page 35 provide the shock and vibration testing results for your Elastic Storage System 3000 system.

Table 15. Shock testing results		
Shock categories	Test level	Performance
Operational	5 g 10 ms 1/2 Sine	<=25 g 10 ms
Non-operational	30 g 10 ms 1/2 Sine	<=75 g 11 ms

Table 16. Vibration testing results		
Vibration categories	Test level	Performance
Operational	0.21 grms 5-500 Hz Random	Throughput loss <=10% FCAL <= 0.68 grms
Non-operational	1.04 grms 2-200 Hz Random	<=3.12 grms
Shipping	0.3 g 2-200 Hz Sine	<=5 g
Rotational vibration	Normal operation performance measurements in enclosure with no external vibration.	Throughput loss for all drives of the same type within performance profile.

IP address allocation and usage

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

ESS 3000 uses 100GbE/100Gb EDR network for cluster communication and data transport. For IP port usage requirement, see [IBM Spectrum Scale Knowledge Center](#).

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 or file module. The storage system also has a management IP address, which is known as the *system IP address*. 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 as 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 high availability

IBM Spectrum Scale can provide rack level redundancy and stretched cluster using file system data replication. AFM-DR can be used for site-level disaster recovery. For more details, see [IBM Spectrum Scale Knowledge Center](#).

Storage configuration planning

ESS 3000 provides optimal configuration of IBM Spectrum Scale RAID. For further customization, see [IBM Spectrum Scale RAID Administration guide](#).

Planning your network and storage network

You need to plan to provide the network infrastructure and the storage network infrastructure that your system requires.

ESS GUI can be configured to provide event notifications.

Planning for 100 Gbps adapter

Review the pre-requisite system requirements and installation considerations before deployment.

It is helpful to be familiar with the following term when you are considering the features of the 100 Gbps adapter for these connections.

Remote Direct Memory Access (RDMA)

RDMA is a networking standard that allows the adapters to transfer data directly to or from the endpoints in a connection without using CPU resources on either of the endpoints. These transfers occur simultaneously with other system operations and do not impact overall system performance. When the system performs an I/O operation over an RDMA-based connection, data is sent directly to the network, which reduces latency and increases the speed of data transfers.

Review the following elements when you are deciding to install the 100 Gbps adapters:

- The following adapters are available:
 - 2-port 100 Gbps Ethernet adapter
 - 2-port 100 Gbps InfiniBand adapter
- Each canister has a four-port 10 Gbps interface. Port 1 is used for management functions. There is an additional port, the SSR service port - 1Gbps, which is used by the SSR to check hardware and set the IP address. During production, the customer will use the high-speed network links (100Gb Ethernet or 100Gb InfiniBand) to serve the IBM Spectrum Scale cluster file system.

Planning for cables

Connections for Elastic Storage System 3000

Care must be taken to note the orientation of each server canister in Elastic Storage System 3000 so that the interconnect cables are properly connected.

Elastic Storage System 3000 contains two server canisters. A label on ESS 3000 identifies each server canister and power supply unit (PSU). As [Figure 14 on page 36](#) shows, server canister 1 is on the top and server canister 2 is on the bottom. Because the server canisters are inverted, the location of the ports and the numbering of the ports are oriented differently on each server canister. It is important to remember this orientation when you are installing adapters and cables.

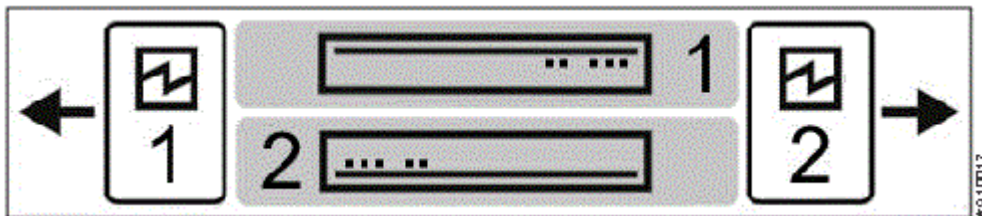


Figure 14. Label showing the orientation of the server canisters and PSUs

For example, [Figure 15 on page 36](#) shows the top server canister. On this canister, the numbering of the PCIe slots and ports goes from right to left.

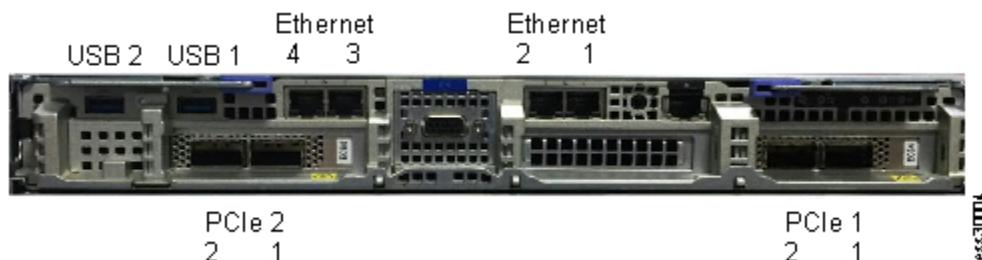


Figure 15. Orientation of ports on server canister 1

Figure 16 on page 37 shows the bottom server canister. This server canister has the same type and number of adapters installed. However, on the bottom canister, the numbering of the PCI slots and ports goes from left to right.

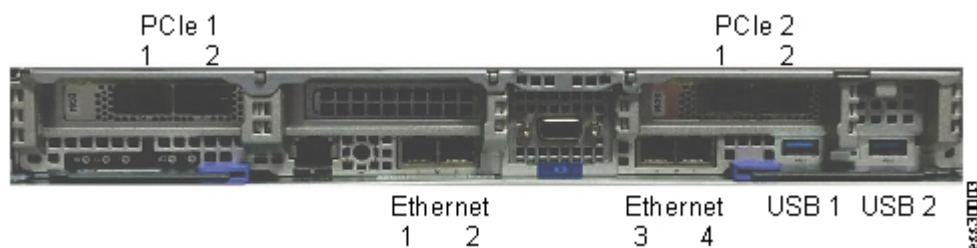


Figure 16. Orientation of ports on server canister 2

First port (Ethernet 1) of the four 10 Gbps Ethernet ports on each server canister provides system management connections. The onboard 10 Gbps Ethernet ports use RJ-45 connections, not optical connections. The 10 Gbps ports operate at 1 Gbps when connected to a 1 Gbps switch. A separate technician port provides access to each I/O server canister for hardware check and setup. Table 17 on page 37 describes each port.

Table 17. Summary of onboard Ethernet ports		
Onboard Ethernet Port	Speed	Function
1	1 Gbps/10 Gbps	Function Management IP
2	10 Gbps	Not used
3	10 Gbps	Not used
4	10 Gbps	Not used
TP (Technician Port)	1 Gbps	Fixed IP address from factory for service and hardware configuration Bottom canister: 10.0.0.101 Top canister: 10.0.0.102 User id: essserv1 Password: - Bottom canister - {Serial # of enclosure} A - Top canister - {Serial # of enclosure} B Example: Enclosure serial AH23P01 - Bottom canister password: AH23P01A - Top canister password: AH23P01B Serial number of the enclosure can be obtained from the front tag located at the left side of the enclosure.

Make the following connections for Elastic Storage System 3000:

- Each ESS 3000 system requires two Ethernet cables to connect it to an Ethernet switch. One cable connects to port 1 of the top server canister, and the other cable connects to port 1 of the bottom

server canister. For 10 Gbps ports, it can auto negotiate with the minimum link speed of 1 Gbps. Only Internet Protocol Version 4 (IPv4) is supported.

Each ESS 3000 server canister also has three PCIe interface slots to support optional host interface adapters. The host interface adapters can be supported in any of the interface slots. [Table 18 on page 38](#) provides an overview of the host interface adapters.

Table 18. Summary of supported host interface adapters				
Protocol	Feature	Ports	FRU part number	Quantity supported
100 Gb EDR Infiniband	EC64	2	00WT176	0-3
100 Gb Ethernet (RoCE)	EC67	2	01FT742	0-3
Note: Each server canister within the ESS 3000 system (building block) must be configured with the same host interface adapters.				

Planning for adapters

Elastic Storage System 3000 contains two server canisters. Each server canister has three PCIe interface slots to support extra adapters. InfiniBand and Ethernet adapters are supported in any of the interface slots. In addition, each server canister contains four Onboard Ethernet ports and one SSR access port.

Important: Both server canisters in an ESS 3000 system (same build block) must be configured with the same adapters.

Note: The server canister in the upper slot (slot 1) of ESS 3000 is inverted, so the adapter slots and port numbers are numbered from right to left. The adapters and ports of the server canister in the lower slot (slot 2) are numbered left to right.

Supported environment

Refer to the [IBM support website](#) for up-to-date information about the supported environment for your system.

Environmental topics can include updates about the following items:

- Host attachments
- Physical disk storage systems
- Host bus adapters
- Switches
- Firmware levels
- Other support hardware

Chapter 4. Installing

This section covers topics on how to rack, stack, unpack, and install an ESS 3000 system. It also guides the customer on how to fill out the installation worksheet.

The SSR can refer to the [“Elastic Storage System 3000 installation \(SSR task\)”](#) on page 51 topic to perform a hardware checkout and set the management interface IP.

Note: Much of the information in this section is intended only for IBM authorized service providers. Customers need to consult the terms of their warranty to determine the extent to which they should attempt any IBM® Elastic Storage System maintenance.

Tasks to be done by the Customers or an IBM service support representatives (SSR) have been marked accordingly in this chapter.

Installation overview

The installation and initial configuration of your system is carried out by an IBM Service Support Representative (SSR), following the plan that you provide to them.

Network switch VLAN instructions

For information on setting up the management switch, see the [Switch VLAN configuration instructions](#).

Note: An IBM intranet connection is required.

Hardware installation tasks performed by an IBM SSR

Note: For new ESS customers, an EMS node is required and connections must be made from C10-T1 and C10-T2 to the management network VLAN. For an existing ESS customer, the SSR must add the new connection from C10-T2 to the management network VLAN. For more information on port locations, see [“Installation worksheet”](#) on page 63.

To install the Elastic Storage System 3000 hardware, an IBM SSR must complete the following tasks:

Important: You must complete the planning tasks and provide completed worksheets to the IBM SSR before they can proceed with installing and initializing your system.

1. An IBM SSR unpacks and installs the 5141- AF8 system in the rack.
2. Referring to the worksheets that the customer provided, the IBM SSR completes the cabling.

Initial setup tasks performed by an IBM SSR

After the hardware is installed, an IBM SSR connects a workstation to a 5141-AF8 system (including EMS) SSR access port and completes the following tasks (as the **essserv1** user using the **essutils** tool):

1. Perform SSR tasks listed in the SSR panel within the **essutils** tool.
2. Configure IP address of the management port.

For more information on port locations, see [“Installation worksheet”](#) on page 63.

For information on how to update the software level, see the Quick Deployment Guide in the IBM Elastic Storage System (ESS) 3000 Knowledge Center.

Detailed installation steps (SSR task)

This section is intended for IBM authorized service personnel only. IBM service support representatives can access service installation information through the links in the following topics.

Note: An IBM intranet connection is required.

ESS system view

Components required to set up EMS

For information on the components required to set up EMS, see [Before Installation \(Sections 1 through 8\)](#).

ESS system network connection diagram

For information on the ESS system network connection diagram, see [Section 2.3.1 - ESS network connection diagrams](#).

Management Server description and feature table

For information on the Management Server description and feature table, see [Section 2.3.2 - 5148-21L Management Server description and feature table](#).

Technical and Delivery Assessments (TDAs)

For information on the Technical and Delivery Assessments (TDAs), see [Section 3.1 - ESS - Technical and Delivery Assessments \(TDAs\)](#).

Rack details

Rack Placement Table for 5148-21L

For information on the rack placement table for 5148-21L, see [B.1 - Rack Placement Table for 5148-21L](#).

Empty Rack Diagram

For information on the empty rack diagram, see [B.2 - Empty Rack Diagram](#).

Prepare the rack for installation work

For information on preparing the rack for installation work, see [Section 10.1 - Prepare the rack for installation work](#).

Verify the position and installation of new system racks

For information on verifying the position and installation of new system racks, see [Section 10.2 - Verify the position and installation of new system racks](#).

Installing the EMS server in a rack

The instructions to install an EMS server on a rack are same as the installation of 8247-21L. The details are mentioned [here](#).

Unpacking Elastic Storage System 3000 (IBM SSR task)

Before you unpack Elastic Storage System 3000 , ensure that you have reviewed and followed all the related instructions.

The ESS 3000 system and related parts are shipped pre-installed in the enclosure:

- The ESS 3000 system comes pre-installed with the following components:

- Two server canisters with adapters, memory feature codes.
- Two power supplies and two power interposers
- 12 or 24 disks
- Rail kit including left and right rails, eight securing screws, and eight locating pins
- Two power cables

Note: You will need a box knife to unpack the ESS 3000 system.



CAUTION: To lift the assembled enclosure, three persons are required unless a suitable lifting equipment is available or the enclosure is unpacked and dismantled as described in the procedure.

Perform the following steps to unpack the ESS 3000 system:

1. Cut the box tape and open the lid of the shipping carton.
2. Remove the rail kit box and set them 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 ESS 3000 system.
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. Carefully cut open the bag covering the rear of the enclosure.
9. Remove the left power supply unit (PSU) from the enclosure.
10. Record the last six digits of the serial number on the back of the power supply, and then set the power supply aside.
11. Remove the right PSU, record its serial number, and set it aside.
12. Remove the left power interposer from the enclosure.
13. Record the last six digits of the serial number on the power interposer, and then set it aside.
14. Remove the right power interposer, record its serial number, and set it aside.
15. Remove the upper server canister from the enclosure.
16. Record the serial number on the canister release handle, and then set the canister aside.
17. Remove the lower server canister, record its serial number, and set it aside.
18. Lift the enclosure from the shipping carton.

Installing support rails for the ESS 3000 system (IBM SSR task)

Before you install the ESS 3000 system, you must first install the support rails for it.

To install the support rails for the ESS 3000 system, complete the following steps:

1. Locate the ESS 3000 system rails ([Figure 17 on page 42](#)).

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

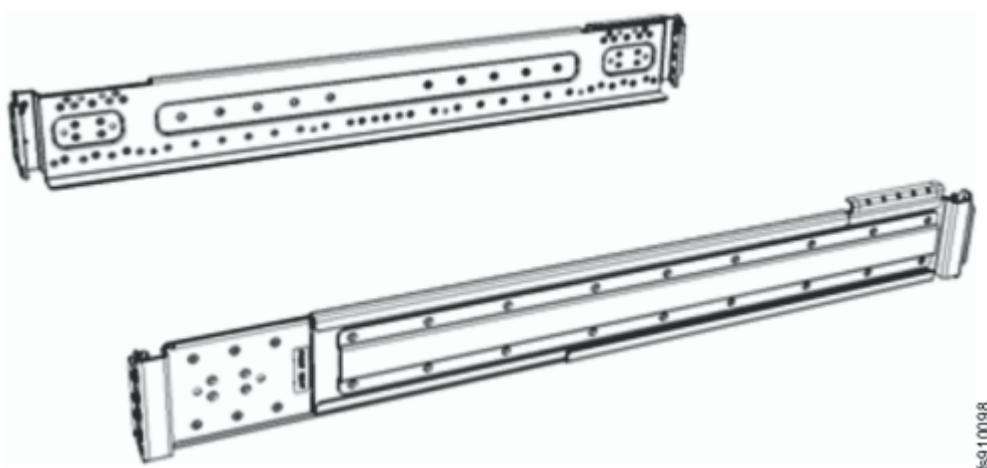


Figure 17. ESS 3000 system support rails

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.

Figure 18 on page 42 shows two rack units with the front mounting holes identified.

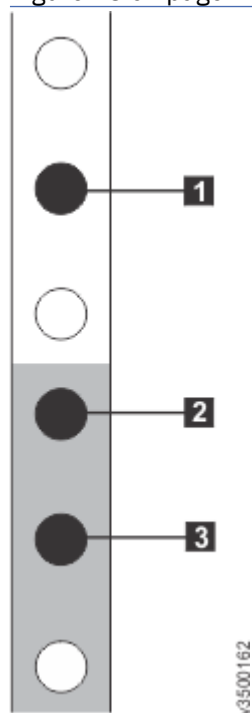


Figure 18. Hole locations in the front of the rack

- **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 pre-installed (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 [Table 19 on page 43](#)).

Table 19. Selecting bracket pins for your rack	
Mounting holes	Bracket pins
Round, unthreaded	Use the pre-installed 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.
(See [Figure 19](#) on [page 43](#).)

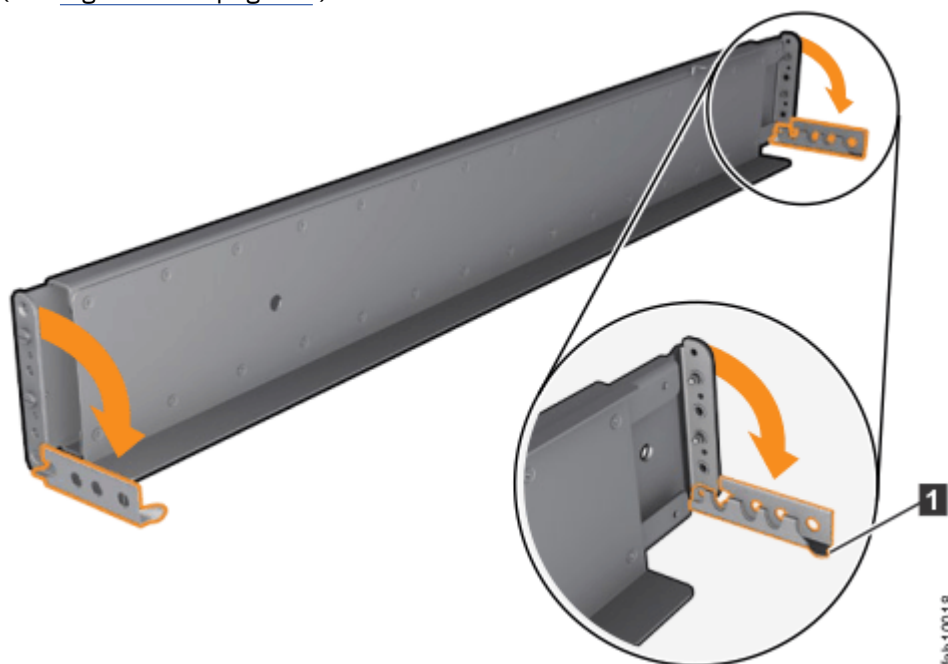


Figure 19. Opening the hinge brackets

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.
(See [Figure 20](#) on [page 43](#).)

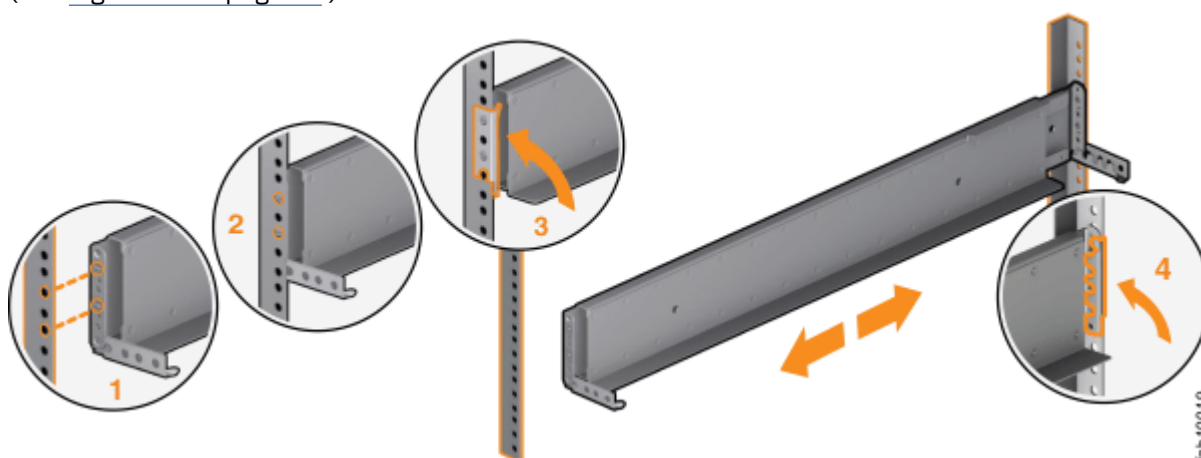


Figure 20. Closing the hinge brackets

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.

(See [Figure 20](#) on [page 43](#).)

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.
12. Repeat the procedure to install rails for each additional ESS 3000 system.

Installing enclosures (IBM SSR task)

Following your enclosure location plan, install the ESS 3000 system.



CAUTION:

- To lift an ESS 3000 system requires at least three people.
- Install an ESS 3000 system only onto the ESS 3000 system rails supplied with the enclosure.
- Load the rack from the bottom up to ensure rack stability. Empty the rack from the top down.

To install an enclosure, complete the following steps:

1. On either side of the drive assemblies, remove the enclosure end caps by grasping the handle and pulling the bottom of the end cap free, then clearing the tab on the top of the enclosure.

(See [Figure 21](#) on [page 44](#).)

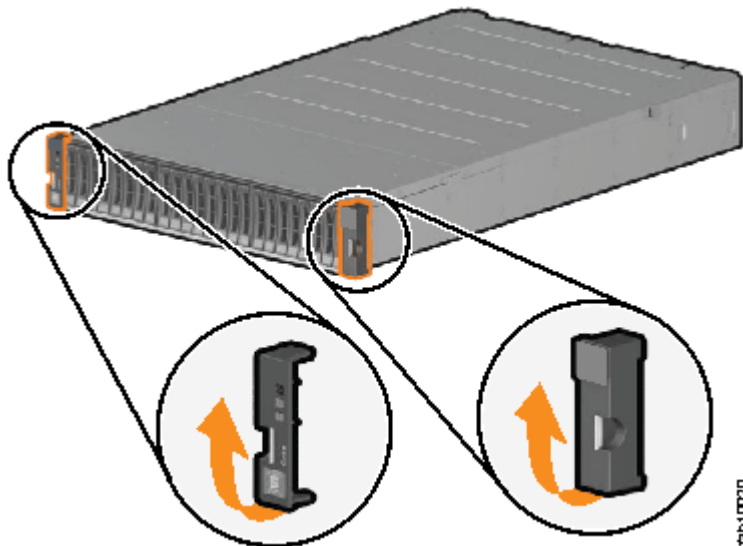


Figure 21. Removing enclosure end caps

2. Align the enclosure with the front of the rack cabinet.
3. Slide the enclosure into the rack along the rails until the enclosure is fully inserted. (See [Figure 22](#) on [page 45](#).)

Note: The rails are not designed to hold an enclosure that is partially inserted. The enclosure must always be in a fully inserted position. The ESS 3000 system must be installed only on the supplied ESS 3000 system rails. Do not install an ESS 3000 system on expansion enclosure rails.

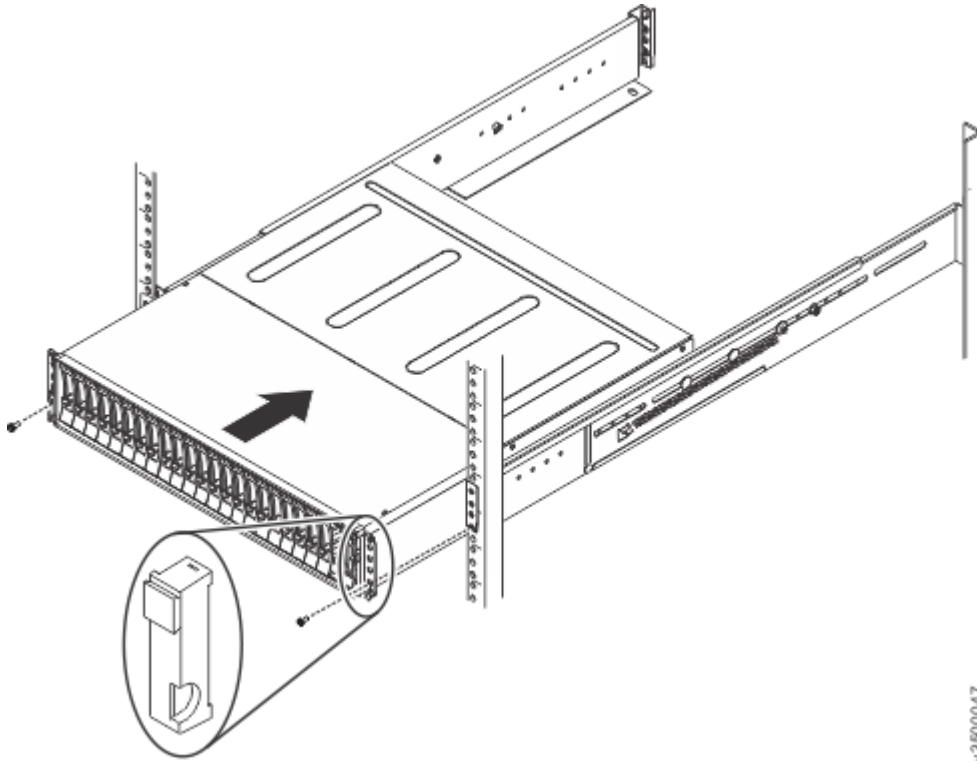


Figure 22. Inserting the enclosure

4. Secure each flange on the front of the enclosure with two black M5 screws.
(See [Figure 22](#) on [page 45](#).)

Some enclosures are secured by one silver captive screw and one black M5 screw on each flange. In this case, align the enclosure, fasten the two captive screws, and then fasten the two M5 screws. See [Figure 23](#) on [page 45](#)

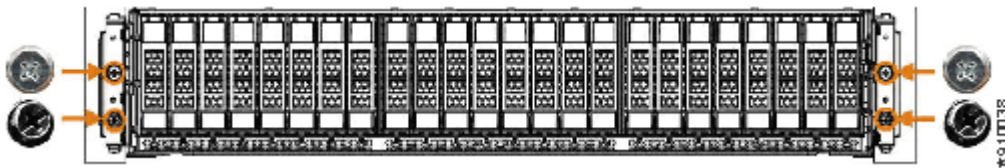


Figure 23. Securing the front of the enclosure

5. Re-install the left and right end caps (See [Figure 24](#) on [page 46](#)).

The left end cap has indicator windows that align with the status LEDs (light-emitting diodes) on the edge of the enclosure.

- a) Ensure that the serial number on the left end cap matches the serial number on the left flange ("ear") on the front of the enclosure.
- b) Fit the slot on the top of the end cap over the tab on the flange.
- c) Rotate the end cap down until it snaps into place.
- d) Ensure that the inside surface of the end cap is flush with the flange.

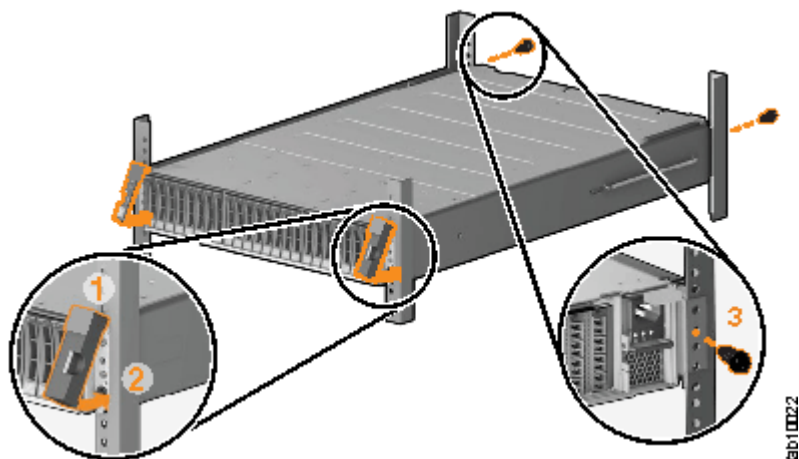


Figure 24. Reinstalling enclosure end caps

6. At this point, the rails and ESS 3000 enclosure are installed, the enclosure is mounted on the rail with all the components that were removed, reinserted into the slots.

Connecting the components (IBM SSR task)

After installing rails and the ESS 3000 enclosure in the rack, the next step is to connect to the power and network.

Connecting Ethernet cables to the server canisters

To provide system management connectivity for your system, you must connect the Ethernet cables to Ethernet port 1 of each server canister in the ESS 3000 system.

Connect Ethernet port 1 of each server canister in the system to the IP network that will provide connection to the system management interfaces, as shown in [Figure 25 on page 46](#) and [Figure 26 on page 46](#).

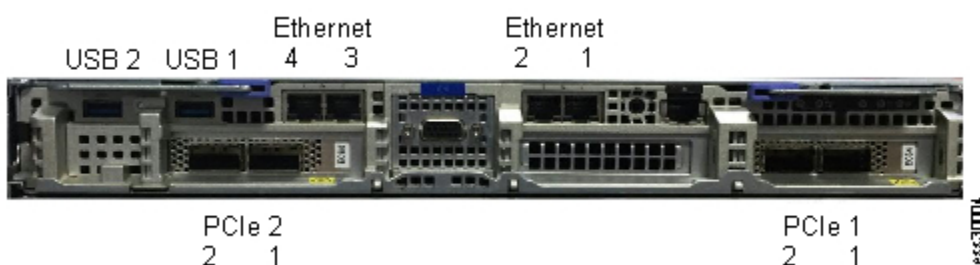


Figure 25. Ethernet ports on canister 1 (upper canister)

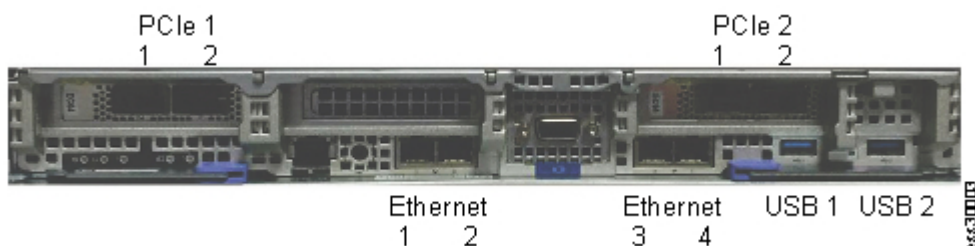


Figure 26. Ethernet ports on canister 2 (lower canister)

Powering on the system

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



Attention: Do not power on the system with any open bays or slots. Open bays or slots disrupt the internal air flow, causing the drives to receive insufficient cooling.

- Every unused drive bay must be occupied by a filler panel.
- Filler panels must be installed in all empty host interface adapter slots.

Use the supplied power cords to connect both power supply units of the enclosure 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 enclosure 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 enclosure.

Next, you will connect an Ethernet cable to the SSR access port on the canister and checkout the hardware.

Connecting an Ethernet cable to SSR access port (IBM SSR task)

Before you check the system, you must connect an Ethernet cable to the SSR access port on the AF8 enclosure.

1. Locate the SSR access ports on the ESS 3000 system, as shown in the following figure:

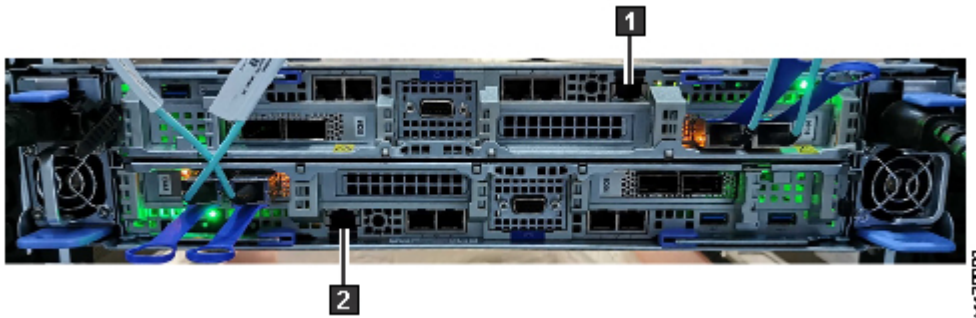


Figure 27. SSR access ports

- 1** Server canister 1 SSR access port
 - 2** Server canister 2 SSR access port
2. Connect an Ethernet cable to an SSR access port. The cable must be long enough to easily connect to a Notebook computer.
For information on how to set an IP on a Windows 10 computer, see the instructions on the [Change TCP/IP settings](#) page at the Microsoft website.
 3. Complete the steps outlined in the [“Elastic Storage System 3000 installation \(SSR task\)”](#) on page 51.

Install and Connect Management Server 5148-21L

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_sguess_rack_switches

Connect power cords to rack PDUs

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_ess_pwr_conn_unit_to_pdu

SAS Cabling for ESS

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_sgress_sas_cabling

ESS Network Cabling

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_sgress_network_cabling

Connect AC (wall) power to the rack PDUs

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_ess_pwr_conn_pdu_to_wall

Power On Switches, Storage Enclosures and Servers

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_ess_chk_cbl_and_pwr_on_srvrs

Connect to the HMC2 port for server checking

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_ess_srvr_chk_hmc2_asmi_connect

Check servers using serial port

For information, see https://w3-01.ibm.com/systems/configuration/mfg/wciiField/WCII/wciireq.pl?page=fromPredefined&outputType=pdf&modelPower_Systems=&modelSystem_i=&modelSystem_p=&modelSystem_z=&modelStorage=&modelHMC=&modelSolutions=12&platform=Solutions&mtmodel=5147-084&installtype=N&predeforders=PGH1201%7EPREDEF&featureadds=&featuresubs=&.cgifields=installtype&.cgifields=predeforders&.cgifields=platform&.cgifields=mtmodel#p8_ess_srvr_chk_serial_port

Best practices for network configuration (Customer reference task)

Use this section for best practices and guidance when filling out the Installation worksheet.

Using these best practices the customer is aided to select IP addresses for the management interfaces and fill out the “Installation worksheet” on page 63. This information from the customer is required to

configure the `essmgr.yml` file. For more information on the `essmgr.yml` file, see the *Quick Deployment guide* in the IBM Elastic Storage System (ESS) 3000 Knowledge Center.

The SSR take the inputs from the worksheet and implements the requested IP addresses

Management server best practices (EMS)

Ensure that each IP in the worksheet is on the same subnet. Recommended subnet is /24 (255.255.255.0).

Keep management interface above .128

Recommendation / Example:

Subnet 192.168.45.0/24

IP Address 192.168.45.130

netmask 255.255.255.0

- Logical interface: enP3p9s0f0
- Physical interface: Port C10-T1 ([Figure 37 on page 65](#))

Canister 1 best practices

Ensure that each IP in the worksheet is on the same subnet. Recommended subnet is /24 (255.255.255.0).

Keep the canister address below .128

Recommendation / Example:

Subnet 192.168.45.0/24

IP Address 192.168.45.30

netmask 255.255.255.0

- Logical interface: enp29s0f0
- Physical interface: Port 1 ([Figure 35 on page 64](#))

Canister 2 best practices

Ensure that each IP in the worksheet is on the same subnet. Recommended subnet is /24 (255.255.255.0).

Keep the canister address below .128

Recommendation / Example:

Subnet 192.168.45.0/24

IP Address 192.168.45.31

netmask 255.255.255.0

- Logical interface: enp29s0f0
- Physical interface: Port 1 ([Figure 35 on page 64](#))

Container interface best practices (Required when using the Quick Deployment Guide)

These are the exact fields that you need to populate in the `essmgr.yml` file:

- CONTAINER_IP:
- HOSTSUBNET:
- HOSTIP:

Recommendations for populating the fields are:

- CONTAINER_IP: 192.168.45.70
- HOSTSUBNET: 192.168.45.0/24
- HOSTIP: 192.168.45.1

- HOSTN: cems1

The hostname must be defined in /etc/hosts (associated with HOSTIP).

The container interface information is as follows:

Logical interface: enP3p9s0f1

Physical interface: Port C10-T2

HOSTIP considerations

The default choice for the container HOSTIP (network bridge based on C10-T2) is the /24 network. This will make the HOSTIP .1.

For example, HOSTSUBNET: 192.168.45.0/24 will result in a HOSTIP of 192.168.45.1.

If .1 is not an option, you may change based on the following rules:

- For a HOSTIP of .129 use a HOSTSUBNET of 192.168.45.128/25. This will allow a CONTAINER_IP greater than .130.
- For a HOSTIP of .193 use a HOSTSUBNET of 192.168.45.192/26. This will allow a CONTAINER_IP greater than .194.

Note:

- As the netmask increase, the range of available IP addresses decrease.
- You must keep all management interfaces on the same subnet.

Installation prerequisites (SSR task)

Customers must fill the “Installation worksheet” on page 63 for the SSR to start installation. This process should be done using the Technical Delivery Assessment (TDA) process. The worksheet describes the IP addresses that the SSR sets on each node.

Racked or rackless installation:

- If the system did not come racked, the SSR would rack the necessary components before the installation starts.
- ESS 3000 needs to be placed in the rack location provided by the user. For example, EIA 1-2 and 3-4.
 - Each additional ESS 3000 unit needs 2U space in the rack.
- The EMS node needs to be racked into the frame.
 - One EMS node is required per ESS 3000 cluster.
- Management Switch
 - A 1Gb/10Gb switch is required.
 - There must be a dedicated switch for ESS or shared switch with isolated VLAN for ESS.
 - It is recommended to procure this switch from IBM, but customer-provided switch can also be used.

If the management switch was purchased from IBM and was racked along with the ESS system, setup for VLAN has been done correctly and no further configuration will be required. However, if it did not come racked, the switch will require to be setup with the correct VLAN configuration. Please contact IBM service for support on this procedure.

For information on setting up the management switch, see the [Switch VLAN configuration instructions](#).

Note: An IBM intranet connection is required.

If the switch was not purchased from IBM, there must be two isolated VLANs for ESS management. Do note that the customer provided switch might not be supported by IBM.

- The switch must be placed in the rack with the Ethernet cables running for the SSR to start.

- High-speed Switch
 - 100 Gb InfiniBand or 100 Gb Ethernet is supported (from IBM or customer provided).
 - This switch is not required to be in place for the SSR to start but it must be ready before the customer begins the cluster setup.
 - The SSR is not responsible for this switch. If the switch is already racked and cabled, the SSR will plug-in to the adapters.
 - A 40G Ethernet switch may also be used with the proper connectors.

Supported connectors per network type:

- EDR cables: QSFP28
- 100G cables: QFSP28 (but different from the EDR cables)
- 40G cables: QSFP+

Note: It is recommended to use IBM branded connectors, especially for the adapter side. When using your own switch, ensure that the connectors are compatible with the switch.

- Ethernet cables (2) run from the 1 Gb or 10 Gb management switch to the EMS as shown in the [Figure 37 on page 65](#) .
 - Slot C10, Port T2 - Canister network
 - Slot C10, Port T1 - EMS management / xCAT network
 - Neither interface has a default IP. The EMS management interface (T1) is set up by the SSR.
- Ethernet cables (2) run from the 1GbE or 10GbE management switch to the ESS 3000 units (1 per server canister to Ethernet port 1).
 - Plug the cable and set the IP address based on the customer specification.

Power

- All the switches has power applied.
- The EMS node has power applied but in a standby state (blinking light).
- Canisters have power cables inserted, which will automatically boot the operating system.

High-Speed Network

- If available at the time of installation, the SSR can plug in the high-speed cables on the node side. Otherwise, this is the responsibility of the customer.

The customer should have a laptop with PuTTY installed. The laptop should be able to connect to the RJ45 Ethernet cable using an Ethernet port or an USB to Ethernet dongle.

- An Ethernet cable is required to connect to the EMS and ESS 3000 units.

The SSR must access each server to run hardware and software health checks and set the management IP interface.

Elastic Storage System 3000 installation (SSR task)

This document is intended to be used by the SSR at the customer site to complete installation. The document is for new customers of Elastic Storage System 3000 only (EMS + one or more ESS 3000 units).

Note: When you run the [Validate Install parameters](#) step under the SSR tasks, note that you can safely ignore any GNR or spectrum scale errors. If you see a red failure at the bottom of the screen, ignore only if the corresponding errors in the output were related to Spectrum Scale or GNR only.

Following are the steps to be done by the SSR at the customer site:

1. Review the installation worksheet filled by the customer to ensure that the following details are provided:

- EMS management interface IP and netmask
- Canister 1 (top) management interface IP and netmask
- Canister 2 (bottom) management interface IP and netmask

Note: If there are more than one Elastic Storage System 3000 being deployed, the customer will need to provide Canister management interface IP addresses for each additional unit.

2. Perform the following EMS checks:

- Ensure that an Ethernet cable is available to be used.
- Check EMS hardware health and configure management network interface:
 - Disable Wi-Fi on your laptop/operating system.
 - Connect the laptop using Ethernet to the C10-T4 (Port 4 - Bottom, see [Figure 37 on page 65](#)) of 1 Gb NIC on the EMS (if it is racked, a cable might be already inserted into this port. Temporarily remove it to plug your laptop). You may also connect into the FSP VLAN as an alternative option vs point-to-point.
 - Define the IP on the laptop to 10.0.0.100 with subnet 10.0.0.0/24, netmask 255.255.255.0, and gateway 10.0.0.1.
 - Power on the EMS using the white button (once pressed, the color of the blinking LED becomes solid). Wait five minutes (or longer) before moving on to the next step.
 - Perform a ping test.

Using a terminal window (not putty), ping the default FSP network interface as shown in the following example:

```
ping 10.0.0.1
```

This should return a successful result. If not, inspect your IP settings and the cable. If you still face issues, use a serial connection to debug the boot process and potentially login as root. For more information, see the [“EMS issues” on page 59](#) topic.

- Open putty and set the target address as 10.0.0.1/24 (port 22 for SSH), accept any security prompts. You will get a login window.
- Log in using the service user ID and default password:

```
uid: essserv1
pw: <server serial #>
```

Note: Look at the front of the EMS server for the serial number. This serves as the password for the essserv1 user. For example, if the EMS serial number is 2133B9A, the password is 2133B9A.

Press the **Enter** key, the essutils menu opens.

- Before using the **essutils** tool, you must set the root password, select the **Advanced tasks** option, and then the **Command Prompt** option. A shell window opens.

In the shell window, type the **passwd** command. Enter **ibmesscluster** as the new password. Retype the same password again (**ibmesscluster**) when prompted.

The system displays a success message similar to:

```
[root@gssio2 essserv1]# passwd
Changing password for user root.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[root@gssio2 essserv1]#
```

To exit, type **exit**, press the **Enter** key. You will be back within the **essutils** tool. Select the **Back** option to return to the main menu.

- 9) Go to the SSR menu, run the **2. Check and validate various install parameters** option, and then the **3. Quick storage configuration check** option. Address all the hardware issues that you find.

Note: Skip any option that says **IO-Node Only**.

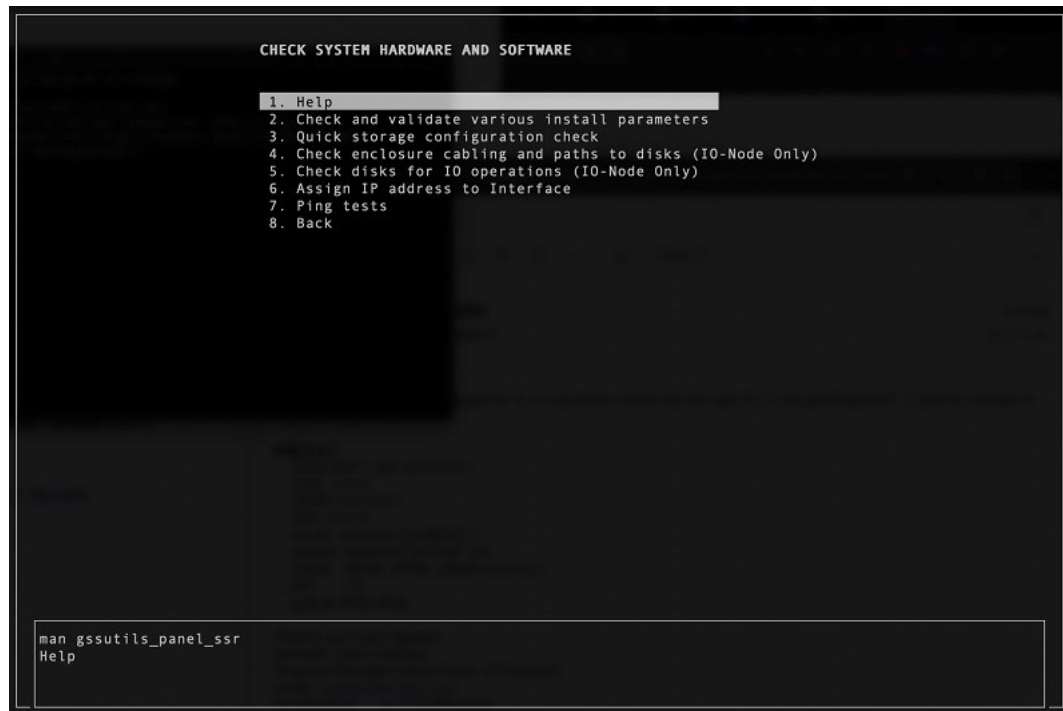
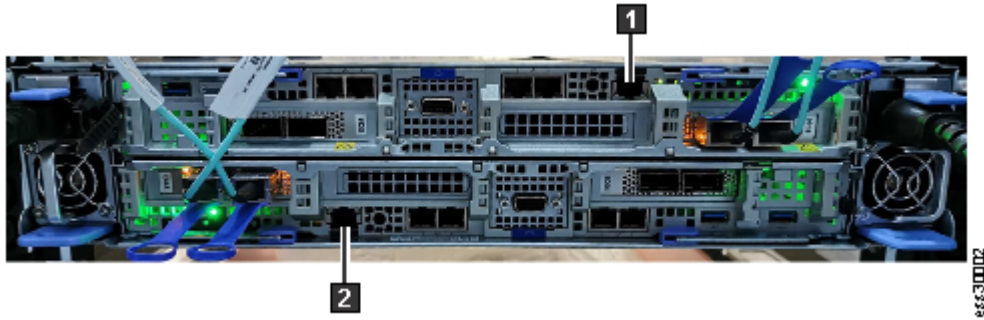


Figure 28. **SSR** menu on the EMS node

- 10) Select the **5. Assign IP address to Interface** option to set the management interface IP. Use the **c** key to change the IP address. A new panel will open which will allow the SSR to change the IP address. Press **Ctrl + G** keys to save the changes.
- Note:** You can see the updated IP address in the box at the bottom of the screen after the changes are saved.
- 11) To run the SSR tool with the updated IP address, select the **5. Assign IP address to Interface** option, and then press the **Enter** key.
- For any issues with this step, see the [Chapter 5, “Troubleshooting \(SSR tasks\),” on page 59](#).
- 12) Use the **Exit** command to quit **essutils**. After you are logged out, disconnect your laptop from C10-T4 and if applicable, put back the Ethernet cable that was removed.
- c. Using an Ethernet cable, connect laptop to the HMC2 port ([Figure 37 on page 65](#)) to run Advanced System Management Interface (ASMI).
- 1) Assign 169.254.3.1 netmask 255.255.255.0(/24) to your laptop.
 - 2) Perform a ping test to the HMC2 port (169.254.3.147).
 - 3) Access 169.254.3.147 by using a web browser.
 - 4) Log in to ASMI using the default username and password:
 - username: **admin**
 - password: *<serial number of server>*
 - 5) Check for any serviceable events.
 - 6) Logout and disconnect the Ethernet cable from the HMC2 port once done with ASMI.
- d. Visually inspect for any bad LED lights on the EMS node. For information on how to debug common Power 8 node issues, see the [Troubleshooting, service, and support for POWER8 processor-based systems](#) section in the Power8 Knowledge Center.

3. For ESS 3000 Canister 1 (top)

- a. Connect the laptop using an Ethernet cable to the service port. See [Figure 29 on page 54](#) for the service port location (also called as technician port).



1 Top canister technician port

2 Bottom canister technician port

Figure 29. Rear view of the ESS 3000 enclosure

Note: Even though the canisters are identical, the second canister is horizontally flipped while placing it in the enclosure.

- b. Define the IP on the laptop to 10.0.0.100 with subnet 10.0.0.0/24, netmask 255.255.255.0.
- c. Open a terminal window (not putty).
- d. Ping 10.0.0.102. If successful, go to the next step. It may take up to five minutes for the server to respond when starting up initially. If there are any issues, check Ethernet cable and switch, and verify the laptop IP address. If the issue persists, see the [“ESS 3000 issues” on page 61](#) topic.
- e. Open putty and set the target address as 10.0.0.102/24 (port 22 for SSH), accept any security prompts. You get a login window.
- f. Before you log in, increase the size of the putty window and the putty text.
- g. SSH login by using the following credentials:

```
uid: essserv1
```

```
pw:<{Enclosure serial number}B>
```

- Add a 'B' at the end of the enclosure serial number for the top canister for password. For example, if the enclosure serial number is 01YM312, the password for the top canister will be 01YM312B.

The **essutils** tool opens.

- h. Before using the **essutils** tool, you must set the root password, select the **Advanced tasks** option, and then the **Command Prompt** option. A shell window opens.

In the shell window, type the **passwd** command. Enter **ibmesscluster** as the new password. Retype the same password again (**ibmesscluster**) when prompted.

The system displays a success message similar to:

```
[root@gssio2 essserv1]# passwd
Changing password for user root.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[root@gssio2 essserv1]#
```

To exit, type **exit**, press the **Enter** key. You will be back within the **essutils** tool. Select the **Back** option to return to the main menu.

- i. Select the SSR tools menu as shown in [Figure 30 on page 55](#).

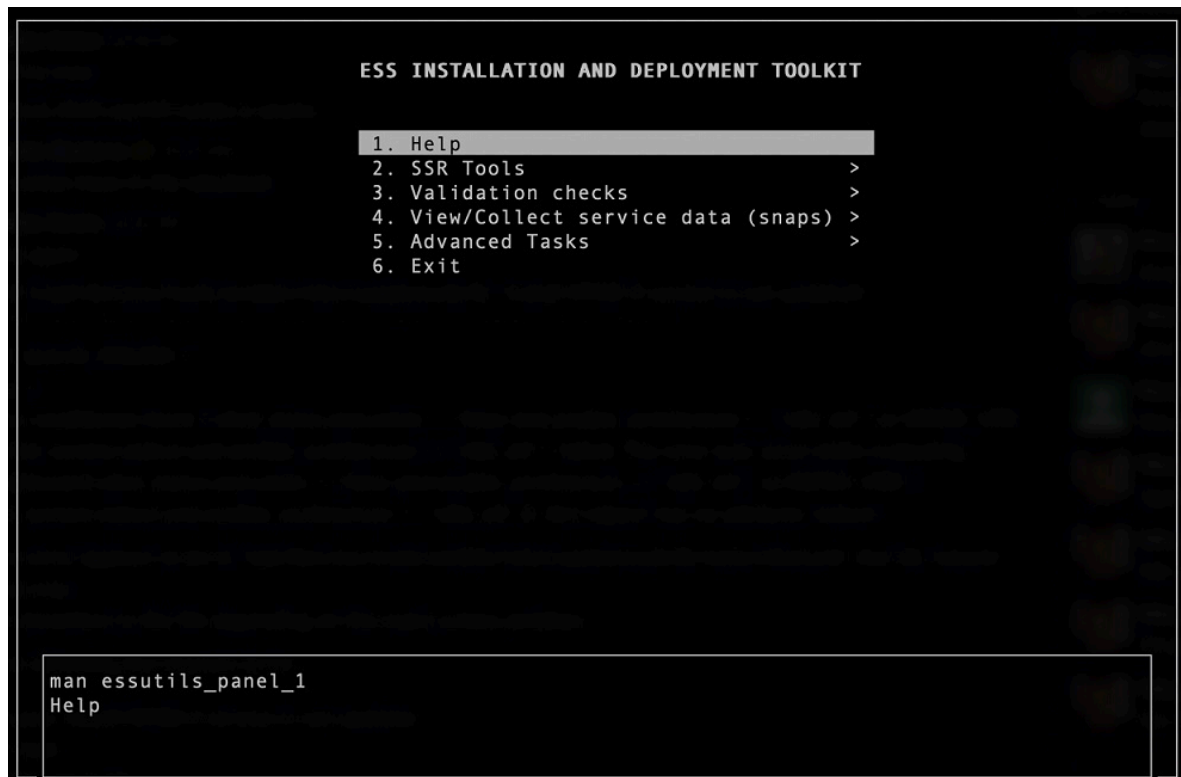


Figure 30. **essutils** tool

- j. Run all steps in the SSR tools menu from option #2 through #7, as shown in the [Figure 31](#) on page 55.



Figure 31. Canister SSR Tools menu options

If a step fails, go through the command output.

- k. To set the IP address of the management port (see Ethernet 1 in [Figure 15](#) on page 36) to the IP address and subnet defined on the customer worksheet, in the **essutils** tool, select the **8**.

Assign IP address to Interface option. For example, use the subnet of the EMS management or canister interface.

Use the c key to change the IP address. A new panel will open which will allow the SSR to change the IP address. Press the Ctrl + G keys to save the changes.

Note: You can see the updated IP address in the box at the bottom of the screen after the changes are saved.

- l. To run the SSR tool with the updated IP address, select the **8. Assign IP address to Interface** option, and then press the Enter key.

For any issues with this step, see the [Chapter 5, “Troubleshooting \(SSR tasks\),” on page 59](#).

- m. To test the ping connection with the EMS node, highlight the **9. Ping tests** option. Use the c key to change the IP address, a new panel will open. Set the IP address that was added during the EMS setup phase and also defined on the customer worksheet. Press the Ctrl + G keys to save the changes.

Note: You can see the updated IP address in the box at the bottom of the screen after the changes are saved.

- n. To ping the EMS node with the target IP address, select the **9. Ping tests** option or highlight the option and press the Enter key.

If the ping test fails, double check the IP addresses used and also the cabling. For more information, see the [Chapter 5, “Troubleshooting \(SSR tasks\),” on page 59](#).

- o. Click Back and then click Exit. You are out automatically.

Before moving on, ensure that there are no bad LED lights on this canister.

4. For ESS 3000 Canister 2 (bottom)

- a. Connect the laptop using an Ethernet cable to service port. See [Figure 29 on page 54](#) for the service port location (also called as technician port).
- b. Define the IP on the laptop to 10.0.0.100 with subnet 10.0.0.0/24, netmask 255.255.255.0.
- c. Open a terminal window (not putty).
- d. Ping 10.0.0.101. If successful, go to the next step. It may take up to five minutes for the server to respond at initial start up process. If there are any issues, check Ethernet cable and switch, and verify the laptop IP address. If the issue persists, see the [“ESS 3000 issues” on page 61](#) topic.
- e. Open putty and set target address as 10.0.0.101/24 (port 22 for SSH), accept any security prompts. You get a login window.
- f. Before you log in, increase the size of the putty window and the putty text.
- g. SSH login by using the following credentials:

```
uid: essserv1
```

```
pw:<{Enclosure serial number}A>
```

- Add an ‘A’ at the end of the enclosure serial number for the top canister for password. For example, if the enclosure serial number is 01YM312, the password for the top canister will be 01YM312A.

The **essutils** tool opens.

- h. Before using the **essutils** tool, you must set the root password, select the **Advanced tasks** option, and then the **Command Prompt** option. A shell window opens.

In the shell window, type the **passwd** command. Enter **ibmesscluster** as the new password. Retype the same password again (**ibmesscluster**) when prompted.

The system displays a success message similar to:

```
[root@gssio2 essserv1]# passwd
Changing password for user root.
New password:
Retype new password:
passwd: all authentication tokens updated successfully.
[root@gssio2 essserv1]#
```

To exit, type exit, press the **Enter** key. You will be back within the **essutils** tool. Select the **Back** option to return to the main menu.

- i. Select the SSR tools menu as shown in [Figure 30 on page 55](#).
- j. Run all steps in the SSR tools menu from option #2 through #7, as shown in the [Figure 31 on page 55](#)

If a step fails, review the output and take corrective action.

- k. To set the IP address of the management port (see Ethernet 1 in [Figure 16 on page 37](#)) to the IP address and subnet defined on the customer worksheet, in the **essutils** tool, select the **7. Assign IP address to Interface** option. For example, use the subnet of the EMS management or canister interface.

Use the c key to change the IP address. A new panel will open which will allow the SSR to change the IP address. Press the Ctrl + G keys to save the changes.

Note: You can see the updated IP address in the box at the bottom of the screen after the changes are saved.

- l. To run the SSR tool with the updated IP address, select the **7. Assign IP address to Interface** option, and then press the Enter key.
- m. To test the ping connection with the EMS node, highlight the **8. Ping tests** option. Use the c key to change the IP address, a new panel will open. Set the IP address that was added during the EMS setup phase and also defined on the customer worksheet. Press the Ctrl + G keys to save the changes.

Note: You can see the updated IP address in the box at the bottom of the screen after the changes are saved.

- n. To ping the EMS node with the target IP address, select the **8. Ping tests** option or highlight the option and press the Enter key.

If the ping test fails, double check the IP addresses used and also the cabling. For more information, see the [Chapter 5, “Troubleshooting \(SSR tasks\),” on page 59](#).

- o. Click Back and then click Exit. You are logged out automatically.

Before moving on, ensure that there are no faulty LED lights on this canister. If you face any issues, see the [Chapter 5, “Troubleshooting \(SSR tasks\),” on page 59](#) topic.

Chapter 5. Troubleshooting (SSR tasks)

This section will help you troubleshoot issues faced while configuring EMS and Elastic Storage System 3000.

Note: Ensure that you have gone through the “[Installation prerequisites \(SSR task\)](#)” on page 50 topic and also followed the steps given in the “[Elastic Storage System 3000 installation \(SSR task\)](#)” on page 51 topic.

EMS issues

EMS Boot issues

When booting up the node, if you face any issue while pinging the FSP interface (C10-T4 IP 10.0.0.1) five minutes after pressing the white button, perform the following checks:

- Verify if the Ethernet cable on both the ends has a solid green light.
- Check if your laptop is set to 10.0.0.100 netmask 255.255.255.0.
- Verify that you are plugged into the correct port - C10-T4 on the EMS.

If the issues still persist, shut down the node (hold the white button until blinking again) and perform the following steps:

1. Connect the laptop point-to-point over serial connection, connecting the USB to RJ45 console cable between the auxiliary laptop and the serial port of the server with active ASMI session from the previous section.

Note:

- The USB to RJ45 console cable shown in the [Figure 32 on page 59](#) works for Linux and Windows laptops.
- Identify the right console cable when using an Apple laptop.

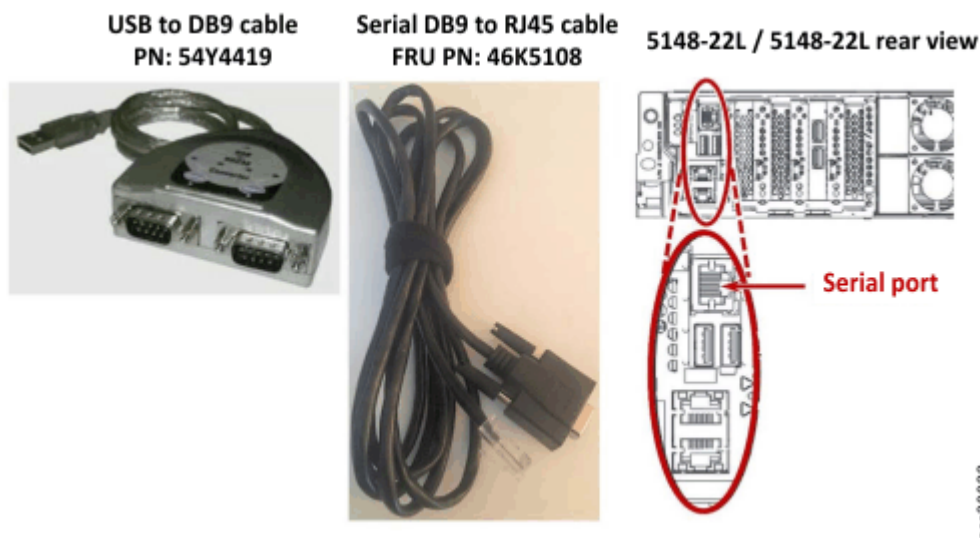


Figure 32. Connecting a laptop to the serial port in the EMS node

2. Open a terminal emulator program such as PuTTY or minicom. Set the following settings for communications using the serial connection:

```
19200 baud rate
Data bits of 8
Parity of None
Stop bits of 1
```

3. For the serial terminal to show an FSP login screen, press any key on the keyboard. Log in using the ASMI credentials:

- username: **admin**
- password: *<serial number of server>*

4. Manually power on the server by pressing the power button on the front.

- After powering on the server, the terminal emulator (for example, PuTTY) will display messages during the system boot.

If there is no output, press the **"UP ARROW"** and **"DOWN ARROW"** a few times to make the terminal respond.

- After the terminal starts showing output as the system boots, **pay close attention** to detect when the system reaches the **"petitboot"** menu (it takes a few minutes before it discovers the disks):
 - System pauses the boot process for a few seconds when it gets the **"petitboot"** menu.
 - Immediately press the **"UP ARROW"** or/and **"DOWN ARROW"** keys a few times while in the **"petitboot"** menu.
 - Boot process stops indefinitely and the user will be able to interact with the **"petitboot"** menu and choose a boot option.

5. In the **"petitboot"** menu, press the **"UP ARROW"** and/or **"DOWN ARROW"** keys to select the **"redhat"** boot option:

- Do not select the Rescue option.
- If several **"redhat"** boot options (besides the Rescue option) are shown, select the newest available.
- Press **Enter** and the server will start to boot the OS. You should see the output going across the screen and come to a login.

6. Log in using the SSR credentials:

- username: **essserv1**
- password: *<serial number of server>*

Note: You must set the terminal variable correctly before attempting to run any commands. Within PuTTY do the following:

```
export TERM=xterm
```

Continue with the rest of the flow (using **essutils**) to check the EMS and set the management IP address.

If there is an issue with the boot process, you will need to call the technical support.

EMS login issues

Note: The default password is **ibmesscluster** and must be changed after the first login. Customers should be advised to change the password once the SSR task is complete.

If you face issues logging in with username: **essserv1** and password: *<serial number of server>*, perform the following steps:

- Log in as a root user:
 - username: **root**
 - password: **ibmesscluster**

Note: You should only login as root when you cannot login as **essserv1** and it is an emergency. The root password is set to expire so you will be prompted to change immediately. Work with the customer to change the root password again after the installation is complete.

- Run **essutils** manually by typing **essutils** and press the **Enter** key.

ESS 3000 issues

ESS 3000 Boot issues

If you face issues when pinging the service port interface ('gear symbol' IP 10.0.0.101 (Canister 2) or 10.0.0.102 (Canister 1)), five minutes after booting the nodes up, perform the following checks:

- Verify if the Ethernet cable on both the ends has a solid green light.
- Check that your laptop is set to 10.0.0.100 netmask 255.255.255.0.
- Verify that you are plugged into the correct port (Service port on Canister).
- Ensure that it is pointing to the correct Canister IP (Canister 1 or 2):
 - 10.0.0.102 for Canister 1 (Top)
 - 10.0.0.101 for Canister 2 (Bottom)

If the issues still persist, shut down the node (pull power) and perform the following steps:

- Connect a terminal to the canister (monitor to VGA port and keyboard to USB port).
- Put power back to the ESS 3000 unit.

Note: You will be able to watch the boot process and take appropriate actions when problems arise.

ESS 3000 Login issues

Note: The default password is **ibmesscluster** and must be changed after the first login. Customers should be advised to change the password once the SSR task is complete.

If you face issues with logging in with username: **essserv1** and password: **<serial number of server>A** or **<serial number of server>B** (depending on Canister), perform the following steps:

Log in as a root user:

- username: **root**
- password: **ibmesscluster**

Note: You should only login as root when you cannot login as **essserv1** and it is an emergency. The root password is set to expire so you will be prompted to change immediately. Work with the customer to change the root password again after the installation is complete.

Run the **essutils** tool manually by typing **essutils** and pressing the **Enter** key.

Assigning the management IP address

This section covers the issues faced while setting the management IP address using the **essutils** tool. This task requires knowledge of the Linux command line and the Vi editor.

1. Login as the root user with the password **ibmesscluster**.

You will be prompted to change the password. Change it back to **ibmesscluster**.

2. To edit the **ifcfg-enp29s0f0** file:

```
cd /etc/sysconfig/network-scripts
```

Press the Enter key.

```
vi ifcfg-<devicename>
```

Press the Enter key.

Note: The device name for ESS 3000 canisters is **enp29s0f0**.

Note: The device name for the EMS is **enP4p1s0f0**.

Ensure that the file has the following information. Use the supplied management IP address from the customer.

```
DEVICE=enp29s0f0
IPADDR=192.168.21.141
NETMASK=255.255.255.0
BOOTPROTO=static
ONBOOT=yes
TYPE=Ethernet
NAME=enp29s0f0
```

Note: If the mac address is already entered, do not remove it.

3. To save the file, press the ESC key, run **:wq** command, and then press the Enter key.
4. To reload the connections, run the **nmcli c reload** command, and then press the Enter key.
5. To see the IP address set to the specified interface, run the **ip addr** command, and then press the Enter key.

You can now do a ping test on the command line or run the **essutils** tool to perform the task.

Appendix A. Planning worksheets (customer task)

Customers are responsible for completing the system planning worksheets.

The customer then provides the worksheets to the IBM SSR when they install and configure the system.

Installation worksheet

This worksheet is intended for customers as part of the TDA process to outline the items required to be implemented by the SSR during setup.

Customer task

Customer fills out the desired IP addresses.

SSR task

The SSR uses this information to properly set the desired IP addresses on each canister and the EMS (if applicable).

Note: The management IPs should be on the same subnet as the EMS bridge interface. If you already have an existing EMS, set IP addresses on the same subnet (all must be reachable).

Note: This document does not describe about the high-speed network. Customers must have that in place and ready to fill in (or update) the `/etc/hosts` file on the EMS node during the software installation. For reference, see Chapter 4, “Installing,” on page 39 and *IBM Elastic Storage System 3000 Quick Deployment Guide*. The high-speed interfaces are on a separate switch and should be defined on a different subnet.

- For instance, if your management interfaces are all 192.168.45.X/24, your high-speed hosts should be any other network. For instance, 172.16.0.0/24. You should use /24 (255.255.255.0), if possible.

Prerequisite (for SSR): You must be connected to the SSR access port of the target canister (top or bottom). See the “Elastic Storage System 3000 installation (SSR task)” on page 51 for steps required to check the hardware and set the desired IP addresses outlined in this worksheet by the customer.

ESS 3000 Architecture

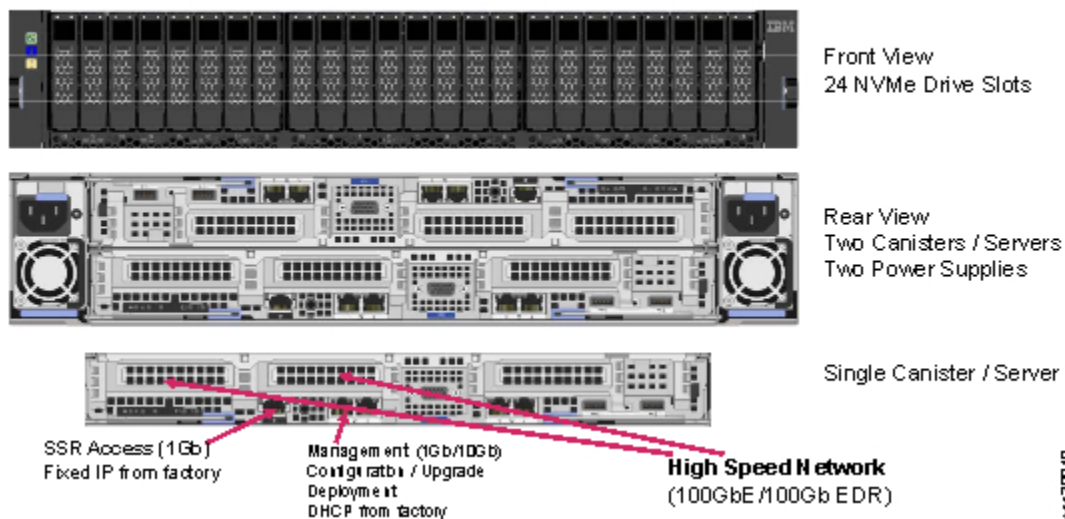


Figure 33. Front and rear view of IBM Elastic Storage System 3000

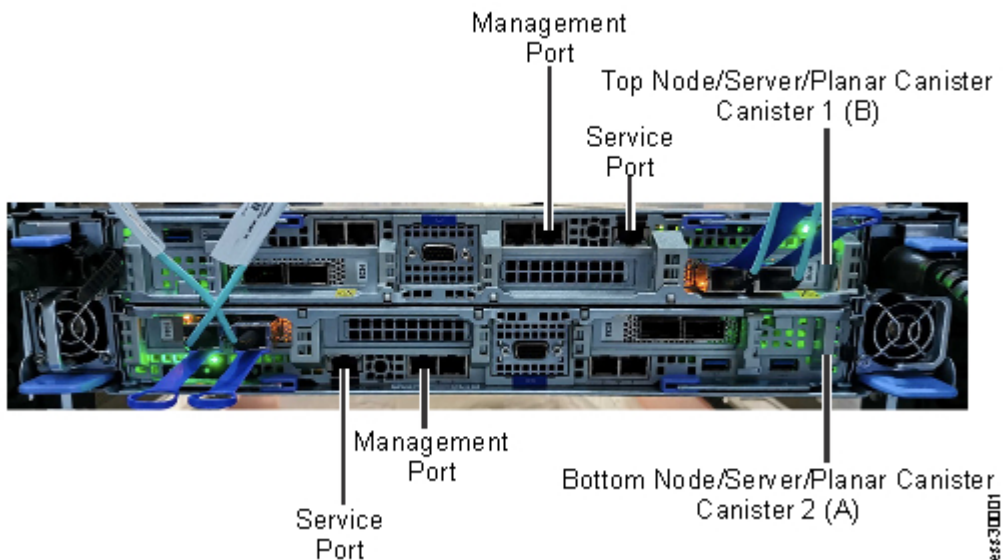


Figure 34. Rear view of ESS 3000

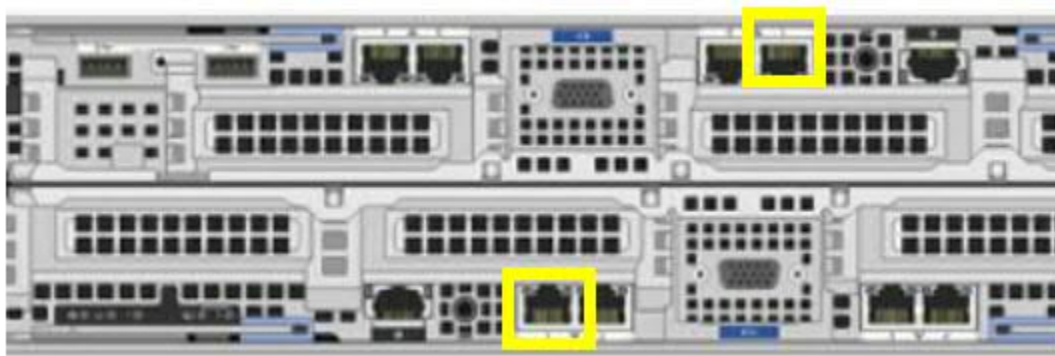


Figure 35. Management ports for each canister

EMS Ethernet (1Gb) port mapping

Note: C10-T2 listed in the figure below would be used as the Container interface.

Required	1G	C10	T1	MGTN	SMN/C10/T1----M_TOR_/Port/___
Not Used			T2	Not Used	Not Used
Not Used			T3	Not Used	Not Used
Required			T4	HMCN	SMN/C10/T4----M_TOR_/Port/___

Figure 36. Port mapping on the back of the EMS

The SSR connects to C10-T4 (bottom port) on the 1Gb card to access the server and run the **essutils** tool.

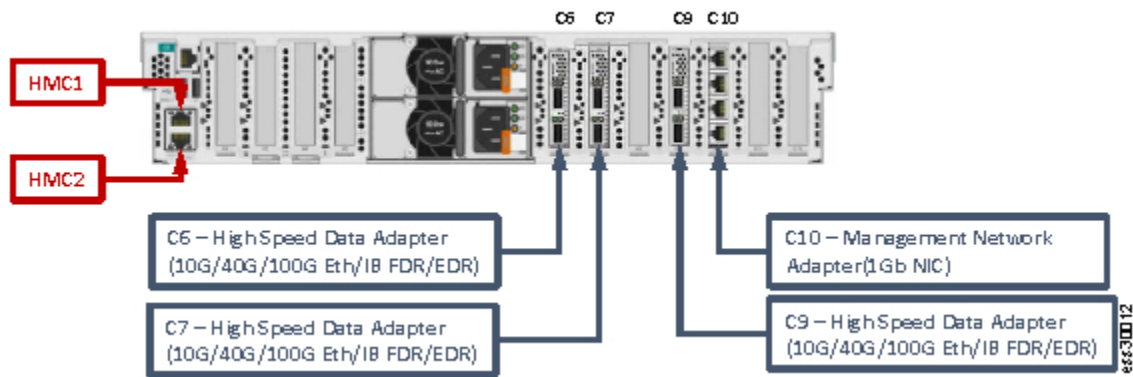


Figure 37. Rear view of the EMS node

SSR / Customer:

- Ensure that the management switch is in the rack and powered on.
- Ensure that there is one Ethernet cable from the management switch (if there are VLANs, connect from the xCAT/management VLAN) to port 1 (management port) on each canister as shown in [Figure 3](#).
- If an EMS node was received with ESS 3000, connect two Ethernet cables from the management switch (if there are VLANs, connect from the xCAT/management VLAN) to port C10-T1 (top port) and to port C10-T2 (second from top).

SSR: General guidance

- For each ESS 3000 canister in the flow (see Chapter 4, “Installing,” on page 39), connect your laptop point-to-point to the Service Port as shown in the [Figure 34 on page 64](#). You need to use this port to access each canister, perform hardware checks, and set the management IP address.
- For the EMS, connect your laptop point-to-point to C10-T4 and use the instructions in the “Elastic Storage System 3000 installation (SSR task)” on page 51 to log in, perform the hardware checks, and set the management IP address.

Reference:

- Canister 1 (top) SSR service port has a default IP address of 10.0.0.102
- Canister 2 (bottom) SSR service port has a default IP address of 10.0.0.101
- SSR user ID is ‘essserv1’
- SSR default password is the ESS 3000 serial number
 - Add ‘B’ for top canister
 - Add ‘A’ for bottom canister
- Other than the SSR access port, there are no default IP addresses set on any node
- All management interfaces should be connected to the same VLAN switch
- Default physical EMS ports
 - C10-T1 = Management Interface (will be set by the SSR)
 - Logical port enP3p9s0f0
 - C10-T4 = FSP interface. Default IP of 10.0.0.1. SSR needs to connect laptop to this port when performing the EMS tasks
 - Logical port enP3p9s0f3
- Default physical ESS 3000 ports (per canister) (see [Figure 34 on page 64](#))
 - Port 1 – Management port (will be set by the SSR)
 - Logical port enp29s0f0

- Port with a gear symbol (see Figure 34 on page 64) – Service/Technician port. The SSR will connect a laptop to this port when performing the ESS 3000 tasks. You need to move the cable when working on a different canister (two per ESS 3000 unit)
- Logical port enp1s0

Use the following table to fill in the desired IP address for each required interface:

Table 20. ESS 3000 Network preference table		
Description	Default	Desired (Fill in)
<u>Target:</u> ESS 3000 unit #1 Canister 1 (top) <u>Task:</u> Set the Management interface IP and subnet mask <u>Goal:</u> Specify the desired management interface IP address for the top canister of the first ESS 3000 unit (There may be more than one unit to deploy). This IP should be on the same subnet and reachable as the other IPs provided in this worksheet.	None. There is no default IP set from manufacturing for this port. Logical interface: enp29s0f0 Physical interface: Port 1	Enter the IP address and subnet mask. Ensure that each IP in this worksheet is on the same subnet. Recommended subnet is /24 (255.255.255.0) Keep the canister address <u>below</u>. 128 Recommendation / Example: Subnet 192.168.45.0 192.168.45.31 netmask 255.255.255.0 (/24)
<u>Target:</u> ESS 3000 unit #1 Canister 2 (bottom) <u>Task:</u> Set the Management interface IP and subnet mask <u>Goal:</u> Specify the desired management interface IP address for the bottom canister of the first ESS 3000 unit (There may be more than one unit to deploy). This IP should be on the same subnet and reachable as the other IPs provided in this worksheet.	None. There is no default IP set from manufacturing for this port Logical interface: enp29s0f0 Physical interface: Port 1	Enter the IP address and subnet mask. Ensure that each IP in this worksheet is on the same subnet. Recommended subnet is /24 (255.255.255.0) Keep the canister address <u>below</u>. 128 Recommendation / Example: Subnet 192.168.45.0 192.168.45.30 netmask 255.255.255.0 (/24)

Table 20. ESS 3000 Network preference table (continued)

Description	Default	Desired (Fill in)
<u>Target:</u> EMS node <u>Task:</u> Set the EMS management IP address <u>Goal:</u> Specify the desired management interface IP address for the EMS. This IP should be on the same subnet and reachable as the other IPs provided in this worksheet.	None There is no default IP set from manufacturing for this port Logical interface: enP3p9s0f0 Physical interface: C10-T1	Ensure that each IP in this worksheet is on the same subnet. Recommended subnet is /24 (255.255.255.0) Keep the management interface address <u>above</u>. 128 Recommendation / Example: Subnet 192.168.45.0 192.168.45.130 netmask 255.255.255.0 (/24)
<u>Target:</u> EMS node Canister interface <u>Task:</u> Reference to what the container interface settings will be. <u>Goal:</u> The EMS canister interface (bridge) is automatically set based on the subnet (HOSTSUBNET) in the <code>essmgr.yml</code> file. This row is for the customer to understand how to fill out the <code>essmgr.yml</code> file. For more information on the <code>essmgr.yml</code> file, see the Quick Deployment guide in the IBM Elastic Storage System (ESS) 3000 Knowledge Center.	None There is no default IP set from manufacturing for this port Logical interface: enP3p9s0f1 Physical interface: C10-T2	Using the information above, fill in the following fields. These are the exact fields you need to populate in the <code>essmgr.yml</code> file: • CONTAINER_IP: • HOSTSUBNET: • HOSTIP: Recommendations: • CONTAINER_IP: 192.168.45.70 • HOSTSUBNET: 192.168.45.0/24 • HOSTIP: 192.168.45.130 • HOSTN: cems1 The hostname must be defined in <code>/etc/hosts</code> (associated with HOSTIP) For information on how to configure the <code>essmgr.yml</code> file, see the “Best practices for network configuration (Customer reference task)” on page 48.

Customers must fill in the following values so that the SSR is able perform the required networking tasks. If there are more than one ESS 3000 node being installed, you will need to add the corresponding rows.

	IP address	Netmask
Canister 1 management interface (Top)		
Canister 2 management interface (Bottom)		
EMS management interface		

Note: The root password is set to expire for each node when they arrive the customer location. The customer will be prompted to change the root password after logging in the first time. The default password is `ibmesscluster`. The password change must meet security standards. Also, note that three failed login attempts will result in a 5 minute lockout period.

Completing the hardware location chart

Planning for the physical location of the system hardware includes documenting the rack locations of the enclosures and other devices. To determine the rack location, review the requirements and specification of each device.

The hardware location chart represents the rack into which the enclosures are installed. Each row of the chart represents one Electronic Industries Alliance (EIA) 19-inch wide by 1.75-inch tall rack space or unit, each of which is commonly referred to as *1U* of the rack. As you design your rack for your system, use [Table 21 on page 68](#) to record the physical configuration of the enclosures and other devices in your system.

Table 21. Hardware locations of enclosures and other devices	
Rack unit	Component
EIA 42	
EIA 41	
EIA 40	
EIA 39	
EIA 38	
EIA 37	
EIA 36	
EIA 35	
EIA 34	
EIA 33	
EIA 32	
EIA 31	
EIA 30	
EIA 29	
EIA 28	
EIA 27	
EIA 26	
EIA 25	
EIA 24	
EIA 23	
EIA 22	
EIA 21	
EIA 20	
EIA 19	
EIA 18	

<i>Table 21. Hardware locations of enclosures and other devices (continued)</i>	
Rack unit	Component
EIA 17	
EIA 16	
EIA 15	
EIA 14	
EIA 13	
EIA 12	
EIA 11	
EIA 10	
EIA 9	
EIA 8	
EIA 7	
EIA 6	
EIA 5	
EIA 4	
EIA 3	
EIA 2	
EIA 1	

Table 22 on page 69 lists the rack requirements for the different Elastic Storage System 3000 enclosure types.

<i>Table 22. Enclosure models and rack requirements</i>			
Device	Machine type and model	Number of EIA units required	Notes
Elastic Storage System 3000 (RMID: FBIII)	5141-AF8	2	24 2.5-inch drive slots; dual power supplies

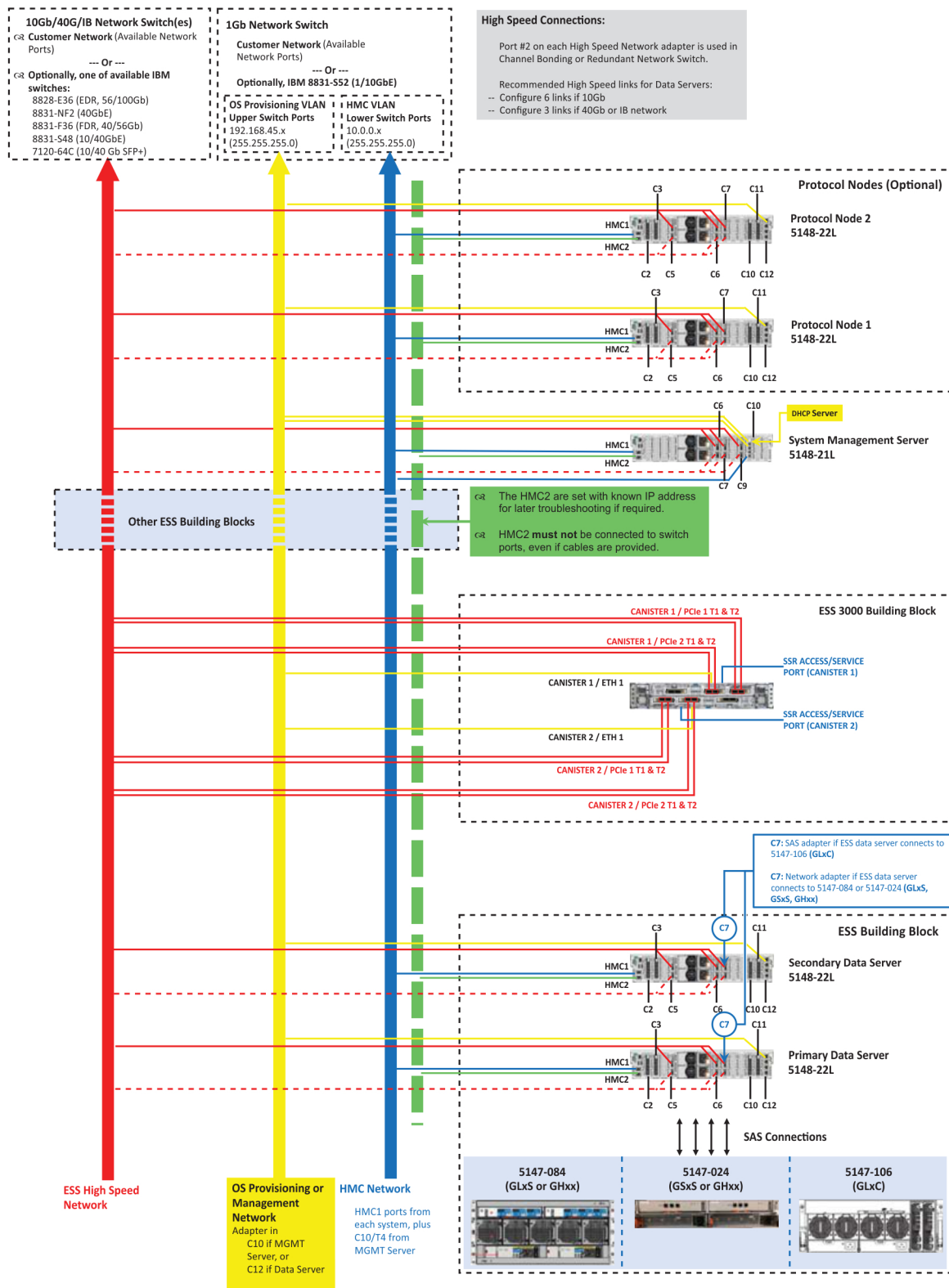
Appendix B. Cabling Guide (SSR tasks)

This chapter illustrates various cabling scenarios of IBM Elastic Storage System 3000.

For information on cables, see [“Connections for Elastic Storage System 3000 ” on page 36.](#)

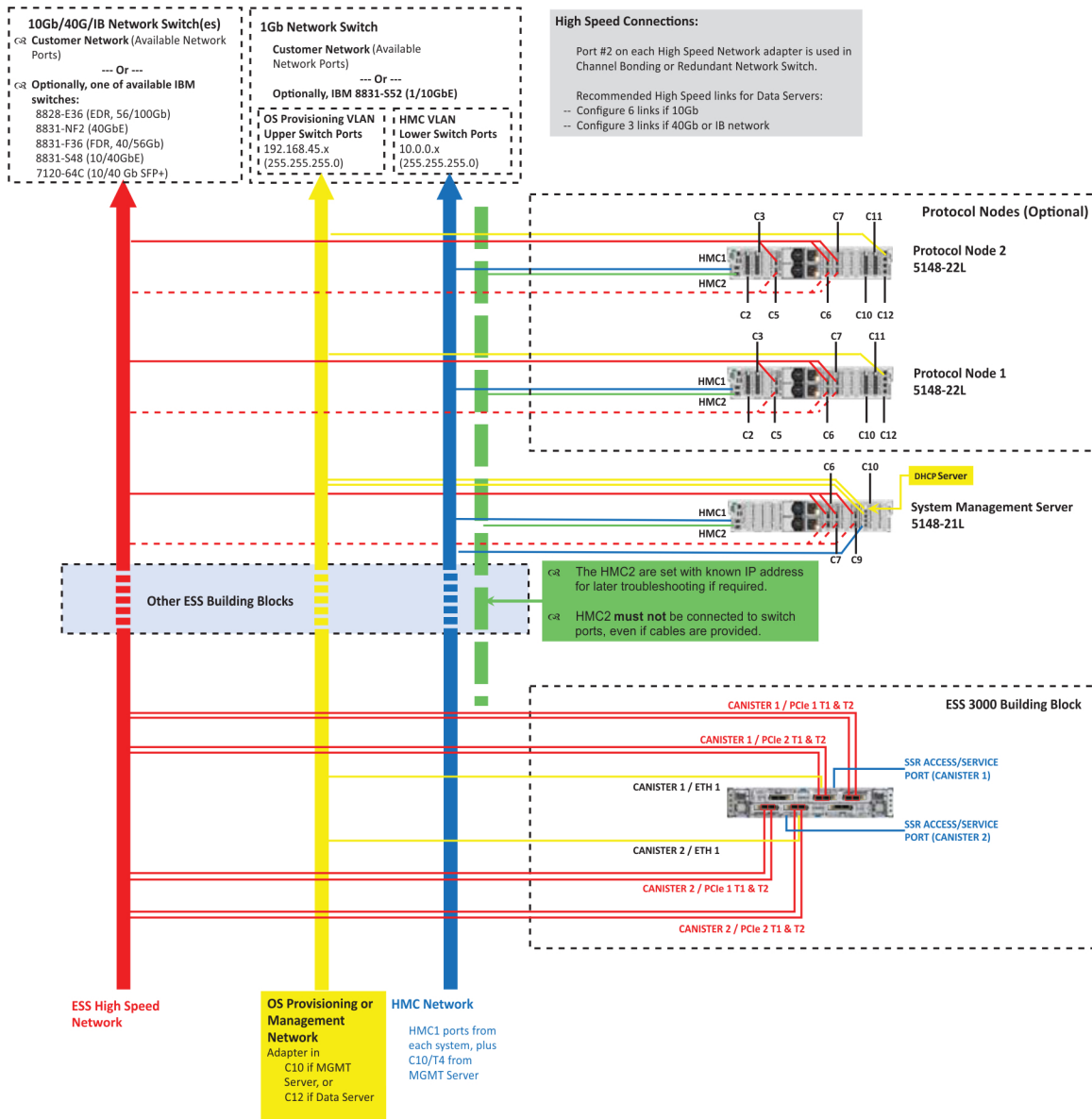
Cabling Scenario 1

IBM Elastic Storage System 3000 as a part of the entire ESS setup including ESS GL / GS / GH units with Protocol nodes and the EMS node.



Cabling Scenario 2

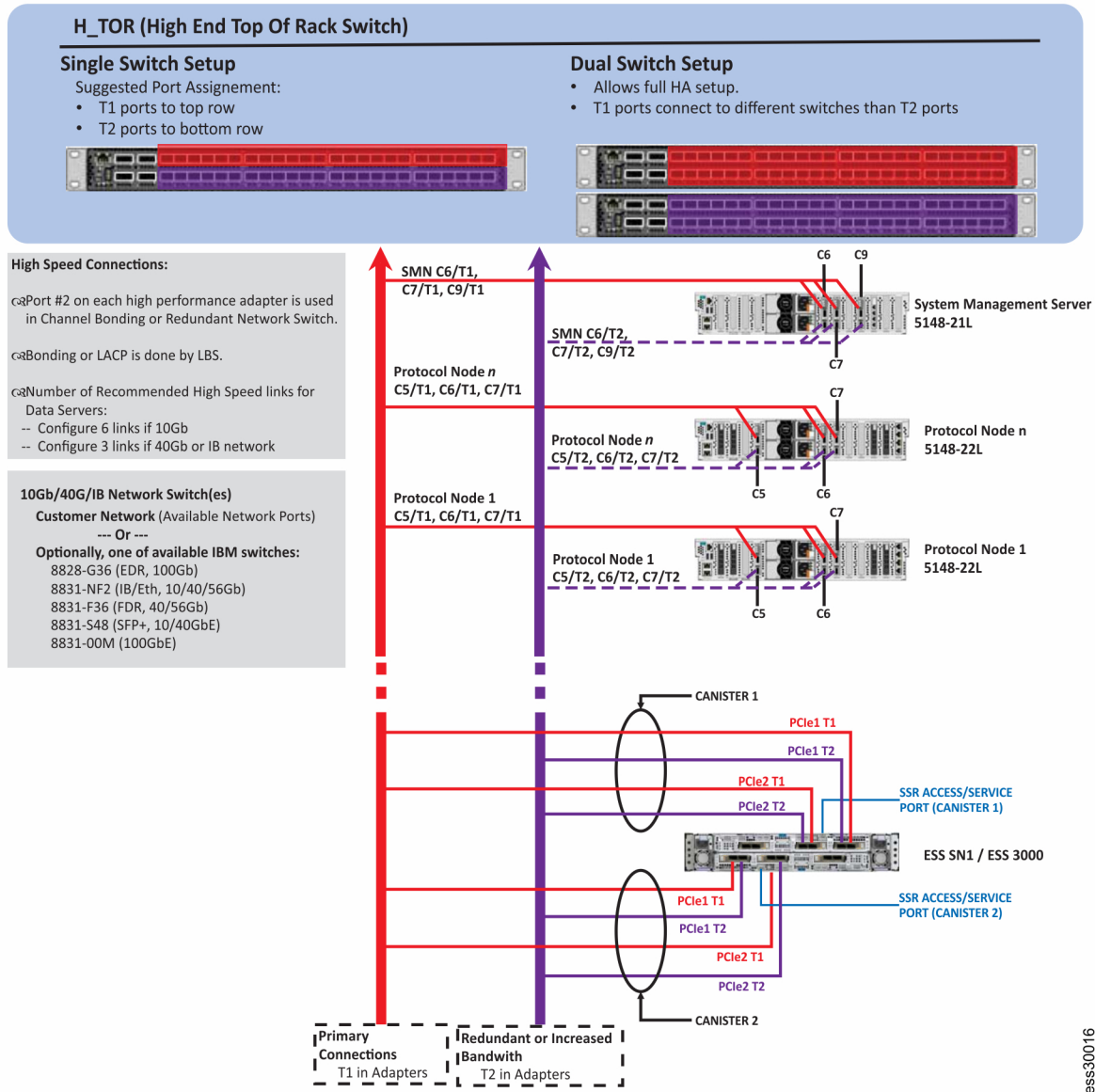
IBM Elastic Storage System 3000 as a part of the entire ESS setup with Protocol nodes and the EMS node.



ess30015

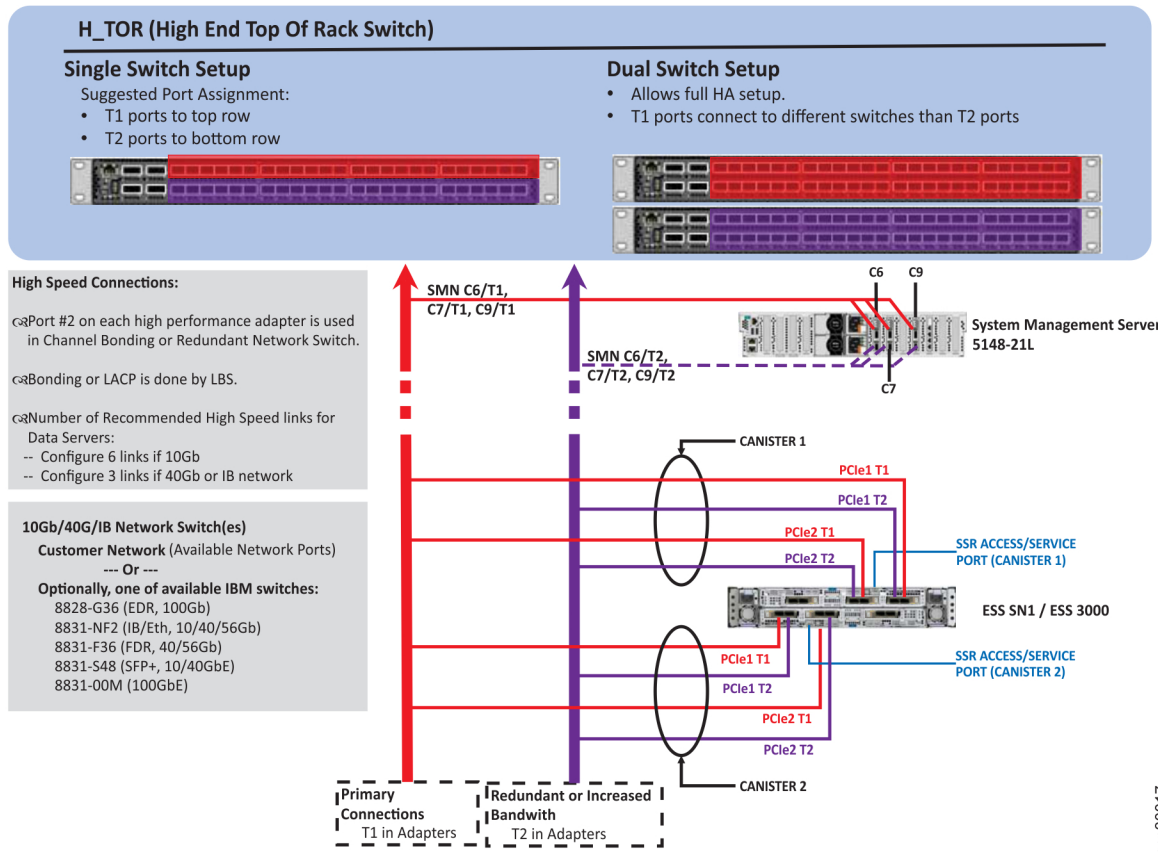
Cabling Scenario 3

High speed networking with IBM Elastic Storage System 3000, Protocol nodes, and the EMS node.



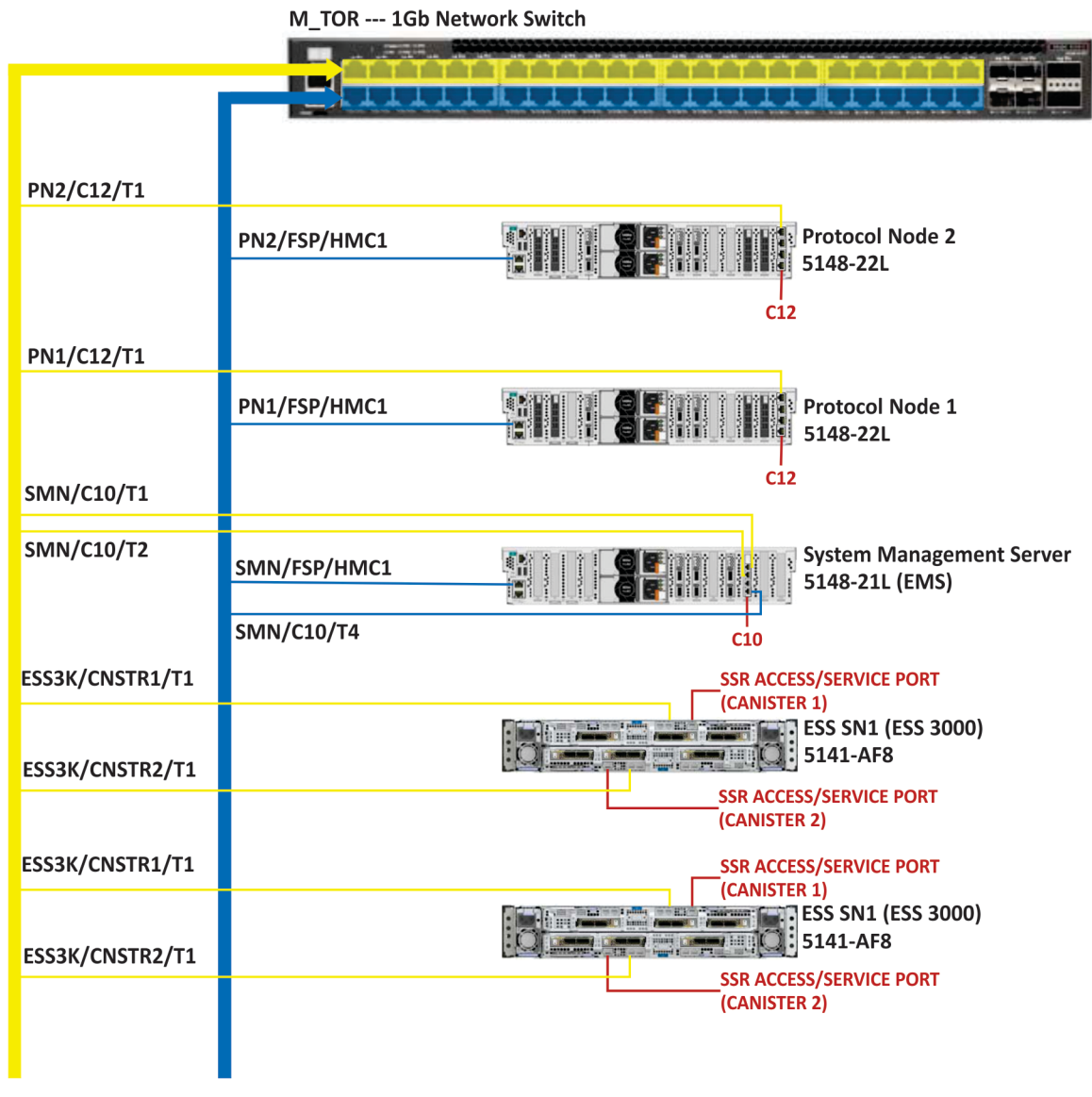
Cabling Scenario 4

High speed networking with IBM Elastic Storage System 3000 and the EMS node.



Cabling Scenario 5

Management networking with IBM Elastic Storage System 3000, Protocol nodes, and the EMS node.



ess30018



Accessibility features for IBM Spectrum Scale RAID

Accessibility features help users who have a disability, such as restricted mobility or limited vision, to use information technology products successfully.

Accessibility features

The following list includes the major accessibility features in IBM Spectrum Scale RAID:

- Keyboard-only operation
- Interfaces that are commonly used by screen readers
- Keys that are discernible by touch but do not activate just by touching them
- Industry-standard devices for ports and connectors
- The attachment of alternative input and output devices

IBM Knowledge Center, and its related publications, are accessibility-enabled. The accessibility features are described in [IBM Knowledge Center \(www.ibm.com/support/knowledgecenter\)](http://www.ibm.com/support/knowledgecenter).

Keyboard navigation

This product uses standard Microsoft Windows navigation keys.

IBM and accessibility

See the [IBM Human Ability and Accessibility Center \(www.ibm.com/able\)](http://www.ibm.com/able) for more information about the commitment that IBM has to accessibility.

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Glossary

This glossary provides terms and definitions for the ESS 3000 solution.

The following cross-references are used in this glossary:

- *See* refers you from a non-preferred term to the preferred term or from an abbreviation to the spelled-out form.
- *See also* refers you to a related or contrasting term.

For other terms and definitions, see the [IBM Terminology website](http://www.ibm.com/software/globalization/terminology) (opens in new window):

<http://www.ibm.com/software/globalization/terminology>

B

building block

A pair of servers with shared disk enclosures attached.

BOOTP

See Bootstrap Protocol (BOOTP).

Bootstrap Protocol (BOOTP)

A computer networking protocol that is used in IP networks to automatically assign an IP address to network devices from a configuration server.

C

CEC

See central processor complex (CPC).

central electronic complex (CEC)

See central processor complex (CPC).

central processor complex (CPC)

A physical collection of hardware that consists of channels, timers, main storage, and one or more central processors.

cluster

A loosely-coupled collection of independent systems, or *nodes*, organized into a network for the purpose of sharing resources and communicating with each other. *See also GPFS cluster.*

cluster manager

The node that monitors node status using disk leases, detects failures, drives recovery, and selects file system managers. The cluster manager is the node with the lowest node number among the quorum nodes that are operating at a particular time.

compute node

A node with a mounted GPFS file system that is used specifically to run a customer job. ESS 3000 disks are not directly visible from and are not managed by this type of node.

CPC

See central processor complex (CPC).

D

DA

See declustered array (DA).

datagram

A basic transfer unit associated with a packet-switched network.

DCM

See drawer control module (DCM).

declustered array (DA)

A disjoint subset of the pdisks in a recovery group.

dependent fileset

A fileset that shares the inode space of an existing independent fileset.

DFM

See *direct FSP management (DFM)*.

DHCP

See *Dynamic Host Configuration Protocol (DHCP)*.

direct FSP management (DFM)

The ability of the xCAT software to communicate directly with the Power Systems server's service processor without the use of the HMC for management.

drawer control module (DCM)

Essentially, a SAS expander on a storage enclosure drawer.

Dynamic Host Configuration Protocol (DHCP)

A standardized network protocol that is used on IP networks to dynamically distribute such network configuration parameters as IP addresses for interfaces and services.

E**Elastic Storage System (ESS 3000)**

A high-performance, GPFS NSD solution made up of one or more building blocks that runs on IBM Power Systems servers. The ESS 3000 software runs on ESS 3000 nodes - management server nodes and I/O server nodes.

ESS 3000 Management Server (EMS)

An xCAT server is required to discover the I/O server nodes (working with the HMC), provision the operating system (OS) on the I/O server nodes, and deploy the ESS software on the management node and I/O server nodes. One management server is required for each ESS 3000 system composed of one or more building blocks.

encryption key

A mathematical value that allows components to verify that they are in communication with the expected server. Encryption keys are based on a public or private key pair that is created during the installation process. See also *file encryption key (FEK)*, *master encryption key (MEK)*.

ESS 3000

See *Elastic Storage System (ESS 3000)*.

environmental service module (ESM)

Essentially, a SAS expander that attaches to the storage enclosure drives. In the case of multiple drawers in a storage enclosure, the ESM attaches to drawer control modules.

ESM

See *environmental service module (ESM)*.

Extreme Cluster/Cloud Administration Toolkit (xCAT)

Scalable, open-source cluster management software. The management infrastructure of ESS is deployed by xCAT.

F**failback**

Cluster recovery from failover following repair. See also *failover*.

failover

(1) The assumption of file system duties by another node when a node fails. (2) The process of transferring all control of the ESS to a single cluster in the ESS when the other clusters in the ESS fails. See also *cluster*. (3) The routing of all transactions to a second controller when the first controller fails. See also *cluster*.

failure group

A collection of disks that share common access paths or adapter connection, and could all become unavailable through a single hardware failure.

FEK

See *file encryption key (FEK)*.

file encryption key (FEK)

A key used to encrypt sectors of an individual file. See also *encryption key*.

file system

The methods and data structures used to control how data is stored and retrieved.

file system descriptor

A data structure containing key information about a file system. This information includes the disks assigned to the file system (*stripe group*), the current state of the file system, and pointers to key files such as quota files and log files.

file system descriptor quorum

The number of disks needed in order to write the file system descriptor correctly.

file system manager

The provider of services for all the nodes using a single file system. A file system manager processes changes to the state or description of the file system, controls the regions of disks that are allocated to each node, and controls token management and quota management.

fileset

A hierarchical grouping of files managed as a unit for balancing workload across a cluster. See also *dependent fileset*, *independent fileset*.

fileset snapshot

A snapshot of an independent fileset plus all dependent filesets.

flexible service processor (FSP)

Firmware that provides diagnosis, initialization, configuration, runtime error detection, and correction. Connects to the HMC.

FQDN

See *fully-qualified domain name (FQDN)*.

FSP

See *flexible service processor (FSP)*.

fully-qualified domain name (FQDN)

The complete domain name for a specific computer, or host, on the Internet. The FQDN consists of two parts: the hostname and the domain name.

G**GPFS cluster**

A cluster of nodes defined as being available for use by GPFS file systems.

GPFS portability layer

The interface module that each installation must build for its specific hardware platform and Linux distribution.

GPFS Storage Server (GSS)

A high-performance, GPFS NSD solution made up of one or more building blocks that runs on System x servers.

GSS

See *GPFS Storage Server (GSS)*.

H**Hardware Management Console (HMC)**

Standard interface for configuring and operating partitioned (LPAR) and SMP systems.

HMC

See *Hardware Management Console (HMC)*.

I

IBM Security Key Lifecycle Manager (ISKLM)

For GPFS encryption, the ISKLM is used as an RKM server to store MEKs.

independent fileset

A fileset that has its own inode space.

indirect block

A block that contains pointers to other blocks.

inode

The internal structure that describes the individual files in the file system. There is one inode for each file.

inode space

A collection of inode number ranges reserved for an independent fileset, which enables more efficient per-fileset functions.

Internet Protocol (IP)

The primary communication protocol for relaying datagrams across network boundaries. Its routing function enables internetworking and essentially establishes the Internet.

I/O server node

An ESS node that is attached to the ESS 3000 storage enclosures. It is the NSD server for the GPFS cluster.

IP

See *Internet Protocol (IP)*.

IP over InfiniBand (IPoIB)

Provides an IP network emulation layer on top of InfiniBand RDMA networks, which allows existing applications to run over InfiniBand networks unmodified.

IPoIB

See *IP over InfiniBand (IPoIB)*.

ISKLM

See *IBM Security Key Lifecycle Manager (ISKLM)*.

J

JBOD array

The total collection of disks and enclosures over which a recovery group pair is defined.

K

kernel

The part of an operating system that contains programs for such tasks as input/output, management and control of hardware, and the scheduling of user tasks.

L

LACP

See *Link Aggregation Control Protocol (LACP)*.

Link Aggregation Control Protocol (LACP)

Provides a way to control the bundling of several physical ports together to form a single logical channel.

logical partition (LPAR)

A subset of a server's hardware resources virtualized as a separate computer, each with its own operating system. See also *node*.

LPAR

See *logical partition (LPAR)*.

M

management network

A network that is primarily responsible for booting and installing the designated server and compute nodes from the management server.

management server (MS)

An ESS 3000 node that hosts the ESS 3000 GUI and xCAT and is not connected to storage. It must be part of a GPFS cluster. From a system management perspective, it is the central coordinator of the cluster. It also serves as a client node in an ESS 3000 building block.

master encryption key (MEK)

A key that is used to encrypt other keys. See also *encryption key*.

maximum transmission unit (MTU)

The largest packet or frame, specified in octets (eight-bit bytes), that can be sent in a packet- or frame-based network, such as the Internet. The TCP uses the MTU to determine the maximum size of each packet in any transmission.

MEK

See *master encryption key (MEK)*.

metadata

A data structure that contains access information about file data. Such structures include inodes, indirect blocks, and directories. These data structures are not accessible to user applications.

MS

See *management server (MS)*.

MTU

See *maximum transmission unit (MTU)*.

N

Network File System (NFS)

A protocol (developed by Sun Microsystems, Incorporated) that allows any host in a network to gain access to another host or netgroup and their file directories.

Network Shared Disk (NSD)

A component for cluster-wide disk naming and access.

NSD volume ID

A unique 16-digit hexadecimal number that is used to identify and access all NSDs.

node

An individual operating-system image within a cluster. Depending on the way in which the computer system is partitioned, it can contain one or more nodes. In a Power Systems environment, synonymous with *logical partition*.

node descriptor

A definition that indicates how IBM Spectrum Scale uses a node. Possible functions include: manager node, client node, quorum node, and non-quorum node.

node number

A number that is generated and maintained by IBM Spectrum Scale as the cluster is created, and as nodes are added to or deleted from the cluster.

node quorum

The minimum number of nodes that must be running in order for the daemon to start.

node quorum with tiebreaker disks

A form of quorum that allows IBM Spectrum Scale to run with as little as one quorum node available, as long as there is access to a majority of the quorum disks.

non-quorum node

A node in a cluster that is not counted for the purposes of quorum determination.

O**OFED**

See *OpenFabrics Enterprise Distribution (OFED)*.

OpenFabrics Enterprise Distribution (OFED)

An open-source software stack includes software drivers, core kernel code, middleware, and user-level interfaces.

P**pdisk**

A physical disk.

PortFast

A Cisco network function that can be configured to resolve any problems that could be caused by the amount of time STP takes to transition ports to the Forwarding state.

R**RAID**

See *redundant array of independent disks (RAID)*.

RDMA

See *remote direct memory access (RDMA)*.

redundant array of independent disks (RAID)

A collection of two or more disk physical drives that present to the host an image of one or more logical disk drives. In the event of a single physical device failure, the data can be read or regenerated from the other disk drives in the array due to data redundancy.

recovery

The process of restoring access to file system data when a failure has occurred. Recovery can involve reconstructing data or providing alternative routing through a different server.

recovery group (RG)

A collection of disks that is set up by IBM Spectrum Scale RAID, in which each disk is connected physically to two servers: a primary server and a backup server.

remote direct memory access (RDMA)

A direct memory access from the memory of one computer into that of another without involving either one's operating system. This permits high-throughput, low-latency networking, which is especially useful in massively-parallel computer clusters.

RGD

See *recovery group data (RGD)*.

remote key management server (RKM server)

A server that is used to store master encryption keys.

RG

See *recovery group (RG)*.

recovery group data (RGD)

Data that is associated with a recovery group.

RKM server

See *remote key management server (RKM server)*.

S**SAS**

See *Serial Attached SCSI (SAS)*.

secure shell (SSH)

A cryptographic (encrypted) network protocol for initiating text-based shell sessions securely on remote computers.

Serial Attached SCSI (SAS)

A point-to-point serial protocol that moves data to and from such computer storage devices as hard drives and tape drives.

service network

A private network that is dedicated to managing POWER8® servers. Provides Ethernet-based connectivity among the FSP, CPC, HMC, and management server.

SMP

See *symmetric multiprocessing (SMP)*.

Spanning Tree Protocol (STP)

A network protocol that ensures a loop-free topology for any bridged Ethernet local-area network. The basic function of STP is to prevent bridge loops and the broadcast radiation that results from them.

SSH

See *secure shell (SSH)*.

STP

See *Spanning Tree Protocol (STP)*.

symmetric multiprocessing (SMP)

A computer architecture that provides fast performance by making multiple processors available to complete individual processes simultaneously.

T**TCP**

See *Transmission Control Protocol (TCP)*.

Transmission Control Protocol (TCP)

A core protocol of the Internet Protocol Suite that provides reliable, ordered, and error-checked delivery of a stream of octets between applications running on hosts communicating over an IP network.

V**VCD**

See *vdisk configuration data (VCD)*.

vdisk

A virtual disk.

vdisk configuration data (VCD)

Configuration data that is associated with a virtual disk.

X**xCAT**

See *Extreme Cluster/Cloud Administration Toolkit*.

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