



Converting an iSCSI HIC to FC-iSCSI Split Mode

StorNext QD7000

Firmware 8.40.xx.xx



Converting an iSCSI HIC to FC-iSCSI Split Mode, 6-68676-01 Rev A, March 2018 Product of USA.

Quantum Corporation provides this publication "as is" without warranty of any kind, either express or implied, including but not limited to the implied warranties of merchantability or fitness for a particular purpose. Quantum Corporation may revise this publication from time to time without notice.

COPYRIGHT STATEMENT

© 2018 Quantum Corporation. All rights reserved.

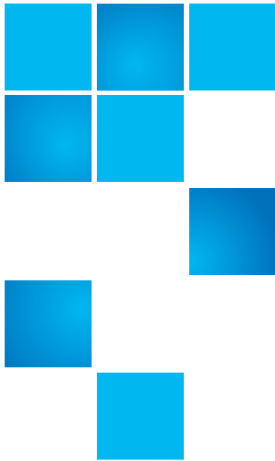
Your right to copy this manual is limited by copyright law. Making copies or adaptations without prior written authorization of Quantum Corporation is prohibited by law and constitutes a punishable violation of the law.

TRAEMARK STATEMENT

Artico, Be Certain (and the Q brackets design), DLT, DXi, DXi Accent, DXi V1000, DXi V2000, DXi V4000, GoVault, Lattus, NDX, the Q logo, the Q Quantum logo, Q-Cloud, Quantum (and the Q brackets design), the Quantum logo, Quantum Be Certain (and the Q brackets design), Quantum Vision, Scalar, StorageCare, StorNext, SuperLoader, Symform, the Symform logo (and design), vmPRO, and Xcellis are either registered trademarks or trademarks of Quantum Corporation and its affiliates in the United States and/or other countries. All other trademarks are the property of their respective owners.

Products mentioned herein are for identification purposes only and may be registered trademarks or trademarks of their respective companies. All other brand names or trademarks are the property of their respective owners.

Quantum specifications are subject to change.



Preface

Note: The 8.40.xx.xx firmware (Madrid) is used in the QD7000 (E5600, Titan RAID controller, only). Refer to the [NetApp to Quantum Naming Decoder](#) section for additional information.

This section provides the following information:

- [Audience](#)
- [Prerequisites](#)
- [NetApp to Quantum Naming Decoder](#)
- [Product Safety Statements](#)
- [Contacts](#)
- [Comments](#)
- [Quantum Global Services](#)

Audience

This manual is intended for storage customers and technicians.

Prerequisites

Prerequisites for installing and using this product include knowledge of:




- Servers and computer networks
- Network administration
- Storage system installation and configuration
- Storage area network (SAN) management and direct attach storage (DAS)
- Fibre Channel (FC) and Ethernet protocols



NetApp to Quantum Naming Decoder

Use [Table 1](#) to correlate the NetApp product nomenclature to the equivalent Quantum-storage naming conventions.

Table 1 Product Nomenclature

E-Series NetApp Product	Quantum-Storage	Description
Controller-Drive Tray	Base System	Quantum uses Base System when referring to a drive tray with the RAID controllers.
Drive Tray	Expansion Unit	Quantum uses Expansion Unit when referring to a drive tray with the environmental services modules (ESMs).
E5600 (Code Name: Titan)	RAID Controller	Four 16Gb/s FC SFP+ host ports
E5500 (Code Name: Soyuz)	RAID Controller	Four 16Gb/s FC SFP+ host ports
E5400 (Code Name: Pikes Peak)	RAID Controller	Four 8Gb/s FC SFP+ host ports
DE6600 (Code Name: Wembley)	4U 60-drive enclosure	Sixty 3.5 inch disk drives

E-Series NetApp Product	Quantum-Storage	Description
<p>E5660</p> <ul style="list-style-type: none"> • DE6600 4U drive enclosure • With E5600 RAID controllers (Titan) 	<p>Quantum StorNext QD7000</p>	
<p>E5560</p> <ul style="list-style-type: none"> • DE6600 4U drive enclosure • With E5500 RAID controllers (Soyuz) 	<p>Quantum StorNext QD7000</p>	
<p>E5460</p> <ul style="list-style-type: none"> • DE6600 4U drive enclosure • With E5400 RAID controllers (Pikes Peak) 	<p>Quantum StorNext QD6000</p>	

E-Series NetApp Product	Quantum-Storage	Description
<p>E5424</p> <ul style="list-style-type: none"> • DE5600 24-drive 2U drive enclosure • Code Name: Camden • With E5400 RAID controllers (Pikes Peak) 	<p>Quantum StorNext QS2400</p>	
<p>E5412</p> <ul style="list-style-type: none"> • DE1600 12-drive 2U drive enclosure • Code Name: Ebbets • With E5400 RAID controllers (Pikes Peak) 	<p>Quantum StorNext QS1200</p>	

Product Safety Statements

Quantum will not be held liable for damage arising from unauthorized use of the product. The user assumes all risk in this aspect.

This unit is engineered and manufactured to meet all safety and regulatory requirements. Be aware that improper use may result in bodily injury, damage to the equipment, or interference with other equipment.

WARNING: Before operating this product, read all instructions and warnings in this document and in the system, safety, and regulatory guide.

警告 在使用本产品之前，请先阅读本文档及系统、安全和法规信息指南中所有的说明和警告信息。

警告 操作本产品前，请先阅读本文件及系统、安全与法规资讯指南中的指示与警告说明。

ADVERSAL Læs alle instruktioner og advarsler i dette dokument og i *Vejledning om system-sikkerheds- og lovgivningsoplysninger*, før produktet betjenes.

AVERTISSEMENT Avant d'utiliser ce produit, lisez la totalité des instructions et avertissements de ce document et du *Guide d'informations sur le système, la sécurité et la réglementation*.

HINWEIS Lesen Sie vor der Verwendung dieses Produkts alle Anweisungen und Warnhinweise in diesem Dokument und im System, Safety, and Regulatory Information Guide (Info-Handbuch: System, Sicherheit und Richtlinien).

אזהרה לפני ההפעלה של מוצר זה, קרא את כל ההוראות והאזהרות הכלולות במסמך זה וכן במדריך מידע בנושאי מערכת, בטיחות ותקינה

警告 この製品を使用する前に、本文書、および『システム、安全、規制に関する情報ガイド』に記載しているすべての警告と指示をお読みください。

경고 이 제품을 작동하기 전에 이 문서 및 시스템, 안전, 및 규제 정보 안내서에 수록된 모든 지침과 경고 표지를 숙지하십시오.

ПРЕДУПРЕЖДЕНИЕ

Перед началом эксплуатации данного устройства ознакомьтесь во всеми инструкциями и предупреждениями, приведенными в данном документе и в *Справочном руководстве по устройству, технике безопасности и действующим нормативам*.

ADVERTENCIA

Antes de utilizar este producto, lea todas las instrucciones y advertencias en este documento y en la Guía informativa sobre sistema, seguridad y normas.

WARNING

Läs alla anvisningar och varningar i detta dokument och i *System, säkerhet och krav från myndigheter - Informationshandbok* innan denna produkt tas i bruk.

Contacts

For information about contacting Quantum, including Quantum office locations, go to:

<http://www.quantum.com/aboutus/contactus/index.aspx>

Comments

To provide comments or feedback about this document, or about other Quantum technical publications, send e-mail to:

doc-comments@quantum.com

Quantum Global Services

Accelerate service issue resolution with these exclusive Quantum StorageCare services:

- **Service and Support Website** - Register products, license software, browse Quantum Learning courses, check backup software and operating system support, and locate manuals, FAQs, firmware downloads, product updates and more in one convenient location. Benefit today at:

<http://www.quantum.com/serviceandsupport/get-help/index.aspx#contact-support>

- **eSupport** - Submit online service requests, update contact information, add attachments, and receive status updates via email. Online Service accounts are free from Quantum. That account can

also be used to access Quantum's Knowledge Base, a comprehensive repository of product support information. Get started at:

<http://www.quantum.com/customercenter/>

For further assistance, or if training is desired, contact the Quantum Customer Support Center:

North America	1-800-284-5101 (toll free) +1-720-249-5700
EMEA	+800-7826-8888 (toll free) +49-6131-324-185
APAC	+800-7826-8887 (toll free) +603-7953-3010

For worldwide support:

<http://www.quantum.com/serviceandsupport/get-help/index.aspx#contact-support>

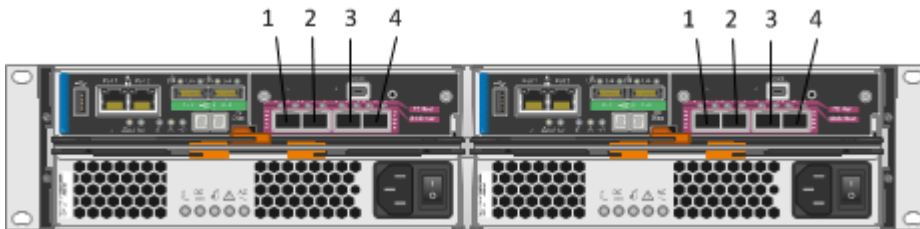
Converting an iSCSI Host Interface Card to Fibre Channel-iSCSI Split Mode

You can apply a feature pack in SANtricity® Storage Manager to convert the protocol of the host interface cards (HIC) in an E-Series storage array or an EF-Series flash array from iSCSI to Fibre Channel-iSCSI split mode. You can convert the protocol of the HICs in a new array or in an array that has already been in use.

You can convert the protocol of the following E-Series or EF-Series systems, assuming they include four-port iSCSI HICs:

- E5600 storage arrays, including the E5612, E5624, and E5660
- EF560 flash arrays

In *split mode*, ports 1 and 2 on both HICs operate as iSCSI ports, while ports 3 and 4 on both HICs operate as Fibre Channel ports. The following figure shows the rear view of the E5612 controller-drive tray with two four-port HICs installed.



HIC port	Before the conversion	After the conversion
1	10 Gb iSCSI	10 Gb iSCSI
2	10 Gb iSCSI	10 Gb iSCSI
3	10 Gb iSCSI	16 Gb Fibre Channel
4	10 Gb iSCSI	16 Gb Fibre Channel

Considerations for this procedure

Before starting this procedure, be aware of the following:

- You must schedule a downtime maintenance window for this procedure, and you cannot access data on the storage array or flash array until you have successfully completed the conversion. You must take the system offline, and the controllers reboot when you apply the feature pack.
- You must use out-of-band management to perform this procedure. This procedure is not supported if you use in-band management.
- The exact steps for performing this procedure vary depending on your configuration. For example, it is easier and more straightforward to convert HIC ports in a new system than to convert ports in a system that has already been in use. If the system has been in use, you might need to re-cable host ports 3 and 4 and change LUN mappings.
- A HIC feature pack conversion changes the HIC protocol in SANtricity OS (controller firmware). The value set in SANtricity OS controls whether the ports on the HIC operate in Fibre Channel mode, iSCSI mode, or Fibre Channel-iSCSI split mode. If you need to replace the controller and HIC due to either controller or HIC failure after applying a HIC feature pack conversion, the new controller and HIC will automatically use whichever protocol you applied earlier with the feature pack.

- This document describes how to convert iSCSI HICs to Fibre Channel-iSCSI split mode; for instructions for performing other HIC feature pack conversions or for performing a HIC hardware upgrade, refer to the list of related documents at the end of this topic.

Before you begin

- You have obtained the necessary hardware for the conversion. For example, you might need replacement cables and SFP transceivers. Your NetApp Sales Representative can help you determine what hardware you need and help you order the correct parts. If your storage array currently uses unified SFPs that you purchased from NetApp, you should not need to replace these SFPs.
- SANtricity Storage Manager version 11.25 or later is installed.
- The storage array is running SANtricity OS (controller firmware) version 8.25 or later. To determine which firmware version you have, check the **Summary** tab in the Array Management Window. To download the latest firmware, go to the NetApp Downloads page, and select **Downloads > Software**. Download the correct version of **E-Series/EF-Series SANtricity OS (Controller Firmware)** for your storage array.
- If you will be using a new host, you have installed SANtricity utilities (the SMutil package) including the Host Context Agent, which automatically creates a new host object and associated host ports on the storage for use with storage partitioning.

Steps

1. [Managing asynchronous mirroring relationships](#) on page 2
2. [Determining whether you have unified SFPs](#) on page 3
3. [Stopping host I/O](#) on page 4
4. [Obtaining the feature pack key](#) on page 5
5. [Applying the feature pack key](#) on page 6
6. [Modifying the configuration for Fibre Channel-iSCSI split mode](#) on page 6

Related information

[NetApp E-Series and EF-Series Systems Documentation Center](#)

[NetApp Downloads](#)

[NetApp Interoperability Matrix Tool](#)

[Converting a Fibre Channel Host Interface Card to iSCSI](#)

[Converting an iSCSI Host Interface Card to Fibre Channel](#)

[Converting a Fibre Channel Host Interface Card to Fibre Channel-iSCSI Split Mode](#)

[Converting a Host Interface Card from Fibre Channel-iSCSI Split Mode to Fibre Channel](#)

[Converting a Host Interface Card from Fibre Channel-iSCSI Split Mode to iSCSI](#)

[Upgrading Host Interface Cards in the E5600 or EF560](#)

Managing asynchronous mirroring relationships

If you currently use the Asynchronous Mirroring feature (also known as ARVM), you might need to move the mirroring relationships to host port 1 or 2 before applying the feature pack to convert an iSCSI HIC to Fibre Channel-iSCSI split mode.

About this task

These steps do not apply if you are converting a new system. They apply only if you are converting a system that uses asynchronous mirroring.

On an iSCSI array, asynchronous mirroring can occur on any of the host ports. When you convert an iSCSI HIC to Fibre Channel-iSCSI split mode, host ports 1 and 2 remain iSCSI, so any asynchronous mirroring operations over these ports are

unaffected. However, if you have set up mirroring on host port 3 or 4, you must move the mirroring relationships to host port 1 or 2 before the conversion. Otherwise, the communication link might be down after the conversion because of a protocol mismatch between the new Fibre Channel ports on the local array and the existing iSCSI ports on the remote array.

Steps

1. Confirm that all secondary volumes are synchronized. Refer to the online help for the Array Management Window if you have questions on how to do this.
2. Verify that the remote mirroring network is connected to port 1 or 2. As required, move the cables from port 3 or 4.
3. Follow the instructions in this document to apply the feature pack to convert the iSCSI HICs to Fibre Channel-iSCSI split mode.
4. After applying the feature pack, use the **Test Communication Link** dialog box in the Array Management Window to ensure that the local and remote arrays are still communicating correctly. Refer to the online help for the Array Management Window.

Determining whether you have unified SFPs

You can use the Array Management Window in SANtricity Storage Manager to determine what type of SFPs you have. Unified SFPs support both 16 Gbps Fibre Channel and 10 Gbps iSCSI, so you can continue to use them after converting the HIC protocol.

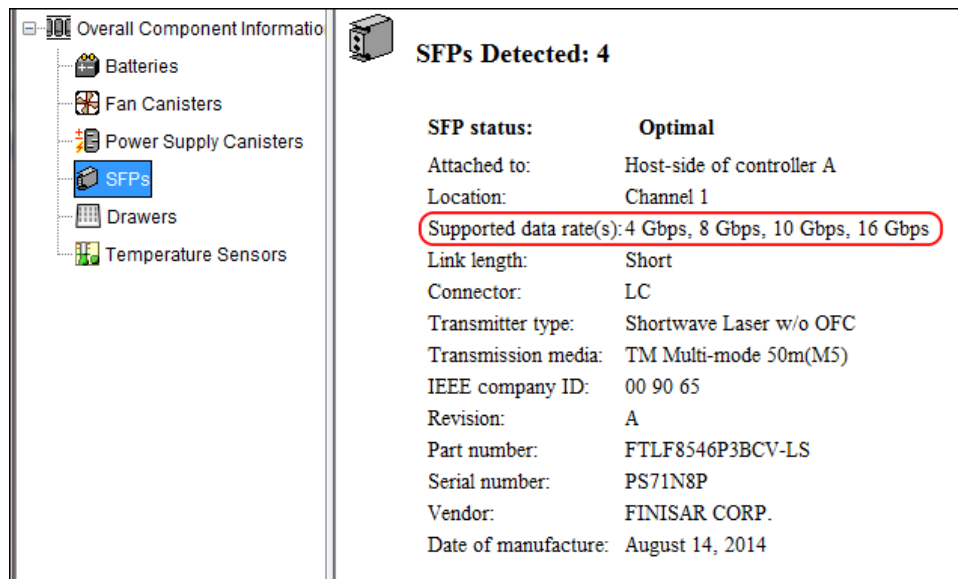
Before you begin

The array has been added to the Enterprise Management Window.

Steps

1. From the Array Management Window, select **Hardware > Tray > View/Edit > Controller/Drive components**.
2. From the **Overall Component Information** navigator on the left, click **SFPs**.

The SFP status is displayed. The screen shot shows the supported data rates for unified SFPs.



The screenshot displays the 'Overall Component Information' window with 'SFPs' selected in the left-hand navigation pane. The main area shows 'SFPs Detected: 4' and a list of SFP details. The 'Supported data rate(s)' entry is circled in red, indicating the supported rates for unified SFPs.

SFP status:	Optimal
Attached to:	Host-side of controller A
Location:	Channel 1
Supported data rate(s):	4 Gbps, 8 Gbps, 10 Gbps, 16 Gbps
Link length:	Short
Connector:	LC
Transmitter type:	Shortwave Laser w/o OFC
Transmission media:	TM Multi-mode 50m(M5)
IEEE company ID:	00 90 65
Revision:	A
Part number:	FTLF8546P3BCV-LS
Serial number:	PS71N8P
Vendor:	FINISAR CORP.
Date of manufacture:	August 14, 2014

3. Locate the **Supported data rate(s)** entry in the results.

Supported data rate	SFP type	Protocol
4 Gbps, 8 Gbps, 10 Gbps, 16 Gbps	Unified	<ul style="list-style-type: none"> • Fibre Channel: 4 Gbps, 8 Gbps, 16 Gbps • iSCSI: 10 Gbps
10 Gbps	10 Gbps	iSCSI only
4 Gbps, 8 Gbps, 16 Gbps	16 Gbps	Fibre Channel only
2 Gbps, 4 Gbps, 8 Gbps	8 Gbps	Fibre Channel only

- Determine whether you can reuse the SFPs, as follows:
 - If you have unified SFPs, you can continue using them after you convert the protocol.
 - If you have 10 Gbps SFPs, and you are converting HIC ports to Fibre Channel, you must remove the SFPs from ports 3 and 4 and replace them with unified or 16 Gbps SFPs after converting the protocol.

Stopping host I/O

You must stop all I/O operations from the host before converting the protocol of the host interface cards (HICs). You cannot access data on the storage array until you successfully complete the conversion.

Steps

- Ensure that no I/O operations are occurring between the storage array and all connected hosts. For example, you can perform these steps:
 - Stop all processes that involve the LUNs mapped from the storage to the hosts.
 - Ensure that no applications are writing data to any LUNs mapped from the storage to the hosts.
 - Unmount all file systems associated with volumes on the array.

Note: The exact steps to stop host I/O operations depend on the host operating system and the configuration, which are beyond the scope of these instructions. If you are not sure how to stop host I/O operations in your environment, consider shutting down the host.

Attention: Possible data loss – If you continue this procedure while I/O operations are occurring, you might lose data.

- If the storage array participates in a mirroring relationship, stop all host I/O operations on the secondary storage array.
- Wait for five minutes to allow any data in cache memory to be flushed to disk.
- In the **Hardware** tab of the **Array Management Window**, select the graphic representation of the storage array, and then select **Monitor > Reports > Operations in Progress**.
- Wait for all operations shown on the **Operations in Progress** window to complete before continuing with the next step.

Obtaining the feature pack key

You can apply a feature pack key in SANtricity Storage Manager to convert the protocol of the host interface cards (HICs) from iSCSI to Fibre Channel-iSCSI split mode. To obtain the feature pack key, you need a Feature Activation Code, the serial number for your storage system enclosure, and the Feature Enable Identifier for your storage system.

Steps

1. From the following table, locate the Feature Activation Code that applies to your storage system and conversion path, and copy the value to a text file.

Storage system	Converting from iSCSI to Fibre Channel-iSCSI split mode
E5600	4GL-QMS-ZYT9N
EF560	PGV-WNS-Z5PL0

2. Locate the serial number for your storage system. You can look at the silver label affixed to the top of your system enclosure, or you can get the serial number from the software, as follows:
 - a. From the Array Management Window, select the **Summary** tab, and click **View Storage Array Profile** in the Monitor area.
 - b. On the Storage Array tab, locate the **Chassis Serial Number**.
 - c. Copy and paste the value into a text file.
3. Locate and record the Feature Enable Identifier for your storage system:
 - a. From the Array Management Window, select **Storage Array > Premium Features** to display the **Premium Features and Feature Pack Information** window.

The 32-digit Feature Enable Identifier is displayed under **Storage Array Feature Information**.
 - b. Copy and paste this 32-digit identifier into a text file.
4. Go to [NetApp License Activation: Storage Array Premium Feature Activation](#), and enter the information required to obtain the feature pack.
 - Feature Activation Code from the table
 - Serial number for the storage system
 - Feature Enable Identifier

Note: The Premium Feature Activation web site includes a link to “Premium Feature Activation Instructions.” Do not attempt to use those instructions for this procedure.
5. Choose whether to receive the key file for the feature pack in an email or to download it directly from the site.
6. Save the key file for later use.

Applying the feature pack key

You can apply a feature pack key to change the HIC protocol.

About this task

This task describes how to apply a feature pack key to a single storage array. If you intend to use mirroring after the conversion, you might need to apply a key to the local storage array and to the remote storage array. Each array requires its own key.

Steps

1. From the Array Management Window, select **Storage Array > Premium Features**.
2. In the **Feature Pack** section at the bottom of the screen, click **Change**.

Note: Do not click the **Use Key File** button in the **Enable a Premium Feature** section.

The Select Feature Key File dialog opens, which lets you select the generated key file.

3. Select the folder in which you placed the generated key file.
4. Select the key file, and click **OK**.
5. Click **Close**.

Both controllers automatically reboot twice as the new feature pack takes effect. Assuming the SFPs and cables are correct for the new protocol, the storage array returns to an optimal state after the reboot operations are complete.

6. Follow these steps to confirm that the protocol was changed:

- a. From the Array Management Window, re-select the **Hardware** tab.

The information shown on the tab is refreshed.

- b. Scroll down to the **Host Interface Board** section and confirm that the value for **Type** is what you expect:

Value for Type	HIC protocol
iSCSI	iSCSI
Fibre channel	Fibre Channel
iSCSI, Fibre channel	Fibre Channel-iSCSI split mode

Modifying the configuration for Fibre Channel-iSCSI split mode

After applying the feature pack to convert iSCSI HICs to Fibre Channel-iSCSI split mode, you might need to modify your existing configuration to support Fibre Channel.

You can use either of the following options to use the new Fibre Channel ports. The exact steps depend on your current and planned network topologies.

Note: If you converted a new system that was not using host ports 3 and 4 for iSCSI, download the Hardware Installation Guide for your storage array or flash array to learn how to install cables and SFPs. Then, follow the instructions in the appropriate SANtricity Express Guides for iSCSI and Fibre Channel to complete the setup for each protocol.

Option 1: Move iSCSI hosts, and then add new Fibre Channel hosts

Option 1 assumes that you want to attach new Fibre Channel hosts to the array. Follow these general steps:

1. Move any iSCSI hosts from ports 3 and 4 to ports 1 and 2.
 - a. Remove any iSCSI cables and SFPs from ports 3 and 4.
 - b. In a direct-attach topology, install the iSCSI cables and SFPs in ports 1 and 2, if available, or install a switch. In a switch topology, zone the switch to allow connectivity between these hosts and iSCSI ports 1 and 2.
2. Attach new Fibre Channel hosts to ports 3 and 4. In a direct-attach topology, insert Fibre Channel or unified SFPs and cables into ports 3 and 4. In a switch topology, zone the switch to allow connectivity between the new Fibre Channel hosts and Fibre Channel ports 3 and 4.
3. Configure Fibre Channel networking for the new hosts and ports. For instructions, refer to the appropriate SANtricity Express Guide for your operating system.

Option 2: Convert iSCSI hosts to Fibre Channel

Option 2 assumes that you want to convert the hosts connected to ports 3 and 4 from iSCSI to Fibre Channel. Follow these general steps:

1. Shut down the iSCSI hosts connected to ports 3 and 4.
2. Provide a Fibre Channel topology for ports 3 and 4. For example, convert any switches connected to those hosts from iSCSI to Fibre Channel.
3. If you are not already using unified SFPs, remove the iSCSI SFPs from ports 3 and 4 and replace them with Fibre Channel SFPs or unified SFPs.
4. Attach cables to the SFPs in ports 3 and 4, and confirm they are connected to the correct Fibre Channel switch or host.
5. Power on the hosts.
6. Use the NetApp Interoperability Matrix Tool to configure the Fibre Channel hosts.
[NetApp Interoperability Matrix Tool](#)
7. After the Fibre Channel hosts reboot, use the applicable procedures on the hosts to register the volumes and to make them available to your operating system.
 - Depending on your operating system, two utilities are included with the storage management software (`hot_add` and `SMdevices`). These utilities help register the volumes with the hosts and also show the applicable device names for the volumes.
 - You might need to use specific tools and options that are provided with your operating system to make the volumes available (that is, assign drive letters, create mount points, and so on). Refer to your host operating system documentation for details.
8. From the Array Management Window, edit the host partition to add the Fibre Channel values and remove the iSCSI values.

Related information

[E5600 Controller-Drive Tray and Related Drive Trays Installation Guide](#)

[EF560 Flash Array and Related Trays Installation Guide](#)

[SANtricity Storage Manager 11.25 Express Guide for Linux and Fibre Channel](#)

[SANtricity Storage Manager 11.25 Express Guide for VMware and Fibre Channel](#)

[SANtricity Storage Manager 11.25 Express Guide for Windows and Fibre Channel](#)

[SANtricity Storage Manager 11.25 Express Guide for Linux and iSCSI](#)

[SANtricity Storage Manager 11.25 Express Guide for VMware and iSCSI](#)

[SANtricity Storage Manager 11.25 Express Guide for Windows and iSCSI](#)

[NetApp Downloads](#)

[NetApp Interoperability Matrix Tool](#)

Copyright information

Copyright © 1994–2015 NetApp, Inc. All rights reserved. Printed in the U.S.

No part of this document covered by copyright may be reproduced in any form or by any means—graphic, electronic, or mechanical, including photocopying, recording, taping, or storage in an electronic retrieval system—without prior written permission of the copyright owner.

Software derived from copyrighted NetApp material is subject to the following license and disclaimer:

THIS SOFTWARE IS PROVIDED BY NETAPP "AS IS" AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE HEREBY DISCLAIMED. IN NO EVENT SHALL NETAPP BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

NetApp reserves the right to change any products described herein at any time, and without notice. NetApp assumes no responsibility or liability arising from the use of products described herein, except as expressly agreed to in writing by NetApp. The use or purchase of this product does not convey a license under any patent rights, trademark rights, or any other intellectual property rights of NetApp.

The product described in this manual may be protected by one or more U.S. patents, foreign patents, or pending applications.

RESTRICTED RIGHTS LEGEND: Use, duplication, or disclosure by the government is subject to restrictions as set forth in subparagraph (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.277-7103 (October 1988) and FAR 52-227-19 (June 1987).

Trademark information

NetApp, the NetApp logo, Go Further, Faster, AltaVault, ASUP, AutoSupport, Campaign Express, Cloud ONTAP, Clustered Data ONTAP, Customer Fitness, Data ONTAP, DataMotion, Fitness, Flash Accel, Flash Cache, Flash Pool, FlashRay, FlexArray, FlexCache, FlexClone, FlexPod, FlexScale, FlexShare, FlexVol, FPolicy, GetSuccessful, LockVault, Manage ONTAP, Mars, MetroCluster, MultiStore, NetApp Insight, OnCommand, ONTAP, ONTAPI, RAID DP, RAID-TEC, SANtricity, SecureShare, Simplicity, Simulate ONTAP, Snap Creator, SnapCenter, SnapCopy, SnapDrive, SnapIntegrator, SnapLock, SnapManager, SnapMirror, SnapMover, SnapProtect, SnapRestore, Snapshot, SnapValidator, SnapVault, StorageGRID, Tech OnTap, Unbound Cloud, and WAFL and other names are trademarks or registered trademarks of NetApp, Inc., in the United States, and/or other countries. All other brands or products are trademarks or registered trademarks of their respective holders and should be treated as such. A current list of NetApp trademarks is available on the web at <http://www.netapp.com/us/legal/netapptmlist.aspx>.

How to send comments about documentation and receive update notifications

You can help us to improve the quality of our documentation by sending us your feedback. You can receive automatic notification when production-level (GA/FCS) documentation is initially released or important changes are made to existing production-level documents.

If you have suggestions for improving this document, send us your comments by email to docomments@netapp.com. To help us direct your comments to the correct division, include in the subject line the product name, version, and operating system.

If you want to be notified automatically when production-level documentation is released or important changes are made to existing production-level documents, follow Twitter account @NetAppDoc.

You can also contact us in the following ways:

- NetApp, Inc., 495 East Java Drive, Sunnyvale, CA 94089 U.S.
- Telephone: +1 (408) 822-6000
- Fax: +1 (408) 822-4501
- Support telephone: +1 (888) 463-8277