

Hitachi Virtual Storage Platform Family

SVOS RF 9.4

Mainframe Host Attachment and Operations Guide

The Hitachi Virtual Storage Platform storage systems provide critical compatibility and value-added storage technologies for operations in the IBM® mainframe environment. These high-end systems are tested and qualified with mainframe operating systems and a broad range of features, providing industry-leading functionality, performance, and reliability.

© 2007, 2020 Hitachi, Ltd. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including copying and recording, or stored in a database or retrieval system for commercial purposes without the express written permission of Hitachi, Ltd., or Hitachi Vantara LLC (collectively "Hitachi"). Licensee may make copies of the Materials provided that any such copy is: (i) created as an essential step in utilization of the Software as licensed and is used in no other manner; or (ii) used for archival purposes. Licensee may not make any other copies of the Materials. "Materials" mean text, data, photographs, graphics, audio, video and documents.

Hitachi reserves the right to make changes to this Material at any time without notice and assumes no responsibility for its use. The Materials contain the most current information available at the time of publication.

Some of the features described in the Materials might not be currently available. Refer to the most recent product announcement for information about feature and product availability, or contact Hitachi Vantara LLC at <https://support.hitachivantara.com/en-us/contact-us.html>.

Notice: Hitachi products and services can be ordered only under the terms and conditions of the applicable Hitachi agreements. The use of Hitachi products is governed by the terms of your agreements with Hitachi Vantara LLC.

By using this software, you agree that you are responsible for:

1. Acquiring the relevant consents as may be required under local privacy laws or otherwise from authorized employees and other individuals; and
2. Verifying that your data continues to be held, retrieved, deleted, or otherwise processed in accordance with relevant laws.

Notice on Export Controls. The technical data and technology inherent in this Document may be subject to U.S. export control laws, including the U.S. Export Administration Act and its associated regulations, and may be subject to export or import regulations in other countries. Reader agrees to comply strictly with all such regulations and acknowledges that Reader has the responsibility to obtain licenses to export, re-export, or import the Document and any Compliant Products.

Hitachi and Lumada are trademarks or registered trademarks of Hitachi, Ltd., in the United States and other countries.

AIX, AS/400e, DB2, Domino, DS6000, DS8000, Enterprise Storage Server, eServer, FICON, FlashCopy, GDPS, HyperSwap, IBM, Lotus, MVS, OS/390, PowerHA, PowerPC, RS/6000, S/390, System z9, System z10, Tivoli, z/OS, z9, z10, z13, z14, z/VM, and z/VSE are registered trademarks or trademarks of International Business Machines Corporation.

Active Directory, ActiveX, Bing, Excel, Hyper-V, Internet Explorer, the Internet Explorer logo, Microsoft, the Microsoft Corporate Logo, MS-DOS, Outlook, PowerPoint, SharePoint, Silverlight, SmartScreen, SQL Server, Visual Basic, Visual C++, Visual Studio, Windows, the Windows logo, Windows Azure, Windows PowerShell, Windows Server, the Windows start button, and Windows Vista are registered trademarks or trademarks of Microsoft Corporation. Microsoft product screen shots are reprinted with permission from Microsoft Corporation.

All other trademarks, service marks, and company names in this document or website are properties of their respective owners.

Copyright and license information for third-party and open source software used in Hitachi Vantara products can be found at <https://www.hitachivantara.com/en-us/company/legal.html>.

Contents

Preface	6
Intended audience.....	6
Product version.....	6
Release notes.....	7
Changes made in this revision.....	7
Document conventions.....	7
Conventions for storage capacity values.....	8
Accessing product documentation.....	9
Getting help.....	9
Comments.....	10
Chapter 1: Overview of mainframe operations	11
Mainframe compatibility and functionality.....	11
Connectivity.....	12
CU emulation support.....	14
System option modes for mainframe operations.....	14
Mainframe system function enablement.....	17
Enabling the mainframe system functions.....	19
Disabling the mainframe system functions.....	20
Logical channel subsystems and multiple subchannel sets.....	21
Chapter 2: FICON®/zHPF host attachment	23
Host connection interface specifications.....	23
Attaching FICON®/zHPF front-end directors.....	24
FICON®/zHPF features.....	25
FICON®/zHPF physical specifications.....	25
FICON®/zHPF logical specifications.....	26
FICON®/zHPF operating environment.....	27
FICON® and FICON®/zHPF protocol sequence.....	28
Hardware specifications.....	28
FICON® front-end directors.....	28
Logical paths.....	29
Supported topologies.....	30
Point-to-point topology.....	30
Switched point-to-point topology.....	31

Cascaded FICON® topology.....	32
Required high-integrity features.....	34
Path information.....	34
Physical host connection specifications.....	36
Logical host connection specifications.....	36
Enabling zHPF operations.....	36
zHPF feature activation.....	37
Enabling the zHPF feature.....	37
Installing zHPF in a cascading switch configuration.....	38
Removing the FICON®/zHPF feature.....	38
Chapter 3: Mainframe host operations.....	39
Mainframe configuration.....	39
Storage subsystem IDs (SSIDs).....	39
Mainframe hardware definition.....	40
Hardware definition using IOCP (z/OS®, z/VM®, or z/VSE®).....	40
Hardware definition using HCD (z/OS®).....	42
2105/2107 CU emulation: defining CU image, base and alias address range.....	42
Dynamic channel management.....	50
Definition of the storage system to z/VM® and z/VSE® systems.....	51
Definition of the storage system to z/TPF.....	51
Definition of the storage system to mainframe Linux.....	51
Mainframe operations.....	52
LVIs initialization.....	52
Using the QDASD option of the IBM® z/OS® DEVSERV MVS command....	52
z/OS® (MVS) cache operations.....	53
z/VM® (VM/ESA) cache operations.....	54
z/VSE® (VSE/ESA) cache operations.....	54
Chapter 4: Mainframe Linux operations.....	56
Overview of mainframe Linux operations.....	56
Running Linux on zSeries hosts	57
Attaching FC adapters on zSeries hosts running Linux	57
FCP support.....	57
Accessing storage units using FC protocol from a zSeries host	58
Setting up storage units for zSeries hosts running Linux.....	58
Setting up a Linux system to use FC protocol devices on zSeries.....	59
Adding permanent devices for zSeries hosts running Linux	60
Appendix A: Notes on using zDAC	63
Notes on executing the zDAC function.....	63
Message output.....	63

Specifications of open volumes..... 64

Preface

The Hitachi Virtual Storage Platform (VSP) storage systems provide critical compatibility and value-added storage technologies for operations in the IBM® mainframe environment. This document describes and provides instructions for configuring the Hitachi RAID storage systems for mainframe operations. The Hitachi RAID storage systems include VSP 5000 series, VSP F1500, VSP G1500, VSP G1000, and VSP.

Please read this document carefully to understand how to use these products, and maintain a copy for your reference.

Intended audience

This document is intended for system administrators, Hitachi Vantara representatives, and authorized service providers who install, configure, and operate the Hitachi RAID storage systems.

Readers of this document should be familiar with the following:

- Data processing and RAID storage systems and their basic functions.
- The Hitachi RAID storage system and the *Hardware Guide* for the storage system.
- The Hitachi Device Manager - Storage Navigator software and the *System Administrator Guide* for the storage system.
- The mainframe operating systems supported by the Hitachi RAID storage systems.
- The hardware used to attach the Hitachi RAID storage system to the mainframe host, including adapters, switches, and directors.

Product version

This document revision applies to the following versions:

- VSP 5000 series: 90-04-04 or later
- VSP G1x00, VSP F1500: 80-06-6x or later
- VSP: microcode 70-06-5x or later
- SVOS RF 9.4 or later

Release notes

Read the release notes before installing and using this product. They may contain requirements or restrictions that are not fully described in this document or updates or corrections to this document. Release notes are available on Hitachi Vantara Support Connect: <https://knowledge.hitachivantara.com/Documents>.

Changes made in this revision

- Added information about using the QDASD option of the IBM® z/OS® DEVSERV MVS command.





Document conventions

This document uses the following typographic conventions:

Convention	Description
Bold	<ul style="list-style-type: none"> ▪ Indicates text in a window, including window titles, menus, menu options, buttons, fields, and labels. Example: Click OK. ▪ Indicates emphasized words in list items.
<i>Italic</i>	<ul style="list-style-type: none"> ▪ Indicates a document title or emphasized words in text. ▪ Indicates a variable, which is a placeholder for actual text provided by the user or for output by the system. Example: <pre>pairdisplay -g group</pre> (For exceptions to this convention for variables, see the entry for angle brackets.)
Monospace	Indicates text that is displayed on screen or entered by the user. Example: <code>pairdisplay -g oradb</code>
< > angle brackets	Indicates variables in the following scenarios: <ul style="list-style-type: none"> ▪ Variables are not clearly separated from the surrounding text or from other variables. Example: <pre>Status-<report-name><file-version>.csv</pre> ▪ Variables in headings.

Convention	Description
[] square brackets	Indicates optional values. Example: [a b] indicates that you can choose a, b, or nothing.
{ } braces	Indicates required or expected values. Example: { a b } indicates that you must choose either a or b.
vertical bar	Indicates that you have a choice between two or more options or arguments. Examples: [a b] indicates that you can choose a, b, or nothing. { a b } indicates that you must choose either a or b.

This document uses the following icons to draw attention to information:

Icon	Label	Description
	Note	Calls attention to important or additional information.
	Tip	Provides helpful information, guidelines, or suggestions for performing tasks more effectively.
	Caution	Warns the user of adverse conditions and/or consequences (for example, disruptive operations, data loss, or a system crash).
	WARNING	Warns the user of a hazardous situation which, if not avoided, could result in death or serious injury.

Conventions for storage capacity values

Physical storage capacity values (for example, disk drive capacity) are calculated based on the following values:

Physical capacity unit	Value
1 kilobyte (KB)	1,000 (10 ³) bytes
1 megabyte (MB)	1,000 KB or 1,000 ² bytes
1 gigabyte (GB)	1,000 MB or 1,000 ³ bytes
1 terabyte (TB)	1,000 GB or 1,000 ⁴ bytes

Physical capacity unit	Value
1 petabyte (PB)	1,000 TB or 1,000 ⁵ bytes
1 exabyte (EB)	1,000 PB or 1,000 ⁶ bytes

Logical capacity values (for example, logical device capacity, cache memory capacity) are calculated based on the following values:

Logical capacity unit	Value
1 block	512 bytes
1 cylinder	Mainframe: 870 KB Open-systems: <ul style="list-style-type: none"> ▪ OPEN-V: 960 KB ▪ Others: 720 KB
1 KB	1,024 (2 ¹⁰) bytes
1 MB	1,024 KB or 1,024 ² bytes
1 GB	1,024 MB or 1,024 ³ bytes
1 TB	1,024 GB or 1,024 ⁴ bytes
1 PB	1,024 TB or 1,024 ⁵ bytes
1 EB	1,024 PB or 1,024 ⁶ bytes

Accessing product documentation

Product user documentation is available on Hitachi Vantara Support Connect: <https://knowledge.hitachivantara.com/Documents>. Check this site for the most current documentation, including important updates that may have been made after the release of the product.

Getting help

[Hitachi Vantara Support Connect](https://support.hitachivantara.com/en_us/contact-us.html) is the destination for technical support of products and solutions sold by Hitachi Vantara. To contact technical support, log on to Hitachi Vantara Support Connect for contact information: https://support.hitachivantara.com/en_us/contact-us.html.

[Hitachi Vantara Community](#) is a global online community for Hitachi Vantara customers, partners, independent software vendors, employees, and prospects. It is the destination to get answers, discover insights, and make connections. **Join the conversation today!** Go to community.hitachivantara.com, register, and complete your profile.

Comments

Please send us your comments on this document to doc.comments@hitachivantara.com. Include the document title and number, including the revision level (for example, -07), and refer to specific sections and paragraphs whenever possible. All comments become the property of Hitachi Vantara LLC.

Thank you!

Chapter 1: Overview of mainframe operations

This chapter provides an overview of mainframe host attachment, functions, and operations for the Hitachi RAID storage systems.

Mainframe compatibility and functionality

The storage systems provide full System-Managed Storage (SMS) compatibility and support the following functionalities in the mainframe environment:

- Sequential data striping
- Cache fast write (CFW) and DASD fast write (DFW)
- Enhanced dynamic cache management
- Extended count key data (ECKD) commands
- Multiple Allegiance
- Concurrent Copy (CC)
- Peer-to-Peer Remote Copy (PPRC)
- Extended Remote Copy (XRC)
- FlashCopy[®]
- Parallel Access Volume (PAV), including the HyperPAV and SuperPAV functions
- Priority I/O queuing
- Red Hat Linux for IBM[®] zSeries[®]
- SUSE Linux for IBM[®] zSeries[®]
- zHyperWrite for DB2[®] (for details, see *Hitachi TrueCopy[®] for Mainframe User Guide*)
- DB2[®] Cast Out Accelerator: 90-04-0x or later
- zHPF Extended Distance II (VSP G1x00, VSP F1500: 80-05-0x or later)
- FICON[®] Dynamic Routing
- FICON[®] Forward Error Correction (VSP G1x00, VSP F1500: 80-05-0x or later)
- Soft Fence, SPID Fence (VSP G1x00, VSP F1500: 80-05-4x or later)
- Query Host Access (VSP G1x00, VSP F1500: 80-05-4x or later)

The following table summarizes the mainframe operating systems supported by the storage systems. For details about the supported operating systems, including supported OS versions and minimum microcode levels, see the Mainframe FICON® Support Matrix on the Hitachi Vantara interoperability site: https://support.hitachivantara.com/en_us/interoperability.html

Vendor	Operating systems
IBM®	z/OS®, z/VM®, z/VSE®
	z/TPF
Red Hat	Red Hat Enterprise Linux (RHEL)
SUSE	SUSE Linux Enterprise Server (SLES)

Connectivity

The storage systems support all-mainframe, all-open-system, and multiplatform configurations. The front-end directors (FEDs) process the channel commands from the hosts and manage host access to cache. The front-end directors support the following types of host channel interface for mainframe attachment: FICON®/zHPF, and Fibre Channel (FC). The FICON®/zHPF and FC FED features are available in shortwave (multimode) and longwave (single-mode) versions.

FICON®/zHPF

The same FICON® features (boards) are used for FICON® and FICON®/zHPF. The FICON® features provide data transfer speeds of up to 1,600 MB/sec (16 Gbps) and have 8 or 16 ports per feature (pair of boards). The CHPID must be set as the FC type.

FICON[®] data transmission rates vary according to configuration:

- z9, z10, z12, z114, z196 series hosts support the following configurations:
 - FICON[®] channel will operate at 1/2/4/8 Gbps (by auto-negotiation process).
 - FICON[®] Express4 is supported in z9/z10 series. FICON[®] Express8 is supported in z10 series.
- z13, z14, and z14-ZR1 series hosts support the following configurations:
 - FICON[®] channel will operate at 4/8/16 Gbps (by auto-negotiation process depending on the installed FED type).
 - FICON[®] Express16S is supported by z13/z13s and z14/z14-ZR1 series.
 - FICON[®] Express16S+ is supported by z14/z14-ZR1 series.
 - FICON[®] Dynamic Routing is supported by z13/z13s and z14/z14-ZR1 series.
- z15 series hosts support the following configurations:
 - FICON[®] channel will operate at 4/8/16 Gbps (by auto-negotiation process depending on the installed FED type).
 - FICON[®] Express16S is supported by z13/z13s and z14/z14-ZR1 series.
 - FICON[®] Express16S+ is supported by z14/z14-ZR1 series.
 - FICON[®] Dynamic Routing is supported by z13/z13s and z14/z14-ZR1 series.
 - FICON[®] Express16A.

IBM[®] FICON[®] channel auto-negotiation rates are:

- FICON[®] Express2 will auto-negotiate to 2 Gbps or 1 Gbps.
- FICON[®] Express4 will auto-negotiate to 4 Gbps, 2 Gbps, or 1 Gbps.
- FICON[®] Express8 will auto-negotiate to 8 Gbps, 4 Gbps, or 2 Gbps.
- FICON[®] Express8S will auto-negotiate to 8 Gbps, 4 Gbps, or 2 Gbps.
- FICON[®] Express16S will auto-negotiate to 16 Gbps, 8 Gbps, or 4 Gbps.

When configured with shortwave (multimode) FICON[®] front-end directors, the storage system can be located according to the following:

- Multimode 62.5 μm : 300m (1 Gbps), 150m (2 Gbps), 70m (4 Gbps), 21m (8 Gbps), 15m (16 Gbps)
- Multimode 50 μm (50/125 μm laser optimized multi-mode (OM4) fiber cable): 860m (1 Gbps), 500m (2 Gbps), 400m (4 Gbps), 190m (8 Gbps), 125m (16 Gbps)

When configured with longwave (single-mode) FICON[®] front-end directors, the storage system can be located according to the following:

- Single-mode 9 μm : 10km, 20km with RPQ

Fibre Channel

The Fibre Channel features on the storage system provide data transfer speeds of 8, 16, and 32 Gbps and can have 8 or 16 ports per feature (pair of boards). The storage systems support shortwave (multimode) and longwave (single-mode) versions of fibre-channel ports on the same front-end director board.

FICON® Dynamic Routing (FIDR)

Connections to IBM® z13, z13s, z14, z14-ZR1, and z15 with FICON® 16S/16S+ channels can utilize FICON® Dynamic Routing for interswitch links on cascaded FICON® director configurations.

The FICON® directors must support the following features:

- Brocade directors:
 - Exchange Based Routing
 - Control Unit Port (CUP) function
- Cisco directors:
 - Open Exchange ID Routing
 - Control Unit Port (CUP) function

CU emulation support

The following table specifies the CU emulation support for the storage systems.

Storage system	CU emulation support
VSP 5000 series VSP G1000, VSP G1500, VSP F1500	<ul style="list-style-type: none"> ▪ 2107
VSP	<ul style="list-style-type: none"> ▪ 2107 ▪ 2105 (2105-F20 and later) ▪ 3990-6, 3990-6E

System option modes for mainframe operations

To provide greater flexibility, the storage system has additional operational parameters called system option modes (SOMs) that allow you to tailor the storage system to your unique operating requirements. The SOMs are set on the service processor (SVP) by your Hitachi Vantara representative.

- Review the SOMs for your operational environment. The SOMs are described in the *System Administrator Guide* or *Hardware Guide* for your storage system.
- Work with your Hitachi Vantara team to make sure the appropriate SOMs are set on your storage system.

The following table lists and describes the SOMs that apply to mainframe operations. The SOM information may have changed since this document was published. For the latest SOM information, contact your Hitachi Vantara representative.

- *SOM*: SOM number
- *Category*: Functions to which the SOM applies
- *Description*:
 - Function that the SOM provides
 - Default setting (ON or OFF)
 - For remote copy functions, storage system on which the SOM should be set: main control unit (MCU), remote control unit (RCU), or both

SOMs for general mainframe operations

SOM	Category	Description
305	Mainframe	<p>Enables the pre-label function (creation of VTOC including VOLSER):</p> <ul style="list-style-type: none"> ▪ ON: Prelabel is enabled. ▪ OFF (default): Prelabel is not enabled. <p>Notes:</p> <ol style="list-style-type: none"> 1. Set SOM 305 to ON before performing LDEV Format for a mainframe volume if you want to perform OS IPL (volume online) without fully initializing the volume after the LDEV Format. However, full initialization is required in actual operation. 2. Processing time of LDEV format increases by as much as full initialization takes. 3. The following functions and conditions are not supported: <ul style="list-style-type: none"> ▪ Quick format ▪ 3390-A (Dynamic Provisioning attribute) ▪ Volume Shredder 4. Full initialization is required in actual operation. 5. Microcode versions earlier than 80-05-32-00/00 or earlier than 80-05-47-00/00 (within 80-05-4x range) have a bug. Refer to BID=RAID800-XXXX (SR# HDS04414070). Make sure to use the workaround or the fixed code when SOM 305 is ON.

SOM	Category	Description
531	Mainframe and Open	<p>When PIN data is generated, the SIM currently stored in SVP is reported to the host:</p> <ul style="list-style-type: none"> ▪ ON: The SIM for PIN data generation is stored on the SVP and reported to the host. ▪ OFF: The SIM for PIN data generation is stored on the SVP and is not reported to the host.
1091	Mainframe VSP 5000 series, VSP G1x00, and VSP F1500 only	<p>Enables or disables the IBM® zHyperWrite function. When the mode setting is changed to ON or OFF, SCI is reported to the host and the zHyperWrite function is enabled or disabled.</p> <ul style="list-style-type: none"> ▪ ON: The zHyperWrite function is enabled. (ReadFeatureCode setting for the zHyperWrite function) ▪ OFF (default): The zHyperWrite function is disabled. <p>Notes:</p> <ol style="list-style-type: none"> 1. The mode can be applied when DKCMAIN version 80-04-21-00/00 or higher that supports the zHyperWrite function is used. 2. To enable the zHyperWrite function, set the mode to ON on both MCU and RCU of TCz. 3. To downgrade the microcode to a version that does not support the zHyperWrite function, set the mode to OFF prior to downgrading the microcode. 4. Even when the mode is set to ON for a storage system in 3DC configuration, the zHyperWrite function does not work for volumes in 3DC configuration. 5. Do not set the mode to ON if SOM474 is set to ON. 6. Do not set the mode to ON if Preserve Mirror configuration is created. 7. Do not set the mode to ON if the TCz Function Switch 12 is set to ON. 8. To use the zHyperWrite function, a HyperSwap environment is required. 9. Ensure that the CFW data setting for the PPRC/TCz pair is set to 'Secondary Volume Copy' so that CFW data is copied to the S-VOL. If this is not set, zHyperWrite will not function.

Mainframe system function enablement

In addition to system option modes (SOMs), certain mainframe system functions can be enabled or disabled by using the Device Manager - Storage Navigator **Edit Mainframe System Functions** window. The following functions can be enabled:

- Soft Fence, SPID Fence, Query Host Access
- ICKDSF INIT/REFORMAT VERIFYOFFLINE
- IBM® zHyperWrite + 3DC multi-target
- TCMF multi-target
- TCMF SVOL Read
- Super PAV
- DB2® Cast Out Accelerator



Note: The following functions are enabled by default:

- Soft Fence, SPID Fence, Query Host Access
- ICKDSF INIT/REFORMAT VERIFYOFFLINE
- IBM® zHyperWrite + 3DC multi-target
- TCMF multi-target
- TCMF SVOL Read

For VSP G1x00 and VSP F1500, these functions are disabled by default on the storage system. For VSP 5000 series, only the Super PAV function is disabled by default. If you plan to use these functions, you must first enable them on the storage system by using the Device Manager - Storage Navigator **Edit Mainframe System Functions** window.



Caution: If the storage system restarts with volatilization (Forced outage with volatile DKC and DKU, PS-OFF to volatile PS-ON, or Offline microcode replacement), the mainframe system functions are reset to the default settings. If you enabled any of the mainframe system functions before the volatilization, you must re-enable them after the volatilization.

Soft Fence, SPID Fence, Query Host Access

Soft Fence and SPID Fence are volume protection functions provided by IBM® that are used for disaster recovery operations. The Query Host Access (QHA) function provides information about DASD and storage control units on IBM® z/OS®. For details about the Soft Fence, SPID Fence, and Query Host Access host functions and related host commands, see the IBM® documentation.

- *Soft Fence*: Soft Fence is defined and canceled from the mainframe host. When you set Soft Fence to pair volumes created by using PPRC commands, the Soft Fence setting prevents unintended access to protect volumes that are needed to recover from a disaster. A volume for which Soft Fence is defined rejects host read/write requests as well as pair operations from the following software products:
 - ShadowImage for Mainframe
 - TrueCopy for Mainframe
 - Universal Replicator for Mainframe
 - FlashCopy®
 - XRC
 - Volume Migration
 - FICON® Data Migration

You can check the Soft Fence status of a volume (enabled or disabled) by using the **Mainframe Fenced Status** window in Device Manager - Storage Navigator.

- *SPID Fence*: SPID Fence is defined and canceled from the mainframe host. When you set SPID Fence to a volume, the VARY ONLINE host command is rejected so that the volume is not allowed to be online.

You can check the SPID Fence status of a volume (enabled or disabled) by using the **Mainframe Fenced Status** window in Device Manager - Storage Navigator.

- *Query Host Access*: The Query Host Access function enables you to display the host access information for a volume when you execute the DEVSERV command with the QHA parameter from the host.



Note: If a host cannot access a volume for which the Soft Fence or SPID Fence setting is enabled, you can forcibly disable the Soft Fence or SPID Fence setting on the volume by using Device Manager - Storage Navigator. You should forcibly disable the Soft Fence or SPID Fence setting only when you cannot access the volume from the host.

ICKDSF INIT/REFORMAT VERIFYOFFLINE

VERIFYOFFLINE is a parameter for the ICKDSF INIT and REFORMAT commands running on IBM® z/OS®. When you execute these commands with this parameter, if the target volume is made online by another system, the INIT or REFORMAT command cannot be executed. To execute these commands, first execute the VARY OFFLINE command from the system that is using the applicable volume, and then execute the INIT or REFORMAT command again. For details about the VERIFYOFFLINE parameter and the ICKDSF INIT and REFORMAT commands, see the IBM® documentation.



Note: This function supports only ports set for I-2107. Even when the INIT/REFORMAT VERIFYOFFLINE function is enabled on the storage system, the VERIFYOFFLINE function is not supported on ports set for I-2107-TPF.

IBM® zHyperWrite + 3DC multi-target

The zHyperWrite function enables hosts to write DB2® logs directly to the TCz P-VOL and the TCz S-VOL. For details about this function, see the IBM® documentation. For details about using this function on the storage system, see *Hitachi TrueCopy® for Mainframe User Guide*.

TCMF multi-target

For details about this function, see *Hitachi TrueCopy® for Mainframe User Guide*.

TCMF SVOL Read

For details about this function, see *Hitachi TrueCopy® for Mainframe User Guide*.

Super PAV

The IBM® HyperPAV function enables you to map alias devices to base devices only within the same CU. If you want to map alias devices in a different CU, you must enable the Super PAV mainframe system function on the storage system. When the Super PAV mainframe system function is enabled, you can map an entire collection of alias devices to a single base device that is in a different CU. For details about IBM® SuperPAV and related host commands, see the IBM® documentation.

DB2® Cast Out Accelerator

See *Provisioning Guide for Mainframe Systems*.

Enabling the mainframe system functions

By default, the following mainframe system functions are disabled on the storage system:

- VSP 5000 series: Super PAV
- VSP G1x00, VSP F1500:
 - Super PAV
 - Soft Fence, SPID Fence, Query Host Access
 - INIT/REFORMAT VERIFYOFFLINE

If you plan to use any of these IBM® host functions, you must enable the corresponding mainframe system function on the storage system in advance.



Caution: If the storage system restarts with volatilization (Forced outage with volatile DKC and DKU, PS-OFF to volatile PS-ON, or Offline microcode replacement), the mainframe system functions are reset to the default setting of disabled. If you enabled any mainframe system functions before the volatilization, you must re-enable them after the volatilization.

Before you begin

- The Storage Administrator (Initial Configuration) role is required to perform this task.

Procedure

1. Click **Actions > Mainframe Connection > Edit Mainframe System Functions**.
2. Select the functions you want to enable, click **Enable**, and then click **Finish**.
3. In the **Task Name** text box, accept the default task name ("date-window name"), or type a unique name for the task.

You can enter up to 32 ASCII characters and symbols, with the exception of the following: \ / : , ; * ? " < > |.

4. If you want the **Tasks** window to open after you click **Apply**, select **Go to tasks window for status**.
5. Click **Apply**.

If **Go to tasks window for status** was selected, the **Tasks** window opens.

Disabling the mainframe system functions

You can disable the following mainframe system functions on your storage system:

- VSP 5000 series: Super PAV
- VSP G1x00, VSP F1500:
 - Super PAV
 - Soft Fence, SPID Fence, Query Host Access
 - INIT/REFORMAT VERIFYOFFLINE



Caution: After you disable the Soft Fence, SPID Fence, Query Host Access or INIT/REFORMAT VERIFYOFFLINE mainframe system function on the storage system, you will not be able to use the corresponding host functions on the storage system.



Note: When you disable the Soft Fence, SPID Fence, Query Host Access function, values for SYSPLEX NAME and MAXIMUM NUMBER OF CYLINDERS SUPPORTED in Query Host Access might be incorrect on the host. If you re-enable the Soft Fence, SPID Fence, Query Host Access function later, incorrect values for SYSPLEX NAME and MAXIMUM NUMBER OF CYLINDERS SUPPORTED in Query Host Access might be displayed. If this occurs, perform VARY OFFLINE and then VARY ONLINE from all paths of hosts.

Before you begin

- The Storage Administrator (Initial Configuration) role is required to perform this task.
- Before you disable the Soft Fence, SPID Fence, Query Host Access option, make sure that the Soft Fence setting and the SPID Fence setting have been disabled on all volumes.
- Before you disable the Super PAV function, make sure that all alias device assignments in the storage system have been deleted.

Procedure

1. Click **Actions** > **Mainframe Connection** > **Edit Mainframe System Functions**.
2. Select each function you want to disable, click **Disable**, and then click **Finish**.
3. In the **Task Name** text box, accept the default task name ("date-window name"), or type a unique name for the task.

You can enter up to 32 ASCII characters and symbols, with the exception of the following: \ / : , ; * ? " < > | .

4. If you want the **Tasks** window to open after you click **Apply**, select **Go to tasks window for status**.
5. Click **Apply**.

If **Go to tasks window for status** was selected, the **Tasks** window opens.



Note: If you disable the Soft Fence, SPID Fence, Query Host Access function and the task ends abnormally, the cause might be that volumes with the Soft Fence or SPID Fence setting remain. If you cannot disable the Soft Fence or SPID Fence setting from the host, use Device Manager - Storage Navigator to forcibly disable the Soft Fence and SPID Fence settings on the volumes, and then retry disabling the Soft Fence, SPID Fence, Query Host Access function.

Also, when the disable Soft Fence, SPID Fence, Query Host Access task ends abnormally, the host receives a report that the functions have been disabled. Therefore, the host might not change the fenced status to disable. If this occurs, use Device Manager - Storage Navigator to forcibly disable the Soft Fence and SPID Fence settings on the volumes, and then retry disabling the Soft Fence, SPID Fence, Query Host Access function.

Logical channel subsystems and multiple subchannel sets

Logical channel subsystems (LCSS): Storage products can be connected to any FICON[®] or FICON[®] (FCP) channel supported by any of the logical channel subsystems implemented on IBM[®] processors. Some IBM[®] processor models can support up to four (4) logical channel subsystems (LCSS0 – LCSS3) that provide the connectivity required by the logical partitions defined in the configuration.

Multiple subchannel sets (MSS): Each logical channel subsystem implemented by IBM® processor models can also support up to four (4) subchannel sets (MSS0, MSS1, MSS2, and MSS3). MSS0 is supported by all IBM® processor models, while the latest zSeries® models also provide support for MSS1 and MSS2. IBM® model z13 (MT 2964), z13s(MT 2965), z14 (MT 3906), z14-ZR1(MT 3907) support MSS3.

IBM® I/O definitions allow the use of subchannel sets 1, 2, and 3 for use by the subchannel information blocks (SCHIBs) that represent special use devices, such as PAV alias devices or PPRC secondary devices.

For the support provided by your IBM® processor model, please consult the latest version of the following IBM® manual, and review Appendix F, Machine limits and rules: *Input/Output Configuration Program User's Guide for ICP IOCP, SB10-7163*

Chapter 2: FICON®/zHPF host attachment

This chapter describes and provides general instructions for attaching the storage system to a mainframe host using a FICON®/zHPF front-end director.

For details about FICON®/zHPF connectivity and supported adapters, switches, and directors for the storage systems, see the Mainframe FICON® Support Matrix on the Hitachi Vantara interoperability site: https://support.hitachivantara.com/en_us/interoperability.html

Host connection interface specifications

The following table lists the host connection interface specifications for mainframe fibre (FICON®) channels.

Host connection interface specifications

Item	FICON® channel
Maximum number of CUs	255
CU address range	0 to FE ^{1,3}
Maximum number of SSIDs	1,020
SSID range	2105 and 2107: 0004 to FEFF
Maximum number of LDEVs	65,280
Number of logical volumes	1 to 65,280 ²

Notes:

1. The number of CUs that can be connected to one FICON® channel (CHPID) is 64 or 255:
 - CU addresses for 2105-F20 emulation and FICON®: 00 to 3F
 - CU addresses for 2107 emulation and FICON®: 00 to FE
2. The maximum number of logical volumes that can be connected to one FICON® channel (CHPID) is 32,768.
3. For storage systems operating in IBM® TPF mode, the control units that can be accessed are in the range of 00-3F.

Numbers of logical paths that can be connected

The following table lists the number of logical paths that can be connected for mainframe fibre channels.

Item	FICON [®] channel
Number of channel ports	8 to 112
Maximum number of logical paths per CU	2,048
Maximum number of logical paths per port	65,536 ^{1,3} / 261,120 ^{2,3}
Maximum number of logical paths per front-end director	65,536 ¹ / 261,120 ²
Maximum number of logical paths per storage system	131,072 ¹ / 522,240 ²
<p>Notes:</p> <ol style="list-style-type: none"> 1. For 2105-F20 CU emulation. 2. For 2107 CU emulation. 3. The maximum number of paths that can be connected to a host per FICON[®] port is 1,024: <ul style="list-style-type: none"> ▪ 2105-F20 emulation: 1,024 host paths × 64 CUs = 65,536 logical paths ▪ 2107 emulation: 1,024 host paths × 255 CUs = 261,120 logical paths 	

Attaching FICON[®]/zHPF front-end directors

FICON[®]/zHPF uses a mapping layer technique based on Fibre Channel and multiplexing technologies to improve data-transfer rates, reduce the number of channel connections, and support greater distances between the storage systems and mainframe hosts. FICON[®] and FICON[®]/zHPF have identical hardware specifications, but FICON[®]/zHPF offers improved data transfer performance.

FICON[®]/zHPF delivers faster data access, higher transaction rates, and higher data movement speeds between mainframe servers and storage devices. Infrastructure management is simplified and allows geographically dispersed data centers for optimal business continuity. This simplifies data center operations and reduces hardware and storage management costs.

In summary, FICON[®]/zHPF provides the following key features:

- Full-duplex, bi-directional data transfers
- Multiple I/O processes
- Allows small and large data transfers to be transmitted at the same time
- High-bandwidth transfer (up to 16 Gbps)
- Lowered interlock between the disk controller and channel

- Executing pipeline CCW
- Use of FCP as the fibre-channel link transport for zHPF

The following sections describe the specifications for FICON®/zHPF.

FICON®/zHPF features

The following table lists the FICON®/zHPF features and specifies storage system support.

Feature	Supported	
	VSP 5000, VSP G1x00, VSP F1500	VSP
Extended Distance FICON®	Yes	Yes ¹
z/OS® Discovery and Auto Configuration (zDAC)	Yes	Yes ²
Single-track operations	Yes	Yes
Multi-track operations	Yes	Yes ²
Bidirectional function	Yes ³	No
QSAM/BSAM/BPAM	Yes ³	No
Format write operations	Yes ³	No
List Prefetch function	Yes ³	Yes ⁴
Notes: <ol style="list-style-type: none"> 1. 70-03-32-00/00 or later 2. 70-04-01-00/00 or later 3. 80-02-01-00/01 or later 4. 70-06-30-00/00 or later – Engineering approval is required. 		

FICON®/zHPF physical specifications

The following table lists the physical specifications of the FICON®/zHPF features.

Item	FICON®/zHPF
Physical interface	ANSI FC-PH/PC-PI-2 etc. For details, see ANSI standard "Fibre Channel Single-Byte Command Code Sets Mapping Protocol – 5".
Logical interface	ANSI FC-SB-2/FC-SB-3/FC-SB-4/FC-SB-5

Item	FICON®/zHPF
Bandwidth and direction	1 Gbps / 2 Gbps / 4 Gbps / 8 Gbps / 16 Gbps Bidirectional
Cable	Single mode/9µm Multi mode/50µm or multi mode/62.5µm
Distance	
Long wave	Single mode/9µm 10 km, 20 km (with RPQ)
Short wave	Multi mode/62.5µm 300m (1Gbps), 150m (2Gbps), 70m (4Gbps), 21m (8Gbps), 15m (16 Gbps) Multi mode/50µm 860m (1Gbps), 500m (2Gbps), 400m (4Gbps), 190m (8Gbps), 125m (16 Gbps)
Connector	LC-duplex (see the figure below)
Topologies	Point-to-point Switched point-to-point



FICON®/zHPF logical specifications

The following table lists the logical specifications for FICON®/zHPF.

Item	FICON®/zHPF
CCW handling	Pipelining Protocol interlock is reduced.
Number of concurrent I/Os	Multiple I/Os execute concurrently per one channel.
Addressing	32,768 devices per channel
Data transfer	Full-duplex

Connectivity improvements of FICON®/zHPF:

- The interlock between the host and the storage system is lowered in terms of the protocol.
- Throughput is increased using multiple I/O process and bidirectional data transfer.
- The number of the connectable devices per channel is increased.

FICON®/zHPF operating environment

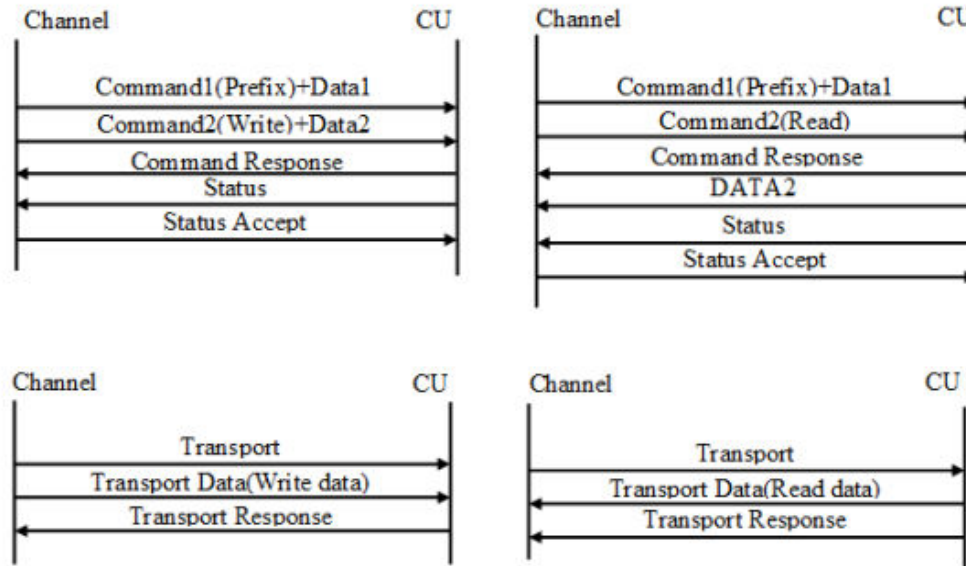
The following table lists the operating environment required for FICON®/zHPF. For more information about FICON®/zHPF operating environments, including supported hosts and operating environments, refer to the IBM® Redbooks.

For details about the supported operating systems, including supported OS versions and minimum microcode levels, see the Mainframe FICON® Support Matrix on the Hitachi Vantara interoperability site: https://support.hitachivantara.com/en_us/interoperability.html

Item	Specification	
CPU	z196, z114, zEC12, zBC12	FICON® Express4 FICON® Express8 FICON® Express8Sa
	z13, z13s, z14, z14 Model ZR1	FICON® Express16S, Express16S+
Operating system	For FICON®: z/OS® R1.V1 and later releases	
	For FICON®/zHPF: <ul style="list-style-type: none"> ▪ z/VM® Version 6 Release 1 and later releases ▪ z/VM® Version 6 Release 2 with APAR VM65041 for guest zHPF support 	
	Linux – (Red Hat / SUSE) With kernel 2.6.38 (released 05-19-2011) provides support for zHPF in LPAR mode and under z/VM® when z/VM® APAR VM65041 is installed.	
	z/TPF 1.1 and later releases	
	z/VSE® V4.1 and later releases z/VSE® V4.2 and later releases z/VSE® V4.3 and later releases z/VSE® V5.1 and later releases	
Control unit emulation	2105-F20 and later 2107	
Host-based software	High Performance FICON® (HPF)	

FICON® and FICON®/zHPF protocol sequence

The following figures show the basic read/write sequence of FICON® and zHPF Protocols. For details, see the ANSI standard document *Fibre Channel Single-Byte Command Code Sets Mapping Protocol - 5*.



Hardware specifications

For details about FICON®/zHPF connectivity and supported adapters, switches, and directors for your storage system, see the Mainframe FICON® Support Matrix on the Hitachi Vantara interoperability site: https://support.hitachivantara.com/en_us/interoperability.html

FICON® front-end directors

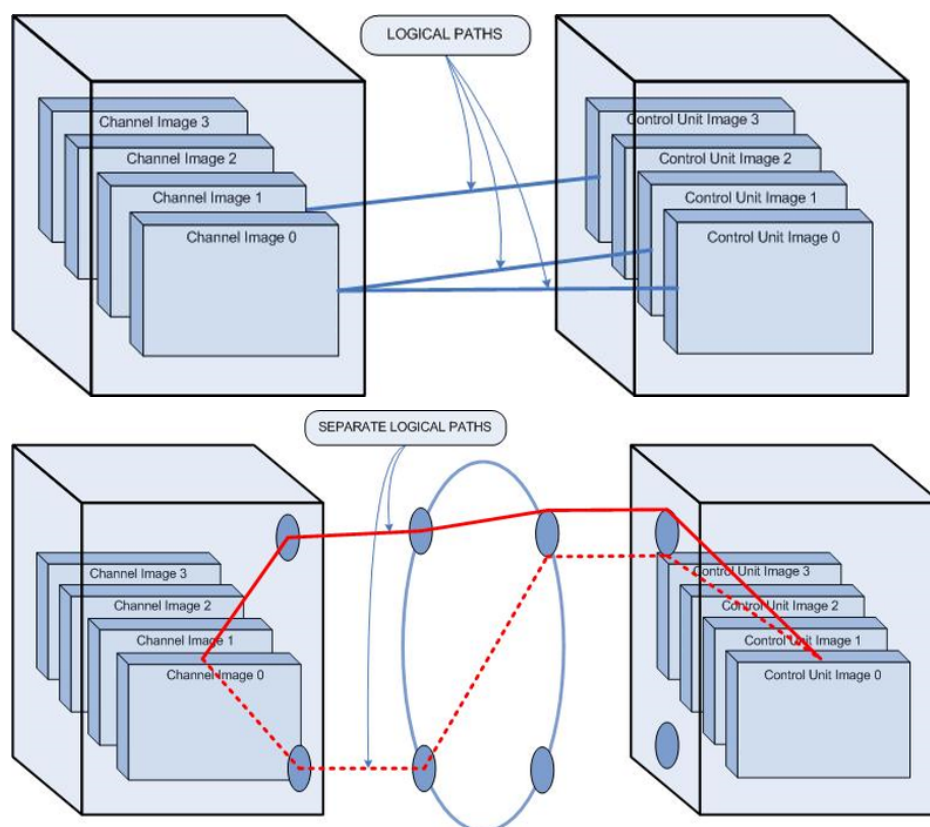
The FICON® front-end directors process the channel commands from the hosts and manage host access to cache. In the mainframe environment, front-end directors perform count-key data (CKD)-to-fixed-block architecture (FBA) and FBA-to-CKD conversion for the data in cache. Front-end director boards are installed in pairs.

The Hitachi FICON® front-end directors provide the storage systems with FICON®/zHPF capabilities. FICON® front-end directors are available in both shortwave (multimode) and longwave (single-mode) versions. For details about the FICON® front-end directors, see the *Hardware Guide* for your storage system.

Logical paths

FICON[®]/zHPF channels are capable of fast I/O rates. However, mainframes have a limited number of paths that can be defined for a single control unit. One way to address this limitation is to use logical paths. With multiple logical paths, additional paths are defined to the logical control units, providing the host with access to a greater number of control unit interfaces and greater bandwidth. FICON[®] and FICON[®]/zHPF support identical logical paths.

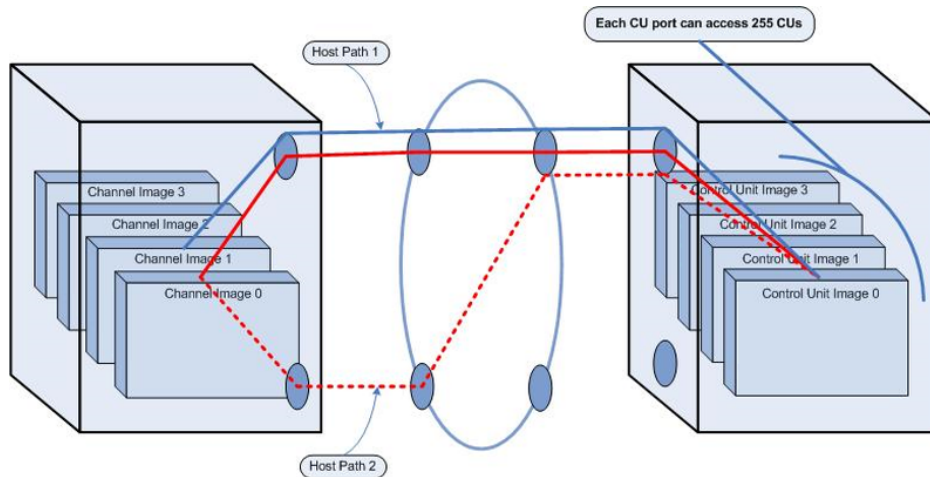
Logical paths are identified through a combination of channel image number, CU image number, channel port address and CU port address. The following figures show two conceptual drawings of mainframe logical paths.



The Hitachi FICON[®]/zHPF front-end directors provide logical path bindings that map user-defined FICON[®]/zHPF logical paths. Specifically:

- Each CU port can access 255 CU images (all CU images of logical subsystem).
- To the CU port, each logical host path (LPn) connected to CU port is defined as a channel image number and a channel port address. The LPn identifies the logical host path by the channel image number and channel port address (excluding CU image number).

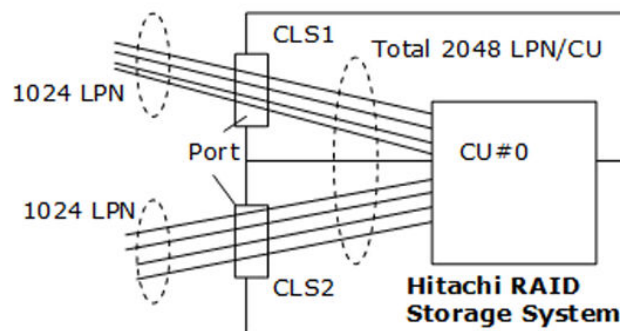
In the following figure, Host Path(1) and Host Path(2) have the same channel image number and CU image number. However, they correspond to different paths because the channel address (and LPn) is different.



The following figure shows another example of logical paths. Instead of being controlled by physical ports, LPNs on the Hitachi RAID storage system are controlled by CU images. Separating LPNs from hardware provides flexibility that allows CU ports to share logical path resources as needed.

Specifically:

- Maximum number of LPn/CU images per storage system = 2,048
- Maximum number of CU images per storage system = 255
- Maximum number of logical paths per storage system = 522,240 (2,048 × 255)

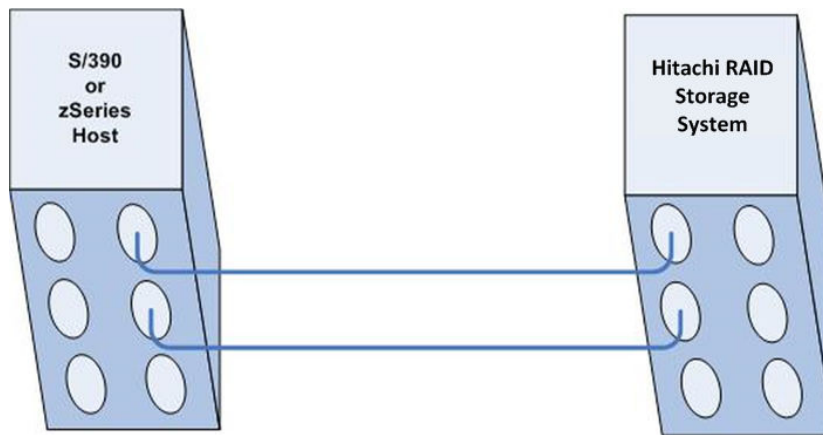


Supported topologies

FICON[®] and FICON[®]/zHPF support the same topologies.

Point-to-point topology

A channel path that consists of a single link interconnecting a FICON[®] channel in FICON[®] native (FC) mode to one or more FICON[®] control unit images (logical control units) forms a point-to-point configuration. A point-to-point configuration is permitted between a channel and control unit when a single control unit is defined on the channel path or when multiple control unit images (logical control units) share the same N Port in the control unit. A FICON[®] channel point-to-point configuration is shown in the following figure.



Switched point-to-point topology

A FICON[®] channel in FICON[®] native mode connects one or more processor images to a Fibre Channel link, which connects to a Fibre Channel switch, and then dynamically to one or more FC switch ports (internally within the switch). From the switch ports, another Fibre Channel link to FICON[®] CU ports interconnects with one or more control units and/or images (logical control units). This forms a switched point-to-point configuration, as shown in the following figure.

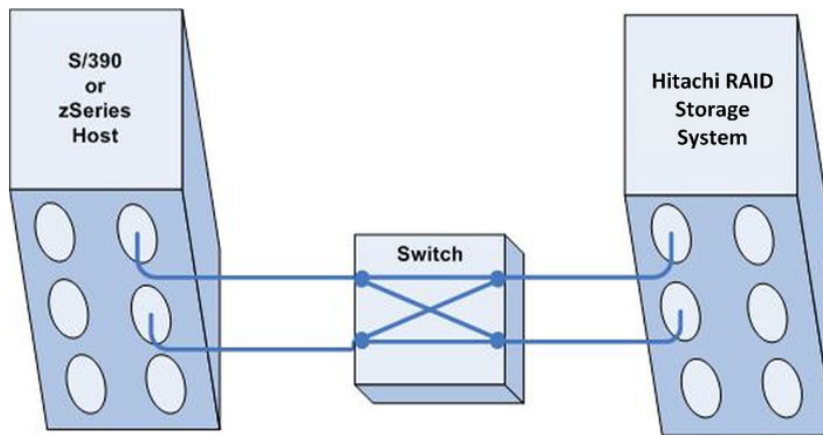
Multiple channel images and multiple control unit images can share the resources of the Fibre Channel link and Fibre Channel switch, permitting multiplexed I/O operations. Channels and control unit links can be attached to the Fibre Channel switch in any combination, depending on configuration requirements and available Fibre Channel switch resources.

Sharing a control unit through a Fibre Channel switch allows communication between a number of channels and the control unit to occur either:

- Over one switch-to-CU link, such as when a control unit has only one link to the Fibre Channel switch, or
- Over multiple-link interfaces, such as when a control unit has more than one link to the Fibre Channel switch.

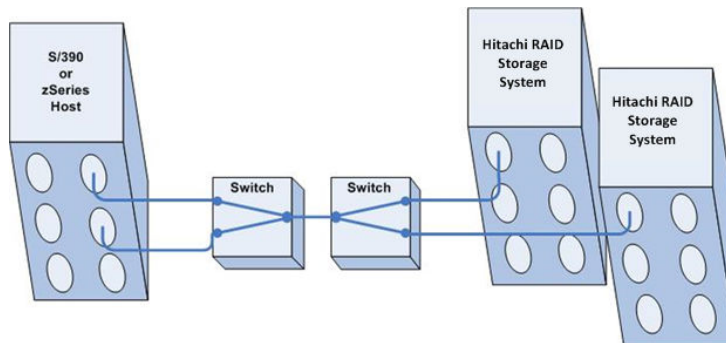
In a FICON[®] switched point-to-point topology, one Fibre Channel link is attached to the FICON[®] channel. From the switch, the FICON[®] channel communicates with a number of FICON[®] CUs on different switch ports. At the control unit, the control unit and device-addressing capability is the same as the point-to-point topology. However, communication and addressing capabilities are increased for the channel when it is connected to a Fibre Channel switch, and can use the domain and port address portion of the 24-bit N_Port address to access multiple control units.

The communication path between a channel and a control unit consists of the physical channel path and the logical path. In a FICON[®] switched point-to-point topology with a single switch, the physical paths are the Fibre Channel links (interconnection of two Fibre Channel links connected by a Fibre Channel switch) that provide the physical transmission path between a channel and a control unit.



Cascaded FICON® topology

A FICON® channel in FICON® native (FC) mode connects one or more processor images to a Fibre Channel link, which connects to a Fibre Channel switch, and then dynamically through one or more FC switch ports (internally within the switch) to a second FC switch in a remote site via FC links. From the second FC switch port, a number of Fibre Channel links connect to FICON® CU ports, which interconnect with one or more control units and/or images (logical control units). This forms a cascaded FICON® topology, as shown in the following figure. The cascaded FICON® directors topology is supported only by IBM® zSeries processors.



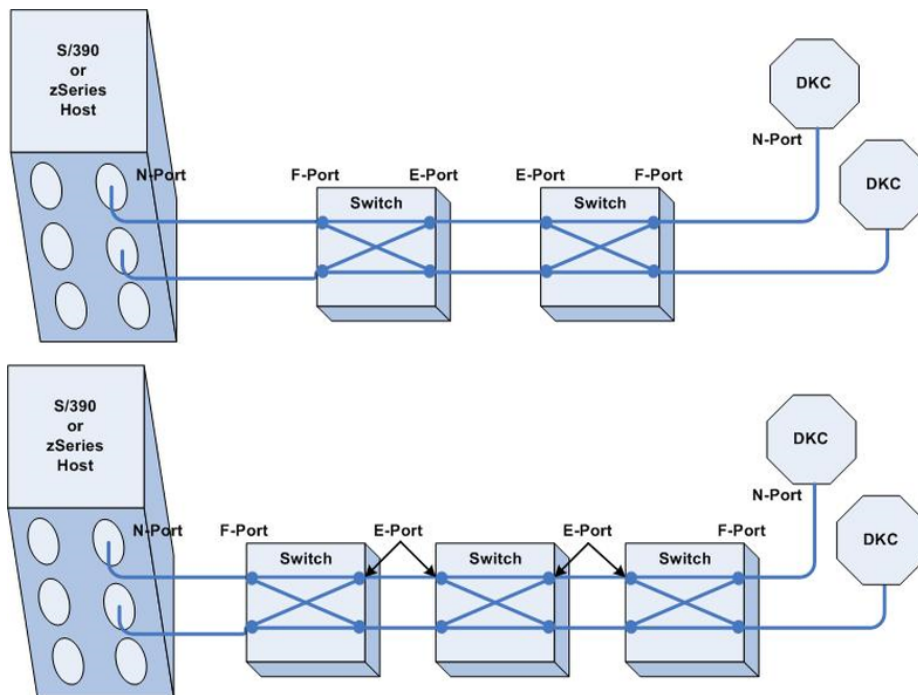
In a cascaded FICON® topology, one or two switches reside at the topmost (root) level, between the channel (CHL) and disk controller (DKC) ports, as shown in the following figure. With this configuration, multiple channel images and multiple control unit images can share the resources of the Fibre Channel link and Fibre Channel switches so that multiplexed I/O operations can be performed. Channels and control unit links can be attached to the Fibre Channel switches in any combination, depending on configuration requirements and Fibre Channel switch resources.

Sharing a control unit through a Fibre Channel switch allows communication between a number of channels and the control unit to occur either:

- Over one switch-to-CU link, such as when a control unit has only one link to the Fibre Channel switch
- Over multiple-link interfaces, such as when a control unit has more than one link to the Fibre Channel switch

In a cascaded FICON® topology, one Fibre Channel link is attached to the FICON® channel. From the switch, the FICON® channel communicates with a number of FICON® CUs on different switch ports. At the control unit, the control unit and device-addressing capability is the same as the point-to-point topology. However, communication and addressing capabilities are increased for the channel when it is connected to a Fibre Channel switch, and can use the domain and port address portion of the 24-bit N_Port address to access multiple control units.

Note: The domain address portion of the FC 24-bit port address is different, since there are two FICON® channel switches in the channel-to-control unit path.



Note: FICON® Dynamic Routing (FIDR) Connections to IBM® z13, z13s, z14, or z14-ZR1 with FICON® 16S channels can utilize FICON® Dynamic Routing for interswitch links on cascaded FICON® director configurations. The FICON® directors must support the following features:

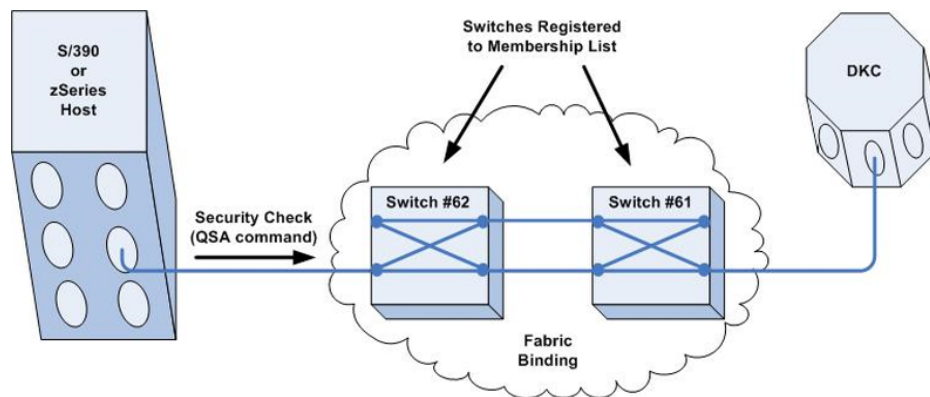
- *Brocade directors:* Exchange Based Routing, Control Unit Port (CUP) function
- *Cisco directors:* Open Exchange ID Routing, Control Unit Port (CUP) function

Required high-integrity features

FICON[®] directors in a cascaded configuration require switches that support the following high-integrity features:

- *Fabric binding*: This feature lets an administrator control the switch composition of a fabric by registering WWNs in a membership list and explicitly defining which switches are capable of forming a fabric. In this way, an operator can deny non-authorized switches access into a fabric. A non-authorized switch attempting to gain entry into a fabric becomes isolated and is prevented from accessing fabric resources
- *Insistent Domain IDs*: This feature prohibits the use of dynamic Domain IDs to ensure that predictable Domain IDs are being enforced within the fabric. For example, if a switch has this feature enabled and a new switch is connected to it via an inter-switch links (ISL) without the preferred Domain ID, the new switch is segmented into a separate fabric and user data will not flow. The Insistent Domain IDs feature also ensures that duplicate Domain IDs are not being used within a fabric.

The channel checks whether these high-integrity features are enabled in the switch by issuing a Query Security Attributes (QSA) command during initialization. If these features are not enabled in switch, Channel initialization process stops. See the following figure.



Path information

Depending on the microcode version installed on the storage system, the Link values displayed on the service processor (SVP) Logical Path Status screen may appear as 3-byte values for cascaded topologies:

- The first byte corresponds to the switch address.
- The second byte corresponds to the port address.
- The third byte corresponds to the FC-AL port (this is a constant value in FICON[®]).

The following figure shows how the link information is displayed in non-cascaded and cascaded topologies.

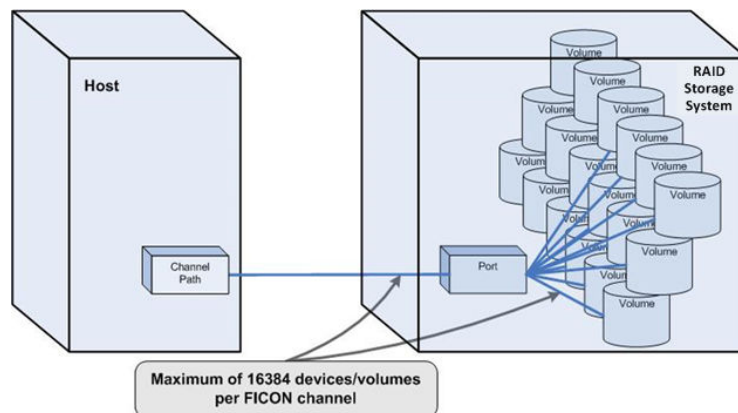
Physical host connection specifications

The following table lists the FICON®/zHPF host and RAID physical connection specifications associated with host connections.

Item	Link bandwidth	Connector	Cable
Storage system	4/8/16 Gbps (Auto-negotiation)	LC-Duplex	Single mode Multi mode
z114, z196, zEC12, zBC12, z13, z13s, z14, z14-ZR1: <ul style="list-style-type: none"> ▪ FICON® Express ▪ FICON® Express2 ▪ FICON® Express4 ▪ FICON® Express8 ▪ FICON® Express16 ▪ FICON® Express16S ▪ FICON® Express16S+ 	1/2/4/8 Gbps 4/8/16 Gbps	LC-Duplex	Single mode Multi mode

Logical host connection specifications

The following figure shows an example of logical host connections. FICON®/zHPF supports up to 32,768 unit addresses for each CHL port (in this case, the maximum limit is increased). In this example, CHL path configuration can be reduced.



Enabling zHPF operations

zHPF feature activation

The zHPF license is required to activate the zHPF feature on the storage system. Launch Device Manager - Storage Navigator and use the following information to activate the zHPF feature:

- *License name:* Compatible High Performance Connectivity for IBM® FICON®
- *Permanent with Capacity Free:* The license allows unlimited storage capacity usage on one storage system.



Caution: When FICON® paths are connected to IBM® z13, z13s, z14, or z14-ZR1 processors using FICON® Express16S or Express16S+ channel cards, do not install or remove the High Performance Connectivity for FICON® license.

When the High Performance Connectivity for FICON® license is installed or removed and you are actively connected to an IBM® FICON® Express16S or Express16S+ channel type, the logical paths on this channel path will be released.

The logical path is restored by the recovery of the host, but depending on the timing, it is possible that all logical paths of the path group are released, causing access loss to the storage system.

Conditions of occurrence:

- The path is connected to a FICON® Express16S or Express16S+ channel on an IBM® z13, z13s, z14, or z14-ZR1 processor.
- The paths are online to the host.
- The High Performance Connectivity for FICON® license is installed or removed.
- The microcode level is:
 - VSP G1x00, VSP F1500: 80-02-24-00/00 or later
 - VSP: 70-02-78-00/00 or later

Installation or removal of the High Performance Connectivity for FICON® license feature is recommended during a period of low I/O rates or during a maintenance window.

Enabling the zHPF feature

After the zHPF feature has been activated, the zHPF function is not enabled automatically. Use the following procedure to enable the zHPF function.

Procedure

1. You need to enable zHPF manually by performing either Option 1 or Option 2:
 - Option 1: From one device under online CU, issue the **DS QD,Device number,VALIDATE** command. Repeat this operation in all online CUs.
 - Option 2: From one online channel path, issue the **VARY PATH(Device number, Channel path ID),ONLINE** command. Repeat this operation in all online CUs and device numbers.
2. Issue the **D M=DEV(device number)** command to check the zHPF status. The status **FUNCTIONS ENABLED=ZHPF** indicates that the zHPF function has been enabled.

Installing zHPF in a cascading switch configuration

In the storage system, when the zHPF feature is installed, the zHPF feature is enabled per channel path. For point-to-point (direct) connection and single-switch connection, zHPF is dynamically enabled per channel path. However, in cascading switch connections, it is not automatically enabled: even if you perform option 1 or option 2 above, zHPF IO will not be issued.

Procedure

1. To install the zHPF function in cascading switch configurations, perform either of the following options:
 - Option 1: Vary the channel path in the switch cascading configuration used for zHPF *offline* with the **CF CHP(Channel path 1-Channel path n),OFFLINE** command, and then vary it online with the **CF CHP(Channel path 1-Channel path n),ONLINE** command. If you always keep the alternate path in the same path group when placing the channel path offline, you can enable zHPF without stopping host access.
 - Option 2: Power cycle the storage system.

Removing the FICON[®]/zHPF feature

When I/O is running in a z/Linux environment (LPAR, Guest OS), OS may hang if you remove the Compatible High Performance Connectivity for FICON[®] feature. This is because in the error recovery processing of zHPF I/O that is performed when the storage discontinues the support of zHPF, z/Linux does not have the retry function with the existing I/O (CCW I/O).

Use the following procedure to remove the Compatible High Performance Connectivity for FICON[®] feature in a z/Linux environment:

Procedure

1. Stop I/Os of all devices under the storage system.
2. Remove the zHPF feature.

Chapter 3: Mainframe host operations

This chapter discusses the operations available for mainframe hosts.

Mainframe configuration

The first step in configuring the storage system is to define the storage system to the mainframe hosts. The three basic areas requiring definition are:

- Storage subsystem IDs (SSIDs)
- Hardware definitions, including I/O Configuration Program (IOCP) or Hardware Configuration Definition (HCD)
- Operating system definitions (HCD or OS commands)



Note: The default primary missing interrupt handler (MIH) time interval that the storage system reports to the host operating system is 30 seconds. Hitachi Vantara recommends that this default MIH time be changed to 45 seconds for those devices that are shared across multiple members of a Sysplex and are not part of a remote copy environment (for example, Universal Replicator, TrueCopy). When devices are part of a remote copy environment, the recommended MIH value is 60 seconds. When devices are the target volumes of a Data Migration effort, the recommended MIH value is 120 seconds.

Storage subsystem IDs (SSIDs)

Storage subsystem IDs (SSIDs) are used for reporting information from the CU (or controller) to the operating system. The SSIDs are assigned by the user and must be unique to all connected host operating environments. Each group of 64 or 256 volumes requires one SSID, so there are one or four SSIDs per CU image. The user-specified SSIDs are assigned during storage system installation. The following table lists the SSID requirements.

CU emulation	SSID requirements	LVI support	Notes
2105 2107*	0004 - FEFF	3390-x OPEN-x	VSP 5000 series, VSP G1x00, and VSP F1500 support 2107 CU emulation. VSP supports 2105 and 2107 CU emulation.

CU emulation	SSID requirements	LVI support	Notes
*Compatible PAV operations require that one SSID be set for each set of 256 LDEVs.			

Mainframe hardware definition

Hardware definition using IOCP (z/OS[®], z/VM[®], or z/VSE[®])

The I/O Configuration Program (IOCP) can be used to define the storage system in z/OS[®], z/VM[®], and z/VSE[®] environments (wherever HCD cannot be used). The storage systems support up to 255 control unit (CU) images and up to 65,280 LDEVs. Each CU image can hold up to 256 LDEV addresses. A CU image is the same as an IBM[®] logical sub-system (LSS). The CUADD parameter defines a CU image by its control unit address, which can be 00 to FE for FICON[®]/zHPF connectivity. FICON[®]/zHPF connectivity can be used with CU emulation types 2105 (2105-F20 or later) and 2107.



Caution: Observe the following cautions when using IOCP or HCD:

- When multiple LPARs/mainframes can access the volumes, use FEATURE=SHARE for the devices.
- Up to 32,768 addresses per physical interface are allowed by z/OS[®] with FICON[®]/zHPF channels. Multiple groups of FICON[®]/zHPF channels may be used to access the maximum of 65,280 devices that can be configured using 255 control unit images (CUADD=00 through CUADD=FE in the CNTLUNIT statement).

The following figure shows a sample IOCP definition for FICON[®] channels (direct connect and over FICON[®] switch) of a storage system configured as follows:

- 2107 CU emulation
- Four FICON[®]/zHPF channel paths:
 - Two channels paths are connected to a FICON[®] switch.
 - Two channel paths are directly connected to the storage system.
- 6 control unit images (00–05) with 256 LVIs per control unit
- 64 base addresses and 128 alias addresses per CU 00, 01, 02, and 03
- 128 base addresses and 128 alias addresses per CU 04 and 05


```

*****
**** Sample FICON CHPID / CNTLUNIT and IODEVICE ****
*****

CHPID PATH=(F9),TYPE=FC,SWITCH=07
CHPID PATH=(FB),TYPE=FC
CHPID PATH=(FD),TYPE=FC
CHPID PATH=(FF),TYPE=FC,SWITCH=07

CNTLUNIT CUNUMR=8100,PATH=(F9,FB,FD,FF),
LINK=(04,++,+,05),
UNIT=2107,CUADD=00,UNITADD=(00,256)
CNTLUNIT CUNUMR=8200,PATH=(F9,FB,FD,FF),
LINK=(04,++,+,05),
UNIT=2107,CUADD=01,UNITADD=(00,256)
CNTLUNIT CUNUMR=8300,PATH=(F9,FB,FD,FF),
LINK=(04,++,+,05),
UNIT=2107,CUADD=02,UNITADD=(00,256)
CNTLUNIT CUNUMR=8400,PATH=(F9,FB,FD,FF),
LINK=(04,++,+,05),
UNIT=2107,CUADD=03,UNITADD=(00,256)
CNTLUNIT CUNUMR=8500,PATH=(F9,FB,FD,FF),
LINK=(04,++,+,05),
UNIT=2107,CUADD=04,UNITADD=(00,256)
CNTLUNIT CUNUMR=8600,PATH=(F9,FB,FD,FF),
LINK=(04,++,+,05),
UNIT=2107,CUADD=05,UNITADD=(00,256)

IODEVICE ADDRESS=(8100,064),CUNUMR=(8100),STADET=Y,UNIT=3390B
IODEVICE ADDRESS=(8180,128),CUNUMR=(8100),STADET=Y,UNIT=3390A+,
UNITADD=80
IODEVICE ADDRESS=(8200,064),CUNUMR=(8200),STADET=Y,UNIT=3390B
IODEVICE ADDRESS=(8280,128),CUNUMR=(8200),STADET=Y,UNIT=3390A+,
UNITADD=80
IODEVICE ADDRESS=(8300,064),CUNUMR=(8300),STADET=Y,UNIT=3390B
IODEVICE ADDRESS=(8380,128),CUNUMR=(8300),STADET=Y,UNIT=3390A+,
UNITADD=80
IODEVICE ADDRESS=(8400,064),CUNUMR=(8400),STADET=Y,UNIT=3390B
IODEVICE ADDRESS=(8480,128),CUNUMR=(8400),STADET=Y,UNIT=3390A+,
UNITADD=80
IODEVICE ADDRESS=(8500,128),CUNUMR=(8500),STADET=Y,UNIT=3390B
IODEVICE ADDRESS=(8580,128),CUNUMR=(8500),STADET=Y,UNIT=3390A
IODEVICE ADDRESS=(8600,128),CUNUMR=(8600),STADET=Y,UNIT=3390B
IODEVICE ADDRESS=(8680,128),CUNUMR=(8600),STADET=Y,UNIT=3390A

```

**Note:**

- If you maintain separate IOCP definitions files and create your SCDS or IOCDS manually by running the IZPIOCP or ICP IOCP program, you must define each CU image on a storage system using one CNTLUNIT statement in IOCP. While it is possible to define a CU image using multiple CNTLUNIT statements in IOCP, the resulting input deck cannot be migrated to HCD due to an IBM® restriction allowing only one CNTLUNIT definition.
- If you receive an error message stating that module IOSTHTC is missing, you can ignore this message. For details, see [Dynamic channel management \(on page 50\)](#).

Hardware definition using HCD (z/OS®)

The Hardware Configuration Definition (HCD) utility can be used to define the storage systems in a z/OS® environment. The HCD procedures for 2105 CU emulation types are described below. FICON®/zHPF interface requires 2105 (2105-F20 or later) or 2107 CU emulation.

2105/2107 CU emulation: defining CU image, base and alias address range

To define a CU image and the base and alias address range that it will support, use the following example for HCD. The following instructions correspond to the 2105/2107 IOCP definition shown in the following figure.

```

CHPID PATH=(60,61,62,63,64,65,66,67),TYPE=CNC
CNTRLUNIT CUNUMBER=8000,PATH=(60,61,62,63,64,65,66,67),      +
          UNITADD=(00,256),CUADD=0,UNIT=2105
CNTRLUNIT CUNUMBER=8100,PATH=(60,61,62,63,64,65,66,67),      +
          UNITADD=(00,256),CUADD=1,UNIT=2105
CNTRLUNIT CUNUMBER=8200,PATH=(60,61,62,63,64,65,66,67),      +
          UNITADD=(00,256),CUADD=2,UNIT=2105
CNTRLUNIT CUNUMBER=8300,PATH=(60,61,62,63,64,65,66,67),      +
          UNITADD=(00,256),CUADD=3,UNIT=2105
IODEVICE ADDRESS=(8000,128),CUNUMBER=(8000),STADET=Y,UNIT=3390B,FEATURE=SHARED
IODEVICE ADDRESS=(8080,128),CUNUMBER=(8000),STADET=Y,UNIT=3390A,FEATURE=SHARED
IODEVICE ADDRESS=(8100,128),CUNUMBER=(8100),STADET=Y,UNIT=3390B,FEATURE=SHARED
IODEVICE ADDRESS=(8180,128),CUNUMBER=(8100),STADET=Y,UNIT=3390A,FEATURE=SHARED
IODEVICE ADDRESS=(8200,064),CUNUMBER=(8200),STADET=Y,UNIT=3390B,FEATURE=SHARED
IODEVICE ADDRESS=(8240,192),CUNUMBER=(8200),STADET=Y,UNIT=3390A,FEATURE=SHARED
IODEVICE ADDRESS=(8300,128),CUNUMBER=(8300),STADET=Y,UNIT=3390,FEATURE=SHARED
IODEVICE ADDRESS=(8380,064),CUNUMBER=(8300),STADET=Y,UNIT=3390B,FEATURE=SHARED
IODEVICE ADDRESS=(83C0,064),CUNUMBER=(8300),STADET=Y,UNIT=3390A,FEATURE=SHARED

```



Note:

- The HCD PAV definitions must match the configurations in the storage system. If not, error messages are issued when the hosts are IPL'd or the devices are varied online.
- If you receive an error message stating that module IOSTHTC is missing, you can ignore this message. For details, see [Dynamic channel management \(on page 50\)](#).

Procedure

1. From an ISPF/PDF primary options menu, select the **HCD** option to display the basic **HCD** panel. On this panel you must verify the name of the IODF or IODF.WORK I/O definition file to be used.

```

San Diego OS/390 R2.8 Master MENU
OPTION ==> HC                                SCROLL ==> PAGE
                                           USERID - HDS
                                           TIME  - 20:23

IS ISMF - Interactive Storage Management Facility
P PDF - ISPF/Program Development Facility
IP IPCS - Interactive Problem Control Facility
R RACF - Resource Access Control Facility
SD SDSF - System Display and Search Facility
HC HCD - Hardware Configuration Definition
BMB BMR BLD - BookManager Build (Create Online Documentation)
BMR BMR READ - BookManager Read (Read Online Documentation)
EMI BMR INDX - BookManager Read (Create Bookshelf Index)
SM SMP/E - SMP/E Dialogs
IC ICSF - Integrated Cryptographic Service Facility
OS SUPPORT - OS/390 ISPF System Support Options
OU USER - OS/390 ISPF User Options
S SORT - DF/SORT Dialogs
X EXIT - Terminate ISPF using list/log defaults

F1=HELP    F2=SPLIT    F3=END      F4=RETURN   F5=RFIND    F6=RCHANGE
F7=UP      F8=DOWN     F9=SWAP    F10=LEFT   F11=RIGHT   F12=RETRIEVE

```

2. On the basic **HCD** panel, select the proper I/O definition file, and then select option 1 to display the **Define, Modify, or View Configuration Data** panel.

```

OS/390 Release 5 HCD
Command ==> _____

Hardware Configuration

Select one of the following.

1_ 1. Define, modify, or view configuration data
   2. Activate or process configuration data
   3. Print or compare configuration data
   4. Create or view graphical configuration report
   5. Migrate configuration data
   6. Maintain I/O definition files
   7. Query supported hardware and installed UIMs
   8. Getting started with this dialog
   9. What's new in this release

For options 1 to 5, specify the name of the IODF to be used.

I/O definition file . . . 'HDS.IODF06.WORK' +
-----
| (C) Copyright IBM Corp. 1990, 1998. All rights reserved. |
-----
F1=Help    F2=Split    F3=Exit    F4=Prompt  F9=Swap    F12=Cancel

```

3. On the **Define, Modify, or View Configuration Data** panel, select option 4 to display the **Control Unit List** panel.

```

OS/390 Release 5 HCD
----- Define, Modify, or View Configuration Data -----
Select type of objects to define, modify, or view data.

 4_ 1. Operating system configurations
      consoles
      system-defined generics
      EDTs
      esoterics
      user-modified generics
 2. Switches
      ports
      switch configurations
      port matrix
 3. Processors
      partitions
      channel paths
 4. Control units
 5. I/O devices

F1=Help  F2=Split  F3=Exit  F9=Swap  F12=Cancel

```

4. On the **Control Unit List** panel, if a 2105/2107 type of control unit already exists, then an 'Add like' operation can be used by inputting an A next to the 2105/2107 type control unit and pressing Enter. Otherwise press F11 to add a new control unit.

```

Goto Filter Backup Query Help
-----
Control Unit List                               Row 27 of 40
Command ==> _____ Scroll ==> PAGE
Select one or more control units, then press Enter. To add, use F11.

/ CU  Type +      Serial-# + Description
- 3107 SCTC      _____
- 3108 SCTC      _____
- 3109 SCTC      _____
- 310A SCTC      _____
- 4000 3990-6    _____
- 4100 3990-6    _____
- 4200 3990-6    _____
- 4300 3990-6    _____
- 5000 3990      _____
- 5001 3990      _____
- 6000 3990      _____
- 6001 3990      _____
- 7000 3990      _____
- 7001 3990      _____

F1=Help  F2=Split  F3=Exit  F4=Prompt  F5=Reset  F7=Backward
F8=Forward F9=Swap   F10=Actions F11=Add   F12=Cancel

```

5. On the **Add Control Unit** panel, input the following new information, or edit the information if preloaded from an 'Add like' operation, and then press Enter:
- Control unit number
 - Control unit type - 2105 or 2107
 - Switch information only if a switch exists. Otherwise leave switch and ports blank.


```

Goto Filter Backup Query Help
----- Add Control Unit -----
Specify or revise the following values.
Control unit number . . : 8000          Type . . . . . : 2105
Processor ID . . . . . : PROD

Channel path IDs . . . . 60  61  62  63  64  65  66  67  +
Link address . . . . .  _  _  _  _  _  _  _  _  +

Unit address . . . . . 00  _  _  _  _  _  _  _  +
Number of units . . . . 256  _  _  _  _  _  _  _

Logical address . . . . 0_ + (same as CUADD)

Protocol . . . . . _ + (D,S or S4)
I/O concurrency level . 2 + (1, 2 or 3)

F1=Help   F2=Split   F3=Exit   F4=Prompt   F5=Reset   F9=Swap
F12=Cancel

```

8. Verify that the data is correct on the **Select Processor / Control Unit** panel, and then press F3.

```

Goto Filter Backup Query Help
----- Select Processor / Control Unit -----
Row 1 of 1 More: >
Command ==> _____ Scroll ==> PAGE

Select processors to change CU/processor parameters, then press Enter.

Control unit number . . : 8000          Control unit type . . . : 2105

          Log. Addr. -----Channel Path ID . Link Address + -----
/ Proc. ID Att. (CUADD) + 1----- 2----- 3----- 4----- 5----- 6----- 7----- 8-----
PROD   Yes  0    60    61    62    63    64    65    66    67
***** Bottom of data *****

F1=Help   F2=Split   F3=Exit   F4=Prompt   F5=Reset
F6=Previous F7=Backward F8=Forward F9=Swap   F12=Cancel

```

9. On the **Control Unit List** panel, add devices to the new **Control Unit**, input an s next to CU 8000, and then press Enter.

```

Goto Filter Backup Query Help
-----
Control Unit List                               Row 40 of 41
Command ==> _____ Scroll ==> PAGE

Select one or more control units, then press Enter. To add, use F11.

/ CU  Type +      Serial-# + Description
_ 7001 3990
s 8000 2105      _____ add 2105 type for 80xx devices
***** Bottom of data *****

F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset      F7=Backward
F8=Forward   F9=Swap       F10=Actions  F11=Add       F12=Cancel

```

10. On the **I/O Device List** panel, press F11 to add new devices.

```

Goto Filter Backup Query Help
-----
I/O Device List                               Scroll ==> PAGE
Command ==> _____

Select one or more devices, then press Enter. To add, use F11.

Control unit number : 8000      Control unit type . : 2105

-----Device----- --#-- -----Control Unit Numbers + -----
/ Number Type +      PR OS 1--- 2--- 3--- 4--- 5--- 6--- 7--- 8--- Base
***** Bottom of data *****

F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset      F7=Backward
F8=Forward   F9=Swap       F10=Actions  F11=Add       F12=Cancel

```

11. On the **Add Device** panel, enter the following, and then press Enter:
- Device number
 - Number of devices
 - Device type: 3390, 3390B for PAV base device, or 3390A for PAV alias device.

```

Goto Filter Backup Query Help
----- Add Device -----
Specify or revise the following values.
Device number . . . . . 8000 (0000 - FFFF)
Number of devices . . . . . 128
Device type . . . . . 3390B _____ +
Serial number . . . . . _____
Description . . . . . 3390 Base addresses 8000-807F__
Volume serial number . . . . . _____ (for DASD)
Connected to CUs . . 8000 _____ +
F1=Help   F2=Split   F3=Exit   F4=Prompt   F5=Reset   F9=Swap
F12=Cancel

```

12. On the **Device / Processor Definition** panel, add this device to a specific **Processor/System-ID** combination by inputting an **s** next to the **Processor**, and then press Enter.

```

----- Device / Processor Definition -----
Row 1 of 1
Command ==> _____ Scroll ==> PAGE
Select processors to change device/processor definitions, then press
Enter.
Device number . . . : 8100      Number of devices . . : 128
Device type . . . : 3390B

/ Processor ID  UA + Time-Out  STADET  CHPID + Candidate List  *****
s PROD         _____ No      Yes      _____ No
***** Bottom of data *****
F1=Help   F2=Split   F3=Exit   F4=Prompt   F5=Reset
F6=Previous F7=Backward F8=Forward F9=Swap   F12=Cancel

```

13. On the **Define Device / Processor** panel, enter the values shown in the figure below, and then press Enter.

```

----- Define Device / Processor -----
Specify or revise the following values.
Device number . . : 8000      Number of devices . . . . : 128
Device type . . . : 3390B
Processor ID . . . : PROD
Unit address . . . . . 00 + (Only necessary when different from
                          the last 2 digits of device number)
Time-Out . . . . . No (Yes or No)
STADET . . . . . Yes (Yes or No)
Preferred CHPID . . . . . _____ +
Explicit device candidate list . NO (Yes or No)
F1=Help   F2=Split   F3=Exit   F4=Prompt   F5=Reset   F9=Swap
F12=Cancel

```

14. On the **Define Processor / Definition** panel, verify that the proper values are displayed, and then press Enter.


```

----- Device / Processor Definition -----
|                                         Row 1 of 1 |
| Command ==> _____ Scroll ==> PAGE |
|                                         |
| Select processors to change device/processor definitions, then press |
| Enter. |
|                                         |
| Device number . . . : 8000           Number of devices . . : 128 |
| Device type . . . : 3390B |
|                                         |
| / Processor ID  UA + Time-Out  STADET  CHPID + Candidate List |
| _PROD          00  No          Yes    _      No |
| ***** Bottom of data ***** |
|                                         |
|                                         |
| F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset |
| F6=Previous  F7=Backward  F8=Forward  F9=Swap       F12=Cancel |
|                                         |
-----

```

15. On the **Define Device to Operating System Configuration** panel, input an s next to the Config ID, and then press Enter.

```

----- Define Device to Operating System Configuration -----
|                                         Row 1 of 1 |
| Command ==> _____ Scroll ==> PAGE |
|                                         |
| Select OSs to connect or disconnect devices, then press Enter. |
|                                         |
| Device number . . : 8100           Number of devices : 128 |
| Device type . . . : 3390B |
|                                         |
| / Config. ID  Type  Description  Defined |
| s PROD       MVS   |
| ***** Bottom of data ***** |
|                                         |
|                                         |
| F1=Help      F2=Split      F3=Exit      F4=Prompt      F5=Reset |
| F6=Previous  F7=Backward  F8=Forward  F9=Swap       F12=Cancel |
|                                         |
-----

```

16. On the **Define Device Parameters / Features** panel, view the default device parameters.



Note: The WLMPAV parameter defaults to “YES”. Set the desired parameters, and then press Enter.

```

----- Define Device Parameters / Features -----
Command ==> _____ Scroll ==> PAGE
Row 1 of 6
Specify or revise the values below.

Configuration ID . . : PROD
Device number . . . : 8000          Number of devices : 128
Device type . . . . : 3390B

Parameter/
Feature  Value  P Req.  Description
OFFLINE No      P Req.  Device considered online or offline at IPL
DYNAMIC Yes     P Req.  Device supports dynamic configuration
LOCANY  No      P Req.  UCB can reside in 31 bit storage
WLMFAV Yes     P Req.  Device supports work load manager
SHARED  Yes     P Req.  Device shared with other systems
SHAREDU No      P Req.  Shared when system physically partitioned
***** Bottom of data *****

F1=Help      F2=Split    F3=Exit     F4=Prompt   F5=Reset
F7=Backward  F8=Forward  F9=Swap     F12=Cancel

```

17. When the **Define Device to Operating System Configuration** panel is redisplayed, press F3.
18. When the the desired device addresses are redisplayed on the **Update Serial Number, Description and VOLSER** panel, repeat the previous steps to add more control units or device addresses.

```

----- Update Serial Number, Description and VOLSER -----
Command ==> _____ Scroll ==> PAGE
Row 1 of 128
Device number . . . : 8000          Number of devices : 128
Device type . . . . : 3390B

Specify or revise serial number, description and VOLSER.

Device Number Serial-#  Description          VOLSER
8000          _____  3390 Base addresses 8000-807F  _____
8001          _____  3390 Base addresses 8000-807F  _____
8002          _____  3390 Base addresses 8000-807F  _____
8003          _____  3390 Base addresses 8000-807F  _____
8004          _____  3390 Base addresses 8000-807F  _____
8005          _____  3390 Base addresses 8000-807F  _____
8006          _____  3390 Base addresses 8000-807F  _____
8007          _____  3390 Base addresses 8000-807F  _____
8008          _____  3390 Base addresses 8000-807F  _____
8009          _____  3390 Base addresses 8000-807F  _____
800A          _____  3390 Base addresses 8000-807F  _____

F1=Help      F2=Split    F3=Exit     F5=Reset    F7=Backward
F8=Forward   F9=Swap     F12=Cancel

```

Dynamic channel management

The storage systems can be used with the IBM® Dynamic Channel Management (DCM) facility. For storage systems defined to operate in IBM® 2105 control unit emulation, a Control Unit Module Table (CUMT) is required. If the CUMT is not installed and you IPL a storage system on a z/OS® operating system that supports DCM, you will receive the following z/OS® IOS message:

```
IOS357I MANUFACTURER HTC LOAD MODULE IOSTHTC NOT FOUND IN THE LNKLST
```

The CUMT named “IOSTHTC” needs to be assembled and link-edited into a LNKLST library. Please contact your Hitachi Vantara representative to obtain the latest jobstream to create this CUMT.



Note: If you receive an error message during IPL stating that module IOSTHTC is missing, you can ignore this message.

Definition of the storage system to z/VM[®] and z/VSE[®] systems

To define a storage system to z/VM[®], enter the LVI address range, storage type, and sharing option for the storage system as shown below. (The address range varies for each installation.)

```
[Address Range] TYPE DASD SHARED YES
```

To define a storage system to z/VSE[®], use the same procedure as for an IBM[®] 3990-6E storage system. For a storage system with more than 64 LVIs, the ADD CUU:CUU ECKD statements are the same as for the IBM[®] 3390.

Definition of the storage system to z/TPF

The storage systems support the IBM[®] Transaction Processing Facility (z/TPF) and Multi-Path Locking Facility (MPLF) functions in either native mode or under z/VM[®]. MPLF support requires z/TPF Operating System. The z/TPF/MPLF capability of the storage system enables high levels of concurrent data access across multiple channel paths.



Caution:

- Hitachi provides specific microcode releases for z/TPF operations. You must contact Hitachi Vantara technical support to obtain the correct microcode releases for your operational environment.
- For storage systems operating in IBM[®] TPF mode, the control units that can be accessed are in the range of 00-3F.

For further information about z/TPF and MPLF operations, please refer to the following IBM[®] documentation:

- *Storage Subsystem Library, 3390 Transaction Processing Facility Support RPQs*, IBM[®] document number GA32-0134
- *Storage Subsystem Library, 3990 Storage Control Reference for Model 6*, IBM[®] document number GA32-0274

Definition of the storage system to mainframe Linux

The storage systems support attachment to the following mainframe Linux operating systems:

- Red Hat[®] Enterprise Linux (RHEL)
- SUSE Linux Enterprise Server (SLES)

For information about supported versions and other details, see the Mainframe FICON[®] Support Matrix on the Hitachi Vantara interoperability site: https://support.hitachivantara.com/en_us/interoperability.html

For information about preparing the storage system for mainframe Linux host attachment, please refer to the following IBM® publication:

- *Implementing Linux with IBM Disk Storage, SG24-6261*

The following links (current at time of document publication) provide information about the different methods for using Linux on mainframe hosts:

- IBM® Enterprise Storage Server (ESS) library
- Linux on S/390® hosts:
<http://www.redbooks.ibm.com/abstracts/sg244987.html?Open>
- FCP use on zSeries hosts:
<http://www.redbooks.ibm.com/abstracts/sg246694.html?Open>

Mainframe operations

LVI initialization

The LVIs on the storage systems require only minimal initialization before being brought online. The following example shows a z/OS® ICKDSF JCL example of a minimal init job to write a volume ID (VOLID) and volume table of contents (VTOC).



Note: PAV base and alias devices require additional definition. For details, see the *Hitachi Compatible PAV User Guide* for the storage system.

```
// EXAMPLE    JOB
//           EXEC    PGM=ICKDSF, PARM=NOREPLYU
//SYSPRINT   DD     SYSOUT=A
//SYSIN     DD     *
INIT UNITADDRESS (XXXX) VFY (*NONE*) VOLID (YYYYYY) -
OWNERID (ZZZZZZ)
/*
```

where XXXX = physical install address, YYYYYY = new volume ID, ZZZZZZ = volume ID owner

Using the QDASD option of the IBM® z/OS® DEVSERV MVS command

If the QDASD option of the IBM® z/OS® DEVSERV MVS command is used, N (No) is displayed in SOLID STATE DRIVES (SSD) and ENCRYPTION (encryption) of the ATTRIBUTE parameters regardless of the configuration of the parity group to which the target LVI belongs.

```
DEVSERV QDASD,E33D,1,ATTRIBUTE
IEE459I 18.15.40 DEVSERV QDASD 811
UNIT VOLSER SCUTYPE DEVTYPE          CYL  SSID SCU-SERIAL DEV-SERIAL EFC
ATTRIBUTE/FEATURE          YES/NO    ATTRIBUTE/FEATURE          YES/NO
```

```

0E33D DV1RES 2107900 2107900 1182006 8400 XX85-00010 XX85-00010 *OK
SOLID STATE DRIVES          N          ENCRYPTION          N
****          1 DEVICE(S) MET THE SELECTION CRITERIA
****          0 DEVICE(S) FAILED EXTENDED FUNCTION CHECKING

```

z/OS® (MVS) cache operations

The storage systems support the following z/OS® cache operations:

- Subsystem counter reports. The cache statistics reflect the logical caching status of the volumes. For the storage systems, Hitachi Vantara recommends that you set the nonvolatile storage (NVS) ON and the DASD fast write (DFW) ON for all logical volumes. This will not affect the way the storage system caches data for the logical volumes.


The default caching status for the storage systems is:

- CACHE ON for the storage system
- CACHE ON for all logical volumes
- CACHE FAST WRITE ON for the storage system
- NVS OFF for the storage system: set NVS ON for the Hitachi storage systems.
- DFW OFF for all volumes: set DFW ON for Hitachi storage systems.



Note: In normal cache replacement, bypass cache, or inhibit cache loading mode, the storage systems perform a special function to determine whether the data access pattern from the host is sequential. If the access pattern is sequential, the storage system transfers contiguous tracks from the disks to cache ahead of time to improve cache hit rate. Due to this advance track transfer, the storage system shows the number of tracks transferred from the disks to the cache slot at DASD/CACHE of the SEQUENTIAL in TRANSFER OPERATIONS field in the storage system counters report, even though the access mode is not sequential.

- IDCAMS LISTDATA STATUS. The LISTDATA STATUS command generates status information for a specific device within the storage system. The storage systems report two storage sizes:
 - Subsystem storage: This field shows capacity in bytes of cache. For a storage system with more than one SSID, the cache is shared among the SSIDs instead of being logically divided. This strategy ensures backup battery power for all cache in the storage system. For the Hitachi storage systems, this field shows 75% of the total cache size.
 - Nonvolatile storage: This field shows capacity in bytes of random access cache with a backup battery power source. For the Hitachi storage systems, this field shows 25% of the total cache size.

- IDCAMS SETCACHE. The storage systems support the IDCAMS SETCACHE commands, which manage caching for subsystem storage through the use of one command (except for REINITIALIZE). The following SETCACHE commands work for the subsystem storage across multiple SSIDs:
 - **SETCACHE SUBSYSTEM ON|OFF**
 - **SETCACHE CACHEFASTWRITE ON|OFF**
 - **SETCACHE NVS ON|OFF**
 - **SETCACHE DESTAGE**
-  **Note:** The SETCACHE REINITIALIZE command reinitializes only the logical subsystem specified by the SSID. You must issue the REINITIALIZE command once for each defined SSID.
- DEVSERV PATHS. The DEVSERV PATHS command is defined as the number of LVIs that can be specified by an operator (from 1 through 99). To display an entire storage system, enter the DEVSERV command for several LVIs, as follows:
 - **DEVSERV PATHS ,100 ,64**
 - **DEVSERV PATHS ,140 ,64**
 - **DEVSERV PATHS ,180 ,64**
 - **DEVSERV PATHS ,1C0 ,64**

z/VM® (VM/ESA) cache operations

When a storage system is managed under z/VM®, the following SET CACHE commands are effective across multiple SSIDs:

- **SET CACHE SUBSYSTEM ON|OFF**
- **SET NVS SUBSYSTEM ON|OFF**
- **SET CACHEFW SUBSYSTEM ON|OFF**
- **DESTAGE SUBSYSTEM**

z/VSE® (VSE/ESA) cache operations

When a storage system is managed under z/VSE®, the following CACHE commands are effective across multiple SSIDs:

- **CACHE SUBSYS=cuu ,ON|OFF|STATUS**
- **CACHE SUBSYS=cuu ,FAST ,ON|OFF**
- **CACHE SUBSYS=cuu ,NVS ,ON|OFF**
- **CACHE SUBSYS=cuu ,REINIT**



Note: SIMs indicating a drive failure may not be reported to the z/VSE® console (reference IBM® document GA32-0253). Since the RAID technology and dynamic spare drives ensure nonstop processing, a drive failure may not be noticed by the console operator. Since all SIMs are also logged on the SVP, you can use Device Manager - Storage Navigator to monitor the SIMs.

Chapter 4: Mainframe Linux operations

This chapter describes storage system operations in a mainframe Linux host environment.

Overview of mainframe Linux operations

The storage systems support attachment to the following mainframe Linux operating systems:

- Red Hat® Enterprise Linux (RHEL)
- SUSE Linux Enterprise Server (SLES)

For details about supported OS versions, FICON®/zHPF connectivity, and supported adapters, switches, and directors (for example, Brocade, Cisco) for the storage systems, see the Mainframe FICON® Support Matrix on the Hitachi Vantara interoperability site: https://support.hitachivantara.com/en_us/interoperability.html

For information about preparing the storage system for mainframe Linux host attachment, refer to the following IBM® publication:

- *Implementing Linux with IBM Disk Storage, SG24-6261*

The following links (current at time of document publication) will enable the reader to understand the details about the different methods for using Linux on mainframe hosts:

- ESS library
- Linux on S/390® hosts:
<http://publib-b.boulder.ibm.com/Redbooks.nsf/RedbookAbstracts/sg244987.html?Open>
- FCP use on zSeries hosts:
<http://www.redbooks.ibm.com/abstracts/sg246694.html?Open>

After physical installation of the storage system has been completed, you can configure the Linux system for operations with assistance as needed from your Hitachi Vantara representative.

Running Linux on zSeries hosts

There are three methods to run Linux on a zSeries host:

- Run Linux in “Native” mode on the machine with no other operating system.
- Create logical partitions (LPARs). Logically partition the hardware into a maximum of 15 separate LPARs per logical channel subsystem. For example, you can run z/OS[®] applications in one partition, z/VM[®] and z/VSE[®] applications in another partition, and Linux applications in a third partition.
- Use z/VM[®] guest support. Run Linux as a virtual machine using z/VM[®] to provide virtualization of central processing units, I/O subsystems, and memory.

It is possible to run hundreds of Linux systems on a single zSeries host. For example, you can create a complete Linux server environment for each application developer and host production system all on the same zSeries host.

For SUSE SLES or Red Hat Enterprise Linux, the storage systems support 64-bit Linux for zSeries on storage units as well as FICON[®] and Fibre Channel protocol (FCP) attached host systems.



Note: zSeries FCP host systems running SUSE SLES or Red Hat Enterprise Linux can be attached through a switched-fabric configuration or a direct-attached configuration. The support for FCP direct attachment depends on the zSeries processor in use. IBM[®] Z9 processors and later support direct connection with FCP.

For details, please refer to the latest version of the following IBM[®] manual: *IBM System z Connectivity Handbook (SG24-5444), section 5.1.1 FICON modes and topologies*

Attaching FC adapters on zSeries hosts running Linux

Linux solutions are available for the 31- and 64-bit environments. The availability of this option depends on the zSeries model and the Linux distribution. Fibre-channel support is available for both direct and switched attachment.

- *Linux for S/390[®] (31-bit):* Linux for S/390[®] is a 31-bit version of Linux. It also runs on zSeries models in 31-bit mode. The 31-bit limitation limits the addressable main storage to 2 GB.
- *Linux for zSeries (64-bit):* Linux on zSeries supports the 64-bit architecture on all zSeries models. The 64-bit support eliminates the 31-bit storage limitation of 2 GB.

FCP support

Linux for zSeries can access FCP and FICON[®]/zHPF controllers and devices with the appropriate I/O driver support. Linux can be run in a logical partition or as a guest operating system under z/VM[®] Version 4 Release 4 or later. For the latest information about supported operating system releases, see the IBM[®] documentation.

A zSeries FCP channel is required to attach storage through a Fibre Channel port. An FCP channel requires the same FICON[®] channel hardware that is used for a FICON[®] channel. FICON[®] channel hardware can be designated as either a FICON[®] or FCP channel by specifying the correct channel path type (FC or FCP) in the IOCP channel path ID (CHPID) statement. The FICON[®]/zHPF requires a CHPID type FC and uses the FCP link transport. Defining FCP-type channels in the IOCP reduces the total number of FICON[®]-type channels that you can configure.

Accessing storage units using FC protocol from a zSeries host

1. Gather the prerequisite information about the SAN setup. See [Setting up storage units for zSeries hosts running Linux \(on page 58\)](#) for a list of the information that you must collect.
2. Set up the storage unit and configure the LUNs for use with Linux for zSeries. See [Setting up storage units for zSeries hosts running Linux \(on page 58\)](#) for the steps you must perform to set up the storage unit
3. Manually load the required modules and parameters to access the disks. See [Setting up a Linux system to use FC protocol devices on zSeries \(on page 59\)](#) for the steps you must perform to view LUNs and set the Linux system to use FCP devices.
4. Make the disks permanently accessible. See [Adding permanent devices for zSeries hosts running Linux \(on page 60\)](#) for the steps you must perform to add permanent devices.

Setting up storage units for zSeries hosts running Linux

To set up the LUNs for use with your Linux system, you first must define the system to the storage unit. You can do this through the IBM[®] TotalStorage DS Storage Manager. The following instructions assume that you are familiar with the IBM[®] TotalStorage DS Storage Manager.

Before you begin

You must begin by first collecting the following software configuration information to prepare a Linux system for accessing the storage unit through a Fibre Channel:

- Host name of the server hosting the Linux system
- Device address and CHPID of the FCP port that is attached to the Linux machine. FICON[®]/zHPF requires a CHPID type FC.
- Worldwide port name (WWPN) of the FCP port on the zSeries
- WWPN of the Fibre Channel port on the storage unit
- Fibre Channel port on the storage unit

This information can be obtained from the hardware management console (HMC), the IBM[®] TotalStorage DS Storage Manager, and the SAN switch, as shown in the following example:

```
Linux hostname linuxa
CHPID of the FCP port on the z800 15
```

```
WWPN of the FCP port on the z800 50:05:07:64:01:40:01:7d
FC port on the storage unit Enclosure 3 Slot 1
WWPN of the FC port on the storage unit 50:05:07:63:00:c8:95:89
```

Procedure

1. Log on to IBM® TotalStorage DS Storage Manager, and in the navigation select **Real-time manager > Manage hardware > Host systems**.
2. From the **Select Action** list, select **Create**, then click **Go**.
3. From the **General host information** panel, complete the following fields for each fibre-channel host adapter. When you are finished, click **OK**.
 - Host type
 - Nickname
 - Description
4. From the **Define host ports** panel, specify the host ports for this host. Click **Add** to add each host port to the defined host ports table.
5. From the **Define host WWPN** panel, specify the worldwide port names for the selected hosts. When finished, click **Next**.
6. From the **Select storage images** panel, specify the storage image for attachment. Click **Add** to add the storage image to the selected storage images table. When finished, click **Next**.
7. From the **Specify storage image parameters** panel, specify the following parameters for each storage image.
 - Host attachment identifier v Volume Group for host attachment
 - Type of I/O port (any valid storage image I/O port or a specific I/O port)
8. Click **Apply** assignment button to apply the current attachment assignment. Use this button to go through this page for each host attachment identifier that you want to assign to the storage image. When you are finished, click **OK**.
9. From the **Verification** panel, verify the data that represents the new host attachments. When finished, click **Finish**.

Setting up a Linux system to use FC protocol devices on zSeries

Before you begin

You must collect the following software configuration information to prepare a Linux system to access the storage unit through a Fibre Channel:

- Host name of the server hosting the Linux system
- Device address (and CHPID) of the FCP port that is attached to the Linux machine
- Worldwide port name (WWPN) of the FCP port on the zSeries
- Fibre-channel port on the storage unit
- WWPN of the Fibre Channel port on the storage unit

You can obtain this information using the hardware management console (HMC), the IBM® TotalStorage DS Storage Manager, and the SAN switch. The following example shows the prerequisite information that you must obtain to run FCP Linux on the zSeries.

```
The device number of the device that is defined in the IOCP for the FCP
channel on the zSeries
The SCSI ID starting at 1
The WWPN of the storage unit fibre-channel port
The SCSI LUN within Linux starting at 0
The FCP LUN of the target volume on the storage unit2
```

Procedure

1. Confirm that you have installed the following modules (at a minimum) to use the FCP device with the storage unit:
 - *qdio*: This is the same module is used for other qdio devices
 - *scsi_mod*: Defines SCSI core parameters
 - *zfcplib*: Provides FCP support for zSeries Linux
 - *sd_mod*: SCSI disk support1
2. Load the modules in the order shown in step 1. Use the **modprobe** command to load all modules. Except for the *zfcplib* module, you can load all modules without parameters.
3. The *zfcplib* module requires parameters to map the FCP devices on the storage unit. Each FCP requires the following parameters:

```
The device number of the device that is defined in the IOCP for the
FCP channel on the zSeries
The SCSI ID starting at 1
The WWPN of the storage unit fibre-channel port
The SCSI LUN within Linux starting at 0
The FCP LUN of the target volume on the storage unit2
```

4. Use the following command string to enter the mapping parameters to the module:

```
map="devno SCSI_ID:WWPN SCSI_LUN:FCP_LUN" map="0x0600
1:0x5005076300c89589 0:0x5301000000000000"
```

Adding permanent devices for zSeries hosts running Linux

Before you begin

Collect the following software configuration information to prepare a Linux system to access the storage unit through a fibre channel. This information can be obtained using the hardware management console (HMC), the IBM® TotalStorage DS Storage Manager, and the SAN switch.

- Host name of the server that is hosting the Linux system
- Device address and CHPID of the FCP port attached to the Linux machine
- Worldwide port name (WWPN) of the FCP port on the zSeries

- Fibre-channel port on the storage unit
- WWPN of the fibre-channel port on the storage unit

The following example shows the prerequisite information that must be obtained to run FCP Linux on the zSeries.

```
Linux hostname linuxa
CHPID of the FCP port on the z800 15
WWPN of the FCP port on the z800 50:05:07:64:01:40:01:7d
FC port on the storage unit Enclosure 3 Slot 1
WWPN of the FC port on the storage unit 50:05:07:63:00:c8:95:89
```

Procedure

1. Choose one of the following methods to add devices: write a script or manually add the device.
 - To add more than one device to your SCSI configuration, write a small script that includes all the parameters included. This is an optional step.
 - Alternatively, you can also add SCSI devices to an existing configuration with the **add_map** command. After using this command, you must manually map the devices in the SCSI stack.
2. To make the devices available permanently, after a reboot, you must create a new initial ramdisk (RAM that is accessed like a disk) that contains the necessary modules and parameter information. First, save the module parameters in the configuration file `/etc/zfcp.conf`, as shown in the following example.

```
The device number of the device that is defined in the IOCP for the
FCP channel on the zSeries
The SCSI ID starting at 1
The WWPN of the storage unit fibre-channel port
The SCSI LUN within Linux starting at 0
The FCP LUN of the target volume on the storage unit2
```

- a. Create a new ramdisk with the `mk_initrd` utility, and then run the `zipl` utility to update the initial program load record to point to the new ramdisk.
3. Enable multipath support using the logical volume manager kernel for Linux z/FCP.
 - a. Create physical volumes using the following commands: **pvcreate /dev/sda1 pvcreate /dev/sdb1...**
 - b. Put the physical volumes into a volume group using the following command: **vgcreate fcpvg /dev/sda1 /dev/sdb1...**
 - c. Create as many logical volumes as you need using the following command: **lvcreate --size 16G fcpvg**
 - d. Enable the alternate paths to the physical volumes using the **pvpath** command: **pvpath --path0 --enable y /dev/sda1 pvpath --path1 --enable y /dev/sda1**. If both paths are set to a weight of 0, they will load balance.

4. These configurations yield the SCSI device `/dev/sda - /dev/sdc`. This device is accessible on the first path and the SCSI device `/dev/sdd - /dev/sdf` accessed on the second path.

Appendix A: Notes on using zDAC

For information and instructions on using the zDAC function, see the *IBM® Hardware Configuration Definition User's Guide*. The following limitations and restrictions apply when the zDAC function is used for the VSP 5000 series, VSP G1x00, and VSP F1500 storage systems.

Notes on executing the zDAC function

The zDAC function has the following specifications. Consider the following when executing the zDAC function:

- The zDAC function in the direct connection configuration supported with z/OS® V2R1 is not supported.
- Volumes such as 3390-V and volumes that are set as system disks that cannot be placed online from mainframe hosts are not defined.
- When FABRIC DISCOVERY is performed for the already created configuration, IFCC or MIH may occur depending on the usage. Note that new CUADD cannot be added to the created configuration.
- When "Force full mode discovery" of "Discovery and Autoconfiguration Options" is set to "NO", CU in which UA=x00-x10 and xFF are not installed may not be discovered. In this case, set "Force full mode discovery" to "YES".
- Whether Alias VOL is installed or not depends on the emulation type of Base VOL when Alias is set. If Base VOL is not installed, Alias VOL is also not installed. For example, with 2107 emulation, if Base VOL is 3390-A, both Base VOL and Alias VOL are not installed.

Message output

When the zDAC function is executed, the following message may be output in CU in which UA is not installed from x00. Note that the execution of zDAC is not affected.

Message: CHP=chpid STAT=SUBCHANNEL PATH AVAILABLE, BUT DEVICE NOT OPERATIONAL

Specifications of open volumes

In IBM® storage, both mainframe and open volumes are defined in the configuration. However, for VSP 5000 series, VSP G1x00, and VSP F1500, only volumes that can be placed online from the mainframe host can be defined in the configuration.

Hitachi Vantara



Corporate Headquarters
2535 Augustine Drive
Santa Clara, CA 95054 USA
HitachiVantara.com | community.HitachiVantara.com

Contact Information
USA: 1-800-446-0744
Global: 1-858-547-4526
HitachiVantara.com/contact