IBM

IBM Flex System FC5024D 4-Port 16Gb FC Adapter

User's Guide

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User's Guide

Note: Before using this information and the product it supports, read the general information in Appendix C, "Notices," the Safety Information and Environmental Notices and User Guide documents on the IBM Documentation CD, and the Warranty Information document that comes with the product.

First Edition (August 2013)

Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الآمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 Safety Information（安全信息）。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας (safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się
z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítaje Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Youq mwngz yungh canjbinj neix gaxgonq, itdingh aeu doeg aen
canjbinj soengq cungj vahgangj ancien siusik.

مەزكۇر مەھسۇلاتنى ئورنتىشتىن بۇرۇن بخەتەرلىك ئۇچۇرلىرىنى ئوقۇپ چىقىڭ.

ཐོན་ཆས་འདི་བདེ་སྲུང་ལ་བྱས་གོང་། སྐོར་གྱི་ཡིད་གཟབ་བྱ་འདུ་མིན་ཡོད་པའི་ཉེན་སྲེང་བལྟ་དགོས།

Bu ürünü kurmadan önce güvenlik bilgilerini okuyun.

Safety statements

Important:

> Each caution and danger statement in this document is labeled with a number. This number is used to cross reference an English-language caution or danger statement with translated versions of the caution or danger statement in the *Safety Information* document.
>
> For example, if a caution statement is labeled "Statement 1," translations for that caution statement are in the *Safety Information* document under "Statement 1."
>
> Be sure to read all caution and danger statements in this document before you perform the procedures. Read any additional safety information that comes with the server or optional device before you install the device.
>
> This device is intended for use with UL Listed IBM devices.

Statement 1:

DANGER

Electrical current from power, telephone, and communication cables is hazardous.
To avoid a shock hazard:
• **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
• **Connect all power cords to a properly wired and grounded electrical outlet.**
• **Connect to properly wired outlets any equipment that will be attached to this product.**
• **When possible, use one hand only to connect or disconnect signal cables.**
• **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
• **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
• **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:	To Disconnect:
1. Turn everything OFF.	1. Turn everything OFF.
2. First, attach all cables to devices.	2. First, remove power cords from outlet.
3. Attach signal cables to connectors.	3. Remove signal cables from connectors.
4. Attach power cords to outlet.	4. Remove all cables from devices.
5. Turn device ON.	

Contents

IBM Flex System FC5024D 4-Port 16Gb FC Adapter

The IBM Flex System™ FC5024 4-Port 16Gb FC Adapter provides four Fibre Channel connections capable of providing 8 Gbps or 16 Gbps to devices on Fibre Channel (FC) SANs. FC communications are routed through the adapter ports to the system chassis midplane and onto Fibre Channel switch elements installed in the chassis. Depending on the system configuration, the adapter provides up to 16 Gbps of full-duplex line-rate bandwidth per port.

The adapter contains two ASICs, each controlling two FC ports. These ports are split between two different compute nodes to provide dual, redundant paths between two switch elements. Adapter properties on a specific compute node will list only two available ports.

This User's Guide contains information and instructions for installing the adapter software, updating the firmware, configuring the adapter, and solving problems. See the *IBM Flex System Installation and Service Guide* that comes with the compute node to install the adapter hardware in the compute node; then, return to this User's Guide for the information and instructions needed to complete the installation.

This User's Guide contains the following instructions and information for the adapter:

- Adapter features and specifications.
- Installing the adapter.
- Installing and updating the adapter boot code, device drivers, utilities, and management software.
- Using the Brocade BIOS Configuration utility, UEFI setup utility, the Host Connectivity Manager (HCM), and Brocade Command Line Utility (BCU) to configure the adapter.
- Performing basic troubleshooting tasks and resolving problems.
- Important notices and safety statements.
- Getting help, service, and technical assistance.

(For information about the types of compatible devices available for IBM products, contact your IBM marketing representative or authorized reseller. For a list of supported optional devices, see http://www.ibm.com/servers/eserver/serverproven/compat/us/.)

Notes:

1. Unless otherwise stated, references to the IBM Flex System FC5024D 4-Port 16Gb FC Adapter is also referred to as "the adapter" throughout this document.

2. Changes are made periodically to the IBM® website. Procedures for locating firmware and documentation might vary slightly from what is described in this document.

3. The illustrations in this document might differ slightly from your hardware.

4. The screens that are described or referenced in this document might differ slightly from the screens that are displayed by your system. Screen content varies according to the type of IBM Flex System chassis and the firmware versions and options that are installed.

Related documentation

This User's Guide contains general information about the adapter and setup and installation instructions, including how to configure, update, and troubleshoot the adapter. For the most up-to-date product documentation for all of your IBM Flex System products, go to the IBM Flex System Information Center at the following location:

http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp.

The following IBM Flex System documentation is available:

- IBM Flex System network device *User's Guides*

  These documents contain detailed information about installing, configuring, updating, and troubleshooting specific IBM Flex System network devices, which include network switches and adapters.

- *IBM Flex System Chassis Management Module Command-Line Interface Reference Guide*

  This document explains how to use the Chassis Management Module command-line interface (CLI) to directly access management functions. The command-line interface also provides access to the text-console command prompt on each compute node through a Serial over LAN (SOL) connection.

- *IBM Flex System Enterprise Chassis Installation and Service Guide*

  This document contains hardware installation instructions for the switches and other components that install in the IBM Flex System chassis.

- *IBM Flex System Chassis Management Module User's Guide*

  This document explains how to use the Chassis Management Module user interface to manage chassis components.

- *IBM Flex System Manager System Management Guide*

  This document explains how to use the IBM Flex System Manager user interface to manage chassis components.

- *Environmental Notices and User Guide*

  This document is provided on the IBM Notices for Network Devices CD, and it contains translated environmental notices.

- *Safety Information*

  This document is provided on the IBM Notices for Network Devices CD, and it contains translated caution and danger statements. Each caution and danger statement that appears in the documentation has a number that you can use to locate the corresponding statement in your language in the Safety Information document.

- *Warranty Information*

  This ships with your product and provides specific warranty information.

For instructions to install the IBM Flex System FC5024D 4-Port 16Gb FC Adapter in the compute node, see the *IBM Flex System Installation and Service Guide* that comes with the compute node.

For other information on the IBM Flex System FC5024D 4-Port 16Gb FC Adapter, refer to sections on the Brocade 1869 Adapter in documentation located at www.brocade.com/adapters-ibm-flex. The following publications are available:

- *Brocade Adapters Installation and Reference Manual*. See the following chapters and information:
  - Product Overview chapter

    This chapter provides detailed information on hardware and software features, driver packages, boot installation packages, and operating system support.

  - Specifications chapter

    This chapter provides complete hardware specifications, including environmental and power information.

  - Boot Code chapter

    This chapter describes host boot support available on the adapter and includes procedures to update adapter boot code, configure boot over SAN, and configure fabric-based boot over SAN. Use this chapter when configuring a host to boot its operating system from a boot device located somewhere on the SAN instead of the host's local disk or direct-attached storage.

  - Adapter Configuration appendix.

    This appendix is optional for expert network administrators who need to modify values for adapter instance-specific persistent and driver-level configuration parameters.

- *Brocade Adapters Administrator's Guide*. Refer to this guide for details on using Brocade Command Line Utility (BCU) commands and the Host Connectivity Manager (HCM) application.

- *Brocade Adapters Troubleshooting Guide*. This guide contains complete information on troubleshooting problems for all Brocade adapter models.

Notices and statements in this document

The caution and danger statements in this document are also in the multilingual *Safety Information* document, which is provided on the IBM *Notices for Network Device* CD. Each statement is numbered for reference to the corresponding statement in your language in the *Safety Information* document.

The following notices and statements are used in this document:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Features and specifications

The IBM Flex System FC5024D 4-Port 16Gb FC Adapter supports the following features for enhanced performance and connectivity in the SAN networks. For more information on these features, refer to the *Brocade Adapters Installation and Reference Manual.*

General features

- BIOS support:
  - x86 and x64 Basic Input/Output System (BIOS)
  - Unified Extensible Firmware Interface (UEFI)
  - UEFI Human Interface Infrastructure (HII)
  - PCI BIOS 3.1 or later
  - SMBIOS specification version 2.4 or later
  - Fabric-based boot LUN discovery
- Extended storage request block (SRB) support
- Human Interface Infrastructure (HII) menu support. These menus are integrated into the UEFI configuration browser. Options in these menus allow you to enable and disable ports for boot over SAN, set port speed, LUN masking, port topology, and other options for adapter ports.
- Host Connectivity Manager (HCM) device management and Brocade Command Line Utility (BCU) tools for comprehensive adapter management.
- Hyper-V. This consolidates multiple server roles as separate virtual machines (VMs) using the Windows Server 2008 operating system and provides integrated management tools to manage both physical and virtual resources.
- Management APIs for integration with a management application, such as IBM System Storage® Network Advisor, and other management frameworks.
- Plug-n-play and power management for all supported operating systems.
- RoHS-6. Certification by the European Union Restriction of Hazardous Substances Directive (RoHS) that adapter hardware components do not contain any of the six restricted materials. These are mercury, chromium VI, cadmium, polybrominated biphenyl ether, lead, and polybrominated biphenyl.
- Storage Management Initiative Specification (SMI-S).

  Specification supporting the Common Information Model (CIM) Provider, which allows any standard Common Information Model (CIM) and SMI-S-based management software to manage installed Brocade adapters.

  NOTE
  Although SMI-S Provider and CIM Provider may be used interchangeably, CIM is the more generic term, while SMI-S is storage-specific.

- Open Fabric Manager (OFM) based WWN provisioning.
- Synthetic Fibre Channel Ports

  For Windows 2012 Server, guest operating systems (virtual machines) running on Hyper-V can detect and manage Fibre Channel ports. The HBAs or Fabric adapter ports configured in HBA mode that are presented to the virtual machines (VMs) are called "synthetic" FC ports. This feature is configured through Hyper-V.

- UCM compliance

  Brocade adapters are compliant with IBM Unified Configuration Manager (UCM).

- Windows Management Implementation (WMI).

- Windows Server 2008, RedHat Enterprise Linux (RHEL), SUSE Linux Enterprise (SLES), and VMware ESX Server.

- Windows Preinstallation Environment (WinPE), a minimal operating system with limited services for Windows Server or Windows Vista used for unattended deployment of workstations and servers. WinPE is supported by Brocade Windows 2008 storage drivers

- Windows Server Core, a minimal server option for Windows Server 2008 operating systems that provides a low-maintenance server environment with limited functionality. All configuration and maintenance is done through command line interface windows or by connecting to a system remotely through a management application.

- Windows 7. Windows 7 x86 is supported by Windows 2008 x86 drivers. Windows 7 x64 is supported by Windows 2008 R2 X64 drivers.

- Windows Server 2012.

Fibre Channel features

The IBM Flex System FC5024D 4-Port 16Gb FC Adapter supports the following Fibre Channel features for enhanced performance and connectivity in the SAN. For more information on these features, refer to the *Brocade Adapters Installation and Reference Manual*.

- Over 500,000 input/output operations per second (IOPS) per port for maximum I/O transfer rates.

- Up to 1,600 Mbps throughput per port full duplex.

- Management APIs for integration with a Management application, such as Network Advisor, and other management frameworks.

- BB Credit Recovery. Buffer-to-buffer credit primitives (R_RDY and VC_RDY) exchanged at the link level can get corrupted and become unrecognizable at the receivers. This will lead to depletion of BB Credits that were exchanged between the adapter and switch ports during fabric login (FLOGI). Similarly, if the start of frame gets corrupted, the receiving port will not send the corresponding R_RDY to the port at the other end of the link and will result in loss of credit for that port. This will cause the ports to operate with few buffer credits and impact throughput until a link reset or link offline event. To avoid this problem, the credit loss recovery feature enables ports to recover the lost credits.

  BCU commands and HCM options are available to enable and disable the feature. When enabling BB Credit Recovery, you provide a buffer-to-buffer state change number (BB_SCN), which specifies the number of frames to send and R_RDYs to return from the receiver before the receiver will detect lost credits and initiate credit recovery.

  BCU commands are also available to query for such information as credit recovery state (offline or online) and offline reasons. In addition, commands are available to display port statistics for BB_Credit recovery, credit recovery frames lost, R_RDYs lost, and link resets. Refer to the *Brocade Adapters Administrator's Guide* for details.

  Following are feature limitations:

  - The feature is also only supported on Brocade switches running Fabric OS 7.1 and later.

  - The feature only works at the maximum supported speed of the port.

- The feature only works in R_RDY mode and not in VC_RDY mode, therefore it is enabled with FA-PWWN and forward error correction (FEC), but not supported when N_Port trunking or QoS are enabled. Note that FEC is supported on 16 Gbps ports only.

- The feature is not supported when a port is in D_Port mode.

- Lost credits are recovered during a link reset.

- Diagnostic (D_Port)

  When a switch or adapter port is enabled as a Diagnostic (D_Port), electrical loopback, optical loopback, and link traffic diagnostic tests will initiate on the link between the adapter and the connected switch port. Results can be viewed from the switch using Fabric OS commands. Results can be viewed from the adapter using BCU commands and HCM. Once an adapter port is enabled as a D_Port, the port does not participate in fabric operations, log in to a remote device, or run data traffic. D_Port testing is supported only on Brocade 16 Gbps switches running Fabric OS v7.1.0 or later. To configure this feature on adapters, refer to the *Brocade Adapters Administrator's Guide*.

- Enhanced Hibernation support

  Before Windows Server 2012, the driver used proprietary logic to pass on special LUN details through the adapter flash memory. With Windows Server 2012, the driver can reliably identify the LUN used for booting the operating system and storing the paging file. The paging file can also reside on a non-boot LUN spanning different adapter ports.

- Fabric Assigned Port World Wide Name (FA-PWWN)

  This is a feature of Dynamic Fabric Provisioning (DFP). FA-PWWN allows the adapter port to acquire its port world wide name (PWWN) from the switch port when it logs into the fabric. An FA-PWWN is a "virtual" port WWN that can be used instead of the physical PWWN to create zoning and LUN mapping and masking.

  FA-PWWN is only supported on Brocade switches running Fabric OS 7.0 and later.

- Quality of Service (QoS) feature working in conjunction with the Advanced SAN Fabric QoS feature on Brocade switches to assign high, medium (default), or low traffic priority to a given source or destination traffic flow.

  Default bandwidth settings for QoS priority levels are 60% for high, 30% for medium, and 10% for low. You can use BCU commands to change percentages for the different priority levels. Refer to the *Brocade Adapters Administrator's Guide* for more information. Note that set percentages are the percentage of the available link speed. Therefore, setting 25% for an 8 Gb link, would be 2 Gb.

- FCP-IM I/O Profiling

  This feature, available through HCM, can be enabled or disabled on a physical port. When enabled, the driver firmware categorizes I/O latency data into average, minimum, and maximum categories. Use this feature to analyze traffic patterns and help tune Fibre Channel adapter ports, fabrics, and targets for better performance. Note that enabling this feature impacts I/O performance.

- Interrupt Coalescing

  This feature provides a method to delay generation of host interrupts and thereby combines (coalesce) processing of multiple events. This reduces the interrupt processing rate and reduces the time that the CPU spends on context switching. You can configure the following parameters per port to adjust interrupt coalescing:

- Interrupt time delay. There is a time delay during which the host generates interrupts. You can increase this delay time and thereby coalesce multiple interrupt events into one. This results in fewer interrupts for interrupt events.

- Interrupt latency timer. An interrupt is generated when no new reply message requests occur after a specific time period. You can adjust this time period and thereby minimize I/O latency.

- 16 Virtual Channels (VCs) per port. VC-RDY flow control can use these multiple channels for Quality of Service (QoS) and traffic prioritization in physical and virtualized network environments.

- Target rate limiting.

  You can enable or disable this feature on specific ports using BCU commands and HCM. Target rate limiting relies on the storage driver to determine the speed capability of discovered remote ports, then uses this information to throttle FCP traffic rates to slow-draining targets. This reduces or eliminates network congestion and alleviates I/O slowdowns at faster targets.

  Target rate limiting is enforced on all targets that are operating at a speed lower than that of the target with the highest speed. If the driver is unable to determine a remote port's speed, 1 Gbps is assumed. You can change the default speed using BCU commands and HCM. Target rate limiting protects only FCP write traffic.

  For more information on BCU commands to control target rate limiting, refer to the *Brocade Adapters Administrator's Guide*.

- Target Reset Control. As part of error recovery for I/O requests, operating systems rely on logical unit reset, target reset, and bus reset in that order. While logical unit reset affects the logical unit where the I/O request encountered an error, target reset affects all logical units configured for the specified target. In configurations with a tape target, a target reset issued while a backup job is running can cause the job to abort on all logical units created for the target. Target Reset Control allows you to specifically disable resets for specific targets, thereby preventing effects on other logical units.

  You can use BCU commands to enable target reset, disable target reset for a remote port, and display a list of initiator vs. target WWNs with target reset disabled, For more information on BCU commands, refer to the *Brocade Adapters Administrator's Guide*.

  A bus reset issues target resets to all targets on a specific bus. Targets are not reset for which target reset has been disabled with a BCU command.

- N_Port ID Virtualization (NPIV)

  Allows multiple N_Ports to share a single physical N_Port. Multiple Fibre Channel initiators can share this single physical port and reduce SAN hardware requirements.

- Server Application Optimization (SAO). When used with Brocade storage fabrics with enabled SAO licensing, Fibre Channel ports can use advanced Adaptive Networking features, such as QoS, designed to ensure Service Level Agreements (SLAs) in dynamic or unpredictable enterprise-class virtual server environments with mixed-SLA workloads.

- Boot over SAN. This feature provides the ability to boot the host operating system from a boot device located somewhere on the SAN instead of the host's local disk or direct-attached Fibre Channel storage. Specifically, this "boot device" is a logical unit number (LUN) located on a storage device.

- Fabric-based boot LUN discovery, a feature that allows the host to obtain boot LUN information from the fabric zone database.

NOTE
This feature is not available for direct-attached targets.

- LUN masking:

  LUN masking establishes access control to shared storage to isolate traffic between different initiators that are zoned in with the same storage target. LUN masking is similar to zoning, where a device in a specific zone can communicate only with other devices connected to the fabric within the same zone. With LUN masking, an initiator port is allowed to only access those LUNs identified for a specific target. Plus, the LUN masking configuration is stored persistently across driver loads and system reboots.

  Enable LUN masking on an adapter physical port through the HCM **Basic Port Configuration** dialog box and the BCU **fcpim –lunmaskadd** command to identify the logical port (initiator) and remote WWN (target) for the LUN number. Refer to the *Brocade Adapter Administrator's Guide* for more information on configuration.

  You can also enable or disable LUN masking through the Brocade BIOS Configuration Utility or your system's UEFI setup screens.

  This feature has following limitations:

  - Only 16 LUN masking entries are allowed per physical port.
  - Multiple BCU instances for adding and deleting LUN masking are not supported.

  You can configure LUN masking for a particular target even without the actual devices being present in the network.

  When configuring boot over SAN, mask the boot LUN so that the initiator has exclusive access to the boot LUN. Refer to the *Brocade Adapters Administrator's Guide* for more information.

- Support for Hyper-V. Hyper-V consolidates multiple server roles as separate virtual machines (VMs) using the Windows Server 2008 operating system and provides integrated management tools to manage both physical and virtual resources.

- Support for Windows Server Core, a minimal server option for Windows Server 2008 operating systems that provides a low-maintenance server environment with limited functionality. All configuration and maintenance is done through command line interface windows or by connecting to a system remotely through a management application. Windows Server Core is supported by Windows Server 2008 adapter drivers.

- Support for MSI-X, an extended version of Message Signaled Interrupts (MSI), defined in the PCI 3.0 specification. MSI-X helps improve overall system performance by contributing to lower interrupt latency and improved utilization of the host CPU. MSI-X is supported by Linux RHEL 5, RHEL 6, SLES 10, SLES 11, Windows 2008, and ESX Server 4.0, 4.1, and 5.0.

- Point-to-point topology.

- Management support for Storage Management Initiative Specification (SMI-S).

- Fibre Channel-Security Protocol (FC-SP) providing device authentication through key management.

- Forward Error Correction (FEC) provides a method to recover from errors caused on links during data transmission.

  FEC works by sending redundant data on a specified port or range of ports to ensure error-free transmission. FEC enables automatically when negotiation with a switch detects FEC capability. Although you cannot enable or disable FEC on adapters manually, you can enable FEC on Brocade switches using appropriate Fabric OS commands.

This feature is enabled by default and persists after driver reloads and system reboots. FEC may coexist with other Brocade port features such as QOS, TRL, trunking, BBCR, and FAA.

Following are limitations of this feature:

- FEC is supported only HBAs connected to 16 Gbps Brocade switches running FOS 7.1 and later
- FEC is not supported when on HBA ports operating in direct-attach configurations.

- I/O Execution Throttle

This feature allows you to set maximum Fibre Channel Protocol (FCP) exchanges for a port to reduce the number of exchanges on the link and prevent a "queue full" error status back to the initiator. Use this feature in cases where target devices have a known small queue depth value to prevent SCSI queue-full conditions. You can configure, clear, and query FCP exchange values for a specific PCI function of a vHBA using BCU **fcpim** commands. The configuration persists with system reboots. For configuration details, refer to the *Brocade Adapters Administrator's Guide*.

- Internet Protocol over Fibre Channel (IPFC) driver

This supports transmission of IP traffic over Fibre Channel links. This driver is only included in the Linux "noarch" RPM package (brocade_driver_linux_<version>.tar.gz).

I/O virtualization features

The IBM Flex System FC5024D 4-Port 16Gb FC Adapter supports physical function-based I/O virtualization to provide data isolation and sharing of the bandwidth resources. For adapter ports, each port has one Fibre Channel (FC) function as the factory default.

Virtual HBAs (vHBAs) are virtual port partitions that appear as virtual or logical HBAs to the host operating system. vHBAs are supported on adapter Fibre Channel ports. Multiple vHBAs are not yet supported, so you cannot create them or delete them from an adapter. The default physical function (PF) associated with HBA ports is *vHBA*. HCM discovers and displays all vHBAs as "FC."

The following are limitations of vHBAs:

- Multiple vHBAs per port are not supported (planned for future software release).
- Target rate limiting (TRL) and Quality of Service (QoS) are not supported at the vHBA level (only at the physical port level).
- Boot over SAN is not supported at the vHBA level (only at the physical port level).

Adapter specifications

Table 1 contains additional specifications for the IBM Flex System FC5024D 4-Port 16Gb FC Adapter.

TABLE 1   Adapter specifications

Feature	Description
Adapters per compute node	One or two four-port 16 Gbps FC Adapters per IBM Flex System compute node
Port speeds	16 Gbps or 8 Gbps speed per Fibre Channel port
System board connectors	Copper high-speed SERDES
ASIC	• Provides the Fibre Channel functionality for the adapter. Each adapter contains two ASICs each controlling two Fibre Channel ports. • Two on-board processors, each operating at 400 MHz, which coordinate and process data in both directions.
External serial FLASH memory	• Stores firmware and adapter BIOS code • 4 MB capacity
Data transfer rate	16 or 8 Gbps full-duplex
Fibre Channel performance	Over 500,000 IOPs (maximum) per port Over 1,000,000 IOPS per dual-port adapter
Data rate	• 16 Gbps Fibre Channel: 14.025 Gbps (1600 MB/sec) full duplex • 8 Gbps Fibre Channel: 8.5 Gbps (800 MB/sec) full duplex
Topology	Fibre Channel - Point-to-Point (N_Port)
Operating environment	Provided by IBM Flex System chassis.
Nonoperatng altitude	12,192 meters (40,000 ft.)
Nonoperating temperature	-40°C (-40°F) maximum
Power dissipation	17 W maximum 16 W nominal
Operating voltage	Per PCIe 2.0 specifications
Dimensions	Approximate height: 36.4 mm (1.43 in.) Approximate width: 107.8 mm (4.24 in.) Approximate depth: 157.9 mm (6.22 in.)
Weight	230 grams (.51 pounds)

TABLE 1 Adapter specifications (Continued)

Feature	Description
Topology	Switched Point-to-Point (N_Port)
Data protection	Cyclic redundancy check (CRC) on PCIE and line-side links ECC within the ASIC memory blocks (2-bit detection and 1-bit correction) Error correction code (ECC) and parity through the ASIC
Supported Fibre Channel features and protocols	• SCSI over FC (FCP) • FCP2 • FCP3 • FC-SP Authentication • NPIV • Quality of Service (QoS) • Target rate limiting • Boot over SAN • Fabric-Based Boot LUN Discovery • I/O Interrupt Coalescing • T10 Data CRC • Multiple Priority (VC_RDY) • Frame-Level Load Balancing • Persistent Binding per Channel • Fabric-Based Configuration • vHBA • Fibre Channel Framing and Signaling Interface (FC-FS) • Fibre Channel - Methodologies for Interconnects (FC-MI) • SCSI Architecture Model - 2 • Private Loop SCSI Direct Attach (FC-PLDA). • Fibre Channel Backbone (FC-BB-5) • Fibre Channel Backbone-(FC-BB-5) - FIP (1.03) dpANS • BB_Credit error recovery • D_Port (diagnostics port) • Forward error recovery (FEC) • Target reset control
Other features	• ASIC Flip-flops Parity Protected • T10 Data CRC • ECC Memory Parity Protected • PCI-Express Base Specification • PCI-Express - Root Complex Discovery Topology • PCI-Express Reset Limit Adjustment • Errata for PCI-Express Base Specification, Rev 1.0a.

NOTE
The IBM Flex System FC5024D 4-Port 16Gb FC Adapter conforms to environmental and power specifications for the supported compute nodes and IBM Flex System chassis in which they are installed. Refer to the documentation provided for these products for more information.

1   Features and specifications

Installing the adapter

This chapter provides information and instructions to install adapter drivers, utilities, and management software. It also provides information to configure the adapter. To install the adapter in the IBM Flex System compute node, see the *IBM Flex System Installation and Service Guide* that comes with the compute node; then, return to this User's Guide to install drivers, utilities, and software.

Installing the device drivers, utilities, and HCM

This section provides details on installing adapter device drivers, utilities, and the Host Connectivity Manager (HCM) management software for your adapter

A single adapter driver "package" is available for installing drivers and other components to all supported host operating systems and platforms. Each driver package contains the following components:

- A driver for your host system.

  The IBM Flex System FC5024D 4-Port 16Gb FC Adapter requires installation of the storage (FC) driver. This driver is included in all driver installation packages. The storage driver provides Fibre Channel frame transport for adapter ports.

- Firmware.

  Firmware is installed in the adapter's on-board flash memory and operates on the adapter's CPU. It provides an interface to the host device driver and off-loads many low-level hardware-specific programming tasks typically performed by the device drivers. The firmware provides appropriate support for drivers to manage the hardware.

- Management utilities.

  These utilities include the Brocade Command Line Utility (BCU), Brocade Adapter Software Installer (BASI), installer scripts, HCM agent, and CIM Provider. The GUI-based Brocade Adapter Software Installer (BASI) application installs HCM, all driver packages, and utilities based on your host operating system.

For details on using HCM and BCU commands to manage the adapter, refer to the *Brocade Adapters Administrator's Guide*.

Download the latest driver packages, boot code image, utilities, and additional Brocade adapter documentation from www.brocade.com/adapters-ibm-flex.

Important notes

The following notes provide information on general software and firmware installation.

- The procedures in this section assume that the host's operating system has been installed and is functioning normally.

- Installing the wrong firmware or adapter driver update might cause the adapter or switch to malfunction. Before you install a firmware or update the driver, refer to all readme and change history files that are provided with the driver or firmware. These files contain important information about the update and the procedure for installing the update, including any special procedure for updating from an earlier firmware or driver version.

Installing software on Windows and Linux systems

This section contains instructions for using the GUI-based Brocade Adapter Software Installer (BASI) on Windows and Linux systems. For detailed instructions on installing software using BASI, BASI commands, native installer scripts, and operating system commands, refer to the *Brocade Adapters Installation and Reference Manual*. Download this publication and driver packages from www.brocade.com/adapters-ibm-flex.

Important notes

The following notes provide information on software and firmware installation in Windows and Linux systems:

- The following Brocade Adapter Software Installers (BASI) are available for Windows and Linux operating systems. For VMware systems, these installers only operate on "guest" operating systems for installing the Host Connectivity Manager (HCM).

  - Windows systems BASI

    ```
    brocade_adapter_software_installer_windows_<version>.exe
    ```

  - Linux systems BASI

    ```
    brocade_adapter_software_installer_linux_<version>.bin
    ```

  Download BASI programs for your system from the adapters download page at www.brocade.com/adapters-ibm-flex.

- If you receive errors when launching the GUI-based Brocade Adapter Software Installer (BASI), such as InvocationTargetException errors, your system may not be able to run a GUI-based application. Refer to the *Brocade Adapters Installation and Reference Manual* for instructions on using software installer commands. When downgrading

- When downgrading HCM using the BASI, refer to instructions for using software installation scripts and system tools in the *Brocade Adapters Installation and Reference Manual*.

- Installing software with the BASI automatically starts the HCM Agent.

- The BASI application or commands are the preferred methods to install the following components on your host system:

  - Storage and network drivers

  - Management Utilities. These include the HCM agent, BCU, BASI, installation scripts, CIM provider, and SNMP agent files

  - HCM only

- You must use BASI to install the Host Connectivity Manager (HCM). You can install HCM to the host system where the adapter is installed or on a separate remote management platform. After installation, an HCM desktop shortcut is available on Windows and Linux systems.

- When using the BASI to install HCM, a "Found Backed up data" message displays if a backup directory exists for previously installed software. This message prompts you to restore or not to restore old configuration data.

- Only one driver installation is required for all Brocade adapters installed in a host system.

- Root or administrator privileges are required for installing the driver package.

- Software installation or upgrade could take much longer than normal under the following conditions:

  - On a host system with a large number of adapters.

  - On a host system where large number of LUNs are exposed through different paths to the multi path software.

- For Windows systems only, installing adapter software creates a BCU desktop shortcut on your system desktop. Use this shortcut to launch the BCU> command prompt and enter BCU commands.

- When installing the driver package on Windows 2008 systems, open the TCP/IP port 34568 to allow HCM Agent communication with the HCM. (This procedure is necessary because of firewall issues.) Use Windows Firewall and Advanced Service (WFAS) to open port 34568.

- Before installing the driver on Windows systems, install the following hot fixes from the Microsoft "Help and Support" website, and then reboot the system:

  - Windows 2008

    KB968675 is recommended. This fixes a non-paged memory leak in a Windows 2008 storage stack.

    KB2490742 is recommended when installing storage drivers to avoid a "Ox000000B8" stop error when shutting down or hibernating a system running Windows 7 or Windows Server 2008 R2.

- Starting with SLES 11 SP2, the Brocade KMP packages are digitally signed by Novell with a "PLDP Signing Key." If your system doesn't have the public PLDP key installed, RPM installation will generate a warning similar to the following:

  "warning: brocade-bna-kmp-default-3.0.3.3_3.0.13_0.27-0.x86_64.rpm: Header V3 RSA/SHA256 signature: NOKEY, key ID c2bea7e6"

  To ensure authenticity and integrity of the driver package, we recommend that you install the public PLDP key (if not already installed) before installing the driver package. The PLDP key and installation instructions can be found at http://drivers.suse.com/doc/pldp-signing-key.html.

- On Linux SLES 10 and 11 systems when installing the source-based (noarch) driver packages (brocade_driver_linux_<version>.tar.gz) or when using the Brocade Adapter Software Installer and the kernel has been upgraded to a version without pre-compiled binaries, perform the following tasks to make sure the drivers will load on system reboot:

  - For Linux SLES 10 systems, perform the following steps:

    1. Make sure that the load_ unsupported_modules_automatically variable on your system is set to "yes." This variable is in the following configuration file: /etc/sysconfig/hardware/config.

    2. Run the **mkinitrd** command to load automatically during system boot.

  - For Linux SLES 11 systems, perform the following steps:

    1. Change the "allow_unsupported_modules" value from 0 to 1 in the following file: /etc/modprobe.d/unsupported-modules

    2. Run the **mkinitrd** command to load automatically during system boot.

- After installing the adapter driver and software on an SLES11 SP1 system, use one of the following methods to update the errata kernel:

  a. Upgrade the kernel using the **rpm -ivh** filename command.

  b. Upgrade the kernel using **rpm -Uvh** or YaST.

  c. Use the Brocade Adapter Software Installer (BASI) to install the driver.

  d. Ensure the boot order in /boot/grub/menu.lst is set to boot from the newly installed kernel.

  e. Reboot the server.

- By default, the initrd file will be backed up automatically during Linux installations. During installation, a dialog box displays with the location of the file. If a file exists, a dialog box displays with its current location and allows you to overwrite the file, not overwrite the file, or quit.

Installing adapter software using BASI

Use these steps to install software using the GUI-based BASI application.

1. Download the appropriate installer for your host's operating system from www.brocade.com/adapters-ibm-flex. Following are the programs for Windows and Linux:

   - Windows

     ```
     brocade_adapter_software_installer_windows_<version>.exe
     ```

   - Linux

     ```
     brocade_adapter_software_installer_linux_<platform>_
     <version>.bin
     ```

2. Execute the appropriate Brocade Adapter Software Installer program (.exe or .bin file) that you downloaded in the previous step.

   A progress bar displays as files are extracted.

   When all files are extracted, a **Brocade Adapter Software** title screen displays.

3. When the Brocade Adapter Software Installer **Introduction** screen displays read the recommendations and instructions, then click **Next.**

4. When the **License Agreement** screen displays, select **I accept the terms of the License Agreement**, then click **Next** to continue.

5. If a backup directory exists for previously installed software, a "Found Backed up data" message displays prompting you to restore old configurations. Select either to restore or not to restore and continue installation. If this message does not display, go on to step 6.

6. If a screen displays listing existing software components already installed on your system, select one of the following options, click **Continue**, then skip to step step 10. If this message does not display, go on to step 7.

   - **Install with existing configuration**. The installer compares each configured property and keeps the original value if different than the default value.

   - **Install with default configuration**. The installer upgrades the software and loads with default configurations.

> **NOTE**
> Existing versions of the software components will be overwritten with the current versions you are installing if you continue.

7. If a message displays prompting you to close HCM, close the application if it is running, and then click **OK**.

   The **Choose Install Set** screen displays.

8. Select which software component you want to install, and then click **Next**.

   If you are installing the management utilities and messages display warning that the HCM Agent requires storage and network driver installation or does not match the current driver installation, click **OK**. and select the **Management Utilities** and **Storage Drivers** options.

   If a message displays warning that the installed boot image is not compatible with the driver installation, perform one of the following steps:

   • Select **Yes** to update the image and continue installation.
   • Select **No** to not update the image and continue installation.

9. If the **Choose Install Folder** screen displays, prompting you to choose a destination folder for the software, select one of the following options. If this screen does not display, proceed to step 10.

   • Enter a location for installing the software.
   • Select **Choose** to browse to a location on your file system.
   • Select **Restore Default Folder** to enter the default installation folder.

10. When the **Package Location Information** screen displays listing the installed software components and their locations on your system, click **Next** to continue.

11. Review information on the **Pre-Installation Summary** screen and click **Install** to begin installation.

    A progress bar displays installation progress.

    > **NOTE**
    > For Windows systems, a **Force Driver Installation** message box displays if a better driver is already installed for the adapter. If a message displays, select **OK** to overwrite the existing driver or **Cancel** to quit installation.

12. When the **Install Complete** screen displays, confirm that all software installed successfully. If the screen instructs you to restart or reboot the system, select any options that apply.

13. Click **Done** to confirm installation.

14. Verify driver installation through tools available on your host system. Refer to the "Confirming driver package installation" section in the "Software Installation" chapter of the *Brocade Adapters Installation and Reference Manual* for details.

15. To make sure that the drivers and boot code are synchronized, be sure to update your adapter with the latest boot image whenever you install or update adapter driver packages. Refer to Chapter 3, "Updating drivers, firmware, and boot code".

NOTE

Installing expansion card software creates a Brocade Command Line Utility (BCU) desktop shortcut on your system desktop. Use this shortcut instead of other methods to launch the BCU> command prompt and enter BCU commands. Select this to open a **Command Prompt** window in the folder where the BCU commands reside. You can also enter full BCU commands (such as **bcu adapter - -list**) or enter **bcu - -shell** to get a bcu> prompt where only the command (**adapter - -list**) is required.

Installing software on VMware systems

For VMware ESX and ESXi systems, drivers and utilities are provided as ISO images packaged in a tarball file (.tr.gz) that you must extract and then install using adapter installer scripts. Scripts are available for ESX 4.X, ESXi 4.X, and ESXi 5.X systems. In addition, you can use VMware tools to install software offline and online bundles. Various installation options are available, depending on your VMware release. Refer to the "Driver installation and removal on VMware systems" section of the *Brocade Adapters Installation and Reference Manual* for instructions.

Obtain driver packages and software ISO images for your host's operating system and platform, as well as installation instructions in the *Brocade Adapters Installation and Reference Manual* from www.brocade.com/adapters-ibm-flex.

Important notes

- There are firewall issues with the HCM Agent and Common Information Model (CIM) Provider on VMware systems. When installing the driver package on these systems, open the following TCP/IP ports from a "guest" system the server to allow communication between the server and agent:

    - For HCM, open port 34568.

    - For CIM Provider, open port 5989.

    Following is an example for opening port 34568:

    ```
    /usr/sbin/esxcfg-firewall-o 34568,tcp,in,https
    /usr/sbin/esxcfg-firewall-o 34568,udp,in,https
    ```
    Note that you can change the default communication port for the HCM Agent using the procedures under "HCM Agent operations" in the *Brocade Adapters Administrator's Guide*.

- Because some versions of the ESX and ESXi driver installation process do not enforce maintenance mode, it is recommended that you put the host in maintenance mode, as a system reboot is required after installation.

Installing HCM to a host from the HCM Agent

You can install HCM to any host system from a functioning HCM Agent on a server system. The following are prerequisites for the server system:

- The adapter and driver package must be installed.

- The HCM agent must be running.

Use the following steps to install HCM:

1. Enter the following URL into your host system's web browser:

    https://*server-host*:34568/index.html

where:

server-host   Is the IP address of a server system with the Brocade adapter and driver installed
                    and HCM Agent running.

34568   Is the TCP/IP port where the HCM Agent communicates with HCM.

2. Respond to prompts as required during HCM installation, and the HCM GUI will launch.

3. Log in to HCM when prompted.

To launch HCM in the future, use the HCM shortcut icon. On Windows, the shortcut is located under
Start menu > **Brocade** > **Host Connectivity Manager**. For Solaris, launch HCM from the command
prompt using the following command.

```
sh /opt/brocade/fchba/client/Host_Connectivity_Manager
```

Configuring the adapter

After you install the device drivers and connect the adapter to the fabric and target devices, you can use
the tools described in this section to further configure its settings, verify its operational status, and check
for proper connection.

To configure and manage the storage and networking features of the IBM Flex System FC5024D 4-Port
16Gb FC Adapter, you can use the following tools:

- Brocade BIOS Configuration Utility

- Host system UEFI setup screens

- Brocade Host Connectivity Manager (HCM)

- Brocade Command Line Utility (BCU)

- Standard networking tools for Windows, Linux, and VMware

Brocade BIOS Configuration Utility and system UEFI setup screens

The Brocade BIOS Configuration Utility for legacy BIOS and your system's UEFI setup screens allow
you to perform the following operations on selected adapters:

- Enable or disable ports for boot over SAN.
    - You must enable BIOS or UEFI to support boot over SAN for an adapter port. If disabled, the
      host system cannot boot from Fibre Channel disk drives.
    - The default setting is *enabled* on all adapter ports.

- Enable one of the following Boot Options (Brocade BIOS Configuration Utility only):
    - Fabric Discovered

      Host boots from LUN information provided by the fabric.

      NOTE
      Fabric-based boot LUN discovery (Fabric Discovered) is not supported for booting from
      direct-attached targets.

- Flash Values

    Host boots from LUN information stored in flash memory.

- First LUN

    Host boots from the first visible LUN.

NOTE
To boot from direct-attached targets, you must use the **First LUN** or **Flash Values** options.

- Select a boot device and LUN from discovered targets.
- Configure adapter properties, such as the following:
    - Port speed
    - Port topology
    - LUN mask
    - Bootup delay (BIOS Configuration Utility only)
- Review adapter information, such as the following:
    - PWWN
    - NWWN
    - BIOS version (BIOS Configuration Utility only)
    - Option ROM version (UEFI setup screens only)
    - HBA firmware version (UEFI setup screens only)

For details on how to activate and use the BIOS Configuration Utility, refer to Appendix A, "Configuring adapters with BIOS and UEFI utilities".

You can also perform many of these tasks using the Host Connectivity Manager (HCM) and Brocade Command Line Utility (BCU) commands. Refer to the Boot Code chapter in the *Brocade Adapters Installation and Reference Manual* for more details on the following topics:

- Configuring BIOS using BCU commands or HCM
- Configuring boot over SAN
- Using the Brocade BIOS Configuration Utility for legacy BIOS.
- Configuring UEFI setup screens
- Installing operating systems and adapter drivers on boot LUNs
- Installing full driver packages on boot LUNs
- Fabric-based boot LUN discovery
- Booting systems without operating systems or local drives
- Updating the Windows driver on adapters used for boot over SAN

Access the *Brocade Adapters Installation and Reference Manual* from www.brocade.com/adapters-ibm-flex.

Configuring storage drivers

This section provides an overview of storage driver functions that you can configure for the IBM Flex System FC5024D 4-Port 16Gb FC Adapter on supported operating systems. For detailed information on configuring these parameters, refer to the "Adapter Configuration" appendix in the *Brocade Adapters Installation and Reference Manual* located at www.brocade.com/adapters-ibm-flex.

ATTENTION
These parameters should only be changed by power users with great caution.

Storage instance-specific persistent parameters

You can modify default values for the following functions using BCU commands and specific driver parameters:

- Authorization algorithm, policy, and secret
- Adapter name
- vHBA interrupt coalesce, delay, and latency
- Log level
- Path time-out value (TOV)
- PCIe maximum read request size
- Port maximum frame size, speed, topology, and name
- Port enable, disable, topology, name, and speed

You can modify default values for these parameters using BCU commands to modify the bfa.conf file. For more detailed information, refer to the "Adapter Configuration" appendix in the *Brocade Adapters Installation and Reference Manual*.

NOTE
Driver parameters should only be changed by power users with great caution.

Storage driver-level parameters

Driver-level configuration parameters are global parameters used by all storage driver instances. The default values for the driver configuration parameters are compiled into the driver. Tools for configuring these parameters depend on the operating system and parameter being configured.

Linux and VMware parameters
You can modify parameters for the following functions:

- Maximum scatter gather elements supported
- Maximum SCSI requests per LUN
- Fabric Device Management Interface (FDMI) enable or disable
- Host name
- Linkup delay
- Enable/disable auto-recover IOC on heartbeat failure
- Adapter log level setting
- Wait time for boot targets to come online

- Auto recover IOC on heartbeat failure

- BFA log level.

- Maximum transfer size

- Maximum logins to initiator and target ports

- NetQueue enable and disable

- MSIx interrupt enable or disable

- Maximum number of logins to targets on a port

- Maximum number of scatter gather pages

- Maximum task management commands

- Maximum unsolicited FC receive buffers

- Maximum unassisted FC exchanges

- Maximum number of FCIP I/O requests

- Maximum number of remote ports

- Maximum number of task management commands

- Maximum number of unsolicited FC receive buffers

- Operating system name

- OS patch level

- Number of elements in request queues

- Delay for deleting offline remote port

- Number of elements in request queues

You can modify parameters on Linux systems using **modprobe**.

You can modify parameters on VMware systems using **esxcfg-module**.

For more detailed information, refer to the "Adapter Configuration" appendix in the *Brocade Adapters Installation and Reference Manual*.

NOTE
These parameters should only be changed by power users with great caution.

Windows driver parameters
You can modify default values for the following parameters:

- Enable or Fabric Device Management Interface (FDMI) registrations

- Maximum SCSI requests per LUN

- Auto recovery of I/O controller on heartbeat failure

- Delay for deleting offline remote port

- Maximum number of concurrent logins to a remote port

- Disable MSIx interrupt

You can modify these parameters using the **drvconf --key** command, the Registry Edit tool, and BCU commands. For more detailed information, refer to the "Adapter Configuration" appendix in the *Brocade Adapters Installation and Reference Manual*.

NOTE
These parameters should only be changed by power users with great caution.

Managing the adapter

You can manage the IBM Flex System FC5024D 4-Port 16Gb FC Adapter using the following tools:

- The Brocade Host Connectivity Manager (HCM) and Command Line Utility (BCU) are the primary management tools for the IBM Flex System FC5024D 4-Port 16Gb FC Adapter. You can load HCM as an optional application through the Brocade Adapter Software Installer (BASI). BCU loads with the driver package either through BASI or HCM.

- The IBM System Storage Network Advisor (also known as the Brocade Network Advisor) provides management features for adapters, such as adapter discovery, in-context launch of HCM, authentication, and other features. Refer to the *Brocade Network Advisor SAN User Manual* for more details.

- BIOS and UEFI boot code support Chassis Management Module (CMM) connectivity and Open Fabric Manager (OFM) for configuring SAN connections and SAN target selection, and for WWN virtualization. Refer to your appropriate IBM documentation covering OFM for more information.

Using HCM and BCU

The Host Connectivity Manager (HCM) is a management software GUI for configuring, troubleshooting, and monitoring the IBM Flex System FC5024D 4-Port 16Gb FC Adapter and device connections on local and remote host systems. The Brocade Command Line Utility (BCU), which loads with the driver package, provides commands that perform comparable functions on a local host system. These functions include the following:

- Discovery using the agent software running on the servers attached to the SAN, which enables you to contact the devices in your SAN.

- Configuration management, which enables you to configure local and remote systems, adapter ports, and adapter features.

- Management and monitoring of ports.

- Diagnostics, which enables you to test the adapters and the devices to which they are connected:
    - Adapter, PHY module, BIOS, and port data.
    - Link status of each adapter and its attached devices
    - Diagnostic port (D_Port) configuration
    - Logs of adapter, port, and HCM events
    - Loopback tests to evaluate the ports and the error rate on the adapter
    - Read/write buffer test, which tests the link between the adapter and its devices
    - FC protocol tests, including echo, ping, and trace route

- Monitoring, which provides statistics for adapter ports, port and link tests, authentication activities, firmware, I/O controller, virtual ports, fabric, FCP initiator mode, remote ports, virtual ports, and other areas.

- Security, which enables you to specify a CHAP secret and configure authentication parameters.

- Event notifications, which provide asynchronous notification of various conditions and problems through a user-defined event filter.

For details on using BCU commands and HCM, refer to the *Brocade Adapters Administrator's Guide* located at www.brocade.com/adapters-ibm-flex.

Updating drivers, firmware, and boot code

Drivers

To update driver packages, simply install new packages using steps for the applicable operating
system under

Notes:

- When upgrading the driver for Windows systems, you do not need to reboot the host system as the
  driver upgrades immediately. The upgrade reloads the adapter firmware and reinitializes the link.

- The recommended procedure for upgrading Windows drivers is to install the new driver without
  first removing the existing driver. If you remove the existing driver before installing a new driver,
  installation may fail and the operating system will become unbootable.

- When upgrading the driver for Linux systems, you do not need to reboot the host system. The new
  driver is effective after system reboot.

- When upgrading the driver for VMware systems, you must reboot the host system. The new driver
  is effective after system reboot. Because some versions of ESX and ESXi do not enforce
  maintenance mode during driver installation, it is recommended that you put the host in
  maintenance mode, as a system reboot is required after installation.

- When using the Brocade Adapter Software Installer commands for installation and an existing
  driver is installed on the system, you must use the following parameter to overwrite with the new
  driver.

  ```
  -DFORCE_WIN_DRIVER_INSTALLATION=1
  ```

  For example, to overwrite the existing driver packages with the new driver packages and start the
  HCM Agent automatically, use the following command.

  ```
  brocade_adapter_software_installer_windows_<platform>_<version>.exe
  -DCHOSEN_INSTALL_SET=DRIVER -DFORCE_WIN_DRIVER_INSTALLATION=1 -i silent
  ```

  For example, to overwrite the existing drivers with the new drivers, use the following command.

  ```
  brocade_adapter_software_installer_windows_<platform>_<version>.exe
  -DCHOSEN_INSTALL_SET=BOTH -DFORCE_WIN_DRIVER_INSTALLATION=1 -i silent
  ```

- Software installation or upgrade on a host system with a large number of adapters could take much
  longer than normal.

- To make sure that the drivers and adapter boot code are synchronized, be sure to update your adapter with the latest boot image from the Brocade adapters website at www.brocade.com/adapters-ibm-flex whenever you install or update adapter driver packages. On the website, navigate to the drivers **Downloads** page. Select your operating system from the Downloads list or download the ISO image. Refer to "Boot code" on page 27 for update instructions.

You can update installed drivers on connected hosts using the **Adapter Software** dialog box in HCM. Updating the driver updates all of the following components to the latest versions:

- Network and storage driver
- HCM Agent
- initrd file (Linux systems)

Updating drivers with HCM

To update drivers with HCM, use the following steps:

1. Download the driver package for your host system operating system and platform from www.brocade.com/adapters-ibm-flex.

2. Launch HCM.

   NOTE
   After installation, an HCM desktop shortcut is available for launching HCM on Windows and Linux systems.

3. Select a host on the HCM device tree, and then select Adapter Software under the Configure menu.

   The Adapter Software dialog box displays.

4. Enter the filename of the updated driver in the Driver File text box.

   OR

   Click the Browse button and navigate to the location of the driver file to update.

5. Select Start Update.

   The selected file downloads. If an error occurs during the downloading process, an error message displays.

6. Review the installation progress details that display in the dialog box to determine if the files install successfully.

   NOTE
   During the installation, a warning message may display that the installed boot image is not compatible with drivers being installed. You can obtain current boot image files from the adapters website and install these through the Adapter Software dialog box. Refer to "Updating boot code using HCM" on page 29 for instructions.

Important notes

Refer to these notes when using HCM to upgrade drivers:

- This feature upgrades existing software installed on the host system. Downgrades are not supported.

- During installation, dialog boxes validate installation success. Since the VMware ESX Server operating systems require a reboot for the driver update to take effect, successful installation is not validated in the dialog boxes.

- It is recommended that you put VMware ESX hosts in maintenance mode during installation procedures since a system reboot is required after installation.

Firmware

Adapter firmware loads with the current driver package for your server operating system and platform. Obtain the latest driver packages from www.brocade.com/adapters-ibm-flex.

To install driver packages, refer to "Installing the device drivers, utilities, and HCM" on page 13.

Determining firmware level

You can determine the current firmware version installed on your adapter flash memory using one of the following methods:

- Enter the **bcu adapter --query** command. The installed BIOS version displays in the Flash Information section of the command output.

- View the adapter **Properties** panel in HCM. To view the panel, select the adapter in the device tree, and then click the **Properties** tab in the right pane.

Boot code

Boot code or the boot image contains BIOS, UEFI, and other supported boot code and firmware used by the code to boot from the adapter. Although boot code for the adapter installs with driver packages, whenever you update drivers, you should also update with the latest boot code image. You can update boot code using the Brocade Command Line Utility (BCU) commands or the Host Connectivity Manager (HCM).

The adapter boot code supports the following systems:

- PCI BIOS 3.1 and PCI firmware 3.0 or later for Brocade Adapters.

  Boot code for PCI system

- BIOS

  Boot code for x86 and x86_x64 platforms. Compliant with PCI BIOS 3.1 or later and PCI Firmware 3.0 or later.

- Unified Extensible Firmware Interface (UEFI)

  Boot code for UEFI systems

- SMBIOS specification version 2.4 or later

  System Management BIOS

- Adapter firmware

Important notes

Consider this information when updating boot code:

- A single, updatable boot code image, stored in the adapter option read-only memory (option ROM) memory, contains all boot code for supported host platforms.
- By default, BIOS and UEFI are enabled on adapter ports for boot over SAN.
- All Brocade adapters installed on a host system must use the same boot code version.
- To keep drivers and boot code synchronized, be sure to update your adapter with the latest boot image *after* you install or update adapter driver packages. Be sure to update drivers before updating the boot code.
- Updating boot code through HCM is not supported on VMware ESXi servers. Use the BCU **boot --update** command instead.

Determining boot code level

You can determine the current BIOS version installed on your adapter using one of the following methods:

- View the BIOS that displays on your system screen during hardware reinitialization, just before you are prompted to press **Ctrl** and **B** or **Alt** and **B** to enter the Brocade Configuration Utility.
- Enter the **bcu adapter --query** command. The installed BIOS version displays in the Flash Information section of the command output.
- View the adapter **Properties** panel in HCM. To view the panel, select the adapter in the device tree, and then click the **Properties** tab in the right pane.

Updating boot code using BCU commands

Use the following steps to update adapters with the latest boot code using BCU commands.

1. Download the latest boot code from the "Boot Code" area on www.brocade.com/adapters-ibm-flex.

2. Extract the boot code image file.

3. Enter the following BCU command:

```
bcu boot --update <ad_id> <image file> -a
```

where:

\<ad_id\>	ID of the adapter (adapter)
\<image file\>	Name of firmware image file
-a	Indicates that the boot code should be updated on all installed Brocade adapters found on the host. Note that the adapter identification (ad_id) should not be specified if the -a option is specified.

Updating boot code using HCM

To update adapters with the latest boot code using HCM, use the following steps:

1. Obtain the latest boot code from the "Boot Code" area of www.brocade.com/adapters-ibm-flex.

2. Extract the boot code image file.

3. Launch HCM.

4. Select a host on the device tree, and then select **Adapter Software** from the **Configure** menu.

   The **Adapter Software** dialog box displays.

5. Enter the filename of the boot image in the **Boot Image File** text box.

   OR

   Click the **Browse** button and navigate to the location of the file to update.

6. Click **Start Update**.

   The selected file downloads. If an error occurs during the downloading process, an error message displays.

7. Review the installation progress details that display in the dialog box to determine if the files install successfully.

NOTE
Because updating the VMware ESX driver requires rebooting the system, the boot code cannot be updated along with the driver using the **Adapter Software** dialog box. HCM will not restrict selecting the boot image for update on the VMware ESX platforms.

Updating firmware and device drivers through IBM

IBM® periodically makes I/O adapter firmware and device driver updates available for the compute node. Provisioning is the set of actions that you take to update the firmware and device drivers and install the operating system. Several tools are available to help you update the firmware and device drivers in the provisioning process.

- **IBM Flex System Manager Update Manager**

  IBM Flex System Manager Update Manager acquires, installs, and manages firmware and device driver updates and monitors your compute nodes to ensure that they remain current. For more information about IBM Flex System Manager Update Manager, see "Updating firmware and software from the IBM Flex System Manager management software".

- **UpdateXpress System Packs**

  UpdateXpress System Packs (UXSP) contain an integration-tested bundle of online, updateable firmware and device drivers for your compute node. The IBM ToolsCenter Bootable Media Creator uses UpdateXpress System Packs to update the firmware and device drivers.

  Typically, use UpdateXpress System Packs to update firmware and devices drivers for a compute node that has previously been provisioned. For more information about UpdateXpress System Packs, see the IBM UpdateXpress website.

- **IBM ToolsCenter Bootable Media Creator**

  You can use IBM ToolsCenter Bootable Media Creator to create bootable media that is suitable for applying firmware updates and running preboot diagnostics. Using IBM ToolsCenter Bootable Media Creator, you can create a single bootable image on supported media (such as CD, DVD, ISO image, USB flash drive, or set of PXE files) that bundles multiple IBM Flex System tools and updates from UpdateXpress System Packs, which contain Windows and Linux® firmware updates.

  Typically, use IBM ToolsCenter Bootable Media Creator for the initial setup of a compute node. For more information about the IBM Bootable Media Creator, see the IBM Bootable Media Creator website.

  To provision a compute node with updated firmware and device drivers by using IBM ToolsCenter Bootable Media Creator, complete the following steps.

  1. Download IBM ToolsCenter Bootable Media Creator to a computer that is connected over the management network to the IBM Flex System Manager management software that is managing the compute node.

  2. Create the bootable media of firmware and device driver updates.

  3. Connect to the IBM Flex System Manager management software that is managing the IBM Flex System chassis in which the compute node is installed.

  4. From IBM Flex System Manager Chassis Manager, select the compute node. In the Actions column, select Remote Control.

     NOTE
     The user ID that you use to log in to IBM Flex System Manager management software must have sufficient user permissions to manage the compute node.

  5. From the Remote Control session, mount the bootable media (using Remote Media).

  6. Start the compute node to boot the media and install the updates.

Important: To avoid problems and to maintain system performance, always make sure that the I/O adapter firmware and device drivers are consistent in all compute nodes in the IBM Flex System chassis.

Solving problems

This chapter provides troubleshooting information to help you solve some problems that might occur while you are setting up the IBM Flex System FC5024D 4-Port 16Gb FC Adapter.

If you cannot locate and correct a problem by using the information in this section, see Appendix B, "Getting help and technical assistance".

Basic troubleshooting

Because adapters, such as IBM Flex System FC5024D 4-Port 16Gb FC Adapter, are installed in compute nodes as part of an IBM Flex System chassis, problems may occur for reasons other than when adapters are installed in standard host systems. This section outlines some general methods for isolating causes of problems with adapter operation. For more information, refer to the troubleshooting and maintenance information published for your specific IBM Flex System compute node and chassis. Also, refer to the support location on the IBM website for your compute node and chassis.

If problems exist with adapter operation in a compute node, verify the following:

- The compute node is turned on.
- The adapter is installed in the appropriate connector in the compute node. On some compute nodes, connectors may only support a specific adapter type. Refer your *IBM Flex System Installation and Service Guide* for help.
- The chassis is configured for adapter operation. Refer to your *IBM Flex System Enterprise Chassis Installation and Service Guide* and documentation on chassis components for help.
- The compute node in which the adapter is installed is correctly configured for adapter operation and is correctly installed in the chassis. Refer to your *IBM Flex System Enterprise Chassis Installation and Service Guide* for help.
- All devices in the chassis that support adapter operation are installed in the appropriate bays and correctly configured. Refer to your *IBM Flex System Enterprise Chassis Installation and Service Guide* for help.
- You are using the latest device drivers, firmware, and BIOS for the compute node and other components in the chassis that support adapter operation.

Detailed troubleshooting

Detailed troubleshooting and debugging procedures for the adapter are available in the *Brocade Adapters Troubleshooting Guide* at www.brocade.com/adapters-ibm-flex.

Parts listing

Replaceable components are of three types:

- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.
- **Tier 2 customer replaceable unit (CRU):** You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.

For information about the terms of the warranty, see the *Warranty Information* document.

The replaceable components in the following table are Tier 1 CRUs. If other components require replacement, see the documentation that came with those devices for instructions.

TABLE 2 Replaceable components and corresponding CRU/FRU identifiers

Name of component	CRU number (Tier 1)
IBM Flex System FC5024D 4-Port 16Gb FC Adapter	95Y2382

Configuring adapters with BIOS and UEFI utilities **A**

You can use setup screens in the following interfaces to configure adapter storage options, such as boot over SAN, port speed, LUN masking, boot delay, and to display adapter properties such as the BIOS version, PWWN, and NWWN:

- Brocade BIOS Configuration Utility. Use the Brocade BIOS Configuration Utility on Legacy BIOS systems or UEFI-capable systems in Legacy BIOS mode.

- Unified Extensible Firmware Interface (UEFI). This interface is applicable to UEFI-capable IBM servers.

Using the Brocade BIOS Configuration Utility

Use the Brocade BIOS Configuration Utility on Legacy BIOS systems or UEFI-capable systems in Legacy BIOS mode to configure boot over SAN options, port speed, and boot delay, and to display adapter properties such as the BIOS version, PWWN, and NWWN.

NOTE
"Brocade BIOS configuration utility" and "Brocade BIOS configuration menu" are used interchangeably in this manual.

To configure BIOS parameters using the Brocade BIOS Configuration Utility, use the following steps.

NOTE
When you change a setting on a BIOS Configuration Utility screen, the setting is saved to the adapter whenever you change to a new screen or close the utility.

1. Power on the host system.

2. Watch the screen as the system boots. When "Brocade BIOS configuration utility" displays, press *Alt+B* or *Ctr*l+B.

    The Brocade BIOS Configuration Menu displays a list of installed adapter ports, similar to the screen in Figure 1 on page 34.
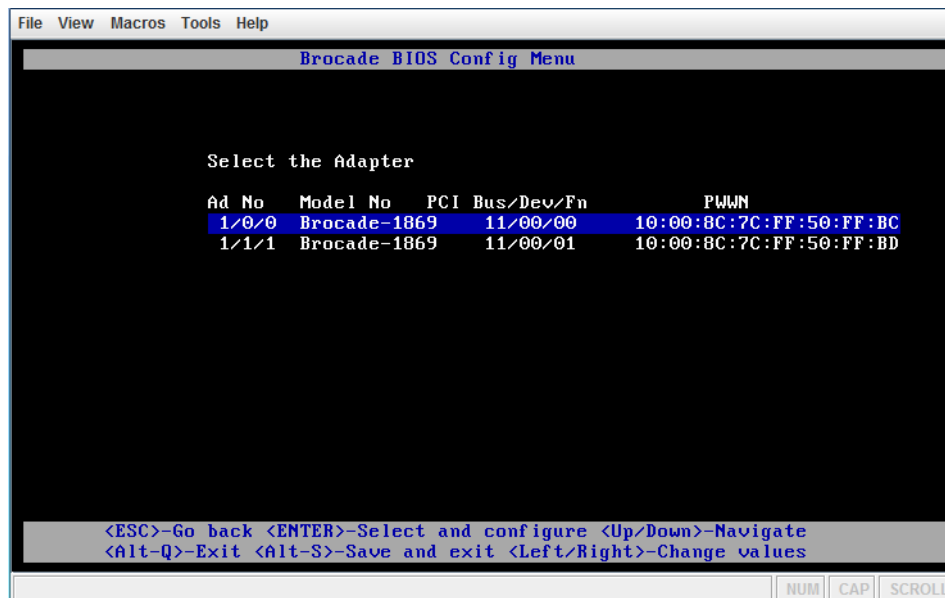
FIGURE 1   BIOS Configuration Menu (Select the Adapter)

Under the **Ad No** column, the first digits 1/0 and 1/1 refer to adapter number/port number, so these are the first and second ports of the first installed adapter. Although the adapter four ports, these ports are split between compute nodes to provide redundant connections for two different switch elements. Therefore, this screen only displays two ports for this host system only.

A maximum of 8 ports can display on a screen, and a maximum of 16 ports are supported by the BIOS Configuration Utility. Select **Page Up** to go to a previous screen or **Page Down** to go to the next screen.

NOTE
To bypass functions and stop loading BIOS for a specific port, you must to press **x** for the port. to bypass functions and stop loading BIOS on all ports, press **X**. Press **x** or **X** within 5 seconds to bypass execution of functions displayed on screens. If you press after 5 seconds, the next function (instead of the current function) will be bypassed.

---

3. Select a port that you want to configure.

A screen similar to the one in Figure 2 on page 35 displays. (In the following illustration, port 0 was selected.)
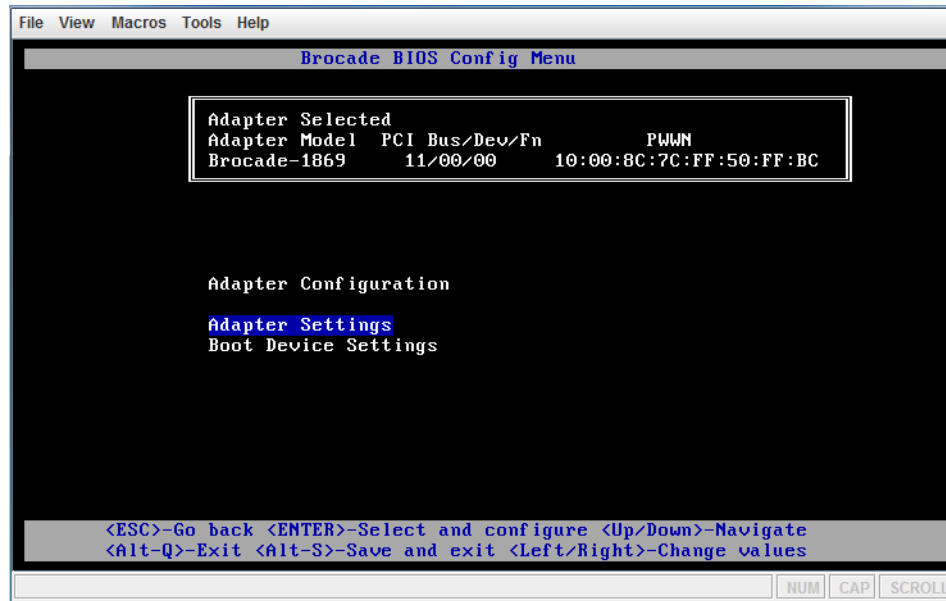
FIGURE 2   BIOS Configuration Menu (Adapter Configuration)

4. Select one of the following:

    •   **Adapter Settings.** Use the Adapter Settings screen to enable BIOS, adapter port speed (HBAs and Fabric Adapter ports configured in HBA mode only), and discovery of boot LUN information from the fabric. You can determine adapter N and PWWN. Proceed to step 5.

    •   **Boot Device Settings**. Use the Device Settings screen to select the boot target and LUN for booting the host system. Proceed to step 7.

5. Select **Adapter Settings** and press **Enter** to begin adapter configuration.

    A screen similar to that shown in Figure 3 on page 36 displays showing the port's current BIOS version, NWWN and PWWN. Table 3 on page 36 explains options available for BIOS, port speed, and boot LUN settings.

```
                   Brocade BIOS Config Menu

        ┌─────────────────────────────────────────────────┐
        │ Adapter Selected                                 │
        │ Adapter Model  PCI Bus/Dev/Fn          PWWN      │
        │ Brocade-1869     11/00/00    10:00:8C:7C:FF:50:FF:BC │
        └─────────────────────────────────────────────────┘


          Adapter Settings

          BIOS Version : 3.2.1.0_beta_bld03
          NWWN         : 20:00:8C:7C:FF:50:FF:BC
          PWWN         : 10:00:8C:7C:FF:50:FF:BC


          BIOS         - [      Enabled    ]
          Port Speed   - [       Auto      ]
          Boot LUN     - [     First LUN   ]
          Bootup Delay - [       0min      ]
          Topology     - [       P2P       ]
          LUN Mask     - [     Disabled    ]
          Press "R" to restore factory defaults
      <ESC>-Go back <ENTER>-Select and configure <Up/Down>-Navigate
      <Alt-Q>-Exit <Alt-S>-Save and exit <Left/Right>-Change values

                                              NUM   CAP   SCROLL
```

FIGURE 3   BIOS Configuration Menu (Adapter Settings)

TABLE 3   Brocade BIOS Configuration Utility field descriptions

Field	Description
BIOS Version	Displays the Brocade BIOS boot code version installed on the card.
NWWN	Displays the port's Node World-Wide Name.
PWWN	Displays the port's unique Port World-Wide Name.
BIOS	The value of BIOS must be *Enable* for the selected adapter port to support boot over SAN. If this setting is set to Disable, the system will not boot from the Fibre Channel disk drives that are connected to the selected adapter port. **NOTE:**The default setting for all adapter ports is Enable.
Port Speed	Sets the speed for the adapter port. **NOTE:**Auto allows the adapter port to automatically negotiate link speed with the connected port.
Boot LUN	• Fabric Discovered. When enabled, LUN information, such as the location of the boot LUN, is provided by the fabric. • Flash Values. Boot LUN information will be obtained from flash memory. Note that values are saved to flash when you configure and save them through the BIOS Configuration Utility and BCU. • First LUN. The host boots from the first LUN visible to the adapter that is discovered in the fabric. **NOTE:**To boot from direct-attached Fibre Channel targets, you must use the **First LUN** or **Flash Values** options. **NOTE:**Fabric-based boot LUN discovery (Fabric Discovered) is not supported for booting from direct-attached targets.

TABLE 3   Brocade BIOS Configuration Utility field descriptions (Continued)

Bootup Delay	You can configure values of 1, 2, 5, and 10 minutes. This adds a delay in discovering the boot LUN to help compensate for the time it takes storage systems to boot up. During storage system boot, boot LUNs are not visible to servers that are also booting up.
Port Topology	Set *Loop* if the port is connecting to storage in a Fibre Channel Arbitrated Loop (FC-AL) and *P2P* if the port is connecting to storage in a point-to-point topology.
LUN Mask	Enable or disable LUN masking. LUN masking establishes access control to shared storage to isolate traffic between different initiators that are zoned in with the same storage target. For more information on LUN masking, refer to the LUN Masking paragraph under "Fibre Channel features" on page 5.

6.   Change any parameters by following the instructions at the bottom of the BIOS Configuration Utility screen. For example, use the following keys to select and change information:

- Up and Down keys - Scroll to a different field.
- **Enter** - Select a field and configure values.
- Left and Right arrow keys - Change a value.
- **Alt** - **S** - Save configuration values to adapter flash memory.
- **Alt** - **Q** - Exit the utility.
- **Esc** - Go back a screen.
- **Page Up** or **Page Down** - Go to preceding or next screen.

NOTE
To restore factory default settings, press **R**.

7.   To configure boot devices, select **Boot Device Settings** from the initial menu screen for the adapter port (step 4) and press **Enter** to designate a discovered LUN as a boot device.

A list of up to four boot devices displays, showing the PWWN of the storage port and the LUN number designated as a boot LUN. The first device listed is the primary boot device. The host first tries to boot from the primary device, and then the succeeding devices in the list. Figure 4 shows an example of the Boot Devices settings.
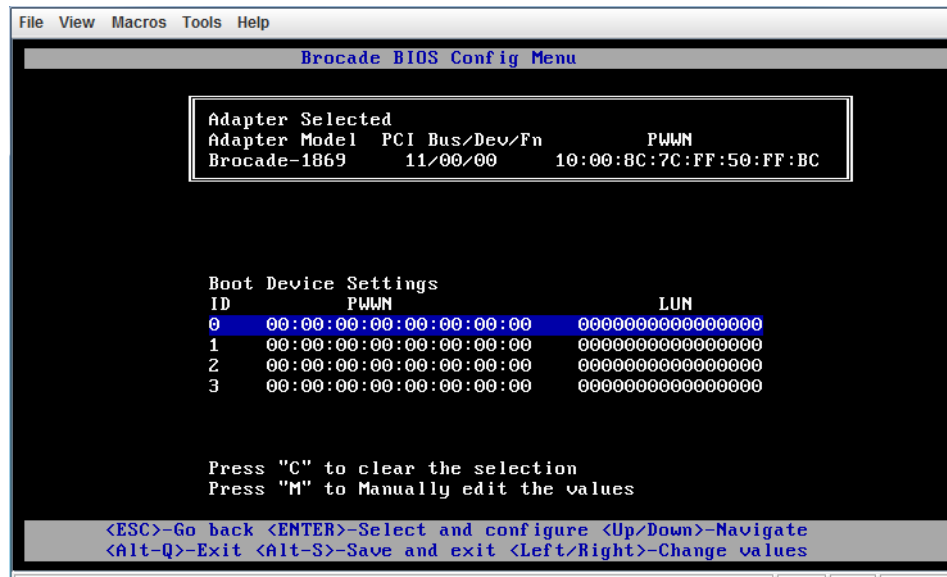
FIGURE 4   BIOS Configuration Menu (Boot Device Settlings)

8. Use the Up and Down arrow keys to select a boot device, and then use one of the following options to configure boot device settings:

    • Press **C** to clear a selected boot device from the list.

    • Press **M** to manually edit boot device information, and then enter the PWWN and LUN values for the boot device. Press **M** to exit.

NOTE
When editing boot device information, you must complete the entire value before pressing **M** or the configuration will reset to the previous value. For example, if you edit part of a PWWN, and then press **M**, the PWWN will return to the previous value.

    • Select a device and press **Enter**. This displays additional screens that allow you to select discovered LUNs as boot devices.

If you select a device under Boot Device Settings and press **Enter**, a screen similar to the one in Figure 5 on page 39 displays listing all discovered boot targets.
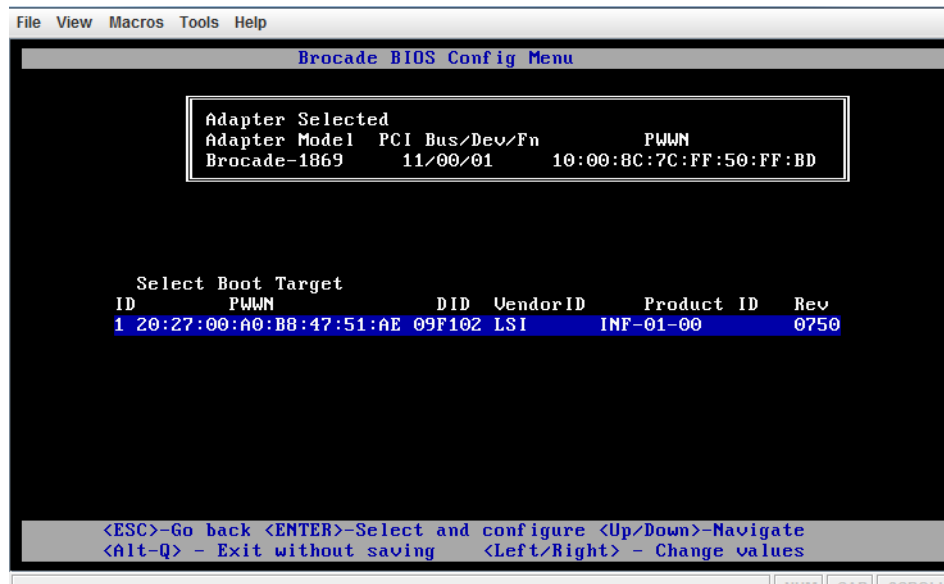
FIGURE 5   BIOS Configuration Menu (Select Port Target)

9. Select a target on which you want to designate a boot LUN and press **Enter**.

A screen similar to the one in Figure 6 displays listing device information and LUNs visible to the adapter.
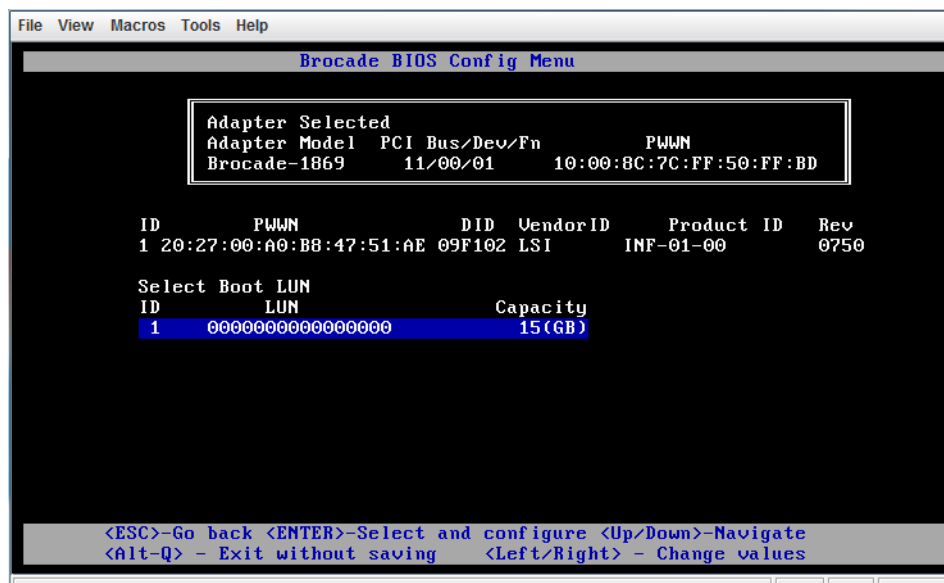
FIGURE 6   BIOS Configuration Menu (Select Boot LUN)

10. Select the LUN on the target device that you want to designate as the boot LUN for the host. This must be the same LUN that you bind to the adapter port using the storage system's management or configuration utility.

> **NOTE**
> You only need to select the bootable LUN once. After the first boot, the same LUN will be used until changed through the BIOS Configuration Utility.

11. Press **Enter**. The selected device will be added to the list of boot devices for the adapter on the Boot Device Settings screen (Figure 7.)
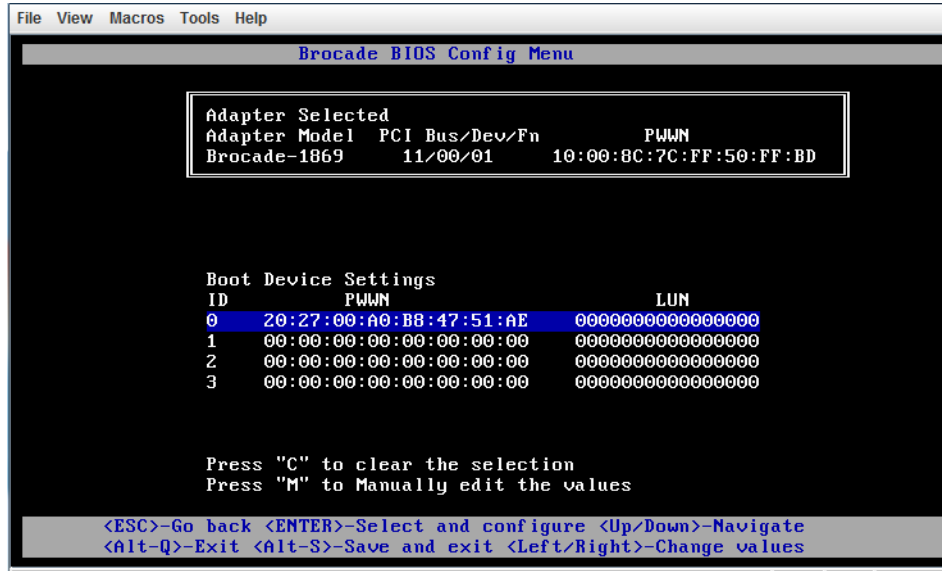
FIGURE 7   BIOS Configuration Menu (Boot Device Settings)

12. Save or exit the configuration utility.

   - To save the configuration, press **Alt + S**.

   - To exit without saving, press the **Alt + Q**.

Using UEFI setup screens

For UEFI systems or UEFI boot mode, use steps in this section to configure boot over SAN and other adapter storage functions using your system's UEFI setup utility Storage menu options. These general instructions are applicable to IBM host systems. Refer to your system's documentation or online help for specific details on using your UEFI setup screens.

> **NOTE**
> When you change a setting on a UEFI setup screen, the setting is saved to the adapter whenever you change to a new screen within the adapter configuration or when you close the utility. Changes are effective even before you explicitly save them.

1. Power on or reboot the host system.

2. Access your UEFI setup screens by booting the system and pressing the **F1** key when prompted for configuration or setup.

   The **System Configuration and Boot Management** menu displays.
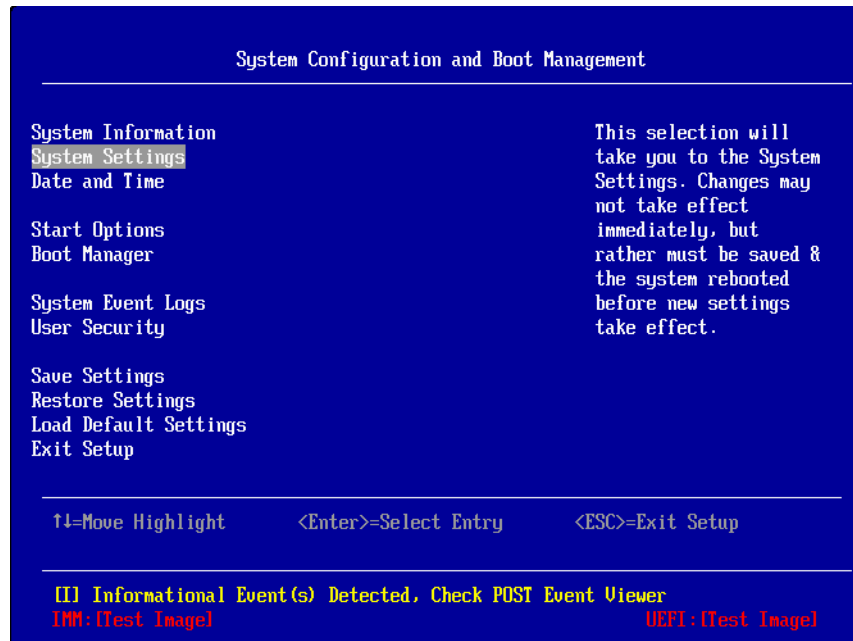
FIGURE 8   System Configuration and Boot Management screen

3. Select **System Settings**.
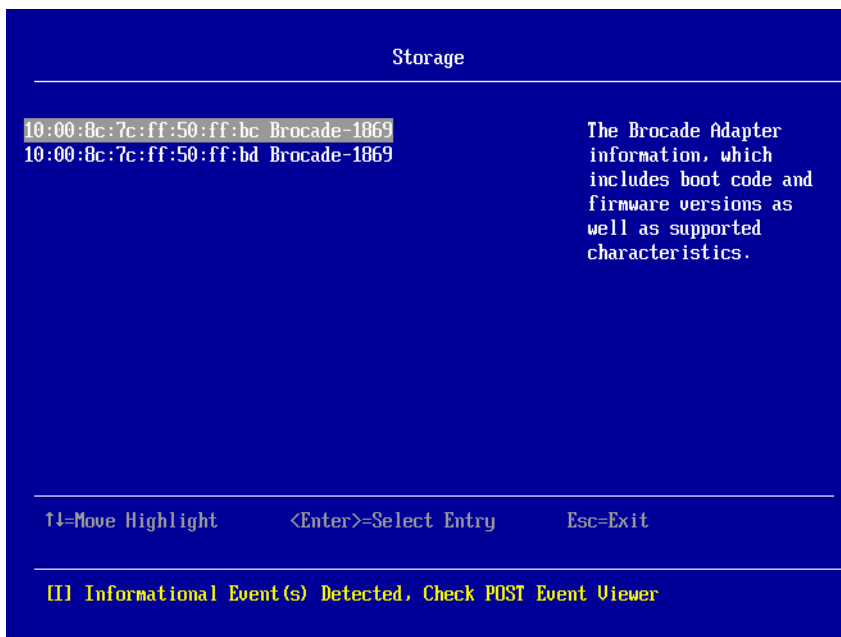
The **System Settings** screen displays.
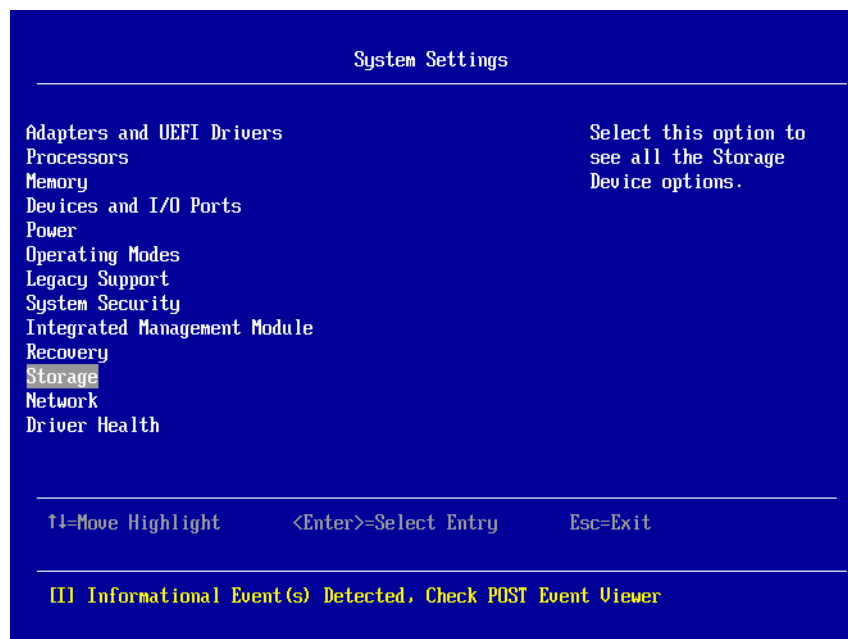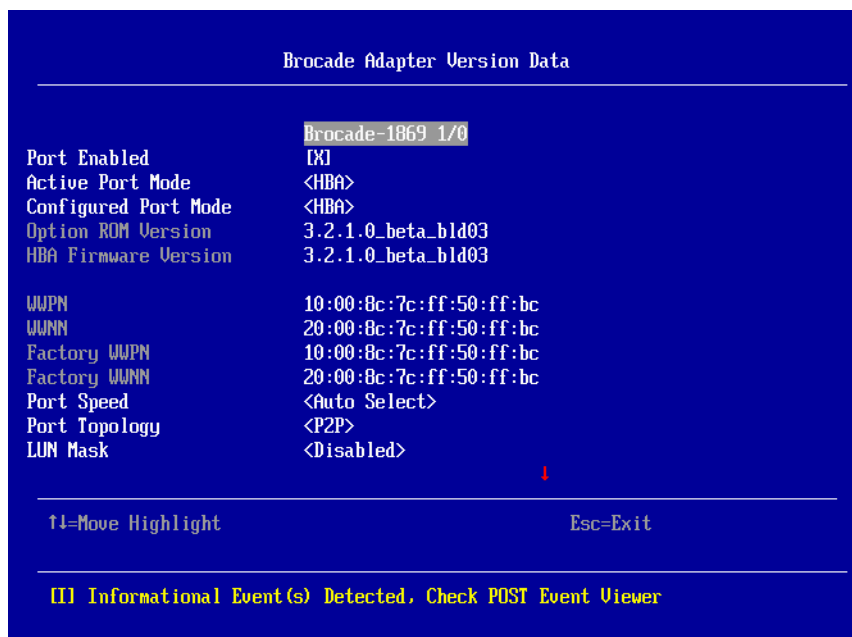

FIGURE 9   Systems Settings menu

4. Select **Storage**.

   A list of installed adapters and MAC addresses displays.

```
                              Storage
   _____

   10:00:8c:7c:ff:50:ff:bc Brocade-1869         The Brocade Adapter
   10:00:8c:7c:ff:50:ff:bd Brocade-1869         information, which
                                                includes boot code and
                                                firmware versions as
                                                well as supported
                                                characteristics.




   _____

    ↑↓=Move Highlight      <Enter>=Select Entry      Esc=Exit
   _____

    [I] Informational Event(s) Detected, Check POST Event Viewer
```

5. From the list of installed devices, select the adapter and port that you want to configure and press **Enter**.

   The **Adapter Version Data** screen displays for the adapter.

```
                    Brocade Adapter Version Data
   _____

                         Brocade-1869 1/0
   Port Enabled          [X]
   Active Port Mode      <HBA>
   Configured Port Mode  <HBA>
   Option ROM Version    3.2.1.0_beta_bld03
   HBA Firmware Version  3.2.1.0_beta_bld03

   WWPN                  10:00:8c:7c:ff:50:ff:bc
   WWNN                  20:00:8c:7c:ff:50:ff:bc
   Factory WWPN          10:00:8c:7c:ff:50:ff:bc
   Factory WWNN          20:00:8c:7c:ff:50:ff:bc
   Port Speed            <Auto Select>
   Port Topology         <P2P>
   LUN Mask              <Disabled>
                                              ↓
   _____

    ↑↓=Move Highlight                        Esc=Exit
   _____

    [I] Informational Event(s) Detected, Check POST Event Viewer
```

6. To enable UEFI for boot over SAN, select **Port Enabled**. You can select the installation boot file using system configuration **Boot Manager** screens.

7. Set the **Port Speed**. The **Auto Select** option allows the adapter port to automatically negotiate link speed with the connected port.

8. Set the **Port Topology** to one of the following:

    - **Loop** for Fibre Channel Arbitrated Loop (FC-AL) topology
    - **P2P** for point to point (**P2P**) topology

9. Enable or disable **LUN Mask**.

    Enable or disable LUN masking. LUN masking establishes access control to shared storage to isolate traffic between different initiators that are zoned in with the same storage target. For more information on LUN masking, refer to the LUN Masking paragraph under "Fibre Channel features" on page 5.

A   Using UEFI setup screens

Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Go to the IBM support website at http://www.ibm.com/supportportal/ to check for technical information, hints, tips, and new device drivers or to submit a request for information.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documentation that is provided with your IBM product. The documentation that comes with IBM systems also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with documentation that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

Using the documentation

Information about your IBM system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to http://www.ibm.com/supportportal/ and follow the instructions.

Getting help and information from the World Wide Web

On the World Wide Web, the IBM website has up-to-date information about IBM systems, optional devices, services, and support. You can find service information for IBM systems and optional devices at http://www.ibm.com/supportportal/.

Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems. For information about which products are supported by Support Line in your country or region, see http://www.ibm.com/services/supline/products/.

For more information about Support Line and other IBM services, see http://www.ibm.com/services/, or see http://www.ibm.com/planetwide/ for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

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B   IBM Taiwan product service

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Electronic emission notices

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This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

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European Community contact:
    IBM Deutschland GmbH
    IBM Technical Regulations, Department M372
    IBM-Allee 1,71139 Ehningen, Germany
    Telephone: +49 7032 15 2941
    Email: lugi@de.ibm.com

Germany Class A statement

Deutschsprachiger EU Hinweis:

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

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

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Generelle Informationen:

Das Gerät erfüllt die Schutzanforderungen nach EN 55024 und EN 55022 Klasse A.

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People's Republic of China Class A electronic emission statement

中华人民共和国 "A类" 警告声明

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