Host Attachment Kit for Linux, Version 1.5.x

Host Attachment Guide

IBM XIV Storage System

Ninth Edition (November 2009)

This edition applies to IBM XIV Storage System Software and to all subsequent releases and modifications until otherwise indicated in new editions.

Book number: GA32-0647-02

Contents

Introduction

This guide discusses the host attachment capabilities for the IBM XIV Storage System.

Purpose and Scope

You can configure the IBM XIV Storage System for the following adapter types and protocols:

- Fiber Channel adapters for support of Fiber Channel Protocol (FCP)
- Ethernet Adapter or iSCSI host bus adapter (HBA) for support of iSCSI over IP Ethernet networks

As explained in the *IBM XIV Theory of Operations* document (see the Related Documentation section for reference), the IBM XIV Storage System has six Interface modules and three Host Interface modules that connect to them. Each Interface module contains four Fiber Channel ports. Each Host Interface module contains two iSCSI ports. These ports are used to attach to hosts.

Note: All host traffic is served through six Interface modules (numbers 4-9).

Although the IBM XIV Storage System distributes the traffic between I/O modules and Data modules, it is important to understand that it is the storage administrator's responsibility to ensure that host I/O operations are equitably distributed among the various Interface modules. This workload balance must be watched and reviewed over time when host traffic patterns change.

The host must be properly configured before it can perform I/O operations on the IBM XIV Storage System.

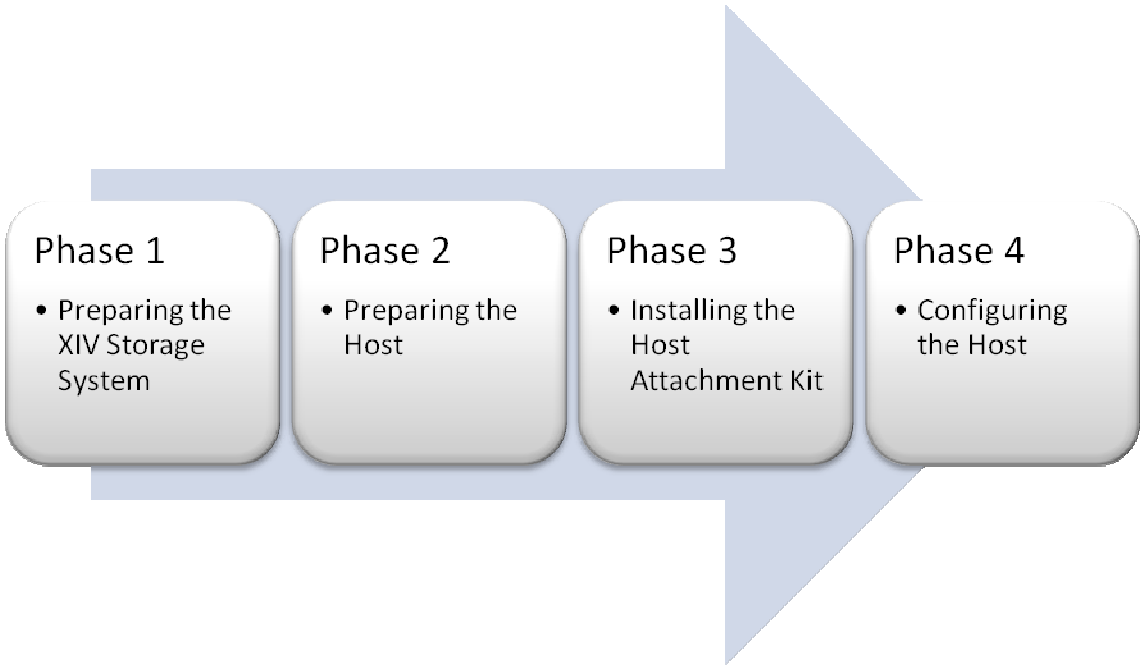
The Host Attachment Kit provides a set of tools that simplifies the host configuration and management.

The XIV Host Attachment Flow

The host attachment process consists of the following four phases:

- Preparing the IBM XIV Storage System for host connectivity
- Preparing the host
- Installing the Host Attachment Kit
- Configuring the host

Each phase can include several steps.



Audience

This guide is intended for customers who want to connect the IBM XIV Storage System to a host. To use this guide, you must have a basic understanding of the Linux operating system and familiarity of the IBM XIV Storage System.

Related Documentation

All the host attachment related documents are available at the following URL:

http://publib.boulder.ibm.com/infocenter/ibmxiv/r2/

The following related documents are available:

- Host Attachment Kit for Linux, Version 1.5.x, Release Notes
- IBM XIV Theory of Operation – describes key concepts and processes of the IBM XIV Storage System.
- IBM XIV XCLI Reference Guide – provides a complete reference to IBM XIV CLI commands, their input, output and completion code.
- IBM XCLI Utility User Manual

Conventions Used in this Guide

XIV uses the following conventions for notes, warning and figures:

Code

These notices indicate referenced text from a source file, scripts and commands.

```
Code
```

Screen output

These notices indicate text from the standard output of the system, host or both.

```
Screen output
```

Warning

These notices indicate possible damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.

Warning

Pay attention

These notices provide important tips, guidance, or advice to help you avoid inconvenient or problem situations.

Pay attention

Before You Proceed

Before you proceed reading this document, you must have a workstation that is equipped with the IBM XIV Storage System management software: the XIV GUI and the XCLI.

For additional assistance and more information on how to get, use and install the IBM XIV Storage System management software, refer to the *IBM XIV Theory of Operations*.

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- Exact publication title
- Form number
- Page numbers to which you are referring

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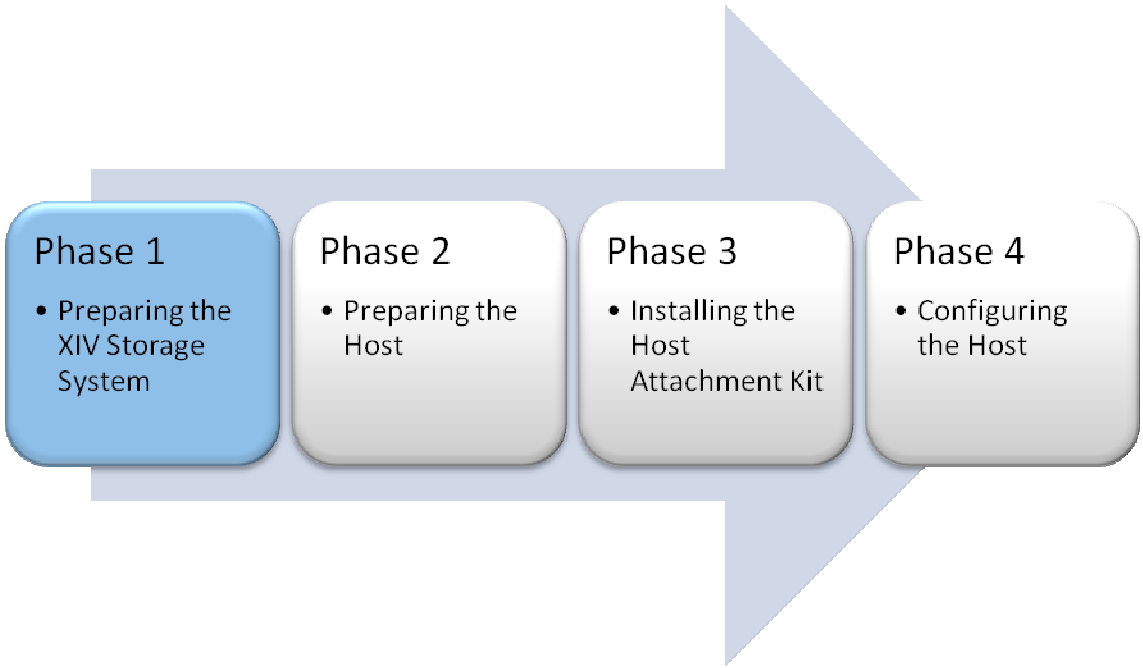
Preparing the XIV Storage System

The first phase in connecting a host to the IBM XIV Storage System is to prepare the storage system.



Overview of XIV Physical Host Connectivity Features

The IBM XIV Storage System supports iSCSI and Fiber Channel protocols for communication with various host systems. The system includes a patch panel in the back of the rack for the physical connections (FC or iSCSI).

Hosts can attach to the Fiber Channel and iSCSI ports through an FC fabric or a Gigabit Ethernet switch. The following figures provide examples for connecting a host through either a storage-attached network (SAN) or an Ethernet Network to the IBM XIV Storage System:

- Fibre Channel connectivity
- iSCSI connectivity
- Mixed connectivity

Fibre Channel connectivity

In the following image, Fibre Channel cables connect between the Fibre Channel switch to the designated ports on the IBM XIV Storage System.

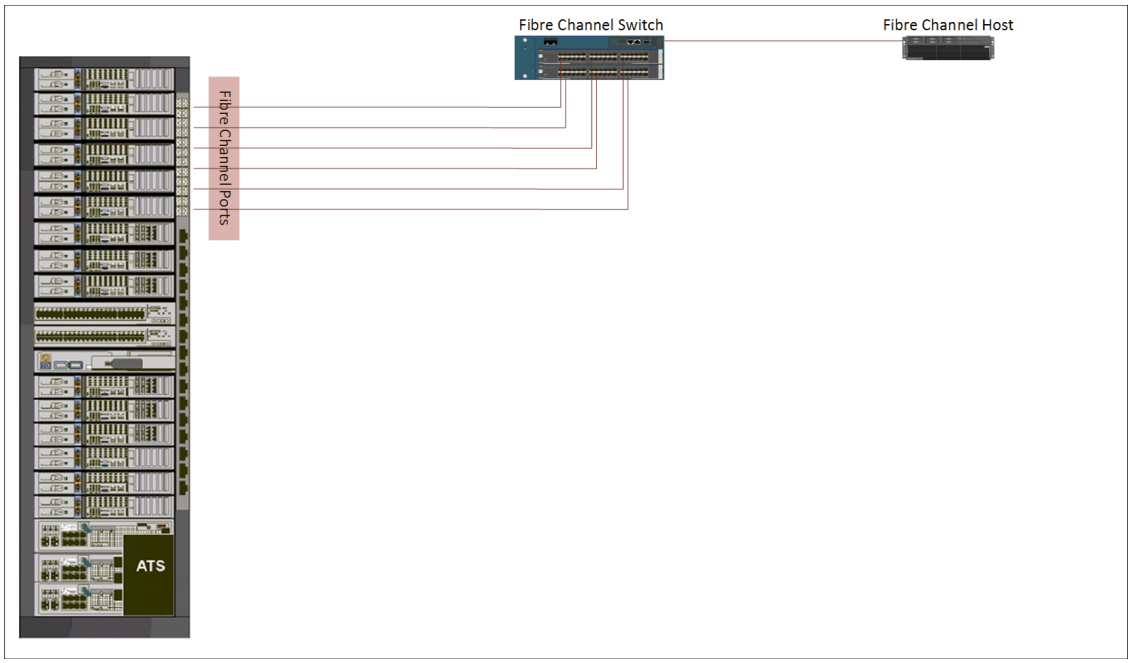


Image 1: Fibre Channel connectivity

iSCSI connectivity

In the following image, iSCSI cables connect the iSCSI switch to the designated ports on the IBM XIV Storage System.

⚠ Fibre Channel and iSCSI ports are located in two different locations on the patch panel of the IBM XIV Storage System.

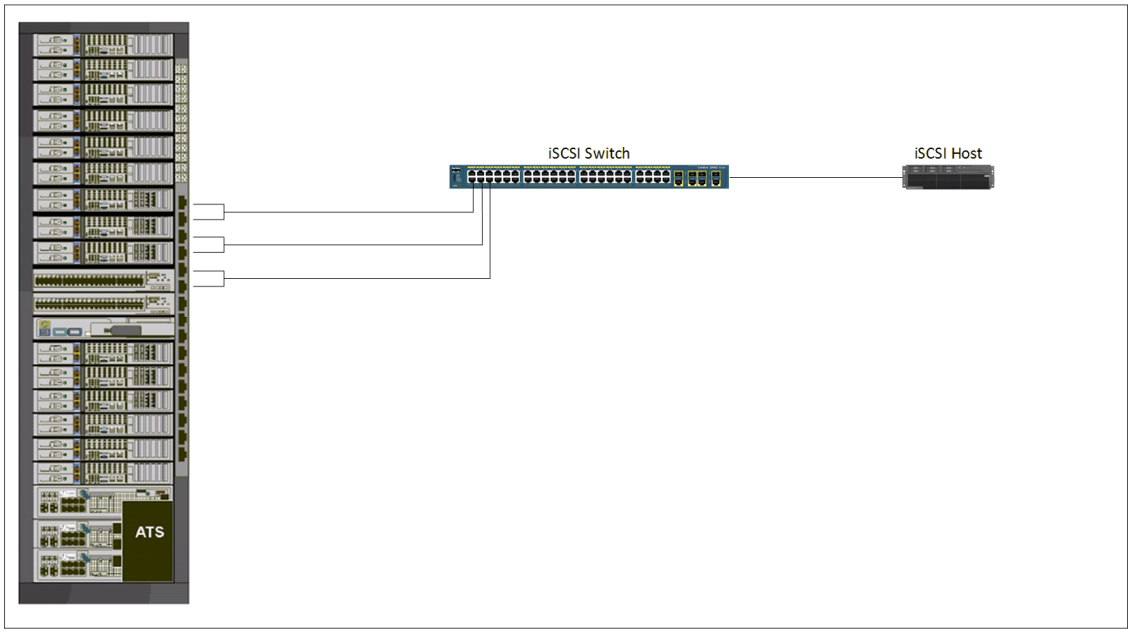


Image 2: iSCSI connectivity

Mixed connectivity

You can also have a mix (or coexistence) of FC and iSCSI connections to attach various hosts. Do not use both FC and iSCSI connections for the same host.

⚠ It is possible to use FC and iSCSI connections concurrently and for attaching the same LUN. This capability is useful and solely recommended when migrating from a former storage system that only supports one of these protocols.

Preparing for iSCSI Connectivity

The IBM XIV Storage System acts as a Transmission Control Protocol (TCP) server for iSCSI connections. Packets are always routed through the Ethernet port from which the iSCSI connection was initiated.

The specification of a default gateway is required only if the attached hosts are not on the same layer-2 subnet.

The maximum transmission unit (MTU) configuration is required if your network supports an MTU that is larger than the standard one. The MTU default value is 1,536 bytes and the maximum value is 8,192 bytes. You must specify the largest possible MTU. If supported by the switches and routers, use up to 8,192 bytes.

iSCSI uses the Internet Protocol (IP) for communication. An iSCSI Qualified Name (IQN) is required for entities that take part in this communication (that is, the IBM XIV Storage System and any attached host).

The IQN uniquely identifies the different entities.

The IQN for the IBM XIV Storage System is configured when the system is delivered. You cannot change this value.

In the IBM XIV Storage System, each iSCSI port is defined as an IP interface with its own IP address. By default, there are six predefined iSCSI target ports on the IBM XIV Storage System to serve hosts through iSCSI.

Planning the Network Topology for iSCSI Connectivity

As shown in Image-2, the iSCSI connectivity makes the best usage of the available iSCSI connectors in the IBM XIV Storage System. With iSCSI connectivity, each Interface module is connected through two ports to two separate Ethernet switches, and each host is connected to the two switches. This configuration provides network architecture that is resilient to the failure of any individual network switch or Interface module.

This high availability configuration is the best practice for iSCSI connectivity. For the best performance, use a dedicated iSCSI network infrastructure. Aggregation of ports is not possible in this solution.

Managing the iSCSI Ports of the XIV Storage System

Initially, no iSCSI connections are configured in the IBM XIV Storage System.

The configuration process is simple but requires several steps (more steps than for the Fibre Channel connection setup). Also, the iSCSI protocol requires a working TCP/IP network.

This TCP/IP network includes the definition and availability of parameters, such as IP addresses, a network mask, and a gateway address to be provided by the network administrator. Additionally, the MTU can be specified.

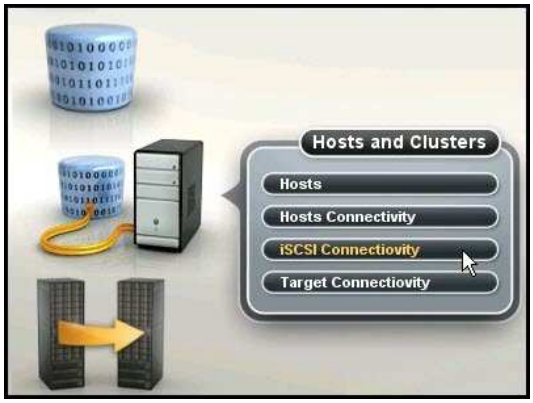
An IQN is also required to uniquely identify the systems for iSCSI communication in the IP network and to play the role of an iSCSI initiator.

Setting an iSCSI Port from the XIV GUI

The following procedure guides you through setting up an iSCSI port using the IBM XIV GUI:

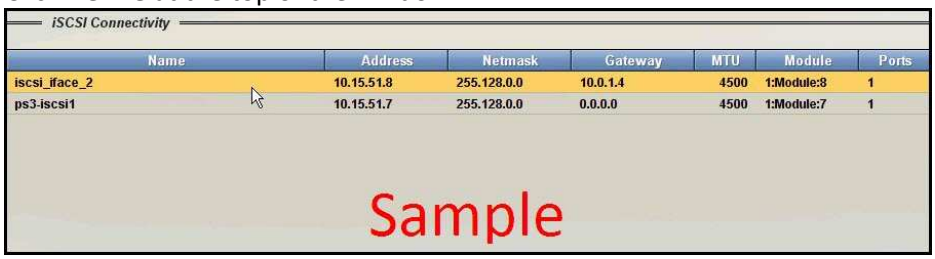
1. Log on to the IBM XIV GUI and select the IBM XIV Storage System you want to configure.

2. Move the mouse over the Hosts and Clusters icon and select **iSCSI Connectivity**.



The iSCSI Connectivity window opens.

3. Click **Define** at the top of the window.

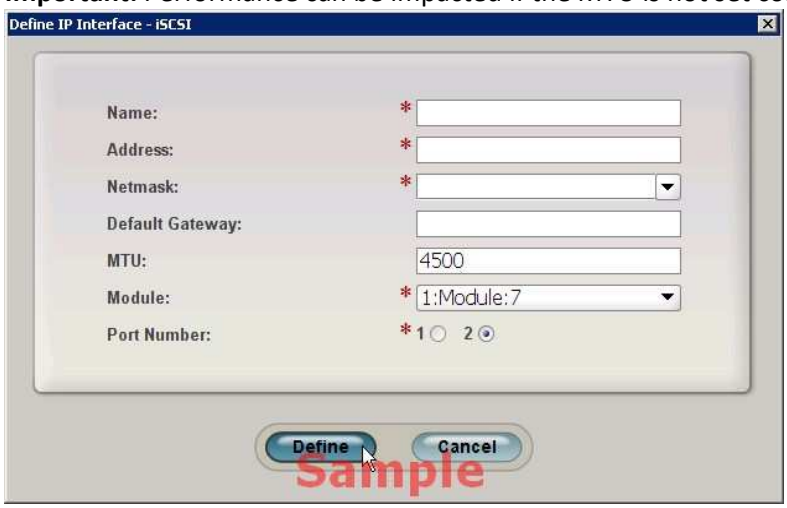


Define IP Interface – iSCSI window opens.

4. Enter the name, address, netmask, and default gateway in the appropriate fields.

   The default MTU is 4500. All devices in a network must use the same MTU. If in doubt, set MTU to 1500 because 1500 is the default value for Gigabit Ethernet.

   Important: Performance can be impacted if the MTU is not set correctly.



5. Click **Define** to define the IP interface and iSCSI setup.
   The window closes and the new port is added to the iSCSI Connectivity window.

Setting an iSCSI port from the IBM XIV CLI (XCLI)

The following XCLI command creates a new IP interface for iSCSI:

```
ipinterface_create ipinterface=IPInterfaceName address=IPaddress
netmask=NetworkMask [ gateway=DefaultGateway ] [ mtu=MTU ]
module=ComponentId ports=P1[,P2]
```

See the *IBM XIV XCLI Reference Guide* for a complete discussion on this command, the parameters it receives and the output it yields.

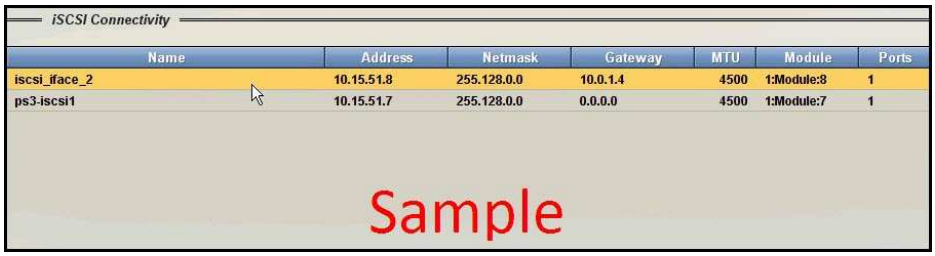
Listing Current iSCSI Port Configuration

iSCSI ports can be easily identified and configured in the IBM XIV Storage System. Use either the GUI or the XCLI to display current settings.

Listing current iSCSI port configuration using the GUI

Log on to the XIV GUI, select the IBM XIV Storage System you want to configure and move the mouse over the Hosts and Clusters icon.

The iSCSI connectivity panel that is shown in the following figure can be used to either view or update the properties of iSCSI ports.



Listing current iSCSI port configuration using XCLI

The following XCLI command displays configured network ports only:

```
ipinterface_list [ ipinterface=IPInterfaceName | address=IPAddress ]
```

Non-configured ports are not listed. To list them, use the XCLI to see all the iSCSI ports of an IBM XIV Storage System.

Listing all IP interfaces

To see a complete list of IP interfaces, including iSCSI, use the XCLI command **ipinterface_list_ports**. This command lists all Ethernet ports together with their configuration and status.

```
ipinterface_list_ports
```

Using CHAP Authentication with iSCSI Connectivity

Starting with microcode level 10.2, the IBM XIV Storage System supports industry-standard unidirectional iSCSI CHAP authentication. The iSCSI target of the IBM XIV Storage System can validate the identity of the iSCSI Initiator that attempts to login to the system.

The CHAP configuration in the IBM XIV Storage System is defined on a per-host basis. That is, there are no global configurations for CHAP that affect all the hosts that are connected to the system.

⚠ By default, hosts are defined without CHAP authentication.

To set up CHAP authentication for a host, the storage administrator must configure the following two parameters:

- iscsi_chap_name : The username that the host must use for CHAP authentication. The username is a string of characters and numbers. It cannot be an empty string.
- iscsi_chap_secret : The password that the host must use for CHAP authentication. See CHAP Name and Secret Parameter Guidelines for more information about the password format.

⚠ For the iSCSI initiator to login with CHAP, both the iscsi_chap_name and iscsi_chap_secret parameters must be set. After both of these parameters are set, the host can only perform an iSCSI login to the IBM XIV Storage System if the login information is correct.

CHAP Name and Secret Parameter Guidelines

The following guidelines apply to the CHAP name and secret parameters:

- Both the iscsi_chap_name and iscsi_chap_secret parameters must either be specified or not specified. You cannot specify just one of them.
- The iscsi_chap_name and iscsi_chap_secret parameters must be unique. If they are not unique, an error message is displayed. However, the command does not fail.
- The secret must be between 96 bits and 128 bits. You can use one of the following methods to enter the secret:
    - Base64 requires that 0b is used as a prefix for the entry. Each subsequent character entered is treated as a 6 bit equivalent length.
    - Hex requires that 0x is used as a prefix for the entry. Each subsequent character entered is treated as a 4 bit equivalent length.
    - String requires that a prefix is not used (that is, it cannot be prefixed with 0b or 0x). Each character entered is treated as a 8 bit equivalent length.
- If the iscsi_chap_secret parameter does not conform to the required secret length (96 to 128 bits), the command fails.
- If you change the iscsi_chap_name or iscsi_chap_secret parameters , a warning message is displayed that says the changes will apply the next time the host is connected.

XCLI Commands for Configuring CHAP

Currently, you can only use the XCLI to configure CHAP. The following XCLI commands can be used to configure CHAP:

If you are defining a new host, use the following XCLI command to add CHAP parameters:

```
host_define host=[hostName] iscsi_chap_name=[chapName]
iscsi_chap_secret=[chapSecret]
```

If the host already exists, use the following XCLI command to add CHAP parameters:

```
host_update host=[hostName] iscsi_chap_name=[chapName]
iscsi_chap_secret=[chapSecret]
```

If you no longer want to use CHAP authentication, use the following XCLI command to clear the CHAP parameters:

```
host_update host=[hostName] iscsi_cha_name= iscsi_chap_secret=
```

Preparing for Fiber Channel Connectivity

This section focuses on Fibre Channel connectivity topics that apply to the IBM XIV Storage System in general.

Planning the Fiber Channel Topology

Hosts must be attached to the Fiber Channel ports through a Fibre Channel fabric. Several configurations are technically possible, and they vary in terms of their cost and the degree of flexibility, performance, and reliability that they provide.

To achieve a highly available and high performance solution, avoid a single point of failure in the connectivity solution by using as many connections as possible. However, to keep the cost of the solution in-line with the business requirement, less expensive, less desirable solutions can be justified.

⚠ The optimal high availability (HA) configuration is illustrated in Image-1 above.

In this configuration:

- Each host is equipped with dual HBAs. Each HBA (or HBA port) is connected to one or two FC switches.
- Each of the FC switches has a connection to a separate FC port of each of the six Interface Modules.
- There is no single point of failure:
    - If a module fails, each host remains connected to the other five modules.
    - If an FC switch fails, each host remains connected to all modules through the second FC switch.
    - During an HBA port failure, the host can still connect over the other HBA port.

Zoning

Zoning is required when a SAN fabric is used to connect hosts to the IBM XIV Storage System. The concept is to isolate any single HBA for security and reliability reasons. Zoning allows for finer segmentation of the switched fabric. Zoning can be used to create a barrier between different environments. Only the members of the same zone can communicate within that zone, and all other attempts from the outside are rejected.

The following are examples of situations that can be avoided with proper zoning:

- HBAs from different vendors behave differently when they perform error recovery, which can impact other hosts connected to the same switch if they are not isolated through zoning.
- Any change in the SAN fabric, such as a change caused by a server restarting or a new product being added to the SAN, triggers a Registered State Change Notification (RSCN).

An RSCN requires that any device that can see the affected or new device to acknowledge the change while interrupting its own traffic flow.

Zoning helps to avoid these situations. The most secure zoning is to have zones that consist of a single initiator and single target.

⚠ In large implementations, this approach increases the zoning management effort. Therefore, a common way of zoning is to have a single initiator with multiple targets.

Follow these best practices recommendations:

- For general configurations, zone each host HBA to a single port from each of three Interface Modules, which provides six paths to dual HBA hosts.
- For high workload applications, consider zoning each HBA to one port from each of the six Interface Modules.

⚠ Do not configure more than 24 logical paths per host because this can impact overall stability. There is no advantage to configuring more than 24 logical paths.

Managing the Fibre Channel Ports

The Fibre Channel port has a unique name that is used for the following purposes:

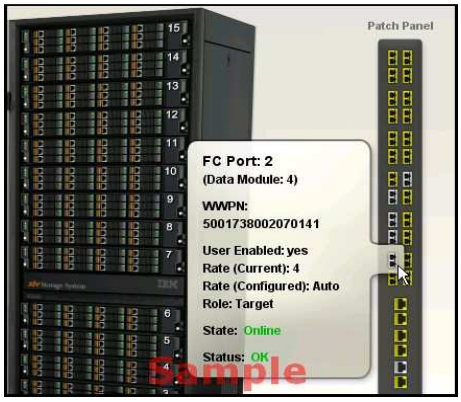
- Setting up zoning
- Checking that the connection to this port was correctly set up

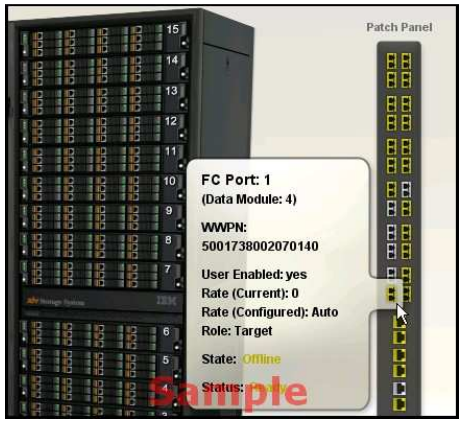
The unique name that identifies a Fibre Channel port is called the World Wide Port Name (WWPN).

Perform the following steps in the XIV GUI to view the WWPN

1. Select the main view of an IBM XIV Storage System, use the arrow at the bottom of the picture of the XIV Storage Array to reveal the patch panel.

2. Move the mouse cursor over a particular port to reveal the port details, including the WWPN. The following figures show examples of the detailed information that is displayed for two Fibre Channel ports in module 4:





To get the same information from XIV XCLI, use the following command:

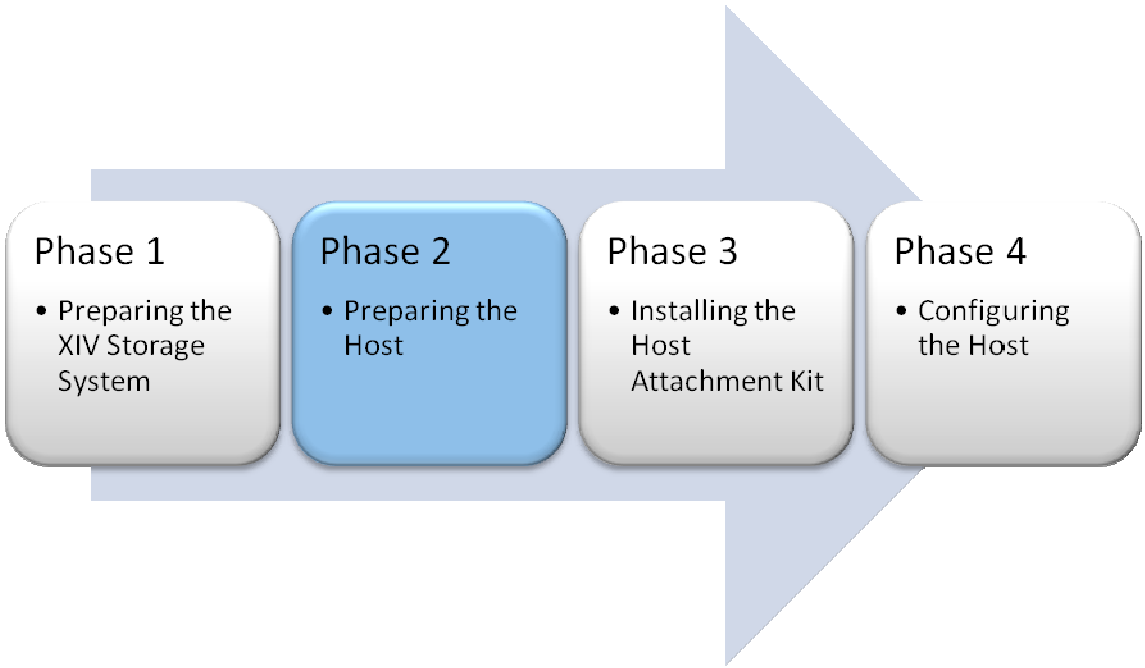
```
fc_port_list [ module=ComponentId | fcport=ComponentId ]
```

⚠ The WWPNs of an IBM XIV Storage System are static. The last two digits of the WWPN indicate from which module and port the WWPN came.

⚠ In the default IBM XIV Storage System configuration, port number 4 of each interface module is configured as an initiator.

Preparing the Host

The second phase in connecting a host to the IBM XIV Storage System is to prepare the host.



Validating the System Requirements

Before installing the Host Attachment Kit on the host, verify that the installed operating system meets the system requirements as detailed in the *Release Notes* document of this version of the Host Attachment Kit (See Related Documentation).

The following sections will guide you through installing the fixes for the operating system, and for the iSCSI initiator software that is required for iSCSI connectivity.

Installing the Operating System on an XIV Volume (Boot From SAN)

Before you boot an operating system on the XIV volume, you must complete the following prerequisite tasks:

1. Get the WWN of the HBA
2. Configure the host and mapping a boot volume
3. Configure the host to boot from the XIV volume
4. Install the operating system

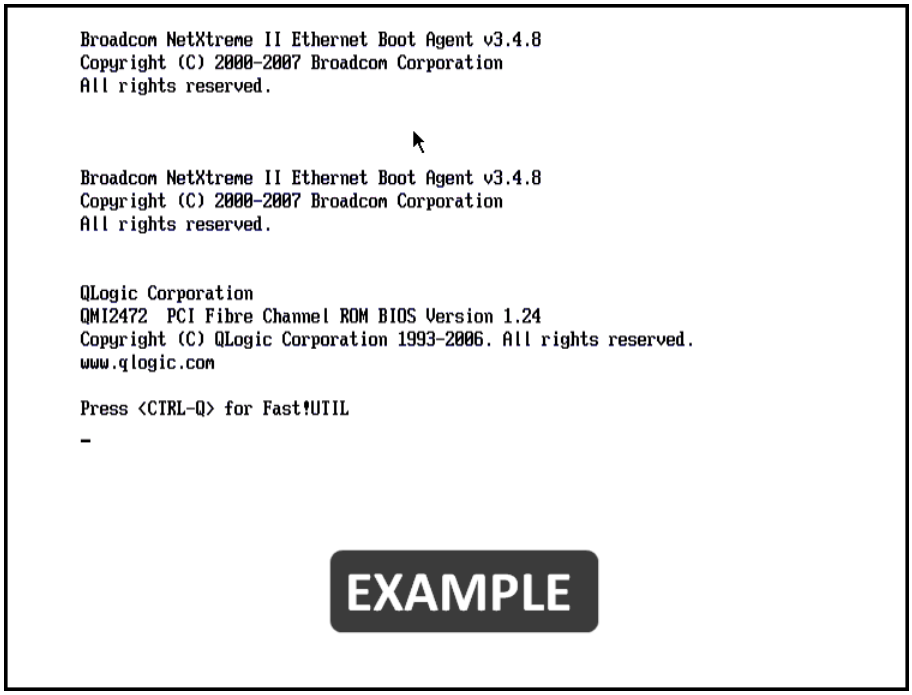
⚠ The IBM XIV Storage System provides boot from SAN capabilities for hosts through Fibre Channel only (no iSCSI).

Getting the WWN of the HBA

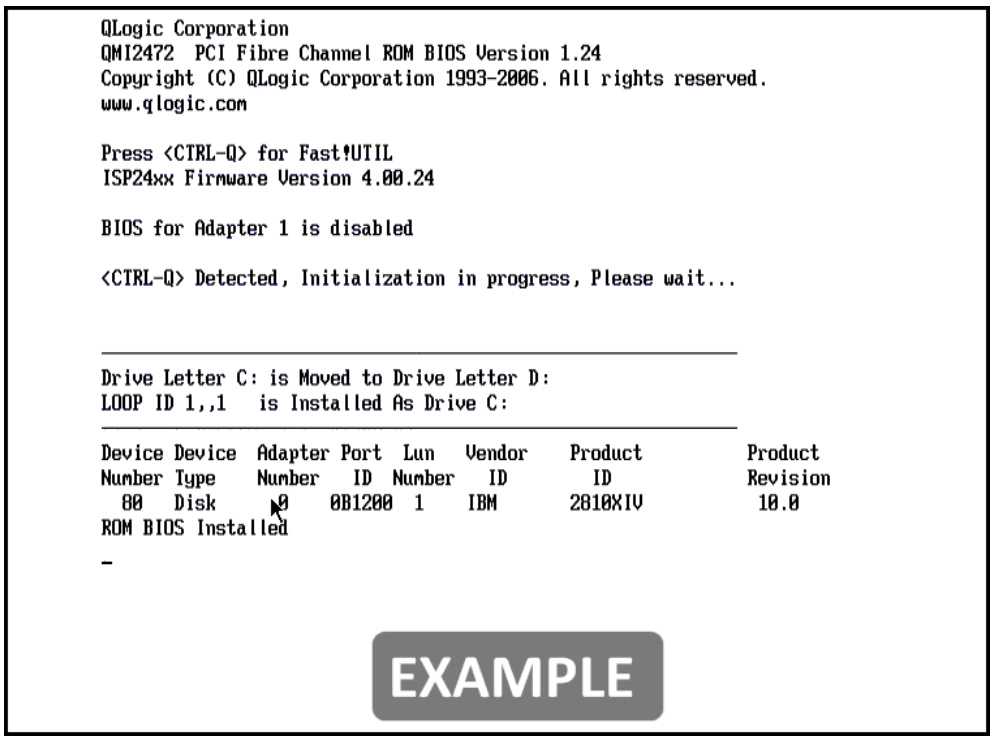
Because there is no operating system installed on the host at this time, you must obtain the WWN of the host HBA ports directly by taking the HBA out of the host chassis and looking on its label, or by looking for that information with the BIOS configuration utility of the HBA.

⚠ This section demonstrates how to configure an IBM blade to boot from an XIV volume by using a two-port QLogic HBA. The following screenshots are an example of the configuration that is needed for a Fiber Channel HBA. While the configuration logic is the same for most HBAs, it can vary from this example.

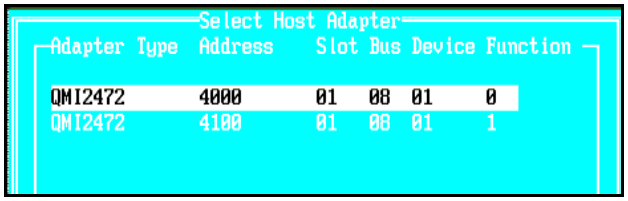
To access the HBA configuration, restart the host and access the BIOS utility of the HBA. To access the BIOS utility of a QLogic HBA, press <CTRL-Q>.



After you press <CTRL-Q>, the following screen is displayed:

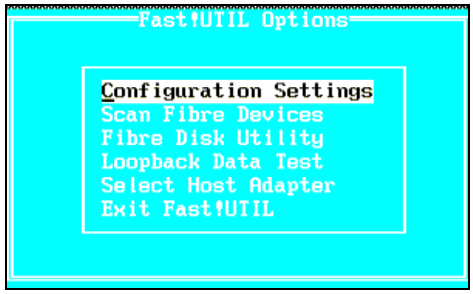


Next, the main window of the BIOS utility appears with a list of the HBA ports.

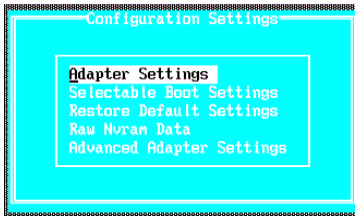


For each HBA port in the list, perform the following actions:

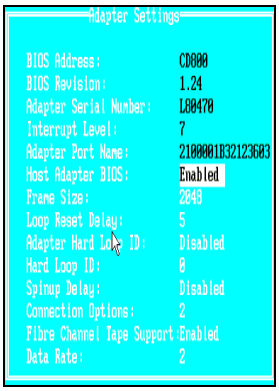
1. Select an adapter in the list and press Enter. The Fast!UTIL Options menu is displayed.
2. Select **Configuration Settings** and press Enter.



3. Select **Adapter Settings** and press Enter.



4. Find the Adapter Port Name in the list of settings. The value that is shown for the Adapter Port Name is the WWN of the port.



Configuring the Host and Mapping a Boot Volume

Now that you have the WWNs of the HBA ports, you can complete the following tasks:

- Define the host in the IBM XIV Storage System
- Map a volume to the host for which you want to load the operating system

See Configuring the Host in the XIV Storage System in this guide for assistance on how to perform this step.

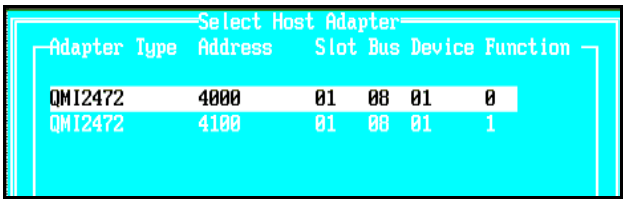
Configuring the Host to boot from a XIV Volume

Now that the IBM XIV Storage System is ready for the host to boot up from it, configure the host to boot from the volume you have just created.

The following step will show you how to configure a QLogic HBA to boot from an XIV volume.

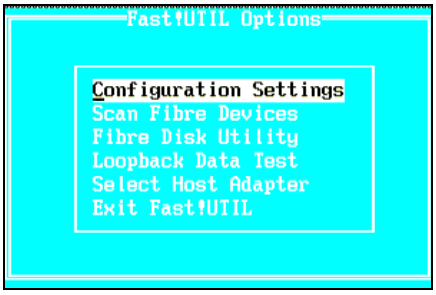
> ⚠ For redundancy, enable at least two HBA ports to boot from an XIV volume. For each port, you must have at least two different paths to the boot volume. This ensures that you can still boot the host if a module fails.

Press Escape to go back to the main screen where the list of HBA ports is displayed.

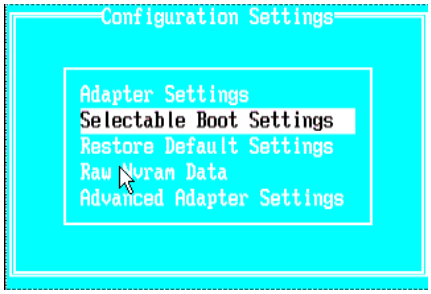


For each port listed, perform the following actions:

1. Select an adapter in the list and press Enter. The Fast!UTIL Options menu is displayed.
2. Select **Configuration Settings** and press Enter.



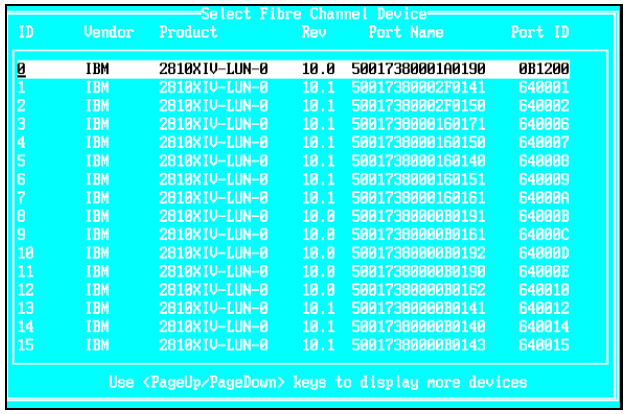
3. Use the keyboard arrows to select **Selectable Boot Settings** and press **Enter**.



4. Select **Selectable boot** and press Enter. This changes Selectable boot to the Enabled state.
5. Complete the list of the Boot Port Name, LUN with paths to the boot volume. You must configure at least two paths.
6. To configure a path, go down to an empty entry and press **Enter**.

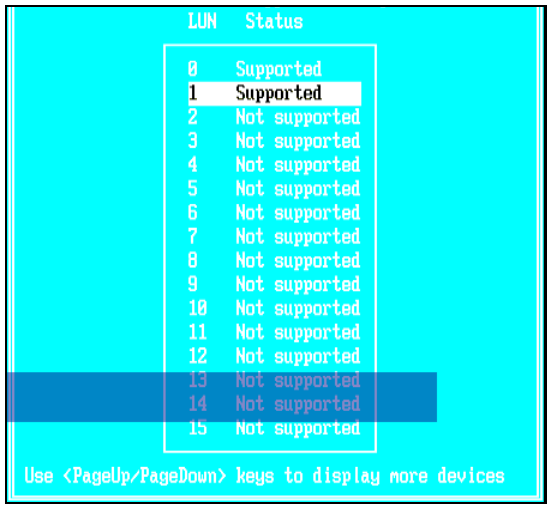
Tip: Empty entries are filled with zeros.

7. Select an XIV target from the list that you have not previously selected and press **Enter**. You can differentiate from two entries by looking at the WWN.

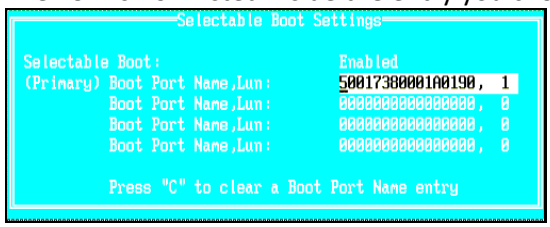


⚠ The WWPNs of an IBM XIV Storage System are static. The last two digits of the WWPN indicate from which module and port the WWPN came. The digits before those indicate the machine serial number in hexadecimal base.

8. Select the LUN that you want to boot from and press **Enter**. That is, the LUN that you mapped the boot volume in the previous section.



The LUN is now listed inside the entry you chose.



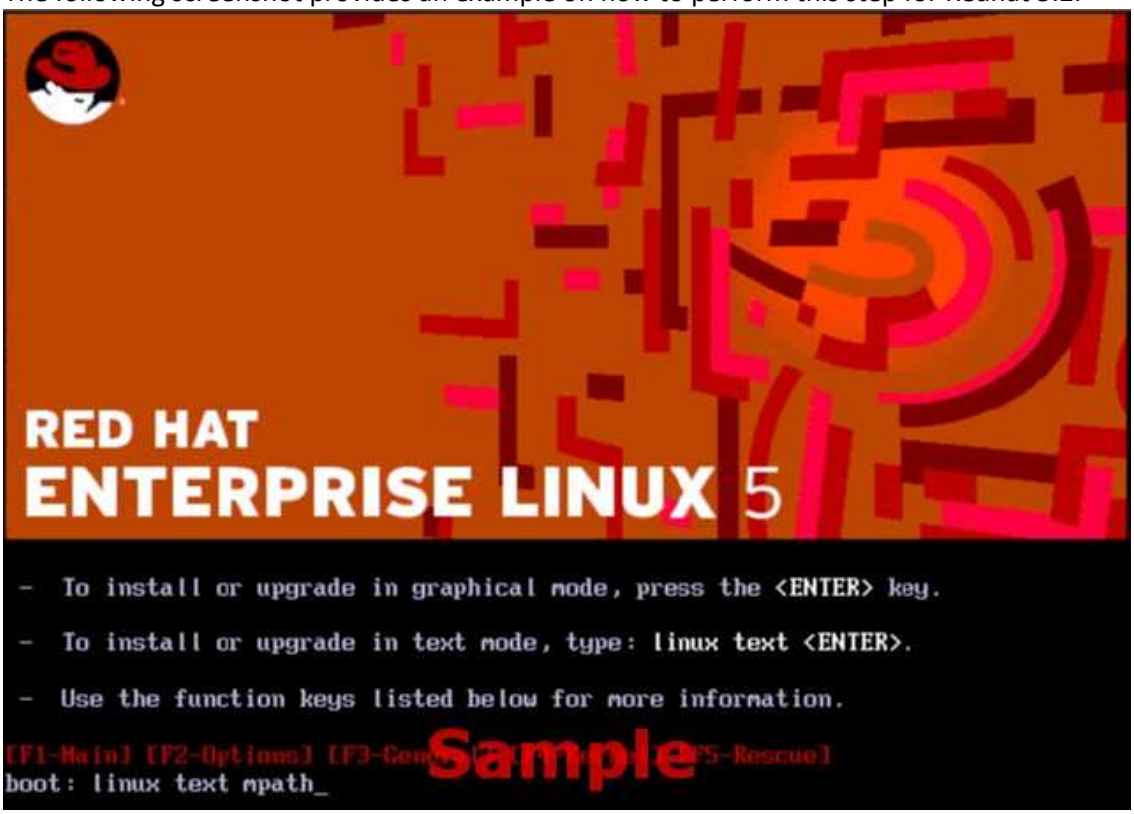
9. Repeat the last steps for boot entry and HBA port.
10. Press **Escape** to quit and save the configuration.

Installing the Operating System

⚠ Make sure your operating system version supports booting from SAN. Refer to the *Release Notes* document for a list of supported operating systems.

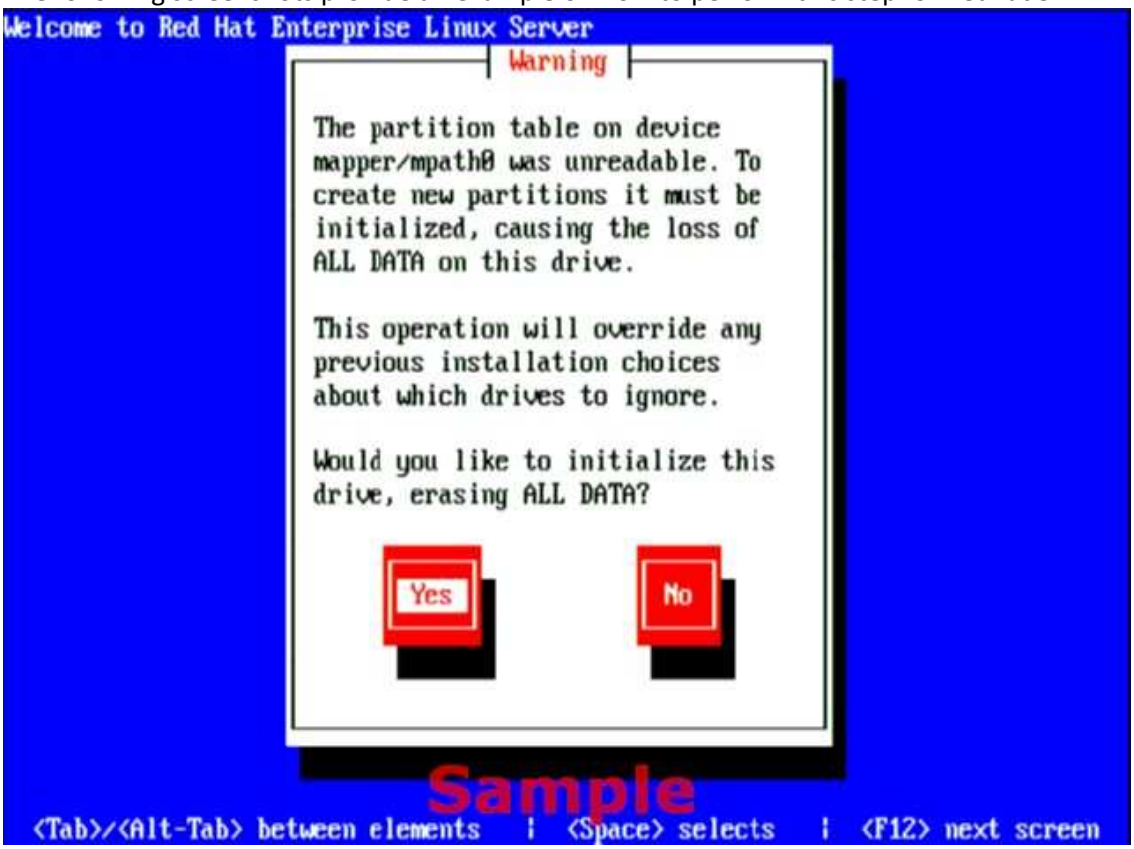
Install your operating system as you would normally have, except for the following changes:

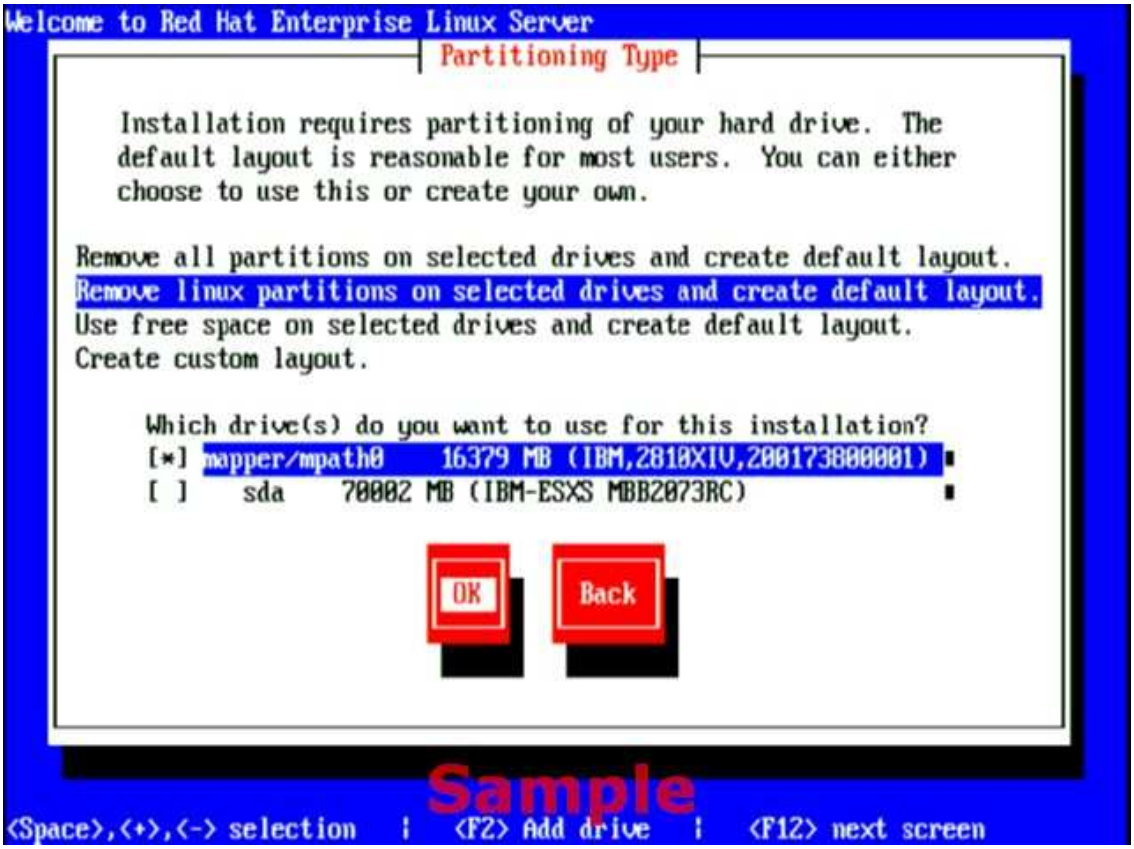
1. When you boot the host from the installation media, start the installation with multipathing support. This is done by adding the parameter `mpath` to the installation boot prompt.
   The following screenshot provides an example on how to perform this step for Redhat 5.2.

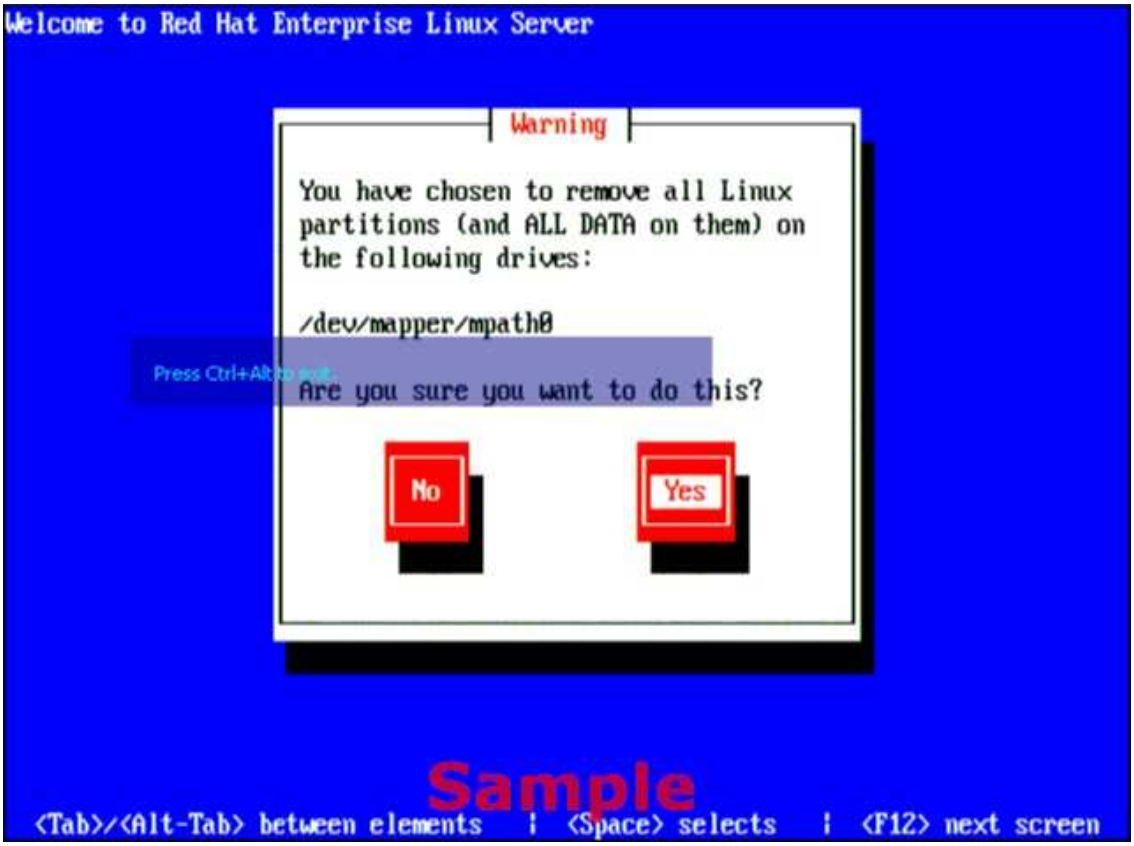


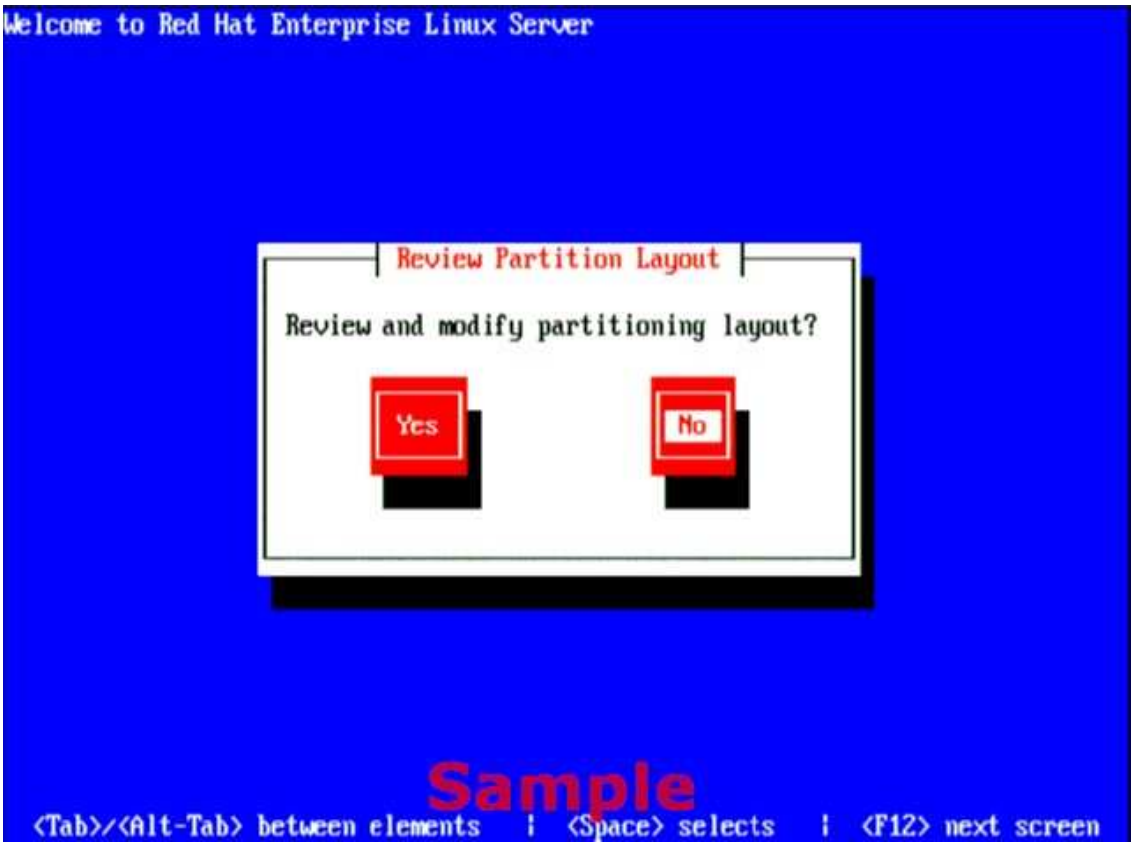
2. Proceed with the installation process as you normally would, until you reach the **Partitioning Type** screen. Choose the device on which to install the operating system.
3. Choose the device named `mapper/mpath0`, which should be the XIV volume you selected in the previous section. Proceed normally with the installation.

The following screenshots provide an example on how to perform this step for Redhat 5.2.





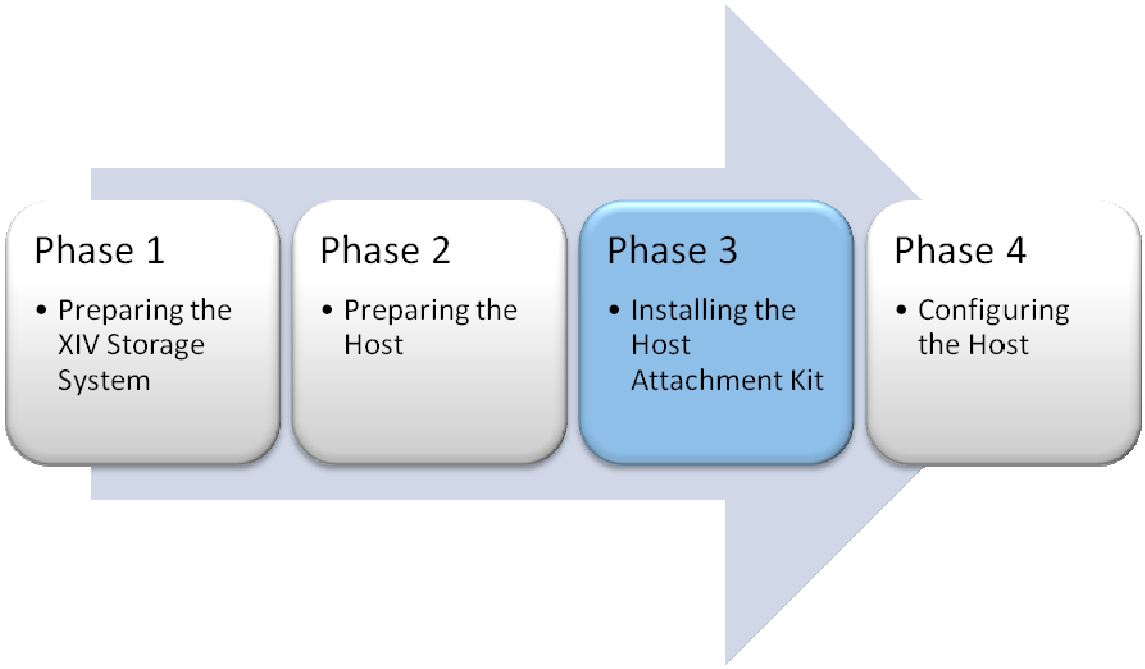

Welcome to Red Hat Enterprise Linux Server
Warning
You have chosen to remove all Linux partitions (and ALL DATA on them) on the following drives:
/dev/mapper/mpath0
Are you sure you want to do this?
No
Yes
Sample
<Tab>/<Alt-Tab> between elements | <Space> selects | <F12> next screen


Welcome to Red Hat Enterprise Linux Server
Review Partition Layout
Review and modify partitioning layout?
Yes
No
Sample
<Tab>/<Alt-Tab> between elements | <Space> selects | <F12> next screen

Installing Software Dependencies for the Host Attachment Kit

⚠ The Host Attachment Kit requires several operating system packages to be installed (for example, multipath and iSCSI support packages). For a list of dependencies and other operating system specific information, see the *Release Notes* document of this version of the Host Attachment Kit (See Related Documentation).

Installing the Host Attachment Kit



Installing the Host Attachment Kit

Before running the installer, make sure you have installed all the required OS packages as specified in the *Release Notes* document (See Related Documentation). The installation process fails if any of the required packages are missing.

1. Obtain the XIV Host Attachment Kit archive and copy it to the host.
2. Open a terminal to the host.
3. Go to the directory that contains the Host Attachment Kit archive and extract the archive:

```
# gunzip –c XIV_host_attach-1.5.*-*.tar.gz | tar xvf –
```

4. Go to the newly created directory and start the Host Attachment Kit installer. Issue the following commands to start the installer:

```
# cd XIV_host_attach-1.1.*-<platform>
# /bin/sh ./install.sh
Welcome to the XIV Host Attachment Kit installer.
Would you like to proceed and install the Host Attachment Kit? [Y/n]:
```

5. Enter y to confirm the installation process. The installer proceeds with the installation. The following is an example of the output that is displayed:

```
Please wait while the installer validates your existing configuration...
---------------------------------------------------------------
Please wait, the Host Attachment Bundle is being installed...
---------------------------------------------------------------
Installation successful.
Please refer to the Host Attachment Guide for information on how to
configure this host.
```

Installing the Host Attachment Kit does *not* configure the host for the IBM XIV Storage System. To configure the host, see the *Host Configuration* chapter of this document.

Upgrading the Host Attachment Kit

1. Obtain the XIV Host Attachment Kit archive and copy it to the host.
2. Open a terminal to the host.
3. Go the directory that contains the Host Attachment Kit archive and extract the archive:

```
# gunzip –c XIV_host_attach-1.5.*-*.tar.gz | tar xvf –
```

4. Go to the newly created directory and start the Host Attachment Kit installer. Issue the following commands to start the installer:

```
# cd XIV_host_attach-1.5.*-<platform>
# /bin/sh ./install.sh
Welcome to the XIV Host Attachment Kit installer.
Would you like to proceed and install the Host Attachment Kit? [Y/n]:
```

5. Enter y to confirm the installation process. The installer proceeds with the installation.

The installer detects the existing Host Attachment Kit installation and offers an upgrade operation.

```
Please wait while the installer validates your existing configuration...
------------------------------------------------------------
NOTICE: Another version of Host Attachment Kit is already installed.
The installer will replace the currently installed version.
Would you like to replace the installed Host Attachment Kit? [Y/n]:
```

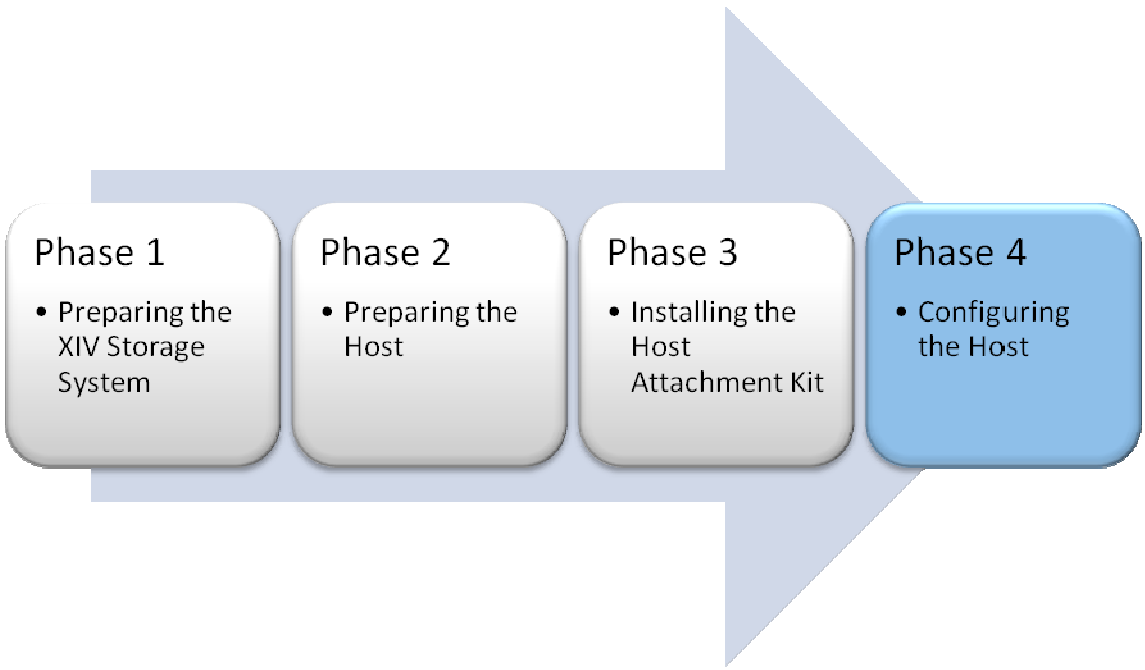
6. Enter y to confirm the upgrade process to complete the installation.

```
Please wait, the Host Attachment Bundle is being installed...
------------------------------------------------------------
Installation successful.
Please refer to the Host Attachment Guide for information on how to
configure this host.
```

Installing the Host Attachment Kit does *not* configure the host for the IBM XIV Storage System. To verify that the host configuration is up-to-date, see the Host Configuration chapter of this document.

Host Configuration

The last phase in connecting a host to the IBM XIV Storage System is the configuration of the host.



Configuring the Host for Multipath I/O

The Host Attachment Kit provides an interactive command-line utility to configure and connect the host to the IBM XIV Storage System.

1. Open a terminal to the host and activate the Host Attachment Wizard:

```
xiv_attach
```

2. If all the prerequisites are met and you are ready to configure and connect the host, enter yes.

```
------------------------------------------------------------------------------
Welcome to the XIV host attachment wizard, version 1.5

This wizard will guide you through the process of attaching your host to the XIV
system.

The wizard will now validate host configuration for the XIV system.
Press [Enter] to proceed
```

3. Choose a connectivity type.

```
Please choose a connectivity type, [f]c / [i]scsi :
```

4. If the host requires configuration the wizard, the following prompt appears. Confirm that you want to update the configuration:

```
------------------------------------------------------------------------------
Please wait while the wizard validates your existing configuration...
The wizard needs to configure the host for the XIV system.
Do you want to proceed? [default: yes ]: yes
Please wait while the host is configured...
```

5. Based on the chosen connectivity type, the wizard offers to attach this host to new storage arrays.

   In fiber-channel connectivity, the attachment wizard displays the port WWNs of all Fiber Channel HBAs that you can zone. In iSCSI connectivity, the wizard asks if you want to discover new XIV storage arrays by entering their IP addresses and CHAP authentication details if they are predefined for the host in the IBM XIV Storage System. For more information about CHAP authentication with iSCSI, see the topic Using CHAP Authentication with iSCSI Connectivity.

   You are then prompted to rescan for new storage devices. Enter yes to scan for new storage devices.

```
Would you like to rescan for new storage devices now? [default: yes ]: yes
Please wait while rescanning for storage devices...
```

The host attachment wizard scans for attached XIV storage arrays and displays a list of the attached systems.

```
The host is connected to the following XIV storage arrays:
Serial          Version         Host Defined     Host Name
MACHINE1         10.0            True            xiv-demo
MACHINE2         10.1            False           --
```

6. If the host is defined in all of the attached IBM XIV Storage Systems, you can press Enter and the Host Attachment Kit wizard ends.

```
This host is defined on all attached XIV storage arrays

Press [ENTER] to proceed.

-------------------------------------------------------------------------
The XIV host attachment wizard successfully configured this host
```

7. If the host is not defined in all of the attached IBM XIV Storage Systems, the Host Attachment Kit wizard defines the host in the IBM XIV Storage Systems that were previously listed:

```
Do you wish to define this host on these systems now? [default: yes ]: yes
Please enter a name for this host [default: xiv-demo ]:
Please enter a username for system MN00022 : [default: admin ]:  admin
Please enter the password of user admin for system MN00022:

Connecting to the storage array...

Press [ENTER] to proceed.
```

8. Proceed to the Managing XIV Volumes on the Host section.

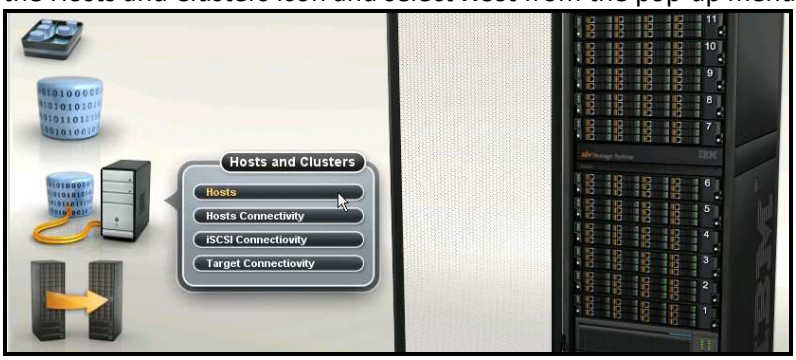
Configuring the Host in the XIV Storage System

Before the host can see XIV volumes, it must be defined in the IBM XIV Storage System. Starting in version 1.5.0, the Host Attachment Kit wizard automatically defines the host in the IBM XIV Storage System. The following sections will guide you through manually defining a host in the IBM XIV Storage System by using the XIV GUI and XCLI commands.

Defining the Host manually

Defining a host from the XIV GUI

1. From the IBM XIV Storage System main GUI window, move the mouse cursor over the Hosts and Clusters icon and select **Host** from the pop-up menu.



The Hosts window opens with a list of hosts that are already defined. If nothing is displayed, no hosts are defined.

2. To add a new host or cluster, click the **Add Host** or in the menu bar.

3. Enter a name for the host. If a cluster was created in the previous step, it is available from the cluster drop-down list.

To add a server to a cluster, select a cluster name.

In the following example, None is selected because a cluster is not being created for this example.

4. Click **Add**.
   The host is added.

Defining a host using XCLI

The following XCLI commands can be used to list the existing hosts and define new ones:

Lists a specific host or all hosts:

```
host_list [ host=HostName ]
```

Define a new host to connect to the IBM XIV Storage System:

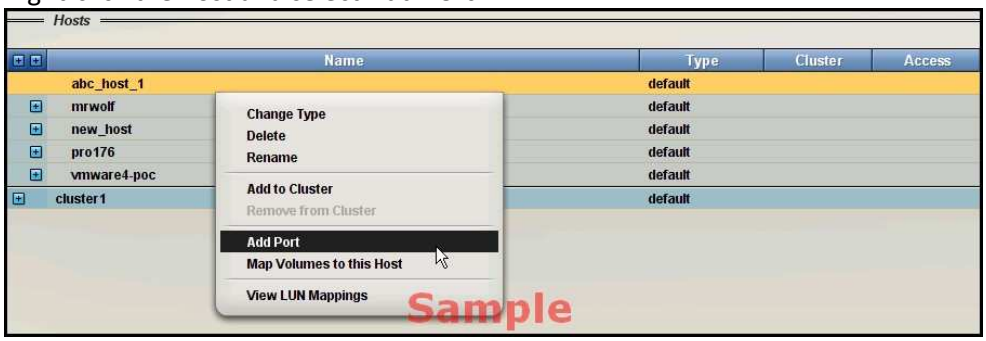
```
host_define host=HostName [ cluster=ClusterName ]
```

Adding Fiber Channel and iSCSI ports to a Host

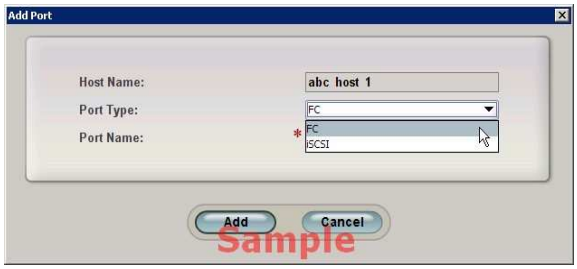
Host access to LUNs is granted depending on the host adapter ID. For a Fibre Channel connection, the host adapter ID is the Fibre Channel HBA WWPN. For an iSCSI connection, the host adapter ID is the host or HBA IQN.

To add a WWPN or IQN to a host definition:

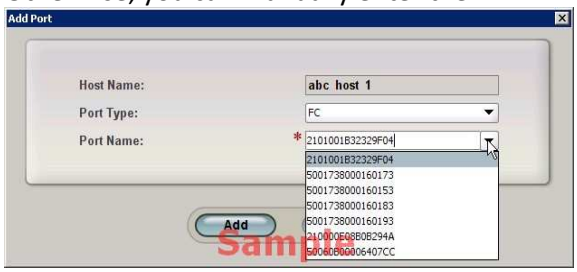
1. Right-click the host and select **Add Port**.



2. Select port type FC or iSCSI.
   - If you choose an FC port, proceed to Step 3.
   - If you choose an ISCSI port, skip Step 3 and proceed to Step 4.



3. In this example, the FC host is defined first. If the host is correctly connected and has done a port login at least one time, the WWPN is shown in the drop-down list. Otherwise, you can manually enter the WWPN.



If the host is connected to the IBM XIV Storage System by more than one HBA ports, follow the previous step to add the others HBA WWPNs. The IBM XIV Storage System does not care which FC port name is added first.

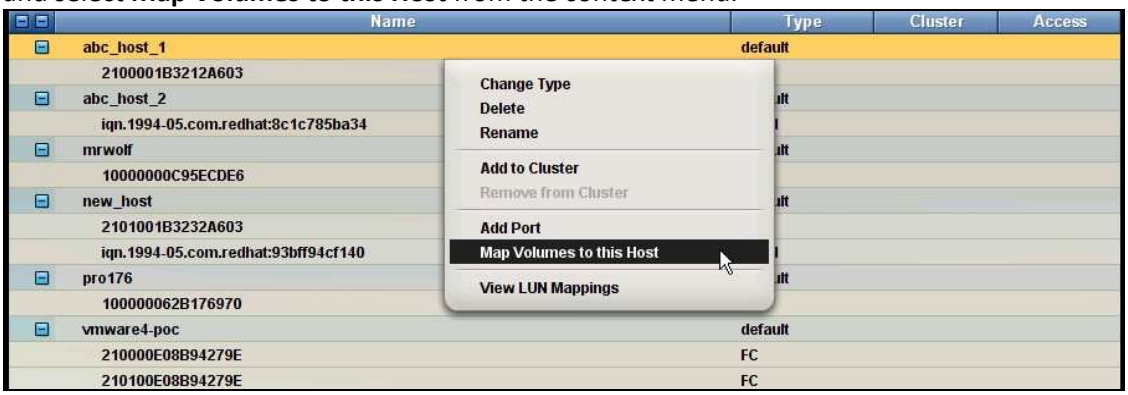
Proceed to Step 5.

4. In this example, there is also an iSCSI HBA installed in the host. In the Add port dialog, specify the port type as iSCSI and enter the IQN of the HBA as the iSCSI Name or port name.

Mapping a volume to a Host

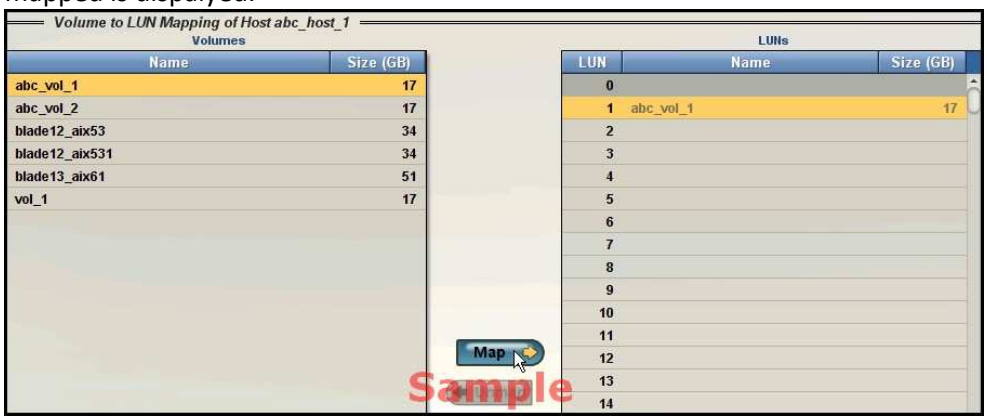
The final configuration step is to map the volume to the host.

From the Hosts configuration panel, right-click the host to which the volume is to be mapped and select **Map Volumes to this Host** from the context menu.

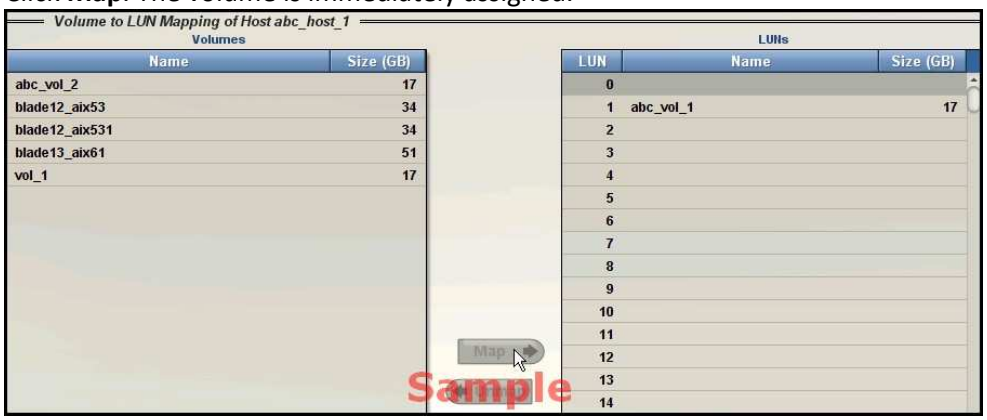


Perform the following steps to add a volume to a host definition:

1. Select an available volume from the left pane. The LUN ID to which the volume is to be mapped is dispalyed.



2. Click **Map**. The volume is immediately assigned.

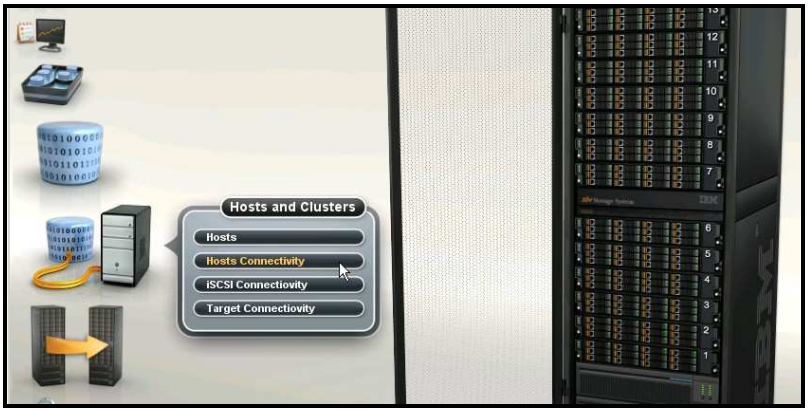


Monitoring host connectivity

The IBM XIV Storage System has a real-time connectivity status overview that can be monitored either from the XIV GUI or from XCLI commands.

From the XIV GUI

1. Select **Hosts Connectivity** from the Hosts and Clusters menu to access the connectivity status.



2. The host connectivity window is displayed (from the XIV Storage System point of view).

From the XCLI

Monitoring host connectivity from the XCLI can be done with the following commands:

Lists FC and iSCSI-level connectivity to a pre-defined host:

```
host_connectivity_list [ host=HostName | fc_host_port=WWPN ] [
module=ComponentId | fcport=ComponentId ]
```

Lists the status and configuration of the system's FC ports:

```
fc_port_list [ module=ComponentId | fcport=ComponentId ]
```

Managing XIV Volumes on the Host

This section instructs you how to have the host discover new volumes (rescan) and how to list the volumes (xiv_devlist).

Discovering for new Fibre Channel Volumes

You can use the interactive Host Attachment Wizard to discover the XIV volumes that are mapped to this host.

> ⚠ To discover XIV volumes properly and with multipathing abilities, the host must first be configured using either the interactive wizard or the xiv_fc_admin and xiv_iscsi_admin utilities.

1. Open a terminal to the host and enter the **xiv_attach** command:

```
xiv_attach
```

2. Enter **yes** to confirm you are ready to configure the host.

```
------------------------------------------------------------------------------
Welcome to the XIV host attachment wizard, version 1.5

This wizard will guide you through the process of attaching your host to the XIV
system.
The wizard will now validate host configuration for the XIV system.
Press [Enter] to proceed
```

3. The wizard will verify the host configuration. If you have already configured this host as described in previous tasks, enter **yes** to discover any new XIV Storage Device.

```
------------------------------------------------------------------------------
Please wait while the wizard validates your existing configuration...
This host is already configured for the XIV system
```

4. Enter **fc** to discover fiber channel devices.

```
------------------------------------------------------------------------------
Please choose a connectivity type, [f]c / [i]scsi: f
------------------------------------------------------------------------------
```

The WWPNs of the HBAs discovered by the wizard are printed, along with information to help identify each HBA. If iSCSI is available, the IQN and Initiator Alias is printed.

If you have not done so already, see the Configuring the Host in the XIV Storage System chapter to define the host and map volumes to it. Press Enter when you are ready to proceed.

5. Enter **yes** to rescan for devices.

```
Would you like to rescan for fiber channel storage devices now? [default:
yes]:
```

The host attachment wizard scans for attached XIV storage arrays and displays a list of the attached systems:

```
The host is connected to the following XIV storage arrays:
Serial          Version         Host Defined     Host Name
MACHINE1         10.0            True            xiv-demo
```

6. If the host is defined in all of the attached IBM XIV Storage Systems, the attachment wizard ends.
7. You can use the **xiv_devlist** utility to view the discovered devices on this host. See the xiv_devlist topic.

Discovering new iSCSI Volumes

It is possible to use the interactive Host Attachment Wizard to discover the XIV Storage volumes mapped to this host.

⚠ To properly discover XIV volumes with multipathing abilities, the host must first be configured using either the interactive wizard or the **xiv_fc_admin** and **xiv_iscsi_admin** utilities.

1. Open a terminal to the host and enter the **xiv_attach** command:

```
xiv_attach
```

2. Enter **yes** to confirm you are ready to configure the host.

```
-------------------------------------------------------------------------------
Welcome to the XIV host attachment wizard, version 1.5

This wizard will guide you through the process of attaching your host to the XIV
system.
The wizard will now validate host configuration for the XIV system.
Press [Enter] to proceed
```

3. The wizard will verify the host configuration. If you have already configured this host as described in previous tasks, enter **yes** to discover any new XIV storage device.

```
-------------------------------------------------------------------------------
Please wait while the wizard validates your existing configuration...
This host is already configured for the XIV system
```

4. Enter **iscsi** to discover iSCSI devices.

```
-------------------------------------------------------------------------------
Please choose a connectivity type, [f]c / [i]scsi: i
```

5. Enter yes to discover devices from a new target.
6. Enter yes to rescan for devices.

```
Would you like to rescan for fiber channel storage devices now? [default:
yes]:
```

The host attachment wizard scans for attached XIV storage arrays, and displays a list of the attached systems:

```
The host is connected to the following XIV storage arrays:
Serial          Version         Host Defined     Host Name
MACHINE1         10.0            True            xiv-demo
```

7. If the host is defined in all of the attached XIV systems, the attachment wizard ends.
8. You can use the **xiv_devlist** utility to view the discovered devices on this host. See the xiv_devlist topic.

Utilities

The Host attachment kit includes the following utilities:

- xiv_fc_admin
- xiv_iscsi_admin
- xiv_devlist
- xiv_diag

xiv_fc_admin and xiv_iscsi_admin

The xiv_fc_admin and xiv_iscsi_admin utilities provide a non-interactive command-line interface for performing administrative attachment tasks and querying Fibre Channel attachment related information.

⚠ Most actions that are provided by these utilities are available in the **xiv_attach** wizard.

Command-line usage

Print usage information for the utility

```
-h –help:
```

The **-h** option prints a brief description of the command-line options for the utility.

Verify host configuration tasks

```
-v –verify:
```

For the xiv_fc_admin utility, the **-v** option lists all of the Fibre Channel related configuration tasks for the host along with their current state.

For the xiv_iscsi_admin utility, the **-v** option lists all of the iSCSI related configuration tasks for the host along with their current state.

The state of configuration tasks can be one of the following:

- **Ok** - The configuration task is already applied on the host
- **Not Ok** - The configuration of the host requires an update
- **Reboot** - The configuration was updated but the host requires a reboot

Configure this host for attachment

```
-C –configure:
```

For the xiv_fc_admin utility, the -**C** option lists all of the Fibre Channel related configuration tasks for the host along with their current state.

For the xiv_iscsi_admin utility, the -**C** option lists all of the iSCSI related configuration tasks for the host along with their current state.

If a task is not configured, the utility performs the configuration task prior to listing it.

Rescan devices

```
-R –rescan:
```

The **-R** option performs a rescan action for storage devices. The rescan action is not XIV specific and applies to all types of storage devices. Both iSCSI and Fibre Channel devices are rescanned by this option.

Define this host on a system

```
-D –define:
```

For the xiv_fc_admin utility, the -**D** option defines the host, along with all the HBA WWPN ports in an XIV Storage Array.

For the xiv_iscsi_admin utility, the -**D** option defines the host with its iSCSI Qualified Name in an XIV Storage Array.

The **-D** option requires additional command-line options that provide credentials to authenticate to the XIV Storage Array. See the Host Definition Options topic.

List attached XIV systems

```
-L – list:
```

The **- L** option lists all the XIV Storage Arrays that are detected from this host even if the host is not yet defined on them.

Both iSCSI and Fibre Channel connected arrays are listed by this option.

The following information is provided by the columns in the list:

- Serial - The serial identification of the XIV Storage Array
- Version - The major version of the XIV Storage Array
- Host Defined - Indicates if the host is defined within the XIV Storage Array
- All Ports Defined - Indicates if all of the host initiator ports are defined in the XIV Storage Array
- Host Name - The name of the host as defined in the XIV Storage Array. This is available when the host is defined.

Print initiator ports of the relevant connectivity method

```
-P –print:
```

For the xiv_fc_admin utility, the **-P** option prints all the Fiber Channel related Initiator WWPNs in a formatted list.

For the xiv_iscsi_admin utility, prints all iSCSI Qualified Names.

Host Definition Options

The following options are only used with the **-D** option:

Username for XCLI

```
-u USERNAME, --user=USERNAME:
```

This option is required.

Password for XCLI

```
-p PASSWORD, --pass=PASSWORD:
```

This option is required.

Hostname for this host

```
-H HOSTNAME, --hostname=HOSTNAME:
```

This option is optional. If you do not specify the -**H** option, the network host name is used.

Serial of machine

```
-S SERIAL, --serial=SERIAL:
```

This option is required. A list of the available XIV Storage Array Serial numbers can be obtained using the **-L** option.

iSCSI-specific Options

The following options are only available when using the xiv_iscsi_admin utility:

Discover a new iSCSI target

```
-c <ISCSI_INTERFACE_IP>, --connect=<ISCSI_INTERFACE_IP>:
```

Disconnect from an iSCSI target

```
-d <ISCSI_INTERFACE_IP>, --disconnect=<ISCSI_INTERFACE_IP>:
```

xiv_devlist

xiv_devlist is a utility that lists XIV volumes that are available to the host, providing the following information for each volume:

- Device
- Volume name
- XIV Host
- Size
- Paths
- XIV ID
- Vol

xiv_devlist lists XIV and non-XIV devices separately.

Output example of xiv_devlist:

```
[root@localhost ~]# xiv_devlist
XIV devices
===========
Device               Vol Name     XIV Host     Size    Paths XIV ID   Vol ID
-------------------------------------------------------------------------------
mpath1               my_ibm_vol   my_ibm_linux 17.2GB  2/2   MN0001A  351
mpath0               my_ibm5      my_ibm_linux 17.2GB  2/2   MN0001A  717
mpath3               my_ibm9      my_ibm_linux 17.2GB  2/2   MN0001A  748
mpath2               my_ibmB      my_ibm_linux 17.2GB  2/2   MN0001A  3491
mpath5               my_ibm-test3 my_ib...nux2 17.2GB  4/4   MN00016  187
mpath4               my_ibm8      my_ibm_linux 17.2GB  2/2   MN0001A  747
mpath7               my_ibm_15    my_ib...nux2 240.5GB 4/4   MN00016  245
mpath6               my_ibm_14    my_ib...nux2 240.5GB 4/4   MN00016  244

Non-XIV devices
===============
Device               Size    Paths
---------------------------------
sda                  8.6GB   1/1
```

xiv_diag

The Host Attachment Kit provides a diagnostic data collector utility xiv_diag. While the xiv xray utility gathers diagnostic utility from the XIV Storage System, the xiv_diag is a cross-platform utility that gathers diagnostic data from supported operating system.

The xiv_diag utility gathers information from the operating system and stores in a zip file, which can be sent to IBM-XIV support teams for review and analysis.

Running the xiv_diag is done by invoking the following command-line:

```
xiv_diag
```

Output example of xiv_diag

Here is an example of the output of a xiv_diag command:

```
xiv_diag
Please type in a directory in which to place the xiv_diag file [default:
/tmp]:
Creating xiv_diag zip file /tmp/xiv_diag-results_2009-5-17_15-7-45.zip

...
...

INFO: Closing xiv_diag zip file /tmp/xiv_diag-results_2009-6-24_19-18-4.zip
Deleting temporary directory...
DONE
INFO: Gathering is now complete.
INFO: You can now send /tmp/xiv_diag-results_2009-6-24_19-18-4.zip to IBM-
XIV for review.
INFO: Exiting.
```

Additional Topics

XIV devices under /dev

The XIV disk devices are accessible through several locations under the /dev hierarchy:

- **/dev/xiv/<machine/<vol>/mpath**:
  a user-friendly hierarchy, based on the XIV machine id and volume id. The hierarchy represents each XIV volume in a constant device on all connected hosts. This is helpful in cluster environments.
  For example, /dev/xiv/by-machine/MN00022/7983/
- **/dev/mapper/mpath***:
  Linux' native multipath device locations.
  For example, /dev/mapper/mpath1

Note: it is also possible to access the single-path devices, i.e. /dev/sdb and similar locations under /dev/xiv hierarchy. However, in most cases you should avoid accessing the storage through non-multipath devices.

Important: The /dev/xiv hierarchy replaced the dev/xiv-2810 hierarchy that was used in previous releases.

- Starting with version 1.5.0, /dev/xiv-2810 is not created on hosts that are being configured for the first time. Older hosts that are being upgraded from a version prior to 1.5.0 will still have the old hierarchy.
- Do not use /dev/xiv-2810 in new configurations.

Removing the Host Attachment Kit

Removing the Host Attachment Kit is done by invoking the Uninstall Wizard included in the kit:

Open a terminal to the Host and invoke the Uninstall Wizard of the Host Attachment Kit

```
# /opt/xiv/host_attach/bin/uninstall
```

You will be prompted for confirmation in order to complete the removal process.

Troubleshooting

For troubleshooting of the installation phase of the Host Attachment Kit, see the Release Notes.

Attaching Clusters to the XIV Storage System

The following section will guide you through the process of attaching a multi-node cluster to a XIV Storage System.

Installing the Host Attachment Kit on the Cluster Nodes

Like in the single Host Attachment process, the first step is to install the Host Attachment Kit on the cluster nodes.

If you are creating a new cluster, you can install the Host Attachment Kit simultaneously.

If you are attaching an existing cluster to an IBM XIV Storage System, install the Host Attachment Kit on the cluster nodes in the following manner:

1. Install the Host Attachment Kit on the passive node or nodes and restart the server when you are prompted.
2. Fail-over the cluster groups and resources from active nodes to the passive nodes that you have just installed the Host Attachment Kit on.
3. Install the Host Attachment Kit on the remaining nodes.

The installation instructions for the Host Attachment Kit on cluster nodes are the same as described in the Installing the Host Attachment Kit section.

Managing Clusters in the XIV Storage System

In clustered environments, the defined hosts that take part in the cluster must be joined into a cluster within the XIV Storage System Management.

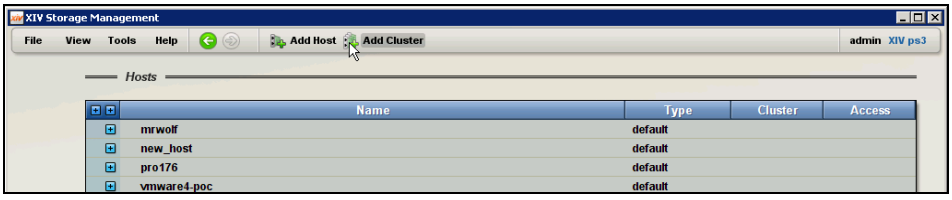
The following example demonstrates how to:

- Define a cluster with the XIV GUI and XCLI
- Add hosts into the cluster
- Map a volume to the cluster

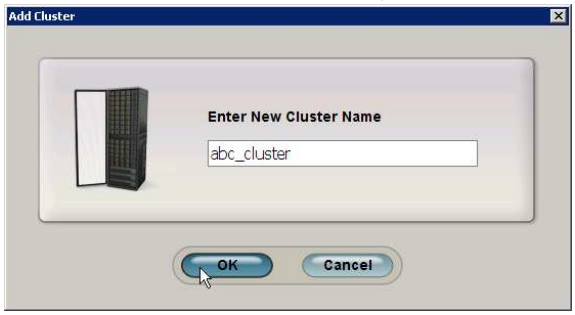
Defining a Cluster with the XIV GUI

1. From the main XIV GUI window, hover with the mouse over the Hosts icon, and click the "Hosts" menu.

2. If the hosts are not yet defined in the IBM XIV Storage System, define them first. In this example we already have the hosts defined in the system.
3. To define a new cluster, click the **Add Cluster** icon on the top toolbar.

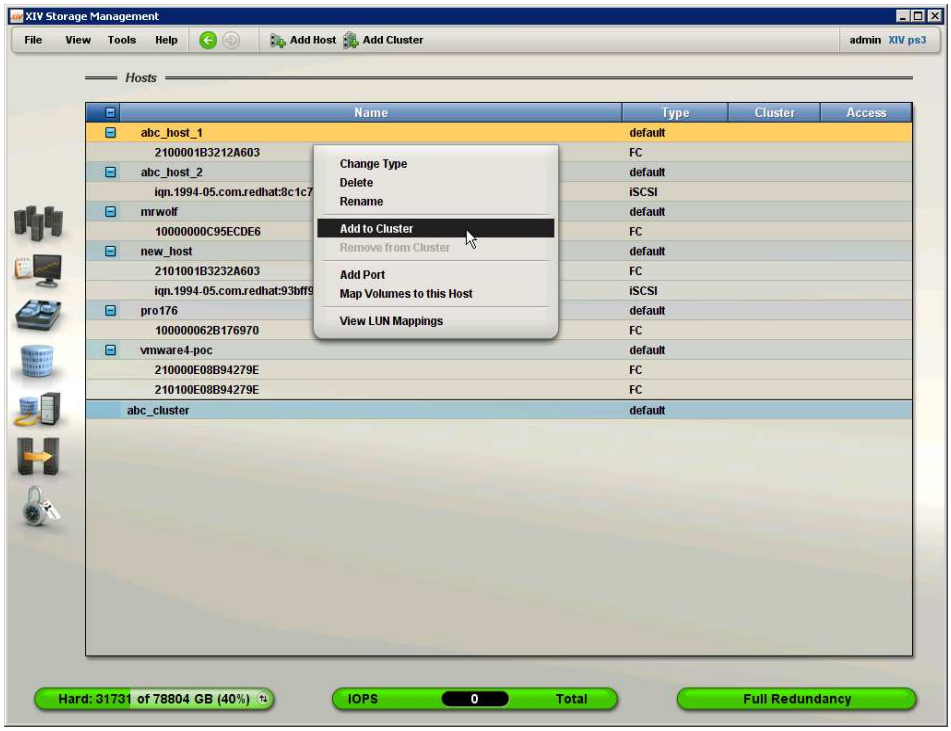


4. Enter a new for the new cluster, and click **OK**.



5. Right-click the host you want to add to the cluster, and choose **Add to Cluster**. **Add host to cluster** screen opens.

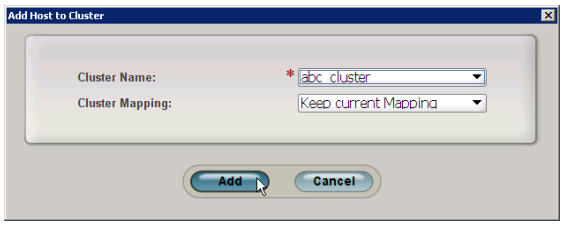
6. In this example, we add the host `abc_host_1` to the cluster `abc_cluster`.



7. On the Add host to cluster screen, select the cluster you want to join the host to from the Cluster Name drop-down list.
   Select a cluster volume mapping option from the Cluster Mapping drop-down list.

   The "Keep current Mapping" option is the default option, which means that the cluster volume mappings will not be changed because of this operation, and that all the mappings that were done to this host prior joining him to the cluster will be un-done.

   The "Copy from Host" option means that the current volume mappings to the host will be copied to the cluster.



8. Repeat steps 5-6 for each host you want to join into the cluster.
9. The cluster is now configured. In this example, we have the hosts `abc_host_1` and `abc_host_2` joined into the cluster `abc_cluster`.

Defining a Cluster with the XCLI

- Creating a new cluster

```
cluster_create cluster=ClusterName
```

- Adding an existing host to a cluster

```
cluster_add_host cluster=ClusterName host=HostName map=<cluster|host>
```

- Listing existing clusters

```
cluster_list [ cluster=ClusterName ]
```

Mapping Volumes to Clusters

The IBM XIV Storage System differentiates between shared volumes and private volumes.

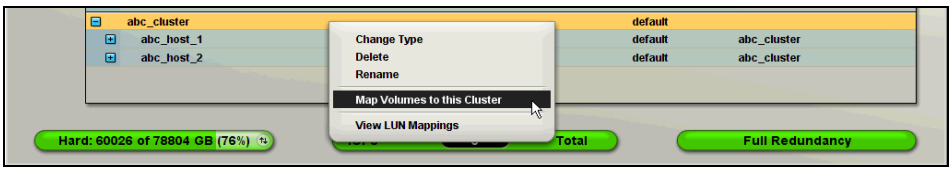
Shared volumes are volumes that are mapped to all the hosts in the cluster and are used by the clustered applications. These are the generally used volumes in a clustered environment.

Private volumes are mapped to a single host in the cluster and are required in scenarios where a single host requires exclusive access to a volume. For example, private volumes are used in environments that have boot volumes in the cluster. Each node in the cluster requires exclusive access to a boot volume so that other nodes in the cluster cannot corrupt the operating system on the boot volume. In these environments, map a designated private boot volume for each host and map the shared volumes to the cluster.

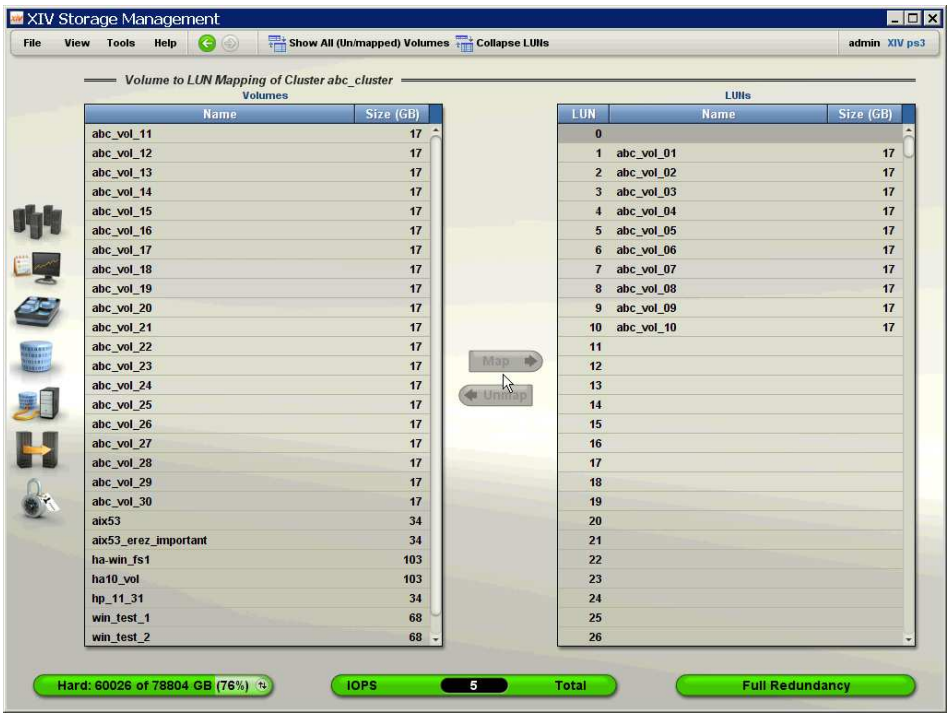
The following examples demonstrate the mapping of shared and private volumes to clusters:

Mapping shared volumes to a cluster

1. From the Hosts screen in the XIV GUI, right-click on the cluster and select **Map Volumes to this Cluster**.



2. Map the volumes that you want accessible to all nodes in the cluster. These volumes are referred to as shared volumes. In this example, 10 volumes (abc_vol01…10) are mapped as shared volumes to the cluster called abc_cluster.

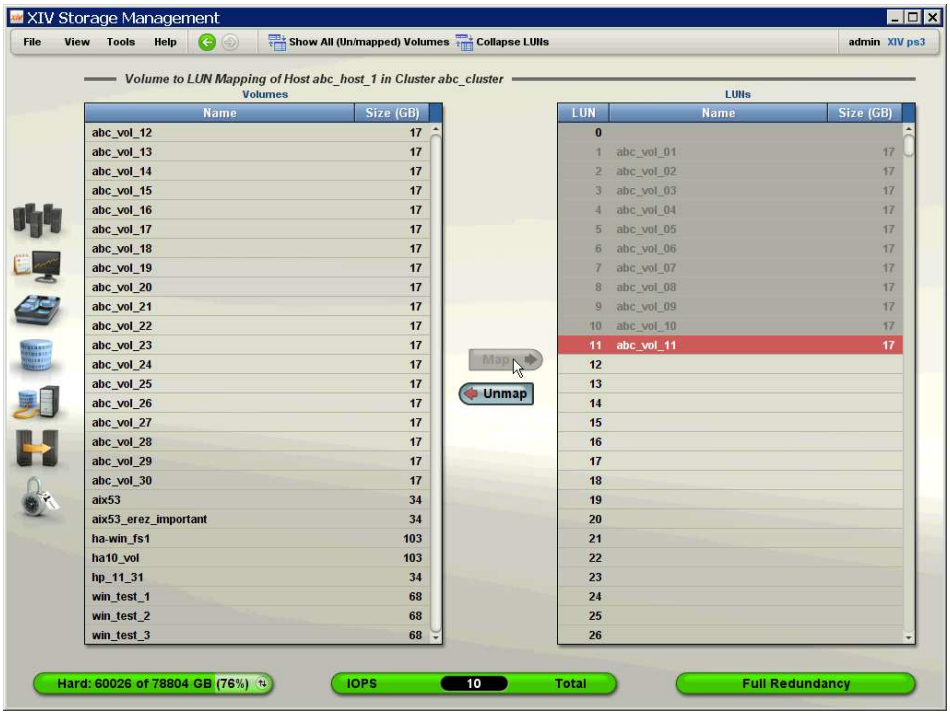


Mapping private volumes to each host

This example demonstrates how to map private volumes to each host in the cluster. In this example, a different private volume is mapped to each host in the cluster.

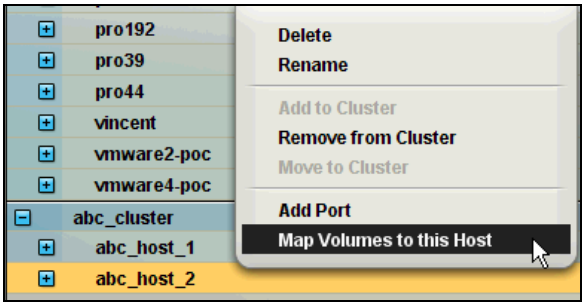
1. From the Hosts screen in the XIV GUI, right-click on a node that you want to map a private volume to, and select **Map Volumes to this Host**.

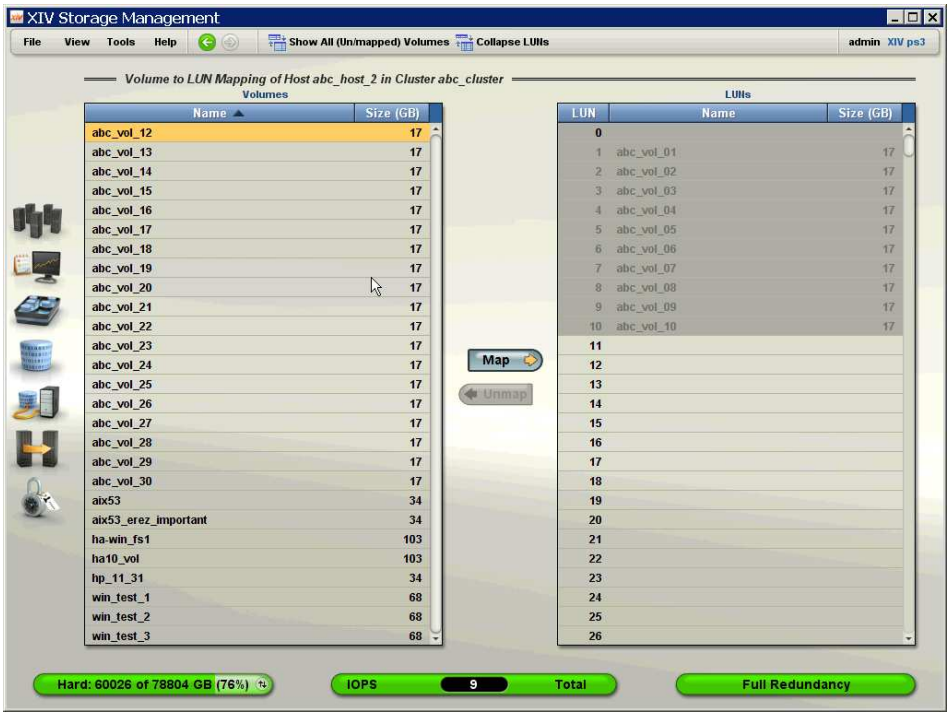
2. Map the volumes that you want only this host to access. These volumes become the private volumes of this host.



After the mapping is done, all the shared volume mappings are grayed out and cannot be altered.

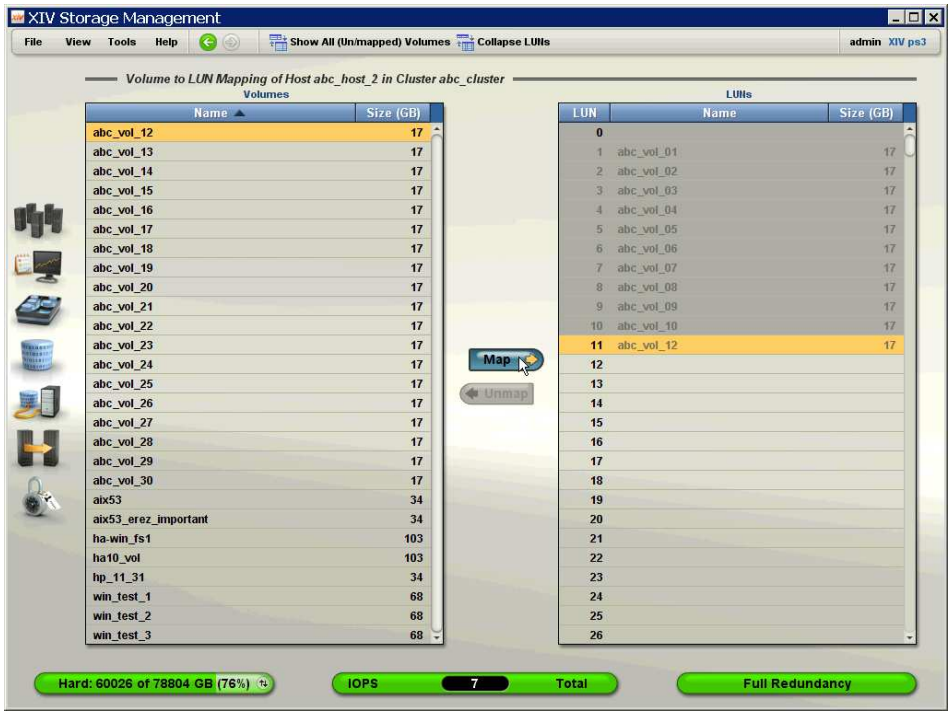
3. Map a private volume for the other hosts in the cluster.



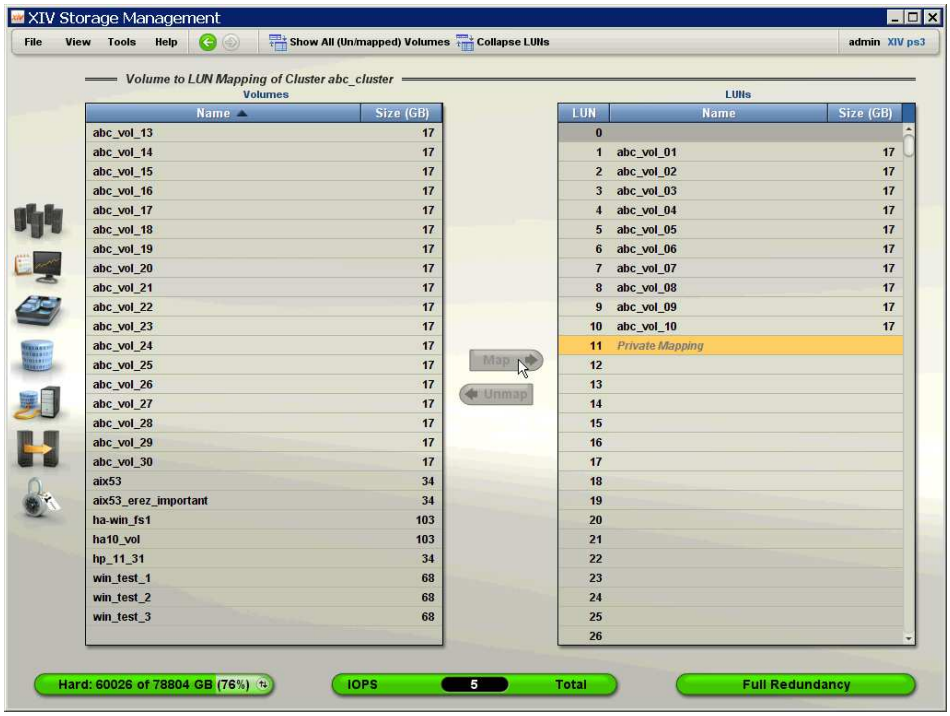


You can see all the shared volumes on the mapping list to the right, but not the private volumes of the other hosts. In this example, 10 shared volumes are mapped to LUNS 1…10, and a private volume is mapped to another host and LUN11.

A different volume can be mapped as a private volume for this host at LUN 11.



⚠ When mapping private volumes to a host, the private mapping is listed in the cluster mapping list as **Private Mapping**.



Known issues

For the complete list of known issues, see the Host Attachment Kit for Linux, Version 1.5.x Release Notes document.