

OceanStor UltraPath for Windows

21.0.2

User Guide

Issue 02

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About This Document

Intended Audience

This document details the functions, pre-installation preparations, procedures for installation and uninstallation, and common commands and their usage for the UltraPath for Windows software.

This document is intended for:

- Technical support engineers
- Maintenance engineers

Conventions

As part of an effort to improve and enhance the product performance and capabilities, Huawei periodically releases revisions of the hardware and software. Therefore, some functions described in this document may not be supported by all versions of the software or hardware currently in use. For the most up-to-date information about product features, refer to the product release notes.

If a product does not function as described in this document, contact Huawei technical support engineers.

To obtain the Open Source Software Notice, go to the following website: <http://support.huawei.com/enterprise/>.

Change History

Updates between document issues are cumulative. Therefore, the latest document issue contains all updates made in previous issues.

Issue 02 (2018-01-05)

This issue is the second official release.

Optimized the document structure and the description of software functions.

Issue 01 (2017-12-14)

The first official release.

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1 Overview

About This Chapter

OceanStor UltraPath is the multipathing software developed by Huawei. Its functions include masking of redundant LUNs, optimum path selection, I/O load balancing, and failover and failback. These functions enable your storage network to be intelligent, stable, and fast.

[1.1 Overview](#)

UltraPath can meet the requirements on high reliability and superb performance of storage networks. This section introduces the background, purpose, and benefits of UltraPath.

[1.2 Principles and Functions](#)

UltraPath provides powerful functions and features, ensuring secure, stable, and fast service operation. This section introduces the basic principles and functions of UltraPath.

[1.3 Typical UltraPath Applications](#)

Installed on an application server, UltraPath supports different networks and helps ensure fast and smooth data transfer.

[1.4 UltraPath Security Feature](#)

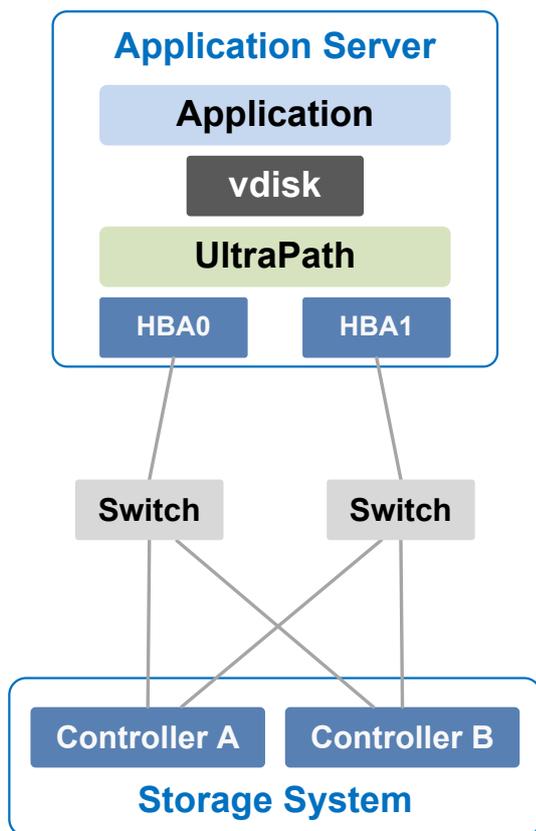
This chapter describes UltraPath security feature.

1.1 Overview

UltraPath can meet the requirements on high reliability and superb performance of storage networks. This section introduces the background, purpose, and benefits of UltraPath.

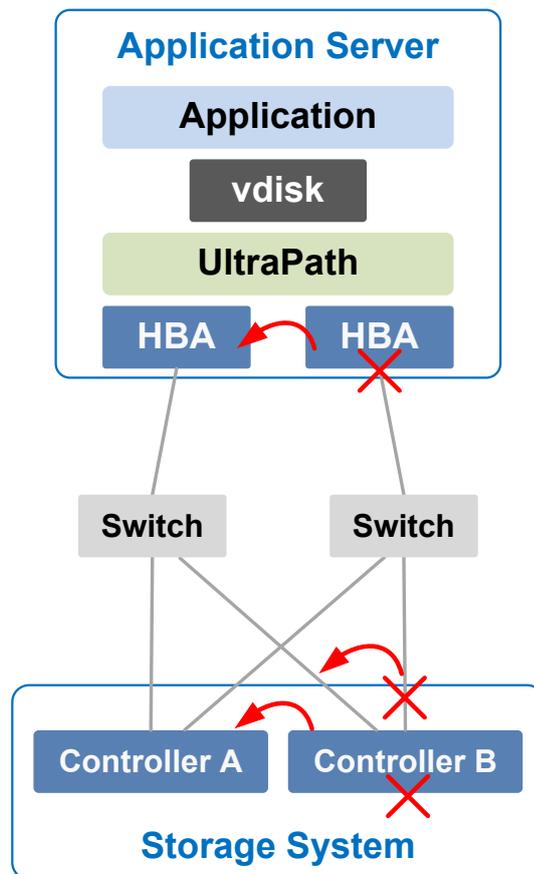
As modern technology develops, the requirements laid upon the security and stability of storage networks increase during the implementation of IT infrastructure. A fault in the storage network may cause the entire network to break down. Such a fault is called a single point of failure in the storage network. To avoid this, a highly reliable storage network not only includes redundant devices and components, but also adopts the interconnection of redundant links, as shown in [Figure 1-1](#). The redundancy design can improve the reliability as well as the performance of the entire storage network. The multipathing technology helps achieve this goal.

Figure 1-1 Multi-path networking



The multipathing technology is realized through multipathing software. If a path fails or cannot meet the performance requirement, multipathing software automatically and transparently transfers I/Os to other available paths to ensure that I/Os are transmitted effectively and reliably. As shown in **Figure 1-2**, multipathing software can handle many faults such as HBA faults, link faults, and controller faults.

Figure 1-2 UltraPath handling path faults



The multipathing software (normally called Multi-Path I/O, MPIO) built-in host operating systems only provides basic failover and load balancing functions, failing to meet the high reliability requirements. Huawei UltraPath cannot only provide these basic functions, but also meet the systems' demands on reliability, performance, maintainability, and adaptation with many advanced functions such as path test, all paths down protection, path isolation, path alarm pushing, and path performance monitoring. Furthermore, UltraPath has better compatibility with Huawei storage. You are advised to use UltraPath for Huawei storage if you do not have any special requirements.

UltraPath is compatible with different host operating systems. For details,click [OceanStor Interoperability Navigator](#).

1.2 Principles and Functions

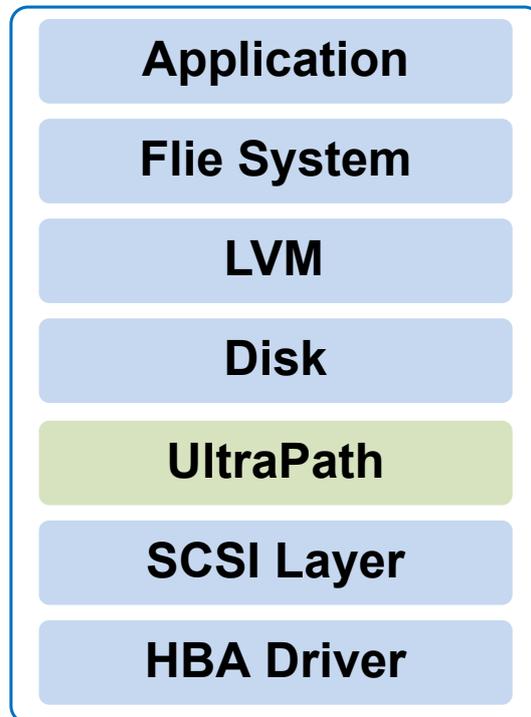
UltraPath provides powerful functions and features, ensuring secure, stable, and fast service operation. This section introduces the basic principles and functions of UltraPath.

Integrating UltraPath with Operating Systems

UltraPath is a type of filter driver software running in host kernels. It can manage and process disk creation/deletion and I/O delivery of operating systems.

- **Figure 1-3** shows the layer where the UltraPath driver resides in Windows, Linux, and Solaris.

Figure 1-3 Layers where UltraPath resides in different operating systems



- On the AIX and VMware ESXi platform, UltraPath is implemented based on the multipath framework of operating systems.
 - UltraPath for AIX is a kernel driver developed based on the MPIO of AIX operating systems.

MPIO is introduced to AIX 5.2 TL04 and 5.3, as well as later versions. With MPIO, a storage system can connect to a host through multiple paths and is present as one device on the host. MPIO employs Path-Control Modules (PCMs) to implement multipath management, such as path adding or deleting, I/O path selection, path detection, and failover.
 - UltraPath for vSphere is a Multipath Plug-in adaptable to the pluggable storage architecture (PSA) of VMware vSphere/ESXi platforms.

UltraPath Functions

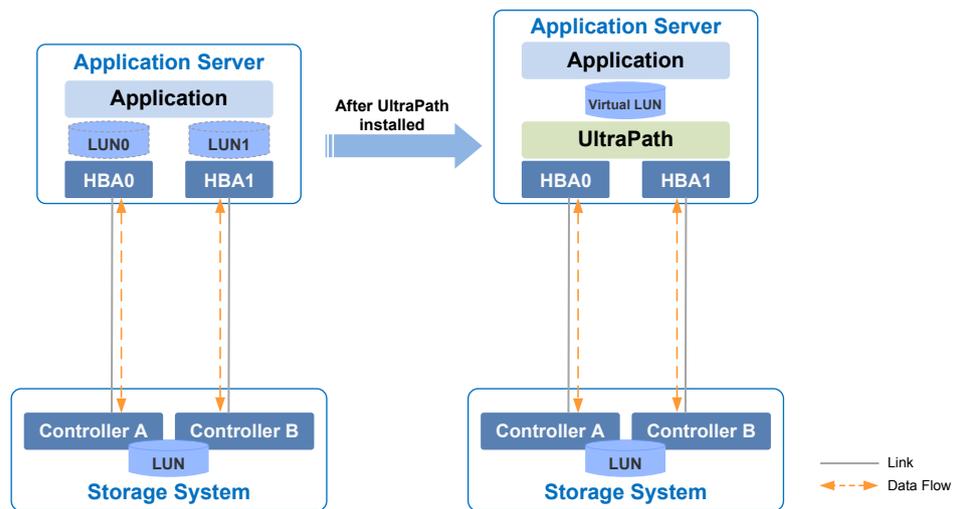
- **Masking of Redundant LUNs**

In a redundant storage network, an application server with no multipathing software detects a LUN on each path. Therefore, a LUN mapped through multiple paths is mistaken for two or more different LUNs. Redundant LUNs exist because each path reports a LUN directly to the application server.

The dual-link direct-connection network shown in the left side of **Figure 1-4** is an example. As shown in the figure, the storage system maps one LUN to the application server. Since two paths exist between the application server and the storage system and no multipathing software is installed, the application server simultaneously detects two

LUNs, LUN0 and LUN1, indicating that a redundant LUN exists. The two detected LUNs actually are the same LUN from the storage system. Due to the identification errors of the application server, different applications on the application server repeatedly write different data to the same location of the LUN, resulting in data corruption. To resolve this problem, the application server must identify which is the real and available LUN.

Figure 1-4 Masking the redundant LUN



As UltraPath is able to acquire configuration information of the storage system, it clearly knows which LUN has been mapped to the application server. As shown in the right side of **Figure 1-4**, UltraPath installed on the application server masks redundant LUNs on the operating system driver layer to provide the application server with only one available LUN, the virtual LUN. In this case, the application server only needs to deliver data read and write operations to UltraPath that masks the redundant LUNs, and properly writes data into LUNs without damaging other data.

- **Optimum Path Selection**

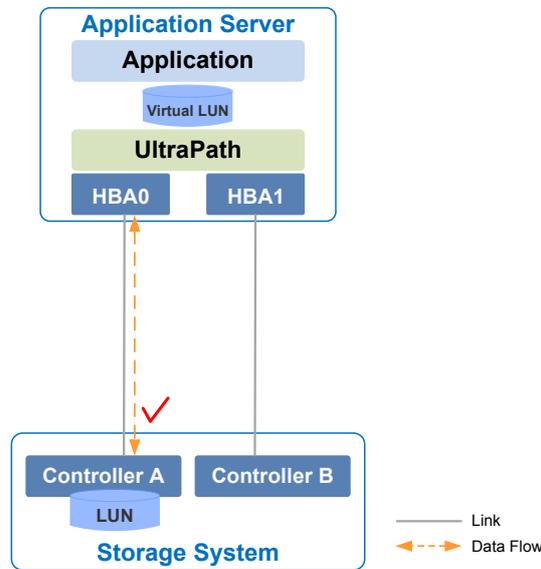
To ensure service continuity and stability, a storage system is generally equipped with two or more controllers to implement redundancy parts. Each LUN in a storage system has its owning controller, and no other controllers can operate on the LUN, preventing data corruption due to possible controller conflicts. If an application server wants to access a LUN through non-owning controllers, this access request is still redirected to the owning controller. Therefore, the highest I/O speed occurs when application servers access the target LUN directly through the owning controller.

In a multipath environment, the owning controller of a LUN on the application server that corresponds to the LUN on the storage array is called the prior controller of the LUN on the application server. Therefore, the highest I/O speed occurs when an application server with UltraPath inside accesses the LUN on the storage system through the prior controller (owning controller). The path to the prior controller is the optimum path.

As UltraPath is able to acquire owning controller information, it can automatically select one or more optimum paths for data streams to achieve the highest I/O speed.

As shown in **Figure 1-5**, the owning controller (prior controller) is controller A, and UltraPath selects the path to controller A as the optimum path.

Figure 1-5 Optimum path selection by UltraPath



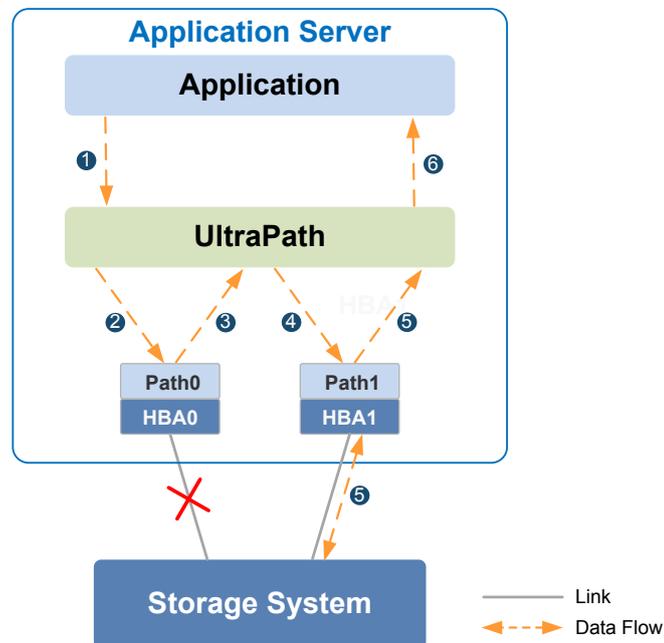
- **Failover and Failback**

- Failover

When a path fails, UltraPath fails over its services to another functional path.

Figure 1-6 shows the failover process.

Figure 1-6 UltraPath failover



- i. An application on the the application server sends an I/O request to the virtual LUNs displayed on UltraPath.

- ii. UltraPath designate **Path0** to transfer this I/O request.
- iii. A fault on **Path0** prevents this I/O from being sent to the storage system. The I/O is returned to UltraPath.
- iv. UltraPath designate **Path1** to transfer this I/O request.
- v. **Path1** is normal. The I/O request is sent to the storage system successfully. A message indicating the I/O request is sent successfully is sent to UltraPath.
- vi. UltraPath sends the message to the application server.

 **NOTE**

In the process displayed in **iii**, the HBA tries reconnection for a period of time after a path is faulty. During the period of time, I/Os remain in the HBA instead of returning back to UltraPath. For this reason, I/Os are blocked for a period of time during the failover.

- **Failback**

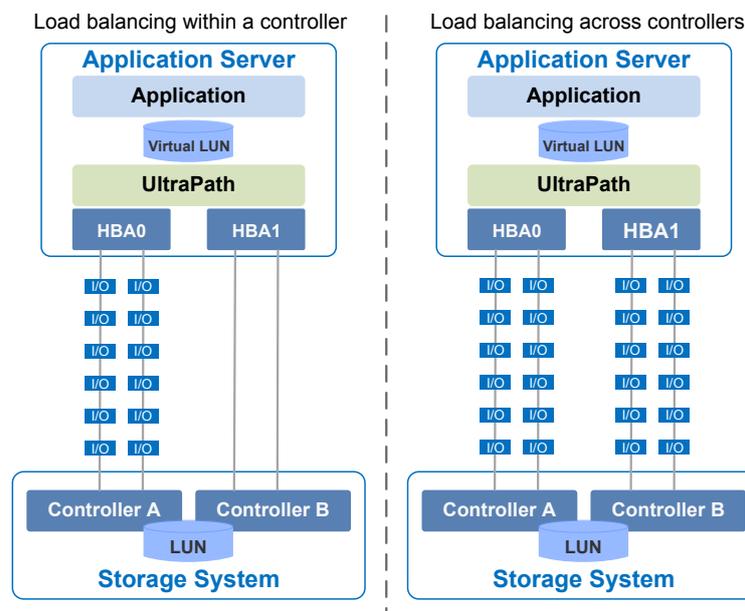
UltraPath automatically delivers I/Os to the first path again after the path recovers from the fault. There are two methods to recover a path:

- For a hot-swappable system (for example, Windows), the SCSI device will be deleted if the link between an application and a storage array is down. After the link is recovered, a SCSI device will be created. UltraPath can immediately sense the path recovery.
- For a non-hot-swappable system (for example, AIX or earlier versions of Linux), UltraPath periodically tests and detects the path recovery.

● **I/O Load Balancing**

UltraPath provides load balancing within a controller and across controllers, as shown in **Figure 1-7**.

Figure 1-7 Two I/O load balance modes



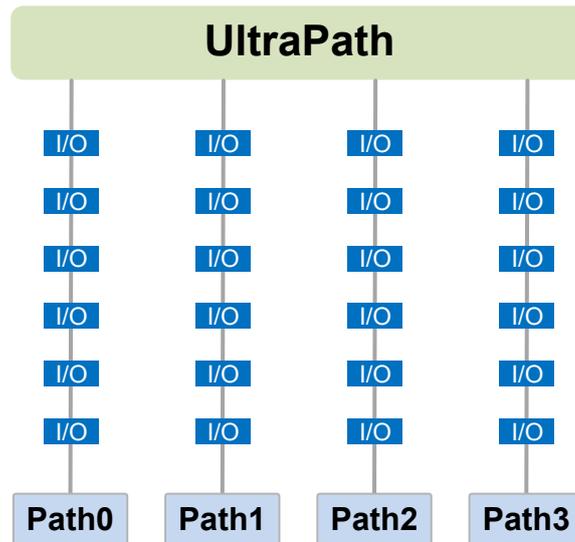
- For load balancing within a controller, I/Os poll among all the paths of the controller.

- For load balancing across controllers, I/Os poll among the paths of all these controllers.

The path selection algorithm provided by UltraPath is as follows:

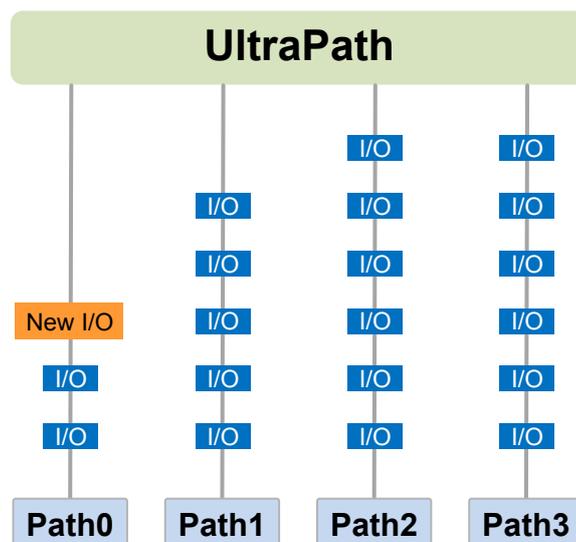
- **Round robin:** As is shown in **Figure 1-8**, when an application server delivers I/Os to a storage system, UltraPath sends the first set of I/Os through **path0** and the second set of I/Os through **path1**, and so on. Paths are used in turn to ensure that each path is fully utilized.

Figure 1-8 Round robin algorithm



- **Minimum queue depth:** As shown in **Figure 1-9**, UltraPath calculates the number of I/Os queuing in each path and delivers new I/Os to the path with minimum number of I/Os. The path with shortest I/O queue has the priority to send new I/Os.

Figure 1-9 Minimum queue depth algorithm



- **Minimum task:** On the basis of minimum queue depth algorithm, UltraPath uses the block size to calculate the overall load of each path and delivers new I/Os to the path with the minimum data load. The path with minimum I/O load has the priority to send new I/Os.

According to the test, the minimum queue depth algorithm is superior than other algorithms in both performance and reliability. You are advised to use the minimum queue depth algorithm.

- **Path test**

UltraPath tests the following paths:

- Faulty paths.

UltraPath tests faulty paths with a high frequency to detect the path recover as soon as possible.

- Idle, available paths.

UltraPath tests idle paths to identify faulty paths in advance, preventing unnecessary I/O retries. The test frequency is kept low to minimize impact on service I/Os.

SAN Boot Functions

SANBOOT is a network storage management system that stores data (including servers' operating systems) totally on storage systems. Specifically, operating systems are installed on and booted from SAN storage devices. Therefore, SANBOOT is also called REMOTE BOOT or boot from SAN.

SAN Boot is beneficial to system integration and central management. Its advantages are as follows:

- **Server integration:** Blade servers are used to integrate a large number of servers within a small space. There is no need to configure local disks.
- **Centralized management:** Boot disks of servers are centrally managed on a storage device. All advanced management functions of the storage device can be fully utilized. For example, the volume replication function can be used for backup. Devices of the same model can be quickly deployed using the volume replication function. In addition, the remote mirroring function can be used for disaster recovery.
- **Quick recovery:** Once a server that is booted from SAN fails, its boot volume can be quickly mapped to another server, achieving quick recovery.

Boot modes supported by UltraPath:

- **Boot from Local:** Install the operating systems on the local disks of an application server and start the application server from local disks.
- **Boot from SAN:** Install the operating systems on the SAN storage devices and start the application server from the SAN storage devices.

1.3 Typical UltraPath Applications

Installed on an application server, UltraPath supports different networks and helps ensure fast and smooth data transfer.

UltraPath is applicable to the following scenarios:

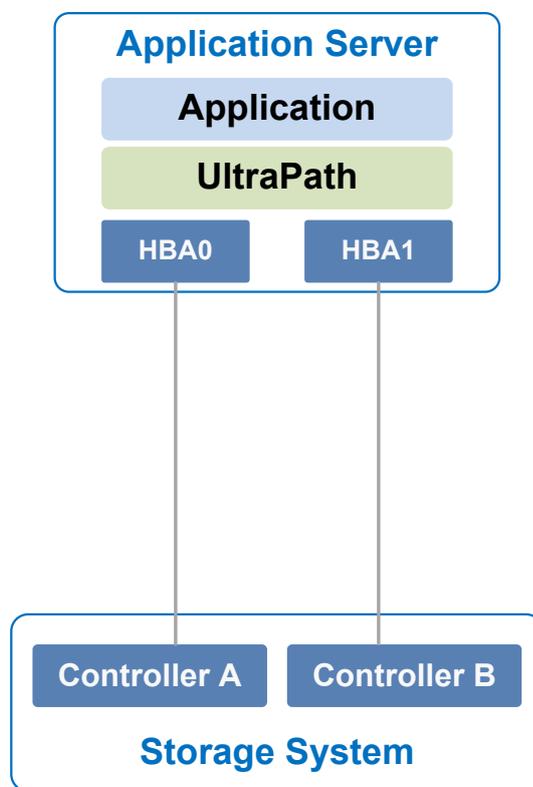
- Dual-link direct connection

- Dual-link single-switch interconnection
- Dual-link dual-switch interconnection
- Dual-link dual-switch interconnection in a cluster environment
- Dual-link dual-switch interconnection in a HyperMetro cluster environment

Dual-Link Direct Connection

Dual-link direct connection is the simplest and most inexpensive storage network connection, as shown in [Figure 1-10](#).

Figure 1-10 UltraPath in dual-link direct connection



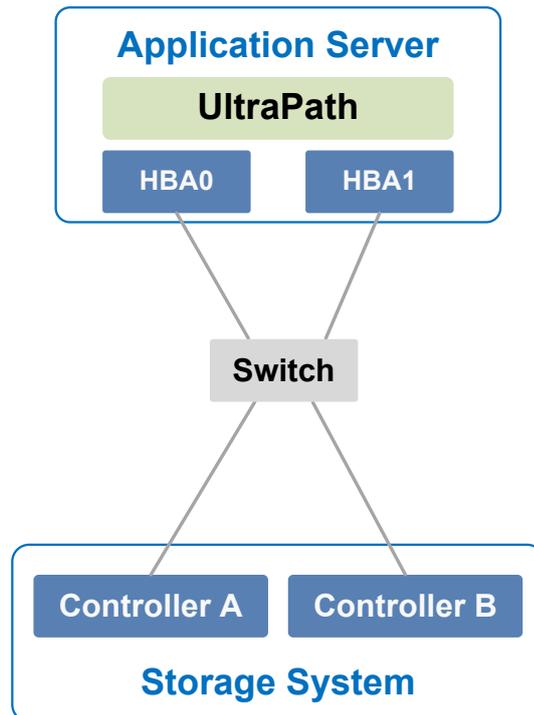
The application server uses optical fibers to connect different storage controllers for redundancy. In this networking mode, the path between the application server and the LUN's owning controller is the optimum one while other paths stand by.

In normal cases, UltraPath selects the optimum path for data transfer. If the optimum path is down, another standby path is used. After the optimum path recovers, it takes over data transfer again.

Dual-Link Single-Switch Interconnection

The dual-link single-switch interconnection adds one switch on the basis of dual-link direct connection, improving data access and forwarding capabilities, as shown in [Figure 1-11](#).

Figure 1-11 UltraPath in dual-link single-switch interconnection



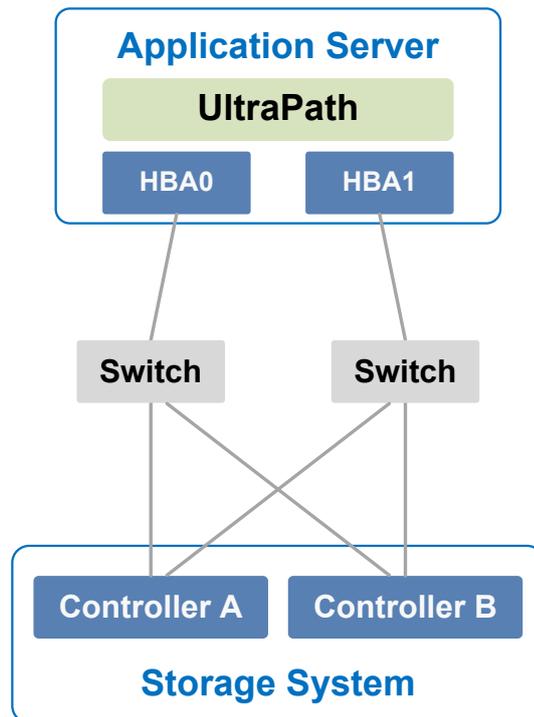
In **Figure 1-11**, there are four paths between the application server and the storage system. In this networking mode, the two paths between the application server and the LUN's owning controller are optimum while other two paths stand by.

A switch expands host ports to improve access capability of the storage system. Besides, a switch extends the supported distance of transfer so that a remote application server can connect to the storage system through the switch. As only one switch is available in this networking mode, it may encounter a single point of failure. To prevent the failure, you can adopt **Dual-Link Dual-Switch Interconnection**, as shown in **Figure 1-12**.

Dual-Link Dual-Switch Interconnection

Dual-link dual-switch interconnection adds one switch on the basis of dual-link single-switch interconnection to provide dual-switch forwarding, as shown in **Figure 1-12**.

Figure 1-12 UltraPath in dual-link dual-switch interconnection

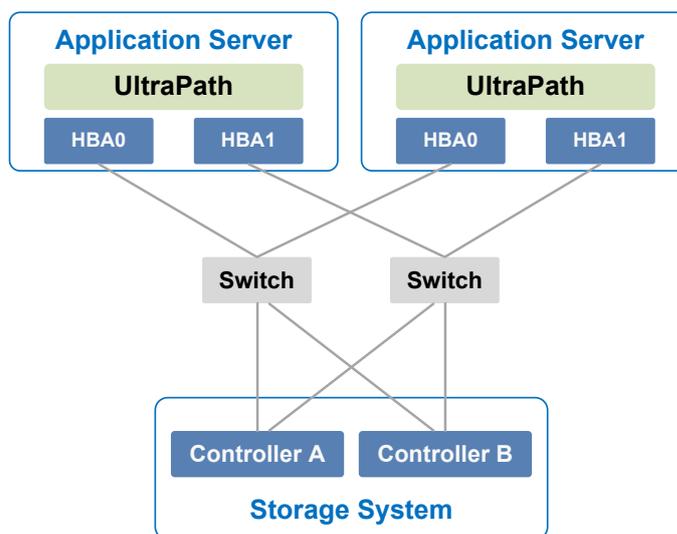


With two switches, the network prevents switch single points of failure to boost the network stabilization.

Dual-Link Dual-Switch Interconnection in a Cluster Environment

On the basis of dual-link dual-switch interconnection, one or more application servers are added to form a cluster environment, which enhances the reliability and processing capability of the application services, as shown in [Figure 1-13](#).

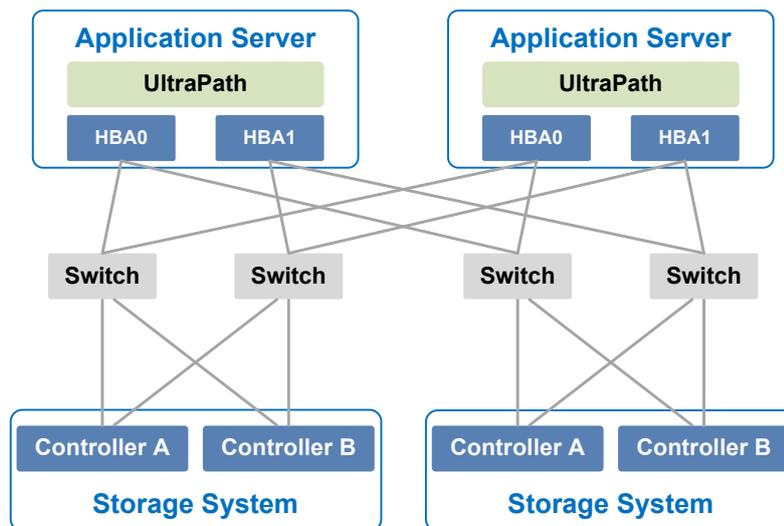
Figure 1-13 Dual-link dual-switch interconnection in a cluster environment



Dual-Link Dual-Switch Interconnection in a HyperMetro Cluster Environment

The dual-link dual-switch interconnection in a HyperMetro cluster environment improves the reliability and processing capability of the application servers. However, a single storage system is a hidden danger to cause a single point of failure in the entire storage network. Two storage systems back up each other in this scenario, greatly improving system reliability, as shown in [Figure 1-14](#).

Figure 1-14 Dual-link dual-switch interconnection in a HyperMetro cluster environment



1.4 UltraPath Security Feature

This chapter describes UltraPath security feature.

- Only users with **administrator** permissions can operate UltraPath.
- All non-query operations are recorded in logs. These logs can be accessed by user **administrator** only.
- The inputs of all users are verified to prevent unauthorized inputs.
- Interaction data of arrays are verified to prevent attacks.
- Ports are not listened and personnel data and sensitive data are not accessed.

2 Installation

About This Chapter

Selecting and managing paths between an application server and the storage system can be realized after the UltraPath is installed.

[2.1 Environment Requirements](#)

This section describes the data, hardware, and software that are required ready before installing UltraPath.

[2.2 Installing UltraPath for Windows](#)

You can install UltraPath for Windows after the preceding preparations are made. This chapter introduces the two installation modes: silent installation and non-silent installation.

2.1 Environment Requirements

This section describes the data, hardware, and software that are required ready before installing UltraPath.

2.1.1 Preparing Software Packages and Data

To smoothly install UltraPath, prepare required software packages or data in advance or based on actual conditions.

Software Package

Check whether you have prepared the required software packages. [Table 2-1](#) lists the software packages.

Table 2-1 Required software packages

Software Name	Software Package Content	Description
UltraPath for Windows installation package	Docs and Packages	Software package directory: /Windows
UltraPath for Windows installation files	UltraPath-X.XX.XXX.exe, Config and Upgrade (update package)	Software package directory: /Windows/Packages

 **NOTE**

Due to constant software upgrades, the actual version and file name of the UltraPath software may differ from that in the document. In this case, use the actual name.

Download the digital signature verification tool from <http://support.huawei.com/enterprise/> to verify integrity of the software package. If the verification fails, contact technical support engineers to obtain the correct software package.

Application Server Data

Table 2-2 describes the data that you need prepare for installing UltraPath.

Table 2-2 Data preparations

Parameter	Description	Example
Management IP address	Used to manage application servers. Log in to the application server using this IP address to make necessary configurations for UltraPath for Windows.	Example: 192.168.100.100
User name	User name for the application server NOTE To install UltraPath for Windows, you must log in as user administrator .	administrator

Parameter	Description	Example
Password	<p>Password of the application server.</p> <p>NOTE The password must:</p> <ul style="list-style-type: none"> ● Contain at least one upper-case letter, one lower-case letter, one digit, and one special character among spaces or ~!@#%&*()- _ =+ \ { } ; : " , < > / ? ● Contain 8 to 32 characters. ● Not contain the user name or the reverse spelling of the user name. 	Huawei@123

2.1.2 Preparing the Installation Environment

Check the application server and hardware and software of the storage system to ensure that UltraPath can be smoothly installed.

Application Servers

- Check that the Windows operating system and its patches running on the application server meet the requirement for installing UltraPath for Windows.

 **NOTE**

After UltraPath is upgraded, its requirements on the operating system may change. For details about operating systems supported by UltraPath, log in to Huawei technical support website (<http://support.huawei.com/enterprise/>). In the search field, enter **UltraPath**, and select a path from the paths that are automatically displayed to go to the document page of the UltraPath. Search, browse, and download the *Release Notes* of the corresponding version.

- Check that the language of the operating system meets the requirements for installing and using UltraPath for Windows.
- Check that the latest version of UltraPath for Windows is installed on the application server. If an earlier version of UltraPath for Windows has been installed, uninstall it by referring to **3.3 UltraPath for Windows Uninstallation**.
- Check that the antivirus software remains disabled when you install UltraPath for Windows. After UltraPath for Windows has been installed, enable the antivirus software and set it to trusted software.
- Check whether the LUN mapping on the current server has been reported or deleted. If the LUN mapping has not been reported or deleted, wait the operation to complete. To check whether the LUN mapping has been reported or deleted, go to Device Manager and check whether the Device Manager is refreshing. If the Device Manager is not refreshing, the system is stable. You can manually refresh the system to make it stable.
- (Optional) If Fibre Channel HBA is installed on the application server, check that the Fibre Channel HBA meets the requirement for installing UltraPath for Windows by referring to **HBAs**.
- After installing UltraPath, you need to reboot the application server. Therefore, stop services running on the application server before installing UltraPath.

HBAs



NOTICE

- On a Fibre Channel or Fibre Channel over Ethernet (FCoE) network, the application server requires a Fibre Channel or FCoE HBA.
- Each HBA must support StorPort driver.

UltraPath for Windows supports the Fibre Channel or FCoE HBA. For details on how to install an HBA on the application server, contact Huawei technicians for help.

When installing a Fibre Channel or FCoE HBA, note the following:

- Disable the failover and failback functions delivered with the HBA before installing UltraPath for Windows, because UltraPath for Windows cannot coexist with them. For details, see HBA driver manual *Read Me*.
- If UltraPath for Windows has been installed, a LUN cannot be mapped to different hosts through HBAs or iSCSI initiators that are from different vendors and with different models and firmware versions.
- Before installing UltraPath for Windows, ensure that the HBA driver has been properly installed.
- After the HBA driver has been installed on an application server, restart the application server for the HBA to take effect.
- If the system fails to detect physical LUNs, uninstall the HBA driver and reinstall it, eliminating problems caused by the plug and play (PnP) operation.

iSCSI Initiator

For Windows Server 2003 and Windows Server 2003 R2, if you use iSCSI for networking, install Microsoft iSCSI Software Initiator over 2.08 free version.

Storport Driver

If you are using Windows Server 2003, upgrade the Storport driver version to 5.2.3790.4485. To download the new version, visit <http://support.microsoft.com/kb/957910>.

Precautions for deploying the UltraPath on VMs

- If LUNs are allocated to a VM in Raw Device Mapping (RDM) mode or **pass-through** mode, the VM does not support the UltraPath.
- If you use a VM to access a LUN of the storage system in the Windows NPIV network, disable the alarm function of the UltraPath after installing the UltraPath.

Storage System

For details about storage systems supported by UltraPath, log in to Huawei technical support website (<http://support.huawei.com/enterprise/>). In the search field, enter **UltraPath**, and

select a path from the paths that are automatically displayed to go to the document page of the UltraPath. Search, browse, and download the *Release Notes* of the corresponding version.

2.1.3 (Optional) SAN Boot Environment Requirements

This chapter introduces the environment requirements for installing UltraPath when SAN Boot is configured.

If SAN Boot is configured for the host, in addition to doing the preceding work before installing UltraPath, the following requirements must also be met:

- Before installing the UltraPath, ensure that the network has been deployed.
- An operating system (OS) has been installed on the virtual LUN mapped to the host by the Huawei storage system.
- The virtual LUN running the host operating system must be a common virtual LUN.



NOTICE

- In SAN Boot scenarios, do not map the LUN that houses the host's operating system to two or more hosts. Otherwise, operating system data may be inconsistent. Besides, the virtual LUN running the host operating system must be a common virtual LUN.
 - In SAN Boot active-active scenarios, you can only configure HyperMetro after SAN Boot is configured, the host starts normally, and UltraPath takes effect after installation.
 - Dynamic disks do not support SAN Boot.
 - After replication operations are complete, use the replicated LUNs to boot the host system. Then restart the host system.
 - If you want to deploy an operating system on HyperMetro LUNs, deploy the operating system on common LUNs, install UltraPath, and convert the common LUNs into HyperMetro LUNs.
 - In a SAN Boot scenario, you are advised to set the path that saves files **Pagefile** and **Dump** to a path on local disks. For details, see [4.3 What Can I Do If I Want to Configure the Path Where Files Pagefile and Dump Are Saved to a Path on Local Disks?](#).
-

2.2 Installing UltraPath for Windows

You can install UltraPath for Windows after the preceding preparations are made. This chapter introduces the two installation modes: silent installation and non-silent installation.

2.2.1 Silent Installation

Install UltraPath in silent installation mode. Before installing UltraPath, you must configure the parameters of the configuration file used for silent installation. The UltraPath installation process does not involve user interactions, enabling one-click installation.

Precautions

Before installing UltraPath for Windows, log in to the application server that runs UltraPath for Windows as user with **administrator** permissions.

Procedure

Step 1 Copy the UltraPath for Windows installer to the application server.

 **NOTE**

A software version upgrade may cause the installation path for UltraPath for Windows to vary from that described in this document. Select an installation path based on site requirements.

Step 2 Enter the **UnattendInstall** directory and open configuration file **unattend_install.conf** to set configuration items of silent installation. [Table 2-3](#) describes related parameters.

Table 2-3 Parameter description

Keyword and Parameter	Description	Default Value
restart	<p>This parameter is used to determine whether the host will be restarted immediately after UltraPath is installed.</p> <p>The value is y or n.</p> <ul style="list-style-type: none"> ● y: The host will be restarted immediately after the installation. ● n: The host will not be restarted after the installation. You need to restart the host manually. 	n

Step 3 Log in to the host running Windows, run **cmd** to open the CLI.

Step 4 Run **pushd** to enter the **OceanStor UltraPath XX.X.X_Windows\Windows\Packages\UnattendInstall** directory. The following takes copying the installation package of UltraPath for Windows to the **Test** file package on drive C as an example:

```
C:\User\Administrator>pushd C:\test\OceanStor UltraPath XX.X.X_Windows\Windows\Packages\UnattendInstall
```

 **NOTE**

Keep files in installation package directory **OceanStor UltraPath XX.X.X_Windows\Windows\Packages\UnattendInstall** and **Packages** unchanged; otherwise, the installation will fail.

Step 5 Run **unattend_install.bat** to start the installation. In this document, **restart** is set to **n**.

```
C:\Test\OceanStor UltraPath XX.X.X_Windows\Windows\Packages\UnattendInstall>unattend_install.bat
```

The installation takes about 3 minutes. The following information will be displayed after the installation succeeds:

```
Install UltraPath successfully. Unattend installation configuration item 'restart' set to 'N/n'. You must restart your system for the configuration changes made to UltraPath to take effect.
```

Step 6 Log in to the host running Windows, check whether the installation succeeds. If **Install UltraPath successfully** is displayed, UltraPath for Windows has been installed successfully.

----End

Follow-up Procedure

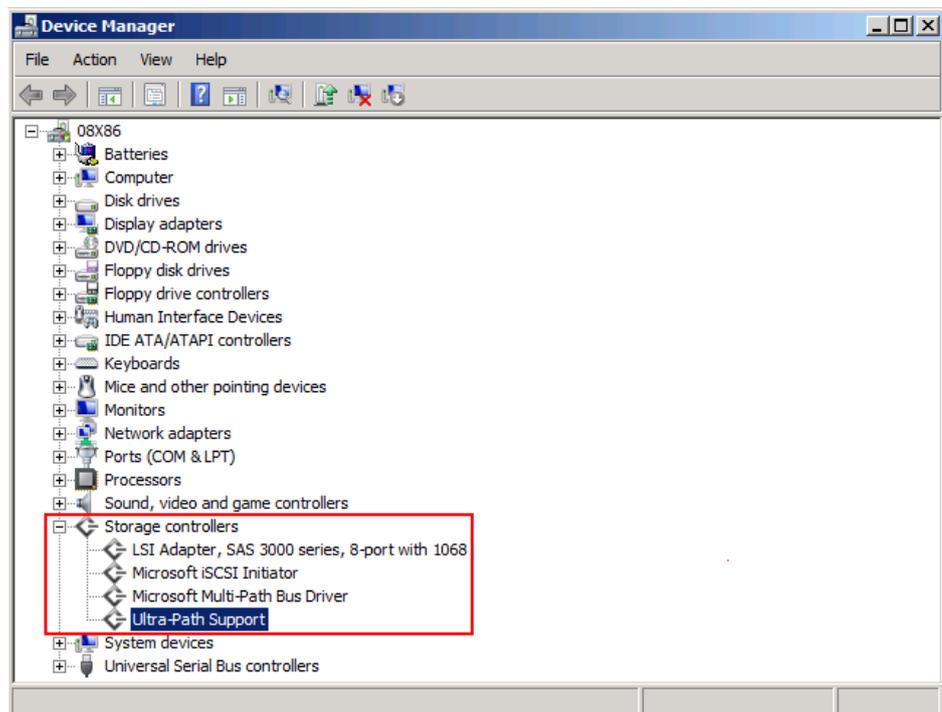
- To check whether UltraPath for Windows has been successfully installed, perform the following steps:

Double-click the **UltraPath Console** shortcut on the desktop to verify that **UltraPath Console** can start properly.

Then, perform the following steps:

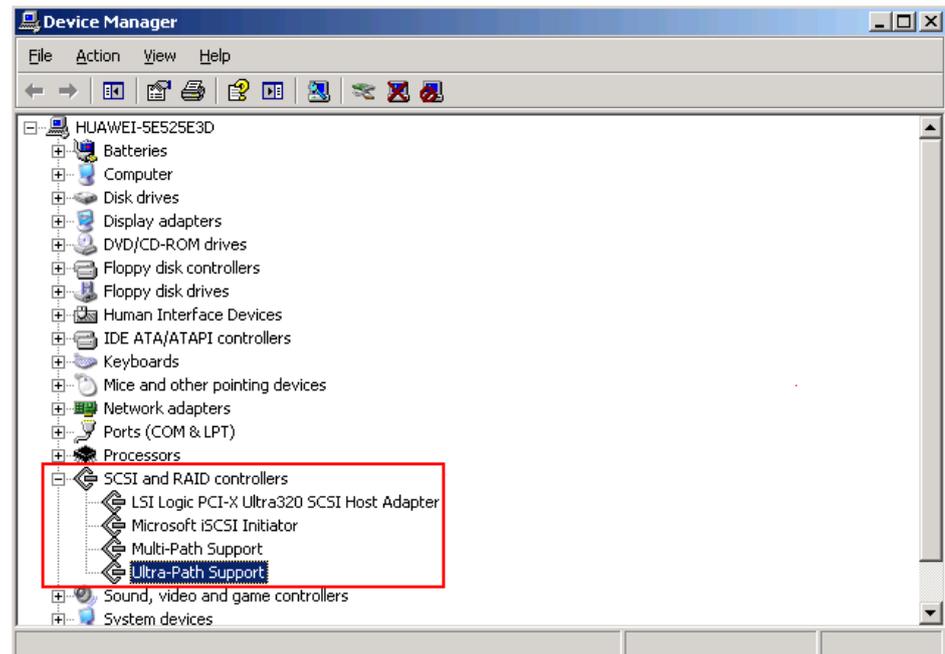
- a. Open the **cmd** CLI and enter **devmgmt.msc** to open the **Device Manager**.
- b. In the **Device Manager** window, expand the **Storage controllers** node to check for **Ultra-Path Support**. If **Ultra-Path Support** is displayed as shown in **Figure 2-1**, the installation succeeded.

Figure 2-1 Device Manager window



For Windows Server 2003, In the **Device Manager** window, expand the **SCSI and RAID controllers** node to check for **Ultra-Path Support**. If **Ultra-Path Support** is displayed as shown in **Figure 2-2**, the installation succeeded.

Figure 2-2 Windows Server 2003 **Device Manager** window



 **NOTE**

- SCSI: Small Computer System Interface
- RAID: Redundant Array of Independent Disks
- In a SAN Boot scenario, check whether a yellow exclamation mark is displayed on an MPIO virtual disk. If the yellow exclamation mark is displayed, clear it.

 **NOTICE**

In a SAN Boot scenario, if a yellow exclamation mark is displayed on an MPIO virtual disk after UltraPath is installed and the operating system is restarted, the dump file generation function of the Windows operating system will be adversely affected. Windows Server 2008 is used as an example here. For other Windows operating systems, the actual interface prevails.

- a. Open the **cmd** CLI and enter **devmgmt.msc** to open the **Device Manager**.
- b. Expand the **Disk drives** node and check whether a yellow exclamation mark is displayed in **Multi-Path Disk Device**.
 - If no, no action is required.
 - If yes, go to **c**.
- c. Choose **Start > All Programs > UltraPath** and repeatedly click **Driver Update** until the yellow exclamation mark disappears. Then restart the application server.

 **NOTICE**

To maintain normal operation of UltraPath for Windows, do not move, modify, or delete any files in the UltraPath installation directory.

2.2.2 Non-Silent Installation

Install UltraPath in non-silent installation mode. In the UltraPath installation process, you must perform operations according to the prompt information.

Precautions

Before installing UltraPath for Windows, log in to the application server that runs UltraPath for Windows as user with **administrator** permissions.

Procedure

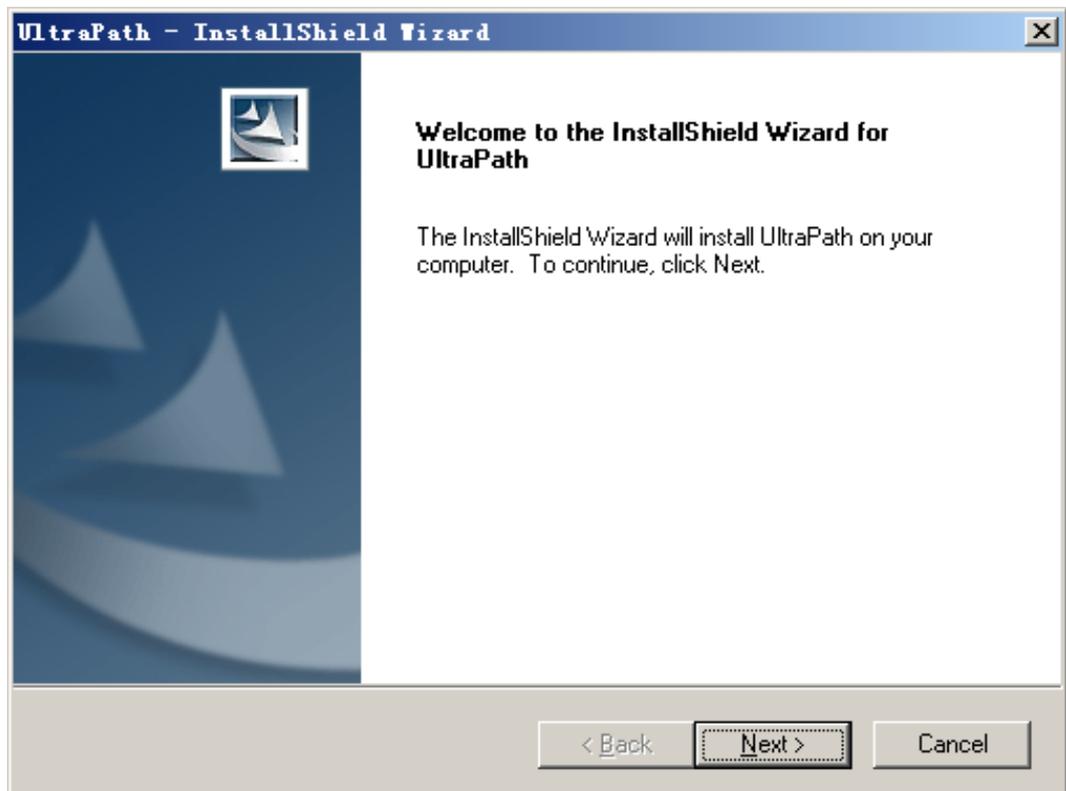
Step 1 Copy the UltraPath for Windows installer to the application server.

 **NOTE**

A software version upgrade may cause the installation path for UltraPath for Windows to vary from that described in this document. Select an installation path based on site requirements.

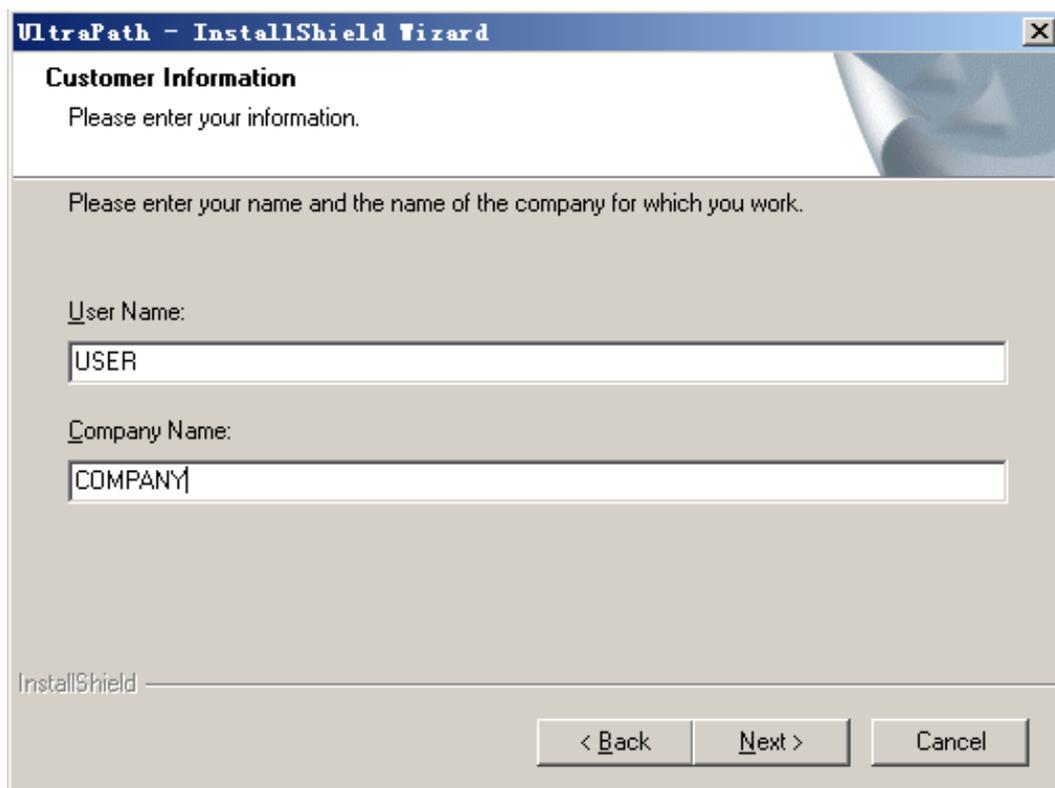
Step 2 Run UltraPath for Windows installer. The UltraPath for Windows welcome page is displayed, as shown in [Figure 2-3](#).

Figure 2-3 Installation welcome page



Step 3 Click **Next**. The **Customer Information** page is displayed, as shown in [Figure 2-4](#).

Figure 2-4 Customer Information page



UltraPath - InstallShield Wizard

Customer Information
Please enter your information.

Please enter your name and the name of the company for which you work.

User Name:
USER

Company Name:
COMPANY

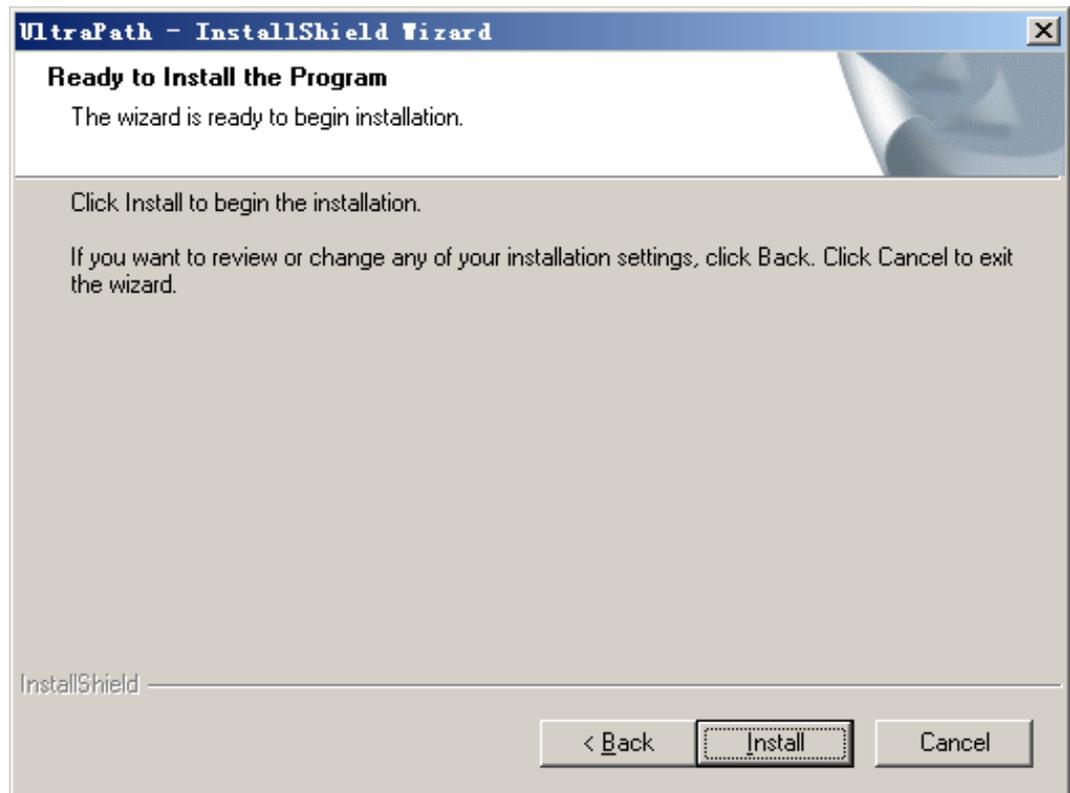
InstallShield

< Back Next > Cancel

Step 4 In the **User Name** and **Company Name** test boxes, enter a user name and company name.

Step 5 Click **Next**. The **Ready to Install the Program** page is displayed, as shown in [Figure 2-5](#).

Figure 2-5 Ready to Install the Program page



Step 6 Click **Install**. The **Setup Status** page is displayed, showing the installation progress.

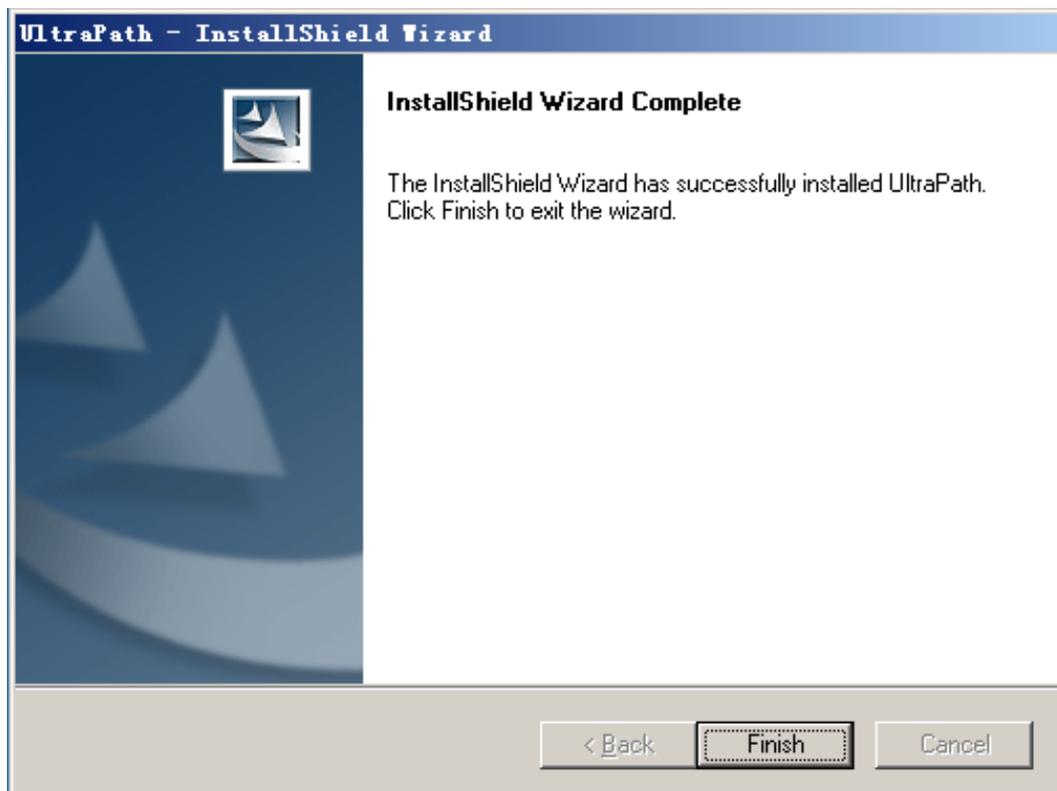
If the option for ignoring driver signature is not selected, a dialog box shown in **Figure 2-6** is displayed many times. Click **Continue** or **Yes** every time this dialog box is displayed until installation of UltraPath for Windows is complete.

Figure 2-6 Security Alert dialog box



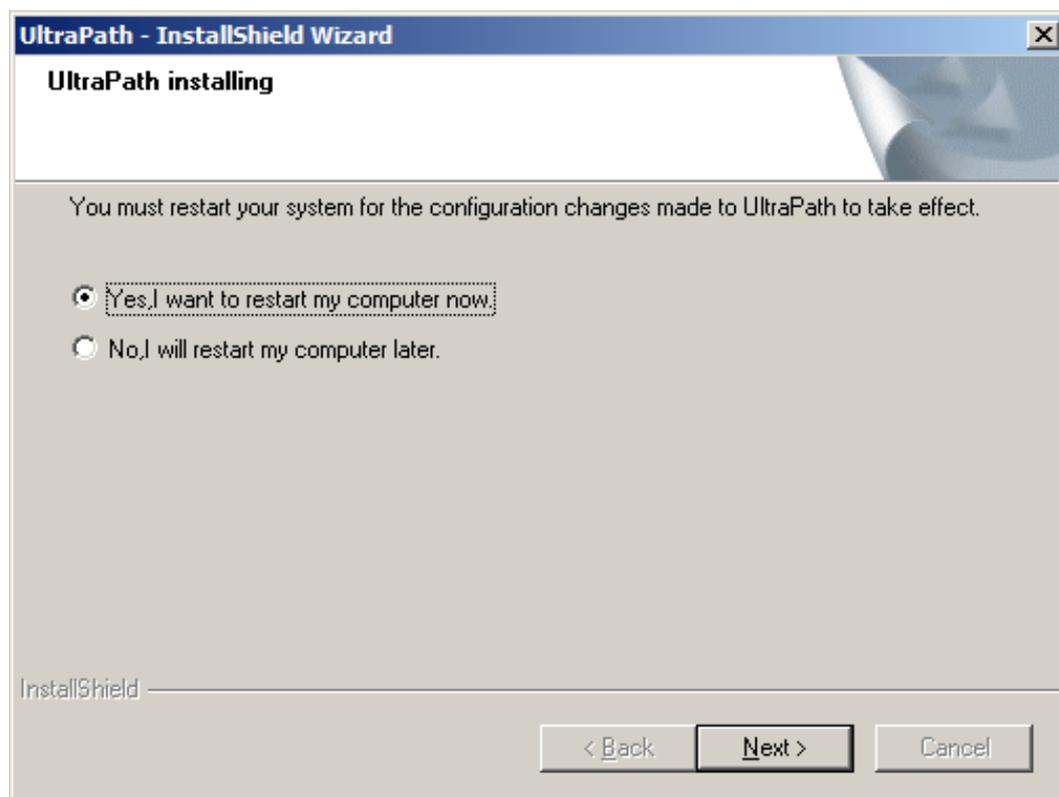
Step 7 [Figure 2-7](#) is displayed, when installation of UltraPath for Windows is complete.

Figure 2-7 Finish page



Step 8 Click **Finish**. A dialog box shown in [Figure 2-8](#) is displayed, asking you to restart your computer.

Figure 2-8 Restart page



Step 9 Select **Yes, I want to restart my computer now**. Click **Next** to restart the computer.

 **NOTE**

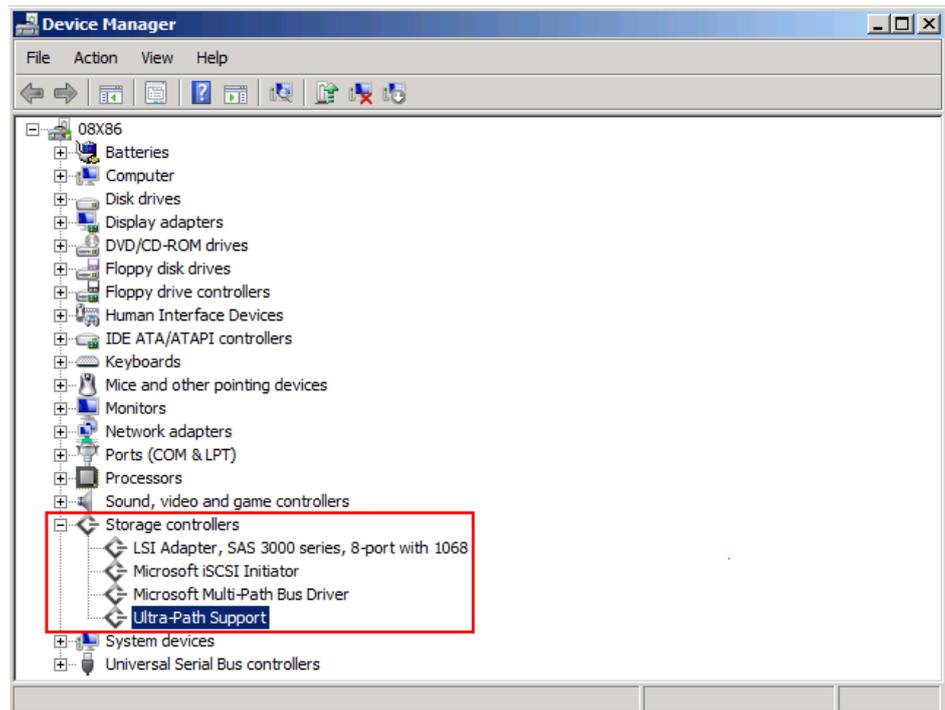
If you choose **NO ,I will restart my computer later**. The UltraPath will check whether the server restarted for every 15 minutes, if not, a information box will be displayed to notice restarting server.

----End

Follow-up Procedure

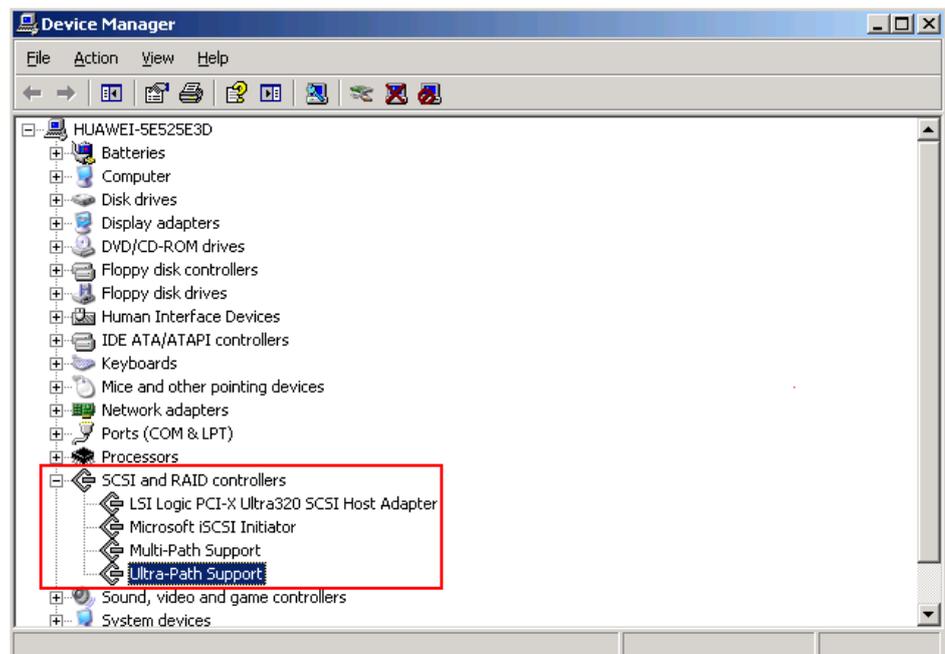
- To check whether UltraPath for Windows has been successfully installed, perform the following steps:
Double-click the **UltraPath Console** shortcut on the desktop to verify that **UltraPath Console** can start properly.
Then, perform the following steps:
 - a. Open the **cmd** CLI and enter **devmgmt.msc** to open the **Device Manager**.
 - b. In the **Device Manager** window, expand the **Storage controllers** node to check for **Ultra-Path Support**. If **Ultra-Path Support** is displayed as shown in **Figure 2-9**, the installation succeeded.

Figure 2-9 Device Manager window



For Windows Server 2003, In the **Device Manager** window, expand the **SCSI and RAID controllers** node to check for **Ultra-Path Support**. If **Ultra-Path Support** is displayed as shown in [Figure 2-10](#), the installation succeeded.

Figure 2-10 Windows Server 2003 Device Manager window



 **NOTE**

- SCSI: Small Computer System Interface
- RAID: Redundant Array of Independent Disks
- In a SAN Boot scenario, check whether a yellow exclamation mark is displayed on an MPIO virtual disk. If the yellow exclamation mark is displayed, clear it.

 **NOTICE**

In a SAN Boot scenario, if a yellow exclamation mark is displayed on an MPIO virtual disk after UltraPath is installed and the operating system is restarted, the dump file generation function of the Windows operating system will be adversely affected. Windows Server 2008 is used as an example here. For other Windows operating systems, the actual interface prevails.

-
- a. Open the **cmd** CLI and enter **devmgmt.msc** to open the **Device Manager**.
 - b. Expand the **Disk drives** node and check whether a yellow exclamation mark is displayed in **Multi-Path Disk Device**.
 - If no, no action is required.
 - If yes, go to **c**.
 - c. Choose **Start > All Programs > UltraPath** and repeatedly click **Driver Update** until the yellow exclamation mark disappears. Then restart the application server.

 **NOTICE**

To maintain normal operation of UltraPath for Windows, do not move, modify, or delete any files in the UltraPath installation directory.

3 Management

About This Chapter

When UltraPath is installed, you can maintain, upgrade, or uninstall it based on service running conditions.

[3.1 Routine Maintenance](#)

Routine maintenance can help UltraPath play a better role in storage networks.

[3.2 Upgrading UltraPath](#)

You can upgrade UltraPath to the latest version to obtain latest UltraPath functions.

[3.3 UltraPath for Windows Uninstallation](#)

This chapter provides a procedure for uninstalling UltraPath for Windows.

3.1 Routine Maintenance

Routine maintenance can help UltraPath play a better role in storage networks.

3.1.1 Viewing Array Information

This section describes how to view details about disk arrays on the array management page of UltraPath for Windows.

Procedure

- Step 1** In the navigation tree of the UltraPath Console, choose **Host > Disk array**.
- Step 2** Select the disk array whose information you want to view.
- Step 3** In the right function pane, view details about the disk array.

Parameter	Description	Value
ID	ID of the storage array.	[Example] 0

Parameter	Description	Value
Name	Name of the storage array.	[Example] SN_2004
Array SN	Serial No. of the storage array.	[Example] 21000022a10ac1bf
Vendor Name	Manufacturer of the storage array.	[Example] HUAWEI
Product Name	Name of the storage array.	[Example] S5500T

 **NOTE**

In the upper part of the function pane, click **Refresh** to refresh information about disk arrays managed by UltraPath for Windows.

---End

3.1.2 Viewing Physical Path Information

This section describes how to view the detailed information about a physical path.

Procedure

- Step 1** In the navigation tree of the UltraPath Console, choose **Host > Disk array**.
- Step 2** Select the disk array whose path information you want to view.
- Step 3** Click **Physical path**.
- Step 4** In the right function pane, view the detailed information about a physical path. The following table describes related parameters:

Parameter	Description	Value
ID	ID of the physical path.	[Example] 0
Initiator Port	Name of an initiator port. NOTE For some arrays such as the S2600 and S5500, the initiator ports are displayed as the initiator port IDs in the SCSI address.	[Example] iqn. 1998-01.com.vmware:localhost-51a7d306
Controller	ID or Name of a controller.	[Example] 0A

Parameter	Description	Value
Target Port	Name of a target port. NOTE For some arrays such as the S2600 and S5500, the initiator ports are displayed as the initiator port IDs in the SCSI address.	[Example] iqn.2006-08.com.huawei:oceanstor: 21000022a10ac1bf::129.97.50.2-1020400
Port ID	Location of the port.	[Example] CTE0.B.H0
Status	Working status of a physical path. The value can be Normal, Fault, I/O discrete error degradation, Intermittent failure degradation, High latency degradation, Potential fault degradation or Disable.	[Example] Normal
Check state	Health status of the physical path displayed when you initiate a query.	[Example] Checking
Port Type	Type of a link port.	[Example] iSCSI
I/O Retry Count	Number of I/O retry attempts.	[Example] 0
Path Fault Count	Number of times for which a path becomes faulty.	[Example] 0
MAX. I/O Latency (ms)	Maximum average I/O latency within a sampling period.	[Example] 200
Min. I/O Latency (ms)	Minimum average I/O latency within a sampling period.	[Example] 1
Average I/O Latency (ms)	Average I/O latency within a sampling period.	[Example] 1

 **NOTE**

In the upper part of the function pane, click **Refresh** to refresh information about physical paths managed by UltraPath for Windows.

---End

3.1.3 Viewing Controller Information

This section describes how to view information about disk array controllers.

Procedure

- Step 1** In the navigation tree of the UltraPath Console, choose **Host > Disk array**.
- Step 2** Select the disk array whose controller information you want to view.
- Step 3** Click **Controller**.
- Step 4** In the right function pane, view the detailed information about the controller. The following table describes related parameters:

Parameter	Description	Value
ID/Name	ID or Name of the controller.	[Example] 0A
Status	Status of the controller. The value can be either Enable or Disable .	[Example] Enable
Location	Location of the controller.	[Default value] Local Device [Example] Local Device

 **NOTE**

In the upper part of the function pane, click **Refresh** to refresh information about disk arrays managed by UltraPath for Windows.

---End

3.1.4 Viewing Virtual LUN Information

This section describes how to view the detailed information about a virtual LUN.

Procedure

- Step 1** In the navigation tree of the UltraPath Console, choose **Host > VLUN**.
- Step 2** On the function pane, view virtual LUN information. Related parameters are explained in the following table.

Parameter	Description	Value
ID	ID allocated by UltraPath for Windows to the virtual LUN.	[Example] 1
Disk	Name of the disk that corresponds to the virtual LUN on the operating system.	[Example] Disk1
Type	Type of the virtual LUN. The value can be Common , HyperMetro , or Migration .	[Example] Common
Capacity	Capacity of the virtual LUN.	[Example] 10.00 GB
Number of Paths	Number of logic paths of the virtual LUN.	[Example] 1
LUN WWN	WWN of the virtual LUN.	[Example] 60022a11000ac1bf0cb9754a0000016e

Step 3 In the function pane, select the virtual LUN whose information you want to view, click the **LUN** tab page. Details about this virtual LUN are displayed. Related parameters are explained in the following table.

Parameter	Description	Value
Name	Name of the virtual LUN. NOTE The name is specified when the LUN is created on its storage array.	[Example] LUN_01
Dev LUN ID	ID of the storage system LUN corresponding to the virtual LUN.	[Example] 001

Parameter	Description	Value
Status	Working status of the virtual LUN. The value can be Normal, Fault, Degraded, Disabled , or --. NOTE If the LUN on the array is in Fault state while the virtual LUN on the host is in Normal state (viewed by using UltraPath), the virtual LUN can be accessed by the host.	[Example] Normal
Working Controller	Working controller of the virtual LUN.	[Example] 0A
Owning Controller	Owning controller of the virtual LUN.	[Example] 0A
Number of Paths	Number of logic paths of the virtual LUN.	[Example] 1
LUN WWN	WWN of the virtual LUN.	[Example] 60022a11000ac1bf0cb9754a0000016e
Disk Array ID	ID of the storage system to which the virtual LUN belongs.	[Example] 0
Disk Array Name	Name of the storage system to which the virtual LUN belongs.	[Example] SN_2004
Array SN	Serial No. of the storage system to which the virtual LUN belongs.	[Example] 201235G6EAZ0C1000025
Vendor Name	Manufacturer of the storage system to which the virtual LUN belongs.	[Example] HUAWEI
Product Name	Name of the storage system to which the virtual LUN belongs.	[Example] S5500T

Step 4 Optional: Check path information about the virtual LUN.

1. In the upper part of the function pane, click the **Path** tab.
2. On the **Path** tab page, view the detailed information about the virtual LUN. The following table describes related parameters:

Parameter	Description	Value
ID	ID of the physical path.ID of the storage system to which the virtual LUN belongs.	[Example] 0
Disk Array ID	ID of the storage system to which the virtual LUN belongs.	[Example] 0
Initiator Port	Name of an initiator port.	[Example] iqn. 1998-01.com.vmware:localhost-51a7d306
Controller	ID or Name of a controller.	[Example] 0A
Target Port	Name of a target port.	[Example] iqn.2006-08.com.huawei:oceanstor: 21000022a10ac1bf::129.97.50.2-1020400
Status	Working status of a physical path. The value can be Normal, Fault, BUSY Degradation, I/O discrete error degradation, Intermittent failure degradation, High latency degradation, Potential fault degradation or Disable.	[Example] Normal
Port Type	Type of a link port.	[Example] iSCSI

----End

3.1.5 Critical Event Management

By managing critical events, you can detect and troubleshoot device faults in a timely manner.

3.1.5.1 Viewing Critical Events

This section describes how to can locate and troubleshoot device faults by viewing critical events.

Procedure

Step 1 On the menu bar of the UltraPath Console, choose **Log > Critical Events**.

The **Critical Events** dialog box is displayed.

Step 2 View critical events. The following table describes related parameters:

Parameter	Description	Value
Level	Severity of a critical event.	[Example] Info
Description	Detailed description of a critical event, including the location of the module where the critical event occurs.	[Example] Add a path to disk {6}: Host Lun ID {6}, Initiator WWN {21000024ff368169}, Target WWN {20080022a1072163}.
Occurred At	Time of a critical event occurred.	[Example] 2013-02-14 12:35:42 CST
Disk Array	Name of the disk array where a critical event occurs.	[Example] HUAWEI S2600T
Type	Type of a critical event.	[Example] Add path to disk

NOTE

Click **Refresh** to view the latest critical events.

---End

3.1.5.2 Saving a Critical Event

This section describes how to save selected critical events on a local disk.

Procedure

Step 1 On the menu bar of the UltraPath Console, choose **Log > Critical Events**.

The **Critical Events** dialog box is displayed.

Step 2 Select the critical events that you want to save.

Step 3 Click **Save As**.

The **Save Log** dialog box is displayed.

Step 4 In **Save Location**, select a path for saving the critical events.

Step 5 In **Name**, enter a name for the file that saves the critical events.

The **Type** list shows file types. Select **CSV file (*.CSV)** as the file type.

Step 6 Click **Save**.

The **Information** dialog box is displayed, indicating that the operation succeeded.

Step 7 Click **OK**.

----End

3.1.6 Operation Log Management

By managing operation logs, you can view the settings performed by users on the UltraPath Console and the CLI of UltraPath for Windows.

3.1.6.1 Viewing an Operation Log

By viewing operation logs, you can view and locate operations performed by users.

Procedure

Step 1 On the menu bar of the UltraPath Console, choose **Log > Operation Log**.

The **Operation Log** dialog box is displayed.

Step 2 View an operation log. The following table describes related parameters:

Parameter	Description	Value
SN	Serial No. of the operation log.	[Example] 100
User ID	User ID.	[Example] Administrator
Severity	Severity of the operation log.	[Example] Warning
Description	Details about the operation.	[Example] Updated the disk driver
Result	Indicating whether the operation succeeded or not.	[Example] Succeeded
Occurred At	Time the operation was performed.	[Example] 2012-05-12 00:00:01 PDT
Source	Indication where the operation was performed.	[Example] GUI
ID	ID of the operation log.	[Example] 0x5341510c



Click **Refresh** to view the latest operation logs.

---End

3.1.6.2 Saving Operation Logs

This section describes how to save selected operation events on a local disk.

Procedure

- Step 1** On the menu bar of the UltraPath Console, choose **Log > Operation Log**.
The **Operation Log** dialog box is displayed.
- Step 2** Select the operation logs that you want to save.
- Step 3** Click **Save As**.
The **Save Log** dialog box is displayed.
- Step 4** In **Save Location**, select a path for saving the critical events.
- Step 5** In **Name**, enter a name for the file that saves the operation logs.
The **Type** list shows file types. Select **CSV file (*.CSV)** to be the alarm file type.
- Step 6** Click **Save**.
The **Information** dialog box is displayed, indicating that the operation succeeded.
- Step 7** Click **OK** to save the operation logs.

---End

3.1.7 Timeout Parameter Settings upon a Link Down Failure

This chapter describes how to set the timeout parameters upon a link down failure of an iSCSI initiator and some mainstream HBAs.

3.1.7.1 Parameter Setting Description

This section describes functions and scenarios of the timeout parameter settings upon a link down failure.

A link down failure triggers an I/O failover. This is a common fault mode. Under this condition, the time for the I/O failover consists of two parts: time for an initiator to sense the link down failure and timeout period of the link down failure of the initiator.

Time for an initiator to sense a link down failure indicates a period from the physical link down failure to the initiator's identification of the link down failure. This period varies based on different initiator hardware, driver versions, networks, and physical fault locations. Generally, HBAs sense a link down failure faster than an iSCSI initiator does. The speed for sensing a link down failure accelerates when the fault location is close to a host. The timeout period of a link down failure of an initiator indicates a period from the initiator's identification of the link down failure to I/O queue suspension. (After I/Os are suspended, the initiator returns I/Os that have the link down error code to UltraPath. UltraPath immediately switches

I/O services to a standby path.) This timeout period depends on the timeout parameters of the initiator. You can control the time for an I/O failover by modifying the timeout parameters.

Typically, you can use the default timeout parameter configuration of an initiator upon a link down failure. However, some application services has special requirements on I/O latency. For example, Oracle RAC requires short I/O latency. Under this condition, you can set a short timeout period upon a link down failure. The timeout parameter value varies based on different service environments. If services have special requirements on an I/O failover, you are advised to set the timeout parameters based on the actual environment.

3.1.7.2 Setting Timeout Parameters for an iSCSI Initiator

UltraPath provides a tool used to check and change the timeout parameters for an iSCSI initiator.

3.1.7.2.1 Obtaining Help

The man pages of the **iscsiConfig** command can be queried by executing this command.

Format

```
iscsiConfig help
```

Parameters

None

Usage Guidelines

None

System Response

After this command is executed successfully, information similar to the following is displayed.

```
Use "iscsiConfig get timeout value" to get iSCSI MaxRequestHoldTime
Use "iscsiConfig set timeout xxx" to set iSCSI MaxRequestHoldTime
Use "iscsiConfig get linkdowntime value" to get iSCSI LinkDownTime
Use "iscsiConfig set linkdowntime xxx" to set iSCSI LinkDownTime
```

3.1.7.2.2 Querying the Timeout Value of an iSCSI Initiator

The timeout value of an iSCSI initiator can be queried by executing this command.

Format

```
iscsiConfig get timeout value
iscsiConfig get linkdowntime value
```

Parameters

None

Usage Guidelines

None

System Response

After this command is executed successfully, information similar to the following is displayed.

```
The operation completed successfully, MaxRequestHoldTime = 60s.  
The operation completed successfully, LinkDownTime = 15s.
```

3.1.7.2.3 Setting Timeout Parameters

The timeout parameters for an iSCSI initiator can be set by executing this command. You can run the **set timeout** command to change **MaxRequestHoldTime**. If you do not obtain the expected result, run the **set linkdowntime** command to change **LinkDownTime**.

Format

```
iscsiConfig set timeout xxx
```

```
iscsiConfig set linkdowntime xxx
```

Parameters

xxx in this command is the preferred value you want to set. The unit is second.

Usage Guidelines

This setting do not take effect until you restart the computer.

System Response

After this command is executed successfully, information similar to the following is displayed.

```
The operation completed successfully, MaxRequestHoldTime = 5s.  
Please restart your computer to make it take effect.  
  
The operation completed successfully, LinkDownTime = 5s.  
Please restart your computer to make it take effect.
```

3.1.7.3 Setting the Timeout Parameters for a QLogic HBA

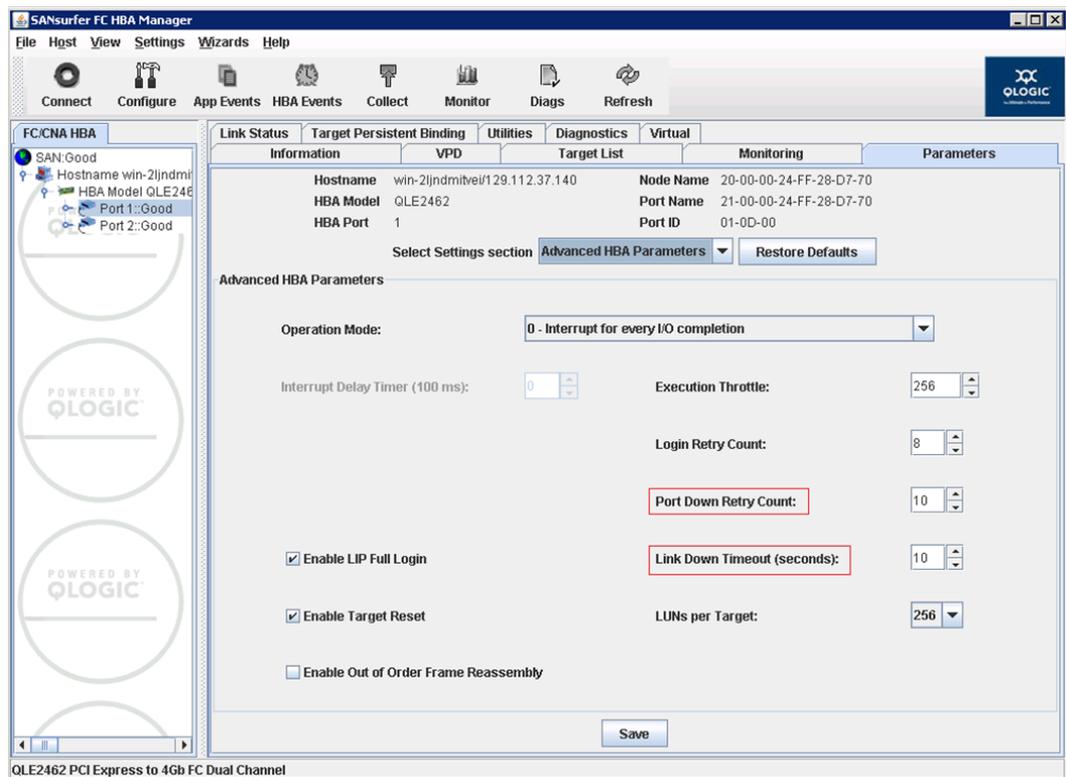
This section explains how to set the timeout parameter for a QLogic HBA.

To set the timeout parameters for a QLogic HBA, use the SANsurfer tool provided by QLogic to change the **Port Down Retry Count** and **Link Down Timeout** values, as shown in [Figure 3-1](#).

NOTICE

- If the timeout parameters are modified, the time required by the system to delete disks upon a link interruption failure is changed. A smaller value indicates that less time is required for deleting disks.
- This operation modifies driver parameters and applies to all storage device links on the host.

Figure 3-1 SANsurfer setting page



3.1.7.4 Setting Timeout Parameters for an Emulex HBA

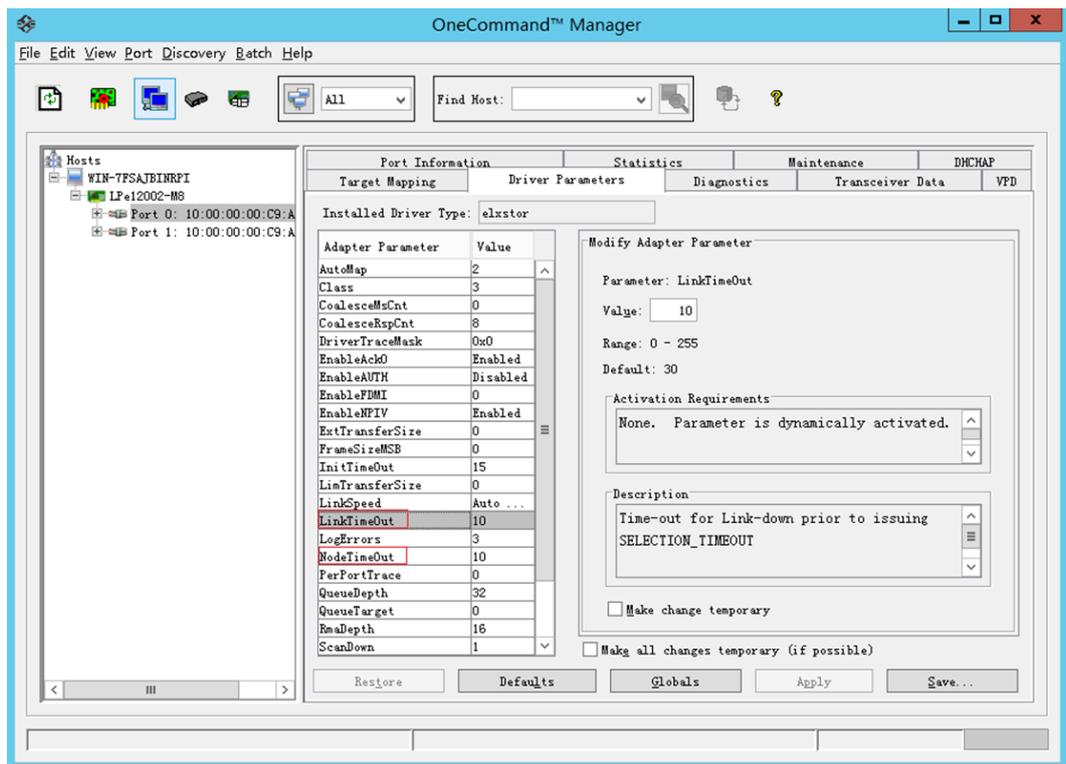
This section explains how to set timeout parameters for an Emulex HBA.

To set the timeout parameter for an Emulex HBA, use the HBAAnyware tool provided by Emulex to change the **linktimeout** and **nodetimeout** values. Using **OneCommand Manager** as an example, set parameters for each port, as shown in [Figure 3-2](#).

NOTICE

- If the timeout parameters are modified, the time required by the system to delete disks upon a link interruption failure is changed. A smaller value indicates that less time is required for deleting disks.
- This operation modifies driver parameters and applies to all storage device links on the host.

Figure 3-2 OneCommand Manager setting page



3.1.7.5 Setting Timeout Parameters for a QLogic CNA

This section use FCoE as an example to explain how to set timeout parameters for a QLogic CNA.

To set timeout parameters for an FCoE, you need to download the FCoE driver package from http://driverdownloads.qlogic.com/QLogicDriverDownloads_UI/DefaultNewSearch.aspx. The product name is **QLE8142** (choose a proper operating system). After the FCoE driver is installed, double-click the **QConvergeConsole CLI** shortcut to enter the CLI mode and set the parameters as follows:

```
CLI - Version 1.0.1 (Build 32)
```

```
Main Menu

1: Adapter Information
2: Adapter Configuration
3: Adapter Updates
```

```
4: Adapter Diagnostics
5: Adapter Statistics
6: Refresh
7: Help
8: Exit

Please Enter Selection: 2

QConvergeConsole

CLI - Version 1.0.1 (Build 32)

Adapter Type Configuration Selection

1: CNA Configuration

(p or 0: Previous Menu; m or 98: Main Menu; ex or 99: Quit)
Please Enter Selection: 1

QConvergeConsole

CLI - Version 1.0.1 (Build 32)

Converged Network Adapter (CNA) Protocol Type Selection

1: CNA FCoE Configuration
2: CNA NIC Configuration

(p or 0: Previous Menu; m or 98: Main Menu; ex or 99: Quit)
Please Enter Selection: 1

QConvergeConsole

CLI - Version 1.0.1 (Build 32)

Converged Network Adapter (CNA) FCoE Configuration

1: Adapter Alias
2: Adapter Port Alias
3: HBA Parameters
4: Target Persistent Binding
5: Boot Devices Configuration
6: Virtual Ports (NPIV)
7: Target Link Speed (iidMA)
8: Driver Parameters
9: Selective LUNs
10: QoS
11: Export (Save) Configuration
12: Generate Reports

(p or 0: Previous Menu; m or 98: Main Menu; ex or 99: Quit)
Please Enter Selection: 3

QConvergeConsole

CLI - Version 1.0.1 (Build 32)

Converged Network Adapter (CNA) FCoE Configuration

CNA Model QLE8142 SN: RFC1002S77768
1. Port 1 [Protocol(s): NIC FCoE]
   MAC Address: 00:C0:DD:13:E2:A0 Link Up
   WWPN: 21-00-00-C0-DD-13-E2-A1 Online
2. Port 2 [Protocol(s): NIC FCoE]
   MAC Address: 00:C0:DD:13:E2:A2 Link Up
```

```
WWPN: 21-00-00-C0-DD-13-E2-A3 Online

(p or 0: Previous Menu; m or 98: Main Menu; ex or 99: Quit)
Please Enter Selection: 1

QConvergeConsole

Version 1.0.1 (Build 32)

HBA Parameters Menu
=====
CNA          : 0 Port: 1
SN           : RFC1002S77768
ENode MacAddr : 00:C0:DD:13:E2:A1
CNA Model    : QLE8142
CNA Desc.    : QLE8142 QLogic PCI Express to 10 GbE Dual Channel CNA (FCoE)
FW Version   : 5.02.01
WWPN        : 21-00-00-C0-DD-13-E2-A1
WWNN        : 20-00-00-C0-DD-13-E2-A1
Link        : Online
=====

1: Display HBA Parameters
2: Configure HBA Parameters
3: Restore Defaults

(p or 0: Previous Menu; m or 98: Main Menu; ex or 99: Quit)
Please Enter Selection: 2

QConvergeConsole

Version 1.0.1 (Build 32)

Configure Parameters Menu
=====
CNA          : 0 Port: 1
SN           : RFC1002S77768
ENode MacAddr : 00:C0:DD:13:E2:A1
CNA Model    : QLE8142
CNA Desc.    : QLE8142 QLogic PCI Express to 10 GbE Dual Channel CNA (FCoE)
FW Version   : 5.02.01
WWPN        : 21-00-00-C0-DD-13-E2-A1
WWNN        : 20-00-00-C0-DD-13-E2-A1
Link        : Online
=====

1: Connection Options
2: Data Rate
3: Frame Size
4: Loop Reset Delay (seconds)
5: Enable BIOS
6: Enable Fibre Channel Tape Support
7: Operation Mode
8: Interrupt Delay Timer (100ms)
9: Execution Throttle
10: Login Retry Count
11: Port Down Retry Count
12: Link Down Timeout (seconds)
13: Enable Target Reset
14: LUNs per Target
15: Enable Receive Out Of Order Frame
16: Enable LR
17: Commit Changes
18: Abort Changes
```

```
(p or 0: Previous Menu; m or 98: Main Menu; ex or 99: Quit)
Please Enter Selection:
```

Input 11 and 12, and then set the delay time

Input 17 to commit changes as follow:

```
Please Enter Selection: 17
HBA Parameters Update Complete. Changes have been saved to HBA instance 0.
```

```
Press <Enter> to continue:
```

```
QConvergeConsole
```

```
Version 1.0.1 (Build 32)
```

3.2 Upgrading UltraPath

You can upgrade UltraPath to the latest version to obtain latest UltraPath functions.

For details about how to upgrade, see Upgrade Guide of UltraPath. Obtaining method is as follows:

Log in to Huawei technical support website (<http://support.huawei.com/enterprise/>). In the search field, enter **UltraPath**, and select a path from the paths that are automatically displayed to go to the document page of the UltraPath. Search, browse, and download the *Upgrade Guide* of the corresponding version.

3.3 UltraPath for Windows Uninstallation

This chapter provides a procedure for uninstalling UltraPath for Windows.

Precautions

- Stop applications related to the UltraPath such as UltraPath Console and updam before removing the UltraPath.
- Removing UltraPath software from a multipath hardware configuration can cause data loss or corruption. Make sure that you disconnect the server from the storage or eliminate all but one path to the storage from the server before removing the UltraPath. In a SAN Boot environment, before removing the UltraPath, ensure that there are available paths between hosts and the storage devices where the operating systems reside.
- Stop Oracle services and processes that are running on the disk arrays.
- Maintain Oracle services and processes that are running on the application server.
- Restart the application server after UltraPath for Windows has been uninstalled.

Procedure

Step 1 Choose **Start > Control Panel**. In the **Control Panel** window, select **Add or Remove Programs**.

Step 2 Select **UltraPath for Windows** and click **Remove**. The **Add or Remove Programs** dialog box is displayed, as shown in [Figure 3-3](#).

Figure 3-3 Add or Remove Programs dialog box

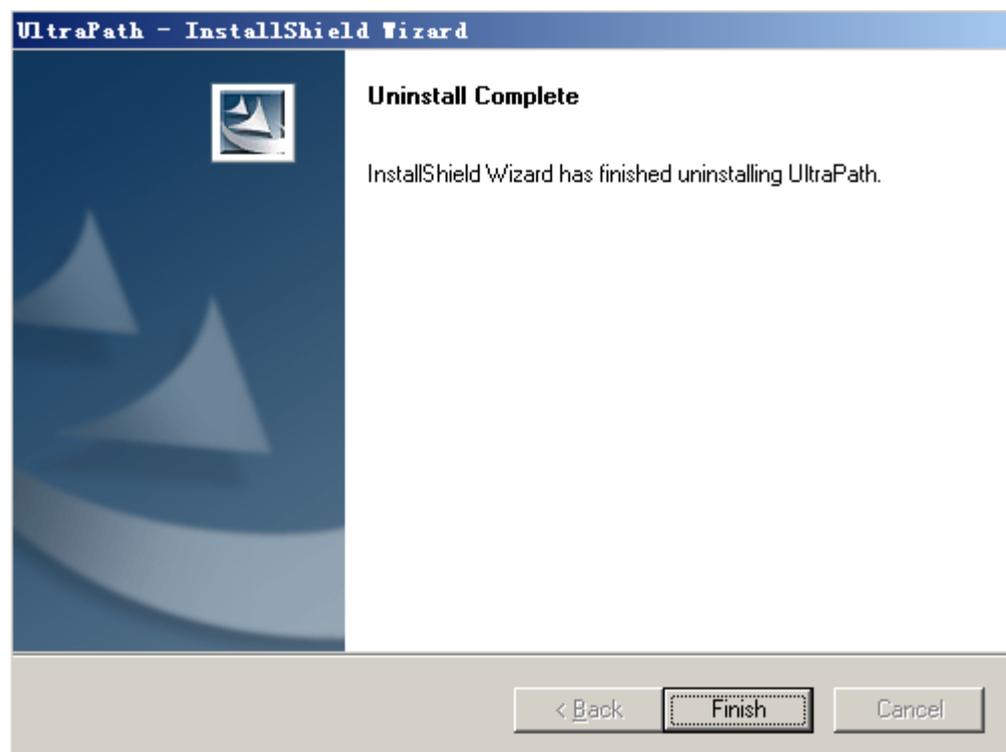


NOTE

If you run UltraPath for Windows again, the **Add or Remove Programs** dialog box will be displayed too.

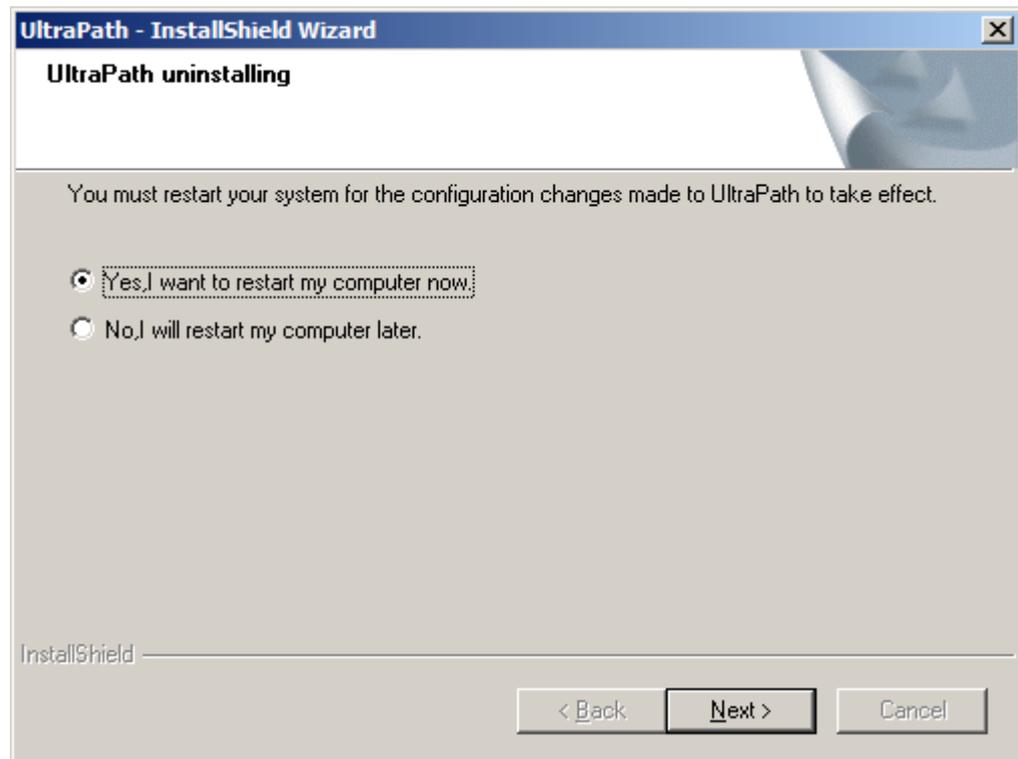
- Step 3** Click **Yes**. The system starts uninstalling UltraPath for Windows. You can also click **No** to cancel the uninstallation.
- Step 4** When uninstallation is complete, the dialog box shown in [Figure 3-4](#) is displayed. Click **Finish**. You are prompted to restart the computer.

Figure 3-4 Uninstall Complete dialog box



- Step 5** Select **Yes, I want to restart my computer now** (recommended), as shown in [Figure 3-5](#). Click **Next**. The application server restarts. You can also select **No, I will restart my computer later.** to defer the restart.

Figure 3-5 Restart dialog box



----End

Follow-up Procedure

After UltraPath for Windows has been uninstalled,

- Restart the application server so that the operating system can work properly.
- Do not uninstall **Microsoft Multi-Path Bus Driver** delivered with Windows Server 2008, Windows Server 2008 R2, Windows Small Business Server 2011, Windows Server 2012, or Windows Server 2016, because **Microsoft Multi-Path Bus Driver** is used to enable UltraPath for Windows installation. To check for **Microsoft Multi-Path Bus Driver**, you can perform the following steps: Open the **cmd** CLI and enter **devmgmt.msc** to open the **Device Manager**, and expand the **Storage Controller** node to check for **Microsoft Multi-Path Bus Driver**.

4 FAQs

About This Chapter

This chapter provides answers to frequently asked questions about UltraPath for Windows configuration or management. You can refer to this chapter when troubleshooting similar problems.

[4.1 How can I Manually Remove the MPIO Component?](#)

[4.2 How to Correctly Change a LUN Mapping View on a Storage Array?](#)

[4.3 What Can I Do If I Want to Configure the Path Where Files Pagefile and Dump Are Saved to a Path on Local Disks?](#)

4.1 How can I Manually Remove the MPIO Component?

Question

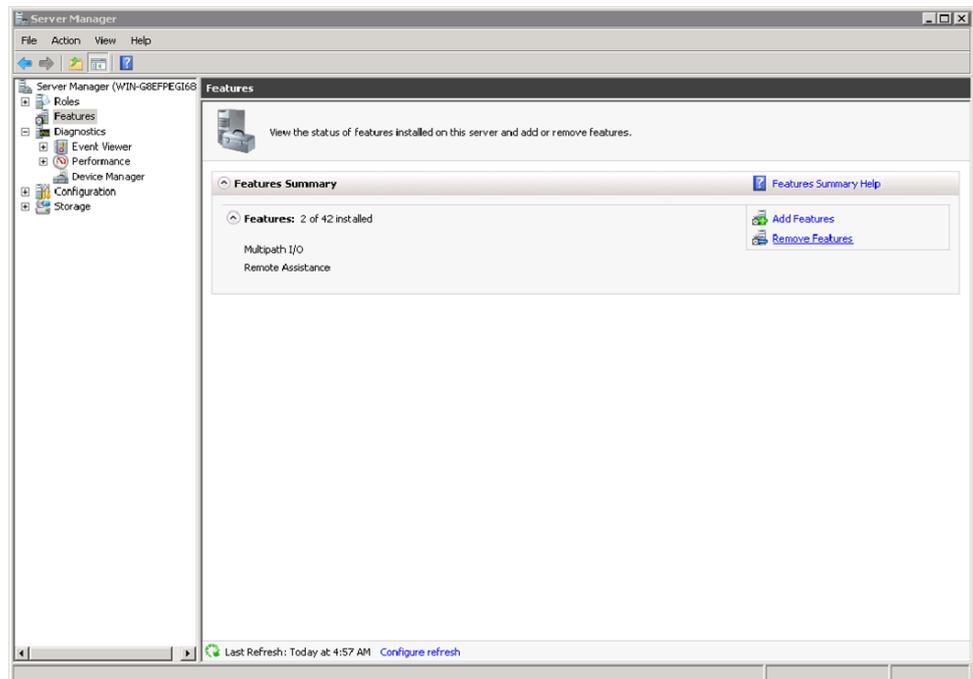
After UltraPath for Windows is uninstalled on Windows Server 2008 or Windows Server 2012, how can I manually remove the MPIO component?

Answer

When you install UltraPath for Windows on Windows Server 2008 or Windows Server 2012, the MPIO component is automatically installed. However, when you uninstall the software, the MPIO component needs to be manually uninstalled. Perform the following operations to manually uninstall the MPIO component:

- Windows Server 2008 R2:
 - a. In the left navigation tree of **Server Manager**, select **Features**, as shown in [Figure 4-1](#).

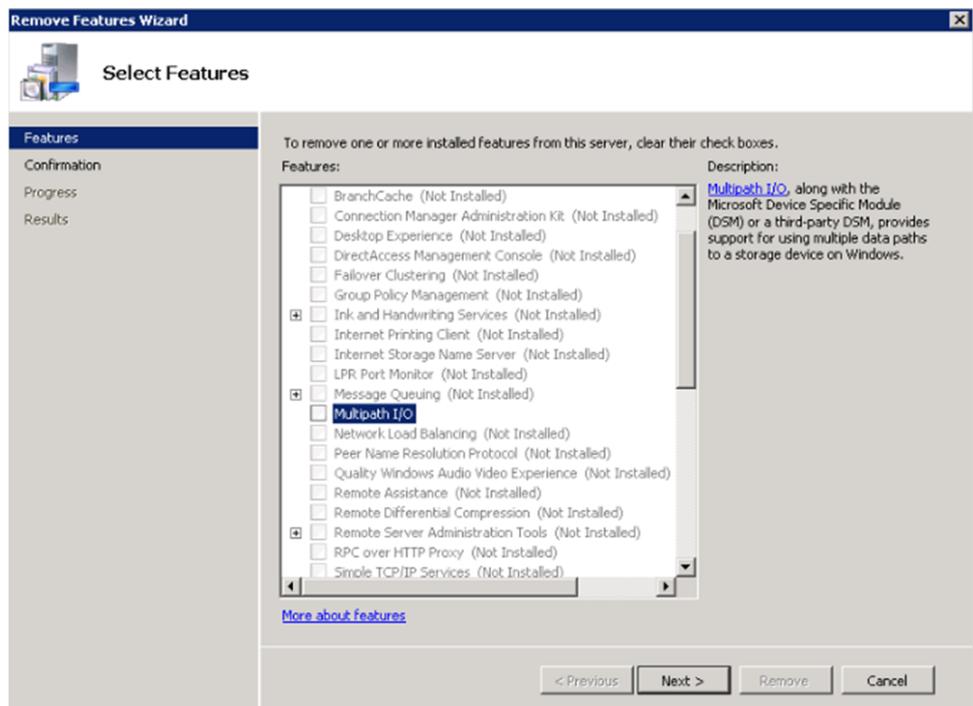
Figure 4-1 Server Manager page of Windows Server 2008 R2



- b. Click **Remove Features**.

The **Remove Features Wizard** dialog box is displayed, as shown in **Figure 4-2**.

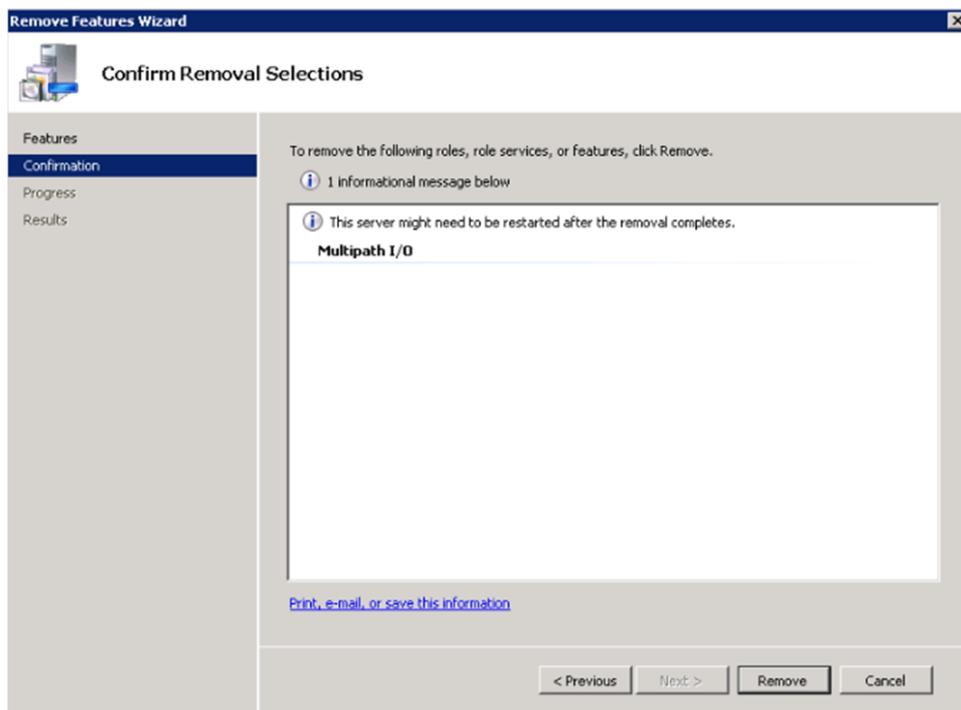
Figure 4-2 Remove Features Wizard dialog box



- c. Deselect **Multipath I/O** and click **Next**.

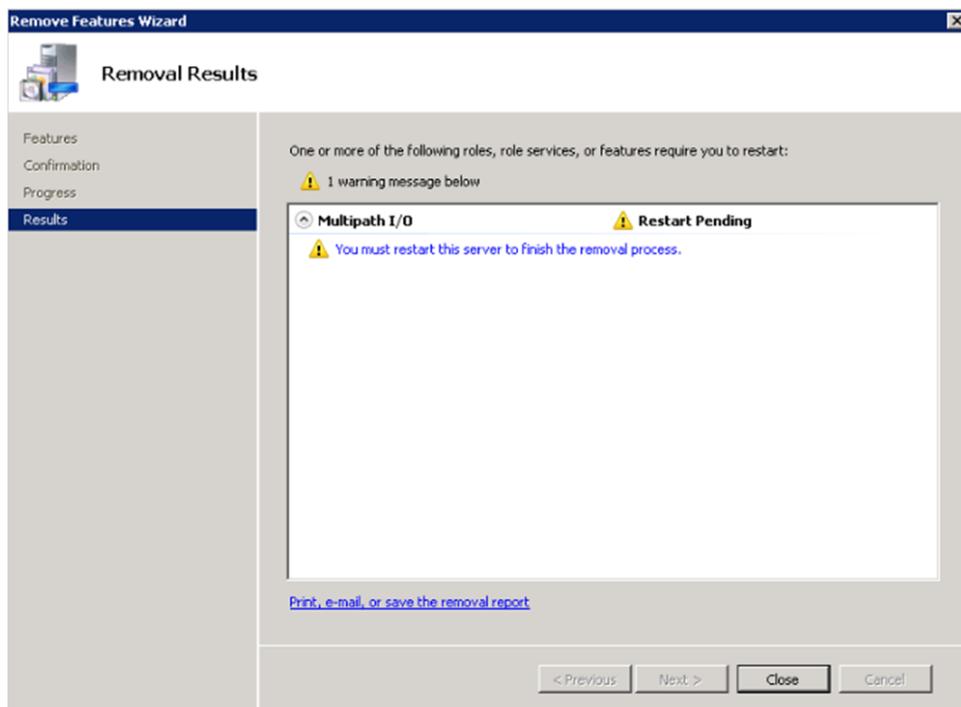
The **Confirm Removal Selections** page is displayed, as shown in **Figure 4-3**.

Figure 4-3 Confirm Removal Selections page



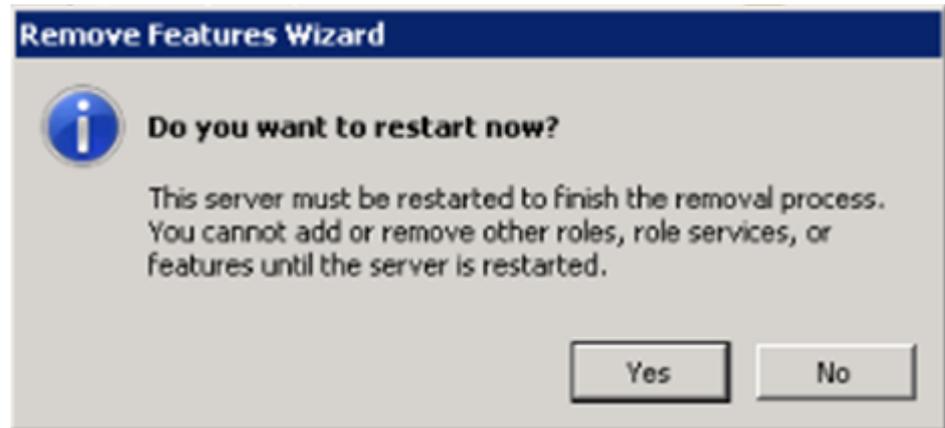
- d. After confirming the information, click **Remove** to start removing **Multipath I/O**. The restart instruction page is displayed, as shown in **Figure 4-4**.

Figure 4-4 Removal Results restart instruction page



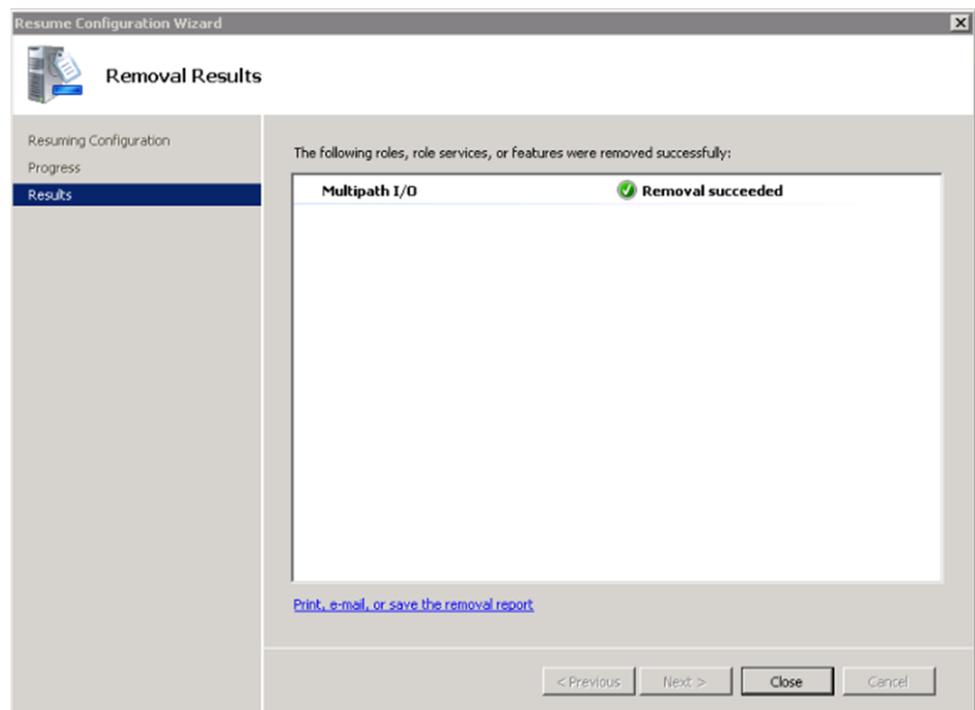
- e. Click **Close**. The restart instruction dialog box is displayed, as shown in **Figure 4-5**.

Figure 4-5 Remove Features Wizard restart instruction dialog box



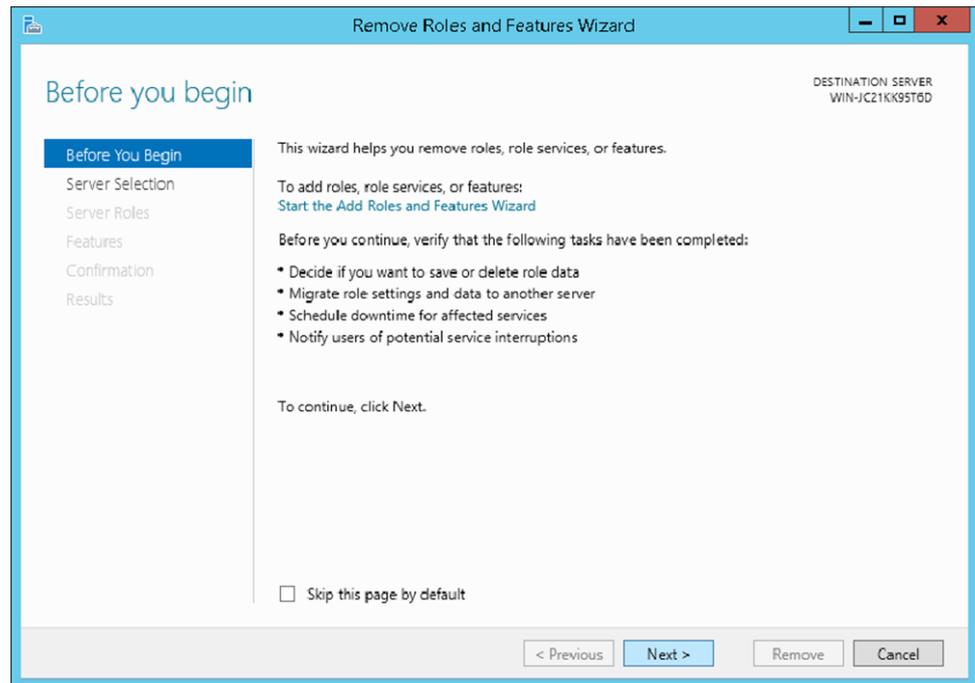
- f. Click **Yes** to restart the operating system.
After the operating system is restarted, **Multipath I/O** is removed, as shown in [Figure 4-6](#).

Figure 4-6 Removal Results page



- Windows Server 2012:
 - a. On the **Server Manager** menu bar, choose **ManageRemove Roles and Features**. The **Remove Roles and Features Wizard** dialog box is displayed, as shown in [Figure 4-7](#).

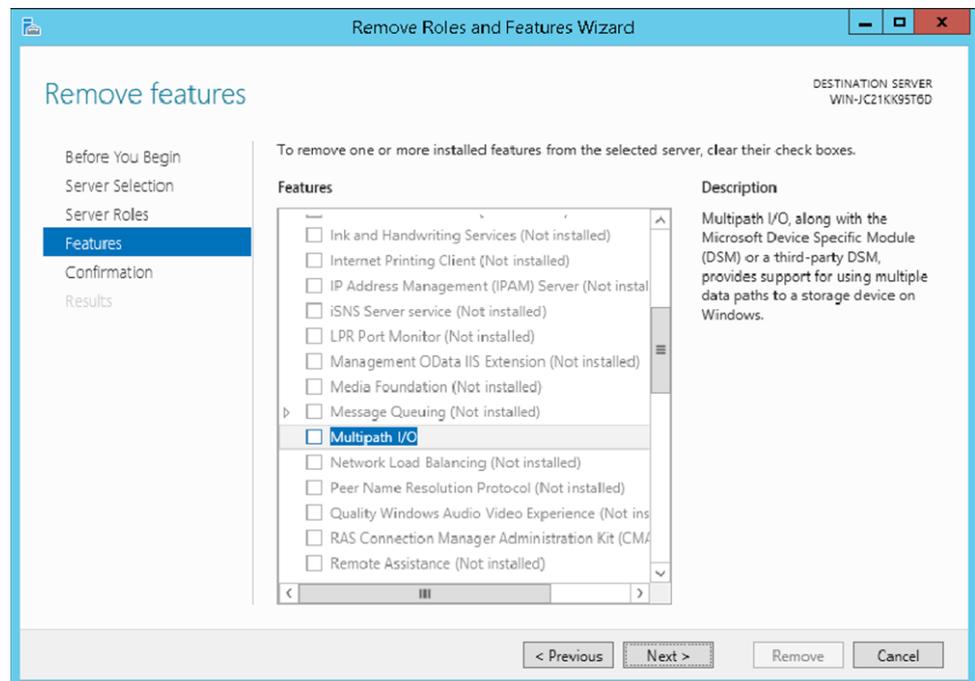
Figure 4-7 Remove Roles and Features Wizard dialog box



b. Click **Next**.

The **Remove features** page is displayed, as shown in [Figure 4-8](#).

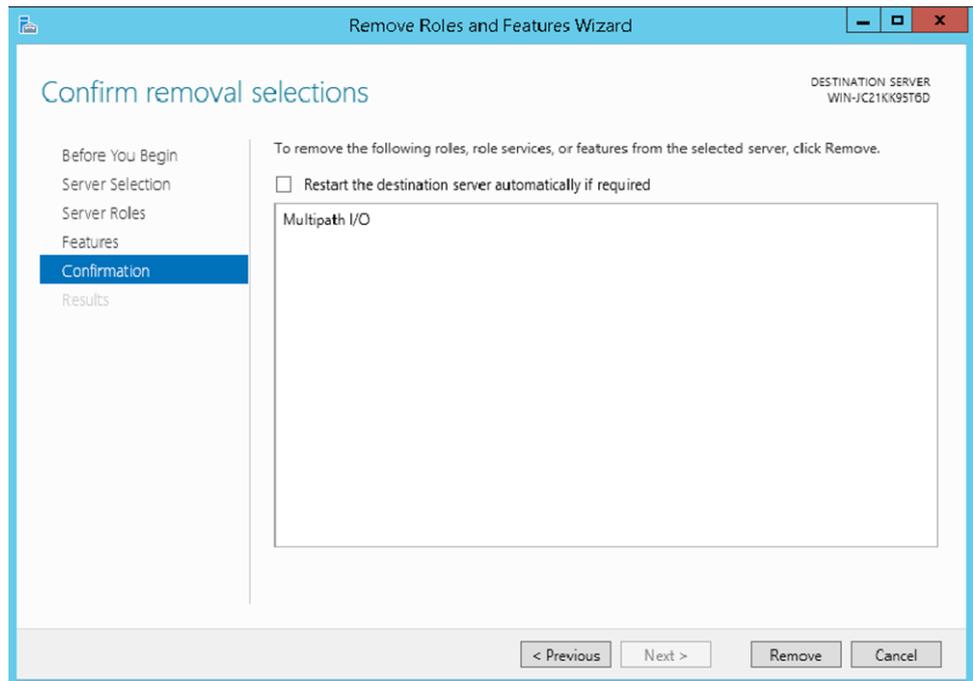
Figure 4-8 Remove features page



c. Deselect **Multipath I/O** and click **Next**.

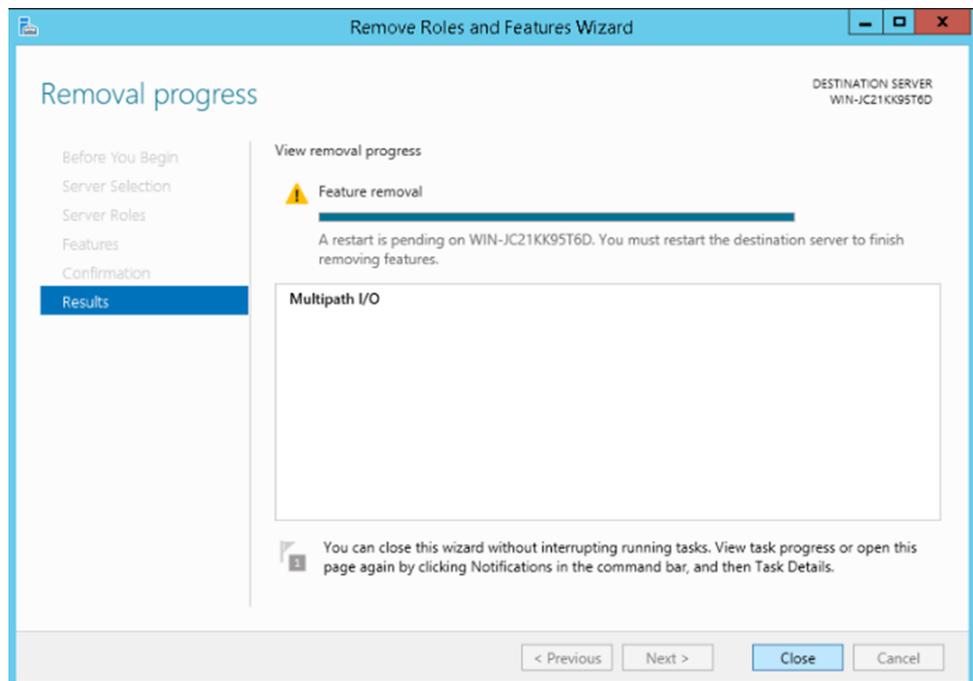
The **Confirm Removal Selections** page is displayed, as shown in [Figure 4-9](#).

Figure 4-9 Confirm Removal Selections page



- d. After confirming the information, click **Remove** to start removing **Multipath I/O**. The restart instruction page is displayed, as shown in [Figure 4-10](#).

Figure 4-10 Start page of SUSE operating system



- e. Click **Close**.
The MPIO component is cleared after the operating system restarts.

4.2 How to Correctly Change a LUN Mapping View on a Storage Array?

Question

How to correctly change a LUN mapping view on a storage array?

Answer

If you remove a LUN mapping on an array and add the LUN to the host again in a different mapping sequence, the corresponding **Host LUN ID** will change and a series of exceptions will be caused.

To rectify this fault, you must comply with the following steps to change the LUN mapping view.

Solution

1. Before removing the LUN mappings on the array, ask the administrator to stop the services running on the disk, namely, the LUN.
2. Delete the LUN mapping view on the GUI management page (ISM or DeviceManager) of the array.
3. Rescan Disks.
 - a. Open the **cmd** CLI and enter **diskmgmt.msc** to open the **Disk Management**
 - b. On the menu bar, choose **Action > Rescan Disks**.
4. Add the LUN mapping view on the GUI management page (ISM or DeviceManager) of the array.
5. Repeat step **3** to scan and detect disks.
6. Contact the administrator to start services.

4.3 What Can I Do If I Want to Configure the Path Where Files Pagefile and Dump Are Saved to a Path on Local Disks?

Question

What can I do if I want to configure the path where files **Pagefile** and **Dump** are saved to a path on local disks?

Answer

To ensure that the system can generate file **Dump** normally when bluescreen is displayed, you are advised to configure the path where files **Pagefile** and **Dump** are saved to a path on local

disks. The configuration method is as follows (the following uses Windows Server 2008 as an example):

1. Right-click the **Computer** icon on the desktop and choose **Properties** from the shortcut menu.

The **System** page is displayed.

2. Click **Advanced system settings**.

The **System Properties** dialog box is displayed.

3. Configure the path that saves file **Pagefile**.

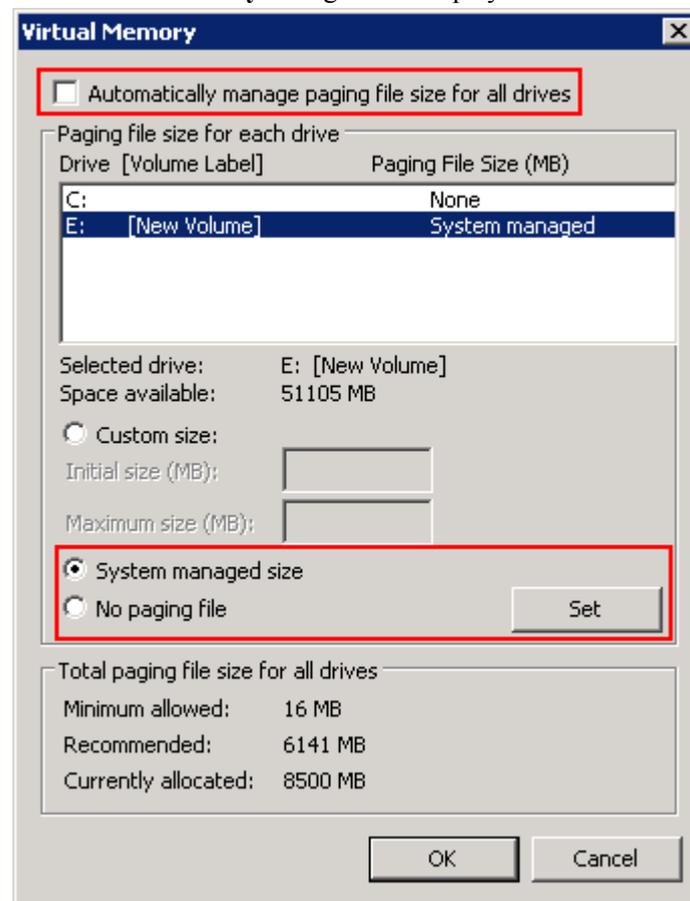
- a. Click the **Advanced** tab. In the **Performance** area of the tab page, click **Settings**.

The **Performance Options** dialog box is displayed.

- b. Click **Advanced**.

- c. In the **Virtual memory** area, click **Change**.

The **Virtual Memory** dialog box is displayed.



- d. Deselect **Automatically manage paging file size for all drives**.

- e. In the **Paging file size for each drive** area, select the disk on which file **Pagefile** will be saved, select **System managed size**, and click **Set**.

- f. Select the disk that used to save file **Pagefile** and **No paging file**, and click **Set**.

The **System Properties** dialog box is displayed.

- g. Click **Yes**.

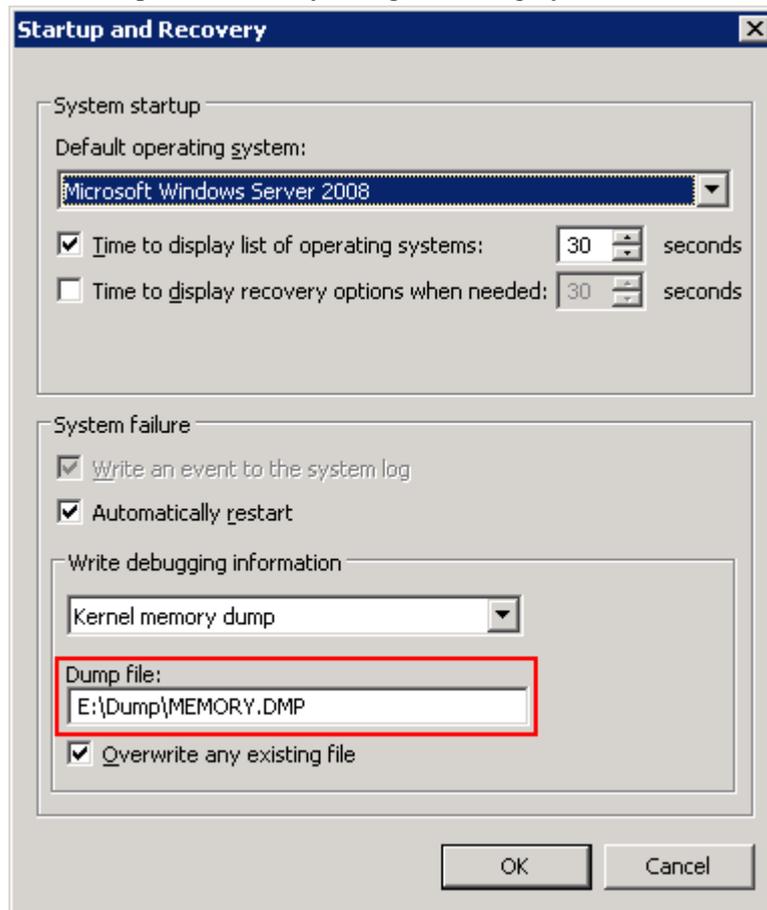
- h. Click **OK**. The path for saving file **Pagefile** is configured.

 **NOTE**

After the configuration, the system prompts that the configuration takes effect only after you restart the operating system. You are advised to restart the operating system after all operations are finished.

4. Configure the path that saves file **Dump**.
 - a. In the **System Properties** dialog box, click the **Advanced** tab.
 - b. In **Startup and Recovery**, click **Settings**.

The **Startup and Recovery** dialog box is displayed.



- c. In **Write debugging information**, configure the path that saves file **Dump**.
 - d. Click **OK**.

The **System Properties** dialog box is displayed.
 - e. Click **Yes** to complete the configuration.
5. **Optional:** For a Windows Server 2008 system, you must configure the registry after the previous operations.
 - a. Click **Start** and enter **Regedit** in the search box to open the registry.

The **Regedit Editor** page is displayed.
 - b. Choose **HKEY_LOCAL_MACHINE > SYSTEM > CurrentControlSet > Control > CrashControl**.
 - c. Right-click in the blank area on the right and choose **New > String Value** to create a registry file. Name the file **DedicatedDumpFile**.

- d. Double-click **DedicatedDumpFile**. Enter the **dedicateddumpfile.sys** path in **Value data**. For example, if file **Pagefile** is saved in disk E, enter **E:\dedicateddumpfile.sys** in **Value data**.
 - e. Click **OK** to complete the configuration.
6. Restart the operating system.

5 Troubleshooting Common Faults

About This Chapter

Faults may occur during the installation, configuration, and use of the UltraPath for windows. This chapter helps you troubleshoot common faults.

[5.1 Disk Paths Managed by The UltraPath is Deleted or High Response Times or No Response Due to Removing and Reinserting Cables](#)

On an iSCSI storage network, removing and reinserting cables when there is a certain amount of workload results in disk paths managed by The UltraPath is deleted or high response times or no response due to removing and reinserting cables.

[5.2 Preventing Ping-Pong Effect](#)

Ping-Pong Effect indicates that in the cluster networking the trespass of LUN working controller goes ceaseless.

[5.3 A Yellow Exclamatory Mark Is Displayed Beside a LUN Name](#)

A yellow exclamatory mark is displayed beside a physical LUN, MPIO virtual LUN, or UltraPath virtual LUN.

5.1 Disk Paths Managed by The UltraPath is Deleted or High Response Times or No Response Due to Removing and Reinserting Cables

On an iSCSI storage network, removing and reinserting cables when there is a certain amount of workload results in disk paths managed by The UltraPath is deleted or high response times or no response due to removing and reinserting cables.

Symptom

The server and storage devices are connected by iSCSI network. There is a certain amount of workload, removing and reinserting cables may cause disk paths managed by The UltraPath is deleted or high response times or no response.

Possible Causes

The possible reason is the immanent bug of iSCSI initiator.

Procedure

- method 1: Rescan hardware.
 - a. Open the **cmd** CLI and enter **devmgmt.msc** to open the **Device Manager**.
 - b. Please find **Disk drivers**, run **Action > Scan for hardware changes**.
 - c. Check whether the status become normal.
 - If yes, the procedure is complete.
 - If no, go to **method 2**.
- method 2: Reduce the amount of workload.

Check whether the status become normal.

 - If yes, the procedure is complete.
 - If no, go to **method 3**.
- method 3: Restart server.

Check whether the status become normal.

 - If yes, the procedure is complete.
 - If no, keep the fault environment intact and contact technical support engineers.

----End

5.2 Preventing Ping-Pong Effect

Ping-Pong Effect indicates that in the cluster networking the trespass of LUN working controller goes ceaseless.

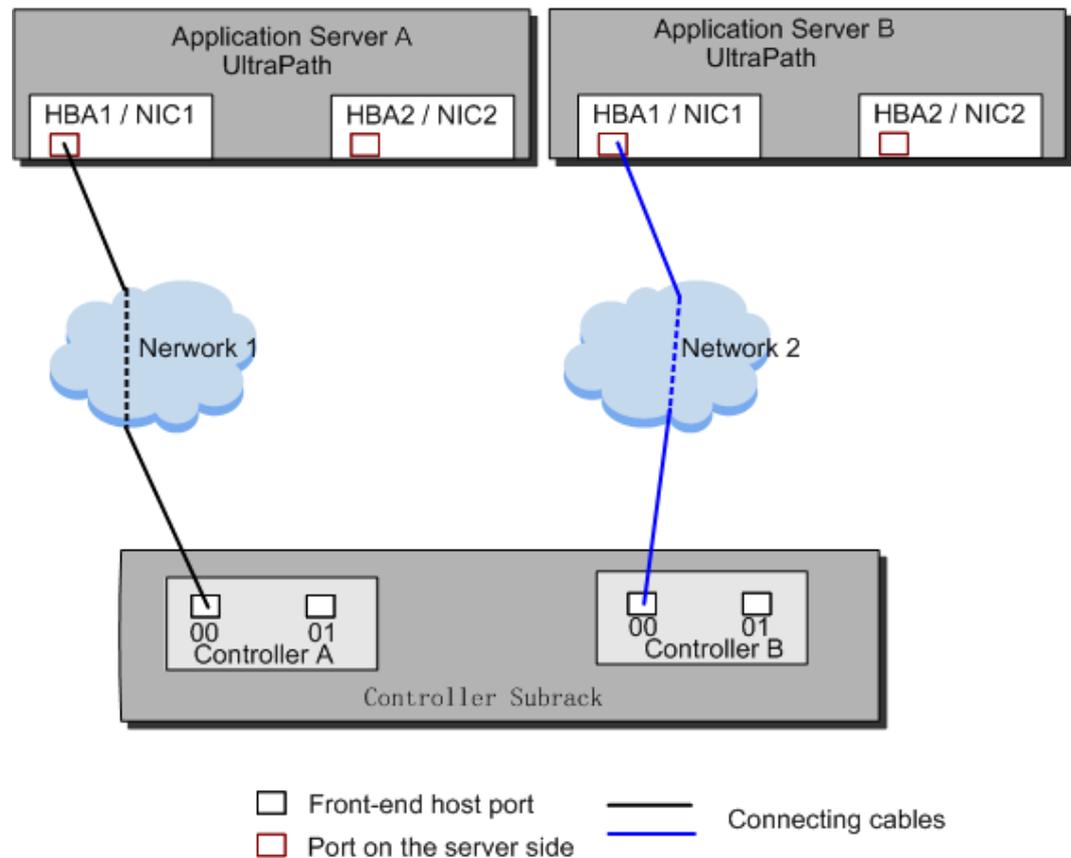
Symptom

For S5000 series and S2600 series Storage System, in the double switch cluster networking, after disconnecting a node to array controller's cable. The trespass of LUN working controller goes ceaseless, thus causes to performance influence.

Possible Causes

By default, the UltraPath opens the trespass between operating and owning controllers of the LUN. That is, when all the paths of the prior controller are faulty, the UltraPath sends the I/O to the owning controller, and use the owning controller of the LUN to replace the working controller. But in some cluster networking. For example, the cluster networking that uses load balancing: Two application servers are connected to two controllers of a storage system respectively and can access the same LUN, as shown in **Figure 5-1**.

Figure 5-1 Cluster networking that uses load balancing



In this cluster networking, the UltraPath on AS A tries to use controller A as the working controller of the LUN, whereas the UltraPath on AS B tries to use controller B as the working controller of the LUN. As a result, the trespass of working controller goes ceaseless between controller A and controller B.

Procedure

- Method One: Restore the disconnecting cables as soon as possible and ensure that there is cable each node to each controller of array.
- Method Two: Disable the trespass between operating and owning controllers of the LUN. Please see [A.3.10 Setting the Working Controller Trespass Policy for a LUN](#).

----End

5.3 A Yellow Exclamatory Mark Is Displayed Beside a LUN Name

A yellow exclamatory mark is displayed beside a physical LUN, MPIO virtual LUN, or UltraPath virtual LUN.

Symptom

- Symptom 1: When cables are rapidly and frequently inserted and removed, a yellow exclamation mark is displayed beside a physical LUN name, but UltraPath for Windows still works properly.
- Symptom 2: After a host is restarted due to the installation or upgrade of UltraPath for Windows, a yellow exclamation mark is displayed beside an MPIO virtual LUN on the **Device Manager** page.
- Symptom 3: When a LUN is being added or deleted, a yellow exclamation mark is displayed beside a physical LUN, MPIO LUN, or UltraPath LUN on the **Device Manager** page.

Possible Causes

Fault diagnosis

- Symptom 1: Physical devices have historical records on their operating systems. After a storage array is connected to a host, its operating system loads a disk-type driver for the storage array. However, UltraPath for Windows masks physical devices, so the disk-type driver fails to be loaded and a yellow exclamation mark is displayed.
- Symptoms 2 and 3: There is a low probability that driver loading encounters an anomaly after a LUN is added or deleted or a host is restarted.

Procedure

- Solution 1: Choose **Start > All Programs > UltraPath > Driver Update**. The driver is automatically updated.
- Solution 2: If the yellow exclamation mark is not cleared after you perform solution 1, right-click the device on the **Device Manager** page and choose **Disable**. Then click **Enable**.

NOTE

Do not use this tool when services are running. Otherwise, the services may be interrupted.

- Perform the two solutions and observe if the yellow exclamation mark is still displayed beside the MPIO virtual LUN. If the mark is not displayed, the fault has been rectified.

---End

A Commonly Used CLI Management Commands

The commonly used CLI management commands of UltraPath include basic operation commands, UltraPath management commands, and LUN management commands. General CLI commands used in operating systems are provided in this document as well.

This document describes commands used by customers when they use Huawei products to deploy and maintain a network.

Some advanced commands are used to implement a project or locate faults. Improper use of those commands may cause device exceptions or service interruptions. This document does not provide the advanced commands. If you need such commands, contact Huawei for help.

Some arrays do not support query of some information. Such information is displayed as -- in UltraPath.

[A.1 Command Conventions](#)

You are required to follow the format conventions when you use the CLI commands.

[A.2 Basic Operation Commands](#)

Basic operation commands are used to query details about commands, and about how to log in to or log out of the UltraPath management module.

[A.3 System Management Commands](#)

The UltraPath system management commands include common management commands and commands for advanced parameter settings.

[A.4 LUN Management Commands](#)

LUN management commands include commands for viewing storage system information and virtual disk information.

[A.5 UltraPath Other Commands](#)

Introduce UltraPath other commands that are excluded in above.

A.1 Command Conventions

You are required to follow the format conventions when you use the CLI commands.

Table A-1 lists the format conventions.

Table A-1 Command conventions

Convention	Description
Boldface	The keywords of a command line are in boldface . This part should stay unchanged and need to be entered as it is.
<i>Italic</i>	Command arguments are in <i>italics</i> . This part needs to be replaced with an actual value.
[]	Items (keywords or arguments) in brackets [] are optional.
{ x y ... }	Optional items are grouped in braces and separated by vertical bars. One item is selected.
[x y ...]	Optional items are grouped in brackets and separated by vertical bars. One item is selected or no item is selected.
{ x y ... }*	Optional items are grouped in braces and separated by vertical bars. A minimum of one item or a maximum of all items can be selected.
[x y ...]*	Optional items are grouped in brackets and separated by vertical bars. Several items or no item can be selected.

 **NOTE**

If the name of the disk array or LUN is in Chinese and the encoding format of the login tool is incorrect, garbled characters are displayed after the multipathing command is executed. Set the encoding format of the login tool.

A.2 Basic Operation Commands

Basic operation commands are used to query details about commands, and about how to log in to or log out of the UltraPath management module.

A.2.1 Logging in to the CLI

Function

If you need to manage the UltraPath or query its status, run the **upadm** command to log in to the CLI.

Format

upadm

Parameters

None

Level

User with **administrator** permissions

Usage Guidelines

The following uses **show version** as an example to show how to use **upadm** commands.

- Log in to the CLI and show the version of UltraPath.

```
# upadm
UltraPath CLI #0 >show version
Software Version : XX.XX.XXX
Driver Version : XX.XX.XXX
```

- Run the **upadm show version** command to view the version of UltraPath.

```
# upadm show version
Software Version : XX.XX.XXX
Driver Version : XX.XX.XXX
```

NOTE

If you directly use the command line in PowerShell to query the information about multiple objects, run the following command: **upadm show path id=0,1**. Keep the **id=0,1** parameter in a quotation mark. For example, run the following command: **upadm show path "id=0,1"**.

Example

Log in to the UltraPath CLI.

```
# upadm
UltraPath CLI #0 >
```

System Response

None

A.2.2 Exiting the CLI

Function

The **quit** command is used to exit the UltraPath CLI.

Format

quit

Parameters

None

Level

User with **administrator** permissions

Usage Guidelines

None

Example

Run the **quit** command to exit the CLI.

```
UltraPath CLI #3 >quit  
~ #
```

System Response

None

A.2.3 Help

Function

The **help** command is used to query all UltraPath commands and their formats and details.

Format

help

?

Parameters

None

Level

User with **administrator** permissions

Usage Guidelines

After logging in to the UltraPath CLI, you can run the **help** command to query UltraPath CLI commands.

Example

Run **help** to query all UltraPath commands. The following figure shows some commands.

```
UltraPath CLI #0 >help  
Usage: [OPTION]  
help [command] [subcommand]      -- Print help message.  
? [command] [subcommand]         -- Print help message.  
quit                               -- Quit UltraPath command line.  
show version                       -- Print version.  
... ..
```

System Response

None

A.3 System Management Commands

The UltraPath system management commands include common management commands and commands for advanced parameter settings.

A.3.1 Querying the Version of UltraPath

Function

The **show version** command is used to query the version of UltraPath.

Format

show version [verbose]

Parameters

Parameter	Description	Default Value
verbose	Used to query the UltraPath version information.	None

Level

User with **administrator** permissions

Usage Guidelines

The version of UltraPath can be queried only after the software is installed successfully.

- Run the **show version** command to query the information about UltraPath version and driver version.
- Run the **show version verbose** command to query the information about UltraPath version, driver version, and product version.

Example

- Run the **show version** command to query the information about UltraPath version and driver version.

```
UltraPath CLI #0 >show version
Software Version : XX.XX.XXX
Driver Version : XX.XX.XXX
```

- Run the **show version verbose** command to query the information about UltraPath version, driver version, and product version.

```
UltraPath CLI #0 >show version verbose
Software Version : XX.XX.XXX
Driver Version : XX.XX.XXX
Product Version : XX.X.X
```

System Response

None

A.3.2 Querying Configuration File Information

Function

The **show upconfig** command is used to query the configuration of UltraPath, including the working mode, load balancing policy, and LUN trespass function.

Format

show upconfig [**array_id=ID** | **vlun_id=ID**]

Parameters

Keyword and Parameter	Description	Default Value
array_id=ID	ID of a storage system. You can run show array without an ID to display all storage system IDs.	None
vlun_id=ID	ID of a virtual LUN. You can run show vlun type=all to display all virtual LUN IDs.	None

Level

User with **administrator** permissions

Usage Guidelines

- Run **show upconfig** to display all configuration information about UltraPath.
- Run **show upconfig array_id=ID** to check UltraPath configuration information about a specified storage system.
- Run the **show upconfig vlun_id=ID** command to check UltraPath configuration information about a specified virtual LUN.

Example

- Query all configuration information about UltraPath.

```
UltraPath CLI #2 >show upconfig
=====
UltraPath Configuration
=====
Basic Configuration
  Working Mode : load balancing within controller
```

```

LoadBalance Mode : min-queue-depth
Loadbanlance io threshold : 1
LUN Trespass : on

Advanced Configuration
  Io Retry Times : 10
  Io Retry Delay : 0
  Faulty path check interval : 10
  Idle path check interval : 60
  Failback Delay Time : 600
  Io Suspension Time : 60
  Max io retry timeout : 1800

Path reliability configuration
  Timeout degraded statistical time : 600
  Timeout degraded threshold : 1
  Timeout degraded path recovery time : 1800
  Intermittent I/O error degraded statistical time : 300
  Min. I/Os for intermittent I/O error degraded statistical : 5000
  Intermittent I/O error degraded threshold : 20
  Intermittent I/O error degraded path recovery time : 1800
  Intermittent fault degraded statistical time : 1800
  Intermittent fault degraded threshold : 3
  Intermittent fault degraded path recovery time : 3600
  High latency degraded statistical time : 300
  High latency degraded threshold : 1000
  High latency degraded path recovery time : 3600
  Sensitive delayed degraded threshold : 30000
  Sensitive delayed degraded recovery time : 120

HyperMetro configuration
  HyperMetro Primary Array SN : Not configured
  HyperMetro WorkingMode : read write within primary array
  HyperMetro Split Size : 128MB
  
```

- Query UltraPath configuration information about a specified storage system.

```

UltraPath CLI #0 >show upconfig array_id=0
=====
UltraPath Configuration
=====
Working Mode : load balancing within controller
LoadBalance Mode : round-robin
Loadbanlance io threshold : 1
LUN Trespass : on
Io Suspension Time : 60
Max io retry timeout : 1800
  
```

- Query UltraPath configuration information about a specified virtual LUN.

The virtual LUN whose ID is **1** is a common virtual LUN. The virtual LUN whose ID is **2** is a virtual HyperMetro LUN.

```

UltraPath CLI #0 >show upconfig vlun_id=1
=====
UltraPath Configuration
=====
Working Mode : load balancing within controller
LoadBalance Mode : round-robin
Loadbanlance io threshold : 1
LUN Trespass : on
Io Suspension Time : 60
Max io retry timeout : 1800
UltraPath CLI #3 >show upconfig vlun_id=2
=====
UltraPath Configuration
=====
Working Mode : load balancing within controller
LoadBalance Mode : min-task
Loadbanlance io threshold : 1
LUN Trespass : on
Io Suspension Time : 0
  
```

```
Max io retry timeout : 1800
HyperMetro Primary Array SN : 210235980510E8000015
HyperMetro WorkingMode : read write between both arrays
HyperMetro Split Size : 4KB
```

System Response

None

A.3.3 Querying Physical Path Information

Function

The **show path** command is used to query information about a specified or all physical paths, including the working status, owning storage system, owning controller, and owning HBA.

Format

```
show path [ id=ID1,ID2,... | array_id=ID ]
```

Parameters

Keyword and Parameter	Description	Default Value
id=ID1,ID2,...	ID of a physical path. You can run show path without an ID to display all physical path IDs. NOTE You can query a maximum of eight physical paths' performance statistics at a time. Use comas (,) to separate physical path IDs.	None
array_id=ID	ID of a storage system. You can run show array without an ID to display all storage system IDs.	None

Level

User with **administrator** permissions

Usage Guidelines

- Run the **show path** command to check the working status of all physical paths.

 **NOTE**

When the **show path** command is executed, you can only view the information about a maximum of eight paths on one controller.

- Run the **show path array_id=ID** command to check the working status of a specified storage system's physical paths.
- Run the **show path id=ID1,ID2,...** command to check the working status of a specified physical path.

Example

- Check the working status and path IDs of all physical paths.

```
UltraPath CLI #0 >show path
-----
Path ID      Initiator Port      Array Name      Controller      Target Port
Path State   Check State         Port Type      Port ID
0           2100001b32053e20   Huawei.Storage48  0B              20184846fb8ca15f
Normal      --                  FC              --
1           2100001b32053e20   Huawei.Storage48  0A              200b4846fb8ca15f
Normal      --                  FC              --
4           2100001b32055f20   Huawei.Storage48  0B              20194846fb8ca15f
Normal      --                  FC              --
5           2100001b32055f20   Huawei.Storage48  0A              20084846fb8ca15f
Normal      --                  FC              --
-----
Path ID      Initiator Port      Array Name      Controller      Target Port
Path State   Check State         Port Type      Port ID
2           2100001b32053e20   Huawei.Storage46  0B              24103400a30d9c5f
Normal      --                  FC              --
3           2100001b32053e20   Huawei.Storage46  0A              24003400a30d9c5f
Normal      --                  FC              --
6           2100001b32055f20   Huawei.Storage46  0B              24113400a30d9c5f
Normal      --                  FC              --
7           2100001b32055f20   Huawei.Storage46  0A              24013400a30d9c5f
Normal      --                  FC              --
-----
```

- Check the physical paths of the storage system whose ID is 0.

```
UltraPath CLI #0 >show path array_id=0
-----
Path ID      Initiator Port      Array Name      Controller      Target Port
Path State   Check State         Port Type      Port ID
0           2100001b32053e20   Huawei.Storage48  0B              20184846fb8ca15f
Normal      --                  FC              --
1           2100001b32053e20   Huawei.Storage48  0A              200b4846fb8ca15f
Normal      --                  FC              --
4           2100001b32055f20   Huawei.Storage48  0B              20194846fb8ca15f
Normal      --                  FC              --
5           2100001b32055f20   Huawei.Storage48  0A              20084846fb8ca15f
Normal      --                  FC              --
-----
```

- Check the working status of the physical path whose ID is 0.

```
UltraPath CLI #0 >show path id=0
=====
Path#0 Information
=====
Initiator Port : 2100001b32053e20
Array Name     : Huawei.Storage48
Controller     : 0B
Target Port    : 20184846fb8ca15f
Path State     : Normal
Check State    : --
Port Type      : FC
```

```

I/O Retry count : 0
Path Fault count: 0
Latency-Low(ms) : 0
Latency-High(ms): 2
Latency-avg(ms) : 0
Port ID         : --
=====
    
```

System Response

The following table explains some parameters in the command output:

Parameter	Description	Default Value
Path ID	ID of the physical path.	None
Initiator Port	Port of the initiator. NOTE For some arrays such as the S2600 and S5500, the initiator ports are displayed as the initiator port IDs in the SCSI address.	None
Target Port	Port of the target. NOTE For some arrays such as the S2600 and S5500, the initiator ports are displayed as the initiator port IDs in the SCSI address.	None
Controller	Name of a controller. NOTE If the controller name is followed by Remote information, the controller is a remote controller.	None

Parameter	Description	Default Value
Path State	<p>State of the physical path. Possible values are as follows:</p> <ul style="list-style-type: none"> ● Normal: The path is normal. ● Fault: The path is faulty. ● I/O discrete error degradation: The path is degraded due to discrete I/O errors. ● Intermittent failure degradation: The path is degraded due to intermittent failures. ● High latency degradation: The path is degraded due to high latency. ● I/O timeout degradation: The path is degraded due to I/O timeout. ● Potential fault degradation: The path is degraded due to potential fault. ● Disable: The path is disabled. 	None
Check State	<p>State check of a path. Possible values are as follows:</p> <ul style="list-style-type: none"> ● Checking: The path is being checked. ● Waiting: The path is waiting to be checked. ● Succeed: The path status check succeeded. ● Fail: The path status check failed. ● Ignore: The path status check is ignored. ● --: The path is not checked. 	None
I/O Retry Count	Number of I/O retry attempts.	None

Parameter	Description	Default Value
Path Fault Count	Number of times for which a path becomes faulty.	None
Port ID	Location of the port.	None

A.3.4 Resetting the Status of a Physical Path

Function

The **set phyathnormal** command is used to restore the working status of a degraded path to normal.

Format

set phyathnormal path_id=ID

Parameters

Keyword and Parameter	Description	Default Value
path_id=ID	ID of the physical path. You can run show path without an ID to display all physical path IDs.	None

Level

User with **administrator** permissions

Usage Guidelines

NOTE

You can perform the following operations to recover an unstable path degraded and isolated by UltraPath if the maintenance personnel have replaced the fault components and eliminated link faults. After the path is recovered, UltraPath will deliver I/Os to it. If you are not sure whether all link faults have been cleared, run the **start pathcheck** command to check the health status of the path. If the path passes the check, reset the path to normal.

Run the **set phyathnormal path_id=ID** command to restore specified degraded physical paths.

Example

Restore the working status of the path whose ID is **1** to normal.

```
UltraPath CLI #2 >set phyathnormal path_id=1
```

```
Please check whether the fault has been rectified. If the fault persists and you
forcibly recover the path, the performance may be decreased.
Are you sure you want to continue? [y,n]: y

Succeeded in executing the command.
```

System Response

None

A.3.5 Setting the Status of a Physical Path

Function

The **set pathstate** command is used to enable or disable a specified physical path.

Format

```
set pathstate={ enable | disable } path_id=ID
```

Parameters

Keyword and Parameter	Description	Default Value
{ enable disable }	Enabling or disabling a physical path. The value is either enable or disable. <ul style="list-style-type: none"> ● enable: enables a physical path. ● disable: disables a physical path. 	enable
path_id=ID	ID of a physical path. You can run show path without an ID to display all physical path IDs.	None

Level

User with **administrator** permissions

Usage Guidelines



NOTICE

- Once the command is run, UltraPath will not choose this path to deliver I/O.
 - Only OceanStor T series V100R005 or later storage systems using Fibre Channel networks support this command.
 - If a controller module is disabled by running the **set tpgstate** command, you cannot run the **set pathstate** command to change the status of the controller's path.
-
- When you replace an HBA, run the **set pathstate=disable path_id=ID** command to disable the designated physical path. UltraPath will switch I/Os smoothly to other physical paths.
 - When the HBA is replaced, run the **set pathstate=enable path_id=ID** command to enable the physical path mentioned earlier.

Example

Enable the physical path whose ID is 0.

```
UltraPath CLI #3 >set pathstate=enable path_id=0  
Succeeded in executing the command.
```

System Response

None

A.3.6 Clearing Statistics About Physical Paths

Function

The **clear path_statistic** command can be used to clear statistics about all or specific physical paths, including I/O Retry count, Path Fault count, Latency-Low, Latency-High, and Latency-avg.

Format

```
clear path_statistic [ path_id=ID1,ID2,... | array_id=ID1,ID2,... ]
```

Parameters

Parameter	Description	Default Value
path_id=ID1,ID2,...	<p>ID of a physical path.</p> <p>You can run show path without parameters to obtain all physical path IDs.</p> <p>NOTE</p> <p>You can clear statistics about eight physical paths at most at a time. To clear statistics about multiple physical paths, use comma (,) to separate the path IDs.</p>	None
array_id=ID1,ID2,...	<p>Storage array ID.</p> <p>You can run the show array command without parameters to obtain IDs of storage arrays.</p> <p>NOTE</p> <p>You can clear statistics about physical paths of eight storage arrays at most at a time. To clear statistics about physical paths of multiple storage arrays, use comma (,) to separate the storage array IDs.</p>	None

Level

User **administrator**

Usage Guidelines

- Run **clear path_statistic** to clear statistics about all physical paths.
-  **NOTE**
- When **clear path_statistic** is used, statistics about at most eight paths of a controller can be cleared.
- Run **clear path_statistic path_id=ID1,ID2,...** to clear statistics about specific physical paths.
 - Run **clear path_statistic array_id=ID1,ID2,...** to clear statistics about physical paths of specific storage arrays.

Example

- Clear statistics about all physical paths.
- ```
UltraPath CLI #0 >clear path_statistic
Statistics of all paths cleared successfully.
```
- Clear statistics about the physical path whose ID is **0**.

```
UltraPath CLI #0 >clear path_statistic path_id=0
Statistics of all specified paths cleared successfully.
```

- Clear statistics about physical paths of storage array whose ID is **0**

```
UltraPath CLI #0 >clear path_statistic array_id=0
Statistics of all specified arrays cleared successfully.
```

## A.3.7 Setting a Controller's Paths

### Function

The **set tpgstate** command is used to enable or disable the paths of a specified controller.

### Format

```
set tpgstate={ enable | disable } array_id=ID tpg_id=ID
```

### Parameters

| Keyword and Parameter   | Description                                                                                                                                                                                                                          | Default Value |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <i>enable   disable</i> | Enabling or disabling a controller's path.<br>Possible values are enable or disable.<br><ul style="list-style-type: none"> <li>● enable: enables a controller's paths.</li> <li>● disable: disables a controller's paths.</li> </ul> | enable        |
| <b>array_id=ID</b>      | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs.                                                                                                                            | None          |
| <b>tpg_id=ID</b>        | ID of a controller.                                                                                                                                                                                                                  | None          |

### Level

User with **administrator** permissions

### Usage Guidelines



#### NOTICE

- Once the command is run, UltraPath will not choose this path to deliver I/O.
- After the replacement or maintenance, you can run the command again to enable the paths of the controller, increasing redundancy and balancing controller workload.

When changing the controller of a storage system or before powering off the controller for maintenance, you can run this command to disable paths of the controller. After the paths are disabled, UltraPath smoothly switches I/Os over to other controller's paths, preventing I/O latency caused by failback.

## Example

Enable the paths of controller **0A** of the storage system whose ID is **0**.

```
UltraPath CLI #12 >set tpgstate=enable array_id=0 tpg_id=0A
Succeeded in executing the command.
```

## System Response

None

## A.3.8 Setting Working Mode for UltraPath

### Function

The **set workingmode** is used to set cross-controller or intra-controller load balancing of UltraPath.

### Format

```
set workingmode={0|1} [array_id=ID | vlun_id={ ID | ID1,ID2... | ID1-ID2 }]
```

### Parameters

| Keyword and Parameter     | Description                                                                                                                                                                                                                                                                                                                                                                                      | Default Value |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>workingmode</b> ={0 1} | <p>Load balancing mode of UltraPath.</p> <p>The value can be <b>0</b> or <b>1</b>.</p> <ul style="list-style-type: none"> <li>● <b>0</b>: cross-controller load balancing mode. That is, I/Os are delivered through paths of all controllers.</li> <li>● <b>1</b>: intra-controller load balancing mode. That is, I/Os are delivered through paths of the current working controller.</li> </ul> | 1             |
| <b>array_id</b> =ID       | <p>ID of a storage system.</p> <p>You can run <b>show array</b> without an ID to display all storage system IDs.</p>                                                                                                                                                                                                                                                                             | None          |

| Keyword and Parameter                                                        | Description                                                                                   | Default Value |
|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------|
| <b>vlun_id</b> ={ <i>ID</i>   <i>ID1</i> , <i>ID2</i> ...   <i>ID1-ID2</i> } | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs. | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

If cross-controller load balancing mode is used, UltraPath does not distinguish between preferred and non-preferred working controllers of a LUN and uses all paths to deliver I/Os. For an OceanStor storage system with asymmetric active-active controllers, I/Os are forwarded between controllers, increasing I/O processing latency. Therefore, cross-controller load balancing is recommended only when the performance bottleneck lies in the transfer paths between a host and the storage system.

- Run **set workingmode={0|1}** to set working mode for all storage systems.
- Run **set workingmode={0|1} array\_id=ID** to set a working mode for a specified storage system.
- **set workingmode={0|1} vlun\_id={ ID | ID1,ID2... | ID1-ID2 }** to set a working mode for a specified virtual LUN.

### NOTE

- **vlun\_id=ID**: ID of a single virtual LUN.
- **vlun\_id=ID1,ID2...**: IDs of multiple virtual LUNs which are not necessarily related.
- **vlun\_id=ID1-ID2**: IDs of all the virtual LUNs from ID1 to ID2.

## Example

- Set the working mode of the storage system whose ID is **0** to **Cross-controller load balancing**.

```
UltraPath CLI #2 >set workingmode=0 array_id=0
```

```
The current configuration will overwrite the configuration of all VLUNs in this array.
```

```
Are you sure you want to continue? [y,n]: y
```

```
Succeeded in executing the command.
```

- Set the working mode of the LUN whose ID is **0** to **Cross-controller load balancing**.

```
UltraPath CLI #3 >set workingmode=0 vlun_id=0
```

```
Succeeded in executing the command.
```

## System Response

None

## A.3.9 Setting a Load Balancing Mode

## Function

The **set loadbalancemode** command is used to set a load balancing mode for UltraPath.

## Format

**set loadbalancemode**={ *round-robin* | *min-queue-depth* | *min-task* } [ **array\_id**=*ID* | **vlun\_id**={ *ID* | *ID1,ID2...* | *ID1-ID2* } ]

## Parameters

| Keyword and Parameter                                              | Description                                                                                                                                                                                                                                              | Default Value   |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <i>round-robin</i>   <i>min-queue-depth</i>   <i>min-task</i> }    | Load balancing mode.<br><ul style="list-style-type: none"> <li>● <i>round-robin</i>: round-robin load balancing</li> <li>● <i>min-queue-depth</i>: minimum queue depth load balancing</li> <li>● <i>min-task</i>: minimum task load balancing</li> </ul> | min-queue-depth |
| <b>array_id</b> = <i>ID</i>                                        | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs.                                                                                                                                                | None            |
| <b>vlun_id</b> ={ <i>ID</i>   <i>ID1,ID2...</i>   <i>ID1-ID2</i> } | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.                                                                                                                                                            | None            |

## Level

User with **administrator** permissions

## Usage Guidelines

- Before resetting the load balancing mode, you are advised to run the **show upconfig** command to query the current load balancing mode. The load balancing modes are described as follows:
  - To set the load balancing mode to minimum task, run the **set loadbalancemode round-robin** command to set the load balancing mode to **round-robin**. When an application server delivers I/Os to a storage system, UltraPath sends the first set of I/Os through path 1 and second set of I/Os through path 2, and so on. Paths are used in turn to ensure that each path is fully utilized. When an application server delivers I/Os to a storage system, the minimum I/O queue takes precedence over other queues in I/O sending.
  - To set the load balancing mode to minimum task, run the **set loadbalancemode min-queue-depth** command to set the load balancing policy to **min-queue-depth**. In

this mode, UltraPath calculates the number of waiting I/Os on each path in real time, and then delivers new I/Os to the path with the minimum waiting I/Os.

- To set the load balancing mode to minimum task, run the **set loadbalancemode min-task** command to set the load balancing policy to **min-task**. In this mode, UltraPath calculates the number of waiting I/Os on each path and the data block size of each I/O in real time. Then UltraPath delivers new I/Os to the path with the lightest load.
- Run **set loadbalancemode={ round-robin | min-queue-depth | min-task } array\_id=ID** to set a load balancing mode for a specified storage system.
- Run **set loadbalancemode={ round-robin | min-queue-depth | min-task } vlun\_id={ ID | ID1,ID2... | ID1-ID2 }** to set a load balancing mode for a specified virtual LUN.

#### NOTE

- **vlun\_id=ID**: ID of a single virtual LUN.
- **vlun\_id=ID1,ID2...**: IDs of multiple virtual LUNs which are not necessarily related.
- **vlun\_id=ID1-ID2**: IDs of all the virtual LUNs from ID1 to ID2.

## Example

Set the load balancing mode of the storage system whose ID is **0** to **round-robin**.

```
UltraPath CLI #3 >set loadbalancemode=round-robin array_id=0

The current configuration will overwrite the configuration of all VLUNs in this array.
Are you sure you want to continue? [y,n]: y

Succeeded in executing the command.
```

## System Response

None

## A.3.10 Setting the Working Controller Trespass Policy for a LUN

### Function

The **set luntrespass** command is used to set the working controller trespass policy for a LUN.

### Format

```
set luntrespass={ on | off } [array_id=ID | vlun_id={ ID | ID1,ID2... | ID1-ID2 }]
```

## Parameters

| Keyword and Parameter                                              | Description                                                                                                                                                                                                                                                                           | Default Value |
|--------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <i>on</i>   <i>off</i>                                             | Working controller trespass policy of a LUN.<br>The value is either <b>on</b> or <b>off</b> .<br><ul style="list-style-type: none"> <li>● <b>on</b>: Enables working controller trespass for a LUN.</li> <li>● <b>off</b>: Disables working controller trespass for a LUN.</li> </ul> | on            |
| <i>array_id= ID</i>                                                | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs.                                                                                                                                                                             | None          |
| <b>vlun_id</b> ={ <i>ID</i>   <i>ID1,ID2...</i>   <i>ID1-ID2</i> } | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.                                                                                                                                                                                         | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

For an OceanStor storage system with asymmetric active-active controllers, UltraPath for Linux switches the working controller of a LUN when switching links, ensuring that I/Os are directly delivered to the working controller. However, when multiple hosts (for example, an active-active host cluster) access the same LUN of an OceanStor S5000 series storage system, the hosts may contend for the working controller and result in frequent working controller trespass (or "ping pong" trespass). Ping-pong trespass severely decreases performance. To prevent this problem, you are advised to disable the working controller trespass function in this case.

- Run the **set luntrespass**={ *on* | *off* } command to set all storage system LUN switches.
- Run **set luntrespass**={ *on* | *off* } **array\_id**=*ID* to set the LUN switches of a specified storage system.
- Run **set luntrespass**={ *on* | *off* } **vlun\_id**={ *ID* | *ID1,ID2...* | *ID1-ID2* } to set the LUN switches of a specified virtual LUN.

### NOTE

- **vlun\_id**=*ID*: ID of a single virtual LUN.
- **vlun\_id**=*ID1,ID2...*: IDs of multiple virtual LUNs which are not necessarily related.
- **vlun\_id**=*ID1-ID2*: IDs of all the virtual LUNs from ID1 to ID2.

## Example

Set the LUN working controller trespass of the storage system whose ID is **0** to **on**.

```
UltraPath CLI #3 >set luntrespass=on array_id=0

The current configuration will overwrite the configuration of all VLUNs in this array.
Are you sure you want to continue? [y,n]: y

Succeeded in executing the command.
```

## System Response

None

## A.3.11 Setting Failback Delay

### Function

The **set failbackdelaytime** command is used to set failback delay.

### Format

**set failbackdelaytime**=*time*

### Parameters

| Keyword and Parameter | Description                                                               | Default Value |
|-----------------------|---------------------------------------------------------------------------|---------------|
| <i>time</i>           | Failback delay.<br>The value ranges from 0 to 3600, expressed in seconds. | 600           |

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Set failback delay to 600 seconds.

```
UltraPath CLI #2 >set failbackdelaytime=600
Succeeded in executing the command.
```

## System Response

None

## A.3.12 Querying I/O Count Information

### Function

The **show io\_count** command is used to query the I/O count of all virtual LUNs or on logical paths of the specified virtual LUNs. The I/O count information includes the error I/O count, queue I/O count, error command count, and queue command count.

### Format

**show io\_count** [ **vlun\_id=ID1,ID2,...**]

### Parameters

| Parameter                  | Description                                                                                                                                                                                                                                                                                                                                                                                                 | Default Value |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>vlun_id=ID1,ID2,...</b> | <p>ID of a virtual LUN</p> <p>If you run <b>show vlun</b> without specifying any parameters, all virtual LUN IDs can be obtained.</p> <p>You can run <b>show io_count</b> with this parameter to query the I/O count on the logical paths of these virtual LUNs.</p> <p><b>NOTE</b></p> <p>You can query a maximum of eight virtual LUNs at a time. Use commas (,) to separate IDs of the virtual LUNs.</p> | None          |

### Level

User with **administrator** permissions

### Usage Guidelines

- Run **show io\_count** to obtain the I/O count information of all virtual LUNs.
- Run **show io\_count vlun\_id=ID1,ID2,...** to query the I/O count information on logical paths of the specified virtual LUNs.

### Example

- Query the I/O count information of all virtual LUNs.

```
UltraPath CLI #3 >show io_count

Vlun ID Disk Name Error I/O Count Queue I/O Count Error Command
Count Queue Command Count
 2 AIX198Lun_001 2 0
 4 0
```

```

 3 AIX198Lun_002 0 0
0


```

- Query the I/O count information on logical paths of the specified virtual LUNs.

```

UltraPath CLI #3 >show io_count vlun_id=2

Vlun ID Disk Name Path ID Error I/O Count Queue I/O Count Error
Command Count Queue Command Count
 2 AIX198Lun_001 0 1 0
2 0
 2 AIX198Lun_001 1 1 0
2 0


```

## System Response

None

## A.3.13 Clearing I/O Count Information

### Function

The **clear io\_count** command is used to clear I/O count information.

### Format

**clear io\_count**

### Parameters

None

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Clear I/O count information.

```

UltraPath CLI #3 >clear io_count
Succeeded in executing the command.

```

## System Response

None

## A.3.14 Querying I/O Latency Information

## Function

The **show io\_latency** command is used to query the latest I/O latency, max I/O latency, and average I/O latency of all virtual LUNs or on the logical paths of the specific virtual LUNs.

## Format

**show io\_latency** [ **vlun\_id=ID1,ID2,...**]

## Parameters

| Parameter                  | Description                                                                                                                                                                                                                                                                                                                                                                                                     | Default Value |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>vlun_id=ID1,ID2,...</b> | <p>ID of a virtual LUN</p> <p>If you run <b>show vlun</b> without specifying any parameters, all virtual LUN IDs can be obtained.</p> <p>You can run <b>show io_latency</b> with this parameter to query the I/O latency on the logical paths of these virtual LUNs.</p> <p><b>NOTE</b></p> <p>You can query a maximum of eight virtual LUNs at a time. Use commas (,) to separate IDs of the virtual LUNs.</p> | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

- Run **show io\_latency** to obtain the I/O latency information of all virtual LUNs.
- Run **show io\_latency vlun\_id=ID1,ID2,...** to query the I/O count information on the logical paths of the specified virtual LUNs.

## Example

- Query the I/O latency information of all virtual LUNs.

```
UltraPath CLI #3 >show io_latency

Vlun ID Disk Name Latest I/O Latency Max I/O Latency Average I/O
Latency
 2 AIX198Lun_001 0 10
0
 3 AIX198Lun_002 0 100
0


```

- Query the I/O latency information on the logical paths of the specific virtual LUNs.

```
UltraPath CLI #3 >show io_latency vlun_id=2

Vlun ID Disk Name Path ID Latest I/O Latency Max I/O Latency
Average I/O Latency
 2 AIX198Lun_001 0 0 0
10 0
 2 AIX198Lun_001 1 0 0
10 0

```

## System Response

None

## A.3.15 Setting I/O Latency Threshold

### Function

The **set io\_latency\_threshold** command is used to set the I/O latency threshold. If the average I/O latency in one minute exceeds this threshold, a critical event about long I/O latency will be recorded.

### Format

**set io\_latency\_threshold**=*time*

### Parameters

| Parameter   | Description                                                                            | Default Value |
|-------------|----------------------------------------------------------------------------------------|---------------|
| <i>time</i> | I/O latency threshold<br>The value ranges from 0 to 120000, expressed in milliseconds. | 20            |

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Set the I/O latency threshold to 30 milliseconds.

```
UltraPath CLI #3 >set io_latency_threshold=30
Succeeded in executing the command.
```

## System Response

None

## A.3.16 Querying I/O Latency Threshold

### Function

The **show io\_latency\_threshold** command is used to query the I/O latency threshold.

### Format

```
show io_latency_threshold
```

### Parameters

None

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Query the I/O latency threshold.

```
UltraPath CLI #3 >show io_latency_threshold
io_latency_threshold : 20
```

## System Response

None

## A.3.17 Setting I/O Retry Times and Interval

### Function

The **set ioretry** command is used to set the number of I/O retries and an I/O retry interval.

### Format

```
set ioretry=number ioretrydelay=time
```

## Parameters

| Keyword and Parameter    | Description                                                                    | Default Value |
|--------------------------|--------------------------------------------------------------------------------|---------------|
| <b>ioretry=number</b>    | Number of I/O retry times.<br>The value ranges from 0 to 60.                   | 10            |
| <b>ioretrydelay=time</b> | Interval of I/O retry.<br>The value ranges from 0 to 10, expressed in seconds. | 0             |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

Increasing I/O retry times and retry interval can reduce the service interruption rate when intermittent path disconnection occurs, but it also prolongs service blockage. Therefore, set the two parameters based your service needs.

## Example

Set the I/O retry times to 3 and retry interval to 10 seconds.

```
UltraPath CLI #8 >set ioretry=3 ioretrydelay=10
Succeeded in executing the command.
```

## System Response

None

## A.3.18 Setting the I/O Suspension Time

### Function

The **set iosuspensiontime** command is used to set the I/O suspension time.

### Format

```
set iosuspensiontime=time [array_id=ID | vlun_id={ ID | ID1,ID2... | ID1-ID2 }]
```

## Parameters

| Keyword and Parameter                                              | Description                                                                                               | Default Value |
|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------|
| <b>iosuspensiontime</b> = <i>time</i>                              | I/O suspension time.<br>The value ranges from 0 to 2,592,000, expressed in seconds.                       | 60            |
| <b>array_id</b> = <i>ID</i>                                        | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs. | None          |
| <b>vlun_id</b> ={ <i>ID</i>   <i>ID1,ID2...</i>   <i>ID1-ID2</i> } | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.             | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

- Runset **iosuspensiontime**=*time* to set the I/O suspension time for all storage systems.
- Runset **iosuspensiontime**=*time* **array\_id**=*ID* to set the I/O suspension time for a specified storage system.
- Runset **iosuspensiontime**=*time* **vlun\_id**={ *ID* | *ID1,ID2...* | *ID1-ID2* } to set the I/O suspension time for a specified virtual LUN.

### NOTE

- **vlun\_id**=*ID*: ID of a single virtual LUN.
- **vlun\_id**=*ID1,ID2...*: IDs of multiple virtual LUNs which are not necessarily related.
- **vlun\_id**=*ID1-ID2*: IDs of all the virtual LUNs from ID1 to ID2.

## Example

On the CLI, run **upadmin** to go to the command management page. Then set the I/O suspension time of all storage systems to 60 seconds.

```
UltraPath CLI #8 >set iosuspensiontime=60
Succeeded in executing the command.
```

## System Response

None

## A.3.19 Checking a Physical Path's Status

## Function

The **start pathcheck** command is used to check the working status of a specified physical path.

## Format

**start pathcheck path\_id=ID1,ID2,...**

## Parameters

| Keyword and Parameter      | Description                                                                                            | Default Value |
|----------------------------|--------------------------------------------------------------------------------------------------------|---------------|
| <b>path_id=ID1,ID2,...</b> | ID of a physical path.<br>You can run <b>show path</b> without an ID to display all physical path IDs. | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

If you are not sure whether all link faults have been cleared, run the **start pathcheck** command to check the health status of the path. If the path passes the check, reset the path to normal.

## Example

Check the working status of the physical path whose ID is **0**.

```
UltraPath CLI #1 >start pathcheck path_id=0

The path check will last about 3 minutes and will consume some bandwidth
resources.
Are you sure you want to continue? [y,n]: y

Check path command send on all pathes successfully, use "show path"command to
investigate the check result.
```

## System Response

None

## A.3.20 Setting a Time Window for I/O Timeout Isolation

### Function

The **set tod\_time** command is used to set a time window for path degradation and isolation upon an I/O timeout.

## Format

**set tod\_time**=*time*

## Parameters

| Keyword and Parameter | Description                                                                                                                         | Default Value |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Time window for path degradation and isolation upon an I/O timeout.<br>The value ranges from 60 to 2,592,000, expressed in seconds. | 600           |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the time window for path degradation and isolation upon an I/O timeout to 600 seconds.

```
UltraPath CLI #1 >set tod_time=600
Succeeded in executing the command.
```

## System Response

None

## A.3.21 Setting a Timeout Threshold for Path Degradation and Isolation

### Function

The **set tod\_threshold** command is used to set a timeout threshold for path degradation and isolation.

### Format

**set tod\_threshold**=*number*

## Parameters

| Keyword and Parameter | Description                                                                                                             | Default Value |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------|---------------|
| <i>number</i>         | I/O timeout threshold for path degradation and isolation upon an I/O timeout.<br><br>The value ranges from 0 to 65,535. | 1             |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the I/O timeout threshold for path degradation and isolation to 3.

```
UltraPath CLI #1 >set tod_threshold=3
Succeeded in executing the command.
```

## System Response

None

## A.3.22 Setting the Recovery Time of a Degraded Path

### Function

The **set tod\_recovery\_time** command is used to set the recovery time of a degraded path.

### Format

```
set tod_recovery_time=time
```

### Parameters

| Keyword and Parameter | Description                                                                                                 | Default Value |
|-----------------------|-------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Recovery timeout of a degraded path.<br><br>The value ranges from 1,800 to 2,592,000, expressed in seconds. | 1800          |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the recovery time of a degraded path to 1800 seconds.

```
UltraPath CLI #1 >set tod_recovery_time=1800
Succeeded in executing the command.
```

## System Response

None

## A.3.23 Setting a Time Window for Calculating Discrete I/O Errors

### Function

The **set ied\_time** command is used to set a time window for calculating discrete I/O errors.

### Format

**set ied\_time**=*time*

### Parameters

| Keyword and Parameter | Description                                                                                                     | Default Value |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Time window for collecting discrete I/O errors.<br>The value ranges from 60 to 2,592,000, expressed in seconds. | 300           |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the time window for calculating discrete I/O errors to 300 seconds.

```
UltraPath CLI #1 >set ied_time=300
Succeeded in executing the command.
```

## System Response

None

## A.3.24 Setting a Rate Threshold for Discrete I/O Error Isolation

### Function

The **set ied\_threshold** command is used to set a rate threshold for discrete I/O error isolation.

### Format

```
set ied_threshold=ratio
```

### Parameters

| Keyword and Parameter | Description                                                                           | Default Value |
|-----------------------|---------------------------------------------------------------------------------------|---------------|
| <i>ratio</i>          | Rate threshold for discrete I/O error isolation.<br>The value ranges from 0% to 100%. | 20            |

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Set the rate threshold for discrete I/O error isolation to 20%.

```
UltraPath CLI #1 >set ied_threshold=20
Succeeded in executing the command.
```

## System Response

None

## A.3.25 Setting the minimum number of I/Os for the I/O discrete error isolation mechanism

## Function

The **set ied\_min\_io** command is used to set the minimum number of I/Os for the I/O discrete error isolation mechanism.

## Format

**set ied\_min\_io=number**

## Parameters

| Keyword and Parameter | Description                                                                                                          | Default Value |
|-----------------------|----------------------------------------------------------------------------------------------------------------------|---------------|
| <b>number</b>         | The minimum number of I/Os for the I/O discrete error isolation mechanism.<br>The value ranges from 5,000 to 65,535. | 5000          |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the minimum number of I/Os for the I/O discrete error isolation mechanism to 5000.

```
UltraPath CLI #1 >set ied_min_io=5000
Succeeded in executing the command.
```

## System Response

None

## A.3.26 Setting the Recovery Time of a Path with Discrete I/O Errors

### Function

The **set ied\_recovery\_time** command is used to set the recovery time of a path with discrete I/O errors.

### Format

**set ied\_recovery\_time=time**

## Parameters

| Keyword and Parameter | Description                                                                                                          | Default Value |
|-----------------------|----------------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Recovery time of a path with discrete I/O errors.<br>The value ranges from 1,800 to 2,592,000, expressed in seconds. | 1800          |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the recovery time of a path with discrete I/O errors to 1800 seconds.

```
UltraPath CLI #1 >set ifd_recovery_time=1800
Succeeded in executing the command.
```

## System Response

None

## A.3.27 Setting a Time Window for Collecting Intermittent Path Errors

### Function

The **set ifd\_time** command is used to set the recovery time of a path with intermittent I/O errors.

### Format

**set ifd\_time**=*time*

## Parameters

| Keyword and Parameter | Description                                                                                                          | Default Value |
|-----------------------|----------------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Time window for collecting intermittent path errors.<br>The value ranges from 60 to 2,592,000, expressed in seconds. | 1800          |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the time window for collecting intermittent path errors to 1800 seconds.

```
UltraPath CLI #1 >set ifd_time=1800
Succeeded in executing the command.
```

## System Response

None

## A.3.28 Setting an Intermittent Path Error Threshold for Path Isolation

### Function

The **set ifd\_threshold** command is used to set an intermittent path error threshold for path isolation.

### Format

**set ifd\_threshold**=*number*

### Parameters

| Keyword and Parameter | Description                                                                                 | Default Value |
|-----------------------|---------------------------------------------------------------------------------------------|---------------|
| <i>number</i>         | Intermittent path error threshold for path isolation.<br>The value ranges from 0 to 65,535. | 3             |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the intermittent path error threshold for path isolation to 3.

```
UltraPath CLI #1 >set ifd_threshold=3
Succeeded in executing the command.
```

## System Response

None

## A.3.29 Setting the Recovery Time of a Path with Intermittent Errors

### Function

The **set ifd\_recovery\_time** command is used to set the recovery time of a path with intermittent errors.

### Format

```
set ifd_recovery_time=time
```

### Parameters

| Keyword and Parameter | Description                                                                                                       | Default Value |
|-----------------------|-------------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Recovery time of a path with intermittent errors.<br>The value ranges from 60 to 2,592,000, expressed in seconds. | 3600          |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the recovery time of a path with intermittent errors to 3600 seconds.

```
UltraPath CLI #1 >set ifd_recovery_time=3600
Succeeded in executing the command.
```

## System Response

None

## A.3.30 Setting a Time Window for Determining a High-latency Path

### Function

The **set hld\_time** command is used to set a time window for determining a high-latency path.

### Format

**set hld\_time**=*time*

### Parameters

| Keyword and Parameter | Description                                                                                                   | Default Value |
|-----------------------|---------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Time window for determining a high-latency path.<br>The value ranges from 60 to 18,000, expressed in seconds. | 300           |

### Level

User with **administrator** permissions

### Usage Guidelines

None

## Example

Set the time window for determining a high-latency path to 300 seconds.

```
UltraPath CLI #1 >set hld_time=300
Succeeded in executing the command.
```

## System Response

None

## A.3.31 Setting a Latency Threshold for High-latency Path Isolation

### Function

The **set hld\_threshold** command is used to set a latency threshold for high-latency path isolation.

### Format

**set hld\_threshold=***time*

### Parameters

| Keyword and Parameter | Description                                                                                                         | Default Value |
|-----------------------|---------------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Latency threshold for high-latency path isolation.<br>The value ranges from 0 to 65,535, expressed in milliseconds. | 1000          |

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Set the latency threshold for high-latency path isolation to 1000 ms.

```
UltraPath CLI #1 >set hld_threshold=1000
Succeeded in executing the command.
```

### System Response

None

## A.3.32 Setting the Recover Time of a High-latency Path

### Function

The **set hld\_recovery\_time** command is used to set the recovery time of a high-latency path.

## Format

`set hld_recovery_time=time`

## Parameters

| Keyword and Parameter | Description                                                                                          | Default Value |
|-----------------------|------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Recover time of a high-latency path.<br>The value ranges from 60 to 2,592,000, expressed in seconds. | 3600          |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the recovery time of a high-latency path to 3600 seconds.

```
UltraPath CLI #1 >set hld_recovery_time=3600
Succeeded in executing the command.
```

## System Response

None

## A.3.33 Setting the Threshold of Switching a Latency-sensitive Path

### Function

`set sdd_threshold` is used to set the threshold of switching a latency-sensitive path.

### Format

`set sdd_threshold=time`

## Parameters

| Parameter   | Description                                                                                                        | Default Value |
|-------------|--------------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i> | Threshold of switching a latency-sensitive path<br>The value ranges from 100 to 60,000, expressed in milliseconds. | 30000         |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

This example shows how to set the threshold of switching a latency-sensitive path to 1000 milliseconds.

```
UltraPath CLI #1 >set sdd_threshold=1000
Succeeded in executing the command.
```

## System Response

None

## A.3.34 Setting the Recovery Time of a Latency-sensitive Path

### Function

**set sdd\_recovery\_time** is used to set the recovery time of a latency-sensitive path.

### Format

**set sdd\_recovery\_time=***time*

### Parameters

| Parameter   | Description                                                                                              | Default Value |
|-------------|----------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i> | Recovery time of a latency-sensitive path<br>The value ranges from 1 to 2,592,000, expressed in seconds. | 120           |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

This example shows how to set the recovery time of a latency-sensitive path to 600 seconds.

```
UltraPath CLI #1 >set sdd_recovery_time=600
Succeeded in executing the command.
```

## System Response

None

# A.3.35 Setting an Interval for Routine Detection of Faulty Paths

## Function

The **set faulty\_path\_check\_interval** command is used to set an interval for routine detection of faulty paths.

## Format

**set faulty\_path\_check\_interval**=*time*

## Parameters

| Keyword and Parameter | Description                                                                                                     | Default Value |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Interval for routine inspection of faulty paths.<br>The value ranges from 1 to 2,592,000, expressed in seconds. | 10            |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Set the interval for routine detection of faulty paths to 10 seconds.

```
UltraPath CLI #1 >set faulty_path_check_interval=10
Succeeded in executing the command.
```

## System Response

None

## A.3.36 Setting an Interval for Routine Inspection of Idle Paths

### Function

The `set idle_path_check_interval` command is used to set an interval for routine inspection of idle paths.

### Format

```
set idle_path_check_interval=time
```

### Parameters

| Keyword and Parameter | Description                                                                                                   | Default Value |
|-----------------------|---------------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>           | Interval for routine inspection of idle paths.<br>The value ranges from 1 to 2,592,000, expressed in seconds. | 60            |

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Set the interval for routine detection of idle paths to 60 seconds.

```
UltraPath CLI #1 >set idle_path_check_interval=60
Succeeded in executing the command.
```

## System Response

None

## A.3.37 Setting I/O Retry Timeout

## Function

The **set max\_io\_retry\_timeout** command is used to set the timeout period for I/O retry on UltraPath.

## Format

```
set max_io_retry_timeout=time [array_id=ID | vlun_id={ ID | ID1,ID2... | ID1-ID2 }]
```

## Parameters

| Keyword and Parameter                        | Description                                                                                               | Default Value |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------|
| <i>time</i>                                  | Timeout period for I/O retry on UltraPath.<br>The value ranges from 1 to 2,592,000, expressed in seconds. | 1800          |
| <b>array_id=ID</b>                           | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs. | None          |
| <b>vlun_id={ ID   ID1,ID2...   ID1-ID2 }</b> | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.             | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

In some cases, I/Os are not successfully processed (for example, due to fully-loaded HBAs) even if no clear faults occur on paths. UltraPath will retry to avoid I/O failure. However, if the I/Os are not returned for a long time, the impact on some upper-layer applications may be worse than an I/O failure. In this case, you can set the timeout period for I/O retry to prevent such an impact.

- Run **set max\_io\_retry\_timeout=time** to set the I/O retry timeout of all storage systems.
- Run **set max\_io\_retry\_timeout=time array\_id=ID** to set the I/O retry timeout of a specified storage system.
- Run **set max\_io\_retry\_timeout=time vlun\_id={ ID | ID1,ID2... | ID1-ID2 }** to set the I/O retry timeout of a specified virtual LUN.

### NOTE

- **vlun\_id=ID**: ID of a single virtual LUN.
- **vlun\_id=ID1,ID2...**: IDs of multiple virtual LUNs which are not necessarily related.
- **vlun\_id=ID1-ID2**: IDs of all the virtual LUNs from ID1 to ID2.

## Example

Set the timeout period for I/O retry on UltraPath to 1800 seconds.

```
UltraPath CLI #1 >set max_io_retry_timeout=1800
Succeeded in executing the command.
```

## System Response

None

## A.3.38 Setting the Number of Consecutive I/Os on a Path

### Function

The **set lb\_io\_threshold** command is used to set the number of consecutive I/Os on a path in load balancing mode.

### Format

```
set lb_io_threshold= number [array_id=ID | vlun_id={ ID | ID1,ID2... | ID1-ID2 }]
```

### Parameters

| Keyword and Parameter                        | Description                                                                                               | Default Value |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------|
| <i>number</i>                                | Number of consecutive I/Os on a path.<br>The value ranges from 1 to 10,000.                               | 1             |
| <b>array_id=ID</b>                           | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs. | None          |
| <b>vlun_id={ ID   ID1,ID2...   ID1-ID2 }</b> | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.             | None          |

### Level

User with **administrator** permissions

### Usage Guidelines

- Run **set lb\_io\_threshold=number** to set the number of consecutive I/Os on a path in load balancing mode for all storage systems.
- Run **set lb\_io\_threshold=number array\_id=ID** to set the number of consecutive I/Os on a path in load balancing mode for a specified storage system.

- Run **set lb\_io\_threshold=number vlun\_id={ ID | ID1,ID2... | ID1-ID2 }** to set the number of consecutive I/Os on a path in load balancing mode for a specified virtual LUN.

 **NOTE**

- **vlun\_id=ID**: ID of a single virtual LUN
- **vlun\_id=ID1,ID2...**: IDs of multiple virtual LUNs which are not necessarily related
- **vlun\_id=ID1-ID2**: IDs of all the virtual LUNs from ID1 to ID2

 **NOTE**

Increasing the consecutive I/Os of a path can improve the efficiency of processing sequential I/Os. However, it does not apply to discrete I/Os, and an extra-large number of consecutive I/Os causes path blockage for short periods of time. Therefore, set an appropriate value based on the service I/O model to improve performance.

## Example

Set the number of consecutive I/Os on a path in load balancing mode to 1.

```
UltraPath CLI #1 >set lb_io_threshold=1
Succeeded in executing the command.
```

## System Response

None

## A.3.39 Setting the Remote Controller of a VIS Storage System

### Function

The **set remote\_controller** command is used to set the remote controller of a VIS storage system so that host I/Os are delivered preferentially from the local VIS node, therefore shortening latency.

### Format

**set remote\_controller array\_id=ID tpg\_id=ID1,ID2... [ remote | local ]**

### Parameters

| Keyword and Parameter    | Description                                                                                                                      | Default Value |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>array_id=ID</b>       | ID of a storage system allocated by UltraPath.<br>You can run <b>show array</b> without an ID to display all storage system IDs. | None          |
| <b>tpg_id=ID1,ID2...</b> | ID of a controller.<br><b>NOTE</b><br>You can specify multiple controllers at the same time.                                     | None          |

| Keyword and Parameter        | Description                                                                                                                                                                                            | Default Value |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <i>remote</i>   <i>local</i> | Status of a remote controller.<br>The value can be <b>local</b> or <b>remote</b> .<br><ul style="list-style-type: none"> <li>● local: local controller</li> <li>● remote: remote controller</li> </ul> | remote        |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

UltraPath supports remote active-active VIS storage systems. In this mode, the I/O processing latency on the local VIS node is much smaller than that on the remote one. Therefore, UltraPath prefers the local VIS node for delivering I/Os. The remote VIS node is used only if the local node experiences a path fault.

## Example

Set remote controller 0 of the storage system whose ID is **0** as a local node.

```
UltraPath CLI #1 >set remote_controller array_id=0 tpg_id=0 local
Succeeded in executing the command.
```

## System Response

None

## A.3.40 Clearing Configuration Information

### Function

The **clear upconfig** command is used to clear the configuration information about a virtual LUN or storage system to recover them to default factory settings.

### Format

```
clear upconfig={ vlun_id=ID | array_id=ID }
```

## Parameters

| Keyword and Parameter | Description                                                                                               | Default Value |
|-----------------------|-----------------------------------------------------------------------------------------------------------|---------------|
| <b>array_id=ID</b>    | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs. | None          |
| <b>vlun_id=ID</b>     | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.             | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

- Run **clear upconfig array\_id=ID** to clear the configuration information about a specified storage system.
- Run **clear upconfig vlun\_id=ID** to clear the configuration information about a specified virtual LUN.

## Example

- Clear the configuration information about the storage system whose ID is **0**.  
UltraPath CLI #1 >clear upconfig array\_id=0  
Succeeded in executing the command.
- Clear the configuration information about the virtual LUN whose ID is **1**.  
UltraPath CLI #1 >clear upconfig vlun\_id=1  
Succeeded in executing the command.

## System Response

None

## A.3.41 Deleting Obsolete Physical Path Information

### Function

The **clear obsolete\_path** command is used to delete obsolete physical path information.

### Format

**clear obsolete\_path path\_id=ID**

## Parameters

| Keyword and Parameter | Description                                                                                            | Default Value |
|-----------------------|--------------------------------------------------------------------------------------------------------|---------------|
| <b>path_id=ID</b>     | ID of a physical path.<br>You can run <b>show path</b> without an ID to display all physical path IDs. | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

- If a storage system administrator changes the path network (for example, changes the Fibre Channel port connected to the storage system), some paths managed by UltraPath may enter faulty state, interfering the administrator's detection of faulty paths. In this case, run the command to delete the paths from UltraPath.
- On an operating system that does not support hot swap or when an iSCSI software initiator is used, changing path ports does not trigger SCSI device deletion on the corresponding host. The path information cannot be deleted, either. In this case, you need run the command provided by the operating system to refresh devices.

## Example

Delete the information about the obsolete physical path whose ID is **1**.

```
UltraPath CLI #1 >clear obsolete_path path_id=1
Succeeded in executing the command.
```

## System Response

None

## A.3.42 Checking the Status of UltraPath

### Function

The **check status** command is used to check UltraPath, including the check of exceptions, software integrity, and environment configuration.

### Format

**check status**

### Parameters

None

## Level

User with **administrator** permissions

## Usage Guidelines

The configuration of the UltraPath can be queried only after it is successfully installed.

## Example

Check the status of UltraPath.

```
UltraPath CLI #1 >check status

Checking path status:
Serverity Array Type description
Major 210000e0fccecc85 No redundant controllers No redundant controllers.

Checking envirement and config:
All Check Passed.

```

## System Response

None

## A.3.43 Viewing Critical Events

### Function

The **show event** command is used to view critical events about UltraPath.

### Format

**show event** [ *count=number* ]

### Parameters

| Keyword and Parameter | Description                                                               | Default Value |
|-----------------------|---------------------------------------------------------------------------|---------------|
| <i>count=number</i>   | Printing number of critical events.<br>The value ranges from 1 to 10,000. | 1000          |

## Level

User with **administrator** permissions

## Usage Guidelines

None



## Format

**start rebalancelun**=[array\_id=*ID* | vlun\_id=*ID*]

## Parameters

| Keyword and Parameter       | Description                                                                                               | Default Value |
|-----------------------------|-----------------------------------------------------------------------------------------------------------|---------------|
| <b>array_id</b> = <i>ID</i> | ID of a storage system.<br>You can run <b>show array</b> without an ID to display all storage system IDs. | None          |
| <b>vlun_id</b> = <i>ID</i>  | ID of a virtual LUN.<br>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.             | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

If a LUN's working controller settings are not optimum (for example, the working controller differs from the initially configured owning controller, resulting load imbalance), you can use this command to manually check the working controller and update the settings.

## Example

Manually update the working controller.

```
UltraPath CLI #1 >start rebalancelun
Succeeded in executing the command.
```

## System Response

None

## A.3.45 Querying and Exporting Performance Statistics

### Function

The **show iostat** command is used to display and export the performance statistics (IOPS, bandwidth and response time) about storage systems and virtual LUNs.

### Format

Run the following command to query and export performance statistics of specified arrays:

```
show iostat array_id=ID1,ID2,... [interval=time] [file_name=file_name
[archive_time=archive_time] [duration=duration]]
```

Run the following command to query and export performance statistics of specified virtual LUNs:

```
show iostat vlun_id=ID1,ID2,... [type={ all | hypermetro | migration }] [interval=time]
[file_name=file_name [archive_time=archive_time] [duration=duration]]
```

## Parameters

| Parameter                                    | Description                                                                                                                                                                                                                                                                                                                                                                                    | Default Value |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>array_id=ID1,ID2,...</b>                  | Specifies IDs of storage systems.<br>You can run <b>show array</b> to obtain all storage system IDs.<br><b>NOTE</b><br>You can query a maximum of eight storage systems' performance statistics at a time. Use comas (,) to separate storage systems.                                                                                                                                          | None          |
| <b>vlun_id=ID1,ID2,...</b>                   | Specifies IDs of virtual LUNs.<br>You can run <b>show vlun type=all</b> to obtain all virtual LUN IDs.<br><b>NOTE</b><br>You can query a maximum of eight virtual LUNs' performance statistics at a time. Use comas (,) to separate virtual LUN IDs.                                                                                                                                           | None          |
| <b>type={ all   hypermetro   migration }</b> | View the virtual LUN information of a specific type. If the <b>type</b> parameter is not specified, common virtual LUN information will be queried.<br>Possible values are all, hypermetro, and migration, where:<br><ul style="list-style-type: none"> <li>● all: all the virtual LUNs</li> <li>● hypermetro: virtual HyperMetro LUNs</li> <li>● migration: virtual migration LUNs</li> </ul> | None          |

| Parameter                                 | Description                                                                                                                                                                                                                                                                                                                                                                                    | Default Value                                                                            |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| <b>interval</b> = <i>time</i>             | Specifies an interval for performance statistics collection.<br><br>The value ranges from 1 to 60, expressed in seconds.                                                                                                                                                                                                                                                                       | 1                                                                                        |
| <b>file_name</b> = <i>file_name</i>       | Specifies the saving path and name of the performance statistics report.<br><b>NOTE</b><br>You are not required to specify the saving path but must specify the name of the performance report. The system automatically adds suffix <b>.CSV</b> to the name.<br><br>If a saving path is not specified, the report is saved in the <b>perf_log</b> file folder of the UltraPath log directory. | C:\Program Files (x86)\UltraPath\log\perf_log or C:\Program Files\UltraPath\log\perf_log |
| <b>archive_time</b> = <i>archive_time</i> | Specifies an interval for performance statistics collection.<br><br>The value can be 5, 60, 120, 300, 1800, and 3600, expressed in seconds.<br><b>NOTE</b><br>This parameter is valid only when <b>file_name</b> is specified. The system writes performance data to the report at the specified time interval.                                                                                | 60                                                                                       |
| <b>duration</b> = <i>duration</i>         | Statistics duration<br><br>The value ranges from 60 to 259,200, expressed in seconds.<br><b>NOTE</b><br>This parameter is valid only when <b>file_name</b> is specified. The system stops performance statistics after the specified duration.                                                                                                                                                 | 900                                                                                      |

## Level

User with **administrator** permissions

## Usage Guidelines

- When performance statistics is being collected, you can press **Ctrl+C** to end the collection.
- If a performance report with the specified name exists in the path, the function of performance statistics is not supported. Delete the existing report or enter a new name. Then export the report.
- If the remaining space of the directory to save the report is smaller than 180 MB, the performance report cannot be exported.

## Example

- View performance statistics of the storage system whose ID is **0** at an interval of **30** seconds.

```
UltraPath CLI #3 >show iostat array_id=0 interval=30
```

```
=====
IO Performance
Information
=====
time (ms) IOPS KB/S response
 Total |Read |Write Total |Read |Write Total |
Read |Write
Array 0 0 |0 |0 0 |0 |0 0 |
0 |0
Controller 1
Phypath 0 :0 |0 |0 0 |0 |0 0 |
0 |0
Phypath 1 :0 |0 |0 0 |0 |0 0 |
0 |0
=====
```

- View performance statistics of the virtual LUNs whose IDs are **0, 1, 2, and 3** at an interval of **30** seconds.

```
UltraPath CLI #4 >show iostat vlun_id=0,1,2,3 interval=30
```

```
=====
IO Performance
Information
=====
time (ms) IOPS KB/S response
 Total |Read |Write Total |Read |Write Total |
Read |Write
VLUN 0 0 |0 |0 0 |0 |0 0 |
0 |0
Controller 0B
Path 0 :0 |0 |0 0 |0 |0 0 |
0 |0
Path 1 :0 |0 |0 0 |0 |0 0 |
0 |0
=====
VLUN 1 0 |0 |0 0 |0 |0 0 |
0 |0
Controller 0B
Path 0 :0 |0 |0 0 |0 |0 0 |
0 |0
=====
VLUN 2 0 |0 |0 0 |0 |0 0 |
0 |0
=====
```

```

Controller 0B
Path 0 :0 |0 |0 |0 |0 |0 |0 |
0 |0
=====
VLUN 3 0 |0 |0 |0 |0 |0 |0 |
0 |0
Controller 0B
Path 0 :0 |0 |0 |0 |0 |0 |0 |
0 |0
=====
=====

```

- Query performance statistics about HyperMetro virtual LUN 4.

```

UltraPath CLI #4 >show iostat vlun_id=4 type=hypermetro
=====
IO Performance
Information
=====
time(ms) IOPS KB/S response
 Total |Read |Write Total |Read |Write Total |
Read |Write
VLUN 4 0 |0 |0 0 |0 |0 0 |
0 |0
Lun Array 210235G6GSZ0C5000004
Controller 0A
Path 1 :0 |0 |0 0 |0 |0 0 |
0 |0
Controller 0B
Path 0 :0 |0 |0 0 |0 |0 0 |
0 |0
Lun Array 210235G6GSZ0C2000008
Controller 0A
Path 2 :0 |0 |0 0 |0 |0 0 |
0 |0
Controller 0B
Path 3 :0 |0 |0 0 |0 |0 0 |
0 |0
=====
=====

```

- Query performance statistics about virtual LUN 0 and export the data to the default path.

```

UltraPath CLI #1 >show iostat vlun_id=0 file_name=perfLogFile
=====
IO Performance Information
=====
time(ms) IOPS KB/S response
 Total |Read |Write Total |Read |Write Total |
Read |Write
VLUN 0 9389 |9389 |0 38457 |38457 |0 0 |
0 |0
Controller 0A
Path 1 :9389 |9389 |0 38457 |38457 |0 0 |
0 |0
Controller 0B
Path 0 :0 |0 |0 0 |0 |0 0 |
0 |0
=====
=====

```

- Query performance statistics about virtual LUN 0 and export the data to the specified path. Specify the statistics interval to 5s and duration to 1000s.

```

UltraPath CLI #1 >show iostat vlun_id=0 file_name=D:\Ultrapath_PerfLog
\perfLogFile archive_time=5 duration=1000

```

```

=====
 IO Performance Information
=====
time (ms) IOPS KB/S response
Read |Write Total |Read |Write Total |Read |Write Total |
VLUN 0 9559 |9559 |0 39153 |39153 |0 0 |
0 |0
Controller 0A
Path 1 :9559 |9559 |0 39153 |39153 |0 0 |
0 |0
Controller 0B
Path 0 :0 |0 |0 0 |0 |0 0 |
0 |0
=====

```

## System Response

The system generates a performance report with suffix `.CSV` in the specified or default path.

## A.3.46 Enabling and Disabling the Performance Data Record Function

### Function

`set performance_record` is used to enable and disable the performance data record function.

### Format

`set performance_record={ on | off } [ duration=time ]`

### Parameters

| Parameter    | Description                                                                                                                                                                                                                                                                                                                                                               | Default Value |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| { on   off } | <p>Performance data record function</p> <p>The value can be <b>on</b> or <b>off</b>.</p> <ul style="list-style-type: none"> <li>● on: Enable the performance data record function.</li> <li>● off: Disable the performance data record function.</li> </ul> <p>The performance data file is saved in the UltraPath log directory and is named <b>perf_record.log</b>.</p> | off           |

| Parameter                     | Description                                                                                                                                                                                               | Default Value |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>duration</b> = <i>time</i> | Time during which the performance data record function works<br><br>The value ranges from 0 to 8,760, expressed in hours. <b>0</b> indicates that the performance data record function works permanently. | 0             |

## Level

User with **administrator** permissions

## Usage Guidelines

- You are not required to specify **duration** when disabling the performance data record function.
- When the size of the performance data file reaches 30 MB, the system automatically dumps it to the **perf\_record** directory which is under the UltraPath **log** directory.

## Example

- Enable the performance data record function and set **duration** to 24 hours.

```
UltraPath CLI #0 >set performance_record=on duration=24
Succeeded in executing the command.
```

- Disable the performance data record function.

```
UltraPath CLI #0 >set performance_record=off
Succeeded in executing the command.
```

## System Response

None

## A.3.47 Producing a Randow Number

### Function

**genprkey** command is used to produce a randow number with nineteen bytes

### Format

**genprkey**

### Parameters

None

## Level

User with **administrator** permissions

## Usage Guidelines

This command runs once when UltraPath is installed, the nineteen-byte random number will be written to the regedit file to make UltraPath work in a SCSI-2 cluster.

## Example

Run **genprkey** command. To produce a random number with nineteen bytes

```
UltraPath CLI #1 >genprkey
1688015227050849615
```

## System Response

None

# A.4 LUN Management Commands

LUN management commands include commands for viewing storage system information and virtual disk information.

### NOTE

If the storage array name or LUN name on the storage array is Chinese and the encoding format of the login tool does not support Chinese characters, UltraPath will display marbled characters after command execution. If this occurs, change the encoding format of the login tool so that Chinese characters are supported.

## A.4.1 Querying Storage System Information

### Function

The **show array** command is used to query information about a specified or all storage systems connected to the application server.

### Format

```
show array [id=ID1,ID2,... [verbose]]
```

## Parameters

| Keyword and Parameter                    | Description                                                                                                                                                                                                                                                                | Default Value |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>id</b> = <i>ID1</i> , <i>ID2</i> ,... | <p>ID of a storage system.</p> <p>You can run <b>show array</b> without an ID to display all storage system IDs.</p> <p><b>NOTE</b><br/>You can query a maximum of eight storage systems' performance statistics at a time. Use comas (,) to separate storage systems.</p> | None          |
| <b>verbose</b>                           | <p>Viewing details configuration information about a specified storage system.</p> <p><b>NOTE</b><br/>Parameter <b>verbose</b> can display details configuration information about a specified storage system only when it is used with parameter <b>id</b>.</p>           | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

- Run **show array** to view information about all storage systems connected to the application server.
- Run **show array id**=*ID1*,*ID2*... to view information about a specified storage system.
- Run **show array id**=*ID1*,*ID2*... **verbose** to view details configuration information about the storage system.

## Example

- Run the following command to query information about all storage systems connected to the application server:

```
UltraPath CLI #9 >show array
```

```

Array ID Name Array SN Vendor Name
Product Name
0 S5300 2102315401Z083000004 HUAWEI
S5300
1 SN_210235G6EDZ0C2000001 210235G6EDZ0C2000001 HUASY
S5600T

```

- Run the following command to view information about the storage system whose ID is **1**:

```
UltraPath CLI #10 >show array id=1
=====
 Array#1 Information
=====
Name : SN_210235G6EDZ0C2000001
Array SN : 210235G6EDZ0C2000001
Vendor Name : HUASY
Product Name : S5600T
Controller 0A
 Status : Enable
 LunCount : 4
 PathInfo:
 Path1: Normal
Controller 0B
 Status : Enable
 LunCount : 4
 PathInfo:
 Path0: Normal
=====
```

- Run the following command to view details configuration information about the storage system whose ID is **0**.

```
UltraPath CLI #2 >show array id=0 verbose
=====
 Array#0 Information
=====
Name : HUAWAIS5500T
Array SN : 210235G6GRZ0C4000008
Vendor Name : HUASY
Product Name : S5500T
Controller 0A
 Status : Enable
 LunCount : 2
 PathInfo:
 Path0: Normal
Working Mode : load balancing within controller
LUN Trespass : on
LoadBalance Mode : min-queue-depth
Loadbanlance io threshold : 1
Io Suspension Time : 60
Max io retry timeout : 1800
=====
```

## System Response

The following table explains some parameters in the command output:

| Parameter    | Description                       | Default Value |
|--------------|-----------------------------------|---------------|
| Name         | Name of the storage system.       | None          |
| Array SN     | Serial No. of the storage system. | None          |
| Vendor Name  | Vendor of the storage system.     | None          |
| Product Name | Model of the storage system.      | None          |

| Parameter  | Description                                                                                                                                                                                                                                                                                                      | Default Value |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Controller | <p>Name of the controller.</p> <p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>● If <b>Remote</b> information is displayed after the controller name, the controller is a remote controller.</li> <li>● You can only view the information about a maximum of eight paths on one controller.</li> </ul> | None          |

## A.4.2 Viewing Virtual LUN Information

### Function

The **show vlun** command is used to query information about a specified LUN or all LUNs mapped from a storage system to an application server.

### Format

**show vlun** [ **array\_id**=*ID1,ID2,...* ] [ **type**={ *all* | *hypermetro* | *migration* } ]

**show vlun id**=*ID1,ID2...* [ **type**={ *all* | *hypermetro* | *migration* } ] [ **verbose** ]

### Parameters

| Keyword and Parameter                | Description                                                                                                                                                                                                                                                                   | Default Value |
|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>array_id</b> = <i>ID1,ID2,...</i> | <p>ID of a storage system.</p> <p>You can run <b>show array</b> without an ID to display all storage system IDs.</p> <p><b>NOTE</b></p> <p>You can query a maximum of eight storage systems' performance statistics at a time. Use comas (,) to separate storage systems.</p> | None          |

| Keyword and Parameter                               | Description                                                                                                                                                                                                                                                                                                                                                                                        | Default Value |
|-----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>id</b> = <i>ID1, ID2...</i>                      | <p>ID of a virtual LUN.</p> <p>You can run <b>show vlun type=all</b> to display all virtual LUN IDs.</p> <p><b>NOTE</b><br/>You can query a maximum of eight virtual LUNs' performance statistics at a time. Use comas (,) to separate virtual LUN IDs.</p>                                                                                                                                        | None          |
| <b>verbose</b>                                      | <p>Viewing details configuration information about a virtual LUN.</p> <p><b>NOTE</b><br/>Parameter <b>verbose</b> views details configuration information about a virtual LUN only when it is used with parameter <b>id</b>.</p>                                                                                                                                                                   | None          |
| <b>type</b> = <i>{ all   hypermetro   migration</i> | <p>View the virtual LUN information of a specific type. If the <b>type</b> parameter is not specified, common virtual LUN information will be queried.</p> <p>Possible values are all, hypermetro, and migration, where:</p> <ul style="list-style-type: none"> <li>● all: all virtual LUNs</li> <li>● hypermetro: virtual HyperMetro LUNs</li> <li>● migration: virtual migration LUNs</li> </ul> | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

- Run **show vlun** to query information about all common virtual LUNs mounted on the application server.
- Run **show vlun array\_id=ID1, ID2,...** to view common virtual LUN information about a specified storage system.
- Run **show vlun id=ID1, ID2...** to view information about a specified common virtual LUN.

- Run **show vlun id=ID1,ID2...verbose** to view details configuration information about a common virtual LUN.
- Run **show vlun type=all** to query information about all virtual LUNs mounted on the application server.
- Run **show vlun array\_id=ID1,ID2,... type=all** to view all virtual LUN information about a specified storage system.
- Run **show vlun type=hypermetro** to query information about all virtual HyperMetro LUNs mounted on the application server.
- Run **show vlun id=ID1,ID2... type=all** to view information about a specified virtual LUN.
- Run **show vlun id=ID1,ID2... type=hypermetro** to view information about a specified virtual HyperMetro LUN.

## Example

- View information about all common virtual LUNs.

```
UltraPath CLI #0 >show vlun

Vlun ID Disk Name Lun WWN
Status Capacity Ctrl (Own/Work) Array Name Dev Lun ID
0 sdb hl_luntest 630d17e100b33e3900135b9900000024
Normal 1.00GB 0A/0B Huawei.Storage 36
1 sdc hl_luntest_2 630d17e100b33e3909eae968000000f2
Normal 1.00GB 0A/0B Huawei.Storage 242

```

- View common virtual LUN information about the storage system whose ID is 0.

```
UltraPath CLI #0 >show vlun array_id=0

Vlun ID Disk Name Lun WWN
Status Capacity Ctrl (Own/Work) Array Name Dev Lun ID
0 sdb hl_luntest 630d17e100b33e3900135b9900000024
Normal 1.00GB 0A/0B Huawei.Storage 36
1 sdc hl_luntest_2 630d17e100b33e3909eae968000000f2
Normal 1.00GB 0A/0B Huawei.Storage 242

```

- View details about the common virtual LUN whose ID is 1.

```
UltraPath CLI #2 >show vlun id=1
=====
 VLUN#1 Information
=====
Disk : sdc
Name : hl_luntest_2
Status : Normal
Capacity : 1.00GB
Driver : Vendor-specific (DEFAULT)
Product Name : XSG1
Vendor Name : HUAWEI
Owning Controller : 0A
Working Controller: 0B
Num of Paths : 1
LUN WWN : 630d17e100b33e3909eae968000000f2
Array Name : Huawei.Storage
Controller 0B
Path 0 [1:0:0:2] (up-1) : Normal
Dev Lun ID : 242
Manual IO Suspension : Off

```

- View details configuration information about a common virtual LUN whose ID is 1.

```
UltraPath CLI #2 >show vlun id=1 verbose
=====
VLUN#1 Information
=====
Disk : sdc
Name : hl_luntest_2
Status : Normal
Capacity : 1.00GB
Driver : Vendor-specific(DEFAULT)
Product Name : XSG1
Vendor Name : HUAWEI
Owning Controller : 0A
Working Controller: 0B
Num of Paths : 1
LUN WWN : 630d17e100b33e3909eae96800000f2
Array Name : Huawei.Storage
Controller 0B
Path 0 [1:0:0:2] (up-1) : Normal
Working Mode : load balancing within controller
LUN Trespass : on
LoadBalance Mode : min-queue-depth
Loadbanlance io threshold : 1
Io Suspension Time : 60
Max io retry timeout : 1800
Dev Lun ID : 242
Manual IO Suspension : Off
=====
```

- View information about all virtual LUNs.

```
UltraPath CLI #0 >show vlun type=all

Vlun ID Disk Name Lun WWN Status
Capacity Ctrl(Own/Work) Array Name Dev Lun ID
0 sdb hl_luntest 630d17e100b33e3900135b9900000024 Normal
1.00GB 0A/0B Huawei.Storage 36
1 sdc hl_luntest_2 630d17e100b33e3909eae968000000f2 Normal
1.00GB 0A/0B Huawei.Storage 242
2 sdd shuanghuo_A 630d17e100b33e390912496800000031 Normal
1.00GB 0A/0B Huawei.Storage 12
2 sdd shuanghuo_B 630d17e100b33e390912496800000031 Normal
1.00GB 0A/0B Huawei.Storage 12

```

- View all virtual LUN information about the storage system whose ID is 0.

```
UltraPath CLI #7 >show vlun array_id=0 type=all

Vlun ID Disk Name Lun WWN Status
Capacity Ctrl(Own/Work) Array Name Dev Lun ID
0 sdb remote0000 63400a31000d9c5f01415fb500000008 Fault
0.00KB 0B/0B Huawei.Storage48 --
1 sdc remote0001 63400a31000d9c5f01415fd700000009 Fault
0.00KB 0A/0A Huawei.Storage48 --
2 sdd remote0002 63400a31000d9c5f0141600b0000000a Fault
0.00KB 0B/0B Huawei.Storage48 --
3 sde remote0003 63400a31000d9c5f014160330000000b Fault
0.00KB 0A/0A Huawei.Storage48 --
4 sdf test20002 64846fb1008ca15f08c0007000000042 Normal
1.00GB 0A/0A Huawei.Storage48 --
5 sdg test20003 64846fb1008ca15f08c00097000000043 Normal
1.00GB 0B/0B Huawei.Storage48 --

```

- View information about all virtual HyperMetro LUNs.

```
UltraPath CLI #0 >show vlun type=hypermetro

Vlun ID Disk Name Lun WWN Status
Capacity Ctrl(Own/Work) Array Name Dev Lun ID
2 sdd shuanghuo_A 630d17e100b33e390912496800000031 Normal
1.00GB 0A/0B Huawei.Storage 12
2 sdd shuanghuo_B 630d17e100b33e390912496800000031 Normal
1.00GB 0A/0B Huawei.Storage 12

```

- View details about the virtual LUN whose ID is 0.

```
UltraPath CLI #10 >show vlun id=0 type=all
=====
VLUN#0 Information
=====
Disk : sdb
Manual IO Suspension : Off
Aggregation Type : Hyper Metro
Aggregation Specific Attribution
 WorkingMode : read write between both arrays
 Primary Array SN : 210235980510E8000015
Aggregation Member#0 Infomation
 Name : local0000
 Status : Normal
 Capacity : 2.00GB
 Aggregation Specific Attribution : N/A
 LUN WWN : 63400a31000d9c5f01415fb500000008
 Array Name : Huawei.Storage46
 Array SN : 210235980510E8000015
 Driver : Vendor-specific(DEFAULT)
 Product Name : XSG1
 Vendor Name : HUAWEI
 Owning Controller : 0A
 Working Controller: 0A
 Num of Paths : 4
 Controller 0A
 Path 3 [3:0:3:1] (up-12) : Normal
 Path 7 [4:0:3:1] (up-28) : Normal
 Controller 0B
 Path 2 [3:0:2:1] (up-8) : Normal
 Path 6 [4:0:2:1] (up-24) : Normal
Aggregation Member#1 Infomation
 Name : remote0000
 Status : Fault
 Capacity : 0.00KB
 Aggregation Specific Attribution : N/A
 LUN WWN : 63400a31000d9c5f01415fb500000008
 Array Name : Huawei.Storage48
 Array SN : SN987654321076543210
 Driver : Vendor-specific(DEFAULT)
 Product Name : XSG1
 Vendor Name : HUAWEI
 Owning Controller : 0B
 Working Controller: 0B
 Num of Paths : 4
 Controller 0A
 Path 1 [3:0:1:1] (up-4) : Fault
 Path 5 [4:0:1:1] (up-20) : Fault
 Controller 0B
 Path 0 [3:0:0:1] (up-0) : Fault
 Path 4 [4:0:0:1] (up-16) : Fault

```

- View details about the virtual HyperMetro LUN whose ID is 2.

```
UltraPath CLI #0 >show vlun id=2 type=hypermetro
=====
VLUN#2 Information
=====
```

```

Disk : sdd
Manual IO Suspension : Off
Aggregation Type : Hyper Metro
Aggregation Specific Attribution
 WorkingMode : read write between both arrays
 Primary Array SN : 210235G6GSZ0C5000004
Aggregation Member#0 Information
 Name : shuangh_A
 Status : Normal
 Capacity : 1.00GB
 Aggregation Specific Attribution : N/A
 LUN WWN : 630d17e100b33e390912496800000031
 Array Name : Array8.1
 Array SN : 210235G6GSZ0C5000004
 Driver : Vendor-specific (DEFAULT)
 Product Name : S5500T
 Vendor Name : HUASY
 Reservation : 0
 Queued I/O : 0
 Owning Controller : 0A
 Working Controller: 0A
 Num of Paths : 2
 Controller 0A
 Path 1 [5:0:0:2] (up-5) : Normal
 Controller 0B
 Path 0 [4:0:0:2] (up-2) : Normal
Aggregation Member#1 Information
 Name : shuangh_B
 Status : Normal
 Capacity : 1.00GB
 Aggregation Specific Attribution : N/A
 LUN WWN : 630d17e100b33e390912496800000031
 Array Name : SN_210235G6GSZ0C2000008
 Array SN : 210235G6GSZ0C2000008
 Driver : Vendor-specific (DEFAULT)
 Product Name : S5500T
 Vendor Name : HUASY
 Reservation : 0
 Queued I/O : 0
 Owning Controller : 0B
 Working Controller: 0A
 Num of Paths : 2
 Controller 0A
 Path 2 [3:0:0:0] (up-6) : Normal
 Controller 0B
 Path 3 [7:0:0:0] (up-7) : Normal

```

## System Response

The following table explains some parameters in the command output:

| Parameter | Description                                                                                                   | Default Value |
|-----------|---------------------------------------------------------------------------------------------------------------|---------------|
| Disk      | Name of the disk that corresponds to the virtual LUN on an host.                                              | None          |
| Name      | Name of the virtual LUN<br><b>NOTE</b><br>The name is specified when the LUN is created on its storage array. | None          |

| Parameter            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Default Value |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Status               | <p>Status of the virtual LUN.<br/>Possible values are as follows:</p> <ul style="list-style-type: none"> <li>● Normal: The virtual LUN is normal.</li> <li>● Fault: The virtual LUN is faulty.</li> <li>● Degraded: The virtual LUN is degraded.</li> <li>● Unavailable: The virtual LUN is unavailable.</li> </ul> <p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>● If the LUN on the array is in <b>Fault</b> state while the virtual LUN on the host is in <b>Available</b> state (viewed by using UltraPath), the virtual LUN can be accessed by the host.</li> <li>● If you remap a LUN from the storage array to a host but do not rescan LUNs on the host, the mapping between the LUN on the storage array and the virtual LUN changes and the status of the virtual LUN is <b>Unavailable</b>.</li> </ul> | None          |
| Capacity             | Capacity of the virtual LUN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | None          |
| Product Name         | Model of the storage system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | None          |
| Vendor Name          | Vendor of the storage system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | None          |
| Num of Paths         | <p>Number of logical paths</p> <p><b>NOTE</b><br/>You can only view the information about a maximum of eight paths on one controller.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | None          |
| LUN WWN              | WWN of the virtual LUN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | None          |
| Dev Lun ID           | ID of the storage system LUN corresponding to the virtual LUN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | None          |
| Manual IO Suspension | Manual I/O suspension time of the virtual LUN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | None          |

| Parameter                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                         | Default Value |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| Aggregation Type                 | Type of the aggregation LUN. Possible values are as follows: <ul style="list-style-type: none"> <li>● Hyper Metro: virtual HyperMetro LUNs</li> <li>● Migration: virtual migration LUNs.</li> </ul>                                                                                                                                                                                                                                                 | None          |
| Aggregation Specific Attribution | Attribution of the aggregation LUN.<br>For virtual HyperMetro LUNs: <ul style="list-style-type: none"> <li>● WorkingMode: working mode for virtual HyperMetro LUNs.</li> <li>● Primary Array SN: SN of the primary array.</li> </ul> For migration virtual LUNs: <ul style="list-style-type: none"> <li>● IO Direction: switch I/O to the target array or source array.</li> <li>● Rollback: enable or disable automatic I/O switchback.</li> </ul> | None          |

## A.4.3 Update the disks' driver

### Function

**start diskdriverupdate** command is used to manually update the disks' driver, associating with UltraPath to their most matched driver.

### Format

**start diskdriverupdate** [*mode*=[1|2|3]]

This command without "mode" option is recommended.

### Parameters

- 1: Execute the cmd in its subprocess with no window.
- 2: Execute the cmd in its subprocess with minimized window.
- 3: Execute the cmd silently without risk prompt.

### Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Run **start diskdriverupdate** command.

```
UltraPath CLI #1 >start diskdriverupdate

Execute this command may affect the stability of the application you're running
or even result in more serious consequences.
Are you sure still want to execute it [y,n]: y

Enumerate disks ...
Enumerate hba disks ...
No disk need to update driver.
Enumerate disks ...
Enumerate mpio disks ...
No disk need to update driver.
Enumerate disks ...
Enumerate upio disks ...
No disk need to update driver.
Command executed successfully.
```

## System Response

None

## A.4.4 Setting the Size of a HyperMetro Fragment

### Function

The **set hypermetro split\_size** command is used to set the fragment size when HyperMetro cross-array load balancing is applied.

### Format

```
set hypermetro split_size=size [vlun_id={ ID | ID1,ID2... | ID1-ID2 }]
```

### Parameters

| Parameter                       | Description                                                                                                                                                   | Default Value |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>split_size</b> = <i>size</i> | Fragment size.<br>The value ranges from 512 bytes to 1 GB. The unit is byte.<br><b>NOTE</b><br>The value must be an integer multiple of 512 and a power of 2. | 128 MB        |

| Parameter                                                                    | Description                                                                                                                                | Default Value |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>vlun_id</b> ={ <i>ID</i>   <i>ID1</i> , <i>ID2</i> ...   <i>ID1-ID2</i> } | ID of an virtual HyperMetro LUN.<br><br>Run the <b>show vlun type=hypermetro</b> command to obtain the IDs of the virtual HyperMetro LUNs. | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

- Run the **set hypermetro split\_size=size** command to set the HyperMetro fragment size for all storage systems.
- Run the **set hypermetro split\_size=size vlun\_id={ *ID* | *ID1*,*ID2*... | *ID1-ID2* }** command to set the HyperMetro fragment size of the virtual LUNs.

### NOTE

- **vlun\_id=ID**: ID of a single virtual LUN.
- **vlun\_id=ID1,ID2...**: IDs of multiple virtual LUNs which are not necessarily related.
- **vlun\_id=ID1-ID2**: IDs of all the virtual LUNs from ID1 to ID2.

## Example

- Set the HyperMetro fragment size to 128 MB for all storage systems.  

```
UltraPath CLI #2 >set hypermetro split_size=128M
Succeeded in executing the command.
```
- Set the HyperMetro fragment size of the virtual LUNs whose ID is 0 to 128 MB.  

```
UltraPath CLI #3 >set hypermetro split_size=128M vlun_id=0
Succeeded in executing the command.
```

## System Response

None

## A.4.5 Setting the HyperMetro Working Mode

### Function

The **set hypermetro workingmode** command is used to set the HyperMetro working mode.

### Format

```
set hypermetro workingmode={ priority | balance } primary_array_id=ID [vlun_id={ ID | ID1,ID2... | ID1-ID2 }]
```

## Parameters

| Parameter                                             | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Default Value                                                                                                                                                                                            |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>workingmode</b> = <i>{ priority   balance }</i>    | HyperMetro working mode.<br>Possible values are priority and balance, where: <ul style="list-style-type: none"> <li>● priority: primary array mode</li> <li>● balance: load balance mode</li> </ul>                                                                                                                                                                                                                                                                                                                                        | priority<br><b>NOTE</b><br>In default configurations, namely manual configuration has not been performed, the system compares the array SNs and selects the largest numbered array as the preferred one. |
| <b>primary_array_id</b> = <i>ID</i>                   | ID of the primary array.<br>You can run <b>show array</b> to display all array IDs.<br><b>NOTE</b> <ul style="list-style-type: none"> <li>● In priority mode, the primary array indicates the array that delivers I/O first.</li> <li>● In balance mode, the primary array indicates the array where the first fragment range resides.</li> <li>● If an array is connected to multiple hosts, the array ID varies on different hosts. Use the array SN to determine whether the arrays queried on different hosts are the same.</li> </ul> | None                                                                                                                                                                                                     |
| <b>vlun_id</b> = <i>{ ID   ID1,ID2...   ID1-ID2 }</i> | ID of an virtual HyperMetro LUN.<br>Run the <b>show vlun type=hypermetro</b> command to obtain the IDs of the virtual HyperMetro LUNs.                                                                                                                                                                                                                                                                                                                                                                                                     | None                                                                                                                                                                                                     |

## Level

User with **administrator** permissions

## Usage Guidelines

### NOTE

Setting the HyperMetro working mode of a specified virtual LUN with a higher priority than that of storage systems. If the HyperMetro working mode of a virtual LUN has been set, its working mode remains unchanged after the HyperMetro working mode of storage systems is set.

- When the working mode is set to primary array mode, UltraPath delivers I/Os to the priority array. UltraPath will deliver I/Os to non-priority arrays only when the primary array encounters a fault.
- When the working mode is set to load balance mode, UltraPath chooses to deliver a specific array based on the start address of I/Os, fragment size, and priority array.  
For example, if the fragment size is 128 MB, then the I/Os with start addresses from 0 MB to 128 MB are delivered to the priority array, and the I/Os with start addresses from 128 MB to 256 MB are delivered to non-priority arrays.
- Run the **set hypermetro workingmode={ *priority* | *balance* } primary\_array\_id** command to set the HyperMetro working mode for all storage systems.
- Run the **set hypermetro workingmode={ *priority* | *balance* } primary\_array\_id=ID vlun\_id={ *ID* | *ID1, ID2...* | *ID1-ID2* }** command to set the HyperMetro working mode of a specific virtual LUN.

 **NOTE**

- **vlun\_id=ID**: ID of a single virtual LUN.
- **vlun\_id=ID1, ID2...**: IDs of multiple virtual LUNs which are not necessarily related.
- **vlun\_id=ID1-ID2**: IDs of all the virtual LUNs from ID1 to ID2.

## Example

- Set the HyperMetro working mode to **primary array mode** for all storage systems, and set the storage systems whose ID is **0**, to the primary array.

```
UltraPath CLI #2 >set hypermetro workingmode=priority primary_array_id=0
Succeeded in executing the command.
```

- Set the HyperMetro working mode of the virtual LUNs whose ID is **0**, to **primary array mode**, and set the storage systems whose ID is **0**, to the primary array.

```
UltraPath CLI #3 > set hypermetro workingmode=priority primary_array_id=0
vlun_id=0
Succeeded in executing the command.
```

## System Response

None

## A.4.6 Configuring I/O Switchover

### Function

The **start migration** is used to switch over I/Os to the target array or the source array.

### Format

**start migration vlun\_id=ID direction={ *source* | *target* } rollback={ *enable* | *disable* }**

## Parameters

| Parameter                                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Default Value |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>vlun_id</b> = <i>ID</i>                          | ID of a virtual LUN.<br>Run the <b>show vlun</b> command to obtain the ID of a virtual LUN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | None          |
| <b>direction</b> ={ <i>source</i>   <i>target</i> } | Switch I/O to the target array or source array.<br>Possible values are source and target, where: <ul style="list-style-type: none"> <li>● source: switch I/O to the source array.</li> <li>● target: switch I/O to the target array.</li> </ul>                                                                                                                                                                                                                                                                                                              | None          |
| <b>rollback</b> ={ <i>enable</i>   <i>disable</i> } | Enable or disable automatic I/O switchback.<br>Possible values are enable or disable, where: <ul style="list-style-type: none"> <li>● enable: automatic I/O switchback is enabled. If an online migration fails, I/Os can be switched back to the source array.</li> </ul> <p><b>NOTE</b><br/>This value can be used only when <b>direction</b> equals <i>target</i>.</p> <ul style="list-style-type: none"> <li>● disable: automatic I/O switchback is disabled. If an online migration fails, I/Os cannot be switched back to the source array.</li> </ul> | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Switch over the I/Os of the LUN whose ID is **0** to the target array and enable automatic switchback.

```
UltraPath CLI #3 >start migration vlun_id=0 direction=target rollback=enable
Succeeded in executing the command.
```

## System Response

None

## A.4.7 Suspending I/Os of a Virtual LUN

### Function

The **start iosuspension** command is used to suspend I/Os of a specific LUN.

### Format

```
start iosuspension vlun_id=ID timeout=value
```

### Parameters

| Parameter            | Description                                                                                                                                   | Default Value |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>vlun_id=ID</b>    | ID of a virtual LUN.<br>Run the <b>show vlun</b> command to obtain the ID of a virtual LUN.                                                   | None          |
| <b>timeout=value</b> | I/O suspension timeout period.<br>The value ranges from 1 to 2,592,000, expressed in seconds. You are advised to set the value to 20 seconds. | None          |

### Level

User with **administrator** permissions

### Usage Guidelines

**start iosuspension** is a blocking command. It runs only when all I/Os of a specific LUN return to UltraPath.

### Example

Set the I/O suspension time of the LUN whose ID is **0** to 20 seconds.

```
UltraPath CLI #3 >start iosuspension vlun_id=0 timeout=20
Succeeded in executing the command.
```

## System Response

None

## A.4.8 Stopping I/O Suspension of a Virtual LUN

### Function

The **start iosuspension** command is used to stop I/O suspension of the a specific LUN.

### Format

**stop iosuspension vlun\_id=ID**

### Parameters

| Parameter         | Description                                                                                     | Default Value |
|-------------------|-------------------------------------------------------------------------------------------------|---------------|
| <b>vlun_id=ID</b> | IDs of the virtual LUNs.<br>Run the <b>show vlun</b> command to obtain the ID of a virtual LUN. | None          |

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

Stop I/O suspension of the virtual LUN whose ID is **0**.

```
UltraPath CLI #3 >stop iosuspension vlun_id=0
Succeeded in executing the command.
```

## System Response

None

## A.5 UltraPath Other Commands

Introduce UltraPath other commands that are excluded in above.

### A.5.1 Showing Array Models Supported by the UltraPath

## Function

The **show supportarraylist** command is used to show all disk array models supported by the UltraPath.

## Format

**show supportarraylist**

## Parameters

None

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

Show all disk array models supported by the UltraPath.

```
UltraPath CLI #0 >show supportarraylist
```

| Vendor | Product    |
|--------|------------|
| HUAWEI | S6800E     |
| HUAWEI | V1500      |
| HUAWEI | V1500N     |
| HUAWEI | V1800      |
| HUAWEI | S2100      |
| HUAWEI | S2300      |
| HUAWEI | S2300E     |
| HUAWEI | S2600      |
| HUAWEI | S2900      |
| HUAWEI | S5300      |
| HUAWEI | S5100      |
| HUAWEI | S5500      |
| HUAWEI | S5600      |
| HUAWEI | S8000-I    |
| HUAWEI | V1600N     |
| HUAWEI | S3900      |
| HUAWEI | S6900      |
| HUAWEI | S2200T     |
| HUAWEI | S2600T     |
| HUAWEI | S5500T     |
| HUAWEI | S5600T     |
| HUAWEI | S5800T     |
| HUAWEI | S6800T     |
| HUAWEI | S3900-M200 |
| HUAWEI | S3900-M300 |
| HUAWEI | S5900-M100 |
| HUAWEI | S5900-M200 |
| HUAWEI | S6900-M100 |
| HUAWEI | Dorado2100 |
| HUAWEI | Dorado5100 |
| HUASY  | S2600T     |
| HUASY  | S3900      |
| HUASY  | S5300      |

```

HUASY S2200T
HUASY S6900
HUASY S5500T
HUASY S5600T
HUASY S5800T
HUASY S6800T
HUASY S3900-M200
HUASY S3900-M300
HUASY S5900-M100
HUASY S5900-M200
HUASY S6900-M100
HUASY S8000-I
HUASY Dorado2100
HUASY Dorado5100
HUAWEI VIS6000
HS VIS6000
HUAWEI VIS6000T
HS VIS6000T
HS V1500
HS V1500N
HS V1800
HS S2100
HS S2300
HS S2300E
HS S2600
HS S2600T
HS S5100
HS S5300
HS S5500
HS S5600
HS S6800E
HS V1600N
HS S8000-I
HS S8000
HUAWEI S8000
HUAWEI Dorado2100 G2
HUAWEI HVS85T
HUAWEI HVS88T
HUAWEI XSG1
Marstor XSG1
UDsafe XSG1
SanM XSG1
AnyStor XSG1
SUGON XSG1
NETPOSA XSG1

```

## System Response

None

## A.5.2 Adding a Disk Array Model Supported by the UltraPath

### Function

The **add supportarraylist** command is used to add a disk array model supported by the UltraPath.

### Format

```
add supportarraylist vendor=<vendor_id> product=<product_id>
[driver=<driver_type>]
```

## Parameters

| Keyword and Parameter                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Default Value |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>vendor</b> =< <i>vendor_id</i> >   | Vendor ID of a disk array.<br><b>NOTE</b><br>The ID contains a maximum of 8 characters. The space at the beginning and end of the ID are omitted. It is recommended that double quotation marks (") are used to mark a vendor ID. If a vendor ID contains spaces, it must be marked with double quotation marks. The number of characters is a value ranging from 32 to 126 (32 ≤ ASCII code ≤ 126). The following characters are not supported: #^&= \\;><,"_   | None          |
| <b>product</b> =< <i>product_id</i> > | Product ID of a disk array.<br><b>NOTE</b><br>The ID contains a maximum of 16 characters. The space at the beginning and end of the ID are omitted. It is recommended that double quotation marks (") are used to mark a vendor ID. If a vendor ID contains spaces, it must be marked with double quotation marks. The number of characters is a value ranging from 32 to 126 (32 ≤ ASCII code ≤ 126). The following characters are not supported: #^&= \\;><,"_ | None          |
| <b>driver</b> =< <i>driver_type</i> > | Driver type of a disk array.<br>The value is <b>default</b> .<br><b>NOTE</b><br>It is recommended that double quotation marks (") are used to mark the driver type of a disk array.                                                                                                                                                                                                                                                                              | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

In Windows, after a disk array model is added, the system must be restarted for the settings to take effect.

## Example

Add a disk array model supported by the UltraPath.

```
UltraPath CLI #0 >add supportarraylist vendor="HUAWEI" product="S2600T"
driver="default"
```

Execute this command may affect the stability of the application you're running or even result in more serious consequences.

You will add the array's information: vendor="HUAWEI" product="S2600T" driver="default".

Are you sure still want to execute it [y,n]: y

Command executed successfully. You need to restart the computer to enable the configuration.

## System Response

None

## A.5.3 Deleting a Disk Array Model Supported by the UltraPath

### Function

The **del supportarraylist** command is used to delete a disk array model supported by the UltraPath.

### Format

**del supportarraylist** vendor=<vendor\_id> product=<product\_id>

### Parameters

| Keyword and Parameter      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Default Value |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>vendor</b> =<vendor_id> | <p>Vendor ID of a disk array.</p> <p><b>NOTE</b></p> <p>The ID contains a maximum of 8 characters. The space at the beginning and end of the ID are omitted. It is recommended that double quotation marks (") are used to mark a vendor ID. If a vendor ID contains spaces, it must be marked with double quotation marks. The number of characters is a value ranging from 32 to 126 (32 ≤ ASCII code ≤ 126). The following characters are not supported: #^&amp;= \\;&gt;&lt;,"_</p> | None          |

| Keyword and Parameter        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Default Value |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>product</b> =<product_id> | <p>Product ID of a disk array.</p> <p><b>NOTE</b></p> <p>The ID contains a maximum of 16 characters. The space at the beginning and end of the ID are omitted. It is recommended that double quotation marks (") are used to mark a vendor ID. If a vendor ID contains spaces, it must be marked with double quotation marks. The number of characters is a value ranging from 32 to 126 (32 ≤ ASCII code ≤ 126). The following characters are not supported: #^&amp;= \;&gt;&lt;,"_</p> | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

- In Windows, a mapped disk array model can be deleted.
- In Windows, after a disk array model is deleted, the system must be restarted for the settings to take effect.

## Example

Delete a disk array model supported by the UltraPath.

```
UltraPath CLI #0 >del supportarraylist vendor="HUAWEI" product="S2600T"

Execute this command may affect the stability of the application you're running
or even result in more serious consequences.
You will delete the array's information: vendor="HUAWEI" product="S2600T".

Are you sure still want to execute it [y,n]: y

Command executed successfully. You need to restart the computer to enable the
configuration.
```

## System Response

None

## A.5.4 Executing a Non-disruptive Upgrade of UltraPath

### Function

The **UltraPath-x.xx.xxx.exe** command is used to execute a non-disruptive upgrade of UltraPath.

## Format

**UltraPath-x.xx.xxx.exe /z"UPMODE:NDU [ CPU:cpuvalue [ MEMORY:memoryvalue [ SPACE:spacevalue ] ] ]"**

### NOTE

The installation package corresponding to the **UltraPath-x.xx.xxx.exe** command is UltraPath-8.06.007.exe that serves as an example.

## Parameters

| Keyword and Parameter     | Description                                                                                                                       | Default Value |
|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>/z</b>                 | The installation package is executed with parameters.                                                                             | None          |
| <b>/z" "</b>              | The content within the double quotation marks is a non-disruptive upgrade control parameter.                                      | None          |
| <b>UPMODE:NDU</b>         | Enables the non-disruptive upgrade mode.                                                                                          | None          |
| <b>CPU:cpuvalue</b>       | Set the maximum CPU usage for a non-disruptive upgrade.<br>The value ranges from 0 to 100.                                        | 80            |
| <b>MEMORY:memoryvalue</b> | Set the minimum system physical memory for a non-disruptive upgrade.<br>The unit is MB. The value ranges from 0 to 2,147,483,647. | 200           |
| <b>SPACE:spacevalue</b>   | Set the minimum system disk capacity for a non-disruptive upgrade.<br>The unit is MB. The value ranges from 600 to 2,147,483,647. | 1024          |

## Level

User with **administrator** permissions

## Usage Guidelines

Run the command to upgrade the UltraPath online.

## Example

- Enable the non-disruptive upgrade mode.  

```
C:\> UltraPath-8.06.007.exe /z"UPMODE:NDU"
```
- Set the maximum CPU usage for an non-disruptive upgrade to 85% and enable the non-disruptive upgrade mode.  

```
C:\> UltraPath-8.06.007.exe /z"UPMODE:NDU CPU:85"
```
- Set the maximum CPU usage, minimum system physical memory, and minimum system disk capacity for an non-disruptive upgrade to 85%, 100 MB, and 1000 MB respectively and enable the non-disruptive upgrade mode.  

```
C:\> UltraPath-8.06.007.exe /z"UPMODE:NDU CPU:85 MEMORY:100 SPACE:1000"
```

## System Response

After running the command, upgrade the UltraPath on the GUI.

## A.5.5 Viewing the Status of the Host Alarm Push Switch

### Function

**show alarmentable** is used to view the status of the host alarm push switch.

### Format

**show alarmentable**

### Parameters

None

### Level

User with **administrator** permissions

### Usage Guidelines

None

### Example

View the alarm push switch for UltraPath:

```
UltraPath CLI #0 >show alarmentable
alarmentable: on
```

### System Response

None

## A.5.6 Setting the Switch of Host Alarm Push

## Function

**set alarmentable** is used to set the switch of host alarm push.

## Format

**set alarmentable**={ *on* | *off* }

## Parameters

| Parameter                                       | Description                                                                                                                                                                                                                                   | Default Value |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>alarmentable</b> ={ <i>on</i>   <i>off</i> } | Alarm push switch for UltraPath.<br>The value can be <b>on</b> or <b>off</b> , where:<br><ul style="list-style-type: none"> <li>● <b>on</b>: Enables the alarm push switch.</li> <li>● <b>off</b>: Disables the alarm push switch.</li> </ul> | on            |

## Level

User with **administrator** permissions

## Usage Guidelines

- When the alarm push switch is enabled, UltraPath will detect the single-controller connectivity, link down, and link degrade, and send the link status to the storage system through alarms.
- When the alarm push switch is disabled, the alarms reported by UltraPath to arrays cannot be cleared on the arrays. Therefore, disable the switch cautiously.

## Example

Disable the alarm push switch for UltraPath:

```
UltraPath CLI #0 >set alarmentable=off
If you close alarm enable, the host would not push alarm to the array, and the
alarm in array will not be cleared.
Are you sure you want to continue? [y,n]: y

Succeeded in executing the command.
Please clear the alarm in the array manually, thanks.
```

## System Response

None

## A.5.7 Viewing the Status of the UltraPath Link Degrade Switch

## Function

**show path\_reliability\_enable** is used to view the status of the UltraPath link degrade switch.

## Format

**show path\_reliability\_enable**

## Parameters

None

## Level

User with **administrator** permissions

## Usage Guidelines

None

## Example

View the status of the UltraPath link degrade switch:

```
UltraPath CLI #0 >show path_reliability_enable
path_reliabilityenable: on
```

## System Response

None

## A.5.8 Setting the Switch for UltraPath Link Degrade

### Function

**set path\_reliability\_enable** is used to set the switch for UltraPath link degrade.

### Format

**set path\_reliability\_enable**={ *on* | *off* }

## Parameters

| Parameter                                             | Description                                                                                                                                                                                                                                                | Default Value |
|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <code>path_reliability_enable={<br/>on   off }</code> | <p>Link degrade switch for UltraPath.</p> <p>The value can be <b>on</b> or <b>off</b>, where:</p> <ul style="list-style-type: none"> <li>● <b>on</b>: Enables the link degrade switch.</li> <li>● <b>off</b>: Disables the link degrade switch.</li> </ul> | on            |

## Level

User with **administrator** permissions

## Usage Guidelines

- When the link degrade switch is enabled, UltraPath will detect and isolate degraded links.
- When the link degrade switch is disabled, some faults cannot be isolated by UltraPath, which results in the deterioration of the host performance. Therefore, disable the switch cautiously.

## Example

Disable the link degrade switch for UltraPath:

```
UltraPath CLI #0 >set path_reliability_enable=off
```

```
If you close reliability enable, this would abandon the path reliability check
and may infect the performance.
```

```
Are you sure you want to continue? [y,n]: y
```

```
Succeeded in executing the command.
```

## System Response

None

## A.5.9 Clearing Inactive Drivers in Online Upgrade Process

### Function

The **UpgradeTool.exe** command is used to clear drivers that do not take effect during an online upgrade.

### Format

**UpgradeTool.exe -r**

## Parameters

| Parameter | Description                                                     | Default Value |
|-----------|-----------------------------------------------------------------|---------------|
| <b>-r</b> | Clear drivers that do not take effect during an online upgrade. | None          |

## Level

User with **administrator** permissions

## Usage Guidelines

Copy the **UpgradeTool.exe** file in the **\Windows\Packages\Upgrade** directory where the UltraPath for Windows software installation package is saved to any directory (directory A) of the Windows host. Use CLI to switch to directory A and run the **UpgradeTool.exe -r** command.

Run **UpgradeTool.exe -r** to clear drivers that do not take effect during an online upgrade.

## Example

Clear drivers that do not take effect during the online upgrade.

```
UpgradeTool.exe -r
Clear invalid nxup driver success
```

## System Response

None

## A.5.10 Viewing the Running Status of the UltraPath Working Thread

### Function

The **show workerstate** command is used to view the running status of the UltraPath working thread.

### Format

```
show workerstate
```

### Parameters

None

### Level

User with **administrator** permissions

## Usage Guidelines

This command is used to show the status of the UltraPath working thread. Administrators can view last refresh time and present time to determine whether the working thread is blocked and calculated the block duration.

## Example

View the status of the UltraPath working thread.

```
UltraPath CLI #0 > show workerstate
worker name: USIImmediateWkq_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: USIDefererdWkq_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: KLSWriteLogWorkQueue_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: VLMVLunNotifyWkq_1 last refresh time: 2016-07-26 08:13:06
present time: 2016-07-26 08:13:07
worker name: CodeStreamWorkQueue_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: LPMSyncCmdPost_1 last refresh time: 2016-07-26 08:13:06
present time: 2016-07-26 08:13:07
worker name: LPMPATHMgrWkq_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PingSpecialWorkQueue_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PingWorkQueue_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PcmCmdWorkQueue_0_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PcmCmdWorkQueue_1_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PcmCmdWorkQueue_2_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PcmCmdWorkQueue_3_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PcmCmdWorkQueue_4_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
worker name: PCM_AttachCmdWkQueue_1 last refresh time: 2016-07-26 08:13:07
present time: 2016-07-26 08:13:07
```

## System Response

| Parameter         | Description                                                  | Default Value |
|-------------------|--------------------------------------------------------------|---------------|
| worker name       | Working thread name.                                         | None          |
| last refresh time | Last refresh time of the working thread.                     | None          |
| present time      | Current system time, that is, execution time of the command. | None          |

# B Files Related to the UltraPath

After the UltraPath is correctly installed on a Windows operating system, the UltraPath adds and modifies certain files that ensure its proper running. Do not modify or delete these files unnecessarily.

## Files Added to the UltraPath

| Name                                                | File path                                                 | Description                                                      |
|-----------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------|
| cmd.ico<br>deiverbloom.ico<br>UltraPath Console.ico | C:\Program Files (x86)\UltraPath\bin                      | Shortcut icon.                                                   |
| configuration.properties                            | C:\Program Files (x86)\UltraPath\bin                      | Configuration file that controls the GUI language.               |
| cfg_upgrade.exe                                     | C:\Program Files (x86)\UltraPath\bin                      | UltraPath configuration tool.                                    |
| installpost.exe                                     | C:\Program Files (x86)\UltraPath\bin                      | UltraPath driver installation, upgrade, and uninstallation tool. |
| iscsiConfig.exe                                     | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32 | iSCSI initiator timeout parameter configuration tool.            |
| kcfreg.exe                                          | C:\Program Files (x86)\UltraPath\bin                      | UltraPath parameter configuration tool.                          |
| UltraPathConsole.exe                                | C:\Program Files (x86)\UltraPath\bin                      | GUI startup program.                                             |
| upadm.exe                                           | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32 | UltraPath CLI execution program.                                 |

| Name              | File path                                                                            | Description                                                                             |
|-------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| uptool.exe        | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32                            | Recovery tool that recovers disk drives to common disks after UltraPath is uninstalled. |
| libxml2_amd64.dll | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32                            | <b>libxml</b> library file used by 64-bit operating systems.                            |
| libxml2_i386.dll  | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32                            | <b>libxml</b> library file used by 32-bit operating systems.                            |
| nxup.cat          | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | Security authentication file of the UltraPath nxup driver.                              |
| nxup.inf          | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | INF file of the UltraPath nxup driver.                                                  |
| nxup.sys          | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\drivers                    | Binary file of the UltraPath nxup driver.                                               |
| nxupdsm.cat       | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | Security authentication file of the UltraPath nxupdsm driver.                           |
| nxupdsm.inf       | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | INF file of the UltraPath nxupdsm driver.                                               |
| nxupdsm.sys       | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\drivers                    | Binary file of the UltraPath nxupdsm driver.                                            |
| nxup_ext_a.cat    | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | Security authentication file of the UltraPath nxup_ext_a driver.                        |

| Name                                        | File path                                                                            | Description                                                      |
|---------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------|
| nxup_ext_a.inf                              | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | INF file of the UltraPath nxup_ext_a driver.                     |
| nxup_ext_a.sys                              | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\drivers                    | Binary file of the UltraPath nxup_ext_a driver.                  |
| nxup_ext_b.cat                              | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | Security authentication file of the UltraPath nxup_ext_b driver. |
| nxup_ext_b.inf                              | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | INF file of the UltraPath nxup_ext_b driver.                     |
| nxup_ext_b.sys                              | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\drivers                    | Binary file of the UltraPath nxup_ext_b driver.                  |
| updisk.cat                                  | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | Security authentication file of the UltraPath updisk driver.     |
| updisk.inf                                  | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\DriverStore\FileRepository | INF file of the UltraPath updisk driver.                         |
| updisk.sys                                  | C:\Program Files (x86)\UltraPath\bin; C:\Windows\System32\drivers                    | Binary file of the UltraPath updisk driver.                      |
| RestartComputer.cmd                         | C:\Program Files (x86)\UltraPath\bin                                                 | Command for restarting a computer.                               |
| up.conf<br>user_cfg.xml<br>user_cfg.xml.bak | C:\Program Files (x86)\UltraPath\bin                                                 | UltraPath configuration file.                                    |

| Name                    | File path                                  | Description                                                                                                                                                                      |
|-------------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NxupService.dll         | C:\Program Files (x86)\UltraPath\bin       | Interface library for UltraPath GUI kernel interaction.                                                                                                                          |
| up_service.exe          | C:\Windows\System32<br>C:\Windows\SysWOW64 | UltraPath background service. <ul style="list-style-type: none"> <li>● System32 is applicable to 32-bit systems.</li> <li>● SysWOW64 is applicable to 64-bit systems.</li> </ul> |
| WatchRestart.vbs        | C:\Program Files (x86)\UltraPath\bin       | Script for scheduled computer restart reminding.                                                                                                                                 |
| jre6u45\*               | C:\Program Files (x86)\UltraPath\bin       | File related to JDK 6.45.                                                                                                                                                        |
| framework\lib\*         | C:\Program Files (x86)\UltraPath\bin       | External JAR package on which GUI depends.                                                                                                                                       |
| framework\framework.jar | C:\Program Files (x86)\UltraPath\bin       | Framework file of GUI.                                                                                                                                                           |

## File Modified by the UltraPath

None.

---

# C How to Obtain Help

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If a problem persists in routine maintenance or troubleshooting, contact Huawei for technical support.

## [C.1 Preparations for Contacting Huawei](#)

To better solve the problem, you need to collect troubleshooting information and make debugging preparations before contacting Huawei.

### [C.2 How to Use the Document](#)

Huawei provides guide documents shipped with the device. The guide documents can be used to handle the common problems occurring in daily maintenance or troubleshooting.

### [C.3 How to Obtain Help from Website](#)

Huawei provides users with timely and efficient technical support through the regional offices, secondary technical support system, telephone technical support, remote technical support, and on-site technical support.

### [C.4 Ways to Contact Huawei](#)

Huawei Technologies Co., Ltd. provides customers with comprehensive technical support and service. For any assistance, contact our local office or company headquarters.

## C.1 Preparations for Contacting Huawei

To better solve the problem, you need to collect troubleshooting information and make debugging preparations before contacting Huawei.

### C.1.1 Collecting Troubleshooting Information

You need to collect troubleshooting information before troubleshoot.

You need to collect the following information:

- Name and address of the customer
- Contact person and telephone number
- Time when the fault occurred
- Description of the fault phenomena
- Device type and software version

- Measures taken after the fault occurs and the relevant results
- Troubleshooting level and required solution deadline

## C.1.2 Making Debugging Preparations

When you contact Huawei for help, the technical support engineer of Huawei might help you do certain operations to collect information about the fault or rectify the fault directly.

Before contacting Huawei for help, you need to prepare the boards, port modules, screwdrivers, screws, cables for serial ports, network cables, and other required materials.

## C.2 How to Use the Document

Huawei provides guide documents shipped with the device. The guide documents can be used to handle the common problems occurring in daily maintenance or troubleshooting.

To better solve the problems, use the documents before you contact Huawei for technical support.

## C.3 How to Obtain Help from Website

Huawei provides users with timely and efficient technical support through the regional offices, secondary technical support system, telephone technical support, remote technical support, and on-site technical support.

Contents of the Huawei technical support system are as follows:

- Huawei headquarters technical support department
- Regional office technical support center
- Customer service center
- Technical support website: <http://enterprise.huawei.com>

You can query how to contact the regional offices at <http://enterprise.huawei.com>.

## C.4 Ways to Contact Huawei

Huawei Technologies Co., Ltd. provides customers with comprehensive technical support and service. For any assistance, contact our local office or company headquarters.

Huawei Technologies Co., Ltd.

Address: Huawei Industrial Base Bantian, Longgang Shenzhen 518129 People's Republic of China

Website: <http://support.huawei.com/enterprise/>

# D Acronyms and Abbreviations

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## F

|             |                             |
|-------------|-----------------------------|
| <b>FC</b>   | Fibre Channel               |
| <b>FCoE</b> | Fibre Channel over Ethernet |

## G

|            |                          |
|------------|--------------------------|
| <b>GUI</b> | Graphical User Interface |
|------------|--------------------------|

## H

|            |                  |
|------------|------------------|
| <b>HBA</b> | Host Bus Adapter |
|------------|------------------|

## I

|              |                                           |
|--------------|-------------------------------------------|
| <b>iSCSI</b> | Internet Small Computer Systems Interface |
| <b>ISM</b>   | Integrated Storage Management             |

## L

|            |                     |
|------------|---------------------|
| <b>LUN</b> | Logical Unit Number |
|------------|---------------------|

## M

|             |                           |
|-------------|---------------------------|
| <b>MPIO</b> | MultiPath Input Output    |
| <b>MSCS</b> | Microsoft Cluster Service |

## N

|             |                                      |
|-------------|--------------------------------------|
| <b>NIC</b>  | Network Interface Card               |
| <b>P</b>    |                                      |
| <b>PnP</b>  | Plug and Play                        |
| <b>R</b>    |                                      |
| <b>RAID</b> | Redundant Array of Independent Disks |
| <b>RDM</b>  | Raw Device Mapping                   |
| <b>S</b>    |                                      |
| <b>SAS</b>  | Serial Attached SCSI                 |
| <b>SCSI</b> | Small Computer System Interface      |
| <b>SN</b>   | Serial Number                        |
| <b>T</b>    |                                      |
| <b>TOE</b>  | TCP Offload Engine                   |
| <b>V</b>    |                                      |
| <b>VLUN</b> | Virtual LUN                          |
| <b>W</b>    |                                      |
| <b>WWN</b>  | World-Wide Number                    |