Hitachi Vantara

Configuring Hitachi Dynamic Link Manager on VMware ESXi using ESXCLI Command and vCenter

v1.0

Implementation Guide

This guide shows how to configure Hitachi Dynamic Link Manager (HDLM) with VMware ESXi on a Hitachi Virtual Storage Platform (VSP) storage system using vCenter and VMware ESXCLI commands.

Hitachi Vantara

December 2024

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Preface

About this document

This document shows how to configure Hitachi Dynamic Link Manager (HDLM) with VMware ESXi on a Hitachi Virtual Storage Platform (VSP) storage system using vCenter and VMware ESXCLI commands.

To use this document, you must have a basic understanding of VMware ESXi systems, Hitachi VSP storage systems, and HDLM.

Revision History

Revision	Changes	Date
v1.0	Initial Release	December 2024

Accessing product documentation

Product user documentation is available on the Hitachi Vantara Support Site: https://docs.hitachivantara.com/. Check this site for the most current documentation, including important updates that may have been made after the release of the product. For more information on the operating system, see the operating system documentation. For the product support matrix, see the Product Compatibility Guide: https://compatibility.hitachivantara.com/

For OS support, please check their support site:
VMware ESXi: https://techdocs.broadcom.com/

Getting Help

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

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Comments

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Introduction

Purpose

Configuring the Hitachi Dynamic Link Manager (HDLM) on VMware ESXi ensures efficient multipathing by managing I/O paths between the host and the Hitachi storage system. HDLM allows administrators to monitor path health, implement load balancing, and set failover policies for high availability. Both the ESXCLI command and the vCenter graphical interface help to verify and configure the Path Selection Policy (PSP) and Storage Array Type Plugin (SATP) settings, ensuring optimal performance. In addition, HDLM enables troubleshooting of path failures and fine-tuning of path selection policies for enhanced reliability. Overall, HDLM ensures uninterrupted access to the storage system, improving performance and fault tolerance.

Hitachi DLM Overview

HDLM is a multipathing software solution developed by Hitachi Vantara to improve data availability and system resilience by managing paths and failover mechanisms in a heterogeneous storage environment, with Hitachi and non-Hitachi storage systems. By efficiently managing multiple paths, HDLM optimizes connectivity and availability between storage systems and host servers, such as VMware ESXi. HDLM provides high availability and dynamic load balancing for connected storage, ensuring continuous access to data. When integrated with VMware ESXi, HDLM intelligently manages paths between VMs and storage infrastructure. This document includes HDLM installation on ESXi, highlighting the benefits, features, and architecture.

Key Features of HDLM

The following lists the key features of HDLM:

- **Automatic Path Failover:** Automatically switches to alternate paths during a failure to ensure continuous access and performs failback when paths recover.
- **Load Balancing:** Balances I/O traffic across all available paths, optimizing performance and reducing system bottlenecks.
- **Path Health Monitoring:** Continuously monitors path health and proactively switches to healthier paths before issues impact operations.
- **Centralized Management:** Simplifies management by offering centralized control over paths, making administration of large environments easier.

Connectivity Diagram

The ESXi server where HDLM is installed is connected to the Hitachi VSP storage system through two SAN switches, as shown in the following figure:

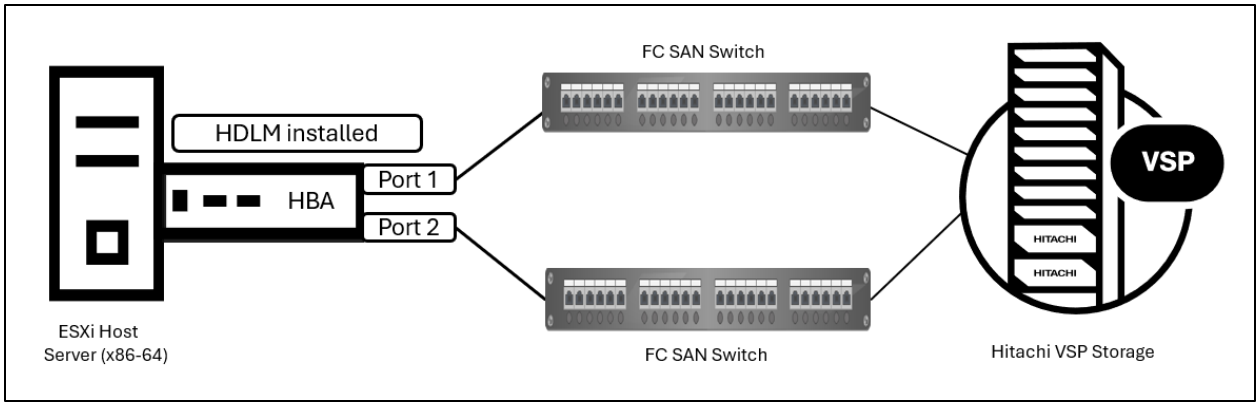


Figure 1: Connectivity of the ESXi Host (with HDLM) to the Hitachi VSP storage system through two FC SAN switches

Hardware Requirements

The following lists the hardware devices used for this implementation:

- Host system: HPE ProLiant DL380 Gen10 Server
- Host HBA: QLogic QLE2742SR Dual Port 16Gb Fiber Channel Adapter
- Switches: Brocade G620 Fabric Switch and Brocade G630 Fabric Switch
- Storage system: Hitachi VSP 5600H

Software Requirements

The following lists the software used for this implementation setup:

- OS install media: ESXi 8.0U1
- vSphere Client version: 8.0.0.10000
- Multipath: HDLM 8.9.0-01

How HDLM Works with ESXi

HDLM integrates with VMware ESXi to manage paths between ESXi hosts and storage systems. The Native Multipathing Plugin (NMP) of VMware ESXi manages the routing of I/O operations across available physical paths. HDLM can replace or work alongside VMware NMP by installing as a third-party Multipathing Plugin (MPP) to provide advanced path management capabilities, such as load balancing and failover, specifically optimized for Hitachi storage environments.

Integrating HDLM with VMware ESXi

This section shows the detailed view of integrating HDLM with VMware ESXi.

HDLM on a VMware ESXi Host

The following diagram shows a VMware virtualization environment that involves an ESXi host managed by a VMware vCenter server. The host is connected to storage controllers through a network of SAN switches.

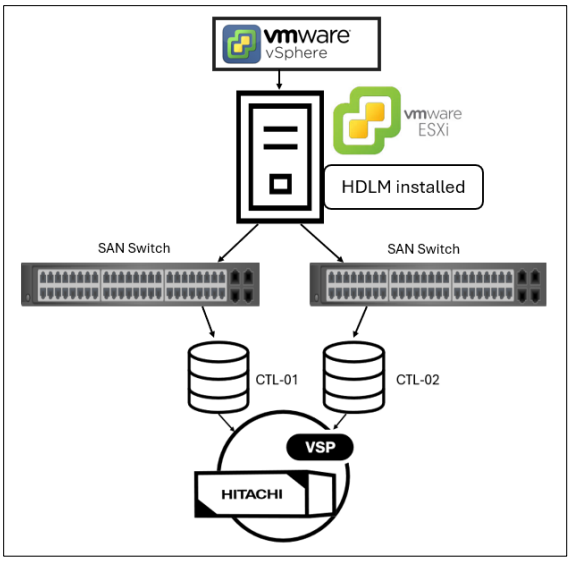


Figure 2: ESXi Host Connectivity

Components and Their Interactions in the Environment

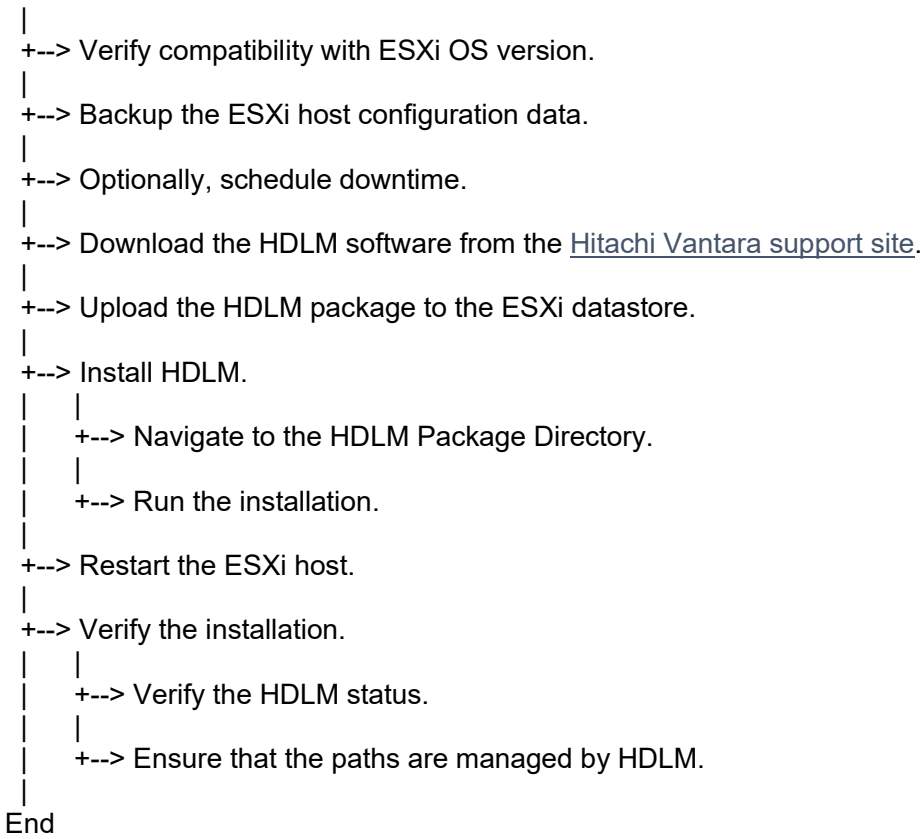
The following lists the components and their interactions in the environment:

- **VMware vCenter:** The central management utility for VMware environments, offering a unified platform to control multiple ESXi hosts and enabling advanced features such as vMotion, DRS, and centralized monitoring.
- **VMware ESXi Host:** A hypervisor that runs directly on hardware, managing virtual machines and providing virtualization services to guest operating systems.
- **HDLM Path Management:** Used for path management in storage environments, improving fault tolerance and load balancing to optimize access to storage resources.
- **SAN Switch:** Connects VMware hosts to storage controllers, managing the FC network for high-speed data transfer and ensuring redundant connectivity.

- **Storage Controller A and B:** Dual storage controllers configured for high availability, where each controller manages a separate set of disks and can take over the other controller workloads if one fails.

Workflow for Configuring HDLM with ESXi

Configuring HDLM involves several steps to ensure proper path management and optimal performance in your storage environment. The following is a typical workflow for HDLM configuration:



Installing HDLM on ESXi

Installing HDLM on VMware involves several steps to ensure proper integration and functionality for managing multiple paths to Hitachi storage systems.

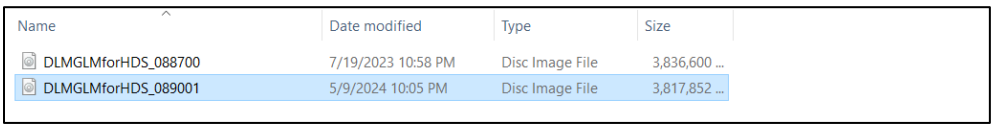
Prerequisites

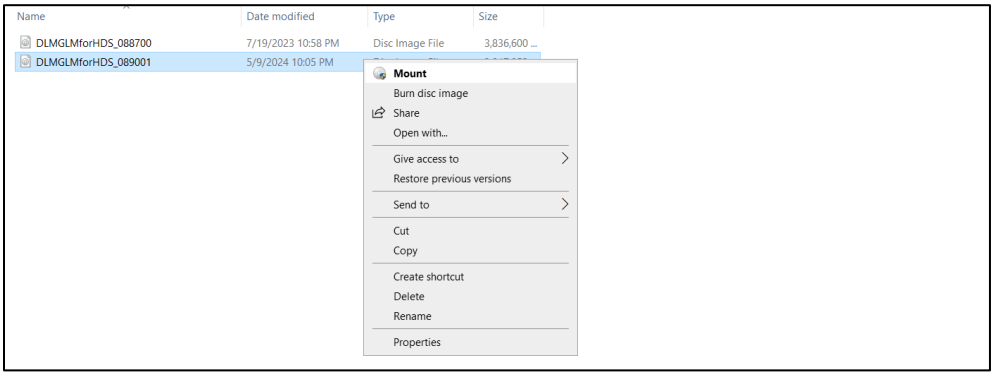
- Ensure compatibility between the VMware ESXi version and the HDLM software. Check the compatibility matrix provided by Hitachi Vantara: Product Compatibility Guide
- Download the HDLM software: HDLM Download
- Confirm that the ESXi host is connected to the Hitachi VSP storage system through Fiber Channel (FC) or iSCSI.
- Verify the availability of the Host Bus Adapters (HBAs) and Network Adapter (NIC/CNA) for redundancy.
- If the Windows version of HDLM is already installed on the machine for use as the remote management client, remove it before proceeding. The VMware and Windows versions of HDLM cannot coexist on the same remote management client.
- A license key is required if you install HDLM for the first time or upgrade HDLM after the license has expired. Keep the license key before proceeding with the upgrade or installation.

Preparing Installation Files in vCenter Server

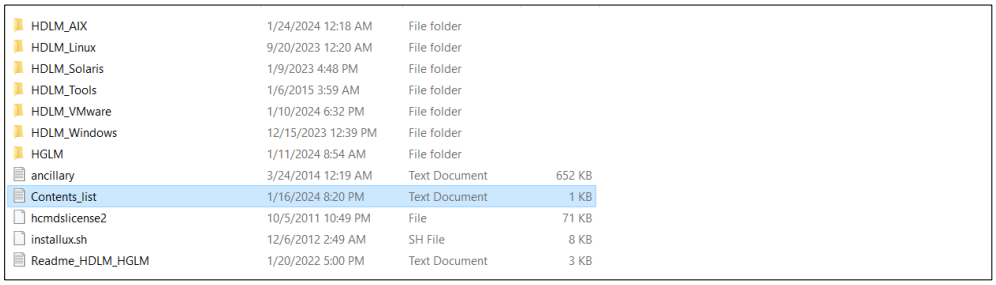
To configure HDLM on ESXi hosts, complete the following steps:

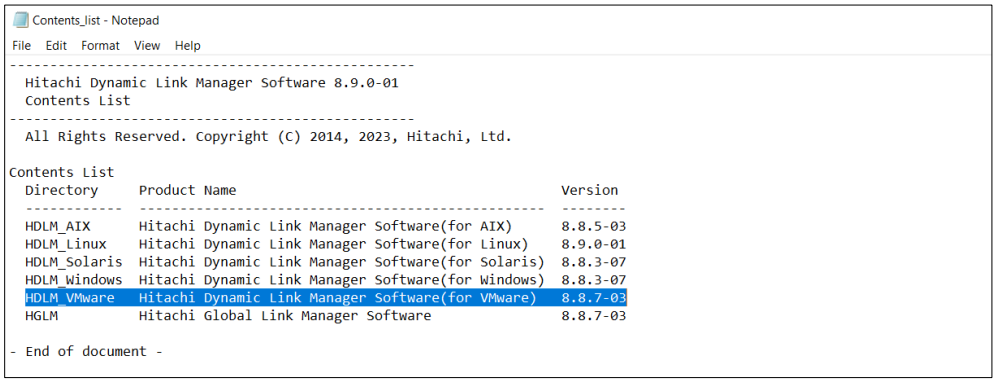
1. Mount the downloaded HDLM iso file in a Windows client machine to extract the HDLM folder.



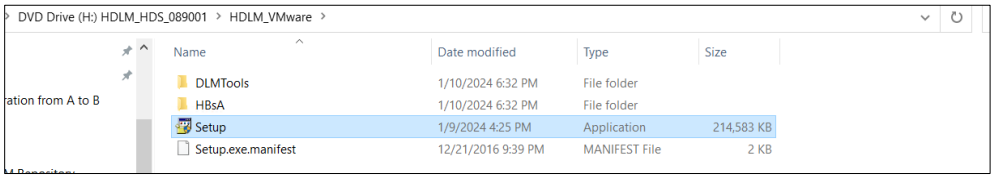


2. Navigate to the ‘Contents_list’ file and verify the VMware HDLM software version for installing HDLM 8.9.0-01.



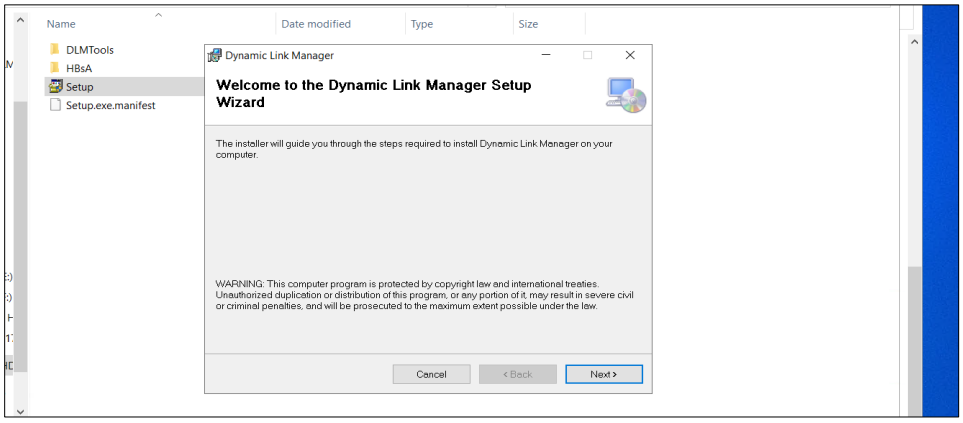


3. Navigate to the HDLM_VMware directory with the executable setup file.

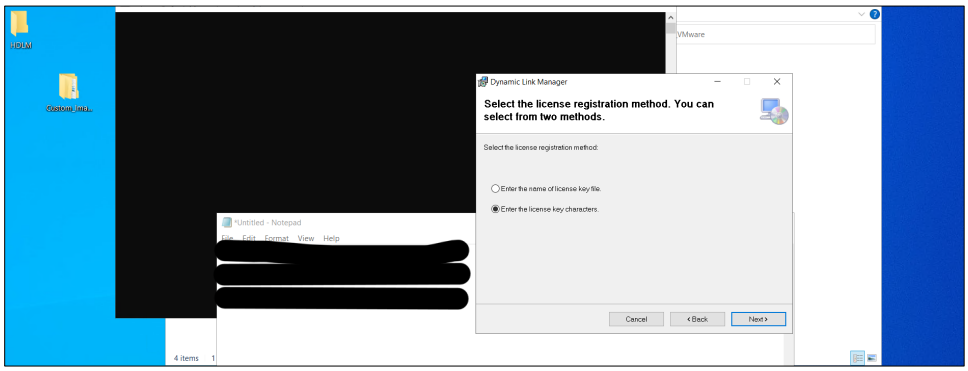


4. Run the Setup file and then click **Yes.**

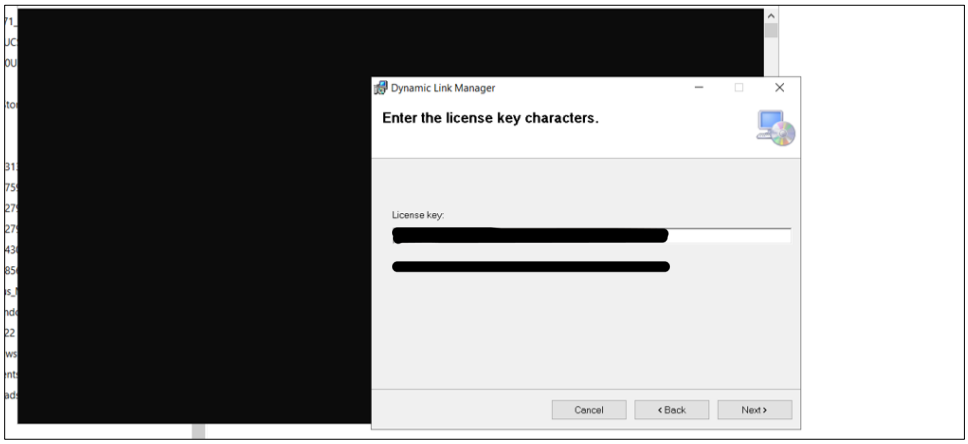
5. When the Dynamic Link Manager setup wizard appears, click **Next**.



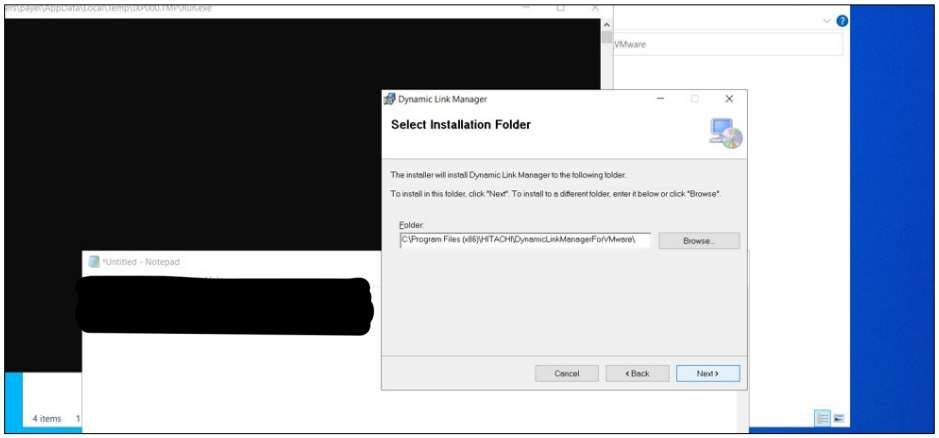
6. Select the license registration method with 'license key characters' and click **Next**.



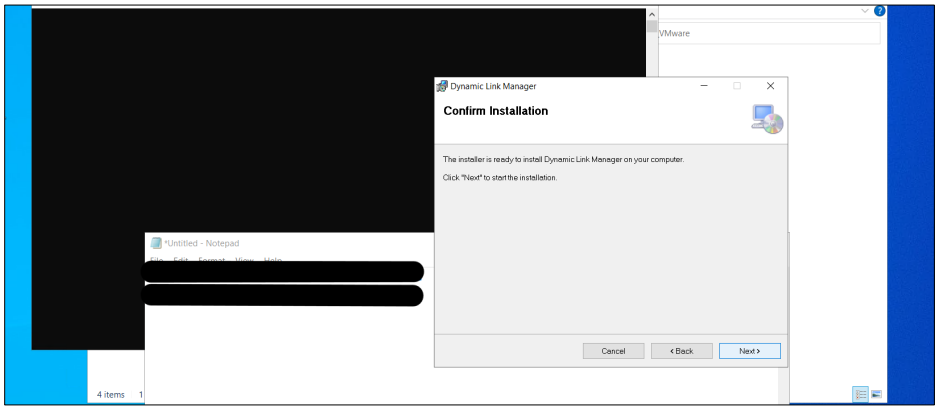
7. Enter the license key and click **Next**.



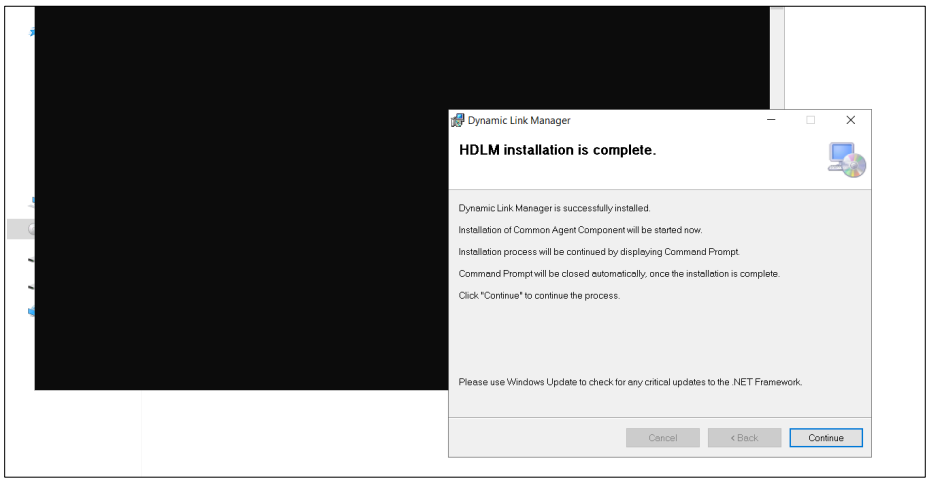
8. Select the installation folder and click **Next**.



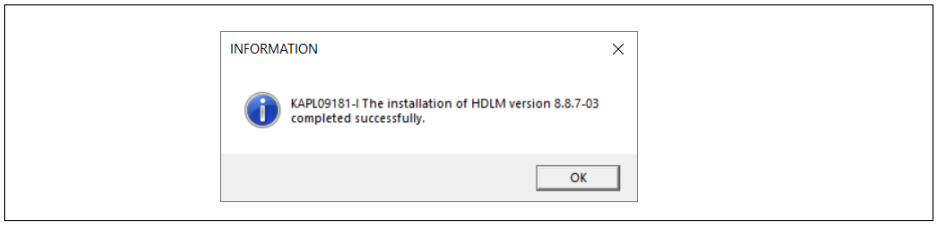
9. When the installation is ready, click **Next**.



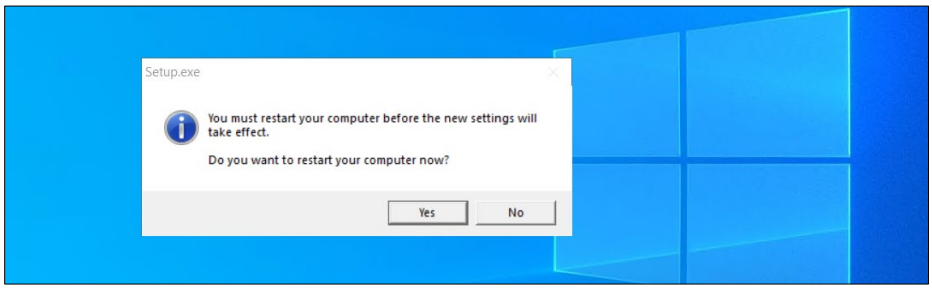
10. When the HDLM installation is completed, click **Continue**.



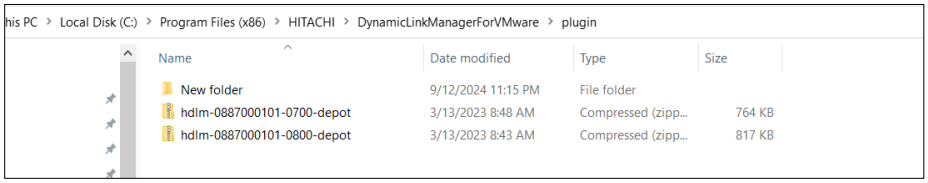
11. The installation is completed successfully with the HDLM version:



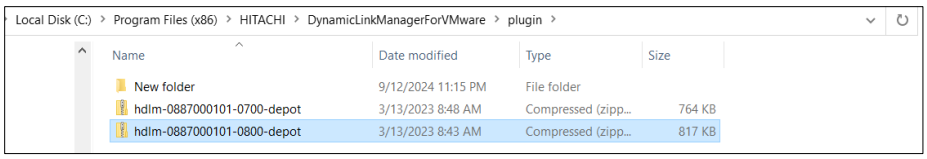
12. To reflect the HDLM version installation on the local system, restart the system.



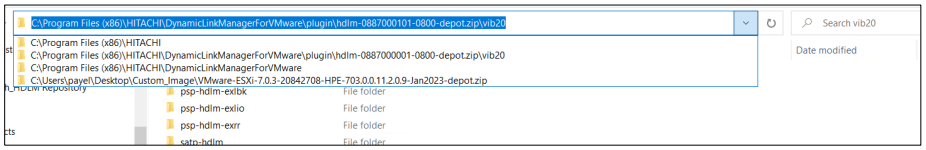
13. To verify the .zip HDLM depot folders to be copied to the testing ESXi server, navigate to the path as shown in the following screenshot after the local windows system comes online.



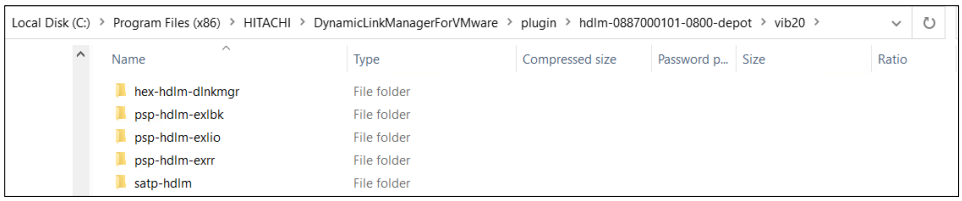
In this scenario, 0800-depot is selected as the host OS of the testing server ESXi 8.0U1:



14. Navigate to the selected depot folder and verify the list of HDLMs found in the /vib20 folder within the depot folder that will be installed on the server.



15. To review the list of HDLMs in the /vib20 directory for installation, copy the depot.zip file to the datastore of the testing server and extract the file.



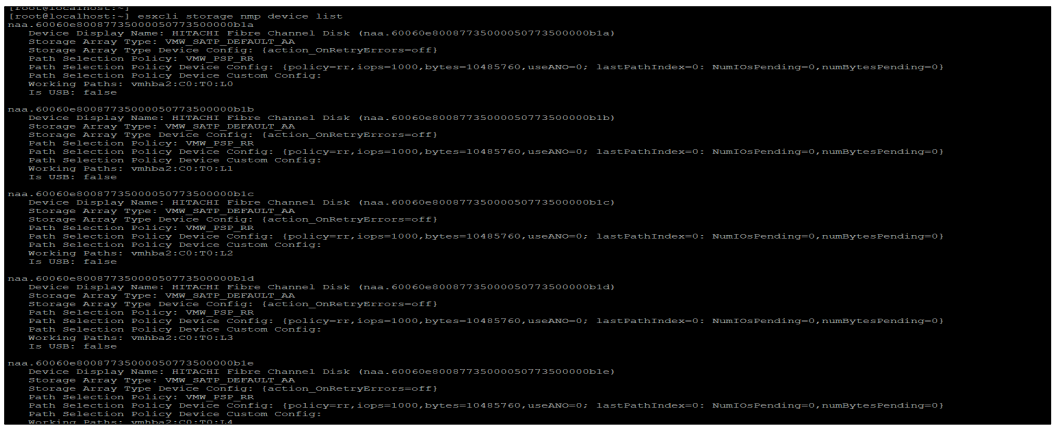

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20] ls
hex-hdlm-dlnkmgr  psp-hdlm-exlbk    psp-hdlm-exlio    psp-hdlm-exrr     satp-hdlm
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20]
```

Installing HDLM Drivers on an ESXi Host using the ESXCLI Command

To install HDLM drivers on an ESXi Host using the ESXCLI command, complete the following steps:

1. Before installing HDLM, verify the path policies of the server by running the following command:

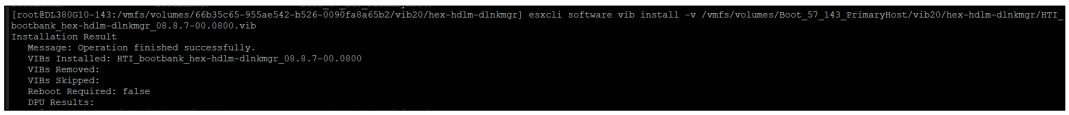
   ```
   esxcli storage nmp device list
   ```



2. Navigate to the hex-hdlm-dlnkmgr directory and locate the .vib file.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20] ls
hex-hdlm-dlnkmgr  psp-hdlm-exlbk    psp-hdlm-exlio    psp-hdlm-exrr     satp-hdlm
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20] cd hex-hdlm-dlnkmgr
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/hex-hdlm-dlnkmgr] ls
HTI_bootbank_hex-hdlm-dlnkmgr_08.8.7-00.0800.vib
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/hex-hdlm-dlnkmgr]
```

3. Install the .vib file in the hex-hdlm-dlnkmgr directory.



4. Navigate to the psp-hdlm-exlbk directory and locate the .vib file.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20] cd psp-hdlm-exlbk/
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlbk] ls
HTI_bootbank_psp-hdlm-exlbk_08.8.0-00.0700.vib
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlbk]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlbk]
```

5. Install the .vib file in the psp-hdlm-exlbk directory.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlbk] esxcli software vib install -v /vmfs/volumes/Boot_57_143_PrimaryHost/vib20/psp-hdlm-exlbk/HTI_boot
bank_psp-hdlm-exlbk_08.8.0-00.0700.vib
Installation Result
   Message: Operation finished successfully.
   VIBs Installed: HTI_bootbank_psp-hdlm-exlbk_08.8.0-00.0700
   VIBs Removed:
   VIBs Skipped:
   Reboot Required: false
   DPU Results:
```

6. Navigate to the psp-hdlm-exlio directory and locate the .vib file.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20] cd psp-hdlm-exlio/
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlio]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlio]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlio]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlio] ls
HTI_bootbank_psp-hdlm-exlio_08.8.0-00.0700.vib
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlio]
```

7. Install the .vib file in the psp-hdlm-exlio directory.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlio] esxcli software vib install -v /vmfs/volumes/Boot_57_143_PrimaryHost/vib20/psp-hdlm-exlio/HTI_boot
bank_psp-hdlm-exlio_08.8.0-00.0700.vib
Installation Result
   Message: Operation finished successfully.
   VIBs Installed: HTI_bootbank_psp-hdlm-exlio_08.8.0-00.0700
   VIBs Removed:
   VIBs Skipped:
   Reboot Required: false
   DPU Results:
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exlio]
```

8. Navigate to the psp-hdlm-exrr directory and locate the .vib file.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20] cd psp-hdlm-exrr/
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exrr] ls
HTI_bootbank_psp-hdlm-exrr_08.8.0-00.0700.vib
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exrr]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exrr]
```

9. Install the .vib file in the psp-hdlm-exrr directory.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/psp-hdlm-exrr] esxcli software vib install -v /vmfs/volumes/Boot_57_143_PrimaryHost/vib20/psp-hdlm-exrr/HTI_bootba
nk_psp-hdlm-exrr_08.8.0-00.0700.vib
Installation Result
   Message: Operation finished successfully.
   VIBs Installed: HTI_bootbank_psp-hdlm-exrr_08.8.0-00.0700
   VIBs Removed:
   VIBs Skipped:
   Reboot Required: false
   DPU Results:
```

10. Navigate to the satp-hdlm directory and locate the .vib file.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20] cd satp-hdlm/
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/satp-hdlm]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/satp-hdlm]
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/satp-hdlm] ls
HTI_bootbank_satp-hdlm_08.8.7-01.0700.vib
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/satp-hdlm]
```

11. Install the .vib file in the satp-hdlm directory.

```
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/satp-hdlm] esxcli software vib install -v /vmfs/volumes/Boot_57_143_PrimaryHost/vib20/satp-hdlm/HTI_bootbank_satp-hdlm_08.8.7-01.0700.vib
Installation Result
   Message: Operation finished successfully.
   VIBs Installed: HTI_bootbank_satp-hdlm_08.8.7-01.0700
   VIBs Removed:
   VIBs Skipped:
   Reboot Required: false
   DPU Results:
[root@DL380G10-143:/vmfs/volumes/66b35c65-955ae542-b526-0090fa8a65b2/vib20/satp-hdlm]
```

12. After installing, verify that all the required files are installed.

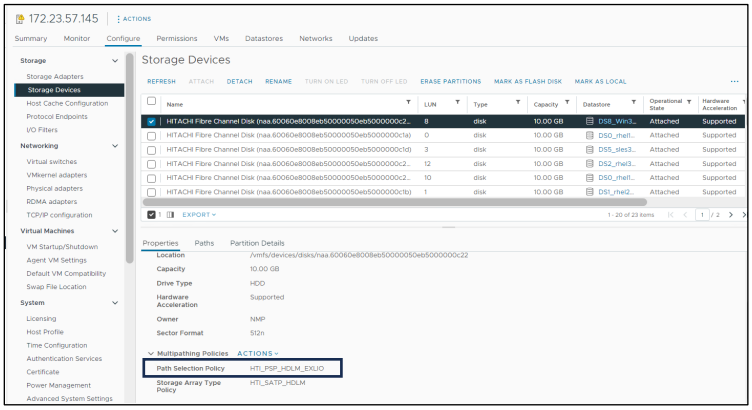
```
[root@DL380G10-143:~] esxcli software vib list
Name                          Version                             Vendor  Acceptance Level  Install Date  Platforms
----------------------------  ----------------------------------  ------  ----------------  ------------  ---------
hex-hdlm-dlnkmgr              08.8.7-00.0800                      HTI     PartnerSupported  2024-09-27    host
psp-hdlm-exlbk                08.8.0-00.0700                      HTI     VMwareAccepted    2024-09-27    host
psp-hdlm-exlio                08.8.0-00.0700                      HTI     VMwareAccepted    2024-09-27    host
psp-hdlm-exrr                 08.8.0-00.0700                      HTI     VMwareAccepted    2024-09-27    host
satp-hdlm                     08.8.7-01.0700                      HTI     VMwareAccepted    2024-09-27    host
```

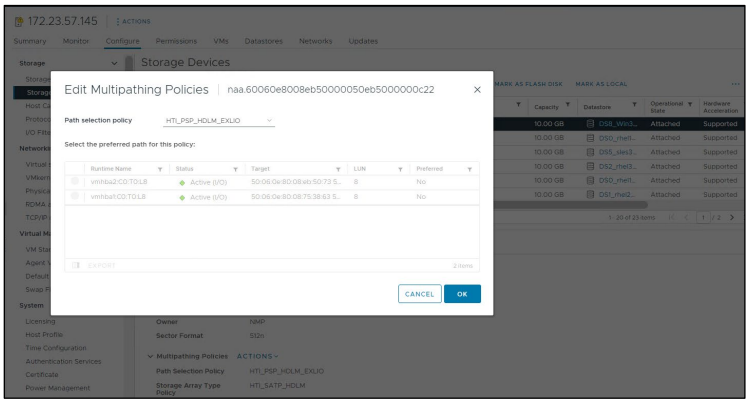
Verifying HDLM Configurations through CLI and vCenter GUI

1. To incorporate multipathing changes, restart the ESXi host and verify the multipathing status. Ensure that the path policy is successfully updated, and that the PSP is changed from **VMW_PSP_RR** to **HTI_PSP_HDLM_EXLIO**.

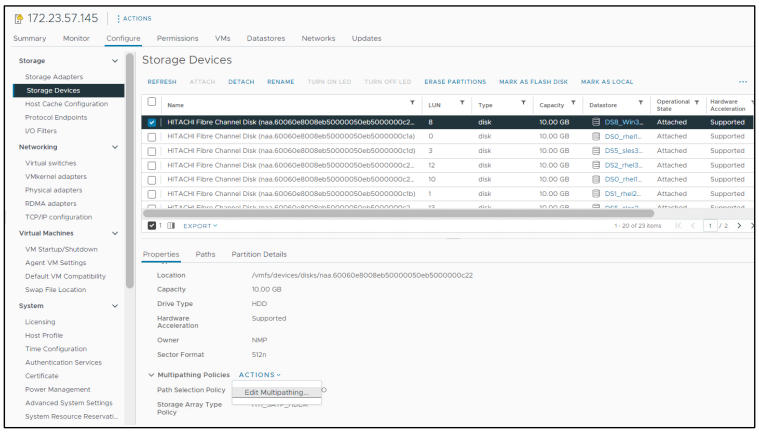
```
[root@DL380G10-143:~] esxcli storage nmp device list
naa.60060e8008d902000050d90200000214
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e8008d902000050d90200000214)
   Storage Array Type: HTI_SATP_HDLM
   Storage Array Type Device Config: {device config options }
   Path Selection Policy: HTI_PSP_HDLM_EXLIO
   Path Selection Policy Device Config:
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba4:C0:T0:L0
   Is USB: false

naa.60060e8008d902000050d902000000e8
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e8008d902000050d902000000e8)
   Storage Array Type: HTI_SATP_HDLM
   Storage Array Type Device Config: {device config options }
   Path Selection Policy: HTI_PSP_HDLM_EXLIO
   Path Selection Policy Device Config:
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba3:C0:T0:L0, vmhba4:C0:T0:L2
   Is USB: false

naa.60060e8008d902000050d90200000119
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e8008d902000050d90200000119)
   Storage Array Type: HTI_SATP_HDLM
   Storage Array Type Device Config: {device config options }
   Path Selection Policy: HTI_PSP_HDLM_EXLIO
   Path Selection Policy Device Config:
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba3:C0:T0:L253, vmhba4:C0:T0:L253
   Is USB: false

naa.60060e8008d902000050d90200000310
   Device Display Name: HITACHI Fibre Channel Disk (naa.60060e8008d902000050d90200000310)
   Storage Array Type: HTI_SATP_HDLM
   Storage Array Type Device Config: {device config options }
   Path Selection Policy: HTI_PSP_HDLM_EXLIO
   Path Selection Policy Device Config:
   Path Selection Policy Device Custom Config:
   Working Paths: vmhba3:C0:T0:L1, vmhba4:C0:T0:L3
   Is USB: false
```

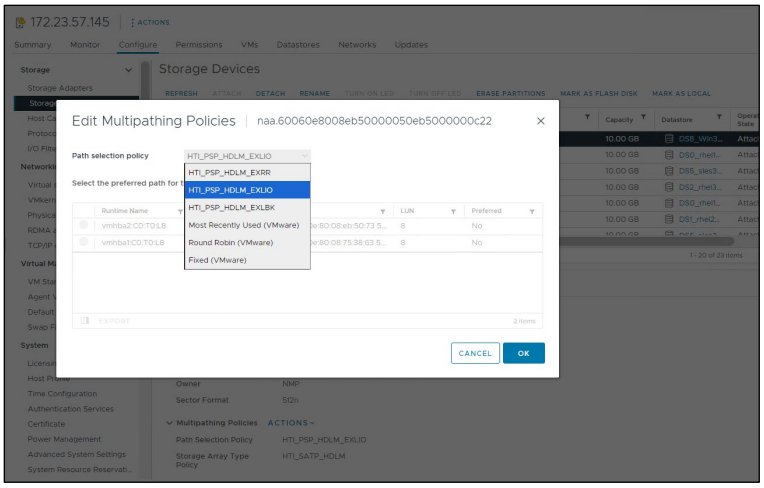
2. Additionally, you can verify the PSP from the vCenter.





3. To change the PSP from the selected policy, under Multipathing Policies, select **ACTIONS > Edit Multipathing…** and then select the PSP.




172.23.57.145
ACTIONS
Summary
Monitor
Configure
Permissions
VMs
Datastores
Networks
Updates
Storage
Storage Adapters
Storage Devices
REFRESH
ATTACH
DETACH
RENAME
TURN ON LED
TURN OFF LED
ERASE PARTITIONS
MARK AS FLASH DISK
MARK AS LOCAL
Edit Multipathing Policies
naa.60060e8008eb50000050eb5000000c22
Path selection policy
HTI_PSP_HDLM_EXLIO
Select the preferred path for t
HTI_PSP_HDLM_EXRR
HTI_PSP_HDLM_EXLIO
HTI_PSP_HDLM_EXLBK
Most Recently Used (VMware)
Round Robin (VMware)
Fixed (VMware)
Runtime Name
LUN
Preferred
vmhba2:C0:T0:L8
vmhba1:C0:T0:L8
No
EXPORT
2 items
CANCEL
OK
Capacity
Datastore
10.00 GB
1 - 20 of 23 items
Owner
NMP
Sector Format
512n
Multipathing Policies
ACTIONS
Path Selection Policy
HTI_PSP_HDLM_EXLIO
Storage Array Type Policy
HTI_SATP_HDLM

Summary

Configuring HDLM on VMware ESXi optimizes path management and load balancing between the host and storage systems. This document provides the process verifying compatibility, installing the HDLM VIB file using ESXCLI, and optionally changing the PSP from vCenter. After installation, HDLM ensures automatic load balancing, failover, and improved storage connectivity performance.

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