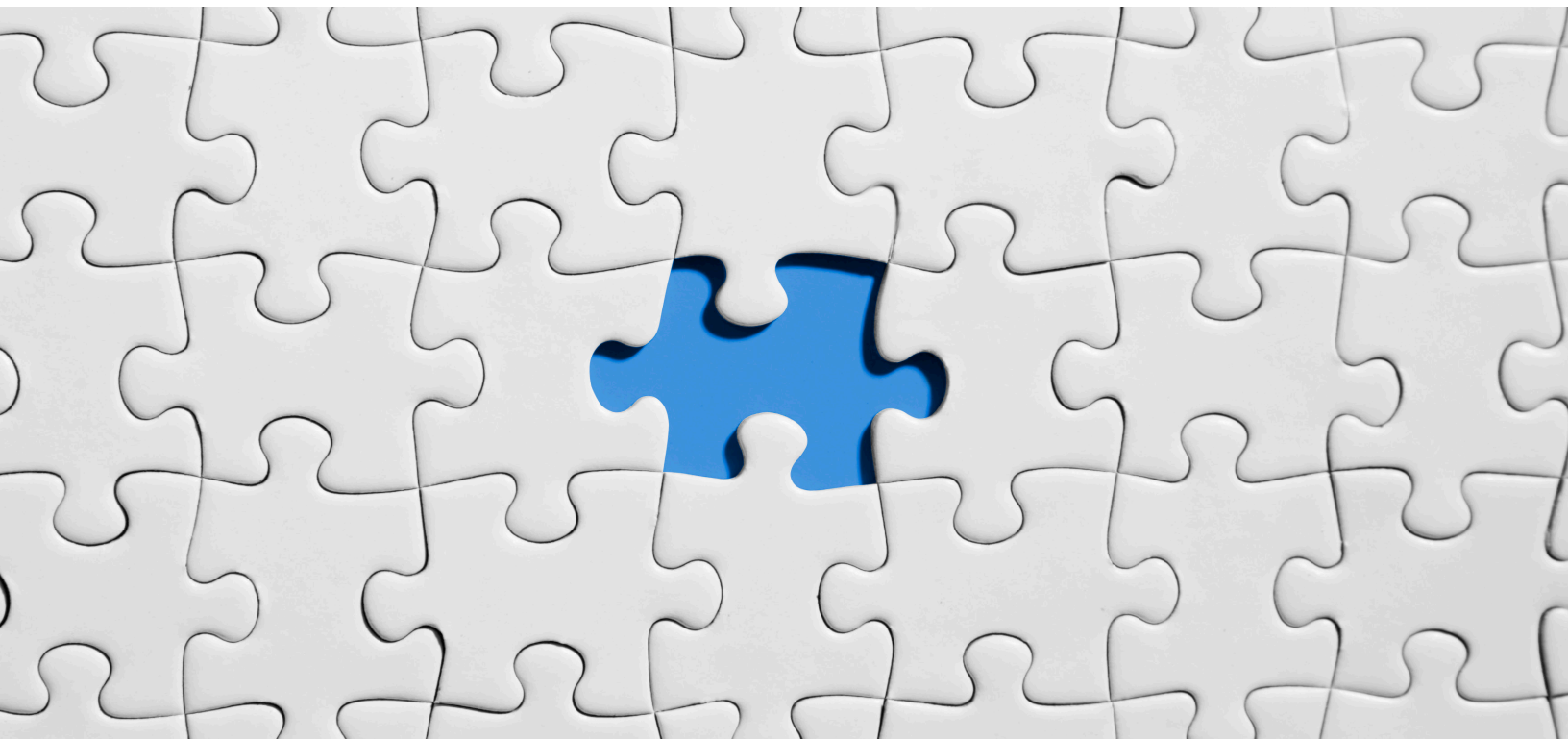


STORAGE MIGRATION – HYBRID ARRAY TO ALL-FLASH ARRAY



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Preface

Data migration involves the transferal of data and hosts connectivity from one storage system to another. When considering which method of migration to use, many factors are considered. The type of data – block, file, or both – influences which tools can be used. Most of the customers who acquire storage data migration inquire about the best storage configuration or implementation. Most of the problems are:

- How to migrate the data from source array into the target array.
- What is the migration methodology (block-level or file-level migration)?
- Does it support the physical platform or virtual platform?
- How long is the service interruption during the storage migration?
- What are the prerequisites of the data migration, e.g. the firmware of storage, the host bus adapter (HBA) driver on hosts, and the multipath software?
- What is the storage design of target array?
- What is the cost of target storage?

Introduction

This Knowledge Sharing article provides all the information you'll need about storage migration. We will consider how to migrate the data from Dell EMC VNX Unified storage into Dell EMC Unity All-Flash storage and discuss one sample environment that includes Windows platform and vSphere hypervisor which are running on Unified Computing System (UCS). In this scenario we will explain the best migration methodology and how to start the preparation of the data migration, taking into consideration five things; compatibility, performance, migration methodology, availability, and cost analysis.

Environment

Before we discuss preparation for the storage migration, here is an overview of the environment in this scenario.

- Three UCS 5108 Blade Server Chassis.
- Eight UCS B200 M4 Blade Server on each Chassis.
- Each UCS 5108 Chassis is connected to one pair of UCS 6200 Series Fabric Interconnects.
- Each UCS Fabric Interconnect is connected to one Dell EMC Connectrix 8GB SAN Switch.
- The source array is one Dell EMC VNX5300 Unified Storage.
- The target array is one Dell EMC Unity 350F All-Flash Storage.
- Source and target array are connected to two Dell EMC Connectrix 8GB SAN Switches.
- vSphere Hypervisor (ESXi) 6.0 running on UCS Blades of Chassis A and B.
- Windows 2008 R2 server is running on UCS Blades of Chassis C.

The following diagram shows a high-level overview of the sample environment in this scenario.

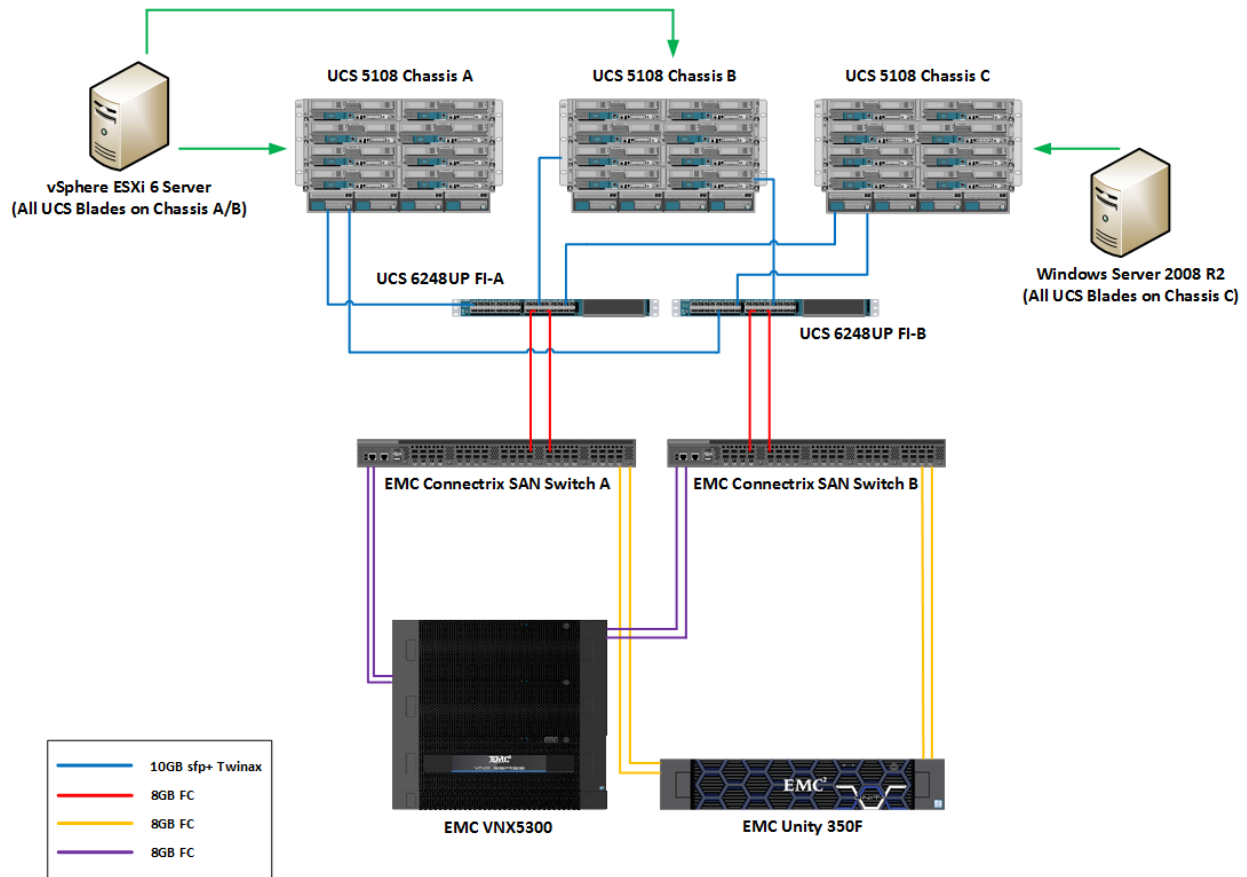


Figure 1 - The infrastructure diagram of this environment

Table 1 shows the hardware and software configuration of the fabric equipment in this environment.

Fabric Network	Switch Model	Switch Mode	Firmware Release
A	UCS 6248UP Fabric Interconnect	End Host Mode	2.2(5)
B	UCS 6248UP Fabric Interconnect	End Host Mode	2.2(5)
A	Dell EMC Connectrix DS-300B	NPIV feature is enabled	6.4.3
B	Dell EMC Connectrix DS-300B	NPIV feature is enabled	6.4.3

NPIV = N-Port ID Virtualization.

Table 1 – The configuration of Fabric equipment

Table 2 shows the hardware and software configuration of each UCS Blade in this environment.

Chassis ID	Blade Servers	Operating System	Host Bus Adapter	Driver/Firmware of HBA	Multipath Software
Chassis A	1 to 8	vSphere 6	UCS VIC 1240 UCS VIC 1280	2.2(5)	Dell EMC PowerPath/VE 6.0 for VMware
Chassis B	1 to 8	vSphere 6	UCS VIC 1240 UCS VIC 1280	2.2(5)	Dell EMC PowerPath/VE 6.0 for VMware
Chassis C	1 to 8	Windows 2008 R2 SP1	UCS VIC 1240 UCS VIC 1280	2.2(5)	Dell EMC PowerPath 6.0 for Windows

VIC stands for Virtual Interface Card.

Table 2 – The configuration of UCS Blade servers

Table 3 shows the hardware and software configuration of source and target EMC storage in this environment.

Brand	Model	Pools Type	Connection Interface	Storage Operating Environment
EMC	VNX5300 (Block)	Storage Pools	8GB Fibre Channel	VNX Block OE: 05.32
EMC	Unity 350F All-Flash	Dynamic Pools	8GB Fibre Channel	Unity OE: 4.2

OE stands for Operating Environment.

Table 3 – The configuration of source array and target array

Now we start to consider the five important elements regarding the storage migration.

Compatibility

According to Dell EMC storage migration best practices, we should first verify the relevant information with Dell EMC compatibility matrix when we plan for the storage migration. This relevant information consists of the software requirement of Unified Computing System, the firmware release of the storage system, the driver and firmware release of the host bus adapter on the servers, the release of Dell EMC multipath software, the system platform, etc. In this section, we will know what information we need to collect on the storage systems and the hosts when we plan the storage migration. We can then use this information to can verify the compatibility matrix.

Before we start the planning of storage migration, we need to collect the relevant information of hosts, SAN switch, source array and target array.

- Host information includes the operating system, the model and the driver/firmware of host bus adapter, the multipath software and Fabric topology.
- SAN switch information consists of the model and the firmware of operating environment.
- Storage information includes the model of source array and target array and the operating system of the source array.

Based on this information, we can start verifying the compatibility of the hardware and software by Dell EMC Support Matrix (EMC E-LAB), a web-based tool used to check the compatibility of all Dell EMC hardware and software, e.g. storage migration, data protection solution, cloud solution, etc. Only a Dell EMC partner or employee can access this web-based tool. Table 4, 5, and 6 are the sample interoperability results of Dell EMC Support Matrix based on the information of our sample environment.

NOTE: The information of table 4, 5 and 6 are for reference only.

Host System	Operating System	Host Bus Adapter	Minimum Driver/Firmware	Storage Array
UCS B200 M4	Windows 2008 R2 SP1	UCS VIC 1240	Recommended version	Dell EMC Unified Storage: VNX5300
UCS B200 M4	Windows 2008 R2 SP1	UCS VIC 1280	Recommended version	Dell EMC Unified Storage: VNX5300
UCS B200 M4	vSphere 6.0	UCS VIC 1240	Recommended version	Dell EMC Unity: 350F
UCS B200 M4	vSphere 6.0	UCS VIC 1280	Recommended version	Dell EMC Unity: 350F

Table 4 – Host connectivity of storage

Storage Array	Operating System	Multipathing software	Storage Array
Dell EMC Unified Storage: VNX5300	Windows 2008 R2 SP1	Dell EMC PowerPath for Windows 6.0	VNX Block OE 05.32
Dell EMC Unified Storage: VNX5300	Windows 2008 R2 SP1	Dell EMC PowerPath for Windows 6.2	VNX Block OE 05.32

Dell EMC Unity 350F	vSphere 6.0	Dell EMC PowerPath/VE 6.0	Unity OE: 4.2
Dell EMC Unity 350F	vSphere 6.0	Dell EMC PowerPath/VE 6.1, 6.2	Unity OE: 4.2
Dell EMC Unified Storage: VNX5300	vSphere 6.0	VMware NMP	VNX Block OE 05.32
Dell EMC Unity 350F	vSphere 6.0	VMware NMP	Unity OE: 4.2

VMware NMP = VMware Native Multipathing Plugin.

Table 5 – Path Management Software

SAN Switch	Switch Firmware Revision	Interoperable Switch	Interoperable Switch Firmware Revision
Dell EMC Connectrix DS-300B	Recommended version	UCS 6248UP	Recommended version
Dell EMC Connectrix DS-6505B	Recommended version	UCS 6248UP	Recommended version

Table 6 - Fabric Topology

After collecting the compatibility information of host, SAN switch and storage from Dell EMC Support Matrix, we can then obtain all requirements and prerequisites for storage migration, e.g. software upgrade. Following that, we can start to design the details of the storage pre-migration plan, i.e. software upgrade of the hosts and storage system.

Performance

Define the best configuration of Pools, type of RAID, thin & thick LUN, the number of disk input/output operations per second (IOPS) required and HBA port distribution on each host. What is the difference between VNX Traditional Pools and Unity Dynamic Pools? We will consider how to improve the read and write performance of disk IOPS after migrating the data into Unity All-Flash storage. In this section, we will then know the best configuration of Pools on Windows platform and vSphere platform.

Table 7 and 8 are the storage pools layout of Dell EMC VNX5300 Unified storage in this scenario. Performance is a very important factor for planning storage migration. How can we ensure the performance is enhanced after migrating the data from the old storage system to the new storage system? It depends on a number of factors. The design of storage pool is very important, e.g. disk type, RAID level, how many disk IOPS can be provided, etc.

ID	RAID Group/Pools	RAID Type	Total Capacity	Number of LUNs	Number of disks	Disk Slots
0	RAID Group	RAID-5 (3+1)	1.3 TB	0	4 x 600GB 15K 3.5" SAS Drive	DPE 0-3
1	Pools	RAID-5 (8+1)	4.18 TB	12	9 x 600GB 15K 3.5" SAS Drive	DPE 4-12
2	Pools	RAID-5 (8+1)	4.18 TB	12	9 x 600GB 15K 3.5" SAS Drive	DAE1 0-8
3	Pools	RAID-5 (4+1)	2.09 TB	7	4 x 600GB 15K 3.5" SAS Drive	DAE1 9-13
4	Pools	RAID-5 (8+1)	4.18 TB	10	9 x 600GB 15K 3.5" SAS Drive	DAE2 0-8
5	--	Hot Spare	--	N/A	1 x 600GB 15K 3.5" SAS Drive	DPE 14
6	--	Hot Spare	--	N/A	1 x 600GB 15K 3.5" SAS Drive	DAE1 14
7	--	Hot Spare	--	N/A	1 x 600GB 15K 3.5" SAS Drive	DAE2 14

DPE = Disk Processor Enclosure, DAE = Disk Array Enclosures.

Table 7 – Storage Pools Layout of Dell EMC VNX5300 storage

ID	Pool	RAID Type	Total Capacity	Number of disks	Disk Slots
1	FAST Cache Pool	RAID-1/0 (1+1) and 1 x HS	100GB	3 x 100GB Flash Drive	DAE2 9-11

Table 8 – FAST Cache Pool Layout of Dell EMC VNX5300 storage

In Dell EMC VNX Series storage, we can define both traditional RAID Group and Storage Pools. The traditional RAID group can support up to 16 drives, and it does not have any optional features on RAID Group, e.g. thin provisioning and storage tier. Storage Pools can support thin and thick provisioning, storage tier, and multiple pools. In Table 7, we can see a RAID group and four Storage Pools. The total usable capacity of VNX5300 Unified storage is 15.93TB (1.3.TB + 4.18TB + 4.18TB + 2.09TB + 4.18TB). VNX5300 is required in order to improve the storage cache, enabling a FAST Cache feature. FAST Cache helps to automatically promote the chunk into FAST Cache by copying it from SAS drives into Flash drives. When we start to plan the storage layout of target storage, we first need to know the following information on the source array (VNX5300 Unified storage):

- What is the total usable capacity?

- What is the RAID level of each RAID Group/Storage Pools?
- What is the disk type, e.g. FC drive, SAS drive, SATA drive or Flash drive?
- Which optional feature is enabled on storage? For example, data replication, snapshot or storage tier, etc.
- What is the connection interface on storage? For example, 8GB Fibre Channel interface, 10GB iSCSI interface, 1GB iSCSI RJ45 interface, etc.
- What is the maximum cache size of storage?
- What is the maximum number of IOPS that can be provided on storage?

In this scenario, the target storage is Dell EMC Unity 350F All-Flash storage. The system architecture of Unity 350F All-Flash storage is different with Dell EMC VNX 5300 storage. According to the information in Table 7 and 8, we can design the hardware and software requirement for target storage. Table 9 is the design of SAN layout of Unity 350F All-Flash storage. We can see the Pool type of Unity 350F is Dynamic Pool. Dynamic Pools is a new Pool technology for All-Flash storage in Dell EMC Unity, replacing the previous Pool technology in Dell EMC VNX storage. Dynamic Pools can provide some benefits over Traditional Pools. Unlike Traditional Pools, Dynamic Pools do not require dedicated Hot Spare Drives. Each drive has reserved some space to replace the failed drive so that there is no spare drive as the hot spare at Unity 350F All-Flash storage. The total usable capacity of Unity 350F is around 50TB. There is enough available space to store all data of VNX5300 storage. The RAID protection of these two Dynamic Pools is RAID-5 which can provide the best usable capacity and IOPS.

ID	Storage Pools	RAID Type	Total Capacity	Number of LUNs	Number of disks	Disk Slots	IOPS
0	Dynamic Pools	RAID-5 (8+1)	25.77 TB	17	10 x 4TB 2.5" SAS Flash Drive	DPE 0-9	36000 IOPS
1	Dynamic Pools	RAID-5 (8+1)	25.77 TB	17	10 x 4TB 2.5" SAS Flash Drive	DPE 10-19	36000 IOPS

Table 9 – Storage Pools Layout of EMC Unity 350F All-Flash storage

Since the base software and features of Dell EMC Unity All-Flash storage include thin provisioning, data replication, Quality of Service (QoS), local snapshot and Virtual Volumes (VVols), most of the storage feature includes the base software package on Unity All-Flash storage. After we initial the configuration of Unity All-Flash storage and enable the software license, all base software and license are enabled on Unity All-Flash storage (Figure 2).

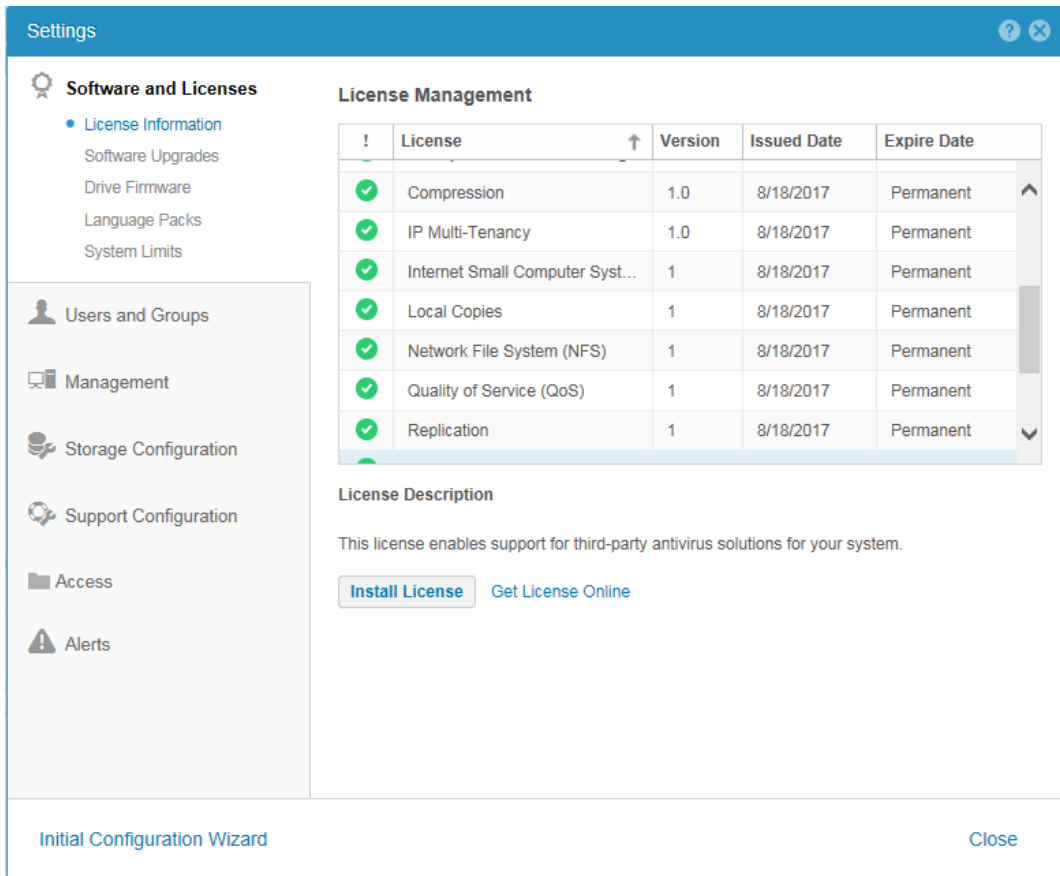


Figure 2 - The License Settings of Unity 350F on Dell EMC Unisphere

For the best practice of host connectivity of Unity 350F All-Flash storage, we should create the two different Dynamic Pools to share the IOPS utilization of a different type of operating system. The first Dynamic Pool shares the disk IOPS with the virtual host environment, the other Dynamic Pool shares the disk IOPS with the physical host environment. Table 10 shows that vSphere host is connected to Dynamic Pool 0, and Windows 2008 R2 host is connected to Dynamic Pool 1. Please note that if we hope to enable thin LUN in a VMware vSphere environment, it is recommended not to enable thin-provisioning on array level, only enable “thin provision” of VMDK on the virtual machine (Figure 3). It is easier to manage and control the space capacity if it is over-provisioning on the pools.

Virtual Hardware	VM Options	SDRS Rules	vApp Options
CPU	4		
Memory	9216	MB	
Hard disk 1	60	GB	
Maximum Size	315.36 GB		
VM storage policy	Datastore Default		
Type	Thin provision		
Sharing	No sharing		
Disk File	[CX4_DS6] SRM65-A/SRM65-A.vmdk		
Shares	Normal	1,000	
Limit - IOPs	Unlimited		
Virtual flash read cache	0	GB	Advanced
Disk Mode	Dependent		
Virtual Device Node	SCSI controller 0	SCSI(0:0)	

Figure 3 - The Edit Settings of virtual machine in vSphere 6

In some cases, the number of device paths on the ESXi host can affect the performance of the VMFS datastore. We will detail device paths and multipath software settings in the next section (Availability). In the VMware vSphere environment, the VMFS datastores are shared with some ESXi hosts in a vSphere cluster. Many vSphere administrators may assign many small capacity LUNs into the vSphere hosts in vSphere cluster because they do not have any idea about the size of each LUN. We need to consider the following reasons:

Fewer large capacity LUNs

- Fewer VMFS datastore is easy for management.
- More flexibility to create the virtual machine without requesting storage administrator for more space on VMFS datastore, e.g. VMDK expansion, create the snapshot of virtual machine, etc.

More small capacity LUNs

- Increase the read/write IOPS loading on each VMFS when the new devices are re-scanned on each ESXi host.
- Wastes storage space.
- Spend more time managing path policy of each VMFS datastore.
- If the guest OS uses the cluster service, it needs the dedicated RDM LUNs.

ID	Server	Operating System	Storage Pools	Thick/Thin	Paths	UCS Chassis
0	UCS Blade 1	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
1	UCS Blade 2	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
2	UCS Blade 3	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
3	UCS Blade 4	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
4	UCS Blade 5	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
5	UCS Blade 6	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
6	UCS Blade 7	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
7	UCS Blade 8	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis A
8	UCS Blade 1	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
9	UCS Blade 2	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
10	UCS Blade 3	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
11	UCS Blade 4	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
12	UCS Blade 5	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
13	UCS Blade 6	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
14	UCS Blade 7	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
15	UCS Blade 8	vSphere 6.0	Dynamic Pools 0	Thick	4	Chassis B
16	UCS Blade 1	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C
17	UCS Blade 2	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C
18	UCS Blade 3	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C
19	UCS Blade 4	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C
20	UCS Blade 5	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C
21	UCS Blade 6	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C
22	UCS Blade 7	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C
23	UCS Blade 8	Windows 2008 R2 SP1	Dynamic Pools 1	Thick	4	Chassis C

Table 10 – The UCS Blades connectivity of Dell EMC Unity 350F

Migration Methodology

This section considers migration methods for data migration, e.g. Dell EMC SAN Copy, Dell EMC MirrorView Replication, Dell EMC PowerPath Migration Enabler, VMware Storage Migration, etc. We will learn the best migration methodology for Windows platform and vSphere Hypervisor and how to minimize the maintenance windows during the storage migration. For

the Windows platform, Dell EMC SAN Copy is a good option for migration. For VMware hypervisor platform, we suggest performing the data migration by using VMware storage vMotion. The details of both migration methodologies and prerequisites can be found in this section. Dell EMC VNX Series storage provides many Block migration methods to migrate the data into new storage, e.g. Dell EMC SAN Copy (Push), Dell EMC MirrorView Synchronous Replication, Dell EMC MirrorView Asynchronous Replication, etc. Now we will discuss the migration methodology.

EMC SAN Copy (Push)

Dell EMC SAN Copy is the free feature on Dell EMC VNX1 and VNX2 Series storage, and it is used to migrate the traditional LUNs, Pools LUNs and Metal LUNs to Dell EMC Unity Hybrid and All-Flash storage from VNX Series storage over Fibre Channel or iSCSI Channel. For this migration method, the SAN Copy feature needs to be enabled on source VNX array. We can choose two types of SAN Copy session; full copy and incremental copy (Figure 4). If we choose the full copy session, the host access needs to be disabled, and then it can start to copy the data from VNX storage to Unity storage. If we select the incremental copy session, the host can continue to access until we cutover the session. The following are the requirements for the configuration of Dell EMC SAN Copy:

- The license of SAN Copy is enabled on source VNX System.
- If the SAN Copy connection between source VNX System and target Unity All-Flash System is done through Fibre Channel, we need to configure Fibre Channel port zoning between the Dell EMC VNX and Unity systems.
- If the SAN Copy connection between source VNX System and target Unity All-Flash System is done through iSCSI Channel, we need to configure the iSCSI connection between the Dell EMC VNX and Unity systems.
- If we use SAN Copy incremental session, we need to create the Reserved LUN Pool (RLP) on source VNX system and create some LUNs on RLP for storing the changed data during the SAN Copy session is configured.

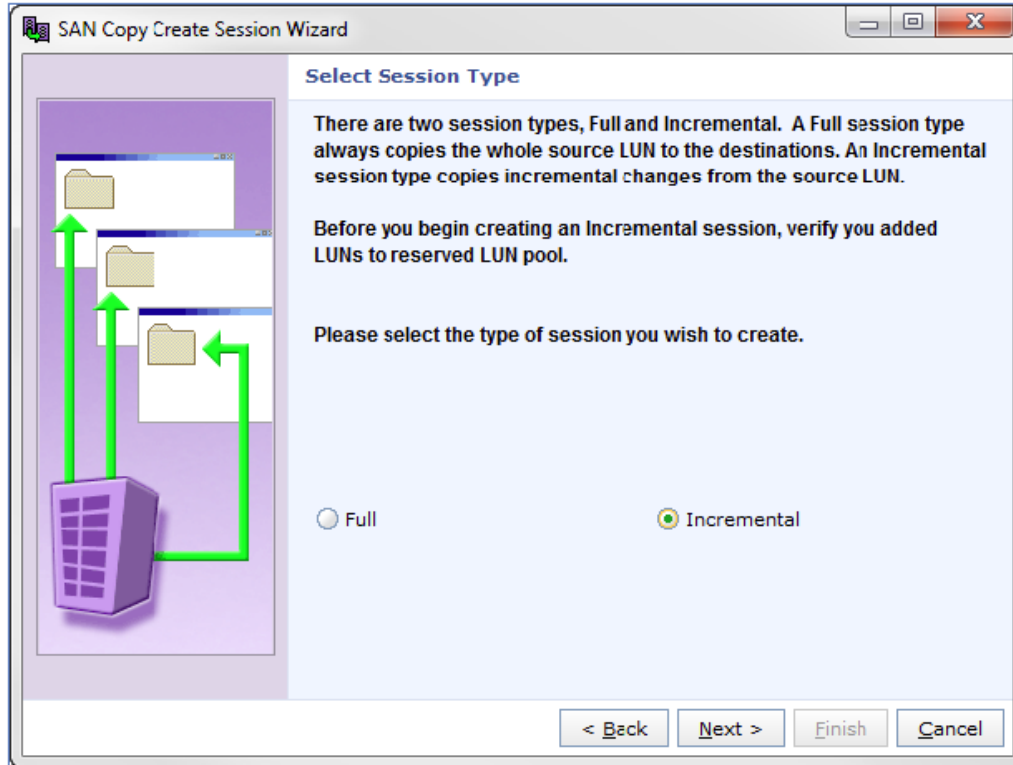


Figure 4 - Create SAN Copy Session Wizard on VNX series storage

Dell EMC Native SAN Copy Import

The feature of Dell EMC Native SAN Copy import is available on Dell EMC Unity system using Dell EMC Unity Operating Environment (OE) is 4.1 or above. This feature supports migration of Block data from VNX storage to Dell EMC Unity storage over Fibre Channel or iSCSI Channel. It integrates the configuration of the SAN Copy operation into Dell EMC Unity storage (Figure 5). For this migration method, the SAN Copy feature needs to enable on source VNX array. After the import connection is completed on Unity storage, we can create import session to migrate the Block data from VNX storage to Unity storage. The following are the requirements for the configuration of Native SAN Copy Import:

- The license of SAN Copy is enabled on source VNX System.
- Dell EMC Unity OE is running in version 4.1 or above.
- If the SAN Copy connection between source VNX System and target Unity All-Flash System is done through Fibre Channel, we need to configure Fibre Channel port zoning between the EMC VNX and Unity Systems.
- If the SAN Copy connection between source VNX System and target Unity All-Flash System is done through iSCSI Channel, we need to configure the iSCSI connection between the Dell EMC VNX and Unity Systems.

- If we use SAN Copy incremental session, we need to create the Reserved LUN Pool (RLP) on source VNX system and create some LUNs on RLP for storing the changed data during the SAN Copy session is configured.

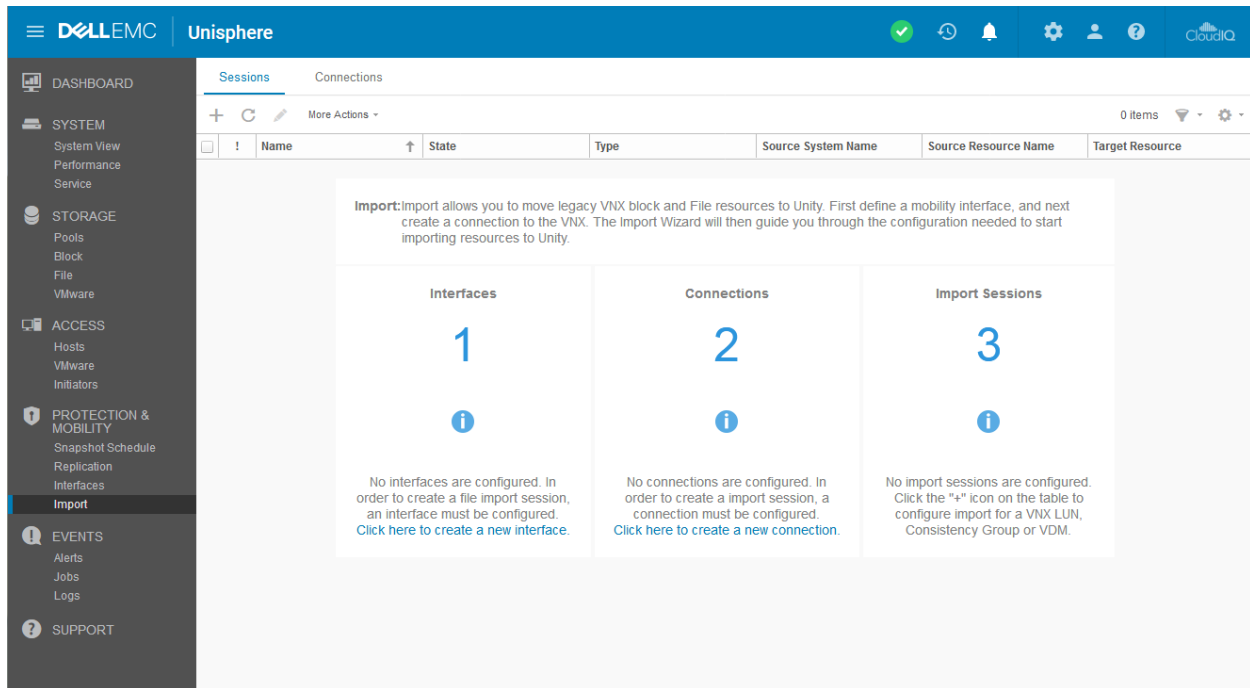


Figure 5 - The management page of Native SAN Copy Import

Dell EMC MirrorView Replication

Dell EMC MirrorView is the replication feature on VNX system. This feature includes two replication modes: MirrorView/Synchronous (MirrorView/S) and MirrorView/Asynchronous (MirrorView/A). It is used to mirror the block data from source VNX system to remote VNX system through Fibre Channel or iSCSI Channel. This feature needs the license to enable on the source and remote VNX systems. Dell EMC MirrorView/S can provide the data replication between the source and remote VNX systems with zero Recovery Point Object (RPO). Dell EMC MirrorView/A can provide the data replication between the source and remote VNX systems over long distances with low network bandwidth. In Dell EMC Unity Hybrid and All-Flash storage, the block replication is not supported on Dell EMC VNX1/VNX2 Series storage. Thus, MirrorView replication is not the solution for this scenario. The following are the requirements for Dell EMC MirrorView configuration between VNX1 storage and VNX2 storage:

- The license of MirrorView is enabled on the source and remote VNX Systems.
- The license of SnapView (Snapshot feature) is enabled on the source and remote VNX Systems if we use MirrorView/A replication.

- If the MirrorView connection between source VNX System and remote VNX System is done through Fibre Channel, we need to configure Fibre Channel port zoning between the source VNX and remote VNX Systems.
- If the MirrorView connection between source VNX System and remote VNX System is done through iSCSI Channel, we need to configure the iSCSI connection between the source VNX and remote VNX Systems.
- If we use MirrorView/A session, we need to create the Reserved LUN Pool (RLP) on source VNX system and create some LUNs on RLP for storing the changed data during the MirrorView/A session is configured.

Dell EMC PowerPath Migration Enabler

Dell EMC PowerPath Migration Enabler (PPME) is a migration tool which is bundled with Dell EMC PowerPath software. PPME is host-based migration software that can provide the file data migration from source Dell EMC storage into target Dell EMC storage. PPME requires the license to enable this feature. The following are the requirements for the configuration of PowerPath Migration Enabler:

- The license of Dell EMC PowerPath is enabled on migration host.
- Dell EMC PowerPath Migration Enabler feature is enabled on migration host (Figure 6).
- The migration host can access the LUNs of the source storage and the LUNs of the target storage.

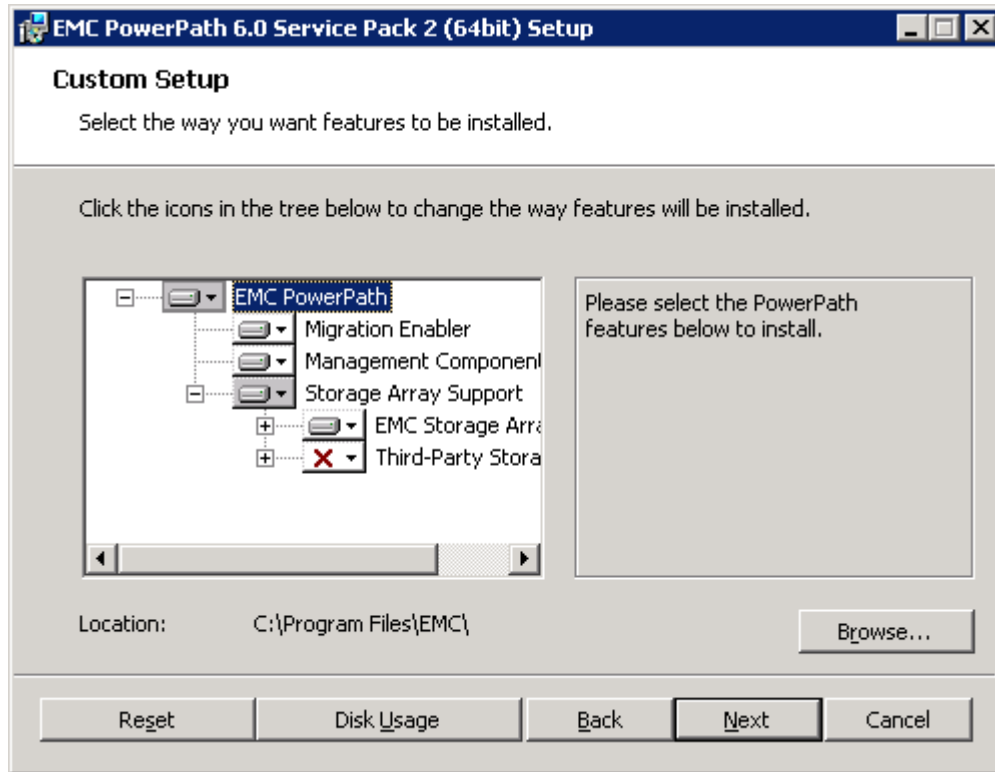


Figure 6 - Custom Setup of Dell EMC PowerPath Migration Enabler

VMware Storage vMotion

Storage vMotion is the migration feature on VMware vSphere. It can provide migration of a virtual machine from one source datastore to the target datastore while this virtual machine is running (Figure 7). The source datastore and target datastore can be different models of storage. The following are the requirements for VMware Storage vMotion:

- The vMotion network is enabled on the source and destination vSphere hosts.
- The license edition of vSphere is Standard, Enterprise, or Enterprise Plus.
- The network speed of vMotion network has at least 1GB or above.
- The physical compatibility mode RDMS is not supported.
- The requirement of vSphere is 5.1 or above if we perform the vMotion operation without shared storage.

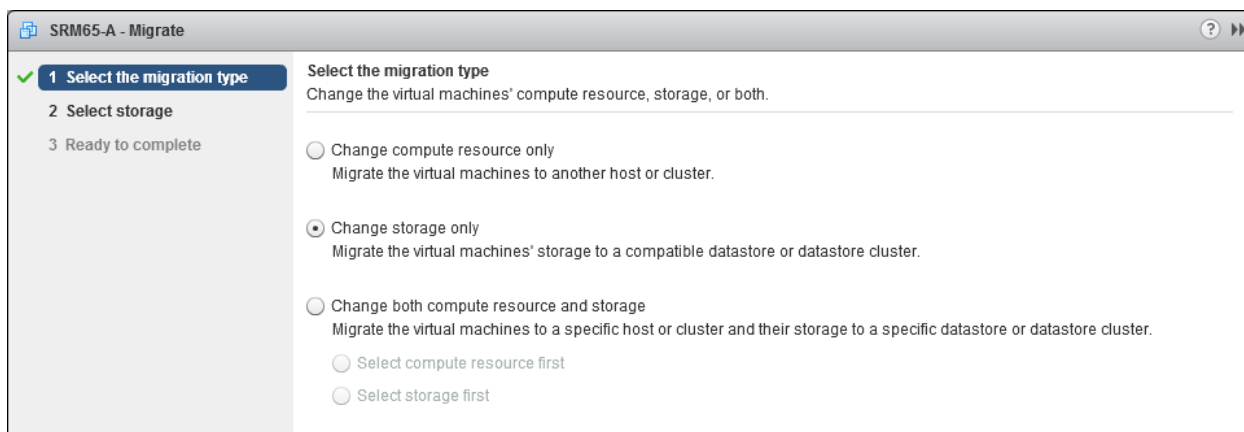


Figure 7 - Migration wizard of virtual machine

Based on the information of above migration methodology, Table 11 shows a summary of migration methodology for the Windows platform and vSphere in this scenario.

NOTE: The migration methodology is dependent on the different environment and scenario.

Migration Methodology	Operating System	Service Interruption during migration	Supported by Dell EMC Unity 350F	The best solution for this scenario
Dell EMC SAN Copy (Push)	Windows 2008 R2 SP1	No*	Yes	Yes
Dell EMC Native SAN Copy Import	Windows 2008 R2 SP1	No*	Yes	Not Suggested
Dell EMC MirrorView	Windows 2008 R2 SP1	No*	No	Not Supported
EMC PowerPath Migration Enabler	Windows 2008 R2 SP1	No*	Yes	Not Suggested
VMware Storage vMotion	vSphere 6	No	Yes	Yes

* The maintenance window is required when cutting-over the session.

Table 11 – The summary of migration methodology for Windows and VMware vSphere

For the data migration of Windows platform, Dell EMC SAN Copy Incremental is suggested as the best migration methodology because throttle rate can be changed at any time during the SAN Copy session. We can change the throttle rate immediately if any performance problem occurs when the SAN Copy session starts. The following is the migration procedure for Dell EMC SAN Copy in this scenario.

1. Make sure SAN Copy feature is enabled on Dell EMC VNX5300 Unified storage.
2. Create the SAN Copy connection between the source storage and destination storage.

In this scenario, the SAN Copy connection is over Fibre Channel between the two storage systems. We first need to create two zones on each SAN Switch; the following is the sample of zoning. Single initiator zoning is highly recommended.

In SAN Switch A, we need to create two zones, and it has two members in each zone.

- Zone1 (FC SPA0 on controller-A of VNX5300 and FC port1 on controller-A of Unity 350F)
- Zone2 (FC SPB1 on controller-B of VNX5300 and FC port2 on controller-B of Unity 350F)

In SAN Switch B, we also need to create two zones, and it has two members in each zone.

- Zone1 (FC SPA1 on controller-A of VNX5300 and FC port2 on controller-A of Unity 350F)
 - Zone2 (FC SPB0 on controller-B of VNX5300 and FC port1 on controller-B of Unity 350F)
3. Create SAN Copy connections between VNX5300 Unified storage and Unity 350F All-Flash storage. We need to update the “SAN Copy Connections” under the Data Migration of VNX5300 when we create the all required zone on SAN Switch.
 4. Create the Reserved LUN Pool (RLP) on VNX5300 storage and create some LUNs on RLP for storing the changed data once the SAN Copy Incremental session is configured.
 5. Create the destination LUNs on Unity 350F All-Flash storage for the source LUNs that we will migrate from the VNX5300 storage. The capacity of destination LUN is same as the source LUN on the VNX5300 storage.
 6. Create the SAN Copy by “SAN Copy Create Session Wizard” that under Wizards of VNX5300 storage.
 - Select “Incremental” as the type of SAN Copy session.
 - Select the source storage and source LUN.
 - Select the destination storage and specify the WWN for the Unity 350F destination LUN which creates in step 5.
 - Verify the connections between destination LUNs and specify the throttle setting.
 7. Start the SAN Copy sessions; this session starts to copy the block data from the source LUN into the destination LUN.
 8. After completing the final update of SAN Copy session between VNX5300 Unified storage and Unity 350F All-Flash storage, delete the SAN Copy session.
 9. Remove the host access the source LUNs on VNX5300 Unified storage.
 10. Go to the Unity 350F All-Flash storage, create a new host group for the original Windows host that connected to VNX5300 and add the destination LUN into this host group.
 11. For migration of other Windows hosts, repeat steps 5 to 10.

12. Once the migration for Windows platform is completed, disable all zones created in step 2 and disconnect the SAN Copy connection.

NOTE: We need to arrange the maintenance window when we perform procedure 9 and 10.

For data migration of vSphere, the VMware vMotion storage is suggested as the best migration methodology because there is no reconfiguration on original vSphere after storage vMotion and no maintenance windows are needed during storage vMotion. The following is the migration procedure for VMware Storage vMotion.

1. On Unity 350F All-Flash storage, create the new host group for each ESXi host. Then create the destination LUNs for each ESXi host on Unity All-Flash storage, and add the destination LUNs into each new host group. The capacity of destination LUN is same as the source LUN on the VNX5300 storage.
2. Go to VMware vCenter server and rescan the storage device on each ESXi host, then verify all destination LUNs that can be detected on each ESXi host and create the new VMFS datastore for each ESXi host.
3. Migrate all the virtual machines that locate the source VMFS datastore.
4. Right-click each virtual machine and choose "Migrate".
 - Select "Change the Storage only".
 - Select the destination VMFS datastore created in step 2.
5. For the migration of the other virtual machines, repeat step 4.
6. Once the migration is completed, un-mount the original VMFS datastore and rescan all storage device again on each ESXi host.
7. Go to VNX5300 system; host access to all ESXi hosts can now be removed.

Availability

Consideration must be given to how data can be affected by hardware failure over the Unity All-Flash storage, RAID type, the number of disks on Pools, hot spare policy. What is Dell EMC's recommended multipath software? In this section, we examine the difference between Native Multipath and Dell EMC PowerPath on Windows and VMware vSphere, e.g. PowerPath for Windows and PowerPath/VE for VMware. The best configuration of multipath software on Windows platform and VMware vSphere can be found in this section.

In the section (Performance), we understand Dynamic Pools is a new Pool technology for All-Flash storage in Dell EMC Unity. Traditional Pools are replaced by Dynamic Pools of Unity All-Flash storage. To prevent the hardware failure of disks, the Dynamic Pools also support RAID protection, e.g. RAID-1/0, RAID-5, and RAID-6. The hot spare is not required on Dynamic Pools, and only Unity Hybrid storage is needed. The multipath software is used to manage and control the device path between the operating system and storage system. For each brand of the

storage system, the hardware vendor recommends their multipath software to maintain the device path on the host. The feature difference between native multipath and Dell EMC PowerPath on Windows platform and VMware vSphere is discussed below.

Native Multipathing I/O on Windows

Native Multipath I/O (MPIO) is the built-in multipath feature in Windows platform. By defaulting this feature as “disabled”, “enable” then has to be done manually. MPIO supports the function of data path failover or load balancing on Windows platform. If we don’t install the hardware vendor recommended multipath software on Windows, we can enable MPIO to manage the data path between the operating system and storage system. Check with the other relevant storage vendors for compatibility with MPIO.

Dell EMC PowerPath for Windows

Dell EMC PowerPath can be supported in the physical and virtual environment. We will discuss the virtual environment in the next section (PowerPath/VE for VMware). PowerPath is host-based multipath software which can support the different physical platform, e.g. Windows, Linux and AIX, etc. PowerPath can provide the various features of path management, e.g. optimized path load balancing, automated I/O path failover and recovery. A license is needed to enable the functions of PowerPath, and PowerPath can also support on EMC storage array, e.g. CLARiiON, VNX, and Unity, etc. When we deployed PowerPath on Windows, we can easily manage and monitor the device path by using PowerPath command-line or PowerPath Console (Figure 8).

Disk Number	Path Status	Path State	Path Mode	IOs/Sec	Q-IOs	Errors	Storage Class	Path Metric
Disk 001	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 002	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 003	Optimal	Alive	Active	6	0	4	VNX	4/4
Disk 004	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 005	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 006	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 007	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 008	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 009	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 010	Optimal	Alive	Active	0	0	4	VNX	4/4
Disk 011	Optimal	Alive	Active	0	0	4	VNX	4/4

Figure 8 – Dell EMC PowerPath Console for Windows

VMware Native Path – Most Recently Used and Fixed Path

VMware vSphere platform has a built-in multipath feature which includes three storage policies – Most Recently Used (MRU), Fixed Path, and Round Robin (RR). Each storage policy can provide the different feature and behavior of device path on each ESXi datastore. For each brand of the storage array, consult the relevant storage vendor for advice on the recommended policy setting. If the storage path selection policy is changed (Figure 9), edit the multipathing of each storage device through vSphere Web Client. The following is the primary function of each storage path policy.

Most Recently Used – When this policy is selected, there is no preferred path. The ESXi host selects the path that is used most recently.

Fixed Path – When this policy is selected, the ESXi host uses this preferred path until the other preferred path is selected.

Round Robin – When this policy is selected, the ESXi host uses all active paths and load balancing across all paths.

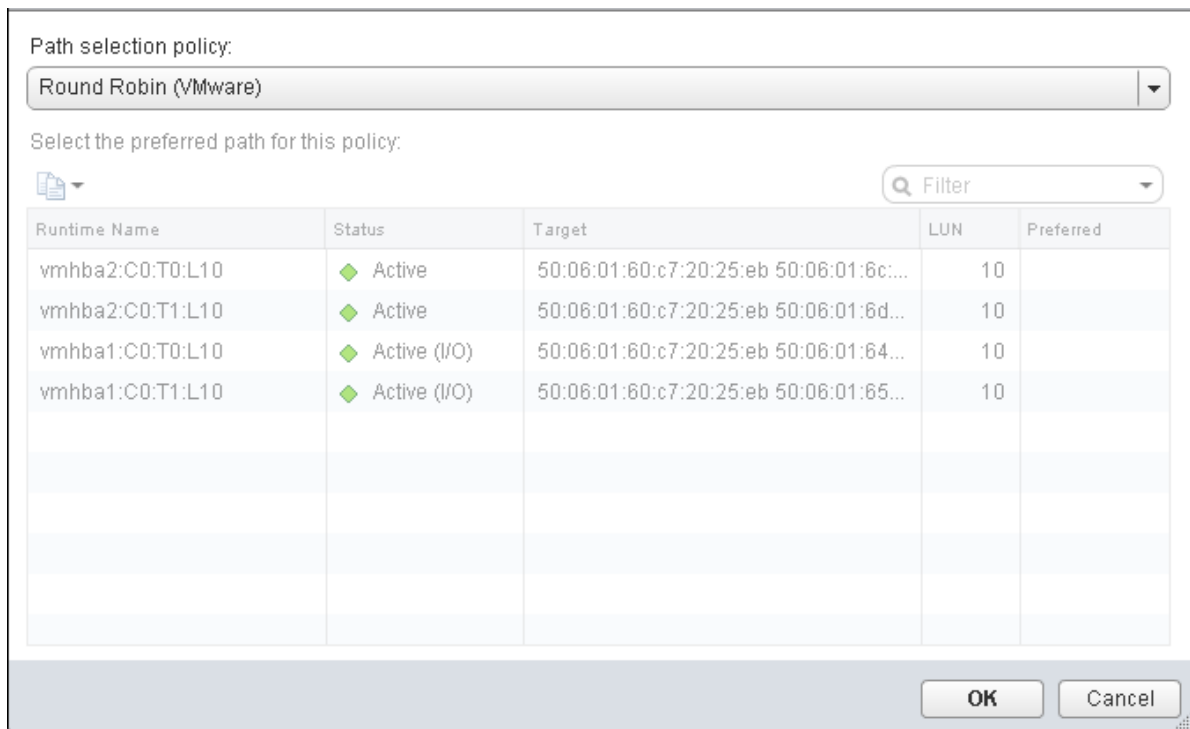


Figure 9 - VMware Path Selection Policy settings on vSphere 6

Figure 10 depicts the device path architecture for storage policy MRU and Fixed Path on VMware ESXi host. Assuming that the storage array includes four Fibre ports, there are four device paths on ESXi datastore. When the ESXi host selects either the path policy of MRU or Fixed Path, we can see there is only an active path; the other paths are in standby mode. When the active path is unavailable, the ESXi host selects the other standby paths automatically. Both storage policies cannot provide load balancing across all paths and cannot maximize the potential performance.

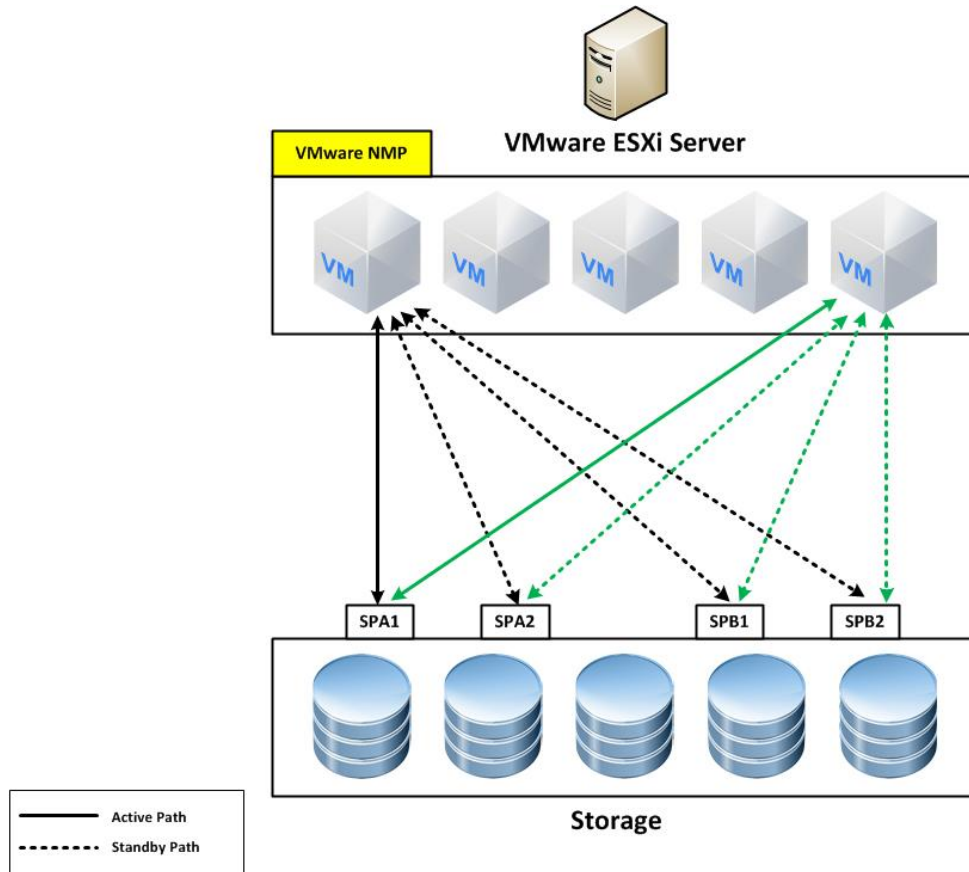


Figure 10 - The Native Path Management - Most Recently Used/Fixed Path

VMware Native Path – Round Robin

Figure 11 depicts the device path architecture for storage policy Round Robin (RR) on VMware ESXi host. Assuming that the storage array includes four Fibre ports, there are four device paths on ESXi datastore. When the ESXi host selects the path policy of RR, we can see all paths in active. RR can only provide load balancing across all paths and uses all paths in a static configuration.

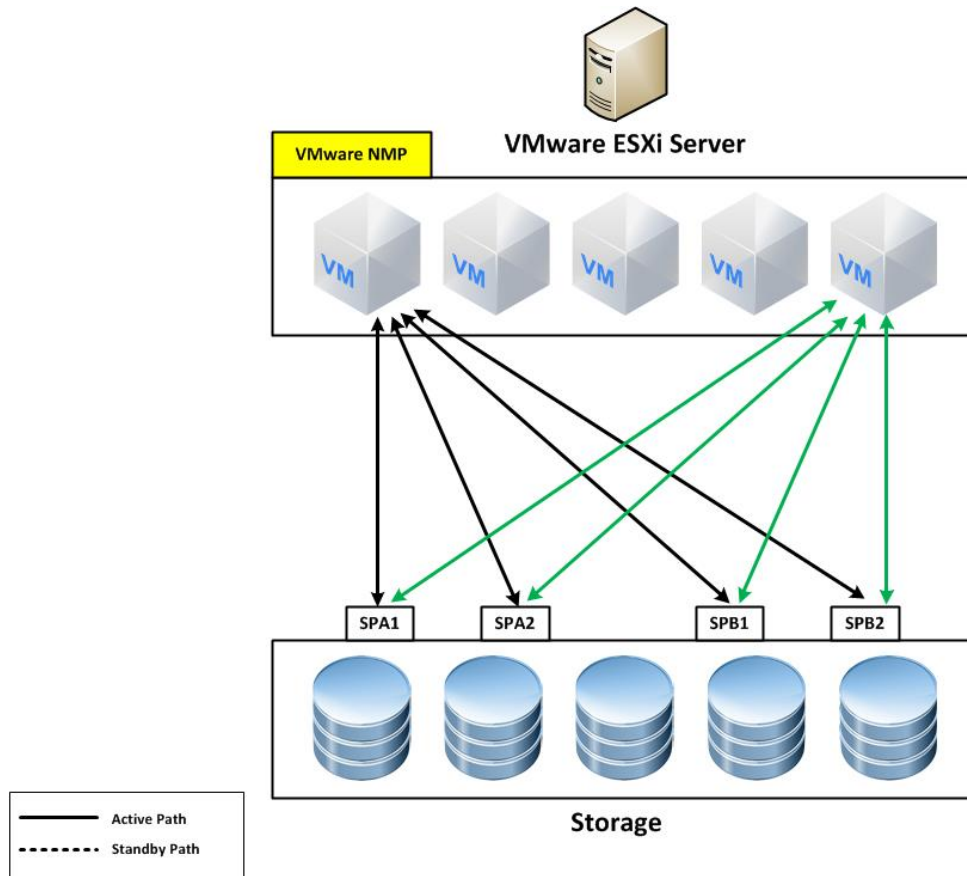


Figure 11 - The Native Path Management - Round Robin

Dell EMC PowerPath/VE for VMware

Dell EMC PowerPath/VE is host-based multipath software for VMware virtual environment. Figure 12 shows the device path architecture for PowerPath/VE on VMware ESXi host. Assuming that the storage array includes four Fibre ports, there are four device paths on ESXi datastore. When PowerPath/VE is enabled on VMware ESXi host, VMware storage path policy is disabled. Figure 12 shows all paths are in an active state. PowerPath/VE can provide optimized load balancing across all paths and maximizes the potential performance.

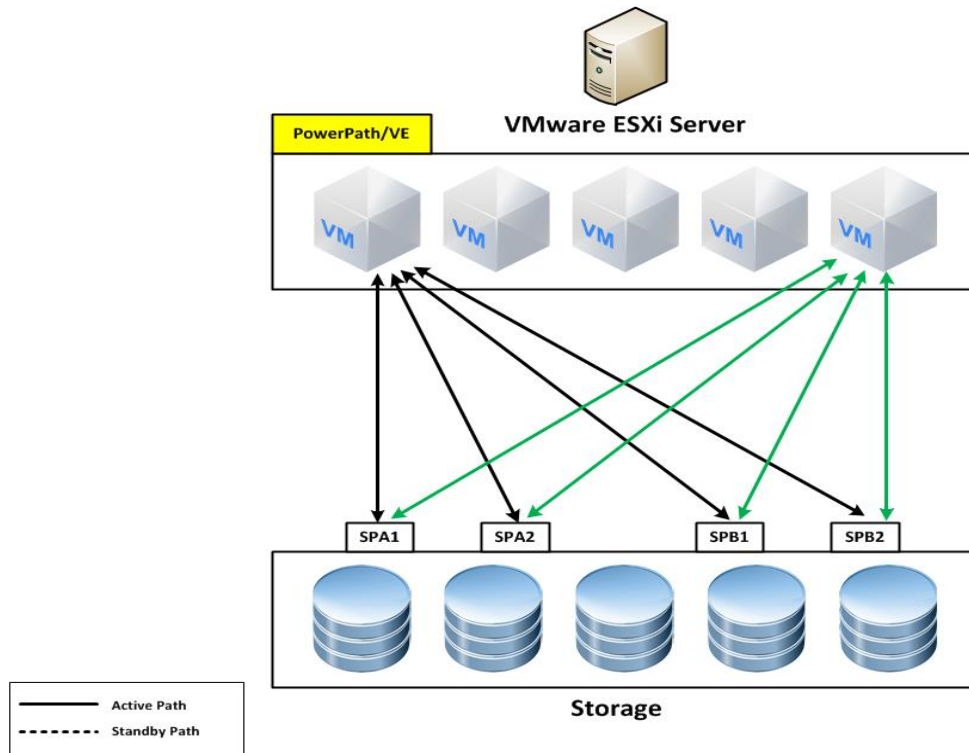


Figure 12 – Dell EMC PowerPath/VE for VMware

According to the information above of Dell EMC PowerPath and native multipathing, Table 12 summarizes the function and feature of each multipath software. We can conclude that PowerPath and PowerPath/VE are the best multipath software in this scenario.

Name	Operating System	All available paths in active	Load balancing	Optimized load balancing
Native MPIO	Windows 2008 R2 SP1	No	Yes*	No
Dell EMC PowerPath 6	Windows 2008 R2 SP1	Yes	Yes	Yes
VMware NMP – Most Recently Used	vSphere 6	No	No	No
VMware NMP – Fixed Path	vSphere 6	No	No	No
VMware NMP – Round Robin	vSphere 6	Yes	Yes	No
Dell EMC PowerPath/VE 6	vSphere 6	Yes	Yes	Yes

* Select the MPIO policy to Round Robin

Table 12 - Features comparison between Native Multipathing and Dell EMC PowerPath

Cost Analysis

If the target storage is an all-Flash model, the total number of disks allocated to all-Flash storage is less than hybrid storage as All-Flash storage can provide high read/write IOPS by fewer flash drives, e.g. if there is one core system requiring 15000 IOPS, hybrid storage can only provide these IOPS by using a large number of disks. One SAS Flash drive can provide 20000 disk IOPS. Based on this information we can conclude that the cost of hybrid storage in this instance is very high. To minimize the cost of new storage, All-Flash storage is a good choice for the storage hardware refresh and performance improvement. In this section, we discuss the cost difference between all-flash storage and hybrid storage.

According to Table 7, we can see there are thirty-eight 600GB 3.5" 15K RPM SAS drives with three 3.5" disk array enclosures. The disk IOPS of each 15K SAS drive is around 180 IOPS. The total usable capacity of the entire Storage Pool is 14.63TB (4.1TB + 4.1TB + 4.1TB + 2.09TB). For the target storage shown in Table 9, there are twenty 4TB 2.5" SAS Flash drives with one 2.5" disk array enclosure. The disk IOPS of each 15K SAS drive is around 180 IOPS. The disk IOPS of each Dynamic Pool can provide around 36000 IOPS, and the total usable capacity of all Dynamic Pool is 51.43TB (25.77TB + 25.77TB). Table 13 shows the comparison of drives between the VNX5300 Unified storage and Unity 350 All-Flash storage. Based on this formation, we can conclude that the performance and number of drives of Unity 350 All-Flash storage are better than VNX5300 Unified storage.

Storage Array	The number of drives	Disk Array Enclosure	Disk IOPS of each drive
Dell EMC VNX 5300 Unified storage	38 x 600GB 3.5" 15K RPM SAS drives	3 x 3.5" Disk Array Enclosures	180 IOPS
Dell EMC Unity 350 All-Flash storage	20 x 4TB 2.5" SAS Flash drive	1 x 2.5" Disk Array Enclosure	20000 IOPS

Table 13 – Difference of drives between the VNX 5300 Unified storage and Unity 350 All-Flash storage

Summary

This article described how we can plan data migration from VNX Unified storage to Unity All-Flash storage. Once the prerequisites and preparation for storage migration are understood, the best migration methodology to minimize the maintenance windows for both Windows platform and vSphere platform can be chosen. Based on five important elements: compatibility, performance, migration methodology, availability, and cost analysis, we described the entire storage migration planning and process. Finally, we explained the integration of vSphere, Unified Computing System and Unity All-Flash storage. Table 14 shows the whole migration process for this scenario.

Phases	Tasks	Details
1	Information collection and data analysis	<ul style="list-style-type: none"> Collect all relevant information of the host systems, SAN switch, both source array and target array. Check the interoperability result with Dell EMC Support Matrix (EMC E-LAB).
2	Design the pre-migration plan	<p>List all the prerequisites and requirements for storage migration. For example, upgrading the software if necessary. It includes the following:</p> <ul style="list-style-type: none"> The software release upgrade of the Unified Computing system, SAN switch and SAN storage. The driver and firmware release upgrade of UCS Virtual Interface Card on the host system. The software release upgrade of PowePath and PowePath/VE on the host system.
3	Design plan for the destination storage	<p>The design plan includes the following:</p> <ul style="list-style-type: none"> What is the requirement of the total usable capacity? The disk type: RAID protection, disk IOPS, and storage pools, etc. What features are needed to enable on Unity 350F All-Flash storage? Which connection interface is required? (e.g., 8GB Fibre Channel port, 1GB iSCSI RJ-45, and 10GB iSCSI SFP+, etc.)
4	Choose the best migration methodology	<p>List all migration methodologies, make the best choice.</p> <ul style="list-style-type: none"> For Windows platform, choose Dell EMC SAN Copy for data migration. For ESXi host, choose VMware Storage vMotion for the data migration.
5	Design the migration plan	<p>Design the migration plan and arrange the migration schedule for each operating system</p> <ul style="list-style-type: none"> Arrange the maintenance window for storage migration if the operating system is Windows. Arrange the migration schedule for the virtual machine.
6	Execute the storage migration	<p>Start the storage migration according to the migration plan.</p>

Table 14 - The storage migration phase for this scenario

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