SAP ONLINE MIGRATION USING VMAX NON-DISRUPTIVE MIGRATION

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ABSTRACT

This solution guide demonstrates the Dell EMC VMAX™ Non-Disruptive Migration (NDM) feature, which enables customers to perform online migrations of their SAP systems in a simple and non-disruptive fashion.

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Executive summary

Business case

Customers deploy SAP systems and integrated applications for mission-critical functions, including manufacturing, financial accounting, inventory management, and sales and marketing. Interruptions to these functions that result in data loss can be catastrophic for a business.

As infrastructure technologies advance, periodic storage infrastructure refreshes, data center consolidations, and system migrations become challenging in an enterprise environment. The complexity and size of very large storage environments make the planning, scheduling, and execution of migrations extremely difficult. SAP systems and applications must be live during the entire process. The ability to perform completely non-disruptive tasks in a simple manner is critical to the success of the migrations. Dell EMC VMAX™ Non-Disruptive Migration (NDM) enables SAP customers to perform online migrations frictionlessly and non-disruptively to the host and application.

Solution overview

VMAX storage systems are widely used in mission-critical SAP landscapes. This solution demonstrates the NDM capability of the VMAX platforms for SAP systems in physical and virtual environments. NDM technology enables customers to migrate their SAP systems from a VMAX array to a VMAX All Flash or VMAX3 array simply and non-disruptively.

Key benefits

Customers using VMAX NDM can:

- Complete migrations from previous generations of VMAX systems to VMAX All Flash or VMAX3 arrays while hosts and SAP applications remain online
- Rely on consistency using industry-leading Symmetrix Remote Data Facility/Synchronous replication (SRDF/s) with no loss of write input/output (I/Os)
- Easily automate the setup and configuration of the migration environment
- Reuse the configurations until all storage migrations from the source to the target array are complete
- Manage the migrations through simple and familiar user interfaces—EMC Solutions Enabler and EMC Unisphere™ for VMAX
- Easily cancel the migration and non-disruptively revert to the source array before the commit operation
- Migrate application-specific data with fine granularity at the storage group level
- Maintain snapshots and SRDF DR position on the source array during migration

We value your feedback!

Dell EMC and the authors of this document welcome your feedback on the solution and the solution documentation. Contact EMC.Solution.Feedback@emc.com with your comments.

Authors: Donagh Keeshan, Fergal Murphy, Aighne Kearney
Introduction

Document purpose
This guide describes a non-disruptive migration solution for SAP systems and databases and provides a comprehensive set of procedures to guide customers through migrating their data to VMAX All Flash or VMAX3 arrays simply and non-disruptively. The guide includes a step-by-step example of migration using an SAP ERP system with a 2 TB Oracle database in both a physical and virtual environment.

Scope
This solution guide provides information about:
- Key components of the VMAX NDM solution for SAP
- Configuration requirements for the solution
- Guidelines for performing NDM operations with Unisphere for an SAP ERP system

Audience
This solution guide is intended for database and system administrators, storage administrators, and system architects who are responsible for designing, implementing, maintaining, and protecting SAP systems and storage systems. It assumes that readers have some familiarity with the VMAX family hardware, software, and SRDF.
Solution overview

Introduction
This section describes the key components and features of VMAX Non-Disruptive Migration (NDM) for SAP.

SAP Business Suite
SAP Business Suite is a set of fully integrated applications that enable enterprises to run their core business operations more efficiently. SAP Business Suite software provides end-to-end process support for areas such as customer engagement, finance, human resources, manufacturing, procurement, logistics, and IT. The software is based on the SAP NetWeaver technology platform. SAP Business Suite applications include SAP ERP, SAP CRM, SAP SCM, and SAP SRM. As part of this NDM solution, SAP ERP 6.0 EHP7 was installed in both a physical and a virtual environment.

VMAX storage systems
The VMAX family of enterprise storage systems offers the world’s most comprehensive range of storage solutions for enterprises of all sizes.

The EMC Symmetrix™ VMAX scales from one to eight VMAX engines, with one system bay and up to ten standard storage bays for standard configurations, and a maximum of one system bay and eight high-density storage bays for high-density configurations. The VMAX array also offers customers the ability to mix standard and high-density drives within a system.

VMAX All Flash and VMAX3 arrays are the first enterprise data services (EDS) platform built to deliver and manage predictable service levels at scale for the hybrid cloud. The VMAX technology is based on EMC’s Dynamic Virtual Matrix architecture, which delivers agility and efficiency at scale by pooling hundreds of CPU cores and allocating them on demand to meet performance requirements for dynamic mixed workloads.

VMAX All Flash arrays deliver the highest possible flash density by supporting the highest-capacity flash drives. The power of VMAX All Flash arrays is in their flexibility to scale with consistent and predictable performance to address a massive variety of real-world workloads.

VMAX Non-disruptive Migration
NDM is available for VMAX All Flash or VMAX3 storage arrays running HYPERMAX OS 5977 Q32016 Service Release and Solutions Enabler 8.3 or later. NDM helps automate the process of migrating hosts and applications running on VMAX platforms to new VMAX All Flash or VMAX3 arrays with no downtime.

NDM uses VMAX auto-provisioning and SRDF replication technologies to move the application data to the new array. NDM also uses VMAX auto-provisioning with EMC PowerPath™ or a supported native host multi-pathing solution to manage host access to the data during the migration process. For more information about supported host operating systems, multipathing software, and cluster software, refer to the NDM support matrix on the E-Lab Navigator website.

Note: For best practices on using multipathing software in an NDM environment, refer to Appendix A in the Non-Disruptive Migration: Configuration and Best Practices Technical Notes.
NDM performs the data migration and device ID swap without host awareness. The path management changes appear as the addition of paths to, or the removal of paths from, the existing source device. To the host and the application, there is no change in the accessing device, and access to the device is maintained throughout the migration process. Figure 1 provides an overview of VMAX NDM.

Figure 1. VMAX NDM overview

**Symmetrix Remote Data Facility/Synchronous technology**

NDM uses VMAX SRDF/S replication technology to move the application data to the new array. The synchronous mode maintains a real-time mirror image of data between the source and target arrays, providing a zero-data-loss solution.

**NDM operations**

The migration of an application from the source to the target array is completed using a sequence of user-initiated operations, each of which is fully automated. These migrations are performed at the storage group (SG) level. The complete migration process can be accomplished with a few clicks in Unisphere, or by using Solutions Enabler commands to perform the following operations:

- Environment setup
- Create
- Cutover
- Commit
- Environment remove

The following sections of this solution guide describe these operations in detail.
Environment setup operation

Setup configures the migration environment that is required to migrate any application from the source array to the target array. It confirms that both the source and target arrays can support the NDM operations. This includes ensuring that a usable replication pathway for data migration is available between the source and target arrays. The Environment Setup command is run only once before the initial migration between two arrays. All other SGs migrating between those arrays use the same migration environment. After the environment setup operation has completed successfully, you can run a create operation.

Create operation

Solutions Enabler examines a specific application’s storage on the source array and automatically provisions equivalent storage on the target array. The target devices are assigned the identity of the source devices and configured in a passthrough mode that allows access to the data from both the source and target devices. Figure 2 provides an illustration.

Figure 2. NDM environment before a host rescan

After the create operation completes, the administrator issues a host rescan to enable the host to discover the paths to the newly created devices. After the host rescan is complete, the migration is in a “CutoverReady” state.

CutoverReady and passthrough mode

Passthrough mode allows the host to write to, or read from, the source or the target array. No data is kept on the target array while it is in a CutoverReady state. I/Os issued by the SAP application are directed to the source or the target arrays through the host multipathing software. Hypermax OS ensures that all I/Os directed to the target by the
host are sent across the SRDF link and serviced by the source array until the cutover operation completes. Figure 3 illustrates this process.

Figure 3. CutoverReady state and passthrough mode

CutoverReady is a transitional state. Because all I/Os are serviced by the source array, the performance overhead is expected to be slightly above SRDF/S. The devices must be in a CutoverReady state and should only use passthrough mode for as long as it takes to check that the create operation has succeeded properly, run the host rescan, and run the cutover operation.

**Cutover operation**

A cutover operation moves the target devices out of passthrough mode, initiates data synchronization from the source to the target, and makes the host paths to the source array inactive so that all I/Os are being serviced by the target array. I/Os that were issued midway through the operation are held in the cache subsystem on VMAX, and then synchronized between arrays when the cutover command is issued. No write I/Os are lost as a result of the cutover. When the cutover operation completes, the data copy starts, as shown in Figure 4.
After the data copy is complete, the migration is in a “CutoverSync” state. As shown in Figure 5, you can complete the migration for that SG with a commit operation. Alternatively, you can revert the host access from the target array to the source array and cancel the migration.
Commit operation

A commit operation is performed after the source to target data synchronization is complete and all application data has been migrated to the target array. During the operation, Solutions Enabler completes the migration by releasing temporary resources that were allocated to perform the migration. This release of resources permanently disables access to the source devices and assigns the target device ID to the source devices. After the operation completes, replication between the source and target arrays is terminated, as Figure 6 shows. The source devices are no longer visible to a host because the masking has been removed. The source device IDs were also permanently swapped with the target device IDs.
Environment remove operation

The environment remove operation removes the migration environment after all migrations have completed. The array-to-array connectivity configured for the data migration pathway is removed, along with the rest of the infrastructure that Hypermax OS configured on both arrays to support the migrations.

Other supported NDM operations

Customers can also run the following NDM operations:

- **Cancel**—Ends a migration that has not been committed. The cancel operation removes storage provisioned for the migration on the target array, releases resources allocated by Solutions Enabler to perform the migration, and places the source devices into the state they were in before the create operation.

- **Cancel with revert**—Moves the application’s data access back from the target array to the source array and cancels the migration. This operation is run after a cutover operation.

- **Recover**—Attempts to complete a failed migration operation. This operation is run after the cause of the failure, for example, a connectivity issue, has been resolved.
This solution guide describes the migration of an SAP ERP system from a VMAX array to a VMAX All Flash array in a manner that is completely non-disruptive to the hosts and the SAP ERP system. We used two SAP ERP 6.0 IDES\(^1\) systems with Oracle databases to validate the solution, as follows:

- Installed an SAP ERP system with Oracle on the VMAX 40K in a physical environment
- Installed an SAP ERP system with Oracle on the VMAX 40K in a VMware virtual environment
- Grew both the SAP ERP IDES systems and Oracle databases to 1.5 TB
- Migrated both SAP ERP systems to a VMAX 250F All Flash array using NDM operations
- Validated that the migrations were non-disruptive to the SAP systems in both environments

Table 1 lists the hardware resources used in the solution:

### Table 1. Hardware resources

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Quantity</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage array</td>
<td>1</td>
<td>VMAX All Flash 250F, single engine</td>
</tr>
<tr>
<td>Storage array</td>
<td>1</td>
<td>VMAX 40K, two-engine</td>
</tr>
<tr>
<td>Physical host</td>
<td>1</td>
<td>Two 10-core CPUs, 512 Gb RAM</td>
</tr>
<tr>
<td>ESXi host</td>
<td>4</td>
<td>Two 10-core CPUs, 512 Gb RAM</td>
</tr>
<tr>
<td>SAN switches</td>
<td>2</td>
<td>8 Gb FC</td>
</tr>
</tbody>
</table>

Table 2 lists the software resources used in this solution.

### Table 2. Software resources

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMware vSphere</td>
<td>6.0</td>
<td>Hypervisor</td>
</tr>
<tr>
<td>VMware vCenter Server</td>
<td>6.0</td>
<td>vSphere Management server</td>
</tr>
<tr>
<td>SUSE Linux</td>
<td>12 SP1</td>
<td>Operating system for the SAP system</td>
</tr>
<tr>
<td>EMC PowerPath/VE</td>
<td>6.0 SP1</td>
<td>Multipathing software used in the virtual environments</td>
</tr>
<tr>
<td>EMC PowerPath</td>
<td>6.1</td>
<td>Multipathing software used in the physical environments</td>
</tr>
<tr>
<td>EMC PowerPath Management Appliance</td>
<td>2.1</td>
<td>Management appliance for the PowerPath hosts</td>
</tr>
<tr>
<td>SAP ERP</td>
<td>6.0 EPH 7</td>
<td>SAP system</td>
</tr>
<tr>
<td>Oracle database</td>
<td>12c</td>
<td>Database for SAP system</td>
</tr>
</tbody>
</table>

\(^1\) Internet Demonstration and Evaluation System (IDES) systems are SAP demo systems that contain the data of the IDES model company.
### Solution overview

<table>
<thead>
<tr>
<th>Software</th>
<th>Version</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>VMAX3 All Flash 250F</td>
<td>HYPERMAX OS 5977 and the Q3’16 Service Release</td>
<td>Single-engine, all-flash storage</td>
</tr>
<tr>
<td>VMAX 40K</td>
<td>(Minimum) Enginuity™ 5876 and the Enginuity 5876 Q3’16 ePack</td>
<td>Two-engine storage</td>
</tr>
<tr>
<td>Solutions Enabler</td>
<td>8.3 (minimum)</td>
<td>Command-based interface to manage VMAX arrays</td>
</tr>
<tr>
<td>Unisphere for VMAX</td>
<td>8.3 (minimum)</td>
<td>Web-based interface to manage VMAX arrays</td>
</tr>
<tr>
<td>Control Host</td>
<td>Windows Server 2012 R2</td>
<td>Separate management host to initiate NDM operations</td>
</tr>
</tbody>
</table>

**Configuration prerequisites and requirements**

Most of the steps for configuring and removing NDM are performed automatically using the Environment Setup and Remove commands. Before you run the setup, ensure that the following prerequisites are met:

- SRDF is enabled in the bin file.
- The source and target arrays have SRDF directors and ports configured.
- The SRDF ports between the source and target arrays in a Fibre Channel environment are zoned to each other.
- A Solutions Enabler or Unisphere management host that sees at least one of the arrays is available.

Before running the create operation, ensure that the following conditions are met:

- The ESXi host /physical host with the application being migrated is zoned to the VMAX All Flash or VMAX3.
- All devices that are to be migrated are set for dynamic SRDF capability (must be RDF1- or RDF2-capable).

**Note:** RDF ports do not need to be dedicated to NDM operations. Ports that are involved in ongoing SRDF disaster recovery (DR) operations may be shared with NDM sessions, but you must perform a full analysis before setting up NDM to ensure that there is adequate bandwidth to handle both DR and migration traffic.
NDM and SRDF restrictions

The following restrictions apply to migrations:

- Migrating devices cannot be R2 devices.
- Device pairs cannot be in synchronous mode.
- Multi session consistency (MSC) must not be enabled
- The R1 cannot be part of an SRDF/Star configuration.
- The RDF relationship cannot be part of an SRDF/Metro configuration.
- SRDF must not replicate data from the target to the source, such as during an in-progress restore.

**Note:** When migrating an existing SRDF R1 device, ensure that the device and its R2 are replicating using SRDF/A (asynchronous mode) for the duration of the process.

**Supported distance**

NDM is supported across SRDF synchronous distance, which is 62 miles (100 km). Because of the requirement that the host sees both the source and target storage, migrations are typically performed between arrays within a data center.
NDM of an SAP ERP system using Unisphere

Before any NDM operation, the SAP system is online with the source VMAX 40K array processing the I/Os. A VMAX 250F All Flash array, the migration target in this example, is attached physically, zoned to the host, and has been discovered by Unisphere.

Like the source VMAX 40K array, the VMAX3 250F All Flash array is locally attached, that is, directly connected to the host and not discovered as a remote array using SRDF. Both arrays appear as local arrays if the Unisphere host is directly attached to both. For NDM operations, only the host being migrated must be zoned to both arrays, with active paths to the source array only, as shown in Figure 7.

Figure 7.  NDM starting environment

**Note:** Use the Solutions Enabler or Unisphere control host to perform the NDM operations. It must be a separate management host from the SAP host and not have volumes that are being migrated.

To test the NDM environment in a physical environment, we used:

- **Control host**—Windows Server 2012 R2 (not shown in Figure 8)
- **Multipath software**—PowerPath 6.1
- **Source**—VMAX 40K array - 000195700895
- **Target**—VMAX 250F All Flash array - 000197800235
Before any NDM operation, the host is attached to both the source and the target arrays. Four volumes are presented to the host from the source array, with the volume IDs and capacity described in Table 3.

Table 3. Volumes presented to the host

<table>
<thead>
<tr>
<th>Volume ID</th>
<th>Capacity (GBs)</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10D1</td>
<td>100</td>
<td>/usr/sap/trans</td>
</tr>
<tr>
<td>10D2</td>
<td>160</td>
<td>/usr/sap/SID</td>
</tr>
<tr>
<td>10D3</td>
<td>200</td>
<td>/sapmnt/SID</td>
</tr>
<tr>
<td>10D4</td>
<td>3,200</td>
<td>Oracle database</td>
</tr>
</tbody>
</table>

This guide focuses on device 10D4. As Figure 9 shows, the devices are contained in a storage group called “NDM_Physical_SG.”

Figure 9. Source storage group

Figure 10 shows the number of paths from the host and the path state before the create operation and the host rescan for device 10D4. For each of the four volumes, there are four paths to the source array. All four paths are alive and active and therefore available for host use. At this stage in the process, there are no paths to the target array.
NDM of an SAP ERP system using Unisphere

Figure 10. Pre-migration multipath configuration

Note: For best practices when using multipathing software in an NDM environment, refer to Appendix A in the Non-Disruptive Migration: Configuration And Best Practices Technical Notes.

Figure 11 shows the online SAP system and Oracle database space overview before the migration.

Figure 11. SAP ERP 6.0 IDES on Oracle database space overview

Setting up the NDM environment

After the required pre-migration tasks are completed, you can configure the environment to use NDM. The environment setup operation:

- Confirms that both the source and target arrays can support the NDM operations
- Ensures that a usable replication pathway for data migration is available

To start the configuration:

1. In Unisphere, select Storage > Migrations. Click the double arrow (>>) and select Manage Environments. The Manage Environments screen shown in Figure 12 appears.
2. Select **Setup** from the **Action** menu, and then select the remote array serial number from the **Remote Array** menu. Click the arrow next to **Add to Job List** and select **Run Now** from the list.

**Note:** Before running the create operation, ensure that the target array has the resources required to configure the migration sessions.

After the run task has completed, the environment is ready to run NDM migrations.

3. Follow steps 1 to 2 in **Setting up the NDM environment**, but this time select **Validate** from the **Action** list, as in Figure 13.

After configuration, NDM automatically handles all further steps required to perform the migrations.

After the setup is complete, the next stage is to create a migration session. The create operation:

- Provisions equivalent storage on the target array
- Assigns the target devices the identity of the source devices and configures the target devices in passthrough mode

To perform a create operation:

1. In Unisphere, select **Storage > Storage Groups** and select the storage group you want to migrate. Click the double arrow (>>) and select **Migrate**.
2. In the Data Migration Wizard, select the remote VMAX array from the **Symmetrix** list and the SRP you want from the **SRP** list. The screen shown in Figure 14 appears.

![Data Migration Wizard - NDM_Physical_SG](image)

**Figure 14.** Creating the data migration

4. Check the **Create Data Migration** option, and then click **Next**. A summary screen appears, as shown in Figure 15.

---

**Note:** If migrating to a VMAX All Flash target array, you will see a **Compression** option in the summary screen. For more information on VMAX All Flash compression and the Oracle database, refer to the *EMC VMAX All Flash for Mission-Critical Oracle Overview*. 

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Review the summary. If everything is satisfactory, click the down arrow next to Add to Job List and select Run Now.

The screen shown in Figure 16 confirms that the migration session was created. After this, I/Os issued by the application are directed to either the source or the target arrays by the host multipath software. HYPERMAX OS ensures that all I/Os directed to the target by the host are serviced by the source array until the cutover.

Click View Details to view further information about the migration session, including the source and target volumes IDs, host information, and Symmetrix front-end port information for both the source and the target arrays.

Perform a host rescan

After the create operation completes, the system administrator must issue a host rescan to enable the host to discover the paths to the newly created devices. This host rescan is operating system-specific. It should include a rescan using the host multipathing software if that rescan must be performed separately from the host rescan, as with PowerPath.

In Figure 17, the host has discovered four new devices after the host rescan. During the create operation, the equivalent storage was created on the target array and the four devices in the NDM_Physical_SG on the source array were provisioned on the target array.
Scanning host 5 for all SCSI target IDs, all LUNs
Scanning host 6 for all SCSI target IDs, all LUNs
Scanning host 7 for all SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 8 for all SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 9 for all SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs
Scanning host 10 for all SCSI target IDs 0 1 2 3 4 5 6 7, all LUNs

4 new or changed device(s) found

Figure 17. Scanning for new volumes

Figure 18 shows the four devices that were created on the target array. They have the same capacity as the source devices and are contained in an SG with the same name as on the NDM_Physical_SG source array. No allocations are made to these devices while they are in a CutoverReady state.

Figure 18. Target storage group after the create operation

After the host rescan is performed, the target devices that are discovered go from a created state to a CutoverReady state. Because the target devices are in passthrough mode, I/Os issued by the application are directed to either the source or the target arrays through the host multipathing software.

Figure 19 shows that device 10D4 now has eight active/alive paths, four from the source array and four from the target array.

PowerPath shows all paths from the source and target as alive. HYPERMAX OS ensures that all I/Os that are directed to the target array by the host are serviced by the source array until the cutover operation completes.

All of the paths remain in an alive state until after the commit operation.
NDM of an SAP ERP system using Unisphere

Figure 19. Multipath configuration after the create operation

**Note:** When performing a host rescan in a virtualized environment, select the host cluster and then select **Storage > Rescan Storage**. To view the PowerPath/VE information after the rescan, log in to the ESXi host and run the appropriate PowerPath commands.

The CutoverReady state is a transitional state. The devices should only be in a CutoverReady state and using passthrough mode for as long as it takes to check that the create operation has succeeded properly, run the host rescan, and run the cutover operation.

To return to the migration session, select **Storage** from the main screen in Unisphere (shown in Figure 20) and then select **Migration**.

Figure 20. CutoverReady state

**Device identities after a create operation**

The create operation automatically provisions matching volumes on the target array. These volumes are the same size and configuration as on the source array, but are unlikely to have the same VMAX volume numbers.

After the create operation, the four new volumes on the target array are 0036, 0037, 0038, and 0039. The Detailed Migration View shows that volume 10D4 and volume 0039 are paired for NDM operations.

The native and external device IDs are the same on the source device (10D4), as Figure 21 shows.
Figure 21. Source device ID after the Create operation

The native and external target device IDs are not the same on the target device (0039), as Figure 22 shows. Device 0039 has a unique native device ID but the same external ID as device 10D4. This is required at this stage of the migration because all device paths are active.

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000158700095</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrix Volume ID</td>
<td>010D4</td>
</tr>
<tr>
<td>HP Identifier Name</td>
<td>N/A</td>
</tr>
<tr>
<td>VMS Identifier Name</td>
<td>N/A</td>
</tr>
<tr>
<td>Nice Name</td>
<td>N/A</td>
</tr>
<tr>
<td>WWN</td>
<td>600000970000197085533031304434</td>
</tr>
<tr>
<td>External Identity WWN</td>
<td>600000970000197085533031304434</td>
</tr>
</tbody>
</table>

Figure 22. Target device ID after the create operation

At any time before running a commit operation on NDM_PHYSICAL_SG, you can cancel a migration that has not been committed before the cutover. The cancel operation does not require the Revert flag because processing has not moved to the target array.

Canceling a migration removes the storage and groups provisioned for the migration on the target array, releases resources allocated by Solutions Enabler to perform the migration, and places the source devices into the state they were in before the create operation. It does not affect the replication pathways put in place with the environment configuration.

After the cancel operation, the host paths to the target array are no longer available. The host system administrator must perform a rescan to remove the dead paths to the target array.

Performing a cutover to the target array

After the migration session has been created and the host rescan performed, the next step is the cutover to the target array. The cutover operation does the following:

- Moves the target devices out of passthrough mode
- Initiates data synchronization from the source to the target
- Makes the paths to the source array inactive.

To perform a cutover operation:

1. In Unisphere, select **Storage > Migrations**. Select the appropriate storage group and click **Cutover**. The screen shown in Figure 23 appears.
Figure 23. Cutover operation details

2. Click the arrow next to Add to Job List and select Run Now.

After the cutover operation completes, the data copy begins. The session is in a migrating state, as Figure 24 shows. It remains in that state until either the pairs are cut over to the target array or another action is taken.

Figure 24. Data migration

Perform a host rescan

After a cutover operation starts, the four paths to the source array (FAs 7f:01, 8f:01, 9f:01 and 10f:01) become inactive while the four paths to the target array (FAs 1d:36, 2d:36, 1d:37 and 2d:37) remain active. Note that PowerPath uses the terms "dead" for inactive and "alive" for active.

Note: The PowerPath mode is "active" for all paths. This PowerPath term is unrelated to the active and inactive path states in NDM terminology. The State field in PowerPath shows the state of the path and whether it is alive or dead.

Figure 25 shows that for device 10D4, four paths to the source array become inactive, while four paths to the target remain active.
NDM of an SAP ERP system using Unisphere

Figure 25. Multipath configuration following cutover operation

As Figure 26 shows, after the data synchronization completes, the migration moves to a CutoverSync state. After the data copy is finished, a commit operation completes the migration.

Figure 26. CutoverSync state

Figure 27 shows the data synchronization and compression from the source array to the target array.

Figure 27. Target storage group after migration

Examine the device identities after a cutover operation

The device IDs of the source and target devices do not change as a result of the cutover operation. The target devices are still using the source devices’ external WWN, and the source devices still have the same native and external IDs.

Because the migration is not permanent until the commit operation, you can still cancel the migration after a cutover operation and revert it to the source array. To revert to the source array following a cutover operation, run a cancel operation by using the Revert option.
The **Revert** option moves the processing back to the source array and the cancel operation removes all of the target-side entities created for the migration. This operation leaves the environment in the state that it was in before the create operation. The revert operation may take some time to run. While the operation is running, the host discovers that the paths to the source array are active again. This is monitored by the VMAX array, which waits for the rediscovery before proceeding.

After the cancel revert operation, the host paths to the target array are no longer available. The host systems administrator should perform a rescan to remove the dead paths to the target array.

After the data copy is complete, the migration can be committed. The commit operation does the following:

- Completes the migration by releasing temporary resources allocated to perform the migration
- Permanently disables access to the source devices
- Assigns the target device ID to the source devices

The state of the migration sessions must be either CutoverSync or CutoverNoSync.

To commit the migration to the target array:

1. In Unisphere, select **Storage > Migrations**. Select the SG you want and click **Commit**. A screen similar to Figure 28 appears.

   ![Figure 28. Commit operation details](image)

2. To commit the migration, click the arrow next to **Add to Job List** and select **Run Now**.

   The migration is complete after the commit operation succeeds.

**Perform a host rescan**

Because the commit operation completes the migration and removes all of the source-side masking, no active paths are visible to the source array.

Figure 29 confirms that, for device 10D4, the source array no longer has access to the host devices, while the target array remains the only array with access.
Examine the device identities after a commit operation

After the commit operation, each device presents the opposite device ID. The source device now presents the target device ID as its external identity, and the target presents the source device ID as its external identity. These changes are permanent and persist across system power cycles and even the deletion and recreation of the devices. Therefore, if device 10D4 is deleted, it shows the identity of device 0039 when it is recreated, as shown in Figure 30 and Figure 31.

### Figure 30. Source ID after the commit operation

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000195700085</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrix Volume ID</td>
<td>01004</td>
</tr>
<tr>
<td>HP Identifier Name</td>
<td>N/A</td>
</tr>
<tr>
<td>VMS Identifier Name</td>
<td>N/A</td>
</tr>
<tr>
<td>Nice Name</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>WWN</strong></td>
<td>600009700019570089533031304434</td>
</tr>
<tr>
<td><strong>External Identity WWN</strong></td>
<td>6000097000195700895330303339</td>
</tr>
</tbody>
</table>

### Figure 31. Target ID after the commit operation

<table>
<thead>
<tr>
<th>Symmetrix ID</th>
<th>000197800235</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symmetrix Volume ID</td>
<td>00039</td>
</tr>
<tr>
<td>HP Identifier Name</td>
<td>N/A</td>
</tr>
<tr>
<td>VMS Identifier Name</td>
<td>N/A</td>
</tr>
<tr>
<td>Nice Name</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>WWN</strong></td>
<td>60000970001978002355330303339</td>
</tr>
<tr>
<td><strong>External Identity WWN</strong></td>
<td>6000097000195700895330303339</td>
</tr>
</tbody>
</table>

Removing the environment

Run this operation after all migrations from the source array have completed. The remove environment operation:

- Takes down the replication pathway between the source and target arrays
- Removes the resources that you configured to support NDM on the source and target arrays
To perform a remove operation:

1. In Unisphere, select **Storage > Migrations**. Click the double arrow (>>) and select **Manage Environments**. The screen shown in Figure 32 appears.

![Manage Environments](image)

**Figure 32. Removing the migration environment**

2. Select **Remove** from the **Action** menu, and then select the remote array serial number from the **Remote Array** list.

3. Click the arrow next to **Add to Job List** and select **Run Now**.

All the NDM steps have now been run and the migrations between the source and target arrays are complete.

**Validation**

SAP system client copies were executed during the NDM migration process to ensure that the migrations to the VMAX All Flash array were non-disruptive. We observed that:

- The SAP hosts and applications were always online and the client copy jobs completed successfully.
- The online migration of the NDM_Physical_SG containing 3.5 TB of data took less than four hours and included all the NDM operations, host rescans, and validation of the paths and device IDs.
- Most of the time (approximately three hours) was spent in the migrating state, synchronizing the data from source to target using two SRDF ports. The amount of time can vary depending on the size of the dataset to be migrated, the number of SRDF ports being used, and other activities on the arrays.

**Note:** The time measurements were obtained in a controlled laboratory environment with the test SAP ERP 6.0 EHP7 test system and NDM configuration, following the steps provided in this solution guide.
Conclusion

The NDM feature helps automate the process of migrating application data to the new VMAX All Flash and VMAX3 arrays. This feature provides the following benefits:

- NDM technology eliminates host and SAP downtime during the migration.
- SAP migration projects for technology refreshes or data center consolidations can benefit from a simplified process and shortened project timeline.
- The new advanced technologies of the VMAX All Flash and VMAX3 arrays deliver greater efficiencies and better performance.
The following documentation on EMC.com or EMC Online Support provides additional and relevant information. Access to these documents depends on your login credentials. If you do not have access to a document, contact your Dell EMC representative.

- *Non-Disruptive Migration: Configuration and Best Practices Technical Notes*
- *VMAX All Flash For Mission-Critical Oracle Overview*
- *EMC Solutions Enabler: CLI Reference Guide*
- *EMC Solutions Enabler Array Controls and Management 8.3.0 CLI User Guide*