

Understanding VMAX3™ SRDF N-1 Device Compatibility

Technical Notes

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Introduction

Historically, the SRDF createpair operation has the following device type requirements to successfully pair devices:

- R1s must be paired to R2s of like sizes
- Device pairs must be the same emulation:
 - CKD 3380 to CKD 3380
 - CKD 3390 to CKD 3390
 - A S400 512 to A S400 512
 - A S400 520 to A S400 520
 - FBA to FBA

The following table lists the valid device configuration combinations for creating an SRDF pair:

Device 1	Device 2
Standard	Standard
Thin	Thin
Standard	Diskless
Thin	Diskless
Thin	Standard

For meta devices, the historical SRDF pairing requirements as follows:

- Concatenated metas must be paired to concatenated metas
- Striped metas must be paired to striped metas
- The number of members in the two metas must be the same
- The stripe size of the two metas must be the same

VMAX3™ HYPERMAX OS with Solutions Enabler 8.0.1 and beyond relaxes some of these existing device pairing requirements with respect to meta devices and device sizes; however, it is critically important to understand the implications of pairing devices of differing sizes and configurations with the

new platform. In these cases, pairing devices of mismatched sizes may result in a smaller to larger device size pairing with restrictions resulting for SRDF restore, failover, SRDF/ Star, and swap operations.

Audience

This technical note is intended for anyone who needs to understand the implications of SRDF N-1 device compatibility from a VMAX3 to the previous generation platform. This document is specifically targeted to EMC customers and technical field personnel who are involved with VMAX3 SRDF solutions.

Platform compatibility

In addition to the aforementioned device pairing requirements, some of the more significant changes related to SRDF N-1 system compatibility to a VMAX3 platform are the following:

- You can use SRDF features in Solutions Enabler/ HYPERMAX OS to replicate to/ from:
 - VMAX3 arrays running HYPERMAX OS
 - VMAX 10K/ 20K/ 40K arrays running Enginuity 5876 with the applicable ePack
- When one array in an SRDF configuration is running HYPERMAX OS, and one or more other arrays are running Enginuity 5876, the following rules and restrictions apply:
 - All SRDF groups and devices must be dynamic
 - Directors on arrays running HYPERMAX OS support up to 16 SRDF ports and 250 SRDF groups. If a port on the array running HYPERMAX OS is connected to an array running Enginuity 5876:
 - The port supports a maximum of 64 RDF groups
 - The director associated with the port supports a maximum of 186 SRDF groups
 - Non-meta VMAX3 SRDF devices paired with N-1 meta-devices are allowed if the N-1 system is running Enginuity 5876
- Adaptive copy write pending is not supported in HYPERMAX OS

Please refer to the *SRDF Interfamily Connectivity tools* available on support.emc.com for the latest information regarding SRDF features supported to arrays running Enginuity versions 5773 through 5876.

Meta devices

HYPERMAX OS does not support meta devices; however, device pairs between non-meta devices on an array running HYPERMAX OS and a meta device on an array running Enginuity 5876 are supported. Device pairs between a non-meta device (HYPERMAX OS) and a meta device (Enginuity 5876) may be either concatenated or striped.

Please also be aware that, in cases where meta head and meta members may have inadvertently been set with different SRDF modes, SRDF will now report a new SRDF mode (MIXED) and an SRDF Pair State of INVALID. Output of the symrdf query, symrdf list, and symdev show commands have been enhanced to display SRDF mode as MIXED when a meta head device on an array running Enginuity 5876 has different SRDF modes than its members. When you see device in MIXED mode, you can then use the set mode command to choose the appropriate mode for the device pair.

Track size implications

As noted previously, some of the original design decisions for SRDF requires that the primary (R1) and secondary (R2) to be the exact same size for full SRDF functionality. R2s can be larger for migration purposes, but once the R2 is used by a host, no restore to the R1 is allowed since some part of the R2's logical image of data may be above the size of the R1. Attempting to restore to the R1 would leave the R1 with a truncated image of data.

Another historical aspect of the Symmetrix in general is that devices are often configured in terms of cylinders. In all existing Symmetrix systems, a cylinder is 15 tracks. On DMX an FBA track was originally 16 KB and later increased to 32 KB on the DMX-3. The track size was then increased to 64 KB upon the introduction of the VMAX. On VMAX3 the track size has now been increased to 128 KB.

Because the FBA track size has now doubled on VMAX3, it also doubles the capacity of one cylinder (again, a cylinder being 15 tracks). If you attempt to use SRDF between two VMAX generations with different FBA track sizes, it is possible that the previous generation has devices that are of a size that is impossible to configure on the VMAX3. Consider a 5 cylinder device on a VMAX. It would be 75 tracks, and 4800 KB large. For VMAX3, it is not possible to configure a number of cylinders that will equal 4800 KB.

You may configure either 2 cylinders, which would be 3840 KB, or 3 cylinders which is 5760 KB. As a result, if the original VMAX device is configured with an odd number of cylinders, it is impossible to create a device of the same size in a VMAX3 system. This odd cylinder scenario has been addressed by the Geometry Compatibility Mode (GCM) described in the next section of this

document.

For 5876 source devices which have been created with an even number of cylinders, you may create a new target VMAX3 device of size $X/2$ cylinders where X is the number of cylinders in the original source 5876 device.

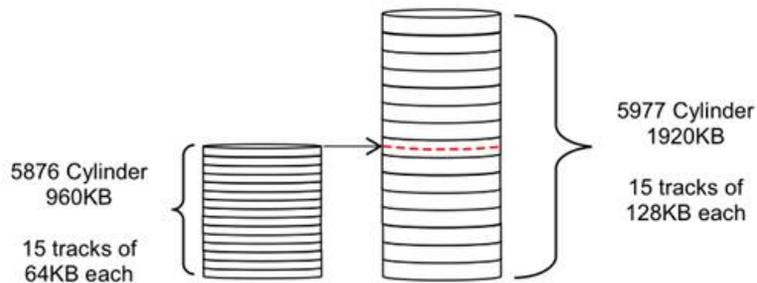
Geometry Compatibility Mode (GCM)

An array running HYPERMAX OS cannot create a device that is exactly the same size as a device with an odd number of cylinders on an array running Enginuity 5876. In order to support the full suite of features, SRDF as well as TimeFinder requires that device pairs be the same size.

To address this, the HYPERMAX OS introduced a new device attribute, Geometry Compatible Mode (GCM). This feature is applicable when a VMAX3 is the recipient (R2) of an SRDF transfer from a previous generation system. A device with GCM set is treated as half a cylinder (960 KB) smaller than its true configured size, enabling full functionality between HYPERMAX OS and Enginuity 5876 for SRDF, TimeFinder SnapVX, and TimeFinder emulations (TimeFinder/ Clone, TimeFinder VP Snap, TimeFinder/ Mirror), and Open Replicator (ORS).

The goal of this feature is to hide the artificial limitations imposed by SRDF due to the change in FBA track size from Enginuity to the HYPERMAX OS. This has been accomplished by treating an SRDF pair, where one side is a Enginuity 5876 device of size $X * 64 \text{ KB track size} * 15 \text{ tracks/cylinder}$ where X is odd, and the other side is a VMAX3 device of size $(X+1) / 2 * 128 \text{ KB track size} * 15 \text{ tracks/ cylinder}$.

X, in this example, is the number of cylinders configured on the Enginuity 5876 side. So if X is 7, the Enginuity 5876 side is 6720 KB and the closest size you may configure on the VMAX3 side is 7680 KB. Note that if X is an even number, then the VMAX3 device can be configured to exactly the same size by halving the number of cylinders as compared to Enginuity 5876.



If an SRDF device pair is created between these two devices and the specified direction of data movement is from the Enginuity 5876 device to the VMAX3 device, it is assumed that the user intended them to be the same size. As such, the GCM attribute on the target device will be set and all SRDF operations will ignore the extra 960 KB of the VMAX3 device. The VMAX3 device will have the GCM attribute set automatically to indicate that it is working “VMAX Compatibility Mode.” If the copy direction had been specified in reverse, the operation would fail since the Enginuity 5876 device would not be able to store the last 960 KBs of data.

Once a device pair exists, all previously in place device size rules still apply. R1’s and R2’s must be the same size for full SRDF functionality. A larger R2 is allowed, but results in limited SRDF functionality as previously explained. The difference with GCM is that the size used for operational decisions is based on the configured size and GCM, not the configured device size alone.

Some of the restrictions and changes necessary to support GCM Mode:

- The `symdev set / unset`, `symdmg set/ unset`, `symcpg set/ unset`, and `symsg set/ unset` commands have been enhanced with a new option `-gcm` to set and unset GCM for a device or group
 - `symdev set / unset -gcm` operations require the device to be in an unmapped state
- The `symrdf createpair` command has been enhanced to transparently `set/ unset` the GCM attribute as part of the create pair operation, as follows:
 - Set the GCM attribute for a target device that is configured $\frac{1}{2}$ a cylinder larger. The source of the copy can be:
 - A device on an array running Enginuity 5876 with an odd number of cylinders and capacity that matches the GCM size of the target device
 - A GCM device on an array running HYPERMAX OS
 - Unset the GCM attribute for a target device that is configured the exact same size as the source of the copy. The source of the copy can

be:

- A source device on an array running Enginuity 5876 with even number of the cylinders and capacity that matches the size of the target device on the array running HYPERMAX OS
 - A source device on the array running HYPERMAX OS without the GCM attribute
- IMPORTANT! The GCM setting for a device cannot be changed if the target of the data device is already part of another replication session.
 - The `symdev show`, `symdev list -v`, `symdmg show Id`, `symdmg list Id -v`, `sympd show`, and `sympd list -v` commands have been enhanced to report the GCM attribute.

Createpair with storage groups

With Solutions Enabler 8.0.2, we now have the option of automatically creating SRDF device pairs based on Storage Groups with the following new syntax:

```
symrdf createpair -sid 123 -sg localSG ...
```

In addition to the historical device type restrictions previously described, devices within two storage groups residing on two previous generation (N-1) systems will be paired as follows:

- Concatenated metas are paired to concatenated metas
- Striped metas are paired to striped metas
- The number of members in the two metas must be the same
- The stripe size of the two metas must be the same
- Thin to thin pairs, and thick to thick pairs are created before thin to thick pairs.

With the VMAX3, the specific device pairings of one storage group to another also has implications with respect to device sizes and configuration. If the R2 is larger than then R1, the device chosen to be the R2 will be selected from available devices within the storage group as close to the R1 size as possible. This may result in a smaller to larger device size pairing with restrictions resulting for SRDF restore, failover, SRDF/ Star, and swap operations.

In the following example, storage group localSG (VMAX, R1) includes 4 devices:

Sym	Pdev Name	Device Config	Sts	Cap (MB)
000A0	N/A	TDEV	RW	3278
000A1	N/A	TDEV	RW	1875
000B1	N/A	TDEV	RW	4125
000C1	N/A	TDEV	RW	3278

The remote storage group remoteSG (VMAX3, R2) also has 4 devices:

Sym	Pdev Name	Device Config	Sts	Cap (MB)
00030	N/A	TDEV	RW	1877
00031	N/A	TDEV	RW	4125
00050	N/A	TDEV	RW	3278
00061	N/A	TDEV	RW	4125

Understanding that the local SG is the VMAX and remote resides on the VMAX3, the following createpair -type r1 operation pairs the devices in the local storage group localSG with devices in remote storage group remoteSG:

```
symrdf createpair -sid 123 -sg localSG -type r1 -remote_sg remoteSG
```

After the storage group createpair operation, the resulting pairings will be as follows with devices **000C1** and **00061** resulting in a mismatched device size and a R2 larger than R1 scenario:

Local storage group		Remote storage group	
Device name	Device size	Device name	Device size
000A0	3278 MB	00050	3278 MB
000A1	1875 MB	00030	1875 MB
000B1	4125 MB	00031	4125 MB
000C1	3278 MB	00061	4125 MB

Identifying devices where R2 is larger than R1

Suspected SRDF device pairing which may have resulted in a R2 which is larger than the R1 can be readily identified with the `symdev show` and similar commands:

```
symdev show <symdev> -sid <sid>

...
RDF Information
  {
    R2 Device Is Larger Than The R1 Device : True
  }
...
```

Blocking createpair when R2 is larger than R1

It is possible to restrict creating mismatched device size configurations where the VMAX3 is the target of a source N-1 (Enginuity 5876) generation system by utilizing the `SYMAPI_RDF_CREATEPAIR_LARGER_R2` option in the Solutions Enabler options file. Adding this option allows the user control to enable/ disable the creation of SRDF pairs where R2 is larger than its corresponding R1.

Valid values for the option are:

- **ENABLE** - (default value) createpair for devices where R2 is larger than its R1 is allowed
- **DISABLE** - createpair for devices where R2 larger than its R1 is blocked

This functionality may be helpful to insure a user does not inadvertently or automatically (in the case of pairing with storage groups), create a smaller to larger device pair configuration where the VMAX3 is the target (R2) of an SRDF pairing operation. It is important to note that this option will not prevent a user from creating mismatched device sizes where the VMAX3 is the source (R1) of the device pairing.

Summary

VMAX3 HYPERMAX OS with Solutions Enabler 8.0.1 and beyond relaxes some of the existing device pairing requirements with respect to meta devices and device sizes. In these cases, pairing devices of mismatched sizes may result in a

smaller to larger device size pairing with restrictions resulting for SRDF restore, failover, SRDF/ Star, and swap operations. As such, it is critically important to understand the implications of pairing devices of differing sizes and configurations with the new platform.

Some of the original design decisions for SRDF requires that the primary (R1) and secondary (R2) to be the exact same size for full SRDF functionality. R2s can be larger for migration purposes, but once the R2 is used by a host, no restore to the R1 is allowed since some part of the R2's logical image of data may be above the size of the R1. Attempting to restore to the R1 would leave the R1 with a truncated image of data.

Because the FBA track size has doubled from 64 KB to 128 KB on VMAX3, it also doubles the capacity of each cylinder. If you attempt to use SRDF between two VMAX generations with different FBA track sizes, it is possible that the previous generation has devices that are of a size that is impossible to configure on the VMAX3 resulting in a R2 that is larger than the R1. For Enginuity 5876 source devices which have been created with an even number of cylinders, you may create a new target VMAX3 device of size $X/2$ cylinders where X is the number of cylinders in the original source 5876 device.

Odd cylinder scenarios have been addressed internally by introducing the Geometry Compatibility Mode (GCM). This feature is applicable when a VMAX3 is the recipient (R2) of an SRDF transfer from a previous generation system. A device with GCM set is treated as half a cylinder (960 KB) smaller than its true configured size, enabling full functionality between HYPERMAX OS and Enginuity 5876 for SRDF, TimeFinder SnapVX, and TimeFinder emulations (TimeFinder/ Clone, TimeFinder VP Snap, TimeFinder/ Mirror), and Open Replicator (ORS).

With Solutions Enabler 8.0.2, we now have the option of automatically creating SRDF device pairs based on Storage Groups (-sg syntax). With the VMAX3, the specific device pairings of one storage group to another also has implications with respect to device sizes and configuration. If the R2 is larger than R1, the device chosen to be the R2 will be selected from available devices within the storage group as close to the R1 size as possible. This may result in a smaller to larger device size pairing with similar restrictions resulting for SRDF restore, failover, SRDF/ Star, and swap operations.

Suspected device pairing which may have resulted in a R2 which is larger than the R1 can be readily identified with the `symdev show` and similar commands. It is also possible to restrict creating mismatched device size configurations where the VMAX3 is the target of a source N-1 (Enginuity 5876) generation system by utilizing the `SYMAPI_RDF_CREATEPAIR_LARGER_R2` option in the Solutions Enabler options file. This functionality may be helpful to insure a user does not inadvertently or automatically (in the case of pairing with storage groups), create a smaller to larger device pair configuration where the VMAX3 is the target (R2)

of an SRDF pairing operation.

The latest *EMC Solutions Enabler SRDF Family CLI User Guide* available on support.emc.com may be referenced for additional information regarding many of the features, commands, and outputs described in this document. In addition, the *SRDF Interfamily Connectivity tools* (also available on support.emc.com) may be referenced for the latest information regarding SRDF features supported to arrays running Enginuity versions 5773 through 5876.

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