



CATE Storage and Backup Engineering
Citi Architecture & Technology Engineering

VMAX3 SRDF and SnapVX

CSBE-15013-RN

Release Notes

Version 0.3

1 Version Control

Version	Date	Author	Reviewed	Comments
0.1	7-14-2015	Quang Le	-	Initial draft
0.2	7-21-2015	Quang Le	Ludwing Derodel Kevin Hobough	Peer Review
0.3	7-24-2015	Quang Le	Global Stakeholders	Release for Comments

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Latest Versions

It is recommended that the latest version of the document be used from the CSBE website <https://catecollaboration.citigroup.net/domains/platstor/gdse/products/techstdshmpgs/symmetrix.aspx>. Newer versions may include expanded scope, or comments on issues discovered after deployment.

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3 Introduction

This document covers VMAX3 SRDF certification with Hypermax 5977, with control via SE8.X.

3.1 Scope

The following was in scope for 5977 certification, and is recertified with 5977.596.583 and SE8.0 or higher:

1. 2-Site SRDF/S and SRDF/A with VMAX 5977 & SE 8.0 (or above) with FAST
2. R2 snapshots with SnapVX as a replacement for R2 BCVs
3. R2 with BCVs (with legacy VMAX commands)

Common SRDF tasks were specifically tested, as detailed in this document, but CSBE is also depending heavily on EMC testing of their product in order to allow a rapid certification of 5977.

The following remain out of scope 5876 / SE7.x certification:

1. 3-Site SRDF

3.1.1 VMAX3 Models

The VMAX 100K/200K are also now supported by CATE.

The configuration policies developed for VMAX3 are aligned to CTI's request for simplified and standardized configurations which can support a predictable performance. Where possible, the replicated offerings are based on the same standard configurations.

Please refer to the CSBE VMAX Solutions guide for hardware and performance related details.

3.1.2 VMAX3 Hardware Configurations for SRDF

Below are SRDF hardware configurations based on modelling done by EMC that will meet Citi's performance and CoB requirements.

VMAX3 Supported SRDF/S Configurations

SRDF/S is supported for replication between sites that are less than 200 km apart. SRDF/S configurations do not require point-in-time copies of the data since data at both sites are always synchronized during normal operations; therefore, both the source and target site should have the same hardware configuration. Below are the Citi standard VMAX3 hardware configurations that should also be used for SRDF/S configurations.

Tier	Model	# of Engines	System Cache (Raw)	# of Drives/Drive type/RAID	Usable Capacity (TB)
Silver	100K	2	1TB	32 x 800GB/EFD/R5(3+1), 432 x 600GB/SAS/R1	130
Silver	200K	2	2TB	64 x 800GB/EFD/R5(3+1), 670 x 600GB/SAS/R1	210
Silver	200K	2	2TB	64 x 800GB/EFD/R5(3+1),	307

				1042 x 600GB/SAS/R1	
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VMAX3 Supported SRDF/A Configurations

The SRDF/A configurations have been sized to support point-in-time (PIT) copies (gold copy) of the data during SRDF resynchronization operations. EMC has done some analysis on the data change rate in Citi's Symmetrix environment and results showed that the peak change rate was 3% of the capacity per day. A snapshot buffer of 30% will allow for approximately 10 days of snap space according to their analysis. The SRDF/A configurations below are based off of Citi's standard VMAX3 hardware configurations with added capacity for the snapshot buffer, delta set extension (DSE), and added cache to handle mounting a single snapshot if needed. These hardware configurations can be used at both the source and target sites to provide equivalent COB protection at both sites. These configurations are not meant to support mounting snapshots for purposes other than recovery from a failure in a replicated configuration.

Tier	Model	# of Engines	System Cache (Raw)	# of Drives/Drive type/RAID	Usable Capacity (TB)
Silver	100K	2	2TB	48 x 800GB/EFD/R5(3+1), 500 x 600GB/SAS/R1	170
Silver	200K	2	2TB	80 x 800GB/EFD/R5(3+1), 886 x 600GB/SAS/R1	275
Silver	200K	3	3TB	112 x 800GB/EFD/R5(3+1), 1290 x 600GB/SAS/R1	402

4 5977 / SE8.0 SRDF Certification Matrix

Certification Matrix	
Solutions Enabler Version	8.0.2/8.0.3
Storage arrays supported	VMAX 200K VMAX 100K
Microcode Version	5977.596.583 ePack 22
2-Site SRDF/S with FAST VP	Certified
2-Site SRDF/A with FAST VP	Certified
3-Site SRDF	Not in Scope.

5 References

Document	Location
EMC documentation	
EMC Solutions Enabler Symmetrix SRDF Family CLI User Guide	EMC Powerlink site
EMC Solutions Enabler TimeFinder Family CLI User Guide	EMC Powerlink site
EMC Solutions Enabler Array Management CLI User Guide	EMC Powerlink site
EMC Solutions Enabler CLI Command Reference	EMC Powerlink site
CSBE documentation	
VMAX3 Solutions guide	https://catecollaboration.citigroup.net/domains/platstor/gdse/products/platforms/Symmetrix/GNAST%20Configuration%20Guide%20-%20EMC%20VMAX3%20v0.5.pdf

6 Known Issues & Significant Changes

6.1 SRDF Limitations

The following table lists the limits for SRDF for all VMAX3 models¹.

SRDF scalability	Max
RDF groups per array	250
RAs/Director	16
RDF groups per RA	250
RDF devices per RA	64K
RDF devices per RDF group	32K
RDF devices per array	64K

VMAX3 SRDF Limits

Note: All RDF groups on VMAX3 are dynamic. It is not possible to create static RDF groups on VMAX3.

6.2 Significant Changes in SRDF

- SRDF Emulation
 - FA to RA conversion is no longer needed on VMAX3. In order to configure RA ports for SRDF, the SRDF emulation must be enabled on the directors. The SRDF emulation can only be enabled on a directors by EMC. Once the SRDF emulation is enabled, Solutions Enabler can be used to associate ports to the SRDF emulation; thus, making them RA ports. Only 8Gbps FC ports can be used for RA ports at this time. A maximum of 16 ports can be associated to the SRDF emulation per director.
- Adding devices to device groups
 - The 'symld' command is no longer available in Solutions Enabler 8.0. The 'symld' command was used to add devices to a device group. Use the 'symdmg' command to add devices to device groups. Any existing scripts using the 'symld' command will need to be modified.
- Default SRDF/A cycle time for VMAX3 and SRDF/A multi-cycle mode
 - The default minimum cycle time for VMAX3 running 5977 code is 15 seconds. When two VMAX3s are using SRDF/A to replicate to each other, SRDF/A operates in multi-cycle mode. Multi-cycle mode allows for 2 or more cycles on the R1 side but only 2 cycles (receive and apply) on the R2 side. A new capture cycle can be started (and queued in the transmit cycle) once the minimum cycle time has elapsed without waiting for a commit on the R2 side. This is different from the legacy mode on earlier VMAXs where a cycle switch could not start until the previous transmit cycle on R1 and apply cycle on R2 are complete.

¹ The following EMC limits are for information only as CATE would not expect Citi deployments to get close to these limits.

Command to change the minimum cycle time

```
symrdf -sid <sid> -rdfg <rdfg> set rdfa -cycle_time <seconds> -both_sides
```

- R2 Point-in-time Copies
 - BCVs were used to provide a PiT copy of the R2 during SRDF resynchronization operations in failure scenarios for prior generation VMAXs. This required the capacity of the R2 array be increased to accommodate the additional mirror copy of the R2 devices which is a fairly expensive configuration. For this reason, it is now recommended that SnapVX be used to provide the point-in-time copy (gold copy) of the R2 devices for SRDF resynchronization operations on VMAX3. This is more cost effective since the additional capacity required to store the snapshot deltas (until everything is fully recovered and resynchronized) is far less than full BCV copies. EMC best practice is to provide an additional 20% capacity to the R2 array to accommodate snapshot space. CSBE recommends 30% capacity to allow for more buffer. Snapshot capacity can also be added to the R1 side to provide a PiT (gold copy) of the data for resynchronization operations on the R1 devices.
- Using BCVs
 - VMAX3 still supports BCVs though SnapVX is used in the background to create the BCVs. The 'symmir' command is still supported to manage BCVs. BCVs should only be used for R2 PiT copies for SRDF resynchronization in environments where the legacy BCV commands are needed. A transition to using SnapVX to provide the PiT copies of the R2 devices should be planned as 'symmir' is a legacy command for prior generation arrays.
- All RDF groups on VMAX3 are dynamic.
- "Zero Space Reclamation" on a source device will not trigger ZSR on the target. ZSR has to be run independently on the R1 and R2 devices.

6.2.1 PRsrdfa Script compatibility

For clarity, the following table indicates which version of the PRsrdfa package is needed for the monitoring scripts to work.

SE version	PRsrdfa1.1	PRsrdfa1.2	PRsrdfa1.3	PRsrdfa1.4
6.x	√	X	X	X
7.0	X	√	X	X
7.1	X	√	√	X
7.2	X	X	√	X
7.3	X	X	√	X
7.4	Not certified by CATE			X
7.5	X	X	√	X
7.6	X	X	X*	√
8.0	X	X	X*	√
*Monitoring scripts in PRsrdfa1.3 will not work once running SE7.6 and above – SRDFA administration scripts are unaffected – recommend to install PRsrdfa1.4 package				

SE platform	SE versions	Script package PRsrdfa version	Location of GDS distribution server
Solaris 10	7.0 → 7.1	1.2	/net/stealth/export1/home1.localhost/sw/PKG/PRsrdfa_1.2.dstream
Solaris 10	7.1 → 7.5	1.3	/net/stealth/export1/home1.localhost/sw/PKG/PRsrdfa1.3.dstream
RHEL 5.x	7.1 → 7.5	1.3	/net/stealth/export1/home1.localhost/sw/Linux/PRsrdfa-1.3-0_E0.noarch.rpm (The RHEL package may also be found on the yum repositories).
RHEL 5.x	7.6 +	1.4	/net/stealth/export1/home1.localhost/sw/Linux/soe5products-x86_64/PRsrdfa-1.4-0_E0.noarch.rpm (The RHEL package may also be found on the yum repositories).

6.3 SnapVX Limitations

- The maximum amount of snapshots per source device is 256.
- Snapshots should primarily be used as point-in-time copies of R2 volumes for SRDF resynchronization operations. The standard SRDF configurations have been sized with extra capacity (20-30%) for snapshot space during SRDF resynchronization operations and not for dev/UAT testing on the snapshots; therefore, if there is intent to use snapshots for dev testing, additional capacity should be planned to accommodate that testing. Since snapshots use the same SRP as the source volumes, capacity should be added to the SRP so that performance SLAs for the SRP is maintained.

7 Best Practice for resynchronization of SRDF/S devices

SRDF/S resynchronizations can have a negative impact on host response times for other applications that share the same SRDF link infrastructure. To prevent this issue the following Best Practice is recommended.

- Where possible, execute resynchronizations during green zones to minimize business impact.
- If a resynchronization is urgent, and must be executed during the business day, you must:
 - place devices to be resynchronized into adaptive copy disk mode prior to executing the resync
 - use the “set RDF pace” option for symqos to throttle the resynchronization. This will minimize the impact of the copy on other applications.

There is a high and low priority queue per RDF group. Adaptive copy goes into the low queue, Sync into the high queue. SRDF will take high priority traffic over low. So typically if an impact is seen with adaptive copy traffic, it is not due to RDF but to the additional copy traffic on the disks. QoS can be used to slow the disk copies down.

7.1 Using symqos

The QoS (Quality of Service) SYMCLI feature allows you to adjust the data transfer (copy) pace on specified devices, or devices in a device group, for certain operations

The license required for copy pace control is part of the base Solutions Enabler key, and hence will already be licensed on your systems.

The recommended steps for an SRDF/S resynchronization are:

```
# symrdf -g <dg> set mode acp_disk
# symqos -g <dg> set RDF pace <value>
# symrdf -g <dg> resume|establish
```

Typically EMC report finding that starting at a value of 4 or 5 relieves the response time impact on the average size box and gets the data copied in a reasonable amount of time. On a very large box (over 1000 disks) you may need to use a qos value of 7 or 8.

Host owners can monitor the application response time and SAN team can monitor the estimated copy time (via `symrdf query -g <dg> -i x`), and adjust the qos levels dynamically. Increase the qos value to reduce host impact (but increase copy duration) or reduce qos value to decrease copy duration (but potentially increase impact on host response time). Do not use a pace value of greater than 10.

Once the RDF pair state is Synchronized, reset the RDF mode and copy pace setting

```
# symqos -g <dg> set RDF pace 0
# symrdf -g <dg> set mode sync
```

Current RDF copy pace settings for devices in a device group can be determined with the command:

```
# symqos -g <dg> query
```

8 Best Practice for resynchronization of SRDF/A devices

Prior to starting a resynchronisation after link recovery, a PiT copy (snapshot or BCV) of the R2 volumes always should be split off to ensure that there is a consistent (albeit aging) point-in-time copy at all times in the remote site during the re-synchronization process when the R2 will be inconsistent.

If the link between sites is down for an extended period, and there is a large build up of invalid tracks on the R1 side, resumption of the link with SRDF/A (the default behaviour in Open Systems) can cause a heavy surge of link traffic, created by the large backlog of invalid tracks being added to the cycles generated by the production traffic. This can lead to an unacceptably high demand being placed on Symmetrix cache, causing SRDF/A to drop again. To avoid this risk, it is best to always switch to adaptive copy mode when resynchronizing after a large build up of invalid tracks.

Appendix A – 2-Site SRDF testing with 5977 & SE8.0.2

Test configuration/notes:

- VMAX200K (5977) → VMAX200K (5977), controlled with SE8.0.2 on Redhat Linux.

Task	Code Drop	Pass/Fail	Comments																																																																																																																																								
Basic 2-Site SRDF/A testing																																																																																																																																											
List RAs between systems	SE8.0.2 5977.596.583	Pass	symcfg -sid 973 list -ra all																																																																																																																																								
Associate a port to the SRDF emulation	SE8.0.2 5977.596.583	Pass	Identify the director IDs for the SRDF emulation: # symcfg -sid 973 list -dir ALL Symmetrix ID: 000196700973 (Local) SYMMETRIX DIRECTORS <table><thead><tr><th>Ident</th><th>Type</th><th>Engine</th><th>Cores</th><th>Ports</th><th>Status</th></tr></thead><tbody><tr><td>IM-1A</td><td>IM</td><td>1</td><td>4</td><td>0</td><td>Online</td></tr><tr><td>IM-2A</td><td>IM</td><td>1</td><td>4</td><td>0</td><td>Online</td></tr><tr><td>IM-3A</td><td>IM</td><td>2</td><td>4</td><td>0</td><td>Online</td></tr><tr><td>IM-4A</td><td>IM</td><td>2</td><td>4</td><td>0</td><td>Online</td></tr><tr><td>ED-1B</td><td>EDS</td><td>1</td><td>8</td><td>0</td><td>Online</td></tr><tr><td>ED-2B</td><td>EDS</td><td>1</td><td>9</td><td>0</td><td>Online</td></tr><tr><td>ED-3B</td><td>EDS</td><td>2</td><td>9</td><td>0</td><td>Online</td></tr><tr><td>ED-4B</td><td>EDS</td><td>2</td><td>8</td><td>0</td><td>Online</td></tr><tr><td>DF-1C</td><td>DISK</td><td>1</td><td>8</td><td>4</td><td>Online</td></tr><tr><td>DF-2C</td><td>DISK</td><td>1</td><td>9</td><td>4</td><td>Online</td></tr><tr><td>DF-3C</td><td>DISK</td><td>2</td><td>9</td><td>4</td><td>Online</td></tr><tr><td>DF-4C</td><td>DISK</td><td>2</td><td>8</td><td>4</td><td>Online</td></tr><tr><td>FA-1D</td><td>FibreChannel</td><td>1</td><td>8</td><td>16</td><td>Online</td></tr><tr><td>FA-2D</td><td>FibreChannel</td><td>1</td><td>6</td><td>15</td><td>Online</td></tr><tr><td>FA-3D</td><td>FibreChannel</td><td>2</td><td>6</td><td>15</td><td>Online</td></tr><tr><td>FA-4D</td><td>FibreChannel</td><td>2</td><td>8</td><td>16</td><td>Online</td></tr><tr><td>RF-1E</td><td>RDF-BI-DIR</td><td>1</td><td>4</td><td>1</td><td>Online</td></tr><tr><td>RF-2E</td><td>RDF-BI-DIR</td><td>1</td><td>4</td><td>1</td><td>Online</td></tr><tr><td>RF-3E</td><td>RDF-BI-DIR</td><td>2</td><td>4</td><td>1</td><td>Online</td></tr><tr><td>RF-4E</td><td>RDF-BI-DIR</td><td>2</td><td>4</td><td>1</td><td>Online</td></tr></tbody></table> List ports available to associate: # symcfg list -sid 973 -port -free Symmetrix ID: 000196700973 <table><thead><tr><th>Slot</th><th>Port</th><th>FCIS</th><th>Speed</th><th>Status</th></tr></thead><tbody><tr><td>4</td><td>10</td><td>Y...</td><td>8</td><td>Powered</td></tr></tbody></table> Legend: Flags: (F)C : Y = Yes, . = No F(C)OE : Y = Yes, . = No F(I)CON : Y = Yes, . = No I(S)CSI : Y = Yes, . = No Associate the port to the SRDF director emulation: # symconfigure -sid 973 commit -f associate_port.cmd -v Execute a symconfigure operation for symmetrix '000196700973' (y/[n]) ? y	Ident	Type	Engine	Cores	Ports	Status	IM-1A	IM	1	4	0	Online	IM-2A	IM	1	4	0	Online	IM-3A	IM	2	4	0	Online	IM-4A	IM	2	4	0	Online	ED-1B	EDS	1	8	0	Online	ED-2B	EDS	1	9	0	Online	ED-3B	EDS	2	9	0	Online	ED-4B	EDS	2	8	0	Online	DF-1C	DISK	1	8	4	Online	DF-2C	DISK	1	9	4	Online	DF-3C	DISK	2	9	4	Online	DF-4C	DISK	2	8	4	Online	FA-1D	FibreChannel	1	8	16	Online	FA-2D	FibreChannel	1	6	15	Online	FA-3D	FibreChannel	2	6	15	Online	FA-4D	FibreChannel	2	8	16	Online	RF-1E	RDF-BI-DIR	1	4	1	Online	RF-2E	RDF-BI-DIR	1	4	1	Online	RF-3E	RDF-BI-DIR	2	4	1	Online	RF-4E	RDF-BI-DIR	2	4	1	Online	Slot	Port	FCIS	Speed	Status	4	10	Y...	8	Powered
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4	10	Y...	8	Powered																																																																																																																																							

			A Configuration Change operation is in progress. Please wait... Establishing a configuration change session.....Established. Processing symmetrix 000196700973 { associate port 10 to dir 4E; } Performing Access checks.....Allowed. Checking Device Reservations.....Allowed. Committing configuration changes.....Started. Committing configuration changes.....Committed. Terminating the configuration change session.....Done. The configuration change session has successfully completed. Confirm the port is associated with the SRDF director emulation: # symcfg -sid 973 list -dir 4e -port Symmetrix ID: 000196700973 (Local) SYMMETRIX DIRECTOR PORTS <table><thead><tr><th>Ident</th><th>Port</th><th>WWN</th><th>Speed Type</th><th>Gb/sec</th><th>Status</th></tr></thead><tbody><tr><td>RF-4E</td><td>8</td><td>50000973500F34C8</td><td>RDF-BI-DIR</td><td>8</td><td>Online</td></tr><tr><td>RF-4E</td><td>10</td><td>50000973500F34CA</td><td>RDF-BI-DIR</td><td>8</td><td>PendOn</td></tr></tbody></table>	Ident	Port	WWN	Speed Type	Gb/sec	Status	RF-4E	8	50000973500F34C8	RDF-BI-DIR	8	Online	RF-4E	10	50000973500F34CA	RDF-BI-DIR	8	PendOn																																																																																																								
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Create RDF groups	SE8.02 5977.596.583	Pass	symrdf addgrp -label DYN1 -rdfg 1 -sid 0973 -dir 1e:8,2e:8,3e:8,4e:8 -remote_rdfg 1 -remote_dir 1e:8,2e:8,3e:8,4e:8 -remote_sid 000196700974 -nop Note: Must use 12 digit SID for remote array in the command																																																																																																																										
Create SRDF Storage Groups	SE8.02 5977.596.583	Pass	symmsg -sid 973 create qtest-rdf1_sg																																																																																																																										
Create and add devices to the SRDF Storage Groups	SE8.02 5977.596.583	Pass	create dev count=10, size=34GB, emulation=FBA, config=RDF1+TDEV, remote_config=RDF2+TDEV, ra_group=1, sg=qtest-rdf1_sg, remote_sg=qtest-rdf2_sg;																																																																																																																										
Create SRDF devices pairs and device group	SE8.02 5977.596.583	Pass	symrdf -file qtest_pair_file -sid 973 -rdfg 1 createpair -type R1 -g qtest_rdf1_dg -invalidate R2																																																																																																																										
View SRDF device group details	SE8.02 5977.596.583	Pass	symdbg show qtest_rdf1_dg																																																																																																																										
View SRDF state of SRDF device group	SE8.02 5977.596.583	Pass	symrdf -g qtest_rdf1_dg query																																																																																																																										
Change SRDF mode for the SRDF device group to asynchronous mode	SE8.02 5977.596.583	Pass	\$ symrdf -g qtest_rdf1_dg set mode async \$ symrdf -g qtest_rdf1_dg query Device Group (DG) Name : qtest_rdf1_dg DG's Type : RDF1 DG's Symmetrix ID : 000196700973 (Microcode Version: 5977) Remote Symmetrix ID : 000196700974 (Microcode Version: 5977) RDF (RA) Group Number : 1 (00) <table><thead><tr><th colspan="4">Source (R1) View</th><th colspan="4">Target (R2) View</th><th>MODE</th></tr><tr><th colspan="4">-----</th><th colspan="4">-----</th><th></th></tr><tr><th>ST</th><th>LI</th><th>ST</th><th></th><th>ST</th><th>LI</th><th>ST</th><th></th></tr><tr><th>Standard</th><th>A</th><th>N</th><th>A</th><th>Standard</th><th>A</th><th>N</th><th>A</th></tr><tr><th>Logical Sym</th><th>T R1 Inv</th><th>R2 Inv</th><th>K Sym</th><th>Logical Sym</th><th>T R1 Inv</th><th>R2 Inv</th><th>K Sym</th></tr><tr><th>Device Dev</th><th>E Tracks</th><th>Tracks</th><th>S Dev</th><th>Device Dev</th><th>E Tracks</th><th>Tracks</th><th>S Dev</th></tr><tr><th colspan="4">-----</th><th colspan="4">-----</th></tr></thead><tbody><tr><td>DEV001</td><td>000AE RW</td><td>0</td><td>278535 NR</td><td>00081 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr><tr><td>DEV002</td><td>000AF RW</td><td>0</td><td>278535 NR</td><td>00082 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr><tr><td>DEV003</td><td>000B0 RW</td><td>0</td><td>278535 NR</td><td>00083 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr><tr><td>DEV004</td><td>000B1 RW</td><td>0</td><td>278535 NR</td><td>00084 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr><tr><td>DEV005</td><td>000B2 RW</td><td>0</td><td>278535 NR</td><td>00085 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr><tr><td>DEV006</td><td>000B3 RW</td><td>0</td><td>278535 NR</td><td>00086 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr><tr><td>DEV007</td><td>000B4 RW</td><td>0</td><td>278535 NR</td><td>00087 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr><tr><td>DEV008</td><td>000B5 RW</td><td>0</td><td>278535 NR</td><td>00088 WD</td><td>0</td><td>0</td><td>A... Suspended</td></tr></tbody></table>	Source (R1) View				Target (R2) View				MODE	-----				-----					ST	LI	ST		ST	LI	ST		Standard	A	N	A	Standard	A	N	A	Logical Sym	T R1 Inv	R2 Inv	K Sym	Logical Sym	T R1 Inv	R2 Inv	K Sym	Device Dev	E Tracks	Tracks	S Dev	Device Dev	E Tracks	Tracks	S Dev	-----				-----				DEV001	000AE RW	0	278535 NR	00081 WD	0	0	A... Suspended	DEV002	000AF RW	0	278535 NR	00082 WD	0	0	A... Suspended	DEV003	000B0 RW	0	278535 NR	00083 WD	0	0	A... Suspended	DEV004	000B1 RW	0	278535 NR	00084 WD	0	0	A... Suspended	DEV005	000B2 RW	0	278535 NR	00085 WD	0	0	A... Suspended	DEV006	000B3 RW	0	278535 NR	00086 WD	0	0	A... Suspended	DEV007	000B4 RW	0	278535 NR	00087 WD	0	0	A... Suspended	DEV008	000B5 RW	0	278535 NR	00088 WD	0	0	A... Suspended
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			DEV009 000B6 RW 0 278535 NR 00089 WD 0 0 A... Suspended DEV010 000B7 RW 0 278535 NR 0008A WD 0 0 A... Suspended \$ symrdf -g qtest_rdf1_dg establish \$ symrdf -g qtest_rdf1_dg query Device Group (DG) Name : qtest_rdf1_dg DG's Type : RDF1 DG's Symmetrix ID : 000196700973 (Microcode Version: 5977) Remote Symmetrix ID : 000196700974 (Microcode Version: 5977) RDF (RA) Group Number : 1 (00) Source (R1) View Target (R2) View MODE ----- ST LI ST Standard A N A Logical Sym T R1 Inv R2 Inv K Sym T R1 Inv R2 Inv RDF Pair Device Dev E Tracks Tracks S Dev E Tracks Tracks MACE STATE ----- DEV001 000AE RW 0 0 RW 00081 WD 0 0 A... Consistent DEV002 000AF RW 0 0 RW 00082 WD 0 0 A... Consistent DEV003 000B0 RW 0 0 RW 00083 WD 0 0 A... Consistent DEV004 000B1 RW 0 0 RW 00084 WD 0 0 A... Consistent DEV005 000B2 RW 0 0 RW 00085 WD 0 0 A... Consistent DEV006 000B3 RW 0 0 RW 00086 WD 0 0 A... Consistent DEV007 000B4 RW 0 0 RW 00087 WD 0 0 A... Consistent DEV008 000B5 RW 0 0 RW 00088 WD 0 0 A... Consistent DEV009 000B6 RW 0 0 RW 00089 WD 0 0 A... Consistent DEV010 000B7 RW 0 0 RW 0008A WD 0 0 A... Consistent
Perform initial synch for the SRDF device group	SE8.02 5977.596.583	Pass	
Set RDFA DSE max capacity	SE8.02 5977.596.583	Pass	symconfigure -sid 973 -cmd "set symmetrix dse_max_cap=100;" commit Note: VMAX3 will use the default SRP for the DSE capacity unless it is configured to use another SRP.
Confirm default SRDF/A Maximum Cache Usage (Percent) is 75%	SE8.02 5977.596.583	Pass	root@gdsese01 log]# symcfg list -sid 4261 -v grep "Maximum Cache Usage" SRDF/A Maximum Cache Usage (Percent) : 75 [root@gdsese01 log]# symcfg list -sid 0524 -v grep "Maximum Cache Usage" SRDF/A Maximum Cache Usage (Percent) : 75
Configure remote BCVs	SE8.02 5977.596.583	Pass	<i>The 'symld' command used to add devices to a device group is no longer available in SE 8.0.2 and has been replaced by the 'symdg' command. In the example below, array 973 is the local array.</i> symdg create -type RDF1 test-rdf1_dg symdg -g test-rdf1_dg -sid 973 addall -dev ae:b7 symbcv -g test-rdf1_dg -sid 973 associateall -devs 008b:0094 -rdf -rdfg 1 symbcv -g test-rdf2_dg -sid 974 associate dev 008b BCV008B
Establish the BCVs on the remote array	SE8.02 5977.596.583	Pass	<i>The BCVs are on the remote array and will be synchronized with the R2 devices on the remote array:</i> symmir -g test-rdf1_dg establish -full -rdf -nop \$ symbcv -sid 974 list Symmetrix ID: 000196700974 BCV Device Standard Device Status ----- Sym Inv. Sym Inv. Physical Dev RDF Att. Tracks Physical Dev Tracks BCV <=> STD -----

			Not Visible 0008B + 0 Not Visible 00081 0 Synchronized Not Visible 0008C + 0 Not Visible 00082 0 Synchronized Not Visible 0008D + 0 Not Visible 00083 0 Synchronized Not Visible 0008E + 0 Not Visible 00084 0 Synchronized Not Visible 0008F + 0 Not Visible 00085 0 Synchronized Not Visible 00090 + 0 Not Visible 00086 0 Synchronized Not Visible 00091 + 0 Not Visible 00087 0 Synchronized Not Visible 00092 + 0 Not Visible 00088 0 Synchronized Not Visible 00093 + 0 Not Visible 00089 0 Synchronized Not Visible 00094 + 0 Not Visible 0008A 0 Synchronized																																				
Split BCVs on the remote array																																							
Change mode to async	SE8.02 5977.596.583	Pass	symrdf -g test-rdf1_dg set mode async -nop																																				
Confirm SRDF/A functions correctly.	SE8.02 5977.596.583	Pass	symstat -type cycle -reptype rdfa -sid 973 -l 5 symstat -type cycle -reptype rdfa -sid 974 -l 5																																				
Controlled suspend	SE8.02 5977.596.583	Pass	symrdf -g test-rdf1_dg suspend																																				
Resume an SRDF group	SE8.02 5977.596.583	Pass	symrdf -g test-rdf1_dg resume																																				
Failover test	SE8.02 5977.596.583	Pass	Run from DR site (gdsese01) symrdf -g test-rdf2_dg failover																																				
Failback test	SE8.02 5977.596.583	Pass	Run from Prod site (namgdse14) symrdf -g test-rdf1_dg failback Run from DR site (gdsese01) symrdf -g test-rdf2_dg failback																																				
Confirm SRDF/A replication recommences	SE8.02 5977.596.583	Pass	symrdf -g test-rdf1_dg query																																				
SRDF swap operations (SRDF/A)	SE8.02 5977.596.583	Pass	At DR site symrdf -g test-rdf2_dg disable -nop symrdf -g test-rdf2_dg failover -nop symrdf -g test-rdf2_dg swap -nop symrdf -g test-rdf2_dg establish -nop symrdf -g test-rdf2_dg enable -nop																																				
Swap back to original direction	SE8.02 5977.596.583	Pass	At prod site symrdf -g test-rdf1_dg disable -nop symrdf -g test-rdf1_dg failover -nop symrdf -g test-rdf1_dg swap -nop symrdf -g test-rdf1_dg establish -nop symrdf -g test-rdf1_dg enable -nop																																				
VP Space reclamation SRDF/A & S Consistent	SE8.02 5977.596.583	Pass	Before ZSR: \$ symcfg -sid 973 list -tdev -bound -detail -sg qtest-rdf1_sg Symmetrix ID: 000196700973 Enabled Capacity (Tracks) : 717373440 Bound Capacity (Tracks) : 2785350 SYMMETRIX THIN DEVICES ----- <table><tr><th></th><th></th><th>Pool</th><th>Pool</th><th>Total</th><th>Compressed</th><th></th><th></th></tr><tr><th></th><th>Bound</th><th>Flags</th><th>Total</th><th>Subs</th><th>Allocated</th><th>Written</th><th>Size/Ratio</th></tr><tr><th>Sym</th><th>Pool</th><th>Name</th><th>ESPT</th><th>Tracks</th><th>(%)</th><th>Tracks</th><th>(%)</th><th>Tracks</th><th>Tracks</th></tr><tr><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></tr></table> ----- 000AE - F..B 278535 - 0 0 278501 100 0 0			Pool	Pool	Total	Compressed				Bound	Flags	Total	Subs	Allocated	Written	Size/Ratio	Sym	Pool	Name	ESPT	Tracks	(%)	Tracks	(%)	Tracks	Tracks										
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			<pre>DG2_FBA10K -- - - 278501 100 - - 278501 0 000AF - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B0 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B1 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B2 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B3 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B4 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B5 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B6 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 000B7 - F..B 278535 - - 0 0 278502 100 0 0 DG2_FBA10K -- - - 278502 100 - - 278502 0 Total ----- Tracks 2785350 0 2785019 0 2785019 0 2785019 0</pre>									
			NOTE the change @8.0.1 – ZSR now initiated @ dev & dg, sg, cg \$ symmsg -sid 973 -nop -v reclaim -sg qtest-rdf1_sg -persistent Requested devices: 000AE 000AF 000B0 000B1 000B2 000B3 000B4 000B5 000B6 000B7 STARTING a 'RECLAIM_START' control operation for 10 devices. Reclaim Start device(s) at local Symmetrix.....Done. The 'RECLAIM_START' control operation SUCCEEDED. \$ symcfg -sid 973 list -tdev -bound -detail -sg qtest-rdf1_sg Symmetrix ID: 000196700973 Enabled Capacity (Tracks) : 717373440 Bound Capacity (Tracks) : 2785350 SYMMETRIX THIN DEVICES <pre>----- Pool Pool Total Compressed Bound Flags Total Sub Allocated Written Size/Ratio Sym Pool Name ESPT Tracks (%) Tracks (%) Tracks (%) Tracks (%) ----- 000AE - F..B 278535 - 0 0 24819 9 0 0 DG2_FBA10K -- - - 24819 9 - - 24819 0 000AF - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 000B0 - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 000B1 - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 000B2 - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 000B3 - F..B 278535 - 0 0 0 0 - - 0 0 000B4 - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 000B5 - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 000B6 - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 000B7 - F..B 278535 - 0 0 1 0 - - 0 0 DG2_FBA10K -- - - 1 0 - - 1 0 Total ----- Tracks 2785350 0 24827 0 24827 0 24827 0</pre>									
	SE8.02	Pass										

Check if SRDF still needs to be suspended when Zero Space Reclamation is run.	5977.596.583		ZSR Works when SRDF is running. SRDF no longer needs to be suspended to run the command, and space reclamation take place on the R1 array however it does NOT initiate a reclaim on R2.
Set mode adaptive copy	SE8.02 5977.596.583	Pass	<code>symrdf -g test-rdf1_dg disable -nop</code> <code>symrdf -g test-rdf1_dg set mode acp_disk</code> <code>symrdf -g test-rdf1_dg set mode async -nop</code>
Basic Point-in-time copy testing with BCVs			
Create and pair thin BCVs against R2 devices		n/a	Thin BCVs already part of earlier test/setup
Test if symrecover works correctly with the thin BCVs and thin R2s with SE8.0.2	SE8.02 5977.596.583	Pass	Check symrecover works as documented against thin BCVs # cat symrecover_options monitor_cycle_time=60 run_once=1 restart_group_on_startup=1 goldcopy_bcv_r2_mirror_state_post_restart=establish # symrdf -g test-rdf1_dg suspend # symrecover start -g test-rdf1_dg -mode async -options symrecover_options
Basic 2-Site SRDF/S testing (5876 – 5876 with SE7.6)			
Change mode for test group to sync mode	SE8.02 5977.596.583	Pass	<code>symrdf -g test-rdf1_dg disable -nop</code> <code>symrdf -g test-rdf1_dg set mode sync -nop</code>
Failover an SRDF/S DG	SE8.02 5977.596.583	Pass	<code>symrdf -g test-rdf1_dg failover</code>
Failback SRDF/S DG	SE8.02 5977.596.583	Pass	<code>symrdf -g test-rdf1_dg failback -nop</code>
Split an SRDF/S DG with I/O running	SE8.02 5977.596.583	Pass	<code>symrdf -g test-rdf1_dg split -nop</code>
Establish an SRDF/S DG	SE8.02 5977.596.583	Pass	<code>symrdf -g test-rdf1_dg establish -nop</code>
Validate Operational Script Commands			
Create RDF1 consistency group	SE8.02 5977.596.583	Pass	<code>symcg create qtest_cg -type rdf1 -rdf_consistency</code>
Add devices in the rdfg to the CG	SE8.02 5977.596.583	Pass	<code>symcg -cg qtest_cg -sid 973 addall devs -rdfg 1</code>
Set RDF mode to async for the CG	SE8.02 5977.596.583	Pass	<code>symrdf -cg qtest_cg set mode async</code>
Establish the RDF link for the CG	SE8.02 5977.596.583	Pass	<code>symrdf -cg qtest_cg establish</code>
Enable consistency protection for the CG	SE8.02 5977.596.583	Pass	<code>symcg -cg qtest_cg enable</code>
Disable consistency protection for the CG	SE8.02 5977.596.583	Pass	<code>symcg -cg qtest_cg disable</code>
Verify consistency protection is enabled on the CG	SE8.02 5977.596.583	Pass	<code>symrdf -cg qtest_cg verify -enabled</code> All devices in the group 'qtest_cg' are 'Enabled'.
Verify the CG is consistent	SE8.02 5977.596.583	Pass	<code>\$ symrdf -cg qtest_cg verify -cg_consistent</code> CG 'qtest_cg' is RDF-Consistent.
For SRDF/S, verify that the CG is in a synchronized state.	SE8.02 5977.596.583	Pass	<code>symrdf -cg qtest_cg verify -synchronized</code>

Suspend SRDF link for the CG	SE8.02 5977.596.583	Pass	symrdf -cg qtest_cg suspend -force
Resume SRDF link for the CG	SE8.02 5977.596.583	Pass	symrdf -cg qtest_cg resume
Create device group	SE8.02 5977.596.583	Pass	symdg create -type RDF1 test-rdf1_dg
Symld to manage device groups	SE8.02 5977.596.583	FAIL	For VMAX3 symld commands for device groups have been replaced with the symdg command. Scripts will need to be modified to use symdg instead of symld.
CATE SRDF/A Script testing - PRsrdfa1.4 version			
Install the PRsrdfa1.4 package on gdsese01.	Not tested	n/a	Already installed The rpm for the script has been relocated to /net/stealth/export1/home1.localhost/sw/Linux/soe5products-x86_64/PRsrdfa-1.4-0_E0.noarch.rpm
mon_srdfa_cyc	SE8.02 5977.596.583	PASS	# ./mon_srdfa_cycle 0973 0 qltest /var/log/messages output: Jun 19 17:59:15 namgdse14 SRDFA_ALERT: Please contact qltest. Current cycle time for RDF group 1 (13 sec) on Symmetrix 0973 has exceeded acceptable threshold (0 sec)
mon_srdfa_cache	SE8.02 5977.596.583	PASS	# ./mon_srdfa_cache 973 -1 qltest /var/log/messages output: Jun 19 18:15:27 namgdse14 ssh-mgmt-sysmonitor[7315]: Next connection attempt to management system will be in 17 seconds, tier 0
mon_srdfa_inactive	SE8.02 5977.596.583	PASS	# ./mon_srdfa_inactive 0973 qltest Jun 22 16:46:49 namgdse14 SRDFA_ALERT: Please contact qltest. SRDF/A session for RDF group 1 is inactive
Srdfa_health	SE8.02 5977.596.583	PASS	# ./srdfa_health 973 1 1 qltest /var/log/messages output: Jun 22 11:40:44 namgdse14 SRDFA_ALERT: Please contact qltest. Current cycle time for RDF group 1 (9 sec) on Symmetrix 973 has exceeded acceptable threshold (1 sec)
Resume_srdfa	SE8.02 5977.596.583	PASS	# ./resume_srdfa test-rdf1_dg 1 *** Starting SRDF/A resynchronization exercise *** Step 1: Verifying remote BCVs already synced up *** Step 2: Splitting remote BCVs Remote 'Split' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... Remote 'Split' operation successfully executed for device group 'test-rdf1_dg'. *** Step 3: Waiting for background BCV split for test-rdf1_dg to finish *** Step 4: Setting mode for test-rdf1_dg to adaptive copy An RDF 'Disable' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The device is already in the requested RDF state An RDF Set 'ACp Disk Mode ON' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF Set 'ACp Disk Mode ON' operation successfully executed for device group 'test-rdf1_dg'. *** Step 5: Establish RDF link for test-rdf1_dg An RDF 'Incremental Establish' operation execution is

			in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Incremental Establish' operation successfully initiated for device group 'test-rdf1_dg'. *** Step 6: Waiting until test-rdf1_dg RDF is fully synced up *** Step 7: Change mode back to async for test-rdf1_dg An RDF Set 'Asynchronous Mode' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF Set 'Asynchronous Mode' operation successfully executed for device group 'test-rdf1_dg'. *** Step 8: Enabling consistency for test-rdf1_dg An RDF 'Enable' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Enable' operation successfully executed for device group 'test-rdf1_dg'. *** Step 9: Incrementally establish remote BCV for test-rdf1_dg Remote 'Incremental Establish' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... Remote 'Incremental Establish' operation successfully initiated for device group 'test-rdf1_dg'. *** Step 10: Wait until remote BCV fully established for test-rdf1_dg *** SRDF/A Resynchronization exercise for device group test-rdf1_dg completed
2site_async_failover	SE8.02 5977.596.583	PASS	# ./2site_async_failover test-rdf1_dg *** Step 1: Disable consistency on the device group An RDF 'Disable' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Disable' operation successfully executed for device group 'test-rdf1_dg'. *** Step 2: Confirming no outstanding tracks not committed to async R2 side RDF group for device group test-rdf1_dg has 0 outstanding tracks. *** Step 3: Failover test-rdf1_dg An RDF 'Failover' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Failover' operation successfully executed for device group 'test-rdf1_dg'.
2site_async_failback	SE8.02 5977.596.583	PASS	# ./2site_async_failback test-rdf1_dg *** Step 1: Failback test-rdf1_dg An RDF 'Failback' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Failback' operation successfully executed for device group 'test-rdf1_dg'. *** Step 2: Waiting until there are no invalid tracks on the async leg R1 updating from R2 on async leg (0.0 MBs to go)

			*** Step 3: Enable consistency for test-rdf1_dg An RDF 'Enable' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Enable' operation successfully executed for device group 'test-rdf1_dg'.
2site_async_swap	SE8.02 5977.596.583	PASS	# ./2site_async_swap test-rdf1_dg *** Step 1: Disable consistency on the device group An RDF 'Disable' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Disable' operation successfully executed for device group 'test-rdf1_dg'. *** Step 2: Confirming no outstanding tracks not committed to async R2 side RDF group for device group test-rdf1_dg has 0 outstanding tracks. *** Step 3: Failover test-rdf1_dg An RDF 'Failover' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Failover' operation successfully executed for device group 'test-rdf1_dg'. *** Step 4: Swap test-rdf1_dg An RDF 'Swap Personality' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Swap Personality' operation successfully executed for device group 'test-rdf1_dg'. *** Step 5: Establish test-rdf1_dg An RDF 'Incremental Establish' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Incremental Establish' operation successfully initiated for device group 'test-rdf1_dg'. *** Step 6: Enable test-rdf1_dg An RDF 'Enable' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Enable' operation successfully executed for device group 'test-rdf1_dg'. *** Step 7: Confirm current RDF type for test-rdf1_dg *** RDF group type for test-rdf1_dg is RDF2
seq_srdfa	SE8.02 5977.596.583	PASS	# ./seq_srdfa 2site_async_failover /home/ql68074/srdf/dglist ***** *** Running script 2site_async_failover for DG test-rdf1_dg

			*** Step 1: Disable consistency on the device group An RDF 'Disable' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Disable' operation successfully executed for device group 'test-rdf1_dg'. *** Step 2: Confirming no outstanding tracks not committed to async R2 side RDF group for device group test-rdf1_dg has 0 outstanding tracks. *** Step 3: Failover test-rdf1_dg An RDF 'Failover' operation execution is in progress for device group 'test-rdf1_dg'. Please wait... The RDF 'Failover' operation successfully executed for device group 'test-rdf1_dg'. ***** *** Running script 2site_async_failover for DG test-rdf2_dg *** Step 1: Disable consistency on the device group An RDF 'Disable' operation execution is in progress for device group 'test-rdf2_dg'. Please wait... The device is already in the requested RDF state Disable operation failed. Script exiting.
SRDF/A FAST Tests			
Source SG (platinum SLO) replicating to target SG (Bronze) SLO. Verify that the target volumes are placed in the SLO defined on the target volumes.	SE8.02 5977.596.583	PASS	The data on target volumes remained in the Bronze SLO drives which did not match the source.
Source SG (platinum SLO) replicating to target SG (Optimum) SLO. Verify that the data is distributed similarly to R1.	SE8.02 5977.596.583	PASS	When the target SLO is set to Optimum, the data distribution on the target volumes should closely resemble the data distribution on the source volumes assuming that the source and target arrays have similar configurations. In our test, the target data distribution moved from the SAS 10K drives to the flash tier which matches the diamond SLO defined for the source volumes.
Source SG (bronze SLO) replicating to target SG (Optimum) SLO. Verify that the data is distributed similarly to R1.	SE8.02 5977.596.583	PASS	The target data distribution did not resemble the source. All the data on the target volumes remained on the flash drives and did not get demoted to the bronze (SAS) tier to match the source. This is expected behavior since the data on the target will not get demoted unless flash capacity needs to be freed to accommodate data with higher precedence.

Appendix B – Snap VX Tests with 5977 & SE8.0.2

Test configuration/notes:

- VMAX200K (5977) controlled with SE8.0.2 on Redhat Linux.

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Task	Code Drop	Pass/Fail	Comments																												
SnapVX Functional Tests																															
Establish snapshot	SE8.02 5977.596.583	PASS	<pre># symsnapvx -sid 973 -sg qtest-rdf1_sg -name qtest-rdf1_snapshot establish</pre> Execute Establish operation for Storage Group qtest-rdf1_sg (y/[n]) ? y Establish operation execution is in progress for the storage group qtest-rdf1_sg. Please wait... Polling for Establish.....Started. Polling for Establish.....Done. Polling for Activate.....Started. Polling for Activate.....Done. Establish operation successfully executed for the storage group qtest-rdf1_sg <pre># symsnapvx -sid 973 list</pre> Symmetrix ID : 000196700973 (Microcode Version: 5977) <pre>----- Sym Num Flgs Dev Snapshot Name Gens FLRG Last Snapshot Timestamp ----- 000AE qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000AF qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B0 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B1 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B2 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B3 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B4 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B5 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B6 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 000B7 qtest-rdf1_snapshot 1 Fri Jun 26 16:07:32 2015 -----</pre> Flgs: (F)ailed : X = Failed, . = No Failure (L)ink : X = Link Exists, . = No Link Exists (R)estore : X = Restore Active, . = No Restore Active (G)CM : X = GCM, . = Non-GCM [Lab root @ namgdse14 ~] #																												
Set snapshot expiration	SE8.02 5977.596.583	PASS	Set ttl to 1 day at snapshot creation: <pre># symsnapvx -sid 973 -sg qtest-rdf1_sg -name qtest-rdf1_snapshot establish -ttl -delta 1</pre> Set ttl to 1 day for a specific generation snapshot: <pre># symsnapvx -sid 973 -sg qtest-rdf1_sg -snapshot_name qtest-rdf1_snapshot -generation 1 set ttl -delta 1</pre>																												
View snapshot details	SE8.02 5977.596.583	PASS	<pre># symsnapvx -sid 973 -sg qtest-rdf1_sg list -detail</pre> Storage Group (SG) Name : qtest-rdf1_sg SG's Symmetrix ID : 000196700973 (Microcode Version: 5977) <pre>-----</pre> <table> <thead> <tr> <th>Sym</th><th>Flgs</th><th>Total</th><th>Non-Shared</th></tr> <tr> <th>Dev Snapshot Name</th><th>Gen FLRG</th><th>Deltas Snapshot Timestamp</th><th>(Track</th></tr> <tr> <th>s) (Tracks) Expiration Date</th><th></th><th></th><th></th></tr> </thead> <tbody> <tr> <td>000AE qtest-rdf1_snapshot</td><td>0</td><td>Fri Jun 26 16:19:32 2015</td><td>27</td></tr> <tr> <td>8432 75942 Sat Jun 27 16:19:32 2015</td><td></td><td></td><td></td></tr> <tr> <td>qtest-rdf1_snapshot</td><td>1</td><td>Fri Jun 26 16:17:59 2015</td><td>27</td></tr> <tr> <td>8441 68786 Sat Jun 27 16:43:35 2015</td><td></td><td></td><td></td></tr> </tbody> </table>	Sym	Flgs	Total	Non-Shared	Dev Snapshot Name	Gen FLRG	Deltas Snapshot Timestamp	(Track	s) (Tracks) Expiration Date				000AE qtest-rdf1_snapshot	0	Fri Jun 26 16:19:32 2015	27	8432 75942 Sat Jun 27 16:19:32 2015				qtest-rdf1_snapshot	1	Fri Jun 26 16:17:59 2015	27	8441 68786 Sat Jun 27 16:43:35 2015			
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qtest-rdf1_snapshot	1	Fri Jun 26 16:17:59 2015	27																												
8441 68786 Sat Jun 27 16:43:35 2015																															

			qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8495 251940 NA 000AF qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8446 75457 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8459 68378 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8500 251981 NA 000B0 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8441 75568 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8456 68342 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8498 251545 NA 000B1 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8449 75783 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8465 68581 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8499 251786 NA 000B2 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8433 75435 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8465 68062 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8498 251579 NA 000B3 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8442 75686 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8456 68476 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8497 251783 NA 000B4 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8447 75296 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8455 68013 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8499 251372 NA 000B5 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8427 75410 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8447 68220 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8496 251551 NA 000B6 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8437 75516 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8457 68013 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8500 251478 NA 000B7 qtest-rdf1_snapshot 0 Fri Jun 26 16:19:32 2015 27 8437 75314 Sat Jun 27 16:19:32 2015 qtest-rdf1_snapshot 1 Fri Jun 26 16:17:59 2015 27 8451 68132 Sat Jun 27 16:43:35 2015 qtest-rdf1_snapshot 2 Fri Jun 26 16:07:33 2015 27 8495 251729 NA ----- 835 3920 3955154 Figs: (F)ailed : X = Failed, . = No Failure (L)ink : X = Link Exists, . = No Link Exists (R)estore : X = Restore Active, . = No Restore Active (G)CM : X = GCM, . = Non-GCM
Restore a snapshot	SE8.02 5977.596.583	PASS	Test Steps: 1. Take snapshot of source volume 2. Copy some files onto the source volume 3. Restore the snapshot 4. Verify that the files copied after the snapshot was taken no longer exist on the volume.

			Command to restore the snapshot to the source volumes: # symsnapvx -sid 973 -sg qtest-rdf1_sg -snapshot_name qtest-rdf1_snapshot -gen 0 restore -remote Execute Restore operation for Storage Group qtest-rdf1_sg (y/[n]) ? y Restore operation execution is in progress for the storage group qtest-rdf1_sg. Please wait... Polling for Restore.....Started. Polling for Restore.....Done. Restore operation successfully executed for the storage group qtest-rdf1_sg <i>Note: the –remote option must be specified to restore the snapshot on rdf devices in certain states. Reference the EMC Timefinder CLI guide for RDF states requiring the –remote option.</i> Command to verify that the restore completed: # symsnapvx -sid 973 -sg qtest-rdf1_sg list -summary Storage Group (SG) Name : qtest-rdf1_sg <table><tr><td>Snapshot State</td><td>Count</td></tr><tr><td>-----</td><td>-----</td></tr><tr><td>Restored</td><td>10</td></tr><tr><td>RestoreInProg</td><td>0</td></tr><tr><td>Established</td><td>40</td></tr><tr><td>EstablishInProg</td><td>0</td></tr><tr><td>Linked</td><td>0</td></tr><tr><td>CopyInProg</td><td>0</td></tr><tr><td>Copied</td><td>0</td></tr><tr><td>NoSnapshot</td><td>0</td></tr><tr><td>Failed</td><td>0</td></tr><tr><td>-----</td><td>-----</td></tr><tr><td>Total</td><td>50</td></tr></table> <table><tr><td></td><td>Track(s)</td></tr><tr><td>-----</td><td>-----</td></tr><tr><td>Total Remaining</td><td>0</td></tr></table>	Snapshot State	Count	-----	-----	Restored	10	RestoreInProg	0	Established	40	EstablishInProg	0	Linked	0	CopyInProg	0	Copied	0	NoSnapshot	0	Failed	0	-----	-----	Total	50		Track(s)	-----	-----	Total Remaining	0
Snapshot State	Count																																		
-----	-----																																		
Restored	10																																		
RestoreInProg	0																																		
Established	40																																		
EstablishInProg	0																																		
Linked	0																																		
CopyInProg	0																																		
Copied	0																																		
NoSnapshot	0																																		
Failed	0																																		
-----	-----																																		
Total	50																																		
	Track(s)																																		
-----	-----																																		
Total Remaining	0																																		
Link a snapshot	SE8.02 5977.596.583	PASS	Test Steps: 1. Linked the snapshot to a target SG. 2. Masked the target LUN to the host and verified that the data matched the data on the source volume at the time the snapshot was taken. Link the snapshot to a target SG: # symsnapvx -sid 973 -sg qtest-rdf1_sg -lnsg qtest-rdf1_sg_LNK_SG_001 -snapshot_name qtest-rdf1_snapshot -gen 0 link Execute Link operation for Storage Group qtest-rdf1_sg (y/[n]) ? y Link operation execution is in progress for the storage group qtest-rdf1_sg. Please wait... Polling for Link.....Started. Polling for Link.....Done. Link operation successfully executed for the storage group qtest-rdf1_sg Verify all tracked are defined on linked target: # symsnapvx list -sid 973 -sg qtest-rdf1_sg -linked Storage Group (SG) Name : qtest-rdf1_sg SG's Symmetrix ID : 000196700973 (Microcode Version: 5977) <table><tr><td colspan="2">-----</td></tr><tr><td>Sym</td><td>Link Flgs</td></tr><tr><td>Dev Snapshot Name</td><td>Gen Dev FCMD Snapshot Timestamp</td></tr><tr><td colspan="2">-----</td></tr><tr><td>000AE qtest-rdf1_snapshot</td><td>1 000A4 ..XX Fri Jun 26 17:07:20 2015</td></tr></table>	-----		Sym	Link Flgs	Dev Snapshot Name	Gen Dev FCMD Snapshot Timestamp	-----		000AE qtest-rdf1_snapshot	1 000A4 ..XX Fri Jun 26 17:07:20 2015																						

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000AE qtest-rdf1_snapshot	1 000A4 ..XX Fri Jun 26 17:07:20 2015																																		

			000AF qtest-rdf1_snapshot 1 000A5 ...X Fri Jun 26 17:07:20 2015 000B0 qtest-rdf1_snapshot 1 000A6 ...X Fri Jun 26 17:07:20 2015 000B1 qtest-rdf1_snapshot 1 000A7 ...X Fri Jun 26 17:07:20 2015 000B2 qtest-rdf1_snapshot 1 000A8 ...X Fri Jun 26 17:07:20 2015 000B3 qtest-rdf1_snapshot 1 000A9 ...X Fri Jun 26 17:07:20 2015 000B4 qtest-rdf1_snapshot 1 000AA ...X Fri Jun 26 17:07:20 2015 000B5 qtest-rdf1_snapshot 1 000AB ...X Fri Jun 26 17:07:20 2015 000B6 qtest-rdf1_snapshot 1 000AC ...X Fri Jun 26 17:07:20 2015 000B7 qtest-rdf1_snapshot 1 000AD ...X Fri Jun 26 17:07:20 2015 Flgs: (F)ailed : F = Force Failed, X = Failed, . = No Failure (C)opy : I = CopyInProg, C = Copied, D = Copied/Destaged, . = NoCopy Link (M)odified : X = Modified Target Data, . = Not Modified (D)efined : X = All Tracks Defined, . = Define in progress
Create a cascading snapshot	SE8.02 5977.596.583	PASS	Test Steps: 1. Create a snapshot of an existing snapshot 2. Copy some files on the linked target volume. 3. Set the mode of the source linked target to copy. This must be done in order to restore to the snapshot to the linked targets. 4. Restore the snapshot to the linked target and verify that the files copied after the snapshot was taken no longer exist on the linked target volume. Create cascading snapshot: symsnapvx -sid 973 -sg qtest-rdf1_sg_LNK_SG_001 -name qtest-rdf1_cascadedsnap establish -ttl -delta 1 Relink source snapshot with copy mode: # symsnapvx -sid 973 -sg qtest-rdf1_sg -lnsg qtest-rdf1_sg_LNK_SG_001 -snapshot_name qtest-rdf1_snapshot -gen 0 relink -copy Execute Relink operation for Storage Group qtest-rdf1_sg (y/[n]) ? y Relink operation execution is in progress for the storage group qtest-rdf1_sg. Please wait... Polling for Relink.....Started. Polling for Relink.....Done. Relink operation successfully executed for the storage group qtest-rdf1_sg Restore the cascading snapshot: # symsnapvx -sid 973 -sg qtest-rdf1_sg_LNK_SG_001 -snapshot_name qtest-rdf1_cascadedsnap -gen 0 restore Execute Restore operation for Storage Group qtest-rdf1_sg_LNK_SG_001 (y/[n]) ? y Restore operation execution is in progress for the storage group qtest-rdf1_sg_LNK_SG_001. Please wait... Polling for Restore.....Started. Polling for Restore.....Done. Restore operation successfully executed for the storage group qtest-rdf1_sg_LNK_SG_001
Terminate snapshot	SE8.02 5977.596.583	PASS	# symsnapvx -sid 973 -sg qtest-rdf1_sg_LNK_SG_001 -snapshot_name qtest-rdf1_cascadedsnap terminate -restored Execute Terminate operation for Storage Group qtest-rdf1_sg_LNK_SG_001 (y/[n]) ? y Terminate operation execution is in progress for the storage group qtest-rdf1_sg_LNK_SG_001. Please wait... Polling for Terminate.....Started. Polling for Terminate.....Done.

			Terminate operation successfully executed for the storage group qtest-rdf1_sg_LNK_SG_001 [Lab root @ namgdse14 ~] # symsnapvx -sid 973 -sg qtest-rdf1_sg_LNK_SG_001 -snapshot_name qtest-rdf1_cascadedsnap terminate Execute Terminate operation for Storage Group qtest-rdf1_sg_LNK_SG_001 (y/[n]) ? y Terminate operation execution is in progress for the storage group qtest-rdf1_sg_LNK_SG_001. Please wait... Polling for Terminate.....Started. Polling for Terminate.....Done. Terminate operation successfully executed for the storage group qtest-rdf1_sg_LNK_SG_001
Copy a modified point-in-time copy to the source	SE8.02 5977.596.583	PASS	# symsnapvx -sid 973 -sg qtest-rdf1_sg_LNK_SG_001 -lsg qtest-rdf1_sg -snapshot_name qtest-modified_snap -gen 0 link -copy -remote Execute Link operation for Storage Group qtest-rdf1_sg_LNK_SG_001 (y/[n]) ? y Link operation execution is in progress for the storage group qtest-rdf1_sg_LNK_SG_001. Please wait... Polling for Link.....Started. Polling for Link.....Done. Link operation successfully executed for the storage group qtest-rdf1_sg_LNK_SG_001 [Lab root @ namgdse14 ~] # <i>Note: All restore sessions must be terminated on the target SG before linking to it.</i>
Relink to a different snapshot	SE8.02 5977.596.583	PASS	# symsnapvx -sid 973 -sg qtest-rdf1_sg -lsg qtest-rdf1_sg_LNK_SG_001 -snapshot_name qtest-rdf1_snapshot -gen 4 relink Execute Relink operation for Storage Group qtest-rdf1_sg (y/[n]) ? y Relink operation execution is in progress for the storage group qtest-rdf1_sg. Please wait... Polling for Relink.....Started. Polling for Relink.....Done. Relink operation successfully executed for the storage group qtest-rdf1_sg

SnapVX Performance Tests

Test configuration/notes:

- VMAX200K (5977) controlled with SE8.0.2 on Redhat Linux.
- Primary load generator
 - Windows 2003 R2 Enterprise x64
 - 2 x Dual-core 1.8 GHz processor
 - 8 GB RAM
 - Emulex LPe12002-E HBA
- Secondary load generator
 - Windows Server 2008 R2 Standard
 - 2 x 6-core 2.1 GHz processor
 - 32 GB RAM
 - Emulex LPe11002-E HBA
- Iometer software used to generate a workload similar to OLTP2HW

- 10% sequential 8KB reads
- 5% sequential 65KB reads
- 35% random 8KB reads
- 35% random 8KB writes
- 15% sequential 65K writes

The purpose of these tests is to determine if SnapVX has any performance impact on the source volumes. The following tests were performed with the source volumes in the SnapVX session set with Platinum SLO forcing all data on the source volumes to be placed on the flash tier. The SLO for the linked target volumes for this test was set to Bronze forcing all data on the target volumes to be placed on the SAS 10K drive tier. This was done to prevent FAST from moving data between tiers of storage; thus, skewing the results of the tests. The baseline test was done with no snapshots created on the source volumes with the OLTP2HW workload being generated on both the source and target volumes. Subsequent tests were done with the following SnapVX setup with the OLTP2HW workload being generated on both source and target volumes:

- Snapshot active but not linked
- Snapshot active and linked (no copy mode)
- Snapshot active and linked (copy mode)
- Snapshot active with target volumes unlinked

A total of 5 test runs were done for each test configuration. The tables below represent the average results of the 5 test runs for each test configuration.

Test Description	Ave. Total IOPS
Base - No Snap	23471.96
Snap - No Link	23394.78
Snap - w/ Linked target (no copy)	23673.76
Snap - w/ Linked target (copy)	23645.97
Snap - w/ Unlinked target	23620.70

Test Description	Ave. Read IOPS
Base - No Snap	11734.99
Snap - No Link	11696.41
Snap - w/ Linked target (no copy)	11773.08
Snap - w/ Linked target (copy)	11823.32
Snap - w/ Unlinked target	11810.45

Test Description	Ave. Write IOPS
Base - No Snap	11736.97
Snap - No Link	11698.37
Snap - w/ Linked target (no copy)	11773.06
Snap - w/ Linked target (copy)	11822.64
Snap - w/ Unlinked target	11810.26

Test Description	Ave. Total RT (ms)
Base - No Snap	0.85
Snap - No Link	0.85

Snap - w/ Linked target (no copy)	0.85
Snap - w/ Linked target (copy)	0.85
Snap - w/ Unlinked target	0.85

Test Description	Ave. Read RT (ms)
Base - No Snap	1.02
Snap - No Link	1.02
Snap - w/ Linked target (no copy)	0.99
Snap - w/ Linked target (copy)	0.98
Snap - w/ Unlinked target	0.98

Test Description	Ave. Write RT (ms)
Base - No Snap	0.68
Snap - No Link	0.69
Snap - w/ Linked target (no copy)	0.71
Snap - w/ Linked target (copy)	0.71
Snap - w/ Unlinked target	0.71

From the results of the tests above, it can be concluded that SnapVX has no noticeable performance impact on source volumes.