



Global Distributed Storage Engineering

SRDF/Star for Open Systems Certification

GDSE-06018b-PS

Project Scope

Version 1.0

VERSION CONTROL

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Contact

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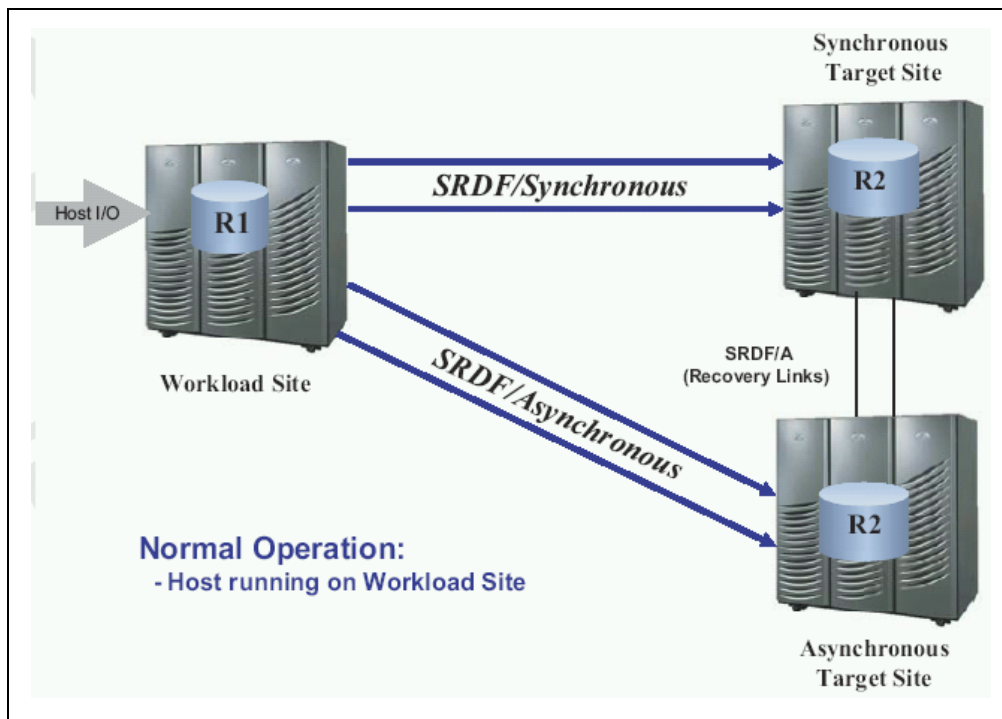
Latest Versions

It is recommended that the latest version of the document be used from the GDSE website <http://gdse.ny.ssmc.com>. Newer versions may include expanded scope, or comments on issues discovered after deployment.

1 Introduction

1.1 What is SRDF/Star?

SRDF/Star is a three-site DR solution from EMC for Symmetrix storage arrays that uses concurrent data replication technology to replicate data from a primary production site to both a nearby remote site and a distant remote site. Data is transferred in SRDF/Synchronous (SRDF/S) mode to the nearby remote and in SRDF/Asynchronous (SRDF/A) mode to the distant remote site.



STAR/Star configuration during normal operations

In the event of a production site failure, there would be no data loss because of the synchronous replication to the regional site. SRDF/Star allows you to *incrementally* establish an asynchronous session between the two remote sites, allowing, for example, data at the synchronous target site to quickly update the distance asynchronous target site with missing data to ensure that there is zero data loss at the remote site.

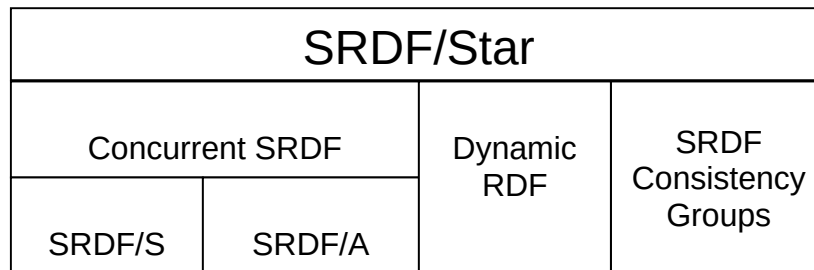
In the event of a regional disruption that knocked out both the workload site and the sync target site, SRDF/Star's concurrent RDF setup ensures that there would be only a minimal data loss because of the asynchronous replication to the more distant async target site.

SRDF/Star also allows you to determine which remote target site (sync or async) has the most current data in the event of a rolling disaster that affects the workload site. With a rolling disaster,

there is no guarantee that the sync site will be more current than the async site. The capability to display where the most current data is located helps determine which site's data should be used for failure recovery.

It is important to understand that SRDF/Star functionality is dependent on an underlying concurrent SRDF implementation, and should be considered as an optional enhancement to that configuration. Star supplies an advanced failover and recover mechanism on top of concurrent SRDF. This project focuses solely on the SRDF/Star specific issues, and not on the underlying generic concurrent SRDF solution.

The following diagram shows a simplified view of the relationship between different SRDF components. SRDF/Star simply brings together a number of separate SRDF technologies that EMC have been developing over the last few years, into a single advanced DR solution.



All of the components shown above that SRDF/Star depends on are already GDSE certified components (note though that SRDF consistency groups are only certified for use with SRDF/A at the time of writing).

1.2 Drivers for certifying SRDF/Star

Global Engineering has received a request from the Global Data Centre Strategy team to provide a zero-data loss long-distance replication solution for EMC SAN storage. To date GDSE have certified:

1. a 2-site SRDF/A solution
2. a 3-site Concurrent SRDF (SRDF/S and SRDF/A) solution

but neither of these solutions as they stand provide zero data loss at the distant remote site in the event of the loss of the production site. SRDF/Star is an enhancement to the 3-site concurrent solution that in principle will meet this need.

The Global Data Centre Strategy (GDCS) is one of the Board of Directors key strategic initiatives. The GDCS project committed to the board in November 2005, to develop and implement the global Data Centre Strategy over the next 5 years. EMEA has to mitigate its processing risk by end 2008, Singapore by end 2007.

In order to meet these board level commitments certain technology enablers are required. Replication of data over long distance is one of those requirements. Both EMEA and Singapore have current business requirements (CIB and GCG) that necessitate the replication of data over distance without data loss or application performance impact. This, given our use of EMC disk technology, will require Citigroup to implement concurrent SRDF-S and SRDF-A in a STAR configuration between mirrored triangulated sites for certain critical applications. This will be a

typical synchronous setup from primary Data Centre to a local bunker (within 40km), with asynchronous replication to the remote Data Centre (>>40km). For non-critical systems, a 2-site SRDF-A only solution will be required.

All GDCS projects have now been initiated and have committed delivery dates. For EMEA, the Riverdale Data Centre will back up synchronously to its bunker site in CGC, with remote replication to a site in mainland Europe. France, Netherlands, Germany and UK are currently short-listed. Singapore will use its current Data Centres at Cintech and Telepark as a synchronous pair, most likely being remote replicated to Hong Kong.

International Consumer have confirmed that they wish to use SRDF/Star for selected applications in EMEA and ASIAPAC.

1.3 Scope overview

Certification is limited to the Open Systems SRDF/Star product. The Mainframe version of SRDF/Star is completely out of scope.

This project will deliver Solutions Guide and Release Notes (including test plan results) documentation. At a high level, the Solutions Guide that will focus on the following:

1. Preparing for an SRDF/Star implementation
2. Setting up SRDF/Star
3. Site Switching (failover) operational procedures
 - o Using BCVs with Star operations
 - o Planned switches
 - o Unplanned switches
 - o Switching back to Site A after a temporary disaster
4. Other Operational procedures
 - o Checking status of a specific Star session
 - o Isolating an SRDF/Star site
 - o Transient remote fault recovery
 - o Rebuilding Star configuration when adding/removing disks
 - o Monitoring SRDF/Star

2 Test Plan

SRDF/Star is effectively an enhancement of concurrent SRDF, which provides superior failover functionality, and subsequent levels of data protection. Hence, the focus is not on testing the underlying technologies such as SRDF/A, concurrent SRDF, and dynamic SRDF etc. but on how these are brought together to provide the Star solutions. Emphasis of testing is heavy biased towards functionality and integration issues.

SRDF/Star operations performance (i.e. runtimes of control operations) will also be measured.

2.1 Basic functionality testing summary

The following topics are in scope for testing. The corresponding test plan can be found in Appendix A.

Each of the following tests may comprise of multiple variations, each with a number of separate steps.

- Test 1 – Setting up SRDF/Star
- Test 2 – Status commands
- Test 3 – Isolating SRDF/Star sites (2 variations)
- Test 4 – Responding to Transient Remote Faults (2 variations)
- Test 5 – Responding to Disaster Faults (4 variations)
- Test 6 – Conducting Planned switching operations (6 variations)
- Test 7 – Disabling SRDF/Star for Device reconfiguration

2.2 Additional Testing Summary

The following topics are in scope for testing. The corresponding test plan can be found in Appendix B.

2.2.1 Star Setup

- o Test creation of star configurations with single and multiple triangles in the composite groups and conducting the above tests with both.
- o Test creation of a star configuration with small and moderate numbers of devices.
- o Determine commands disabled when Star is setup
 - RDF control for an isolated site
- o Test -reload_options setup option

2.2.2 Analysis of practical usage of this technology in real-world situations within Citigroup

- o Ease of use of the product
 - Additional tasks required not covered by symstar
 - Operational runtime
- o Interoperability with GNS
- o Interoperability with SYMCLI
- o Failover/Failback to/from synchronous site variations
 - Failover to sync site (and failback) of single application (own composite group)
 - Failover to sync site (and failback) of single application (shared composite group)
 - Failover to sync site (and failback) of single server within an application (own composite group)
 - Failover to sync site (and failback) of single server within an application (shared composite group)

Note: Failover/failback can either be via star or by removing from star protection and failing over with symrdf commands.

- o High-availability of the SRDF/Star control process
 - Check HA can be configured
 - Check Star trips when no rdf daemons running at workload site
- o Monitoring star status
 - Listing Star sessions
 - Real-time monitoring via CLI
 - Reporting SRDF/Star exceptions to a central monitoring system
- o BCV issues
 - Use with symstar
 - Impact of recovery leg on BCV usage
- o Concurrent MSC
 - Are composite groups containing concurrent devices now fully supported (e.g. do they propagate via GNS correctly)
 - Effect of enabling consistency on concurrent devices; can consistency be managed separately on each leg?
- o Using symstar for controlling existing concurrent SRDF sessions
 - Attempt control of SRDF setup with no links between Sites B and C

3 Other Project Scope information

3.1 Project Classification

This is a maintain project for the SRDF component of the EMC Symmetrix Product. The WTS work effort number is 4540.

3.2 Project Deliverables

This project will result the delivery of the following documentation, as a minimum:

- SRDF/Star for Open Systems – Solutions Guide (GDSE-06018-SG)
- SRDF/Star for Open Systems – Release Notes (GDSE-06018-RN)
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3.3 Project pre-requisites

The project requires three SRDF-linked DMX running 5671.48 microcode or later. Also required is at least two SAN mgt server running Solutions Enabler 6.3. This environment is in place.

Also required is local support in NA for the above environment to deal with failures and changes.

3.4 Project Risks

Access to the three SRDF-linked DMX test environment must be made available for the duration of the certification process.

4 Appendix A - Basic functionality test plan

Task	Success Criteria	PASS/FAIL	Notes
Test 1 - Setting Up SRDF/Star			
Step 1 - Verify Symmetrix Settings	All settings in POC match Star 6.2 requirements		
Step 2 - Create concurrent SRDF environment	All required RDF triangles set up successfully using dynamic RDF commands		
Step 3 - Create SRDF/Star Composite Groups	CGs required by Star set up correctly at R1 site.		
Step 4 - Create the SRDF/star Option file	Options file created		
Step 5 - Perform the symstar setup operation	Star setup executes without error and resulting configuration matches design specification		
Step 6 - Create R2 Composite Groups	R2 CGs created		
Step 7 - Add BCV devices to the SRDF/Star configuration	BCV successfully added to Composite Groups		
Step 8 - Bringing up SRDF/Star for Normal Operations	Star Protected status reached.		
Test 2 – Status Commands			
Step 1 - Run sysmtar show	Command runs correctly and output reflects configuration set up in Test 1		
Step 2 - Run symstar query	Command runs correctly and output reflects configuration set up in Test 1		
Test 3 – Isolating SRDF/Star sites			
Test 3a – Isolating Sync Site			
Step 1 - Isolate protected sync site	Sync site isolated		
Step 2 - Rejoin isolated sync site	Sync site Star protected again		
Step 3 – Isolate disconnected sync site	Sync site isolated		

Step 4 - Rejoin isolated sync site	Sync site Star protected again		
Test 3b – Isolating Async Site			
Step 1 - Isolate protected Async site	Step 1 - Isolate protected sync site	Sync site isolated	
Step 2 - Rejoin isolated Async site	Step 2 - Rejoin isolated sync site	Sync site Star protected again	
Step 3 – Isolate disconnected Async site	Step 3 – Isolate disconnected sync site	Sync site isolated	
Step 4 – Rejoin isolated Async site	Step 4 - Rejoin isolated sync site	Sync site Star protected again	
Test 4 – Responding to Transient Remote Faults			
Test 4a – Fault on Sync Leg			
Step 1 – Trigger fault on Sync leg	Sync leg in PathFail state		
Step 2 – Clean up Sync site (reset)	Sync leg in Disconnected state		
Step 3 – Connect Sync site	Sync leg in Connected state		
Step 4 – Protect Sync site	Sync let in protected state		
Step 5 - Star-protect Star configuration	Star session Star-protected		
Test 4b – Fault on Async Leg			
Step 1 – Trigger fault on Async leg	Async leg in PathFail state		
Step 2 – Clean up Async site (reset)	Async leg in Disconnected state		
Step 3 – Connect Async site	Async leg in Connected state		
Step 4 – Protect Async site	Async let in protected state		
Step 5 – Enable Star protection	Star session Star-protected		
Test 5 – Responding to Disaster Faults			
[Note: Switch to Sync keeping Async Data and Switch to Async keeping Async data not in test plan. Also, not all combinations of site from which the commands are issues are tested; just a sample.]			
Test 5a – Switching workload to Synchronous Target Site (keeping Sync data)			
Step 1 – Disable Workload site	Star session in tripped state		
Step 2 – Cleanup Async site	Async leg in PathFail state		
Step 3 – Switch to Sync keeping sync data	Switch to sync site successful		
Step 4 – Connect Async site	Async site connected		
Step 5 – Protect Async site	Async site protected		

Step 6 – Connect original workload site (now sync target)	Original workload site connected		
Step 7 – Protect original workload site (now sync target)	Original workload site protected		
Step 8 – Enable Star protection	Star session star protected		
Test 5b – Switching workload back from original Sync target to original workload Site			
Step 1 – Halt Star	Star session halted		
Step 2 – Switch to Original workload site	Switch to original workload site successful		
Step 3 – Connect other two sites	Remaining two sites connected		
Step 4 – Protect other two sites	Remaining two sites protected		
Step 5 – Enable Star Protection	Star session star protected		
Test 5c – Switching workload to Asynchronous Target Site (Keeping Sync data)			
Step 1 – Disable Workload site	Star session in tripped state		
Step 2 – Cleanup Async c site	Async leg in PathFail state		
Step 3 – Switch to Async keeping sync data	Switch to async site successful		
Step 4 – Protect original sync site	Original sync site protected		
Step 5 – Connect original workload site (now Adaptive Copy Mode target)	Original workload site connected		
Step 6 – Confirm we cannot Protect original workload site (now Adaptive Copy Mode target)	Protect operation should fail		
Step 7 – Confirm we cannot enable Star protection	Check Star consistency capable = No		
Test 5d – Switching workload back from original Async target to original workload Site			
Step 1 – Halt Star	Both remote sites in Halted state		
Step 2 – Switch to Original workload site	Switch completed successfully		
Step 3 – Connect other two sites	Sites both connected		
Step 4 – Protect other two sites	Sites both protected		
Step 5 – Enable Star Protection	Star session Star protected		
Test 6 – Conducting Planned Switching Operations			
Test 6a – Planned switch to Sync target			

Step 1 – Halt Star	Both remote sites in Halted state		
Step 2 – Switch to Sync target	Switch completed successfully		
Step 3 – Connect other two sites	Sites both connected		
Step 4 – Protect other two sites	Sites both protected		
Step 5 – Enable Star Protection	Star session Star protected		
Test 6b – Planned switch back to original workload site			
Step 1 – Halt Star	Both remote sites in Halted state		
Step 2 – Switch to Original workload site	Switch completed successfully		
Step 3 – Connect other two sites	Sites both connected		
Step 4 – Protect other two sites	Sites both protected		
Step 5 – Enable Star Protection	Star session Star protected		
Test 6c – Planned switch to Async target			
Step 1 – Halt Star	Both remote sites in Halted state		
Step 2 – Switch to Async target	Switch completed successfully		
Step 3 – Connect other two sites	Sites both connected		
Step 4 – Protect other two sites	Sites both protected		
Step 5 – Enable Star Protection	Star session Star protected		
Test 6d – Planned switch back to original workload site			
Step 1 – Halt Star	Both remote sites in Halted state		
Step 2 – Switch to Original workload site	Switch completed successfully		
Step 3 – Connect other two sites	Sites both connected		
Step 4 – Protect other two sites	Sites both protected		
Step 5 – Enable Star Protection	Star session Star protected		
Test 6e – Restarting workload at original workload site after halt			
Step 1 – Halt Star	Both remote sites in Halted state		
Step 2 – Reset with halt -reset	Both sites now is disconnected state		

Step 3 – Reconnect, protect and enable Star	Star session Star protected		
Test 7 – Disabling SRDF/Star for Device Reconfiguration			
Step 1 – Disable Star	Star protection disabled		
Step 2 – Disconnect both target sites	Both sites disconnected		
Step 3 – Clear up metadata	Clean up runs successfully		

5 Appendix B - Additional Testing Plan

Task	Success Criteria	PASS/FAIL	Notes
Star Setup			
Test creation of star configurations with single and <u>multiple</u> triangles in the composite groups and conducting the above basic EMC tests with both.			
Single triangle test (Configuration 2)	Single Triangle Star set up o.k.		
Multiple (two) triangle test (Configurations 1 & 3)	Multiple (two) Triangle Star set up o.k.		
Test creation of a star configuration with small and moderate numbers of devices			
Small number of devices (2 per triangle)	Multiple (two) Triangle Star set up o.k. with 2 devices per triangle (Configurations 1 and 3)		
Moderate number of devices (16 in a single triangle)	Single Triangle Star set up o.k. with 16 devices in triangle (Configuration 2)		
Determine commands disabled when Star is setup.	Identification of type of symrdf commands that are disabled when star is configured		
RDF control for an isolated site	Identification of type of symrdf commands that are disabled when star is configured		
Test -reload_options setup option	Test is parameters are correctly changed in a Star configuration when the – reload_options file is used		

Analysis of practical usage of this technology in real-world situations within Citigroup

Operations issues			
Additional tasks required not covered by symstar	Can symstar be used exclusively for star control, or are other scripts needed.		
Operational runtime			
Interoperability with GNS	Star must interoperate with GNS without issue		
Interoperability with SYMCLI	Star must work with a SYMACL secured Symm without issue		
Switch to/from synchronous site (Single application variation)			
Switch to sync site (and switch back) of single application (own composite group) UNDER STAR CONTROL.	Determine if it is possible to failover a single application under star control that has its own composite group		
Switch to sync site (and switch back) of single application (shared composite group) UNDER STAR CONTROL.	Determine if it is possible to failover a single application under star control that is part of a shared composite group		
Switch to sync site (and switch back) of single server within an application (application has own composite group) UNDER STAR CONTROL.	Determine if it is possible to failover a single server under star control that has its own composite group		
Switch to sync site (and switch back) of single server within an application (application part of shared composite group) UNDER STAR CONTROL.	Determine if it is possible to failover a single server under star control that is part of a shared composite group		
High-availability of the SRDF/Star control process			
Check HA can be configured	Determine if multiple RDF daemons and parallel star setup can provide HA for Star protection failover.		
Check Star trips when no rdf daemons as workload site	Check that if no storrdfd at workload site then Star still trips		

Monitoring star status			
▪ Listing Star sessions	High level overview of state of all Star sessions must be possible		
▪ Real-time monitoring via CLI	Can detailed status of a Star session be obtained interactively?		
▪ Reporting SRDF/Star exceptions to a central monitoring system	Is there a mechanism for Star to report exceptions to a central monitoring system		
BCV issues			
▪ Use with symstar	Test successful control of BCVs in a Star environment.		
▪ Consider impact of recovery leg on BCV usage	Determine any issues that might arise with mirror positions after failover and recovery operations due to usage of BCVs as PIT copies at target sites		
Concurrent MSC			
▪ Are composite groups containing concurrent devices now <u>fully</u> supported (e.g. do they propagate via GNS correctly)?	Are definitions visible correctly via GNS on other local servers?		
	Are definitions visible correctly via GNS remote mirroring on remote servers?		
▪ Effect of enabling consistency on concurrent devices; can consistency be managed separately on each leg?	Can consistency be managed separately on each leg?		
Using symstar for controlling existing			
• Attempt control of concurrent SRDF setup when there are no links between Sites B and C	Symstar can be used to do switch operations when no link between sites B and C		