

IBM System Storage IBM DS8000

**Storage Replication Adapter for VMware SRM
Installation and Users Guide**

Version 1.21

About this guide

The IBM System Storage DS8000 Storage Replication Adapter for VMware SRM Installation and Users Guide provides information that helps you install and configure Storage Replication Adapter.

Who should use this guide

The IBM System Storage DS8000 Storage Replication Adapter for VMware SRM Installation and Users guide is intended for system administrators or others who install and use the VMware Site Recovery Manager with IBM System Storage DS8000. Before installing and using the Storage Replication Adapter for DS8000, you should have an understanding of storage area networks (SANs), DS8000 Metro Mirror Copy Services and the capabilities of your storage units. For more information on how to use Metro Mirror and Global Mirror Copy Services, refer to IBM System Storage DS8000 Administration guide that can be downloaded from <http://www.ibm.com>.

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1. Overview

VMware Site Recovery Manager in conjunction with IBM DS8000 Storage Replication Adapter provides a Disaster/Recovery solution for VMware environments, based on hardware replication features provided by the storage array, which in DS8000's case are Metro Mirror and Global Mirror. VMware SRM communicates with the DS8000 Storage Array to manage data replication (Metro Mirror and Global Mirror), test host data consistency at the recovery site and to failover volumes to recovery site and bring up the virtual machines, in case of a disaster.

a. IBM DS8000 SRA Functional Block Diagram

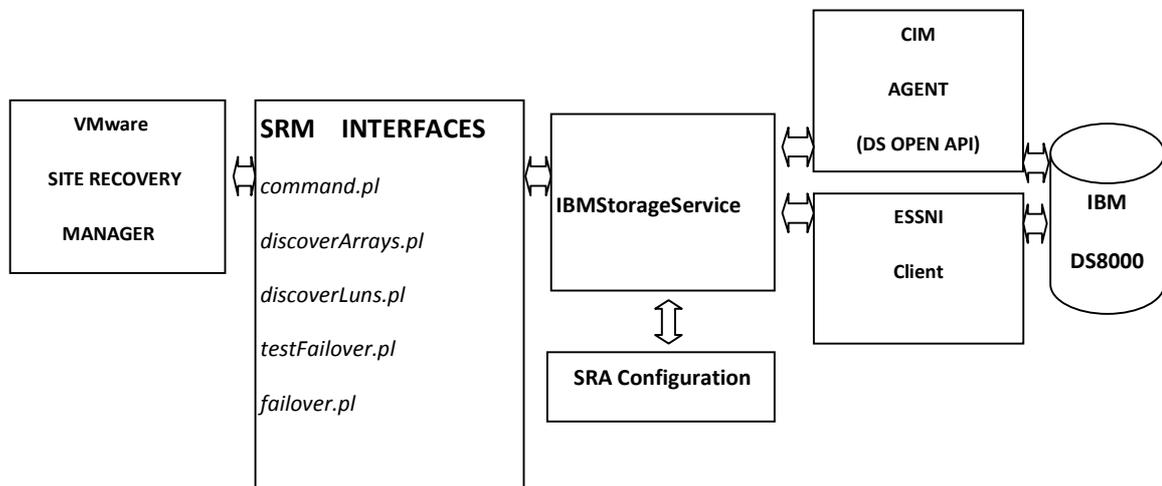


Figure 1

VMware Site Recovery Manager plug-in communicates with IBM DS8000 Storage Replication adapter via five Perl script interfaces viz. *command.pl*, *discoverArrays.pl*, *discoverLuns.pl*, *testFailover.pl* and *failover.pl*. The DS8000 SRA implements the interfaces in a manner to collect and parse the input information from VMware SRM and pass the information to IBMStorageService module (IBMStorageService.jar).

command.pl – Calls the appropriate Perl script from the remaining four, depending on the incoming request from SRM.

discoverArrays.pl – This interface is called by *command.pl* for an array discovery request from SRM to DS8000 SRA, this Perl script in turn calls the appropriate function within the IBMStorageService module, supplying it with relevant input information.

discoverLuns.pl – This interface is called by *command.pl* (at protected site) for all replicated LUNs’ (that are participating in SRM) discovery request from SRM to DS8000 SRA, this Perl script in turn calls the appropriate function within the IBMStorageService module with relevant input information, to report all replicated (MM/GM) LUNs that are mapped to “VMware” type hosts.

testFailover.pl – This interface is called by *command.pl* (at recovery site) when SRM requests a test operation on the replication targets, this Perl script in turn calls the appropriate function within the IBMStorageService module with relevant input information.

failover.pl – This interface is called by *command.pl* (at recovery site) when SRM requests a recovery operation, this Perl script in turn calls the appropriate function within the IBMStorageService module with relevant input information to accomplish the failover.

The IBMStorageService module communicates with the DS8000 device via CIMOM/SMIS agent and ESSNI interface.

b. IBM SRA and VMware SRM Implementation

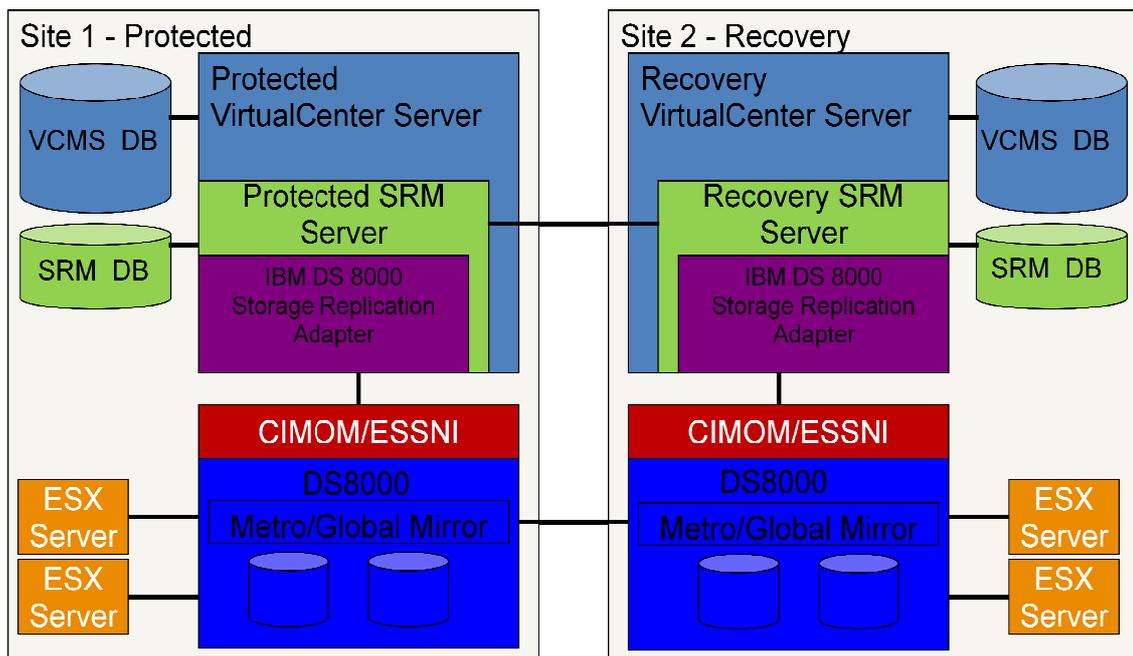


Figure 2

2. Planning

a. Supported Configurations

This version of DS8000 Storage Replication Adapter supports Metro Mirror and Global Mirror features and Space Efficient Volumes (with appropriate licenses installed and activated). MGM (Metro Global Mirror) feature is not supported

This version of SRA does not support dual image DS8000 storage arrays. Multi-array Metro Mirror and/or Global Mirror is not supported

b. Installation overview

The steps for implementing the IBM System Storage DS8000 Storage Replication Adapter for VMware SRM software must be completed in the correct sequence. Before you begin, you must have experience with or knowledge of administering an IBM DS8000.

Complete the following tasks:

1. Verify that the system requirements are met.
2. Install the IBM System Storage DS8000 Replication Adapter software.
3. Verify the installation.
4. Create appropriate sized target set volumes on the recovery site DS8000 and create Metro Mirror/Global Mirror relationships between the source volumes at the protected site and target volumes at the recovery site. For more information on Metro Mirror/Global Mirror Copy Services refer to IBM System Storage DS8000: Copy Services in Open Environments (<http://www.redbooks.ibm.com/redbooks/pdfs/sg246788.pdf>).

Note: For more information on how to install DS Open API (CIM Agent) refer to DS Open API Installation and Configuration Guide.

c. System requirements

Ensure that your system satisfies the following requirements before you install the IBM System Storage™ DS8000 Storage Replication Adapter for VMware SRM software on a Windows Server 2003 operating system.

The following software is required:

1. If the DS8000 storage is running firmware v2.4 or later, it is recommended the SRA connect to the embedded CIMOM running on the HMC.
2. DS8000 with Microcode version 2.4 or later installed with the Metro Mirror/Global Mirror feature licenses installed and activated at protected and recovery site DS8000s and FlashCopy feature licenses installed and activated on the recovery site DS8000.
3. If the user wants SRA to use SE volumes during test failover operations and for FlashCopy volumes for Global Mirror, Space Efficient volume feature must be enabled on the DS8000
4. IBM System Storage DS8000 Storage Replication Adapter software version 1.1.
5. VMware vSphere Virtual Center Server v4.0 or later with Site Recovery Manager 4.0 or later Plug-in must be installed before you install the DS8000 Storage Replication Adapter.

Note: For more information on how to install VMware Virtual Center Server and Site Recovery Manager Plug-in, refer VMware Virtual Center installation and administration guide.

d. VMware SRM/IBM DS8000 SRA and Other DR Solutions' Coexistence

Due to the current DS8000 design limitation of only one Global Mirror session per array, it becomes important to make sure both DR solutions work properly in a given environment. If the Global Mirror session consists of VMware and other open system volumes, then the failover operation initiated from one solution will impact all volumes that are part of that Global Mirror session and thus impacting the other DR solution.

3. Installation

a. Installation of IBM System Storage DS8000 SRA software

This section includes the steps to install the IBM System Storage DS8000 Storage Replication Adapter for VMware SRM software.

You must satisfy all of the prerequisites that are listed in the system requirements section before starting the installation. Perform the following steps to install the IBM System Storage DS8000 Storage Replication Adapter for VMware SRM software on the Windows server.

1. Log on to Windows Server where VMware Virtual Center Server and Storage Replication Manager are installed, as an administrator.
2. Double click on IBMDS8KSRA.exe that you downloaded to start the installation process.

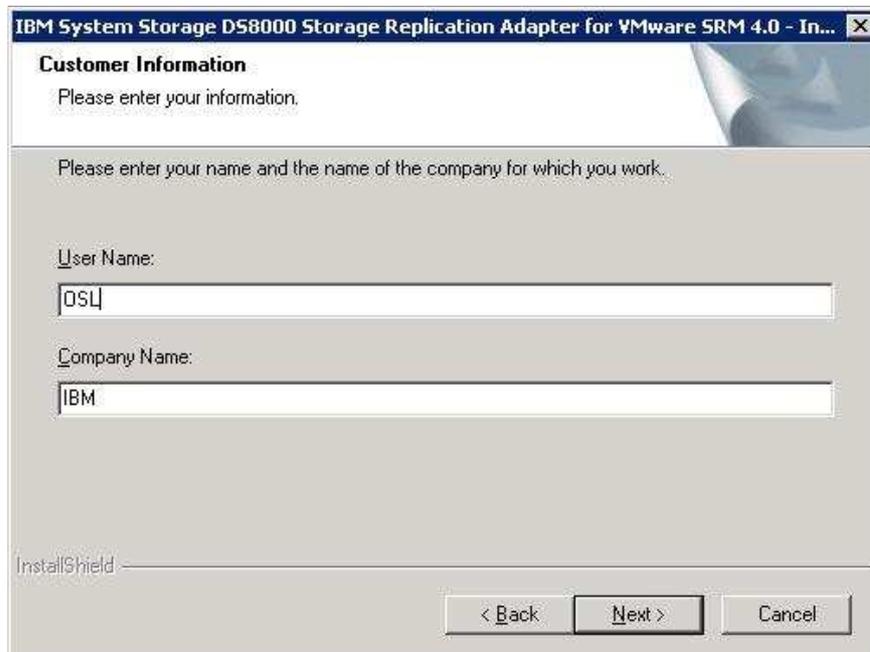


3. Click **Next** to continue. The License Agreement panel is displayed. You can click **Cancel** at any time to exit the installation. To move back to previous screens while using the wizard, click **Back**.

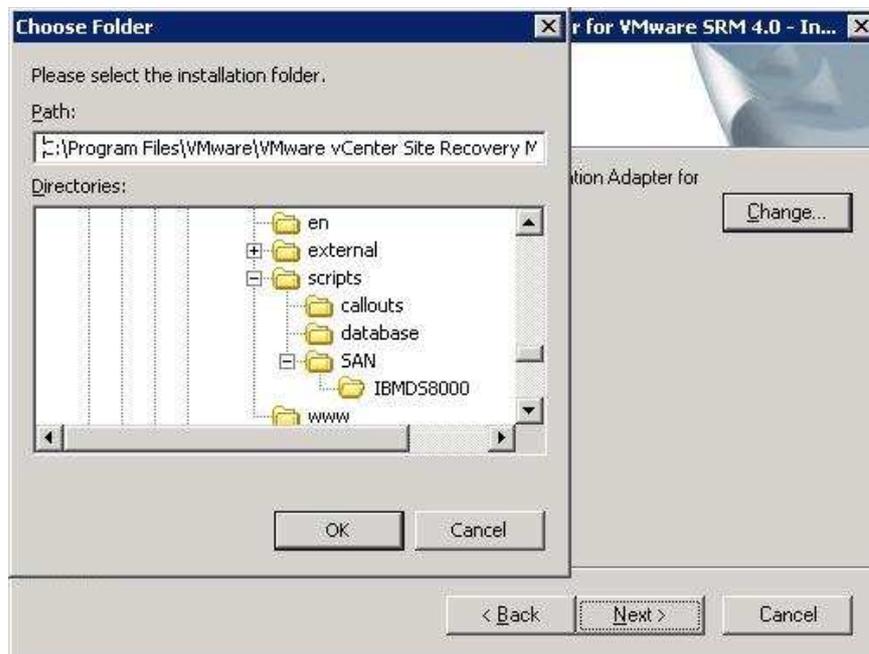
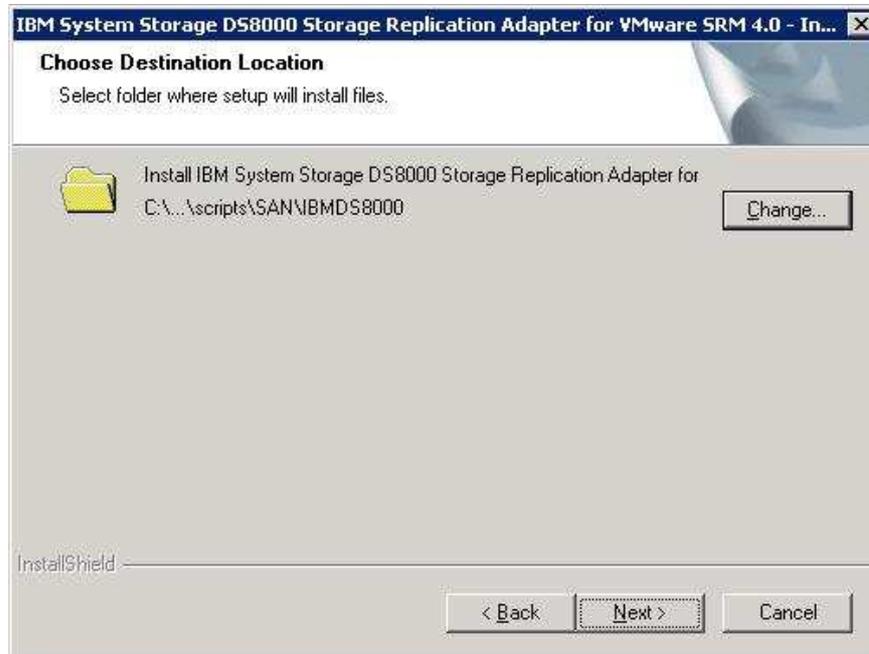


4. Read the license agreement information. Select whether you accept the terms of the license agreement, and click **Next**. If you do not accept, you cannot continue with the installation.

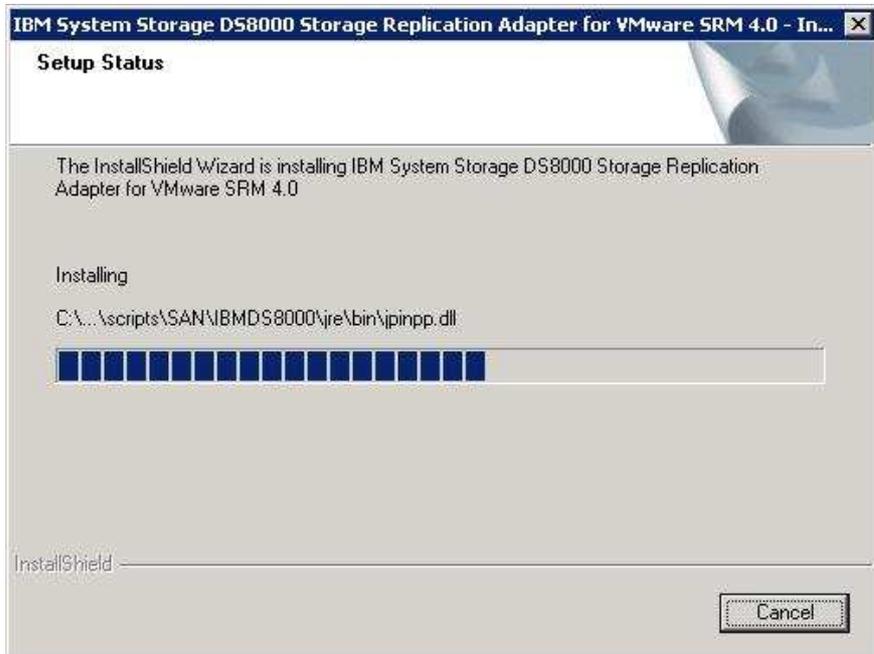
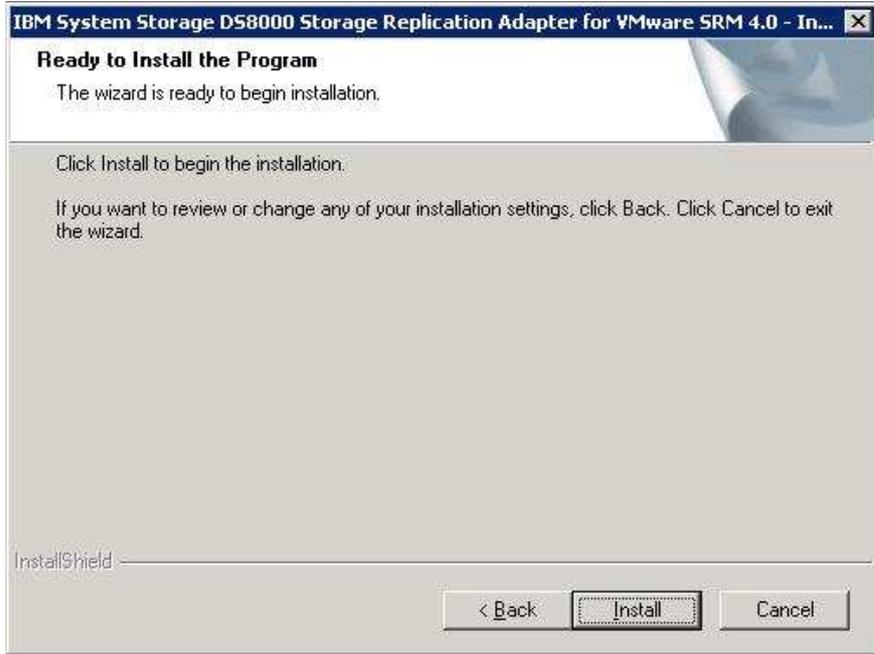
5. The Customer information page is displayed. Enter the appropriate user and organization names.



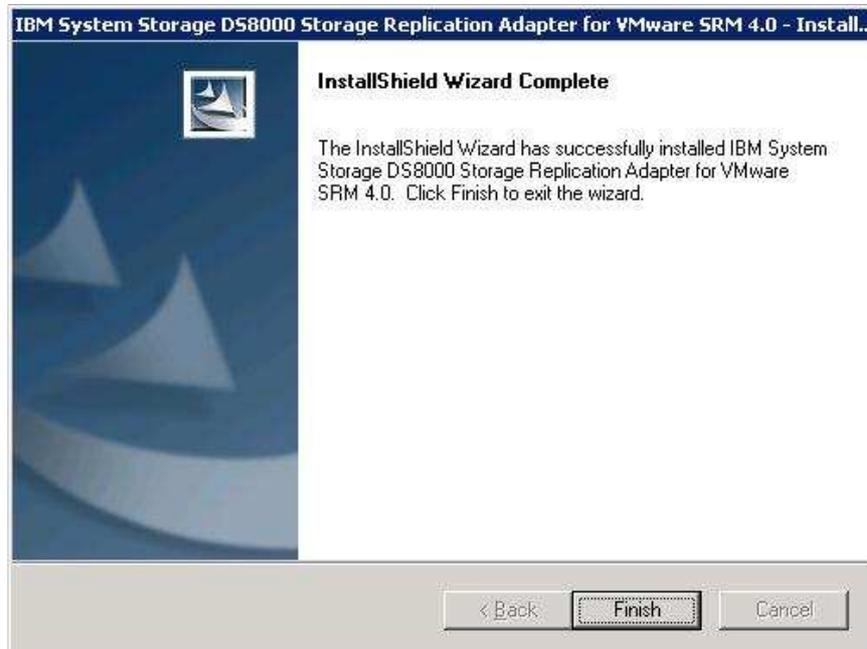
6. On the next page, select the install location for the SRA. Click **Change** to change the default install location. Once done click **Next**.



7. On the next page click **Install** to initiate the installation process.



8. After the install completes, click **Finish**. If necessary, the InstallShield Wizard prompts you to restart the system.



b. Un-Installation of IBM System Storage DS8000 SRA Software

You must use the Storage Replication Adapter installation executable to uninstall the IBM System Storage DS8000 Storage Replication Adapter software from the Windows server. Perform the following steps to uninstall the software:

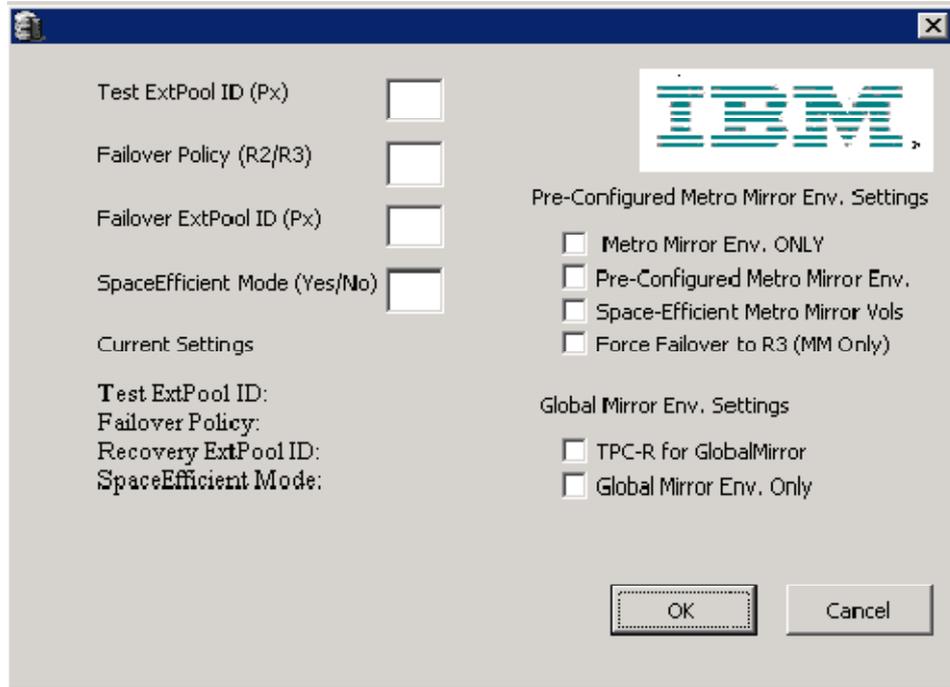
1. Log on to the Windows server as the local administrator.
2. Double-click on the IBMDS8KSRA.exe and select Remove.
3. Click Finish on the final screen to complete the uninstall. If necessary, InstallShield will prompt the user to re-start the system.

c. Configuring the Storage Replication Adapter

The installation of IBM DS8000 SRA creates a short-cut named "IBMDS8000SRAUtil.exe" on the desktop.

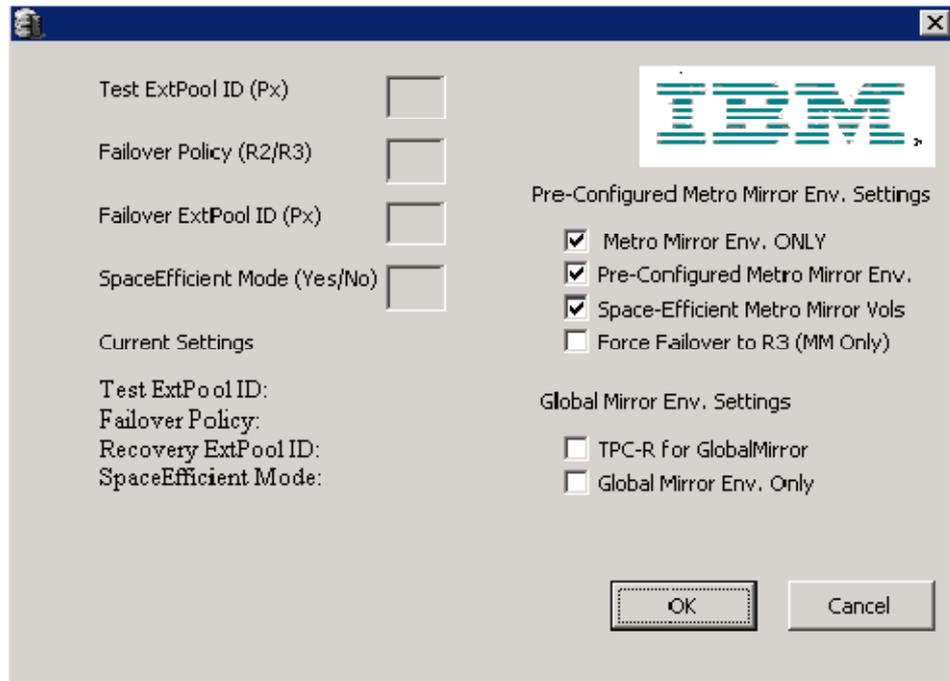
Important: The configuration utility must be run on recovery site VC to configure the recovery site SRA only.

Double clicking the short-cut will bring-up the window below.



The configuration utility has to be configured at the RECOVERY Site, before the user configures SRM with the array. The environment can be configured to be a pre-configured environment (supported only with Metro Mirror replication method), where the user pre-creates the snapshot target volumes (and/or R3 recovery volumes) and pre-maps the volumes to the ESX server(s) at the recovery site, a mixed Metro Mirror and Global Mirror environments, or a non-precreated environments where the SRA creates/deletes and maps snapshot volumes during test failover and R3 recovery operations.

For Metro Mirror only and pre-created environment and to inform SRA that pre-created snapshot volumes are Space Efficient, select the options on the configuration utility screen as follows .



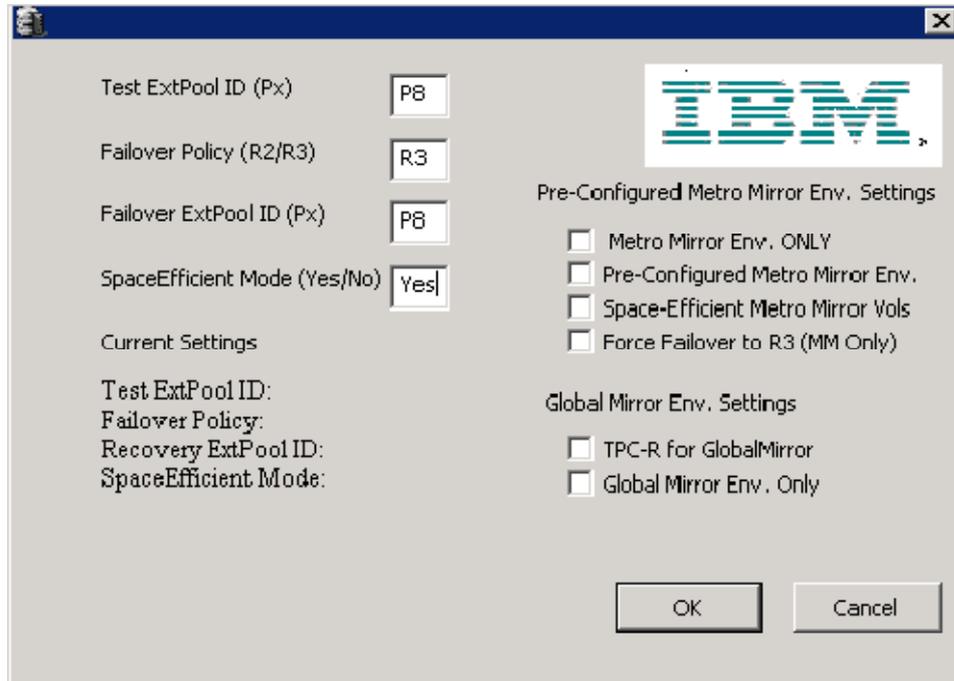
For standard volumes use, un-check the “Space-Efficient Metro Mirror Vols” option. The Metro Mirror Only pre-configured environments option assumes the Metro Mirror relationships are synchronized, the snapshot target (R3 recovery) volumes created, FC maps created between the Metro Mirror target and snapshot volumes, and map the snapshot volumes are mapped to the ESX server(s) at the recovery site.

The FC maps must be created with “-record” “-persist” options so that SRA will just have to re-fresh the FC map(s) during test failover and R3 recovery operations.

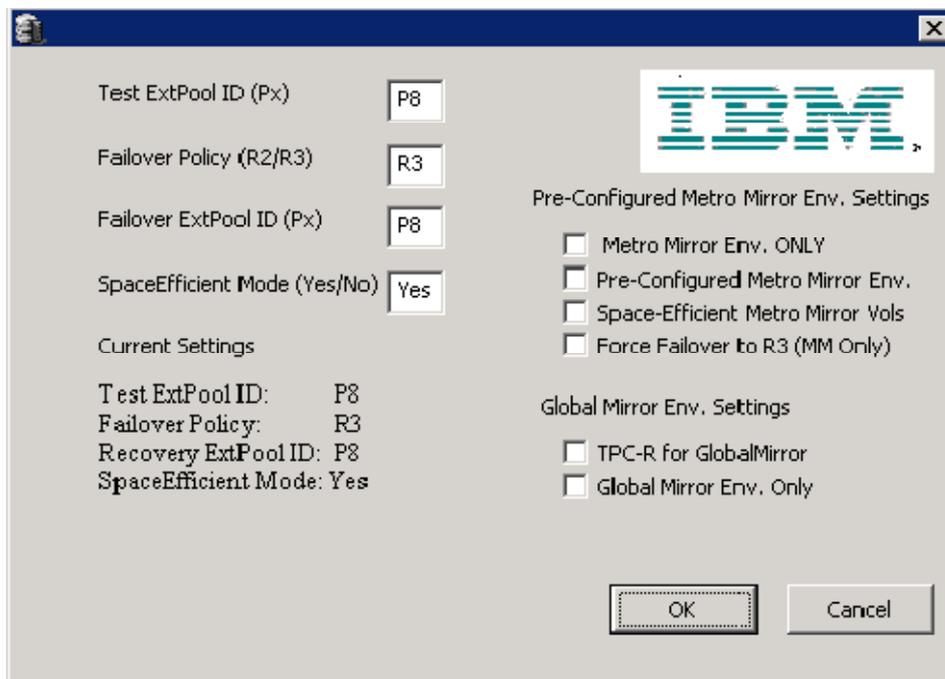
Note: Metro Mirror only pre-created environments will always do an R3 recovery.

Once the user has selected the required options, click OK. To confirm/check the configured options, re-start the DS8000 configuration utility.

For non pre-created environments, the user needs to un-check all “Pre-Configured Metro Mirror Env. Settings” options, and input the appropriate values for Test ExtPool ID, Failover Policy, Failover ExtPool ID and SpaceEfficient Mode options. Example configuration screen below ...

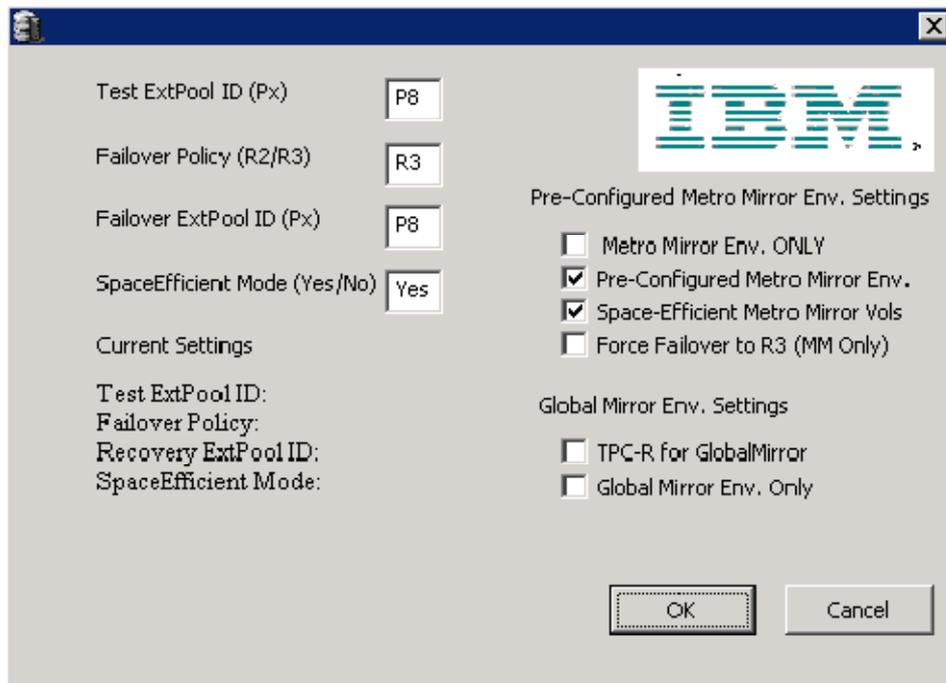


Click OK to confirm the selections. To confirm and/or change the options re-start the configuration utility. The current selections will be displayed under “Current Settings” as shown below.

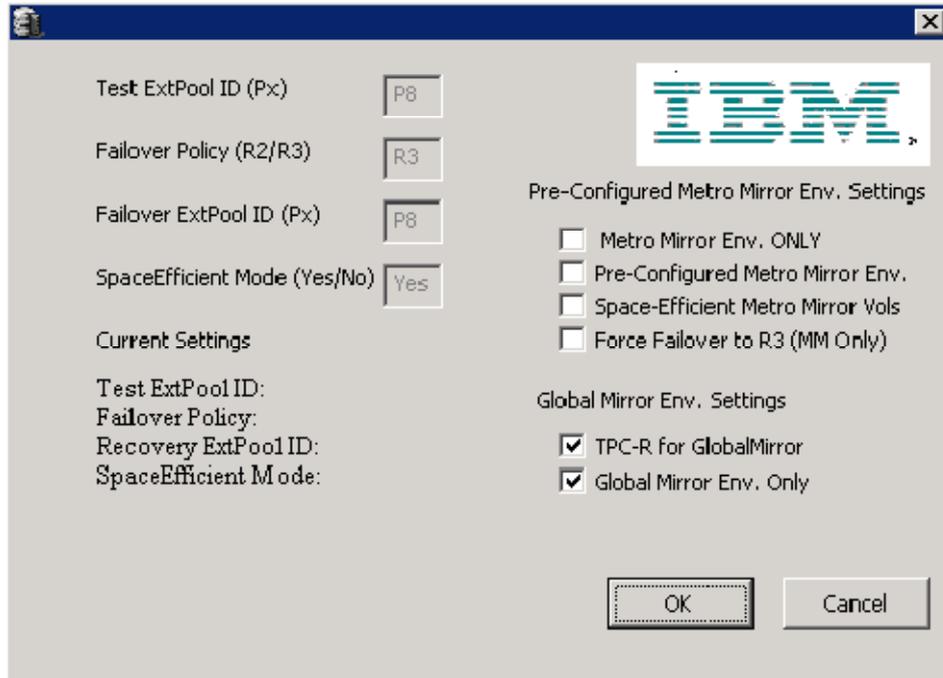


Click OK to submit changes or click Cancel to leave the selections unchanged. If “R2” is input for Failover Policy any input in “Failover ExtPool ID” field is ignored.

For mixed Metro Mirror and Global Mirror environments, the selections should be as shown below...



If the users choose to use TPC-R in conjunction with VMware SRM, using the former to recover DS8000 volumes for non-VMware environments with single global mirror session, then configure the SRA as shown below...



In this configuration, the user needs to set-up the environment for TPC-R, before setting-up SRM and SRA.

SRM's Test Failover operation has no dependency on TPC-R's practice test operation. It is strongly recommended that the SRM's Test Failover and TPC-R's practice test tasks be NOT done at the same time.

SRM's Failover task has a great dependency on TPC-R's recovery process. In Global Mirror environments, TPC-R's recovery procedure must be run first to recover ALL volumes in the Global Mirror session. Once it's confirmed that TPC-R's recovery is successful, recovery (failover) on SRM can be initiated. SRM will simply pick-up where TPC-R has left off.

d. User Privileges for Storage Replication Adapter Configurations

For **R2 failover policy**, where the SRA creates the snapshot volumes and maps the volumes to the ESX server(s) at the recovery site, during **test failover** operation(s), an "admin" privileged user is needed. If, the replicated targets are pre-mapped to the recovery site ESX server(s), then a "CopyOperator" privileged user will suffice for **failover** operation(s).

For **R3 failover policy**, where the SRA creates the snapshot volumes and maps the volumes to the ESX server(s) at the recovery site, during **test failover** and **failover** operation(s), an "admin" privileged user is needed.

For **Pre-Configured Env**, where the user pre-creates the needed volumes and maps those volumes to the recovery site ESX server(s), a "CopyOperator" privileged user will suffice.

Note: If a non “admin” privileged user is used (in pre-configured environment for example ;), embedded CIMOM on the HMC cannot be used. For this user an external (proxy) CIMOM has to be used.

4. Configuration

a. Creating Target Volumes and Metro Mirror/Global Mirror Relationships

You must create equal number of target volumes (for Metro Mirror targets), and an additional set of volumes for FlashCopy targets for Global Mirror set-up, on the recovery site DS8000, to source volumes.

Important: When creating volumes on the recovery site make sure that the DS8000 has enough free space that is needed for volumes’ creation during test failover operations. If the recovery DS8000 has Space Efficient volume support enabled, the SRA will create SE (TSE) FlashCopy target volumes during test failover operations. Before SRA can create SE volumes sufficient SE storage must be configured on the array first. For more information on SE storage configuration and SE concepts in general refer to IBM DS8000 Thin Provisioning (<http://www.redbooks.ibm.com/redpapers/pdfs/redp4554.pdf>).

1. Create Metro/Global Mirror relationships between the source and target volumes. The Metro/Global Mirror target volumes should NOT be mapped to the ESX server(s) on the recovery site, as the mapping process is completely automated by the SRA for failover and test failover operations. For more information on Metro Mirror/Global Mirror Copy Services refer to IBM System Storage DS8000: Copy Services in Open Environments (<http://www.redbooks.ibm.com/redbooks/pdfs/sg246788.pdf>).

Important: Before you start using the DS8000 Storage Replication Adapter, make sure the Metro Mirror relationships are in “Full Duplex” mode and for Global Mirror relationships’ “First Pass” status is “True” and Consistency Groups forming at the set intervals.

Important: If the DS8000 arrays are not SE volume support enabled, the SRA creates fully allocated volumes during test failover operations. Fully allocated volumes need to be completely initialized before they can be used as FlashCopy targets. This might take several minutes depending on the size of the newly created volume. To accommodate this initialization time, the user needs to modify the command time out values of VMware SRM appropriately. This can be done by changing the value of command time out entry in vmware-dr.xml file

found under VMware SRM installation directory. For the changes to take effect, the VMware SRM service must be re-started.

For example: `<CommandTimeout>900</CommandTimeout>`

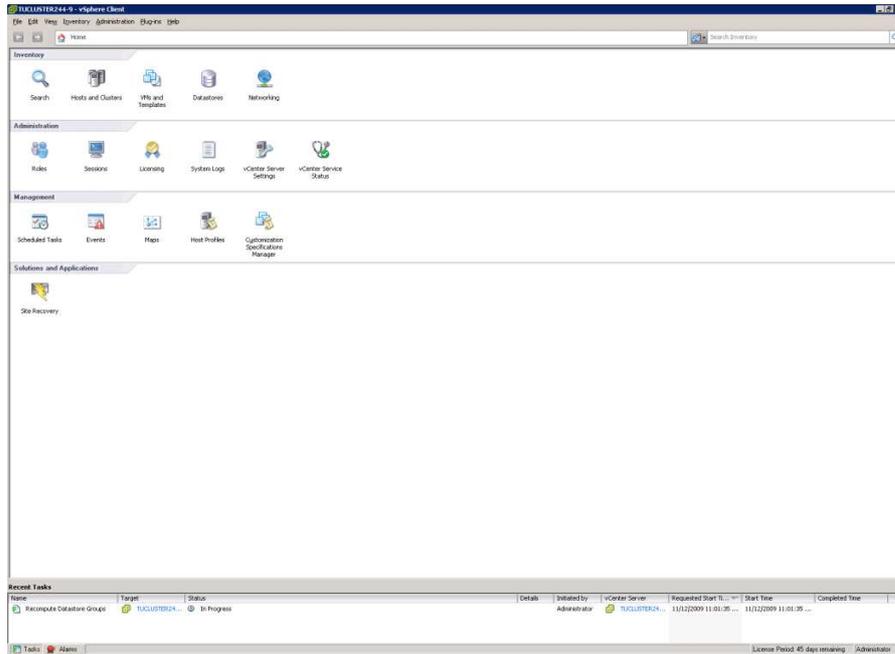
b. Adding Array Managers to VMware Site Recovery Manager

To add arrays to VMware Site Recovery Manager execute the following.

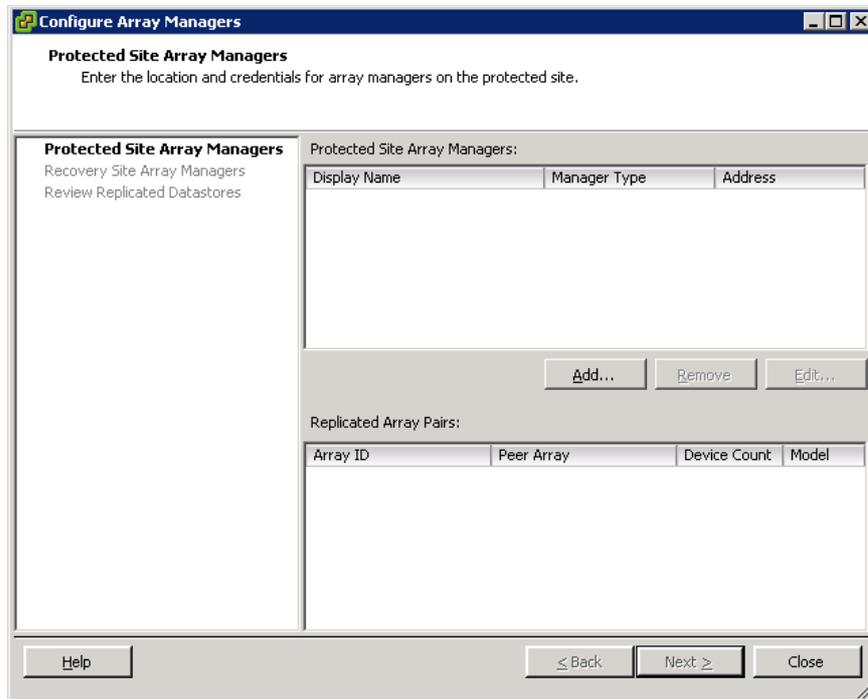
1. Log on to the VMware Virtual Center Server machine



2. Click Site Recovery on the VI client home page



3. Click **Configure** option next to Array Manager in the Setup panel.



4. Click **Add** in the Configure Array Manager panel.

5. Enter array manager information on the Add Array Manager screen. Reinstigate the connection information for the array. Click Connect.

- **Display Name** - Enter the name of your array.
- **Manager Type** - From the pull down menu, select the type of array you are using
- **Local Array CIM Server** – Enter the IP address and the port number of the local array's CIM agent. For example, 192.168.15.2:5989, where 5989 is the CIM agent's port number if using a proxy CIM agent. If connecting to an embedded CIMOM use 6989.

Note: IBM System Storage DS8000 Storage Replication Adapter only supports secure ports for CIM agents and only one DS8000 device managed by each CIM agent.

- **Local Array HMC** – Enter the IP address of the protected site DS8000 device's HMC. For example, 192.168.15.3.

Note: IBM System Storage DS8000 Storage Replication Adapter works with only one of the HMCs (in dual HMC environments).

- **Remote Array HMC** – Enter the IP address of the recovery site array's HMC. For example 192.168.17.2

Note: IBM System Storage DS8000 Storage Replication Adapter works with only one of the HMCs (in dual HMC environments).

- **User Name** - Enter the user name configured for the CIM agent.
- **Password** - Enter the password configured for the CIM agent.

Array Manager Information

Display Name: DS8K-7502301

Manager Type: IBM-DS8000-Native

Local Array CIM Server: 9.11.110.176:5989

Local Array HMC: 9.11.108.35

Remote Array HMC: 9.11.108.38

Username: admin

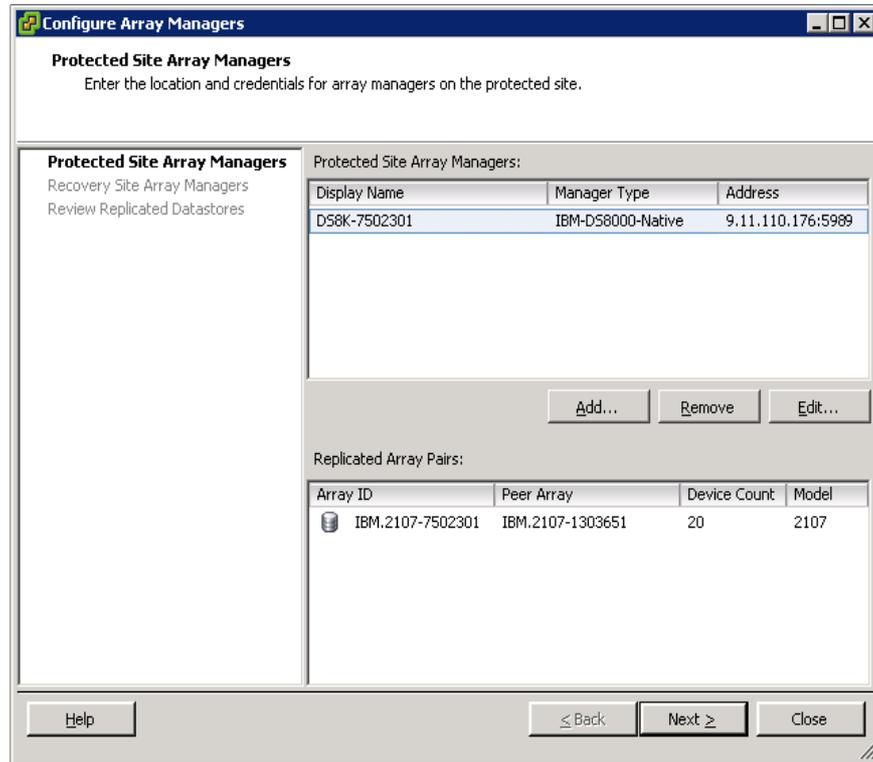
Password: *****

Connect

Array ID	Model
<input checked="" type="checkbox"/> IBM.2107-7502301	2107

Help OK Cancel

6. Click **OK** to initiate LUN discovery on the protected site.



7. Confirm the DS8000 image IDs of protected and recovery site arrays and click **Next**. On the next page click **Add** to add the recovery site array information and click **Connect**

Array Manager Information

Display Name: D58K-1303651

Manager Type: IBM-DS8000-Native

Local Array CIM Server: 9.11.108.38:6989

Local Array HMC: 9.11.108.38

Remote Array HMC: 9.11.108.35

Username: admin

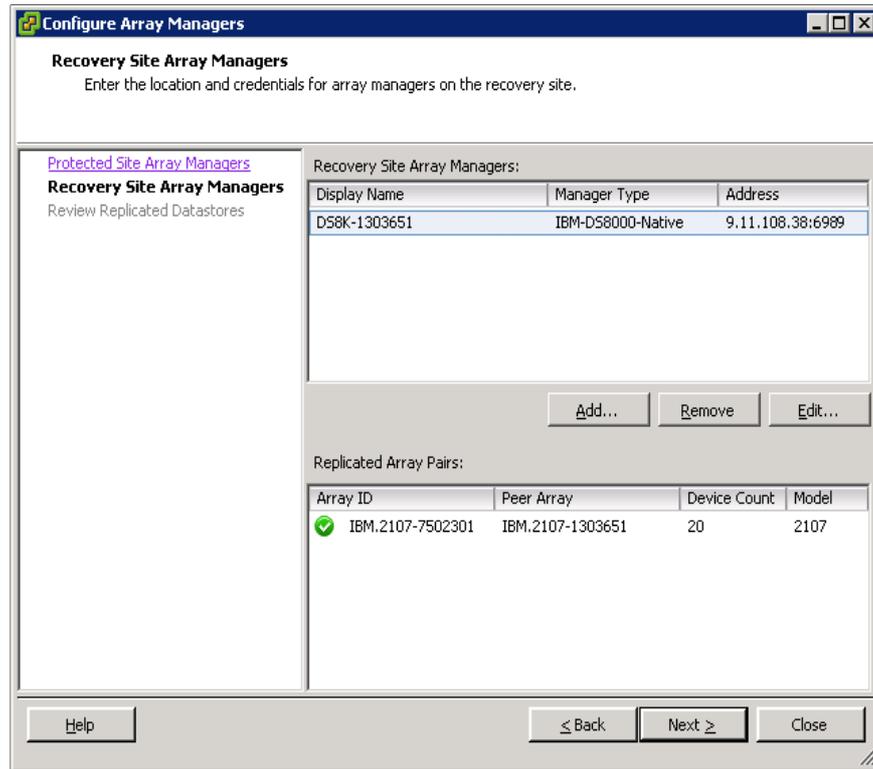
Password: *****

Connect

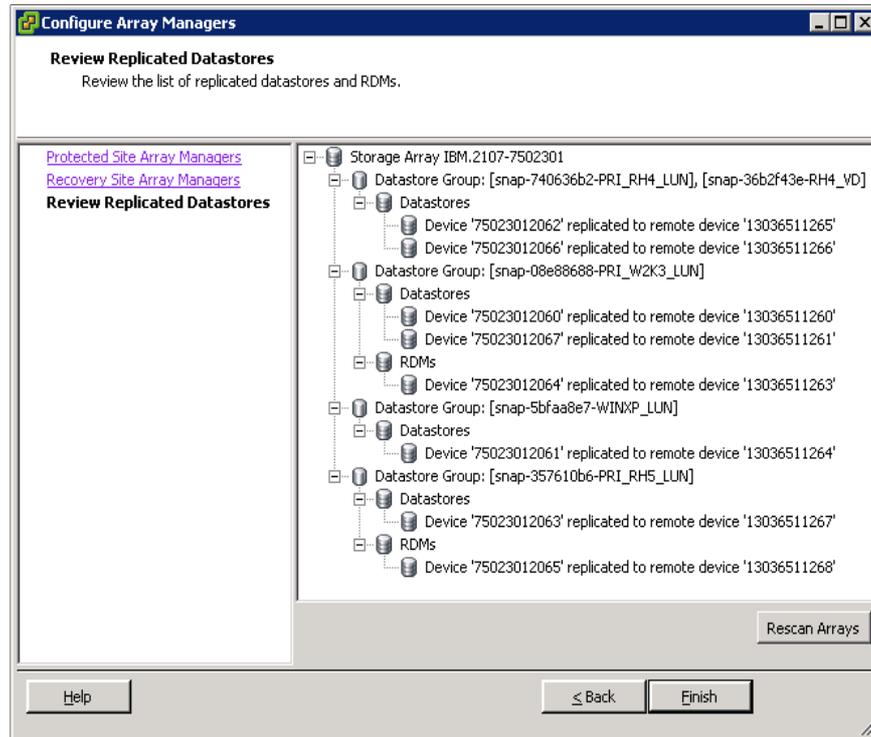
Array ID	Model
<input checked="" type="checkbox"/> IBM.2107-1303651	2107

Help OK Cancel

8. Confirm the image ID of the recovery site DS8000 and click **OK**



9. Confirm that a Green icon appears on the screen as seen in the above image. Click **Next** to see the list of replicated VMware datastores.



Review and confirm the Datastore list and click **Finish**

5. TestFailover Procedure

The IBM System Storage DS8000 SRA completely automates the TestFailover procedure. During this procedure, the SRA creates Space Efficient FlashCopy target volumes, if SE volume support feature is enabled and SE storage defined on the storage array. If the recovery site DS8000 does not have SE support enabled, the SRA creates fully allocated volumes for test failover operations. The only pre-requisite this procedure needs, from the Storage Replication Adapter's perspective, is to have enough free space available in one of the extent pools to accommodate the FlashCopy target volumes

Please refer to important notes under “Creating Target Volumes and Metro/Global Mirror Relationships” section.

This procedure doesn't require anything specific to the Storage Replication Adapter, be done by the user as long as all the steps and pre-requisites mentioned in this document are carried out properly.

6. Failover Procedure

DS8000 SRA does a failover of the Metro/Global Mirror target volumes to the recovery site during a failover operation.

This procedure doesn't require anything specific to the Storage Replication Adapter to be done by the user as long as all the steps and pre-requisites mentioned in this document are carried out properly.

7. Failback Procedure

a. Managing Failback

Managing failback using SRM is a manual process given that the protection site could have completely different hardware and network configuration after a disaster occurs. Failback can be managed like any planned server migration.

b. Failback Scenario

The following failback scenario uses SRM as a failback tool to Site A after executing a recovery plan R1 at Site B in recovery mode for recovered virtual machines.

i. To manually execute a failback scenario for Metro Mirror Set-ups

1. Delete recovery plan R1 at Site B.
2. If Site A still has DR protection configured for the protection groups P1 in recovery plan R1, delete protection groups P1 at Site A.
3. If it is not already in place, use the VI Client at Site B to establish Site A as the secondary site for Site B. (If Site A does not have SRM installed, install SRM at Site A.)
4. Establish appropriate array replication from Site B to Site A for the datastores containing recovered virtual machines.
 - Mask the volumes on the protected site DS8000 from the ESX server at Site A.
 - On the recovery DS8000 at Site B, issue failback operations on B volumes with A volume as targets.

Note1: Before issuing the failback command ensure that paths are defined from remote site LSS to its corresponding LSS at the local site.

Note2: If volumes at Site A were online when a crash happened use “-resetreserve” switch with the failback command, so that any stale reservations on Site A volumes are cleared.

Note3: The failback can be done in three ways

- A. Synchronous data transfer from volumes at Site B to volumes at Site A for both Metro Mirror and Global Mirror relationships, if the applications are active on Site B volumes.

```
dscli> failbackpprc -dev IBM.2107-1303651 -remotedev  
IBM.2107-7502301 -type mmir 1260:2060
```

For more information on failback refer to IBM System Storage DS8000: Copy Services in Open Environments

(<http://www.redbooks.ibm.com/redbooks/pdfs/sg246788.pdf>).

5. Create protection group or groups P2 at Site B to protect recovered virtual machines to Site A.
6. At Site A, create a recovery plan R2 for the protection group or groups P2.
7. After the user has determined that the virtual machines have been fully replicated to Site A, execute recovery plan R2 at Site A in test mode.
8. If the test is successful, execute recovery plan R2 in recovery mode.
9. At this point, the user may want to re-protect recovered virtual machines to Site B:
10. Delete recovery plan R2 at Site A.
11. Delete protection group(s) P2 at Site B.
12. Establish appropriate array replication from Site A to Site B for datastores containing recovered virtual machines.
 - Mask the volumes on the protected site DS8000 from the ESX server at Site B.
 - On the protected DS8000 at Site A, issue failback of Metro/Global Mirror relationships on A volumes with B volume as targets.

Note1: For Metro Mirror relationships execute failbackpprc command with “-type mmir” switch.

```
dscli> failbackpprc -dev IBM.2107-7502301 -remotedev  
IBM.2107-1303651 -type mmir 2060:1260
```

Note2: For Global Mirror relationships execute failbackpprc command with “-type gcp” switch.

```
dscli> failbackpprc -dev IBM.2107-7502301 -remotedev  
IBM.2107-1303651 -type gcp 2060:1260
```

- Once the failback is complete, re-start the Global Mirror session. Nothing needs to be done for the Metro Mirror relationships

For more information on failback refer to IBM System Storage DS8000: Copy Services in Open Environments (<http://www.redbooks.ibm.com/redbooks/pdfs/sg246788.pdf>).

13. Create protection group(s) P3 at Site A to protect recovered virtual machines from Site A to Site B.

Create a recovery plan R3 at Site B for the groups.

ii. To manually execute a failback scenario for Global Mirror Set-ups

1. Delete recovery plan R1 at Site B.
2. If Site A still has DR protection configured for the protection groups P1 in recovery plan R1, delete protection groups P1 at Site A.
3. If it is not already in place, use the VI Client at Site B to establish Site A as the secondary site for Site B. (If Site A does not have SRM installed, install SRM at Site A.)
4. Establish appropriate array replication from Site B to Site A for the datastores containing recovered virtual machines.
 - Mask the volumes on the protected site DS8000 from the ESX server at Site A.
 - On the recovery DS8000 at Site B, issue failback operations on B volumes with A volume as targets.

Note1: Before issuing the failback command ensure that paths are defined from remote site LSS to its corresponding LSS at the local site.

Note2: If volumes at Site A were online when a crash happened use “-resetreserve” switch with the failback command, so that any stale reservations on Site A volumes are cleared.

Note3: The failback can be done in three ways

A. Synchronous data transfer from volumes at Site B to volumes at Site A for both Metro Mirror and Global Mirror relationships, if the applications are active on Site B volumes.

```
dscli> failbackpprc -dev IBM.2107-1303651 -remotedev  
IBM.2107-7502301 -type mmir 1260:2060
```

B. Asynchronous data transfer from volumes at Site B to volumes at Site A for Global Mirror relationships. This method does not provide a DR solution in the reverse direction i.e. B to A. If this method is chosen, then all applications (writes) on the B volumes must be quiesced (or stopped), before the asynchronous data transfer is initiated, thus guaranteeing write ordering on A volumes.

```
dscli> failbackpprc -dev IBM.2107-1303651 -remotedev  
IBM.2107-7502301 -type gcp 1260:2060
```

C. Global Mirror in reverse direction i.e. (original) recovery site to (original) protected site. For more information on DS8000 Global Mirror setup, refer to the document below. This method is recommended if the B volumes will act as primaries (production) for a long time.

For more information on failback refer to IBM System Storage DS8000: Copy Services in Open Environments (<http://www.redbooks.ibm.com/redbooks/pdfs/sg246788.pdf>).

5. Create protection group or groups P2 at Site B to protect recovered virtual machines to Site A.
6. At Site A, create a recovery plan R2 for the protection group or groups P2.
7. After the user has determined that the virtual machines have been fully replicated to Site A, execute recovery plan R2 at Site A in test mode.
8. If the test is successful, execute recovery plan R2 in recovery mode.

9. At this point, the user may want to re-protect recovered virtual machines to Site B:

10. Delete recovery plan R2 at Site A.

11. Delete protection group(s) P2 at Site B.

12. Establish appropriate array replication from Site A to Site B for datastores containing recovered virtual machines.

- Mask the volumes on the protected site DS8000 from the ESX server at Site B.

- On the protected DS8000 at Site A, issue failback of Metro/Global Mirror relationships on A volumes with B volume as targets.

Note1: For Metro Mirror relationships execute failbackpprc command with “-type mmir” switch.

```
dscli> failbackpprc -dev IBM.2107-7502301 -remotedev  
IBM.2107-1303651 -type mmir 2060:1260
```

Note2: For Global Mirror relationships execute failbackpprc command with “-type gcp” switch.

```
dscli> failbackpprc -dev IBM.2107-7502301 -remotedev  
IBM.2107-1303651 -type gcp 2060:1260
```

- Once the failback is complete, re-start the Global Mirror session. Nothing needs to be done for the Metro Mirror relationships

For more information on failback refer to IBM System Storage DS8000: Copy Services in Open Environments

(<http://www.redbooks.ibm.com/redbooks/pdfs/sg246788.pdf>).

13. Create protection group(s) P3 at Site A to protect recovered virtual machines from Site A to Site B.

Create a recovery plan R3 at Site B for the groups.