SQL Server Disaster Recovery with Compellent Storage Center

Solution Guide

Document revision

Date	Revision	Comments
11/14/2011	A	Initial Draft

Contents

Figures

General syntax

Table 1.   **Document syntax**

Item	Convention
Menu items, dialog box titles, field names, keys	**Bold**
Mouse click required	Click:
User Input	`Monospace Font`
User typing required	Type:
Website addresses	http://www.compellent.com
Email addresses	info@compellent.com

Conventions

Notes are used to convey special information or instructions.

Timesavers are tips specifically designed to save time or reduce the number of steps.

Caution indicates the potential for risk including system or data damage.

Warning indicates that failure to follow directions could result in bodily harm.

Preface

Audience

The audience for this document is System Administrators who are responsible for the setup and maintenance of SQL servers and associated storage. Readers should have a working knowledge of Windows, SQL Server, and the Dell Compellent Storage Center.

Purposes

This document provides an overview of Dell Compellent storage replication and how it can be used to provide high availability and disaster recovery solutions for using SQL Server on Dell Compellent Storage Center.

Customer support

Dell Compellent provides live support 1-866-EZSTORE (866.397.8673), 24 hours a day, 7 days a week, 365 days a year. For additional support, email Dell Compellent at support@compellent.com. Dell Compellent responds to emails during normal business hours.

Introduction

High Availability and DR for SQL Server using Dell Compellent Replication

With Dell Compellent, organizations of all sizes can protect business-critical applications like SQL Server against downtime and disaster. Compellent's Enterprise Manager and Replay Manager software enable administrators to deploy a robust disaster recovery (DR) plan with multi-site failover.

Enterprise Manager features an intuitive, point-and-click interface for managing any number of Compellent systems at primary and remote sites. The software, which includes wizards that guide administrators through setup and configuration, provides a comprehensive view of all connected storage. Other functionality includes monitoring, alerting, trending, analysis and reporting. Setting up and optimizing replication of SQL Server data is quick and easy, and it doesn't require any server-side agents that may complicate the process. In fact, administrators can activate a DR site with a single mouse click.
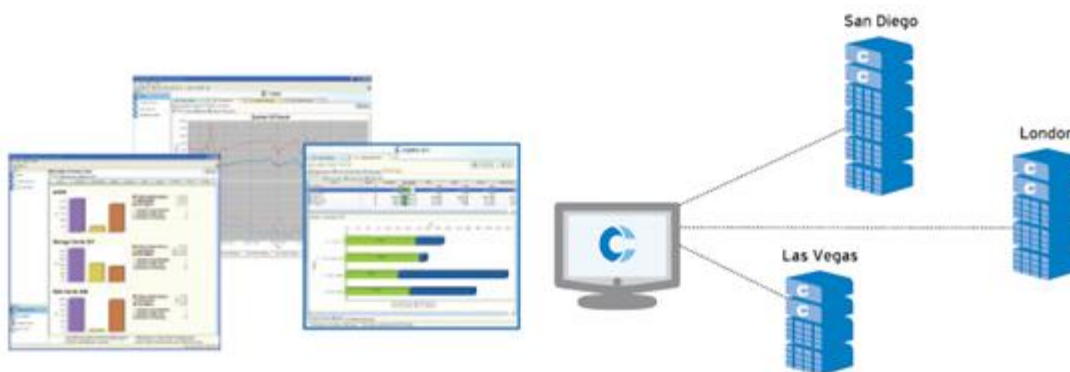
Figure 1: Enterprise Manager provides a single pane of glass for managing multiple Compellent storage systems, including replication of storage volumes for SQL Server.

Pre-requisites and Tools for Replication and SQL Server

Setting up Dell Compellent Replication for SQL Server disaster recovery has the following pre-requisites:

o   SQL Server 2000 or above version installed on both Production and DR site.
o   Dell Compellent Replay Manager services installed on both Production and DR site.
o   Dell Compellent Enterprise Manager Data Collection Manager Installed and configured.
o   Dell Compellent Enterprise Manager client on any machine for administration.
o   Dell Compellent Replay Manager Explorer on any machine for administration.
o   Dell Compellent Storage Center Command Set snap-in installed on both Production and DR site [to use Powershell].
o   Dell Compellent Replay Manager Command Set snap-in installed on both Production and DR site [to use Powershell].

Replication Deployment and Setup

Scenario Background

Microsoft SQL Server was deployed with named instance at the production site in a lab environment with 3 databases namely adventureworks2008r2, adventureworksdw2008r2, and AW_VLDB, a500 gb database. The over-all goal of the exercise is to establish a DR Site which is in a different building than my production site. In order to achieve the goal, Compellent Asynchronous replication was utilized to provide near-instantaneous recovery with minimal transaction lag.

This exercise will demonstrate how to:

- Establish an easily implemented process for setting up replication, activating the DR site and Re-activating the production site.
- Replicate SQL Server data with minimal impact on servers and applications
- Meet the required recovery point objective in event of a production site failure of the entire environment once back online.

Environment and Servers

Production Site
SQL Server Name: PG-SQL2K8R2-CL2N2\Prod
SQL Version: SQL Server 2008R2
OS: Windows 2008R2
Replay Manager: 6.0.2 services
Volume Layout: C: (Used for boot volume), F: (Used for storing SQL Data files for user databases), G: (Used for storing SQL Log files for user databases), H: (Used for storing tempdb data & log files), T: (Used for storing Native SQL Backups)

DR Site
SQL Server Name: PG-SQL2K8R2-CL2N1\Dev
SQL Version: SQL Server 2008R2
OS: Windows 2008R2
Replay Manager 6.0.2 services
Volume Layout: C: (Used for boot volume), F: (Used for storing SQL Data files for user databases), G: (Used for storing SQL Log files for user databases), H: (Used for storing tempdb data & log files), T: (Used for storing Native SQL Backups).

Replay Manager Explorer, Enterprise Manager client and Storage Center client were installed on alaptop. The replication set-up and configuration will be done using this laptop.

A "dual fabric" was implemented for the FC infrastructure. This configuration provided redundancy for the communications without affecting the functionality of the overall solution. For the storage infrastructure, the Compellent Storage Center SAN was Installed at each site. After creating the active disks to be used by the cluster, the disks were mapped and connected to the cluster from the production site.

Set-up Process

The set up process consists of the following steps:

- Setting up Database Replays on production site using Replay Manager.
- Setting up target server/volume folders on DR Storage Center using storage center client.
- Setting up Replication of Database volumes using enterprise manager client.
- Pre-defining disaster recovery site.

See details of all the above 4 steps below:

Setting up Database Replays (Snapshots)

The first step before setting up replication for the databases is to set up replays of each database on the production site. Replays can be set up using either of the following 2 applications:

a. *Replay Manager for SQL Server*: Replay manager is used to take application consistent replays of all the databases involved in replication. This is the recommended way of taking database volume replays as it guarantees consistency of the database. In order to learn how to use Replay manager to take SQL Database replays, please refer to the Replay Manager User guide (http://kcint.compellent.com/Published%20Documents/680-008-007.pdf).

b. *Storage Center:* Storage Center can also be used to take replays, however it is strongly recommended to use Replay Manager to take replays of the SQL Server databases. If it is decided to use Storage Center to take a replay, it is highly recommended to group all the SQL volumes (Data and Logs) into a consistency groups and take a replay. In order to learn how to use Storage Center to take replays and create consistency groups, please refer to the Storage Center User guide (http://kcint.compellent.com/Published%20Documents/680-019-009.pdf).

For the scenario above, using Replay Manager Explorer installed on the laptop,

a.   A connection to the production Server PG-SQL-CL2N2 was made and a new job named "UserDB Backup - Hourly" was created under SQL Database extension of Replay Manager.

b. This job was scheduled to run every hour and create a Replay of the 3 user databases.

As indicated earlier, the User database files are hosted on F-Drive and G-Drive. Hence the replay generated out of this job consists of these 2 volumes.
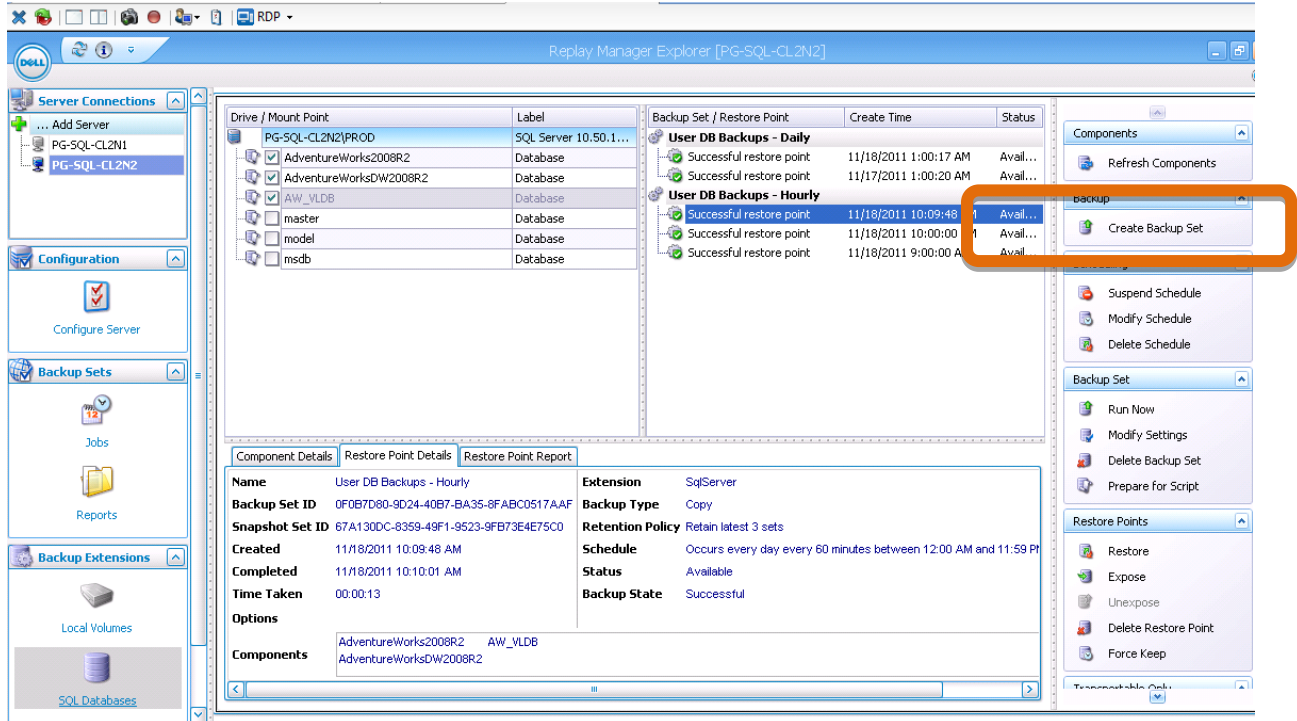
Figure 2: Taking a Replay using Replay Manager

Setting up target server/volume folders on DR Storage Center

a. Add the DR SQL Server as a server object on the DR SAN using Storage Center application.

b. Set up appropriate Volume folder where the replicated volumes will reside. This can also be done using either Storage Center application.

For the scenario above, using Storage Center client installed on the laptop,

a. The Storage Center on the DR site was connected and a new server object named PG-SQL-CL2N1 was created (DR server name).

b. A new Volume Folder named "Repl of PG-SQL-CL2N2" was created. This is the volume folder where all the production volume replicas would be housed.
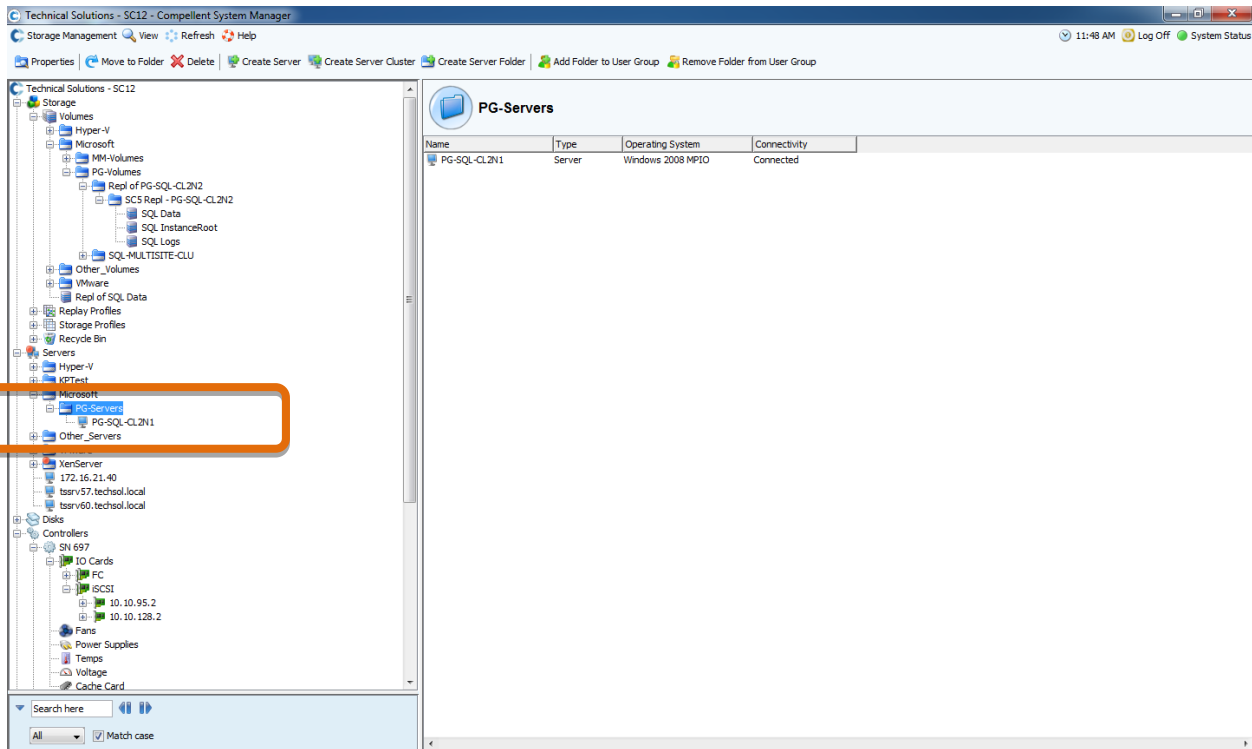
Figure 3: Setting up Target volumes/server on Compellent Storage Center

Setting up Replication of SQL Databases (volumes)

Once replays are set up, replication of all the database volumes from primary site to DR site would be set up. Follow are the steps to be followed to set up replication.

a. *Identify Database Volumes:* Identify all the database volumes that need to be replicated. This consists of all the volumes, where SQL Data files, SQL Log files, SQL System database files, and SQL Server backup volumes reside.

   For the scenario above, the following 4 volumes were replicated from Prod to DR site:

   F:\ -> SQL Data, G:\ -> SQL Logs, H:\ -> SQL TempDB, I:\ -> SQL Instance Root, T:\ -> SQL Backups

   For each of the volume that needs to be replicated, steps (b) through (d) were followed

b. *Start Replication wizard:* Using the Enterprise Manager client, Connect to the Production Storage Center and browse to the volume folder where all the source volumes to be replicated are housed. Right click on the appropriate volume and select "Replicate Volume".
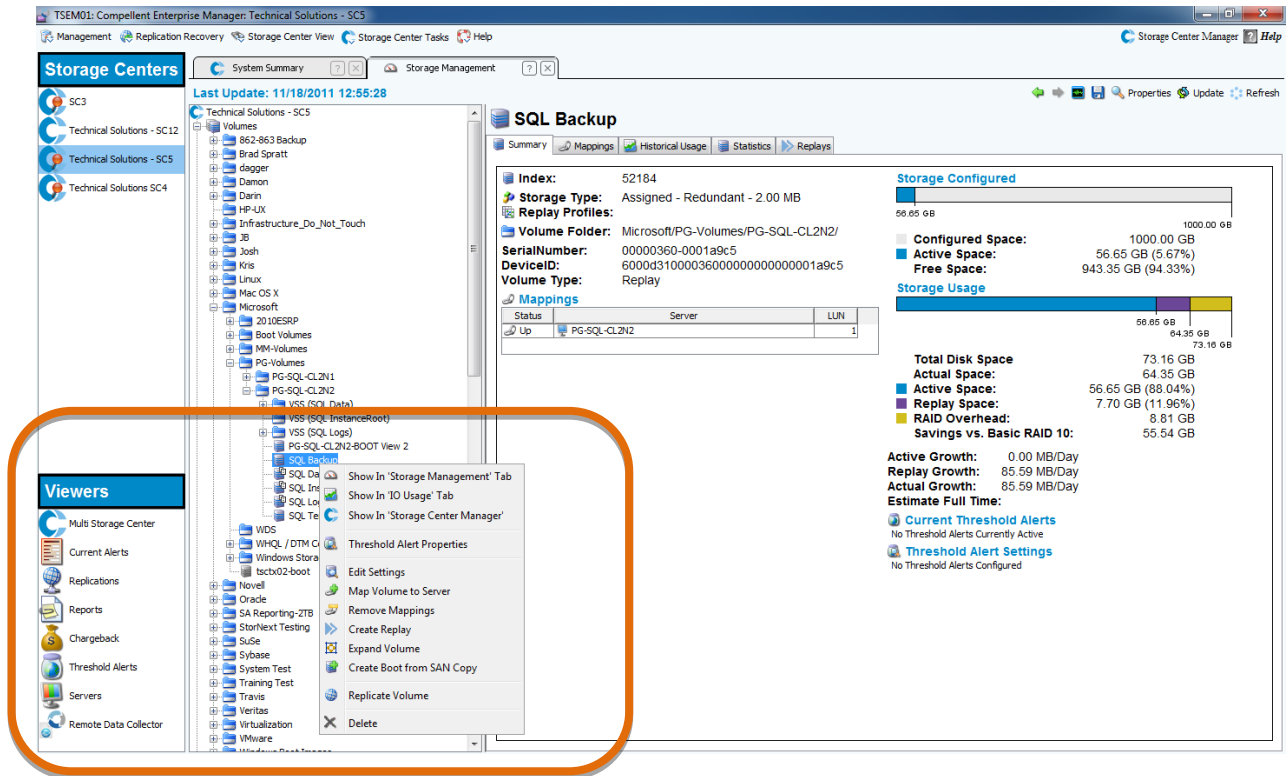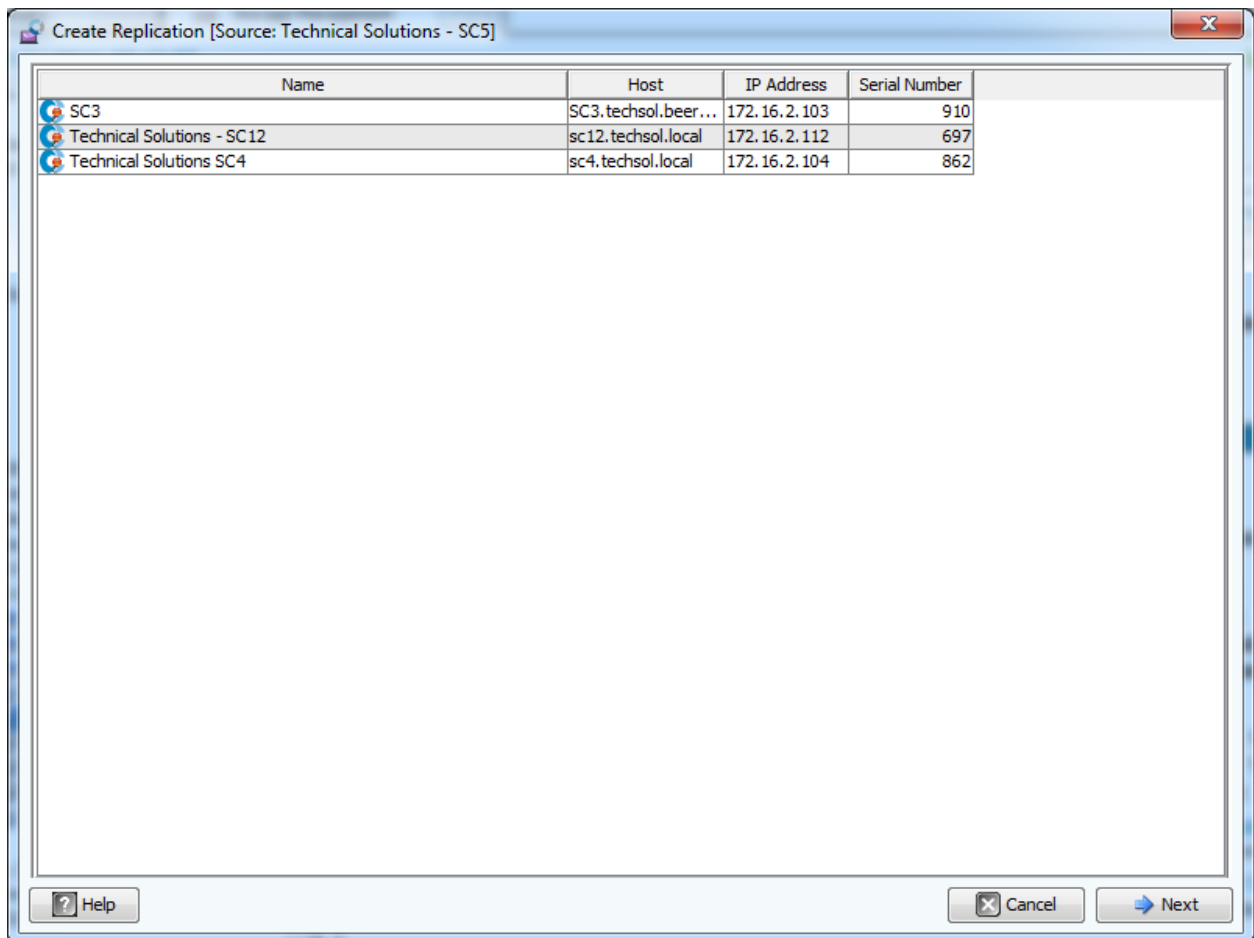
Figure 4: Enterprise Manager – Storage Management

c. Select Target Storage center

Selecting "Replicate Volume" in previous step will pop up a new window where the destination storage center (DR) needs to be selected.

For the scenario above, volumes were replicated to SC12 (Storage Center on DR site)


d. Select Replication attributes in the screen below.

For the scenario above, the configuration was selected as per best practices for SQL Replication as below:
a. Asynchronous replication
b. Replicate Active Replay
c. Change the Folder location of the destination volume and point it to the folder that was created in previous step.

All the other options were kept to default.
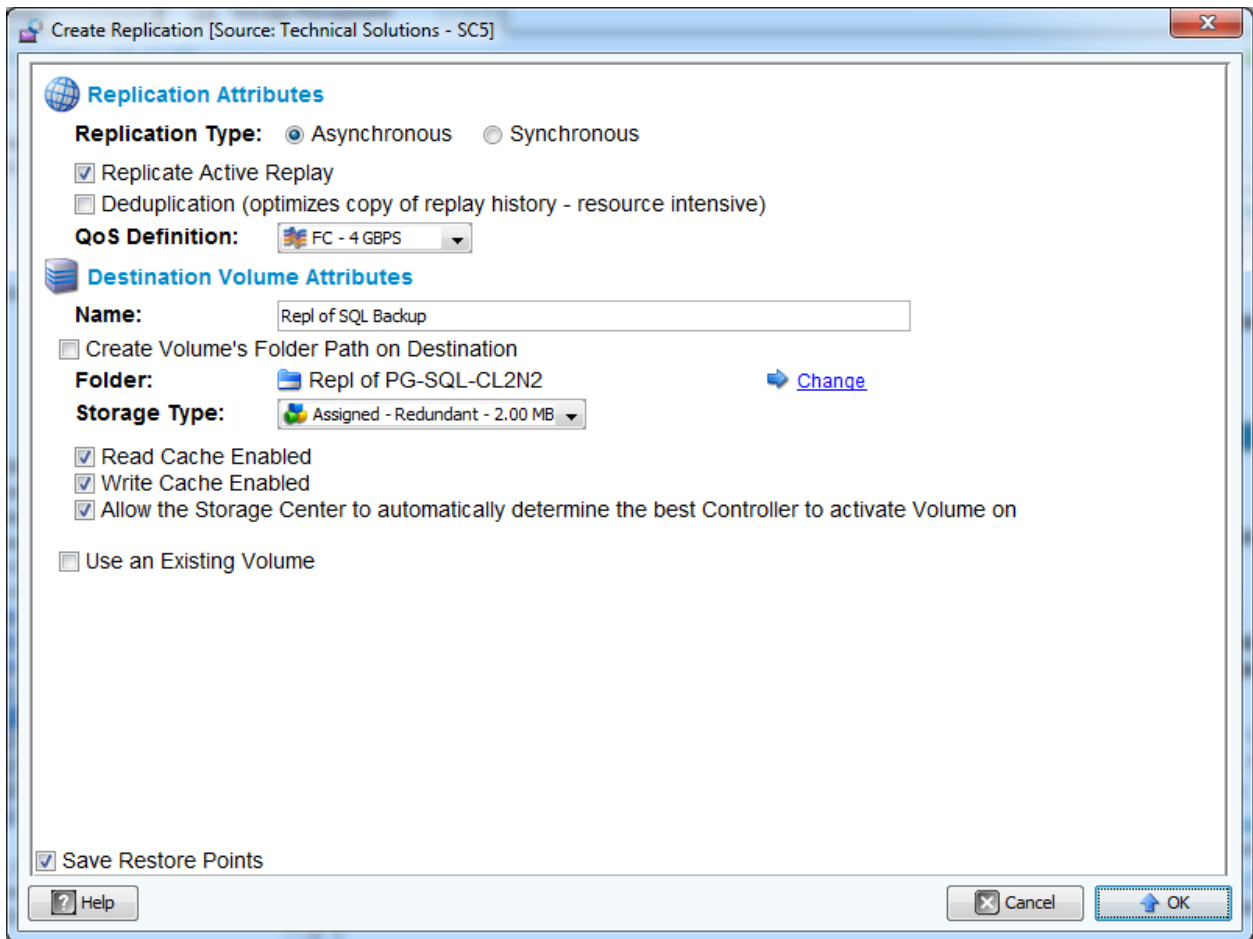
Pre-defining Disaster Recovery Site

Once all the required volumes are replicating successfully, the disaster site can be pre-defined. Doing this will enable quick recovery in time of disaster. Although not mandatory, this is a highly recommended step.

For the Scenario above using Enterprise Manager Client, Select the following menu option: Replication Recovery -> Predefine Disaster Recovery Site.
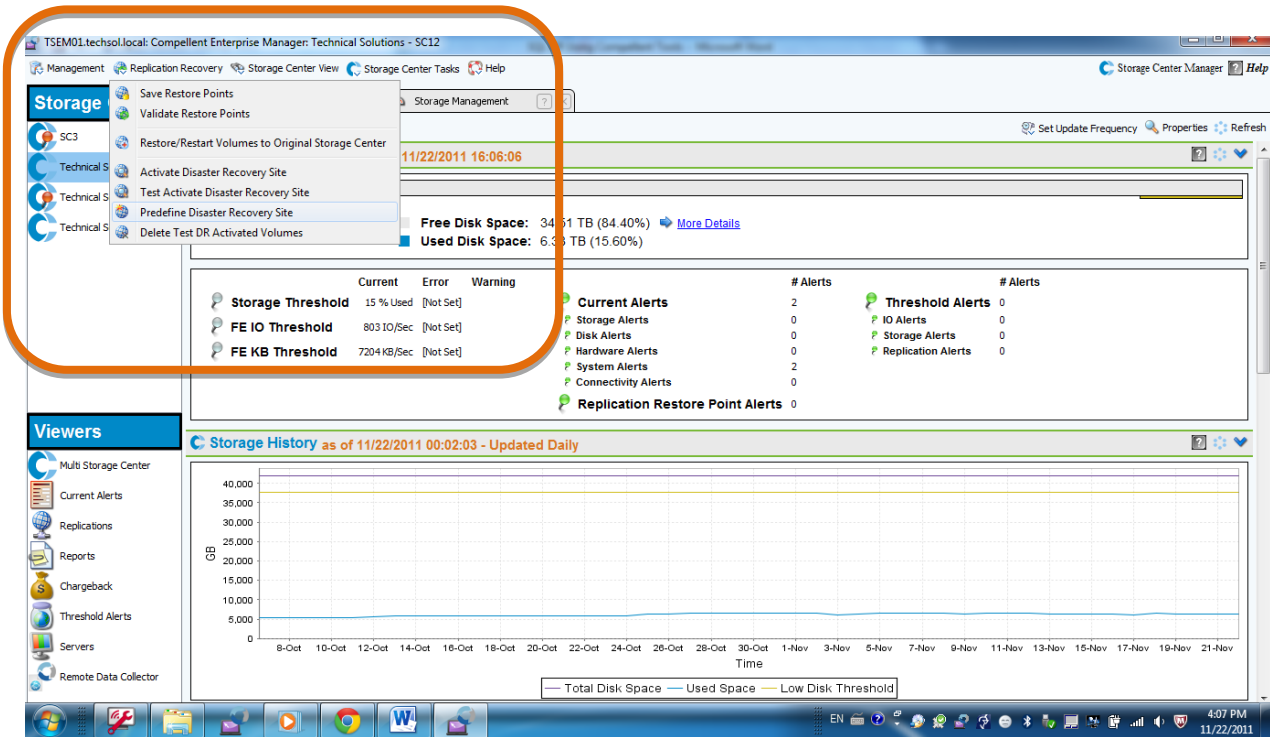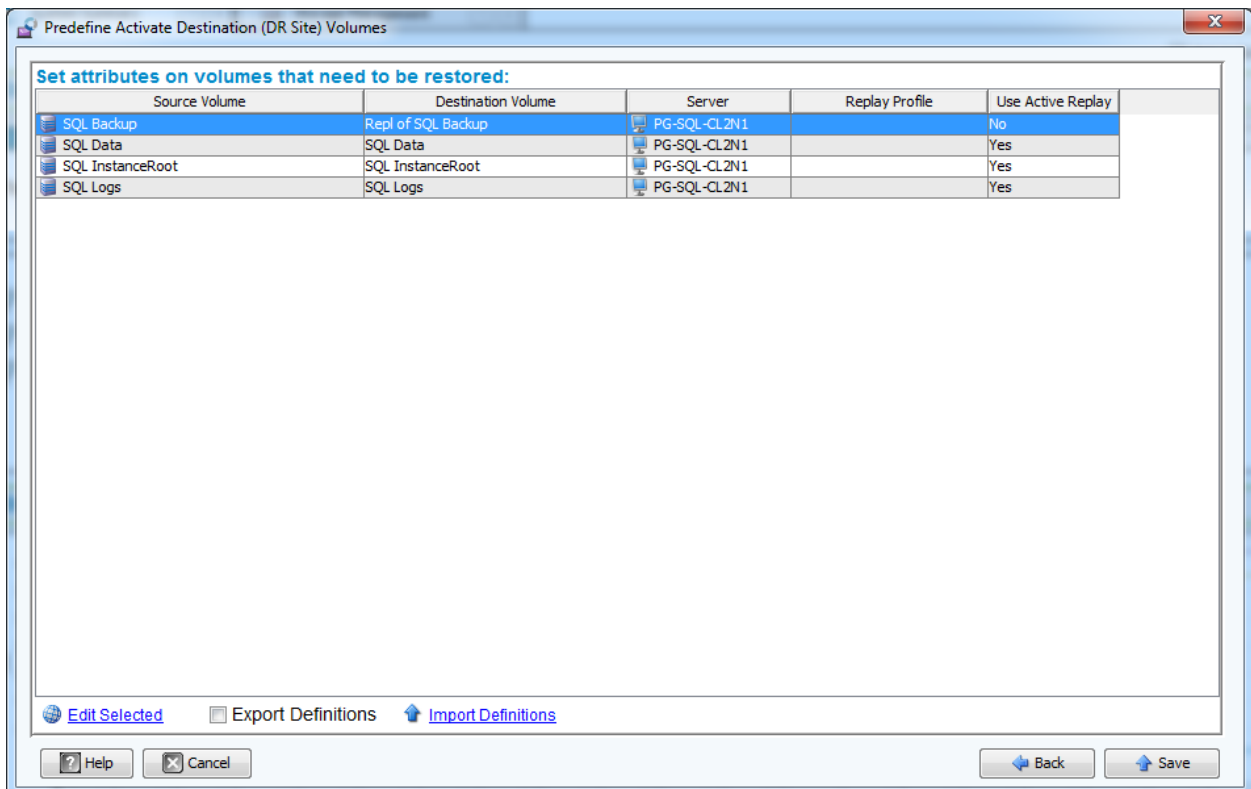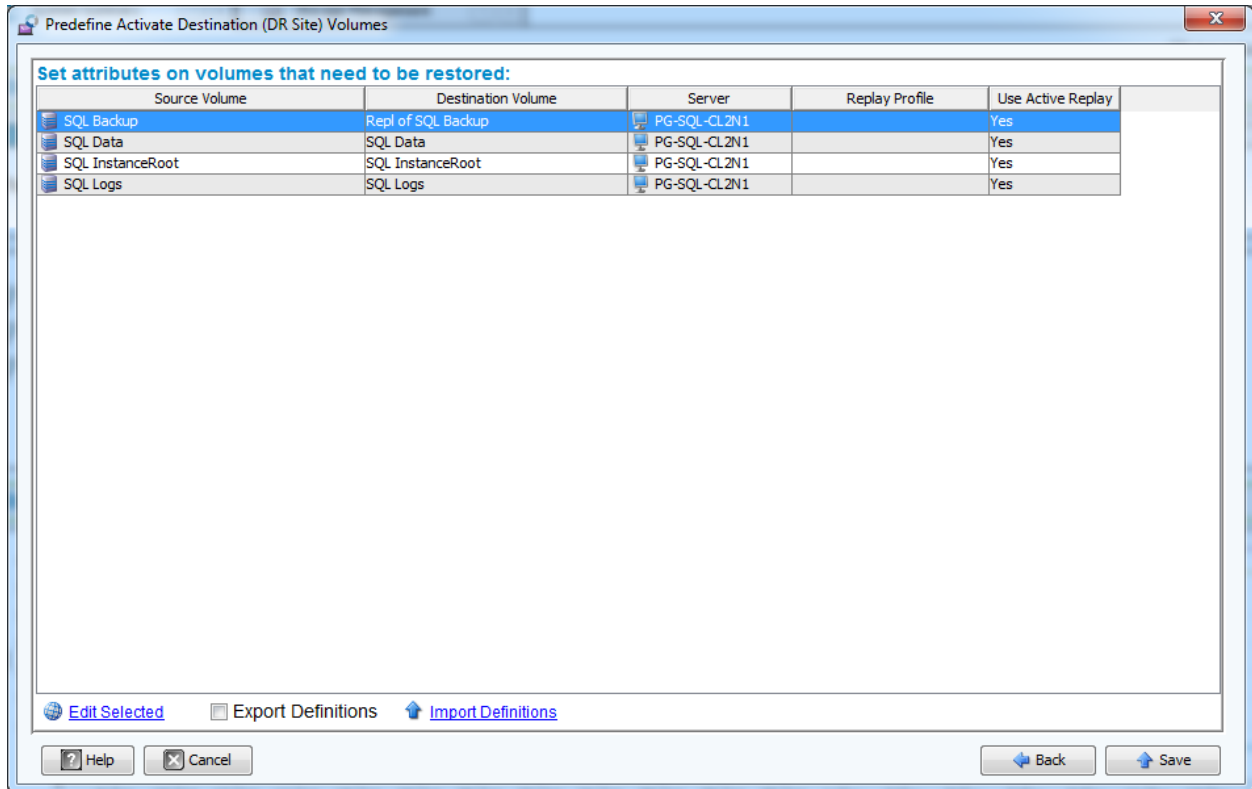
Figure 5: Enterprise Manager Client – Predefining DR site

Select the source and target Storage Center. In the case above, the source system is SC5 and target system is SC12 and click Next. On Screen after, select each volume and click on "edit selected" on the screen below.

On the screen below make sure to select the correct destination DR server by clicking on the change button. In the scenario above, the server named PG-SQL-CL2N1 (DR server) was selected.

Predefine Activate Destination (DR Site) Volumes

Set attributes on volumes that need to be restored:

Source Volume	Destination Volume	Server	Replay Profile	Use Active Replay
SQL Backup	Repl of SQL Backup	PG-SQL-CL2N1		Yes
SQL Data	SQL Data	PG-SQL-CL2N1		Yes
SQL InstanceRoot	SQL InstanceRoot	PG-SQL-CL2N1		Yes
SQL Logs	SQL Logs	PG-SQL-CL2N1		Yes

Edit Selected   ☐ Export Definitions   ⬆ Import Definitions

[? Help] [✖ Cancel]   [⬅ Back] [⬆ Save]

Monitoring Replication

After configuring replication, information about the status of all the volumes involved in replication can be monitored. Using Enterprise manager, replication threshold alerts can be set up. These thresholds can be set up and customized for each volume being replicated.

1. Select the "Replication" option on bottom left pane of EM Client. This will show a list of all volumes being replicated on the right top pane. For each of the volume, right click and select "Threshold Alert properties"

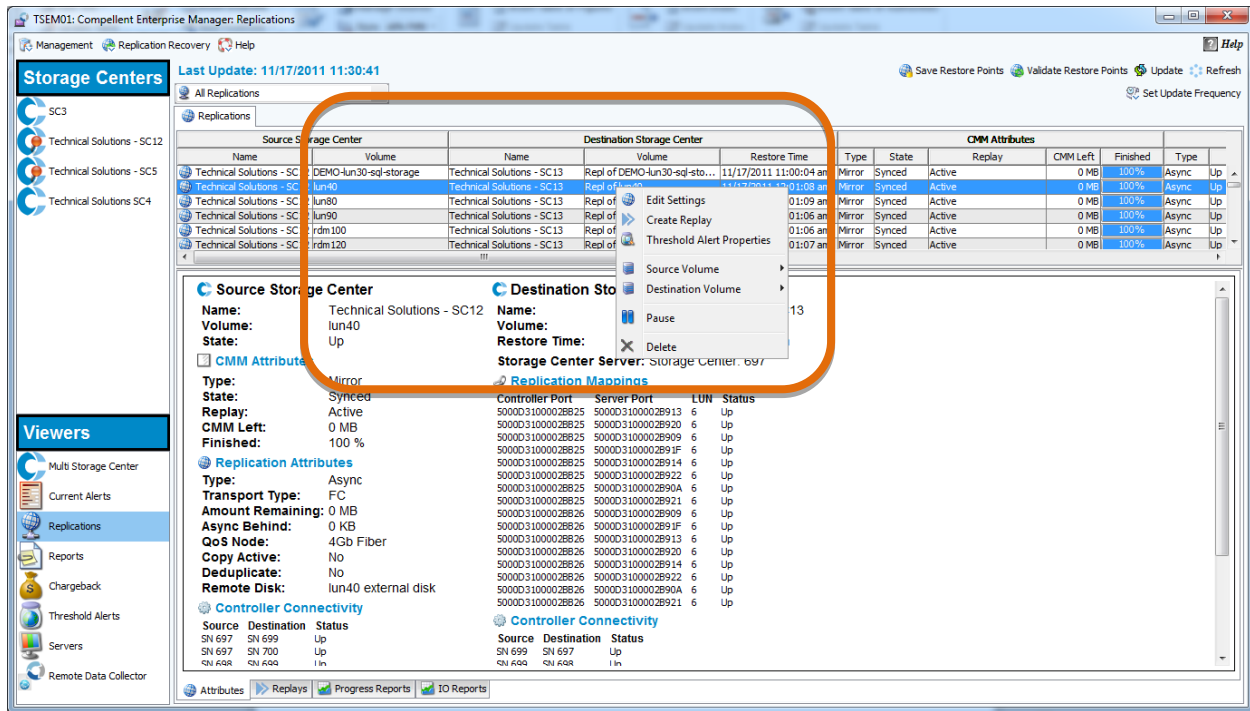SQL Server Disaster Recovery with Compellent Storage Center

Figure 6: Enterprise Manager – Setting up Replication Monitoring

2. The above step will pop up a screen that lets us define threshold definitions. There are 2 options for setting up Replication Alerts. These thresholds can either be based on
   a. Amount Remaining (GB)
   b. Percent Complete.
   Based on the criteria required for the threshold, click "change" on the screen below
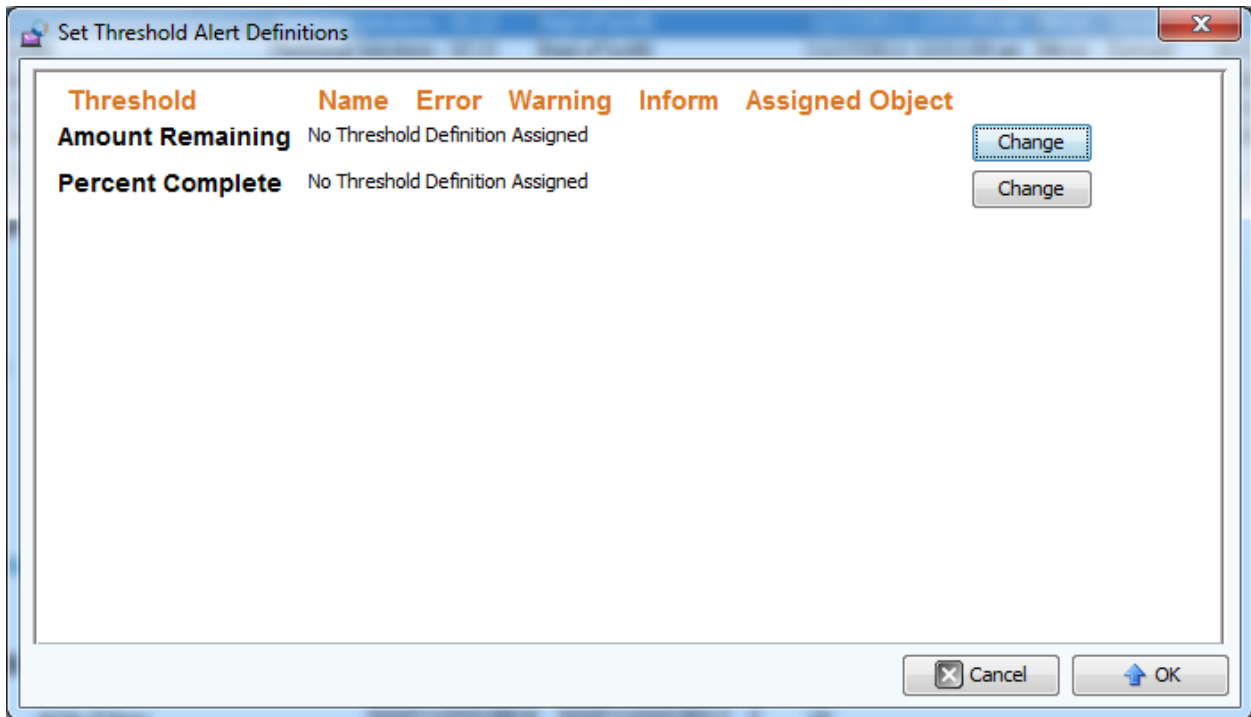
3. On the Threshold Alert Definition Configuration screen, Name the threshold and set up the threshold values for sending out Error/Warning and Information. The schedule of when alerts need to be sent can also be selected. While setting up schedule, certain days of the week or certain time of the day can

also be excluded for sending alerts.

All the alert definitions created above can be edited/delete using the "Threshold Alerts" option on left bottom pane.

Replication Administration

DR Drill – Test activating DR

Now that the database volume replication was all set up and DR site pre-defined, a DR drill (testing the DR solution) could easily be performed without really breaking the existing replication. This is one of the really cool features that differentiate from a traditional DR solution like SQL Log-shipping where testing DR solution would mean re-setting the entire set up after the test completes.

In order to test the DR solution in the scenario above, the Enterprise Manager Client was connected from the laptop and following option from menu was selected:

"Replication Recovery -> Test Activate Disaster Recovery Site" (please see the screen below)

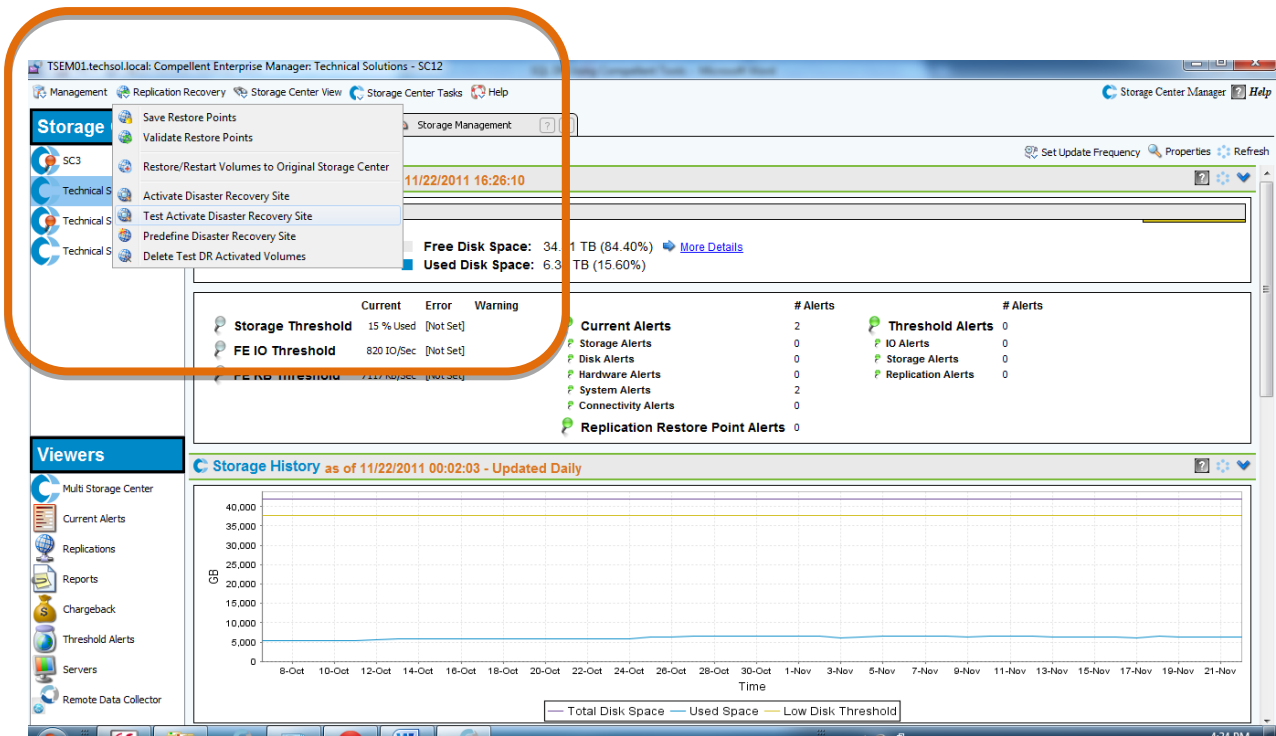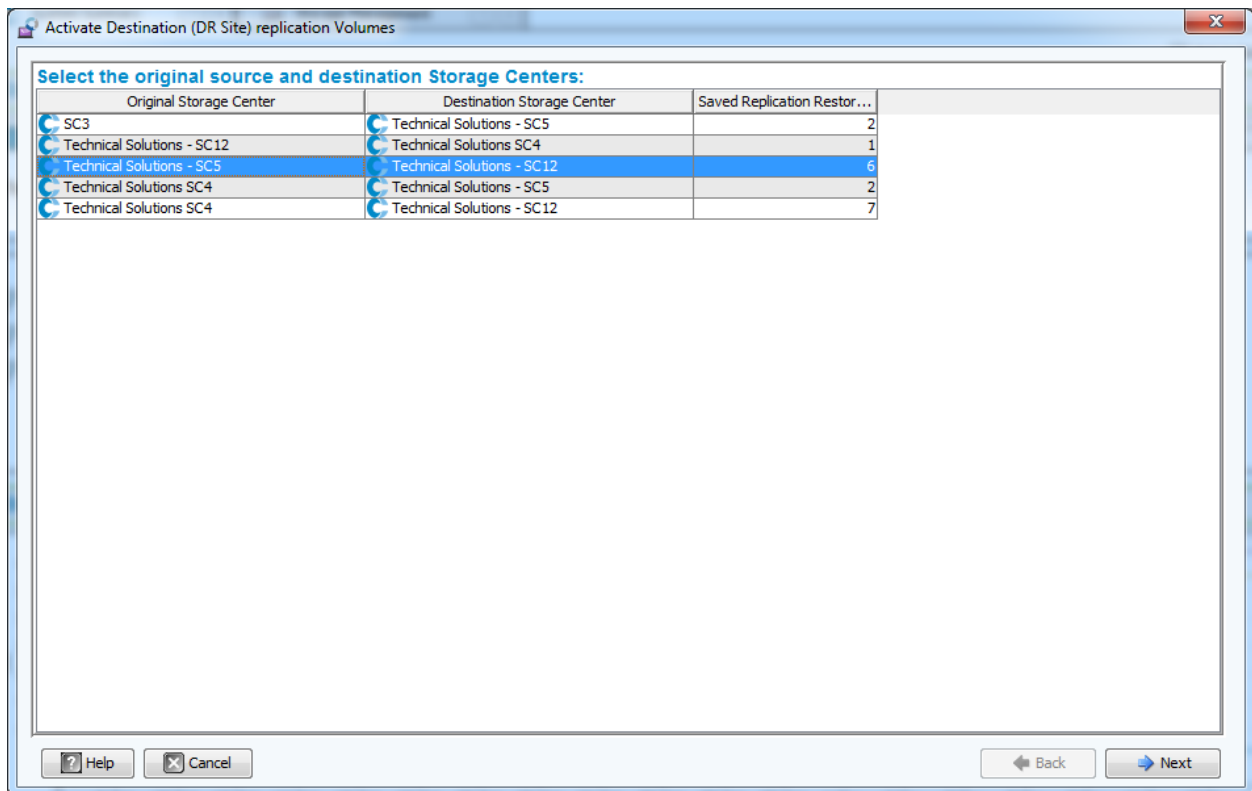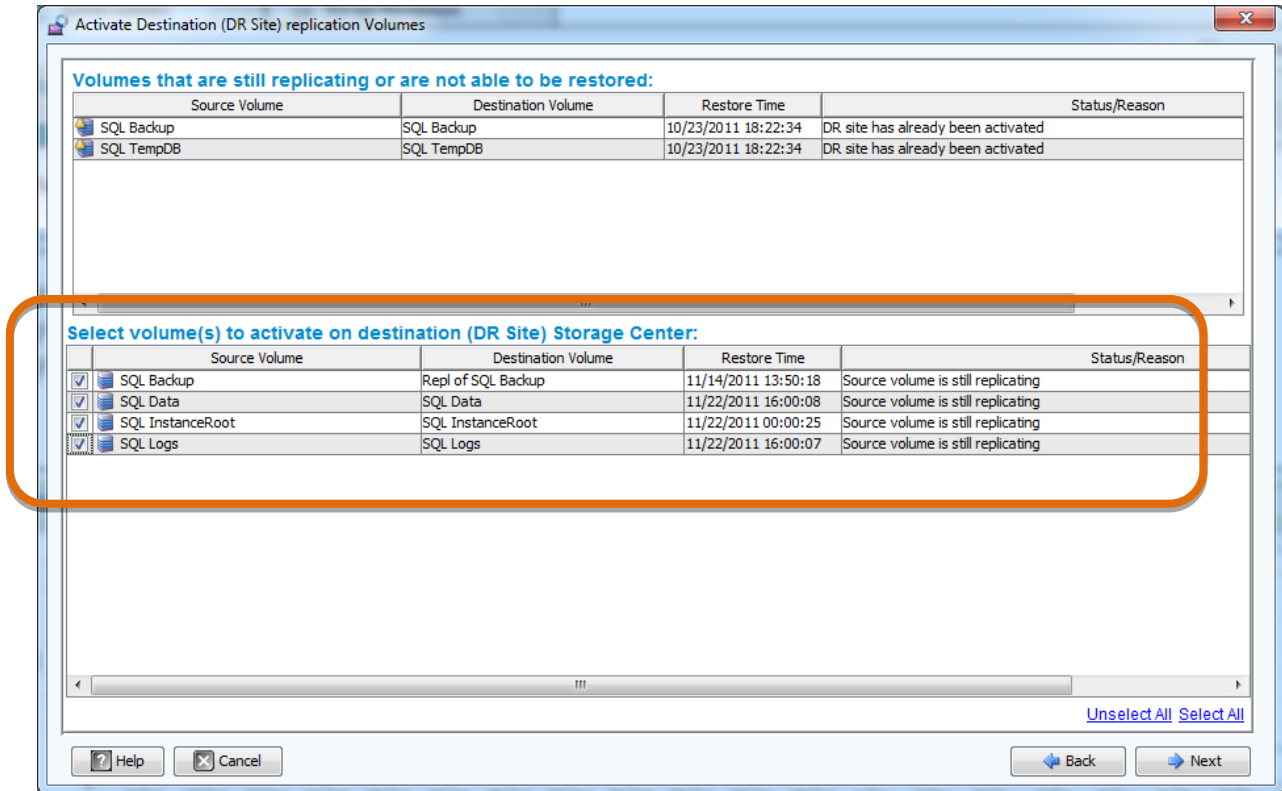SQL Server Disaster Recovery with Compellent Storage Center

Figure 7: Enterprise Manager – DR Test Activation

Select the source and destination Storage Centers.

On the next screen, select "Test Activation of View Volumes on Destination" and click "Next" to see the next screen.

On the screen below, select all the volumes that need to be "test activated" and click Next


On the next screen, click start. Please make sure to see the correct DR server name under the column Server. If there are changes that need to be made for any volume, select the volume and make the changes using "Edit Selected" button and click on Start.
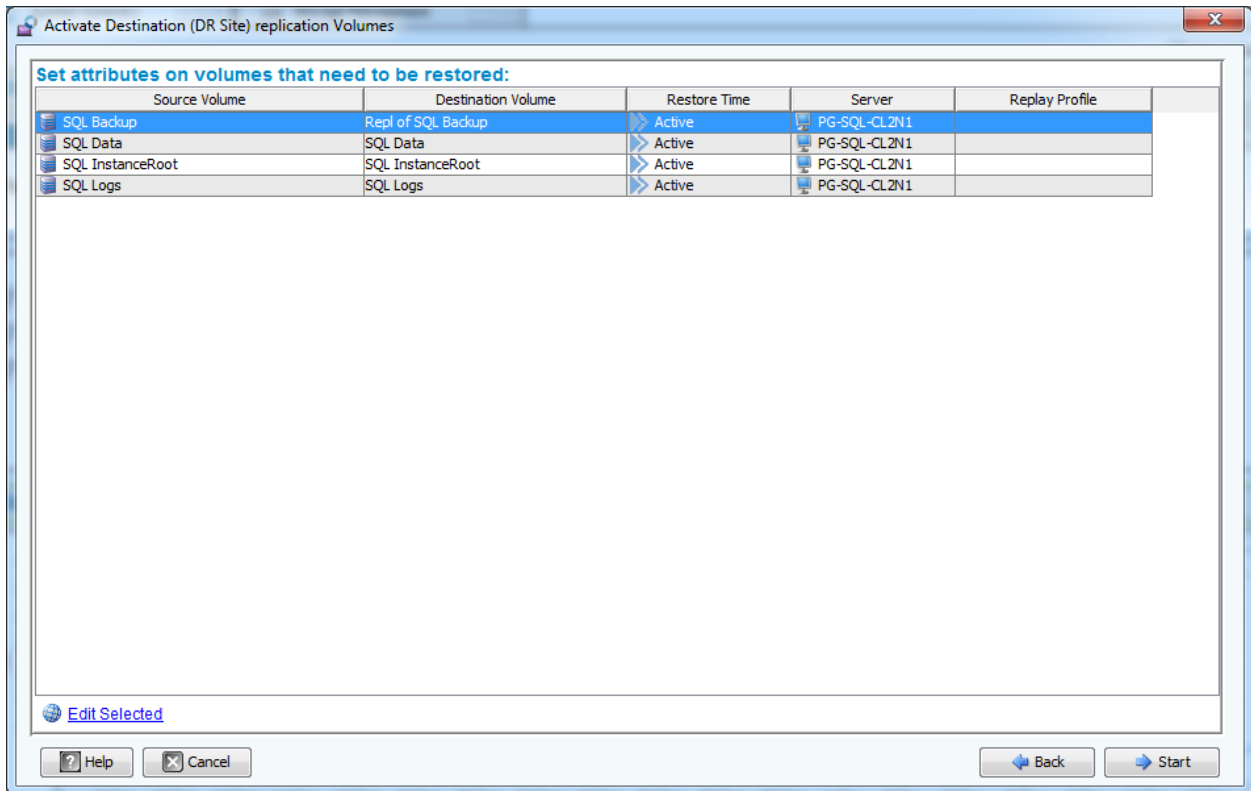
Wait till the next screen shows the "Restore Progress" state as "Restored" for all required volumes and click on "Finish" once done.
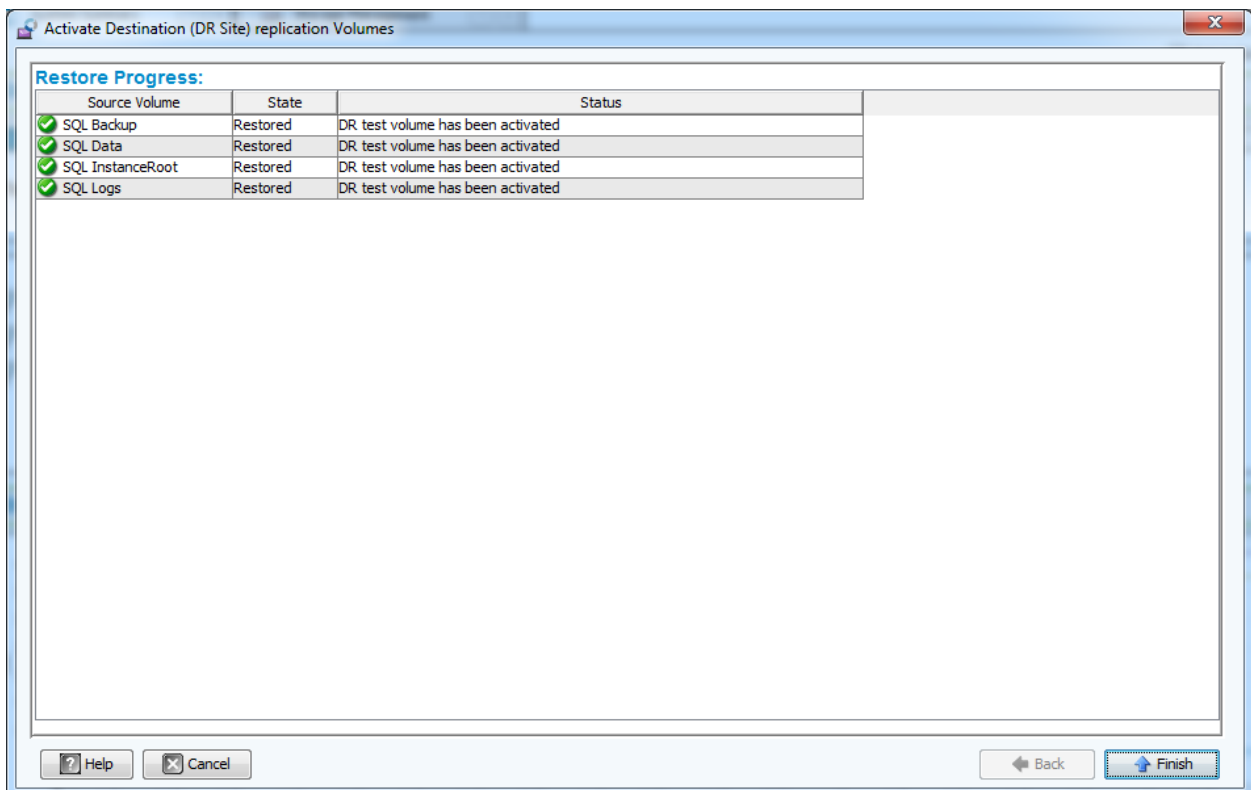
Once the DR Test Activation completes, connect to the DR server and within storage disk management, rescan the disks. Re-Scanning the disks will start showing up all the 4 disks. Online, Initialize the disks and assign appropriate drive letters to all these 4 disks. In the scenario above, the 4 volumes on DR server were named with drive letters J-> SQL Data, K -> SQL Logs, L -> SQL Instance Root and M -> SQL Backups.

After getting the volumes visible on the DR server, certain attributes on these volumes need to be cleared in order to recover the databases. This step is needed only when using the replays taken by Replay Manager which uses VSS (as compared to storage center). VSS assigns read-only, Hidden and Shadow-copy attributes to any volumes that have been created as a part of replay. It is important to clear these attributes for every volume being recovered. This activity can be automated using powershell or batch files. Please see below the process to clear the above attributes.

    A. Open command prompt on the DR server and type Diskpart. This will open the diskpart.exe command window.
    B. Type "List Volume" on the diskpart window. This command will list all the volumes that are shown up on this DR Server.
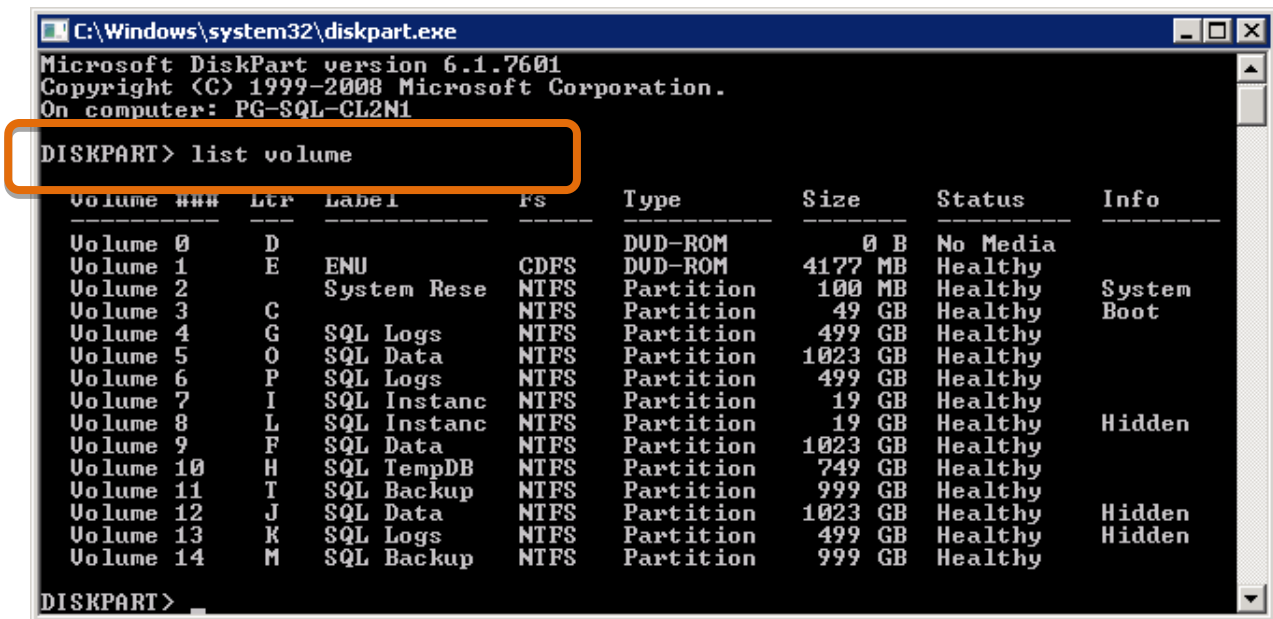

Figure 8: Disk part – Listing volumes

    c. Select the volume for which attributes need to be changed. In the scenario above, the attributes of the J-drive (volume 12) were changed. The command to be used for the activity would be "Select vol 12"
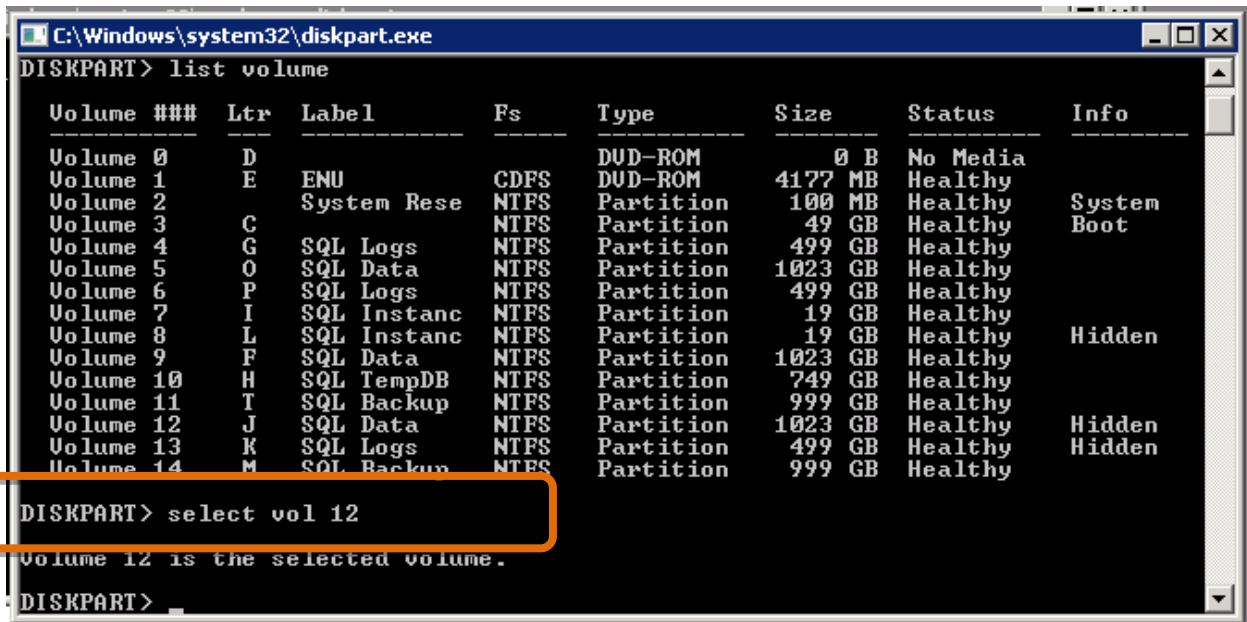
Figure 9: Disk part – Selecting volumes

d. Run the command below to confirm the attributes are set to Read-Only, Hidden and Shadow-Copy. The command is "Attribute vol"
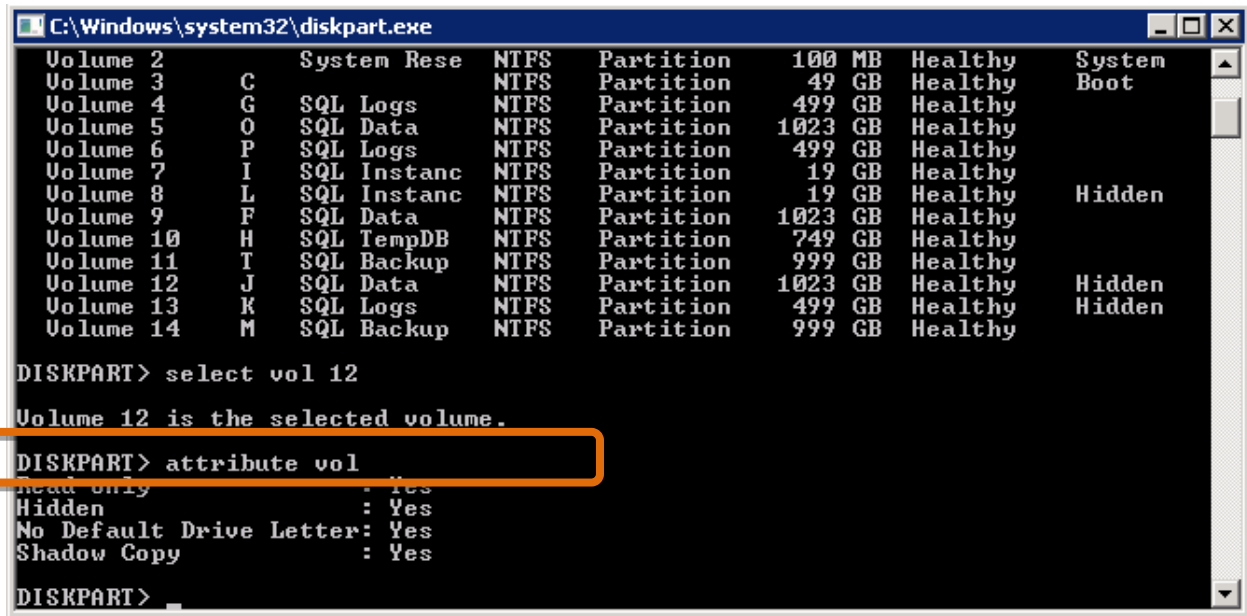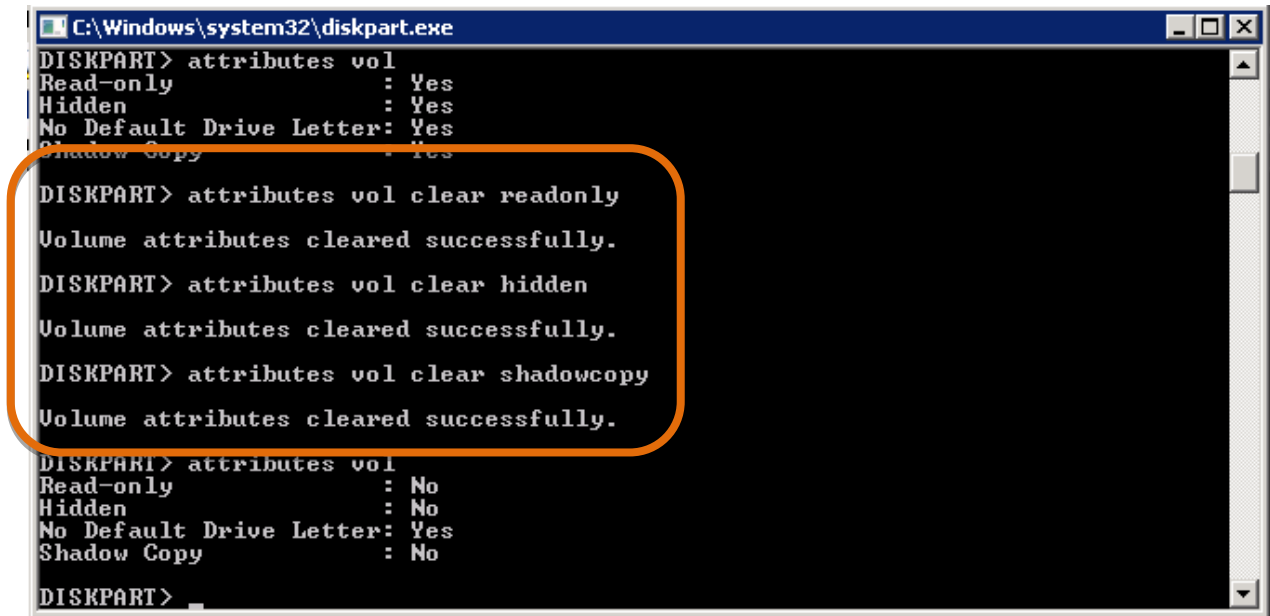

Figure 10: Disk part – View volume attributes

e. Run the following 3 commands to clear all these attributes and set the value to False.
  1. Attributes volume clear readonly
  2. Attributes volume clear hidden

3. Attributes volume clear shadowcopy

After running all these commands, re-run "attributes vol" to confirm that the attributes have cleared.

Figure 10: Disk part – Clear volume attributes

After getting the volumes visible on the DR server and setting appropriate attributes to each volume, recovering a database is a fairly straight forward process. Using SQL Server Management studio, the database can be attached using GUI or a script just as if attaching a normal SQL Database with data and log files.
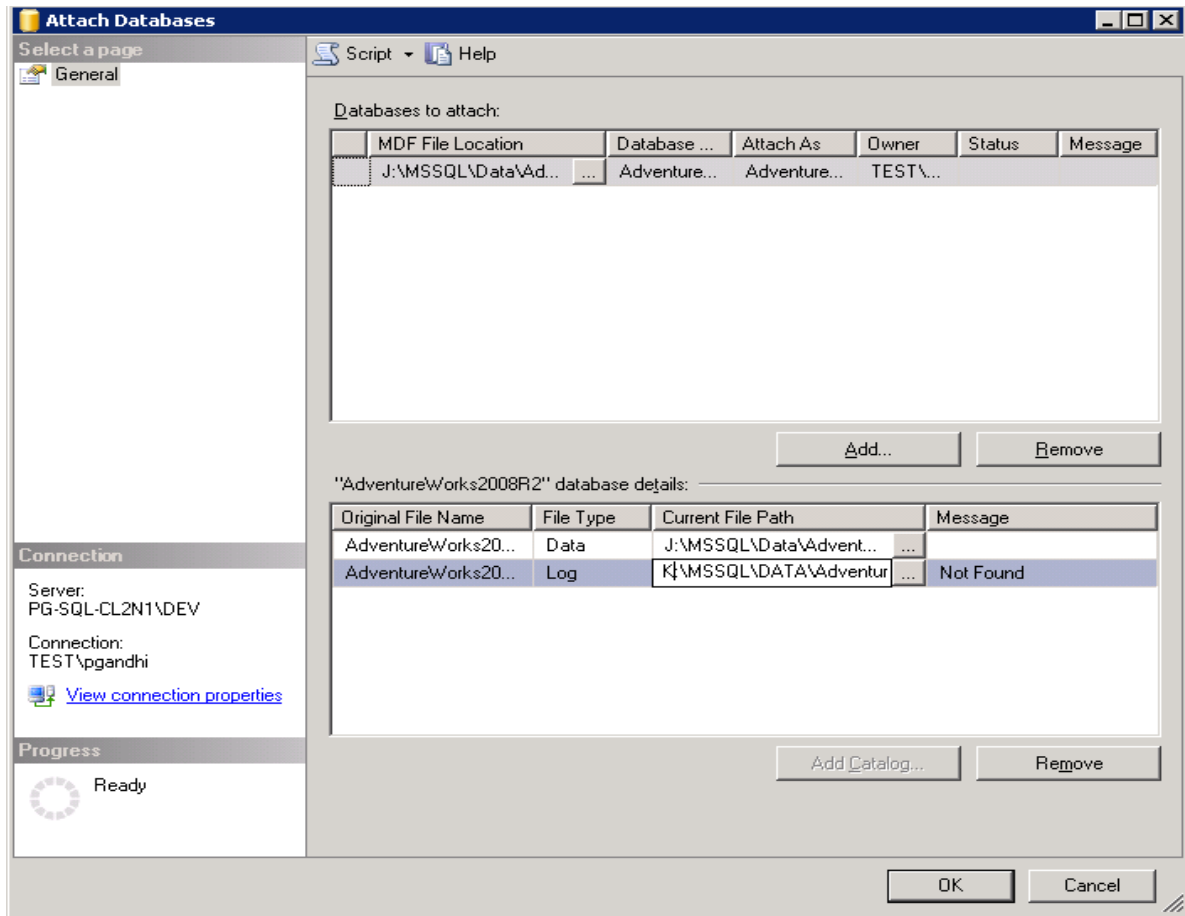
Figure 11: SQL Server Management studio – Attaching a database

Failing over to DR site

Now that the database volume replication is all set up and DR site pre-defined, DR site fail over can easily be achieved, if need be.

In order to fail over to the DR server in the scenario above, Enterprise Manager Client was used. Select the following option from menu:

"Replication Recovery -> Activate Disaster Recovery Site" (please see the screen below)
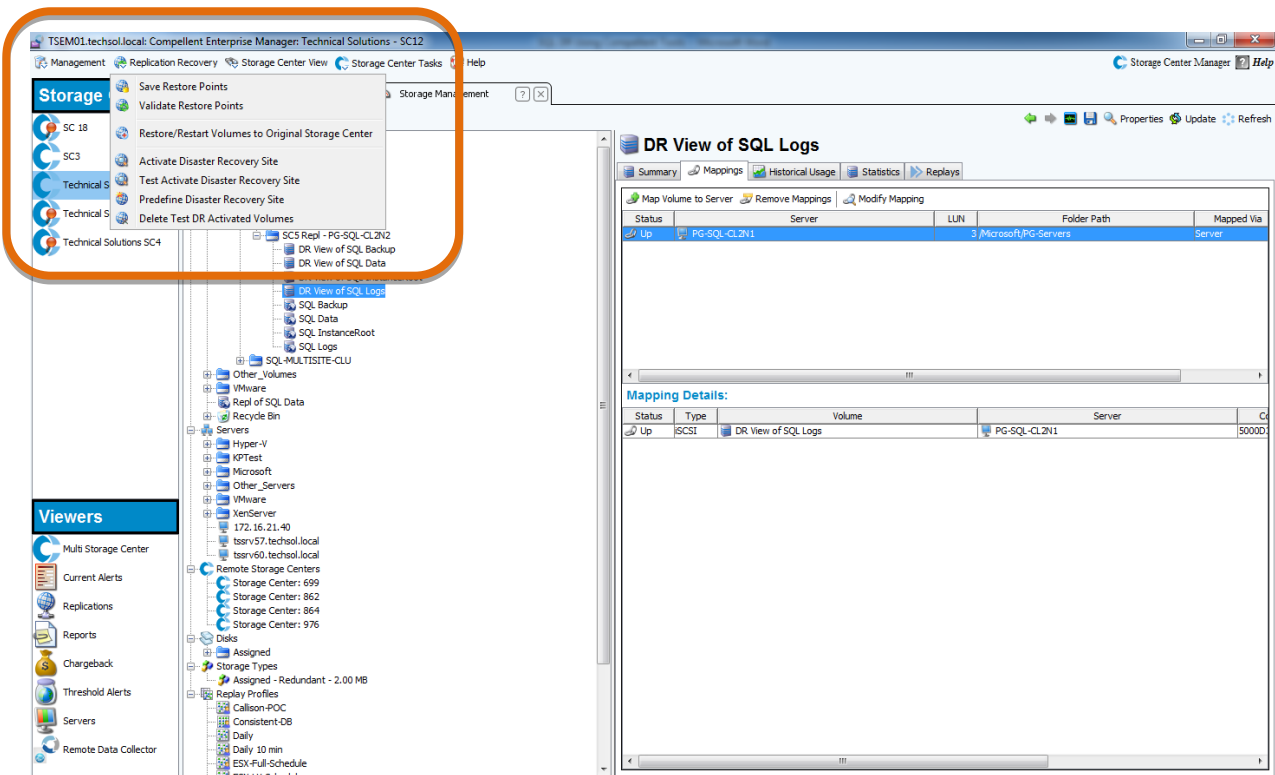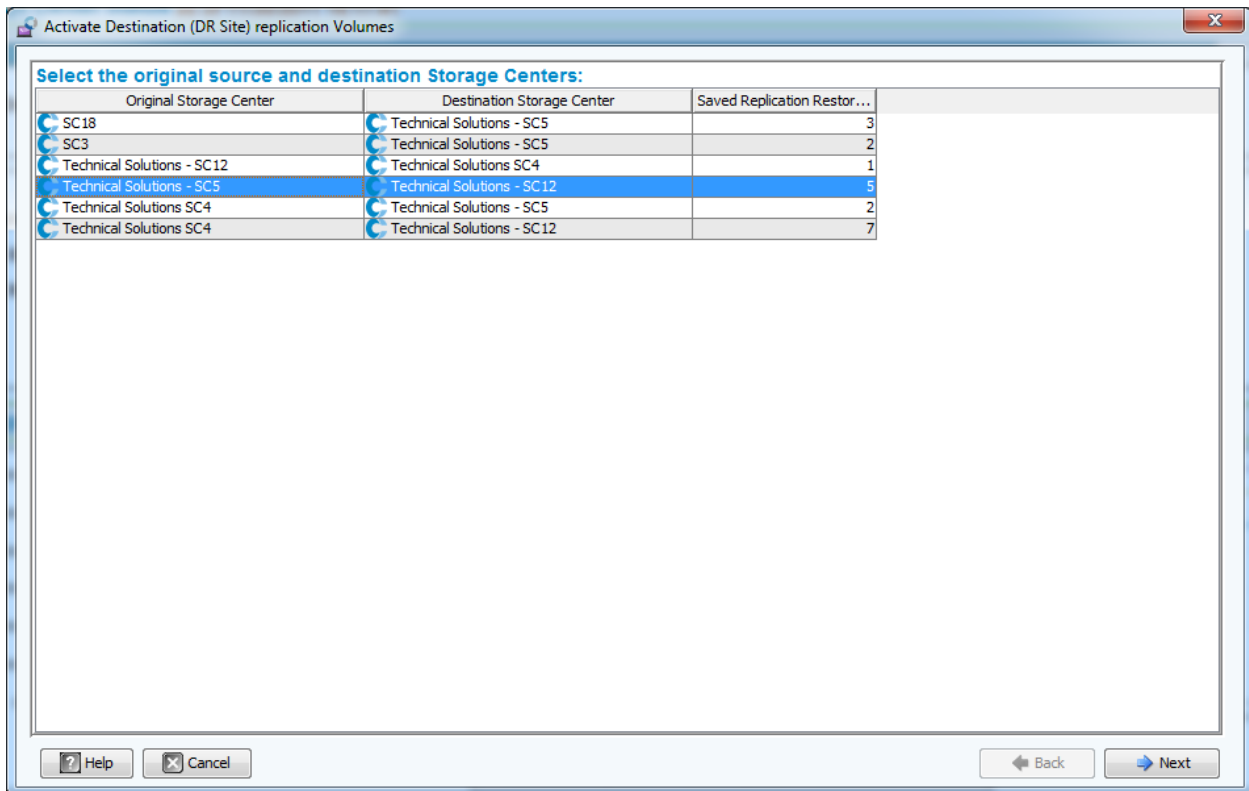
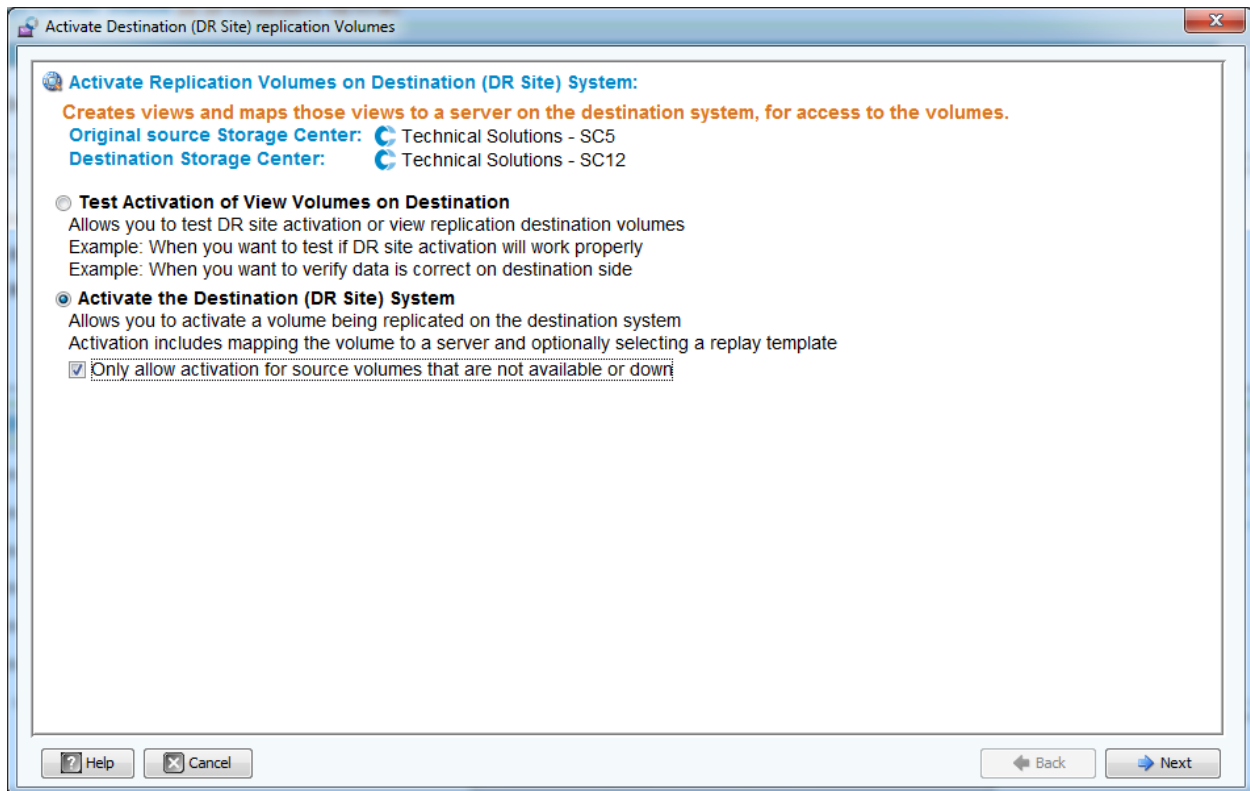**Figure 12: Enterprise Manager – DR Failover**

Select the source and destination Storage Centers. (SC5 to SC12 in the above scenario)

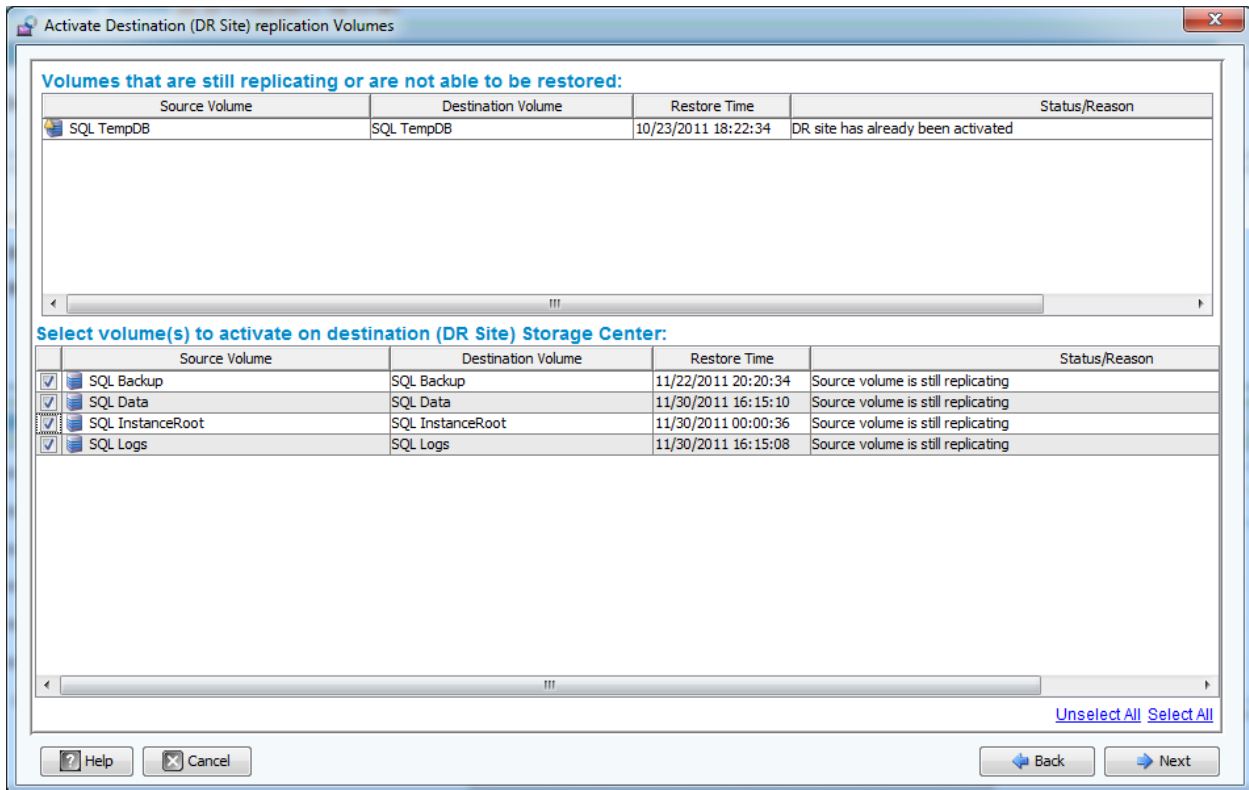On the next screen, select "Activate the Destination (DR Site) system", check the box "Only allow activation for source volumes that are not available or down" and click "Next" to see the next screen.

On the screen below, select all the volumes that need to be "Activated" and click "Next"

Select "Yes" for the warning below.
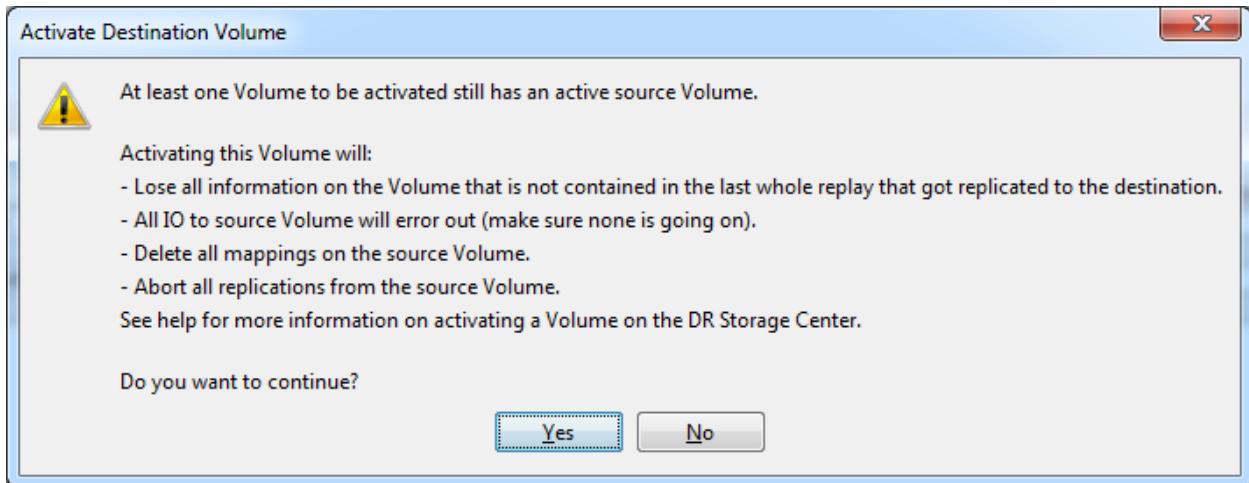
On the next screen, click start. Please make sure to see the correct DR server name under the column Server. If there are changes that need to be made for any volume, select the volume and make the changes using "Edit Selected" button and click on Start.

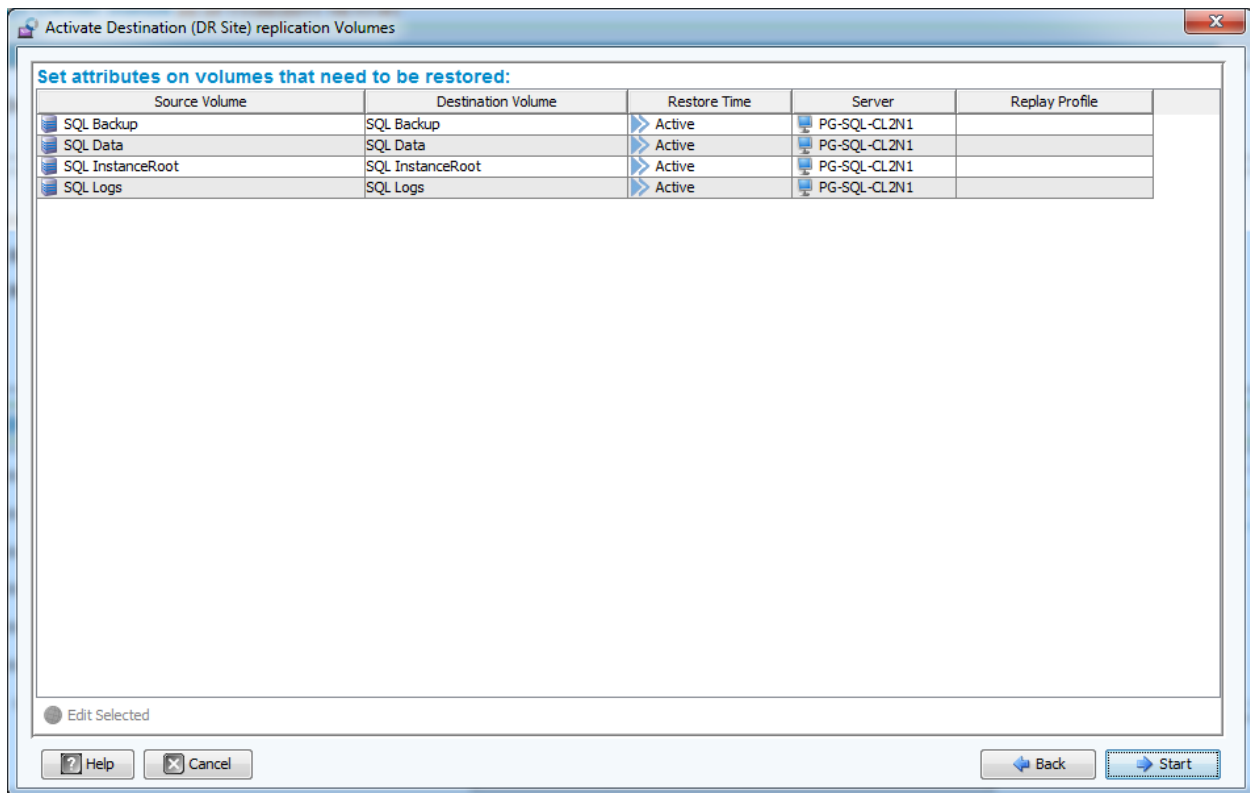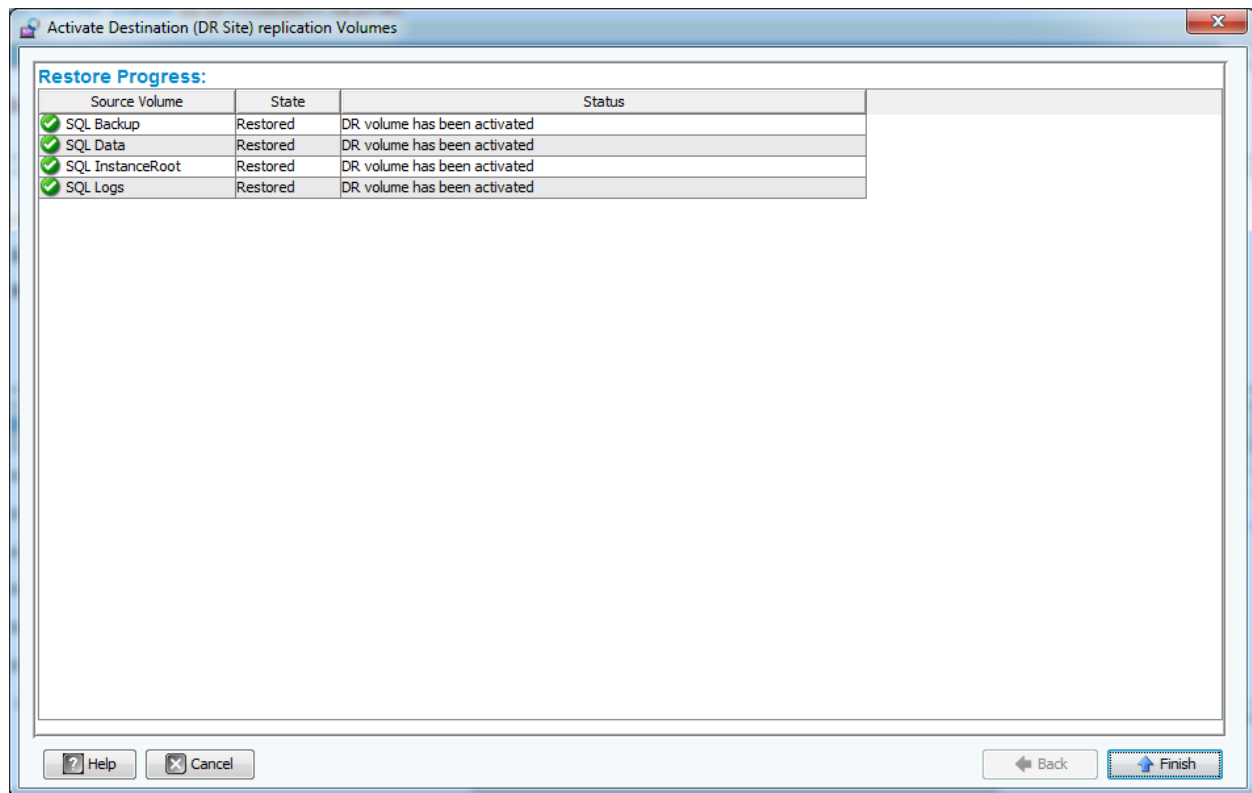Wait till the next screen shows the "Restore Progress" state as "Restored" for all required volumes and click on "Finish" once done.

Once the DR Activation completes, connect to the DR server and within storage disk management, rescan the disks. Re-Scanning the disks will start showing up all the 4 disks. Go ahead and Online, Initialize the disks and assign appropriate drive letters to all these 4 disks. In the scenario above, the 4 volumes on DR server were named with drive letters J-> SQL Data, K -> SQL Logs, L -> SQL Instance Root and M -> SQL Backups.

After getting the volumes visible on the DR server, certain attributes on these volumes needed to be cleared in order to recover the databases. This step is needed only when using the replays taken by Replay Manager which uses VSS (as compared to storage center). VSS assigns read-only, Hidden and Shadow-copy attributes to any volumes that have been created as a part of replay. It is important to clear these attributes for every volume being recovered. This activity can be automated using powershell or batch files. Please see below the process to clear the above attributes.

C. Open command prompt on the DR server and type Diskpart. This will open the diskpart.exe command window.

D. Type "List Volume" on the diskpart window. This command will list all the volumes that are shown up on this DR Server.

```
C:\Windows\system32\diskpart.exe                                        _ □ ×
Microsoft DiskPart version 6.1.7601
Copyright (C) 1999-2008 Microsoft Corporation.
On computer: PG-SQL-CL2N1

DISKPART> list volume

  Volume ###  Ltr  Label        Fs     Type        Size     Status     Info
  ----------  ---  -----------  -----  ----------  -------  ---------  --------
  Volume 0    D                        DVD-ROM         0 B  No Media
  Volume 1    E    ENU          CDFS   DVD-ROM     4177 MB  Healthy
  Volume 2         System Rese  NTFS   Partition    100 MB  Healthy    System
  Volume 3    C                 NTFS   Partition     49 GB  Healthy    Boot
  Volume 4    G    SQL Logs     NTFS   Partition    499 GB  Healthy
  Volume 5    O    SQL Data     NTFS   Partition   1023 GB  Healthy
  Volume 6    P    SQL Logs     NTFS   Partition    499 GB  Healthy
  Volume 7    I    SQL Instanc  NTFS   Partition     19 GB  Healthy
  Volume 8    L    SQL Instanc  NTFS   Partition     19 GB  Healthy    Hidden
  Volume 9    F    SQL Data     NTFS   Partition   1023 GB  Healthy
  Volume 10   H    SQL TempDB   NTFS   Partition    749 GB  Healthy
  Volume 11   T    SQL Backup   NTFS   Partition    999 GB  Healthy
  Volume 12   J    SQL Data     NTFS   Partition   1023 GB  Healthy    Hidden
  Volume 13   K    SQL Logs     NTFS   Partition    499 GB  Healthy    Hidden
  Volume 14   M    SQL Backup   NTFS   Partition    999 GB  Healthy

DISKPART>
```

f. Select the volume for which attributes need to be changed. In the scenario above, the attributes of the J-drive (volume 12) were changed. The command to be used for the activity would be "Select vol 12"

```
C:\Windows\system32\diskpart.exe                                        _ □ ×
DISKPART> list volume

  Volume ###  Ltr  Label        Fs     Type        Size     Status     Info
  ----------  ---  -----------  -----  ----------  -------  ---------  --------
  Volume 0    D                        DVD-ROM         0 B  No Media
  Volume 1    E    ENU          CDFS   DVD-ROM     4177 MB  Healthy
  Volume 2         System Rese  NTFS   Partition    100 MB  Healthy    System
  Volume 3    C                 NTFS   Partition     49 GB  Healthy    Boot
  Volume 4    G    SQL Logs     NTFS   Partition    499 GB  Healthy
  Volume 5    O    SQL Data     NTFS   Partition   1023 GB  Healthy
  Volume 6    P    SQL Logs     NTFS   Partition    499 GB  Healthy
  Volume 7    I    SQL Instanc  NTFS   Partition     19 GB  Healthy
  Volume 8    L    SQL Instanc  NTFS   Partition     19 GB  Healthy    Hidden
  Volume 9    F    SQL Data     NTFS   Partition   1023 GB  Healthy
  Volume 10   H    SQL TempDB   NTFS   Partition    749 GB  Healthy
  Volume 11   T    SQL Backup   NTFS   Partition    999 GB  Healthy
  Volume 12   J    SQL Data     NTFS   Partition   1023 GB  Healthy    Hidden
  Volume 13   K    SQL Logs     NTFS   Partition    499 GB  Healthy    Hidden
  Volume 14   M    SQL Backup   NTFS   Partition    999 GB  Healthy

DISKPART> select vol 12

Volume 12 is the selected volume.

DISKPART>
```

g. Run the command below to confirm the attributes are set to Read-Only, Hidden and Shadow-Copy. The command is "Attribute vol"
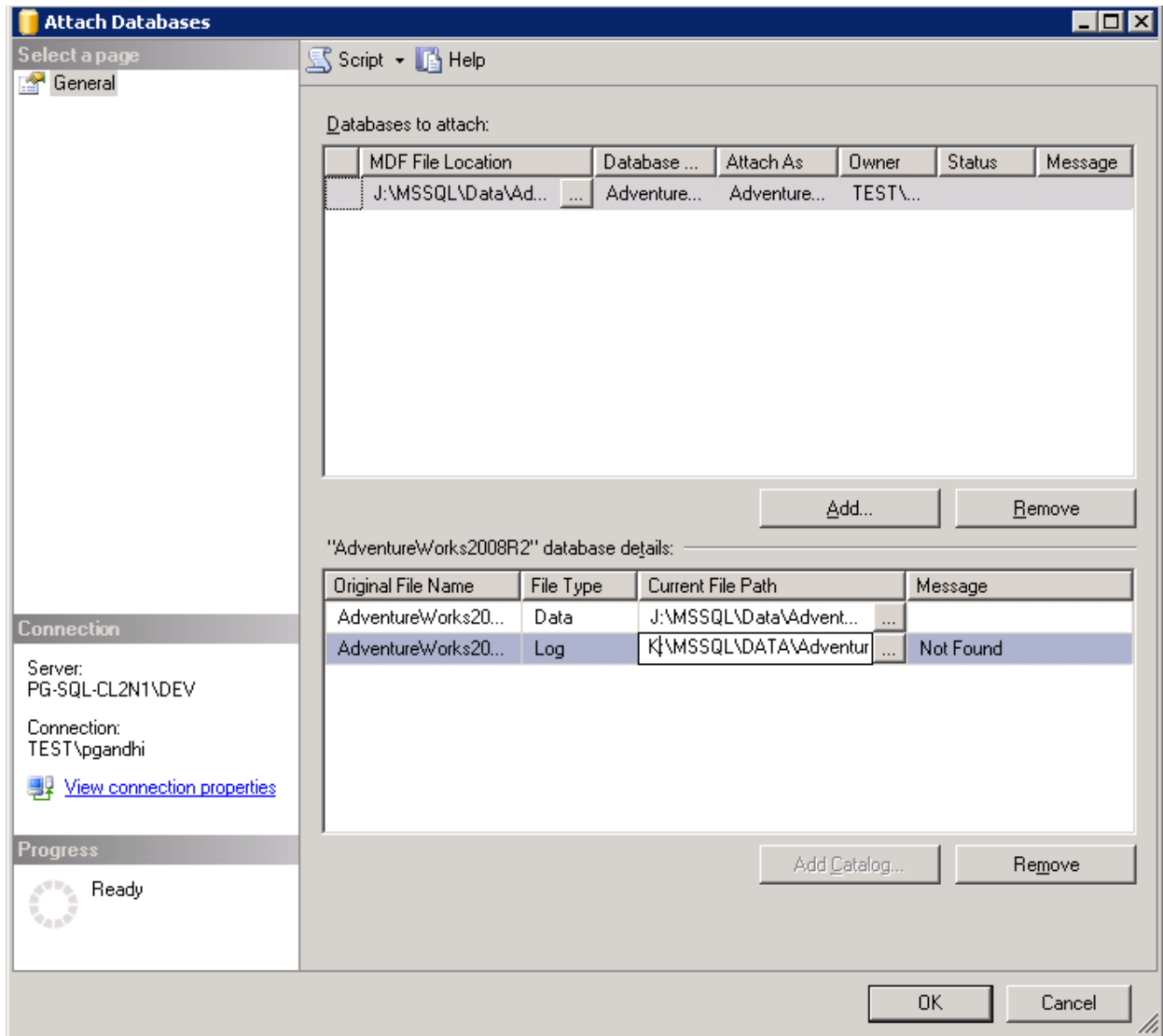
h. Run the following 3 commands to clear all these attributes and set the value to False.
    4. Attributes volume clear readonly
    5. Attributes volume clear hidden
    6. Attributes volume clear shadowcopy

After running all these commands, re-run "attributes vol" to confirm that the attributes have cleared.

After getting the volumes visible on the DR server and setting appropriate attributes to each volume, recovering a database is a fairly straight forward process. Using SQL Server Management studio, the database can be attached using GUI or a script just as if attaching a normal SQL Database with data and log files.

Pausing/Removing Replication

If replication needs to be either paused or removed replication for a particular volume, it can be done using Enterprise Manager Client.

For the scenario above, using Enterprise Manager Client,

1. Logon to the Enterprise Manager client

2. Click on "Replications" on the left bottom pane. This will populate a list of all the volumes that are being replicated on the right pane. In order to Narrow down, select the "Source storage center" (SC5) in my case. This will show all the volumes being replicated from SC5.

3. Right click the volume that needs to be paused or deleted and select "Pause" or "Delete" depending on the action needed.
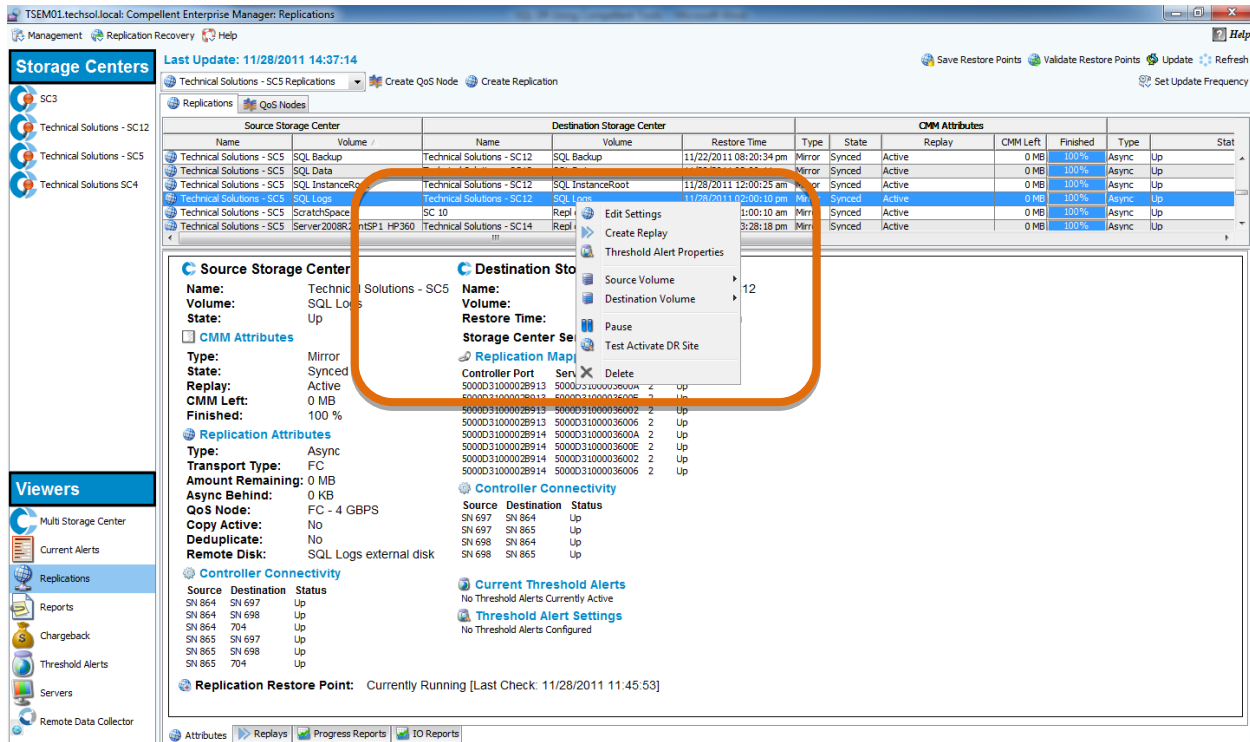

Figure 13: Enterprise Manager Client – Pausing/Deleting volume Replication

Powershell Automation

Dell Compellent provides an extremely powerful Powershell Command set. Using this Command set, one can automate all the activities that were performed above. The powershell documentation can be downloaded (http://kcint.compellent.com/Knowledge Center Documents/PSCS060100_003A.zip)

Conclusion

Using Compellent storage level replication data can be quickly and efficiently replicated across various sites geographically separated with extreme ease. This storage level replication provides various benefits over traditional SQL HA/DR solutions like point in time recovery, DR drill capability without impacting actual DR process. It is extremely easy to fail over between DR sites and also to fail back.