Protecting Hyper-V Workloads with Microsoft DPM 2012 R2 and Dell Compellent Storage Center

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Revisions

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Executive summary

It is not uncommon for enterprise companies to struggle with protecting company data produced by many different sources. In addition, this data may reside on many different platforms making data backup and recovery results inconsistent, difficult and time consuming.

Microsoft System Center 2012 – Data Protection Manager (DPM) enables disk-based and tape-based data protection and recovery for servers. This includes SQL Server, Exchange Server, SharePoint, virtual servers, file servers, and support for Windows desktops and laptops. DPM can also centrally manage system state and Bare Metal Recovery (BMR). DPM integrates with Dell Compellent Storage Center arrays to enable DPM to use the Microsoft Volume Shadow Copy Service (VSS). This ensures that the data is consistent when backed up and reliable if needed for recovery.
1 Preface

This document provides an overview of Microsoft System Center DPM 2012 R2 and introduces best practice guidelines for configuring DPM and Dell Compellent Storage Centers to take advantage of the Microsoft VSS and Dell Compellent space efficient Replay technology on Windows Hyper-V workloads.

1.1 Audience

The target audience for this white paper is DPM administrators, Exchange administrators, SQL Server system administrators, storage administrators, and architects who analyze, design, and maintain robust storage systems. Readers should be familiar with Microsoft Data Protection Manager and Dell Compellent Storage Center.

1.2 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.
2. **DPM Overview**

The Microsoft enterprise-scale backup and recovery tool, DPM, was updated for the release of System Center 2012 R2 (See section 2.2). It has a better centralized administration, more efficient use of SQL Server, better backup and restore of individual items in SharePoint and virtual machines, and improvements to tape backups.

2.1 **The role of DPM**

System Center DPM enables network backup-to-disk based storage including direct attached and storage area network drives. DPM can take backups many times per day which reduces file restore times and the risk of lost data. It also lets users restore their own files without IT assistance, removing a source of numerous help desk calls.

DPM natively supports tape backup and can back up running installations of SQL Server, Exchange Server, and SharePoint Server. DPM also backs up VMs and supports full bare-metal restoration of computers through the System Recovery Tool that is provided with DPM.

DPM protects VMs even during live migration of VMs among computers and can recover individual VM files, folders, volumes, and virtual hard disk files from a host-level backup. VMs can be restored to their original location or to an alternate host. DPM allows backup to the cloud and backup of data from non-Microsoft software through third parties.

2.2 **Improvements with DPM 2012 R2**

New or improved features in the 2012 R2 version of DPM include:

- Central management of more DPM servers (now up to 100); the ability to manage, administer, and monitor both new DPM 2012 and legacy DPM 2010 servers; perform remote recovery; and consolidate alerts via a centralized console.
- More granular role-based access (RBA) for administrators (similar to Exchange, SharePoint, and other Microsoft enterprise products) with seven built-in roles (such as recovery operator or tape operator) that all can be used with the Operations Manager console as well as DPM.
- Multiple DPM servers can share one instance of SQL Server for the backup database.
- Certificate-based authentication allows DPM to protect non-domain-joined computers in workgroups, and computers in untrusted domains without requiring local accounts or NTLM authentication.
- Better item-level recovery for SharePoint and VMs, including the backup and restoration of individual items such as files in Hyper-V guest VMs; even when DPM server itself is running as a VM. In DPM 2010, DPM server must be running on a physical machine for item-level recovery.
- Change block tracking so that DPM 2012 only transfers changed blocks in a VM rather than the entire virtual hard disk. This improves both backup and VM performance by reducing input-output operations.
- Automatic detection and protection of Virtual Machine Manager (VMM) servers.
• More flexible tape set definitions, including Protection Group Sets, which allows more efficient tape usage by allowing multiple DPM servers to use the same tapes.
• An updated console, similar to other System Center products, including the Ribbon with a WunderBar on the left side similar to Microsoft Outlook 2010.
• DPM now supports the use of clustered SQL Server nodes for its database. This removes the standalone limitation that existed in System Center 2012 and System Center 2012 SP1.
• DPM can be deployed in a virtual environment. DPM can be installed on a virtual machine, and configure storage using .vhd storage pool disks that are shared through the VMM library.
• DPM provides support for the protection and backup of Linux virtual machines, in addition to the support already provided for Hyper-V virtual machines.

Dell Compellent Storage Center overview

The Dell Compellent Storage Center SAN is an all-in-one storage array that allows organizations to actively manage data at a highly granular level using built-in intelligence and automation. This ultra-efficient, easy-to-manage storage solution optimizes drive utilization, dynamically moves data between storage tiers and RAID levels continuously protects data against downtime and disaster, scales on demand, and quickly adapts to ever-changing business needs. Storage Center enables organizations to cut the time, cost and risk of managing enterprise storage today and in the future.

3.1 Manage data differently

Part of the Dell Fluid Data architecture, Storage Center changes the way organizations manage data. Empowered by real-time system information about each block of data, Storage Center optimizes data placement, management and protection throughout its lifecycle. Storage is provisioned without wasting capacity. Data is moved where it’s needed, when it’s needed and is based on actual use and performance needs. Data is continuously protected using pointer-based snapshots. This level of data awareness also enables Storage Center to virtualize the storage infrastructure, bringing new efficiency, agility and resiliency to enterprise storage by creating a pool of high-performance storage shared by all servers and applications.

3.2 Scale on a persistent, open, agile platform

Storage Center is built on a flexible, persistent hardware platform that dynamically scales to meet business requirements. Unlike systems that require a rip-and-replace technology as your business needs change, Storage Center supports the continual adoption of new technologies as growth is required. Drive technologies can easily be mixed and matched to build a unified storage solution without ever worrying about a forklift upgrade. Any combination of industry-standard technology can be used at any time and capacity or configuration changes can be made at any time without downtime or disruption. Incorporating the latest data center technologies is as simple as plugging in new components on the fly. Storage Center adjusts automatically, restriping data across all drives and updating the in-flight use characteristics.

3.3 Increase storage efficiency with intelligent, automated software

Dell Compellent and Dell Fluid Data architecture empower organizations to move beyond simply storing data to actively managing data. Built-in intelligence and automation optimize the storage environment, and every enterprise feature is fully integrated for optimum efficiency, flexibility and performance. Storage Center leverages comprehensive software suite with advanced functionality. At the core of the solution is true storage virtualization, which pools all resources across the array for maximum efficiency and performance. Thin provisioning, automated tiered storage software, and space-efficient snapshot technology helps to get more out of your storage investment. Thin replication and dynamic business continuity software provide a cost-effective recovery and allow for the movement of volumes between arrays without disruption.
3.4 Resilient, available data keeps the enterprise at work

Dell Compellent Storage Center keeps critical customer data at the ready. With resilient hardware and software combined with world-class Copilot Support, enterprises realize the continuous data availability that is critical to customer success.
4 DPM process overview

DPM helps manage the process of protecting and recovering data on the file and application servers of a network. This topic describes the high-level steps needed to successfully protect and recover data in the DPM environment.

Protecting data: As illustrated in Figure 1, the high-level process used to protect data involves the following steps:

1. Select the data sources on a server that need protecting; whether it is an application server or a file server.
2. To start protecting data, DPM creates a full copy (referred to as a replica) of the selected data sources on the DPM server.
3. To continue protecting data, DPM synchronizes each replica with the data sources on a recurring schedule. When a replica is updated, it replaces the previous replica.
4. To support data recovery, DPM creates point-in-time copies (referred to as recovery points) of the replica on a recurring schedule. DPM maintains up to 64 recovery points for each replica.

![Figure 1 DPM Protection](image)
Recovering data: As illustrated in Figure 2, the high-level process for recovering data involves the following steps:

1. Select the version of the data to be recovered from the recovery points on the DPM server.
2. DPM restores a copy of the selected data to its point of origin on the server or to an alternate specified destination.

Figure 2 Recovery Points
Initial replication and recovery process

In this scenario, a single dynamic volume (sized accordingly) is presented from the Dell Compellent Storage Center to the DPM server which uses the volume for the recovery points.

Note: The transfer of backup data from the protected server to the DPM server occurs over the local area network (LAN).

DPM server configuration

1. If not already done, install a DPM server. This server, and the ones it will protect, must be a member of the same domain. For information on planning, deploying and installing System Center Data Protection Manager R2, refer to the Microsoft article Installing DPM on the TechNet Library at http://technet.microsoft.com/en-us/library/hh758153.aspx.

2. Open the Microsoft DPM Server console and install the DPM agent on the server to be protected (Management > Install...). The DPM agent install process uses the version of the Windows server to determine the restart requirements. For details see the Installing and Configuring Protection Agents article on the Microsoft TechNet Library at http://technet.microsoft.com/en-us/library/hh758039.aspx.

Storage pool configuration

1. DPM uses a storage pool to store its replicas and recovery points. This storage pool must be created as part of the DPM install process. Using the Dell Compellent Storage Center Manager or Enterprise Manager, create a new volume to be used in the storage pool which will contain the recovery points for DPM and its protected servers. Map the new volume up to the DPM server.

Note: This volume should be at least two times the size of the total amount of data that needs to be protected.

2. Open the Disk Management tool on the DPM server and rescan the disks. When the newly created disk appears, bring it online and initialize the disk. Do not create any partitions on the new disk; DPM creates the necessary partitions.

Figure 3 DPM Storage Pool
3. In the DPM console, click **Management in** the bottom left corner of the console, and then click **Disks**. Click **Add** to open the dialog box shown.

![Figure 4: Adding disks to storage pool](image)

4. Select the new disk under **Available Disks**, click **Add**, and then **OK**.

5. DPM will display that it is going to convert the selected disks to dynamic. Click **Yes**.
6. The disk is now assigned as a DPM storage pool disk.

Figure 5  Disks added to disk pool successfully
5.3 Protection group creation

A protection group is created to back up the servers assigned to it. Multiple protection groups containing different types of servers and applications can be created.

1. In the bottom left corner of the DPM console, click Protection; and then in the top left corner, click New to open the New Protection Group Wizard.
2. Click Next.

![New Protection Group Wizard screen](image)

3. Select Servers, and then click Next.
4. Select Group members from the **Available members** box. Clicking the plus sign expands the list to display all available data sources. Check the data source desired and then click **Next**.
5. Name the Protection group and click **Next**.

![Name the Protection group](image1)

6. Specify the short-term protection goals and click **Next**.

![Specify short-term goals](image2)

7. Review the storage pool disk space allocated for this protection group and click **Next**.

![Review Disk Allocation](image3)
8. Choose whether the replica gets created manually or automatically, and then click **Next**.

![Figure 12 Choose how the replica gets created](image)

9. Choose how a consistency check is run, and then click **Next**.

![Figure 13 Consistency check options](image)

10. On the presented summary page, review the settings and then click **Create Group**.

11. When the replica has been created, click **Close**.

12. The DPM server will configure the necessary partitions on the dynamic disk and then start to replicate across the network.
13. Windows task manager can be started on the DPM server. The network traffic generated by the initial replica creation can be monitored.

**Note:** This process can be network bandwidth intensive. Consider performing the initial replica creation process on large data sets during off-peak hours.
Figure 15  Example of traffic generated by initial replica creation
5.4 Recovery

The recovery process can be network intensive as data is copied from the DPM server back to the protected server. During this time, the DPM server will attempt to utilize as much of the NIC resources as possible on both the DPM server and protected server as indicated below.

**Note:** Consider using computer-level network bandwidth throttling. This is an option offered by DPM.

To recover data, follow these steps:

1. Click **Recovery** in the DPM Administrator Console.
2. Expand the **Recoverable Data** tree under the **Browse** filter and select an object to recover.
3. In the lower right-hand panel, select the desired recoverable item.
4. In the **Recovery Points for:** section, choose a date and time for the recovery point.

![Choose a Recovery Point](image-url)

Figure 16  Choose a Recovery Point
5. In the upper left-hand corner, click **Recover**.

![Figure 17 Click Recover button](image)

6. Follow the Recovery Wizard and choose the appropriate settings for the recovery.
6 Utilizing VSS integrated backup and recovery

In this scenario, a stand-alone Hyper-V guest VM running SQL Server will be backed up using DPM. Snapshots or replays of the volumes from the protected Hyper-V guest VM will be used as recovery points and backed up to the DPM server. This process leverages Dell Compellent Storage Center Data Instant Replay and uses the Microsoft VSS which is a built-in Windows service that facilitates and coordinates the creation of consistent copies of transaction-based data.

There are three important components of VSS:

1. **Requesters** initiate Shadow Copy creation, in this case, DPM.
2. **Providers** create the Shadow Copy; in this case the provider is the Dell Compellent Storage Center.
3. **Writers** prevent data inconsistency by coordinating with and providing a state of quiescence for the SQL database application prior to backup (please see Figure 20).

![Figure 18 VSS](image-url)
Hyper-V protection with Dell Compellent VSS hardware provider

**Note:** Dell Compellent’s VSS hardware provider is only available with the purchase of Dell Compellent Replay Manager for Microsoft servers. Microsoft strongly recommends the use of hardware snapshots via a VSS hardware provider for its applications.

7.1 Install the DPM agent

Open the Microsoft DPM Server console and install the DPM agent on the Hyper-V guest VMs that will be protected (Management > Agents > Install...). The server may require rebooting. The DPM agent install process determines this based on the version of Windows server being used.

7.2 Install the Dell Compellent VSS hardware provider

The Dell Compellent VSS hardware provider is configured via the Replay Manager Configuration wizard. The configuration of this wizard enables the connection to the Dell Compellent Storage Center which contains the cluster shared volumes (CSV) that are part of the Hyper-V cluster. Once the host, user name, password, and server object are specified and saved, VSS uses this configuration information to perform the hardware-based snapshots (replays).

1. On the Hyper-V host server, launch the Replay Manager installer and run the Service Setup Wizard. In the Feature Selection window, ensure that the Hyper-V Host Extension is selected.

![Install Replay Manager Extension](image-url)
2. Click **Install** to finish. This installs the Hyper-V extension and the service on the Hyper-V host.

**Note:** The Replay Manager Explorer must be installed in the same domain as the server that has the Replay Manager Service installed on it. This tool establishes the connection between the server and the Storage Center it uses. If the Replay Manager Explorer is installed already in this environment, this installation can be used to create the connection in steps 4 - 6 below (installing Replay Manager can be skipped). For more information about configuring Replay Manager, see the *Replay Manager v7.1 Administrator’s Guide* available on the Compellent Knowledge Center at [kc.compellent.com](http://kc.compellent.com).

3. On the Hyper-V Host, install the Replay Manager Explorer and start the application.

4. Click on **Add Server** in the upper left hand corner to display the **Connect to Server** box. Specify the server name or IP address or enter **LocalHost** and click **Connect**.

![Adding a server in Replay Manager Explorer](image)

5. Provide a user name and password for the server.

6. Click on the **System Configuration** tab. In **System Information**, enter the IP address, user name and password of the Dell Compellent Storage Center to which the server is attached. Once this connection is established, the Replay Manager Explorer can be closed. For more information about configuring Replay Manager, see the Replay Manager v7.1 Administrator’s guide.
7. To set up protection for the Hyper-V guest VM, open the DPM Administrator Console and create a new protection group. (See steps for creating a protection group in Section 5.3 of this document).

8. On the Group Members screen, expand Hyper-V and select the Hyper-V guest VM with SQL server running on it.

9. Name the protection group and continue through the wizard. Choose the appropriate settings for the environment and finish creating the group.

10. This will start the full replica of the Hyper-V guest VM. The following illustrations represent how this is accomplished.
   a. DPM (the VSS Requester) tells the Hyper-V guest VM that it is preparing to create an initial replica or recovery point of the guest VM. The VSS Writer then prepares the guest VM and its applications (SQL) for back up. The Replay Manager VSS Hardware Provider receives the call from DPM to take a replay of the guest VM.
b. With the Hyper-V guest VM and its application in a quiesced state, a replay is taken. A view volume is then created and mapped to the Hyper-V host that owns the guest VM.

Figure 24  View volume mapped to host
**Note**: This process can be viewed within the Dell Compellent Storage Center Manager. When the Replay is taken and the view volume is mapped to the Hyper-V host, a folder is created within the volumes area called VSS *(volume name)*. Within this folder, the volume, named VSS *(date) *(time)* can be viewed as it is mapped and backed up. This volume is then unmapped and deleted, however the folder will remain and will be re-used. (See *figure 25*).

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**Figure 25**  Dell Compellent Storage Manager view of mounted volume

- The data from the view volume of the replay that was mapped to the Hyper-V host is copied over the network to the DPM server storage pool.

**Figure 26**  Data copied to DPM storage pool

- Once the backup is complete, the volume is unmapped from the Hyper-V host server and deleted from the Storage Center.
e. The DPM console can be viewed to verify the backup job has completed successfully.

Figure 27  Volume unmapped and deleted
f. The application log of the Hyper-V guest VM that has been backed up can be viewed to determine if the VSS process properly quiesced and restarted I/O to the SQL database.

Figure 28  Verifying backup has completed

Figure 29  Viewing the SQL Server log
As stated above, DPM 2012 can leverage Dell Compellent VSS hardware provider for replays of Hyper-V guest VMs with either stand-alone or clustered guests using CSV. However, only Hyper-V workloads are supported using this method with the VSS hardware provider.
8 Recovery

The Recovery Wizard can be used to restore the entire Hyper-V guest VM. An item level recovery can be used to restore, for example, just SQL server databases and logs. Note that the recovery process uses the network to copy data from the DPM storage pool back to the target host. For more information on recovery options, refer to Operations Guide for System Center 2012 – Data Protection Manager at http://www.microsoft.com/en-us/download/details.aspx?id=29698.

![Recovery Wizard](image)

Figure 30 Recovering the data
Conclusion

Microsoft System Center Data Protection Manager 2012 R2 and Dell Compellent Replay Manager can utilize Dell Compellent Replay technology to create space efficient snapshots for data to be protected. The benefit of utilizing this method is automating the process of taking and using Replays, thus eliminating several potential breaking points in the backup operation. By leveraging Microsoft VSS, true application consistent protection can be achieved on Hyper-V workloads.
A Additional resources

For complete up-to-date information on Microsoft System Center Data Protection Manager please visit:  

For all operational documentation related to Microsoft System Center Data Protection Manager, please visit:  

For additional information about the Microsoft VSS, please visit: http://www.dellstorage.com/data-protection/data-protection-and-recovery/microsoft-vss.aspx

For additional information about Dell Compellent Replay Manager, please visit:  

For additional Dell Compellent best practices and resources, please visit the Tech Center at:  
http://en.community.dell.com/techcenter/