



SIOS DataKeeper Cluster Edition

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SIOS TECHNOLOGY CORP.

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1. SIOS DataKeeper Cluster Edition

Your information resource for SIOS DataKeeper Cluster Edition

SIOS Technology Corp. maintains documentation for all supported versions of SIOS DataKeeper Cluster Edition. We welcome your suggestions and feedback. To help us continue to improve our documentation, please complete our brief [Documentation Feedback Survey](#).

2. DataKeeper Cluster Edition Release Notes

SIOS DataKeeper Cluster Edition

Release Notes

Version 8.8.0

(Version 8 Update 8)

Released July 6, 2021

Important!!

Read This Document Before Attempting To Install Or Use This Product!

This document contains last minute information that must be considered before, during and after installation.

Introduction

SIOS DataKeeper Cluster Edition is a highly optimized host-based replication solution which integrates seamlessly with Windows Server 2019, Windows Server 2016, Windows Server 2012, Windows Server 2012 R2, and Windows Server 2008 R2/2008 R2 SP1 Failover Clustering. Features of Windows Server Failover Clustering such as cross-subnet failover and tunable heartbeat parameters make it easy for administrators to deploy geographically dispersed clusters. SIOS DataKeeper provides the data replication mechanism which extends both versions of Windows Clustering, allowing administrators to take advantage of these advanced features to support non-shared disk high availability configurations.

Once SIOS DataKeeper Cluster Edition is installed, a new storage class resource type called DataKeeper Volume is available. This new SIOS DataKeeper Volume resource can be used in place of the traditional Physical Disk shared storage resource to enable geographically dispersed clusters, also known as multi-site clusters.

New Features of SIOS DataKeeper Cluster Edition v8

Feature	Description
New in This Release	
General maintenance	Bug Fixes
New in Version 8.7.2	
vSphere 7.0	Support for VMware vSphere 7.0
General maintenance	Bug Fixes
New in Version 8.7.1	

Azure Stack	DataKeeper Cluster Edition now supports Azure Stack on Windows 2019
General maintenance	Bug Fixes
New in Version 8.7.0	
Windows 2019 Support	Full Support of Windows 2019 with Secure Boot
AWS Nitro System	DataKeeper now supports AWS Nitro System
General maintenance	Bug Fixes
New in Version 8.6.5	
General Maintenance	Bug Fixes.
New in Version 8.6.4	
Windows 2019 Support	DataKeeper now supports Windows 2019 (Restrictions v8.6.4 only)
Delay Writes when Write Queue limit is reached	Introduced the BlockWritesOnLimitReached tunable, which will delay writes when a mirror's queue reaches the HighWater or ByteLimit, rather than pausing the mirror and going into a resync state.
General maintenance	Bug Fixes
New in Version 8.6.3	
Queue Current Age	This Performance Monitor Counter value is the age of the oldest write request in the write queue.
General maintenance	Bug Fixes
New in Version 8.6.2	
Integration with SIOS iQ	DataKeeper now includes the DataKeeper Signal package to deliver events to SIOS iQ.
General Maintenance	Bug Fixes
New in Version 8.6.1	
General Maintenance	Bug Fixes
New in Version 8.6	
Tunable Write Queue Byte Limit	Users can specify the maximum number of bytes that can be allocated for the write queue of a mirror by changing the WriteQueueByteLimitMB registry value.
General Maintenance	Bug Fixes
New in Version 8.5.1	
Windows 2016 Support	DataKeeper now supports Windows 2016.
VSS Provider	SIOS VSS Provider has been disabled by default.
General Maintenance	Bug Fixes
New in Version 8.5	
CHANGEMIRRORTYPE	This EMCMD command is used to change the mirror type of a mirror that is part of a DataKeeper job.
Tunable bitmap block size	Users can modify the effective size of an entry in the DataKeeper intent log (bitmap) by changing the BitmapBytesPerBlock registry value.
General Maintenance	Bug Fixes
New in Version 8.4	

DataKeeper Volume Resource Health Check	DataKeeper Volume Resource Health Check determines if the underlying volume device becomes unreachable.
Target Bitmap File	Target writes are now tracked in a persistent target bitmap file.
General Maintenance	Bug Fixes
New in Version 8.3	
DataKeeper Notification Icon	The DataKeeper Notification Icon shows a summary of your DataKeeper mirrors in the Windows Notification Tray. In addition to the display functions, the DataKeeper Notification Icon also serves as a shortcut to managing your DataKeeper mirrors.
mirrorcleanup.cmd	This command will remove all remnants of a mirror for a selected volume on the local system only and should only be run when recommended by SIOS Support.
Powershell cmdlet support	Powershell cmdlets that can be used to create job(s), create mirror(s), remove job(s), remove mirror(s) and fetch information about a volume used in DataKeeper (New-DataKeeperMirror, New-DataKeeperJob, Remove-DataKeeperMirror, Remove-DataKeeperJob, Add-DataKeeperJobPair, Get-DataKeeperVolumeInfo).
DKHEALTHCHECK	Support status and issue identification tool. Provides command line interface for basic mirror status and problem detection.
General Maintenance	Bug Fixes
New in Version 8.2.1	
General Maintenance	Bug Fixes
New in Version 8.2	
DataKeeper Non-Mirrored Volume Cluster Resource	The DataKeeper Non-Mirrored Volume Cluster Resource allows users to use a local volume in a failover cluster without requiring that it be part of a mirror. Some of the common use cases for this feature include enabling rolling cluster OS upgrades on existing hardware and moving tempdb to local storage in SQL 2008 R2 clusters and earlier.
General Maintenance	Bug Fixes
New in Version 8.1	
General Maintenance	Bug Fixes
New in Version 8.0.1	
General Maintenance	Bug Fixes
New in Version 8.0	
Replicate to Node Outside of Cluster	DataKeeper now allows you to have a replication target which resides outside of the failover cluster.
Operating System Support	DataKeeper now only supports Windows 2008R2 and later 64-bit Operating Systems. To run on an earlier version of Windows or on 32-bit systems, you must use DataKeeper v7.
Windows 2012 R2 Support	DataKeeper now supports Windows 2012 R2.
General Maintenance	Bug Fixes

Bug Fixes

The following is a list of the latest bug fixes and enhancements.

	Description
PW-2284	emcmd . createjob should set shared volume configuration flags as appropriate
PW-2886	Warn users, and handle, missing and incorrectly initialized bitmap volumes
PW-3241	EMTray doesn't exit completely
PW-3360	Allow Failover Clustering File Share creation on non mirrored volume
PW-3412	Add information to logs to help debug Event ID 264 causing full resyncs
PW-3455	Server crashes when snapshot is taken

Product Definitions and Platforms

Product Requirements

Product	Operating Systems	Additional Software
Server Components	See the DKCE Support Matrix	<p>Hotfix – KB 951308</p> <p>https://support.microsoft.com/en-us/help/951308</p> <p>If protecting Hyper-V resources, Hotfix KB 958065</p> <p>https://support.microsoft.com/en-us/help/958065</p> <p>Note: These hotfixes are not required for Windows Server 2008 R2/2008 R2 SP1.</p> <p>Contact Microsoft for a fix that will allow NICs to be added to a Virtual Machine after the VM has been placed into a Failover Cluster. (For more information, see Hyper-V Host Cluster Error.)</p>
User Interface	See the DKCE Support Matrix	<p>MMC 3.0 – download from:</p> <p>https://download.cnet.com/Microsoft-Management-Console-3-0-for-Windows-XP-KB907265/3000-2206_4-10741230.html</p>

Note: All servers should run the same version of Windows and the same version of DataKeeper software.

Make sure you verify the following settings prior to installing and configuring SIOS DataKeeper Cluster Edition.

- **Important:** SIOS Technology Corp. recommends that users use Domain accounts that have local Admin privileges on all servers running DataKeeper. If you are using Local accounts, the username and passwords must match on all servers running DataKeeper. This recommendation is for all editions and all platforms.

- Follow Microsoft best practices for deploying geographically dispersed clusters, including changing the quorum mode majority node setting with a file share witness.
- DataKeeper Failover Cluster registration is automatic and occurs 60 seconds after the following events have occurred on each cluster node:
 - A DataKeeper Cluster Edition license has been installed on each cluster node.
 - The Windows server Failover Clustering feature has been installed on each server.
 - A Windows server Cluster configuration has been formed.

System Requirements for Datakeeper

Memory – with no mirrors or jobs configured.

Baseline Memory Usage:

Emtray.exe = 7,560 KB

Extmirrsvc.exe = 2,504 KB

Mmc.exe = 56,944 KB

Poolmon.exe(EmDB & EmMi) = 102.704 KB

Extmirr.sys = 367 KB

Processor Requirements – Refer to [Windows Processor Requirements](#).

Total = 167,277.7KB or 167.28 MB

Disk Space for Installation

667 MB

 **Note:** Memory and CPU usage will increase based on the number, size, and write activity of the mirrors.

Local Security Policy Requirement

If your Windows servers are not in a domain and you are going to run the DataKeeper Service as the local system account, the Local Security policy setting “**Network Access: Let Everyone permissions apply to anonymous users**” must be enabled.

Known Issues

Windows 2016

- [Occasional job creation failure](#)

SCVMM 2012

If using DataKeeper with SCVMM 2012, you must use SCVMM 2012 SP1.

Windows Server 2012

For issues and enhancements related to **Windows Server 2012**, see the following topics:

[WSFC 2012 Failover Cluster Manager UI Defect](#)

[Manual Creation of a Mirror in WSFC](#)

[WSFC 2012 Cluster Creation Default Setting Issue](#)

[WSFC 2012 File Shares Cannot be Created for File Server Resource](#)

[WSFC 2012 Server Manager — Incorrect Volume Display](#)

[WSFC 2012 Server Manager — DataKeeper “Disk” Not Shown as Clustered](#)

[Windows Server 2012 Default Information Missing During Mirror Creation](#)

[Windows Server 2012 DataKeeper MMC Snap-in Crash](#)

[Windows Server 2012 — Simultaneous Move of Multiple Clustered File Server Roles Can Result in DataKeeper Switchover Failures](#)

[Windows Server 2012 iSCSI Target Role Does Not Support Dynamic Disks](#)

[Using iSCSI Target with DataKeeper](#)

Also see the [Known Issues and Workarounds](#) and [Restrictions](#) sections of DataKeeper Cluster Edition Technical Documentation.

DataKeeper Cluster Edition Quick Start Guide

To get started using SteelEye DataKeeper Cluster Edition, refer to the [DataKeeper Cluster Edition Quick Start Guide](#).

3. DataKeeper Cluster Edition Quick Start Guide

This topic provides step-by-step instructions for installing and configuring DataKeeper Cluster Edition. The series of steps includes links to the documentation that describe each step in detail.

Prerequisites and Installation

1. Read the [DataKeeper Cluster Edition Release Notes](#) for late breaking information.
2. [Firewall Configurations](#) – Make sure you understand what ports must be opened on any firewalls.
3. [Network Bandwidth](#) – If replicating across a WAN, it is critical that a [rate of change](#) analysis be done to ensure there is adequate bandwidth.
4. DataKeeper is a block-level volume replication solution and requires that each node in the cluster have additional volume(s) (other than the system drive) that are the same size and same drive letters. Please review [Volume Considerations](#) for additional information regarding storage requirements.
5. Configure your Cluster – It is important to have Windows Server configured as a cluster using either a node majority quorum (if there is an odd number of nodes) or a node and file share majority quorum (if there is an even number of nodes). Consult the Microsoft documentation on clustering or this article on the [Clustering for Mere Mortals](#) blog for step-by-step instructions. Microsoft released a [hotfix](#) that allows disabling of a node's vote which may help achieve a higher level of availability in certain multi-site cluster configurations. This hotfix and when it should be used is described in this article in [Clustering for Mere Mortals](#).
6. After the basic cluster is configured but prior to any cluster resources being created, install and license DataKeeper Cluster Edition on all cluster nodes. See the [DataKeeper Cluster Edition Installation Guide](#) for detailed instructions.

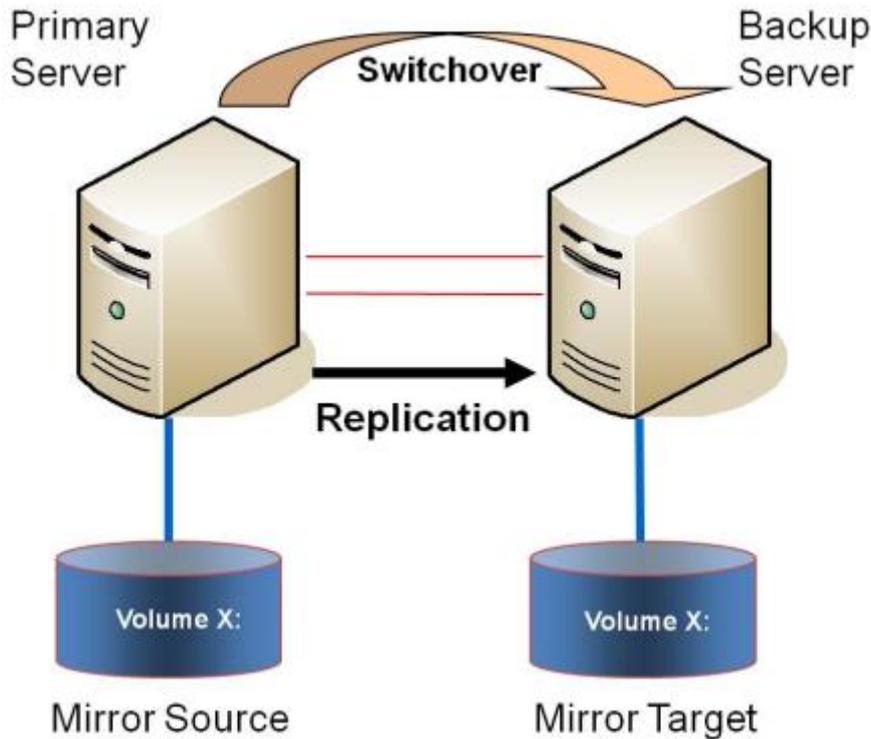
 DataKeeper automatically installs .NET 4.7.2 and does not uninstall/remove any existing versions that are already installed.

 **Note – If installing DataKeeper Cluster Edition on Windows “Core” (GUI-less Windows), make sure to read this section for detailed instructions – [Installing and Using DataKeeper on Windows 2008R2 Server Core Platforms](#).**

Configuration

The following sections describe the most common cluster configurations. Follow the instructions in the section that most likely matches your environment.

2-Node Replicated Cluster

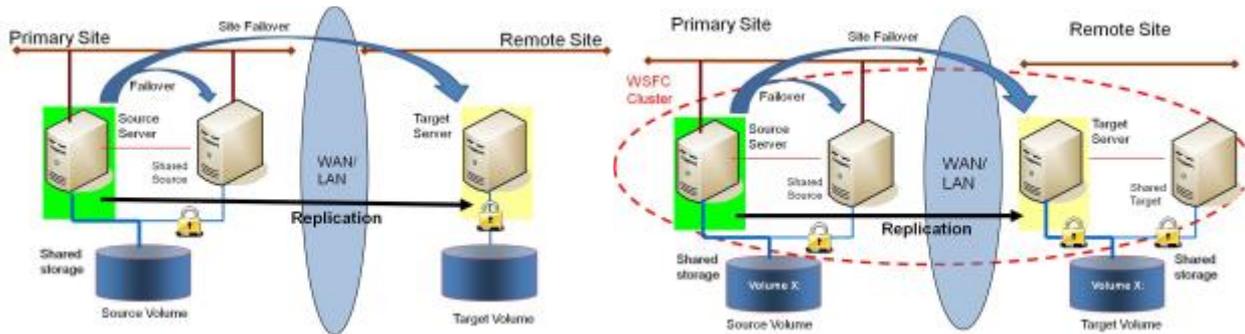


1. [Verify/Install licensing](#) via the License Manager.
2. The initial configuration must be done from the [DataKeeper UI](#) running on one of the cluster nodes. If it is not possible to run the DataKeeper UI on a cluster node, such as when running DataKeeper on a Windows Core only server, install the DataKeeper UI on any computer running Windows XP or higher and follow the instruction in the [Core Only](#) section for creating a mirror and registering the cluster resources via the CLI.
3. Once the DataKeeper UI is running, [connect to each of the nodes](#) in the cluster.
4. [Create a Job](#) using the DataKeeper UI. This process creates a mirror and adds the DataKeeper Volume resource to the Available Storage.

Note – If clustering Hyper-V VMs, do not add the DataKeeper Volume Resource to Available Storage at the end of the mirror creation process. Instead, allow the mirror to create but do not choose to register the DataKeeper Volume in Available Storage at the end of the Mirror Creation Wizard, then follow the instructions on this page, [Using DataKeeper Cluster Edition to Enable Multi-Site Hyper-V Clusters](#). Make sure that Virtual Network Names for NIC connections are identical on all cluster nodes.

5. If additional mirrors are required, you can [Add a Mirror to a Job](#).
6. With the DataKeeper Volume(s) now in Available Storage, you are able to create cluster resources (SQL, File Server, etc.) in the same way as if there were a shared disk resource in the cluster. Refer to Microsoft documentation for additional information or view this article in [Clustering for Mere Mortals](#) for step-by-step cluster configuration instructions.

3- or 4-Node Multi-Site Cluster with Mixed Shared/Replicated Storage



1. [Verify/Install licensing](#) via the License Manager.
2. The initial configuration must be done from the [DataKeeper UI](#) running on one of the cluster nodes. If it is not possible to run the DataKeeper UI on a cluster node, such as when running DataKeeper on a Windows Core only server, install the DataKeeper UI on any computer running Windows XP or higher and follow the instruction in the [Core Only](#) section for creating a mirror and registering the cluster resources via the CLI.
3. Once the DataKeeper UI is running, [connect to each of the nodes](#) in the cluster. Important – In order for DataKeeper to detect that a disk is shared, ALL of the nodes of the cluster must be connected to through the DataKeeper UI.
4. Prior to creating the DataKeeper Job, the storage must be configured such that the nodes located in the same location each have access to the shared storage. The instructions for the [Safe Creation of a Shared-Storage Volume](#) contain the information needed to safely give both servers access to shared storage once the storage has been provisioned and the same LUN has been handed off to each of the shared cluster nodes. The process of provisioning the storage and handing it off to two or more servers at the same time will be dependent upon the storage array. Please refer to your storage documentation for instructions on provisioning storage for clustered environments.
5. [Create a job](#) using the instructions in “[Creating Mirrors With Shared Volumes.](#)” This process creates a mirror as well as collects information about the shared disks and then adds the DataKeeper Volume resource to the Available Storage.

Note – If clustering Hyper-V VMs, do not add the DataKeeper Volume Resource to Available Storage at the end of the mirror creation process. Instead, allow the mirror to create but do not choose to register the DataKeeper Volume in Available Storage at the end of the Mirror Creation Wizard, then follow the instructions on this page, [Using DataKeeper Cluster Edition to Enable Multi-Site Hyper-V Clusters](#). Make sure that Virtual Network Names for NIC connections are identical on all cluster nodes.

6. If additional mirrors are required, you can [Add a Mirror to a Job](#).
7. With the DataKeeper Volume(s) now in Available Storage, you are able to create cluster resources (SQL, File Server, etc.) in the same way as if there were a shared disk resource in the cluster. Refer to Microsoft documentation for additional information or view this article in [Clustering for Mere Mortals](#) for step-by-step cluster configuration instructions.

Management

Once a DataKeeper volume is registered with Windows Server Failover Clustering, all of the management of that volume will be done through the Windows Server Failover Clustering interface. All of the management functions normally available in DataKeeper [will be disabled](#) on any volume that is under cluster control. Instead, the DataKeeper Volume cluster resource will control the mirror direction, so when a DataKeeper Volume comes online on a node, that node becomes the source of the mirror. The properties of the DataKeeper Volume cluster resource also display basic mirroring information such as the source, target, type and state of the mirror.

For more information, please refer to the [DataKeeper Cluster Edition Technical Documentation](#).

Troubleshooting

Use the following resources to help troubleshoot issues:

- [Troubleshooting](#) issues section
- For customers with a support contract – <http://us.sios.com/support/overview/>
- For evaluation customers only – [Pre-sales support](#)

4. Deploying DataKeeper Cluster Edition in AWS

Introduction

- [Best Practices](#)
- [Recommended Instance Types](#)
- [Manual Deployment of a SQL Server Failover Cluster Instance](#)
- [Automatic Deployment of a SQL Server Failover Cluster Instance](#)

4.1. Best Practices

The following recommendations should be followed for optimal performance. They include considerations specific to both the Windows operating system and AWS Cloud configuration. The primary component of SIOS DataKeeper is an upper filter volume driver. This driver tracks and processes every request sent to a source volume, and therefore incurs some overhead for all volume operations. When properly configured this overhead can be as low as 2%, but this is not usually expected in cloud environments. The average customer should see somewhere between 10% and 20% overhead when operating in the cloud.

- **Instance Size** – Replication performance relies on several factors. CPU usage is minimal, but RAM utilization depends entirely on network performance, peak active workload, volume read/write latency, and the number of concurrent mirrors under load. With these considerations in mind SIOS recommends using instance sizes that have at least medium network performance, enable EBS optimization by default, and provide at least one instance storage volume that is NOT EBS-only. The r3.xlarge instance size is the smallest recommended instance size if performance is a concern. However, SIOS DataKeeper can be installed on any size currently available. For a full list of sizes supported refer to Supported Instance Sizes.
- **Instance Storage Automatic Initialization** – If you are using Instance Storage for DataKeeper Bitmaps, make sure that the Amazon EC2Launch Disk Initialization script is set to automatically initialize the instance storage disks. You can run the Powershell script “get-scheduledtasks” and verify that the Amazon “InitializeDisks.ps1” script is set to be automatically executed at system boot. If your system is using the EC2Launch V2 service, look at the Volume initialization tab and verify that volumes are chosen to be initialized at boot time.

These Amazon initialization scripts initialize instance storage disks and create volumes on them, assigning the highest available drive letter (Z: by default – Y: if Z: is already in use, etc.). Set your bitmap drive to be the correct letter assigned by the Amazon script.

 Before checking for the following two features (EBS Optimization and ENA Support), verify the **AWS CLI client software is installed** on the system and then run “aws configure”.

- **EBS Optimization** – This feature needs to be Enabled / True for performance in AWS with DK. Confirm using the following command:

```
aws ec2 describe-instances --instance-ids instance_id --region region --query "Reservations[.Instances[.EbsOptimized]"
```
- **ENA Support (Enhanced Networking)** – This feature needs to be Enabled / True for performance in AWS with DK. Confirm using the following command:

```
aws ec2 describe-instances --instance-ids instance_id --region region --query
"Reservations[].Instances[].EnaSupport"
```

✿ To avoid poor performance, relocate the bitmap file to AWS ephemeral storage. See [DataKeeper Intent Log files on AWS Ephemeral Storage](#) for more information.

✿ When installing DataKeeper manually, make sure the ephemeral drive is reattached after the instance is shut down and restarted. Refer to [EC2Launch](#) for more information.

- **Instance Storage** – Several features of SIOS DataKeeper rely on very low latency volume access. Bitmap storage must be configured to reside on a *non*-EBS-only instance storage volume. This should be automatically configured if using one of the general purpose SIOS DataKeeper AMIs, but any nodes in which SIOS DataKeeper is installed manually will need to configure this manually as well (refer to [Relocation of Intent Log](#)). Manual configuration will also be needed if using the SIOS DataKeeper for SAP ASCS/ERS on Windows AMIs as they do not have this setting pre-configured. It is also possible to place the bitmap file on either a storage pool volume consisting of several disks striped together or low latency io1 volumes. There is a cost-performance trade-off that should be evaluated and performance tested before using either of these methods in production. Using instance storage volumes however is extremely low cost, and offers comparable performance without unnecessary configuration required.
- **Volume Properties** – While a simple volume is all that is required for proper mirror operation, more advanced techniques can be used to minimize read/write latency. SIOS recommends creating identical **Storage Pools** to support mirror volumes on both source and target systems. This QuickStart does **not** configure Storage Pools during deployment. Storage Spaces Direct is not compatible with SIOS DataKeeper and should not be used (refer to <https://techcommunity.microsoft.com/t5/Storage-at-Microsoft/Using-the-Storage-Pools-page-in-Server-Manager-to-create-storage/ba-p/424656> for more information).
- **Rolling Back A System Snapshot** – The snapshot taken gives you the state of the system at that time. Using AWS / Azure as an example – if that system is restored with that full system snapshot then you have to **force a full resync** for all of the mirrors (whether it is the **source system or the target system**) to make sure the data is the same on **both systems** after the restore is done.

RTO and RPO – SIOS DataKeeper does not add significantly to a typical cluster single-server outage failover RTO. Assuming appropriate instance sizes are utilized, resource contention is not an issue, SIOS DataKeeper is properly configured and in the mirroring state, and assuming trivial application recovery time an RTO of <1 minute is possible. Realistically an RTO of between 2 and 5 minutes should be expected unless the application being protected (MSSQL, SAP, etc.) has an unusually large recovery time.

Assuming the same conditions, RPO should be only a few milliseconds larger than the current network write latency between the source and target nodes. RPO can be measured with this counter [Performance Monitor Counters](#).

In many cases the RPO will be measured in milliseconds, but things like network congestion, abnormally high disk write activity, or slow write performance on the target server can impact RPO greatly. SIOS DataKeeper does not conflict with EBS snapshots, and can be used in conjunction with them on the source system. However, restoring a source volume from snapshot is not trivial, and will require a full resync of all data protected by the applicable mirror before the above RPO guidelines are applicable again.

4.2. Recommended Instance Types

SIOS maintains AMIs for the following instances. Not all instance types are available in all regions. If one of the bellow types are not available it is probably due to the base instance type not being available in the region currently selected.

The following were chosen as they all support EBS-optimization enabled by default, true instance storage, and at least medium network performance. SIOS DataKeeper is supported on most other instance types, but will need to be manually installed and configured. If a desired size is not included below please refer to [Best Practices](#) to ensure proper configuration.

Instance types currently available as AMIs:

m3.xlarge
m3.2xlarge
m5d.large
m5d.xlarge
m5d.2xlarge
m5d.4xlarge
m5d.8xlarge
m5d.12xlarge
m5d.16xlarge
m5d.24xlarge
m5d.metal
m5dn.large
m5dn.xlarge
m5dn.2xlarge
m5dn.4xlarge
m5dn.8xlarge
m5dn.12xlarge
m5dn.16xlarge
m5dn.24xlarge
c3.xlarge
c3.2xlarge
c3.4xlarge
c5d.large
c5d.xlarge
c5d.2xlarge
c5d.4xlarge
c5d.9xlarge
c5d.12xlarge
c5d.18xlarge
c5d.24xlarge
c5d.metal
x1.16xlarge

x1.32xlarge
x1e.xlarge
x1e.2xlarge
x1e.4xlarge
x1e.8xlarge
x1e.16xlarge
x1e.32xlarge
r3.xlarge
r3.2xlarge
r3.4xlarge
r5d.large
r5d.xlarge
r5d.2xlarge
r5d.4xlarge
r5d.8xlarge
r5d.12xlarge
r5d.16xlarge
r5d.24xlarge
r5d.metal
r5dn.large
r5dn.xlarge
r5dn.2xlarge
r5dn.4xlarge
r5dn.8xlarge
r5dn.12xlarge
r5dn.16xlarge
r5dn.24xlarge
p2.xlarge
p2.8xlarge
p2.16xlarge
p3dn.24xlarge
g2.2xlarge
g3.4xlarge
g3.8xlarge
g3.16xlarge
g3s.xlarge
g4dn.xlarge
g4dn.2xlarge
g4dn.4xlarge
g4dn.8xlarge
g4dn.12xlarge
g4dn.16xlarge
h1.2xlarge
h1.4xlarge
h1.8xlarge

h1.16xlarge
i2.xlarge
i2.2xlarge
i2.4xlarge
i3.large
i3.xlarge
i3.2xlarge
i3.4xlarge
i3.8xlarge
i3.16xlarge
i3.metal
i3en.large
i3en.xlarge
i3en.2xlarge
i3en.3xlarge
i3en.6xlarge
i3en.12xlarge
i3en.24xlarge
i3en.metal
d2.xlarge
d2.2xlarge
d2.4xlarge
d2.8xlarge
z1d.large
z1d.xlarge
z1d.2xlarge
z1d.3xlarge
z1d.6xlarge
z1d.12xlarge
z1d.metal

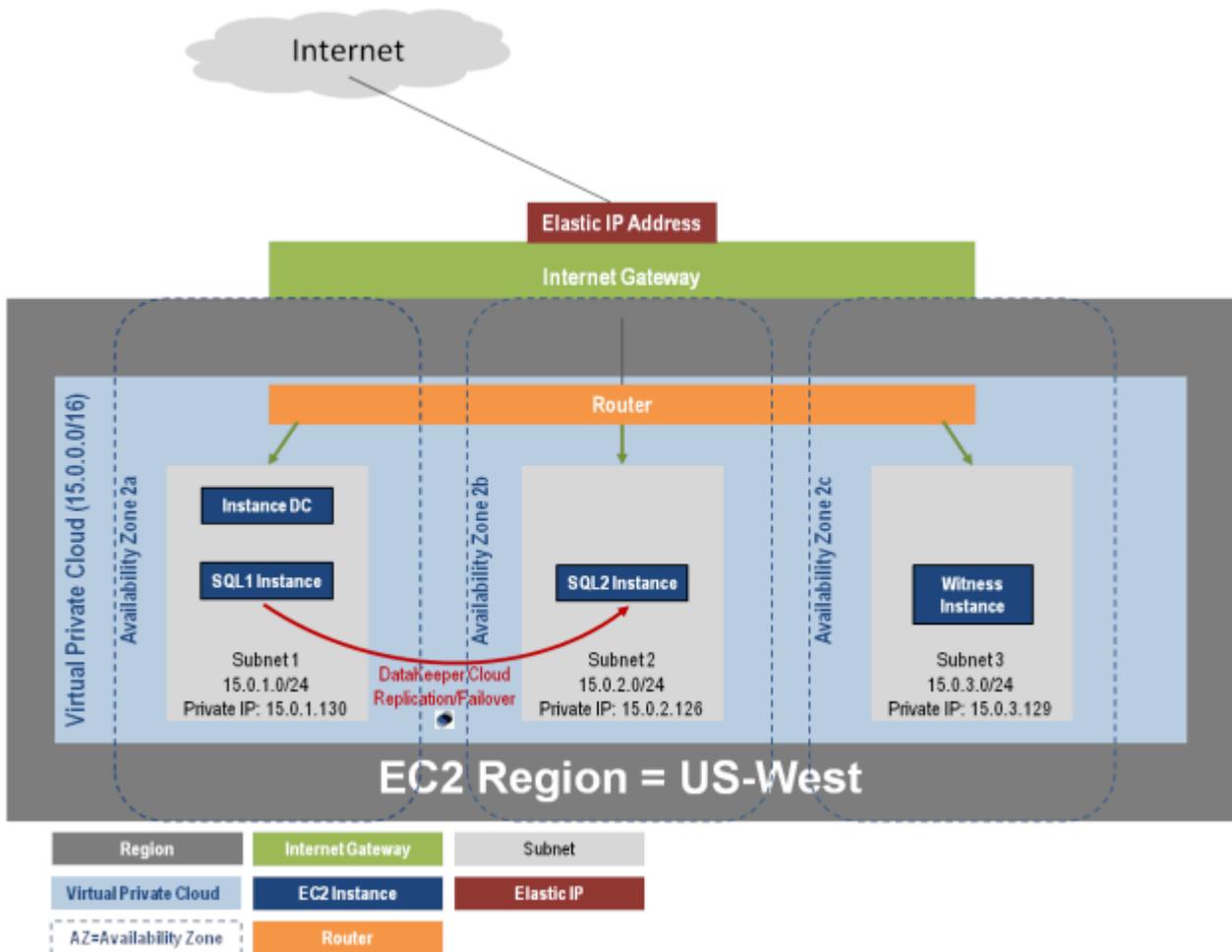
4.3. Manual Deployment of a SQL Server Failover Cluster Instance

* **DISCLAIMER:** While the following completely covers the high availability portion within the scope of our product, this is a setup “guide” only and should be adapted to your own configuration.

* Please refer to the [AWS Marketplace](#) for a list of supported instance sizes.

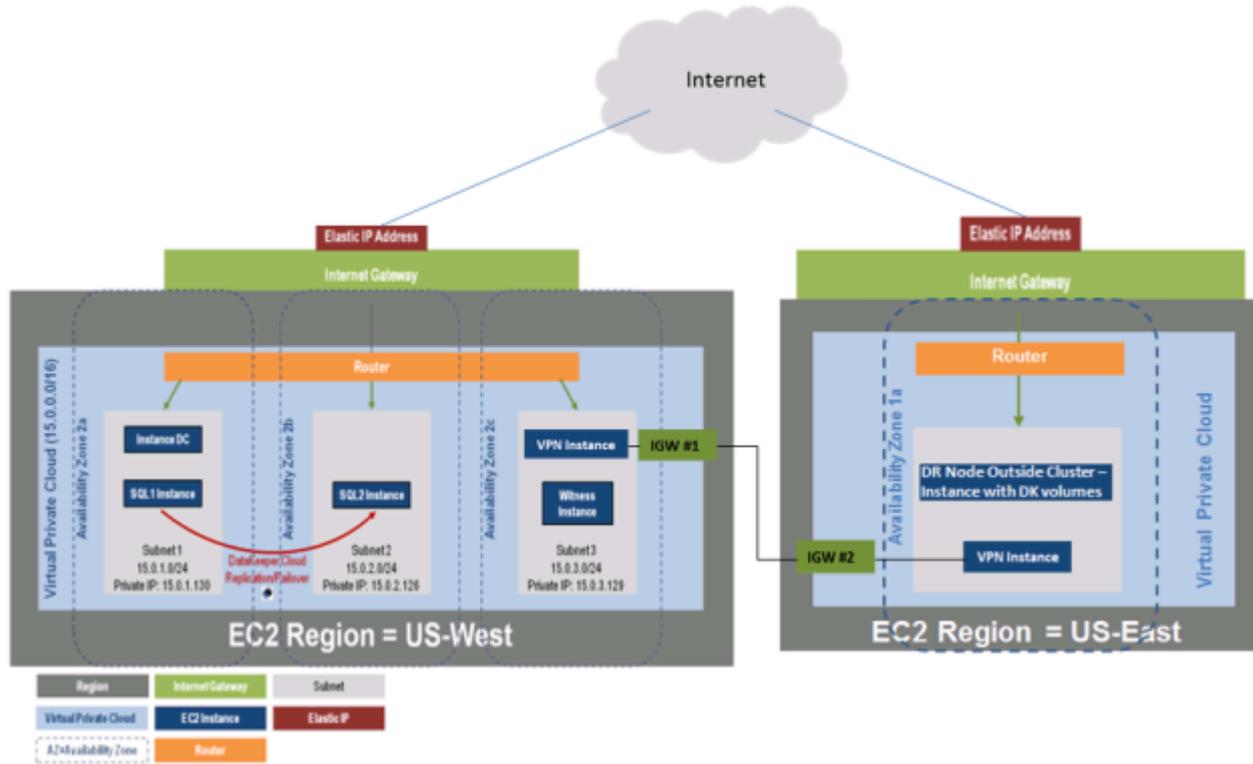
Overview

DataKeeper Cluster Edition provides replication in a virtual private cloud (VPC) within a single region across availability zones. In this particular SQL Server clustering example, we will launch four instances (one domain controller instance, two SQL Server instances and a quorum/witness instance) into three availability zones.

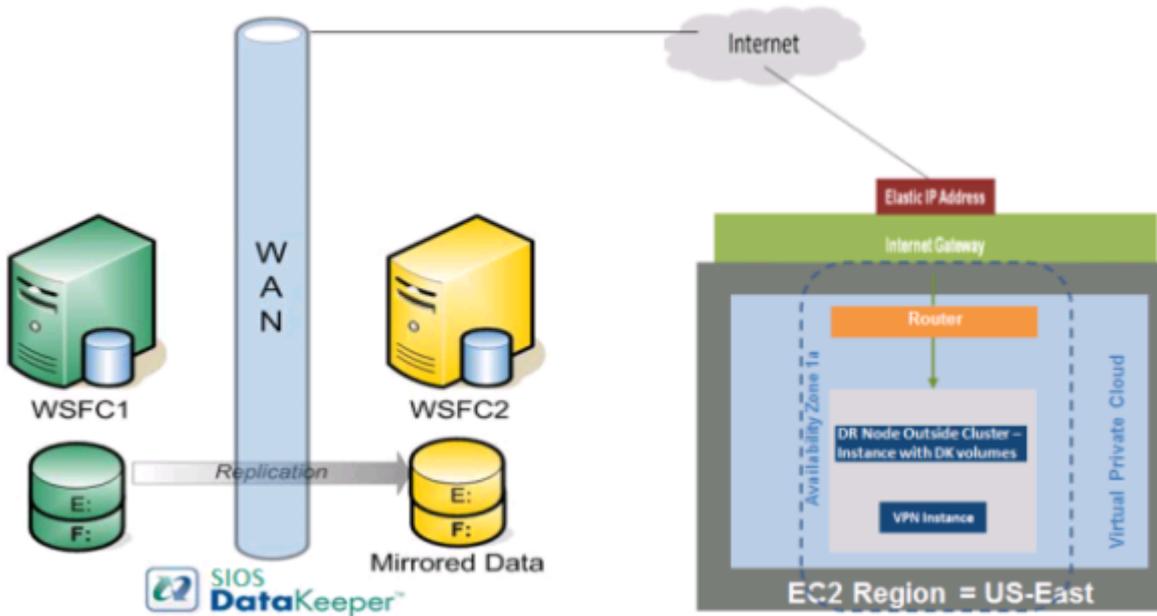


DataKeeper Cluster Edition provides support for a data replication node outside of the cluster with all nodes in AWS. In this particular SQL Server clustering example, four instances are launched (one

domain controller instance, two SQL Server instances and a quorum/witness instance) into three availability zones. Then an additional DataKeeper instance is launched in a second region including a VPN instance in both regions. Please see [Configuration of Data Replication From a Cluster Node to External DR Site](#) for more information. For additional information on using multiple regions please see [Connecting Multiple VPCs with EC2 Instances](#).



DataKeeper Cluster Edition also provides support for a data replication node outside of the cluster with only the node outside of the cluster in AWS. In this particular SQL Server clustering example, WSFC1 and WSFC2 are in an on-site cluster replicating to an AWS instance. Then an additional DataKeeper instance is launched in a region in AWS. Please see [Configuration of Data Replication From a Cluster Node to External DR Site](#) for more information.



Requirements

Description	Requirement
Virtual Private Cloud	In a single region with three availability zones
Instance Type	Minimum recommended instance type: M1 Medium
Operating System	See the DKCE Support Matrix
Elastic IP	One elastic IP address connected to the domain controller
Four instances	One domain controller instance, two SQL Server instances and one quorum/witness instance
Each SQL Server	ENI (Elastic Network Interface) with 4 IPs <ul style="list-style-type: none"> • Primary ENI IP statically defined in Windows and used by DataKeeper Cluster Edition • Three IPs maintained by EC2 while used by Windows Failover Clustering , DTC and SQLFC
Volumes	Three volumes (EBS and NTFS only) <ul style="list-style-type: none"> • One primary volume (C drive) • Two additional volumes <ul style="list-style-type: none"> ◦ One for Failover Clustering ◦ One for MSDTC

Release Notes

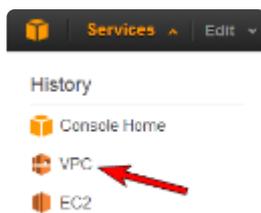
Before beginning, make sure you read the [DataKeeper Cluster Edition Release Notes](#) for the latest information. It is highly recommended that you read and understand the [DataKeeper Cluster Edition Installation Guide](#).

Create a Virtual Private Cloud (VPC)

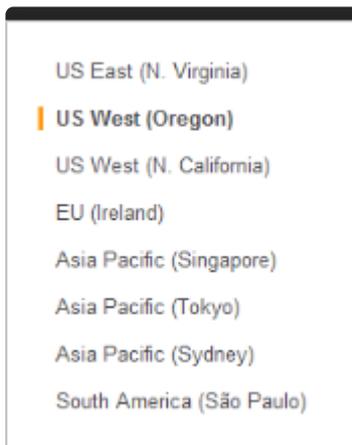
A virtual private cloud is the first object you create when using DataKeeper Cluster Edition.

* A virtual Private Cloud (VPC) is an isolated private cloud consisting of a configurable pool of shared computing resources in a public cloud.

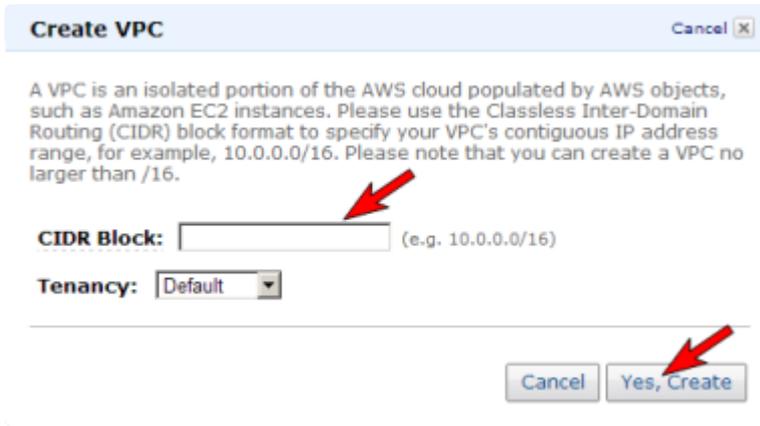
1. Using the email address and password specified when signing up for **Amazon Web Services (AWS)**, sign in to the [AWS Management Console](#).
2. From the **Services** dropdown, select **VPC**.



3. On the right side of the top navigation bar, select the region for your virtual private cloud.



4. On the **VPC Dashboard**, select **Your VPCs** from the left navigation pane.
5. Select **Create VPC**.
6. Define your virtual private cloud subnet by entering your **CIDR (Classless Inter-Domain Routing)** as described below, then click **Yes, Create**.



7. Once your virtual private cloud has been successfully created, click **Close** to return to the **VPC Dashboard**.

* A Route Table will automatically be created with a “main” association to the new VPC. You can use it later or create another Route Table.

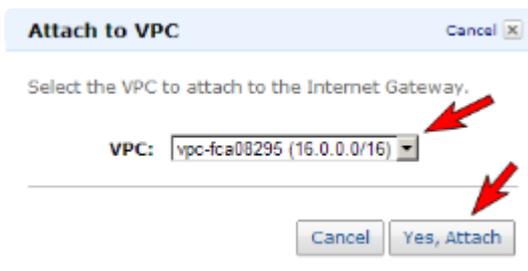
* **HELPFUL LINK:**
[Amazon's Creating a Virtual Private Cloud \(VPC\)](#)

Create Internet Gateway and Attach to Virtual Private Cloud

Create and attach an **Internet Gateway** which provides access to your virtual private cloud from the Internet (from outside the virtual private cloud).

* An Internet Gateway connects your VPC directly to the Internet and provides access to other AWS resources.

1. Select **Internet Gateways** from the left navigation pane.
2. Select your **Gateway ID** from the list of **Internet Gateways**.
3. Click **Attach to VPC**.
4. Select your **virtual private cloud** from the dropdown list and click **Yes, Attach**.



Create Subnets and Select Availability Zones

Create network subnets and select an availability zone for each subnet. You will launch your instances into these availability zones and their associated subnet address space. This will enable you to group server instances based on your security and high availability requirements. For a DataKeeper configuration, you will want to configure at least two subnet/availability zones. In this example, we will also configure a third availability zone for the quorum witness server.

1. From the left navigation pane of the **VPC Dashboard**, select **Subnets**.
2. Click **Create Subnet**.
3. On the **Create Subnet** dialog, select your **virtual private cloud** and choose an **availability zone**, then enter a **CIDR** based on the instructions in the dialog (shown below). Click **Yes, Create**.

Create Subnet
Cancel ✕

Please use the CIDR format to specify your subnet's IP address block (e.g., 10.0.0.0/24). Please note that block sizes must be between a /16 netmask and /28 netmask. You can create no more than 20 subnets per VPC. Also, please note that a subnet can be the same size as your VPC.

VPC:

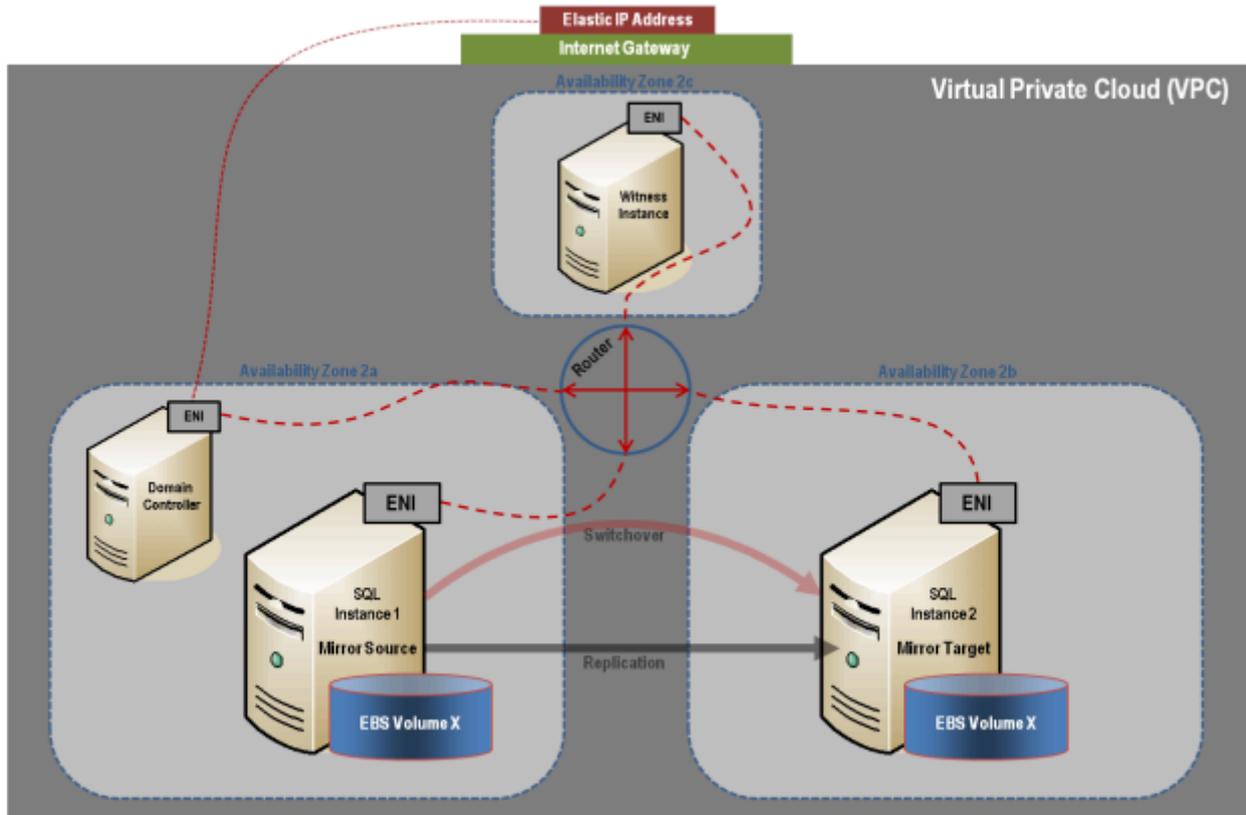
Availability Zone:

CIDR Block: (e.g. 10.0.0.0/24)

 As part of your Virtual Network Topology you will add these subnets to your Route Table below.

Virtual Network Topology Overview

The VPC with a default Route Table, multiple Subnets each in an Availability Zone, and an Internet Gateway have now been created. Server instances will be created below in each of the Availability Zones. An Elastic IP address will also be created and attached to the domain controller instance to provide a consistent and direct interface to your “virtual lab”. More about these steps below.



Set Up Routing and Security

You will set up routing and security to control the flow of traffic in and out of the availability zones.

Set Up Route Tables

Each subnet in your virtual private cloud must be associated with a route table to determine how the traffic between availability zones flows. If you use the default Route Table created for your VPC, you can skip to step 4 below.

1. From the left navigation pane of the **VPC Dashboard**, select **Route Tables**.
2. Select **Create Route Table**.
3. Select your **virtual private cloud** and click **Yes, Create**.
4. Select your new **route table**.
5. Under the **Routes** tab in the bottom pane, the first row is the local route. This enables communication within the virtual private cloud. Click on **Edit routes** and associate your **Internet Gateway** with **0.0.0.0/0**. This will appear in the second row and provides access into the virtual private cloud (0.0.0.0/0). This subnet is referred to as public because all traffic from the subnet goes to the **Internet Gateway**.

In the box under **Destination**, enter **0.0.0.0/0**, then under **Target**, select your **Internet Gateway** created above and click **Save**.

Destination	Target	States	Propagated	Actions
15.0.0.0/16	local	active	No	Remove
0.0.0.0/0	igw-4fd7f526	active	No	Remove

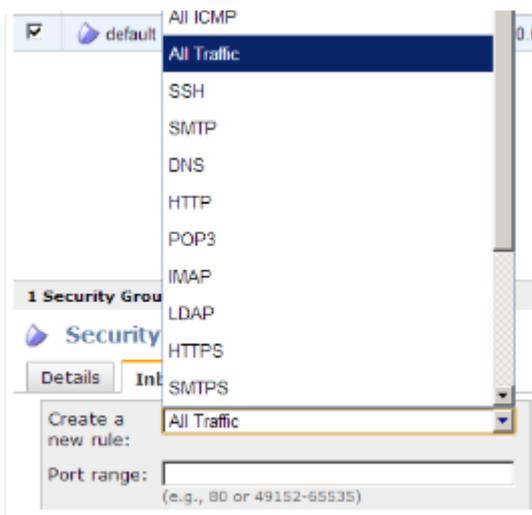
- Under the **Subnet Associations** tab, click on **Edit Subnet Associations**, select all of your subnets then click **Save**.

Create Network Security Group

In order to control inbound traffic as well as traffic between availability zones within the virtual private cloud, a security group should be set up.

✿ When you create a server instance you can optionally create a new Security Group at that time for that server and configure it, or you can create a new Security Group now and configure it in advance.

- From the left navigation pane of the **VPC Dashboard**, select **Security Groups**.
- Click **Create Security Group**.
- Enter **Name** and **Description** then select your **virtual private cloud** and click **Create security group**.
- Under the **Inbound rules** tab, click on **Edit Inbound rules**, then click on **Add rule**.



- To enable a **Remote Desktop Connection**, select **RDP** from the **TYPE** selection box and **TTY** protocol and **Port 3389** will be inserted for you. Then enter a custom **Source** address **0.0.0.0/0** and click **Save rules**.
- Under the **Outbound rule** tab, ensure that **Type** is set to **All Traffic** and **Destination** is set to **0.0.0.0/0**. If not, use the **Edit Outbound rules** button and set this up.

✿ **HELPFUL LINKS:**
[Amazon EC2 Security Groups](#)

Create and Configure Your Amazon EC2 Security Group

Launch an Instance

The following walks you through launching an instance into your subnet. You will want to launch two instances into one availability zone, one for your domain controller instance and one for your SQL instance. Then you will launch another SQL instance into another availability zone and a quorum witness instance into yet another availability zone.

✿ **HELPFUL LINKS:**
[Amazon EC2 Instances](#)
[Available Instance Types](#)

1. Using the email address and password specified when signing up for Amazon Web Service (AWS), sign in to the “[Amazon EC2 Console](#)”.
2. From the top right of the navigation bar, select the region for your instance from the dropdown selection.



3. Select **Instances** from the left navigation pane, then click the **Launch Instances** button.
4. Choose an AMI. Select the **Microsoft Windows Server 2016 Base AMI (Datacenter Edition)**
5. Select your Instance Type. (**Note:** Select M1 Small or larger.).
6. Click on **Configure Instance Details**
 - a. For **Network**, select your VPC.
 - b. For **Subnet**, select an Availability Zone/Subnet that you created.
 - c. Accept defaults in the **Network Interface** section.
 - d. Accept defaults in the **Advanced Details** section.
7. Click on **Review and Launch**.
 - a. Review the **Instance Type** information.
 - b. Accept a new **Security Group**, or Edit and select an existing one.
 - c. Review **Instance Details** information (accept defaults)
 - d. Review **Storage** information (accept defaults).
 - e. Add a **Tag** to name your instance and Click on **Review and Launch** (again).
8. Perform final review of the Instance and click on **Launch**.
9. Unless choosing an existing Key Pair, you'll select **Create a New Key Pair**.

10. Enter a key pair name and then select **Create & Download your Key Pair**.
11. Save the **Key Pair** file in a place you'll remember. **Note:** You can use this key pair to launch other instances in the future or visit the Key Pairs page to create or manage existing ones.

Get Windows Admin Password

You will need an administrator password to connect to your instance with Remote Desktop. **Note:** You will need the private key file that you created when you launched your instance.

1. Click **Instances** in the left navigation pane to view the status of your new instance. The status should be **pending** while it is launching, but status will change to **running**.
2. Select your new instance.
3. From the **Actions** dropdown menu, select **Connect, RDP Client tab**, then select **Get Password**. Browse to your saved **Key Pair** then press **Decrypt Password**. The password will be displayed. Save it in a safe place.



 **IMPORTANT:** Make a note of this initial administrator password. It will be needed to log on to your instance.

Repeat the above steps for all instances.

Assign a Virtual Private Cloud Elastic IP Address to the Domain Controller Instance

For an instance in your virtual private cloud to be reachable from the Internet, it must have a virtual private cloud elastic IP (EIP) address assigned to it. This is your entry point into your “virtual lab.”

This elastic IP address is being associated with the domain controller’s primary elastic network interface (ENI). The domain controller’s elastic network interface is attached to a public subnet and through a rule that you will create, routes 0.0.0.0/0 (all traffic) to the virtual private cloud’s Internet Gateway. You also created a rule in your **Security Group** (above) to allow Remote Desktop Connections to connect to your instances. You will initially connect to your domain controller through the elastic IP via a Remote Desktop Connection. Once connected to your domain controller, a router allows you to Remote Desktop into your other instances. Alternatively, you can also connect directly to each server instance via Remote Desktop Connection using a temporary **Public IPv4 Address** created each time an instance is started.

1. From the left navigation pane of the **VPC Dashboard**, select **Elastic IPs**.
2. Click **Allocate Elastic IP Address**, then select **Allocate**.
3. For the new Elastic IP Address (EIP), enter a name and click **Save**.
4. Return to the main **Elastic IPs** page. The new EIP will appear in the list.
5. Select the **new EIP** and Click on **Actions > Associate Elastic IP Address**.
6. Choose the Domain Controller **Instance** to attach this new **EIP Address**.
7. Choose a **Private IP address** (one will be provided), click the **Associate button**.

Connect to Instances

Once you've retrieved your initial administrator password and set up your Remote Desktop Connection (RDP) "Rule", you can connect to your domain controller instance via Remote Desktop Connection. Once you are connected to your domain controller instance, you can Remote Desktop into your other instances from there. Alternatively, you can also connect directly to each server instance via Remote Desktop Connection using a temporary **Public IPv4 Address** created each time an instance is started.

1. Open a **Remote Desktop Connection** and enter the **Elastic IP address** of your **domain controller instance**.
2. Login as administrator and enter your **administrator password**.

 **BEST PRACTICE:** Once logged on, it is best practice to change your password.

Configure the Domain Controller Instance

Now that the instances have been created, we started with setting up the Domain Service instance.

This guide is not a tutorial on how to set up an Active Domain server instance. We recommend reading [articles](#) on how to set up and configure an Active Directory server. It is very important to understand that even though the instance is running in an AWS cloud, this is a regular installation of Active Directory.

Alternatively you may create an AWS Active Directory Service instead of using a server instance for this purpose.

Static IP Addresses

Configure Static IP Addresses for your Instances

1. Connect to your domain controller instance.
2. Click **Start / Control Panel**.
3. Click **Network and Sharing Center**.
4. Select your network interface.
5. Click **Properties**.
6. Click **Internet Protocol Version 4 (TCP/IPv4)**, then **Properties**.
7. Obtain your current **IPv4 address**, **default gateway** and **DNS server** for the network interface

from **Amazon**.

8. In the **Internet Protocol Version 4 (TCP/IPv4) Properties** dialog box, under **Use the following IP address**, enter your **IPv4 address**.
9. In the **Subnet mask** box, type the subnet mask associated with your virtual private cloud subnet.
10. In the **Default Gateway** box, type the **IP address** of the default gateway and then click **OK**.
11. For the **Preferred DNS Server**, enter the **Primary IP Address of Your Domain Controller** (ex. 15.0.1.72).
12. Click **Okay**, then select **Close**. Exit **Network and Sharing Center**.
13. Repeat the above steps on your other instances.

Join the Two SQL Instances and the Witness Instance to Domain

* Before attempting to join a domain make these network adjustments. On your network adapter, Add/Change the Preferred DNS server to the new Domain Controller address and its DNS server. Use `ipconfig /flushdns` to refresh the DNS search list after this change. Do this before attempting to join the Domain.

* Ensure that **Core Networking** and **File and Printer Sharing** options are permitted in Windows Firewall.

1. On each instance, click **Start**, then right-click **Computer** and select **Properties**.
2. On the far right, select **Change Settings**.
3. Click on **Change**.
4. Enter a new **Computer Name**.
5. Select **Domain**.
6. Enter **Domain Name** – (ex. docs.aws.com).
7. Click **Apply**.

* Use **Control Panel** to make sure all instances are using the correct time zone for your location.

* **BEST PRACTICE:** It is recommend that the System Page File is set to **system managed** (not automatic) and to always use the C: drive.

Control Panel > Advanced system settings > Performance > Settings > Advanced > Virtual Memory. Select **System managed size**, **Volume C:** only, then select **Set** to save.

Assign Secondary Private IPs to the Two SQL Instances

In addition to the Primary IP, you will need to add three additional IPs (Secondary IPs) to the elastic

network interface for each SQL instance.

1. From the left navigation pane of the **EC2 Dashboard**, select **Instances**.
2. Right-click the instance for which you want to add secondary private IP addresses.
3. Select **Actions > Networking > Manage Private IP Addresses**.
4. Select the Network Interface (eth0) and view the current IPv4 address list.
5. Click on **Assign new IP address** and enter a **Private IP address** that is within the subnet range for the instance (ex. For 15.0.1.25, enter 15.0.1.26). Click **Save**. Repeat to add two more additional IP addresses to this instance.
6. Click **Save** to save your work.
7. Perform the above on **both SQL Instances**.



HELPFUL LINKS:

[Configuring a Secondary Private IP Address for Your Windows Instance](#)
[Private IP Addresses Per ENI Per Instance Type](#)
[Multiple IP Addresses](#)

Create and Attach Volumes

DataKeeper is a block-level volume replication solution and requires that each node in the cluster have additional volume(s) (other than the system drive) that are the same size and same drive letters. Please review [Volume Considerations](#) for additional information regarding storage requirements.

Create Volumes

Create two volumes in each availability zone for each SQL server instance, a total of four volumes.

1. From the left navigation pane of the **EC2 Dashboard**, select **Instances** to display your instances.
2. Click on your **instance ID**. In the **Instance Summary** block at the top, note the **Subnet ID/Availability Zone**.
3. Return to the EC2 Dashboard.
4. From the left navigation pane, select **Volumes** under **Elastic Block Store (EBS)**.

The console displays a list of the current elastic block store volumes in that region. You should see the elastic block store volume that serves as the root device volume for your instance. The state will be **in-use**. To quickly identify it in the future add a name to the elastic block store for your instance.

At this time create 2 additional volumes, one for your SQL Database, and another one for a DTC resource. Do this for both SQL instances.

1. Click **Create Volume**.
2. In the **Create Volume** dialog box, select the **General Purpose** volume type, enter the desired size, select the correct availability zone/subnet (noted above), enter a Name tag, then click **Create Volume** at the bottom.

Attach Volumes

Once your volumes are created, attach them to your two SQL instances.

1. From the left navigation pane of the **EC2 Dashboard**, select **Volumes**.
2. Select a new volume. Click **Actions > Attach Volume**.
3. Select the **Instance** to attach the volume to and accept the default Device. Click Attach. You will see the volume status go from **available** to **in-use**.
4. Do this for all four volumes.



HELPFUL LINKS:

[Creating an Amazon EBS Volume](#)

[Making an Amazon EBS Volume Available for Use / Make the Volume Available on Windows](#)

Configure the Cluster

Prior to installing DataKeeper Cluster Edition, it is important to have Windows Server configured as a cluster using either a node majority quorum (if there is an odd number of nodes) or a node and file share majority quorum (if there is an even number of nodes). Consult the Microsoft documentation on clustering in addition to this topic for step-by-step instructions. **Note:** Microsoft released a [hotfix](#) for Windows 2008R2 that allows disabling of a node's vote which may help achieve a higher level of availability in certain multi-site cluster configurations.

Add Failover Clustering

Add the Failover Clustering feature to both SQL instances.

1. Launch **Server Manager**.
2. Select **Features** in the left pane and click **Add Features** in the **Features** pane. This starts the **Add Features Wizard**.
3. Select **Failover Clustering**.
4. Select **Install**.

Validate a Configuration

1. Open **Failover Cluster Manager**.

2. Select Failover Cluster Manager, select **Validate a Configuration**.
3. Click **Next**, then add your two **SQL instances**.

Note: To search, select **Browse**, then click on **Advanced** and **Find Now**. This will list available instances.

4. Click **Next**.
5. Select **Run Only Tests I Select** and click **Next**.
6. In the **Test Selection** screen, deselect **Storage** and click **Next**.
7. At the resulting confirmation screen, click **Next**.
8. Review **Validation Summary Report** then click **Finish**.

Create Cluster

1. In **Failover Cluster Manager**, click on **Create a Cluster** then click **Next**.
2. Enter your two **SQL instances**.
3. On the **Validation Warning** page, select **No** then click **Next**.
4. On the **Access Point for Administering the Cluster** page, enter a unique name for your WSFC Cluster. Then enter the **Failover Clustering IP address** for each node involved in the cluster. This is the first of the three **secondary IP addresses** added previously to each instance.
5. **IMPORTANT!** Uncheck the "Add all available storage to the cluster" checkbox. DataKeeper mirrored drives must not be managed natively by the cluster. They will be managed as DataKeeper Volumes.
6. Click **Next** on the **Confirmation** page.
7. On **Summary** page, review any warnings then select **Finish**.

Configure Quorum/Witness

1. Create a folder on your quorum/witness instance (witness).
2. Share the folder.
 - a. Right-click folder and select **Share With / Specific People....**
 - b. From the dropdown, select **Everyone** and click **Add**.
 - c. Under **Permission Level**, select **Read/Write**.
 - d. Click **Share**, then **Done**. (Make note of the path of this file share to be used below.)
3. In **Failover Cluster Manager**, right-click cluster and choose **More Actions** and **Configure Cluster Quorum Settings**. Click **Next**.
4. On the **Select Quorum Configuration**, choose **Node and File Share Majority** and click **Next**.
5. On the **Configure File Share Witness** screen, enter the path to the file share previously created and click **Next**.
6. On the **Confirmation** page, click **Next**.
7. On the **Summary** page, click **Finish**.

Install and Configure DataKeeper

After the basic cluster is configured but prior to any cluster resources being created, install and license **DataKeeper Cluster Edition** on all cluster nodes. See the [DataKeeper Cluster Edition Installation Guide](#)

for detailed instructions.

1. Run **DataKeeper setup** to install **DataKeeper Cluster Edition** on both SQL instances.
2. Enter your **license key** and reboot when prompted.
3. Launch the **DataKeeper GUI** and **connect to server**.

 **Note:** The domain or server account used must be added to the Local System Administrators Group. The account must have administrator privileges on each server that DataKeeper is installed on. Refer to [DataKeeper Service Log On ID and Password Selection](#) for additional information.

4. Right click on **Jobs** and connect to both SQL servers.
5. [Create a Job](#) for each mirror you will create. One for your DTC resource, and one for your SQL resource..
6. When asked if you would like to auto-register the volume as a cluster volume, select **Yes**.

 **Note:** If installing DataKeeper Cluster Edition on Windows “Core” (GUI-less Windows), make sure to read [Installing and Using DataKeeper on Windows 2008R2/2012 Server Core Platforms](#) for detailed instructions.

Configure MSDTC

1. For Windows Server 2012 and 2016, in the **Failover Cluster Manager GUI**, select **Roles**, then select **Configure Role**.
2. Select **Distributed Transaction Coordinator (DTC)**, and click **Next**.

 For Windows Server 2008, in the **Failover Cluster Manager GUI**, select **Services and Applications**, then select **Configure a Service or Application** and click **Next**.

3. On the **Client Access Point** screen, enter a name, then enter the **MSDTC IP address** for each node involved in the cluster. This is the second of the three **secondary IP addresses** added previously to each instance. Click **Next**.
4. Select the **MSDTC volume** and click **Next**.
5. On the **Confirmation** page, click **Next**.
6. Once the **Summary** page displays, click **Finish**.

Install SQL on the First SQL Instance

1. On the domain controller server create a folder and share it..
 - a. For example “TEMPSHARE” with Everyone permission.
2. Create a sub folder “SQL” and copy the SQL .iso installer into that sub folder.
3. On the SQL server, create a network drive and attach it to the shared folder on the domain controller.

- a. For example “net use S: \\TEMPSHARE
4. On the SQL server the S: drive will appear. CD to the SQL folder and find the SQL .iso installer. Right click on the .iso file and select **Mount**. The setup.exe installer will appear with the SQL .iso installer.

```
F:\>Setup /SkipRules=Cluster_VerifyForErrors
/Action=InstallFailoverCluster
```

5. On **Setup Support Rules**, click **OK**.
6. On the **Product Key** dialog, enter your **product key** and click **Next**.
7. On the **License Terms** dialog, accept the **license agreement** and click **Next**.
8. On the **Product Updates** dialog, click **Next**.
9. On the **Setup Support Files** dialog, click **Install**.
10. On the **Setup Support Rules** dialog, you will receive a warning. Click **Next**, ignoring this message, since it is expected in a multi-site or non-shared storage cluster.
11. Verify **Cluster Node Configuration** and click **Next**.
12. Configure your **Cluster Network** by adding the “third” secondary IP address for your SQL instance and click **Next**. Click **Yes** to proceed with multi-subnet configuration.
13. Enter **passwords** for service accounts and click **Next**.
14. On the **Error Reporting** dialog, click **Next**.
15. On the **Add Node Rules** dialog, skipped operation warnings can be ignored. Click **Next**.
16. Verify features and click **Install**.
17. Click **Close** to complete the installation process.

Install SQL on the Second SQL Instance

Installing the second SQL instance is similar to the first one.

1. On the SQL server, create a network drive and attach it to the shared folder on the domain controller as explained above for the first SQL server.
2. Once the .iso installer is mounted, run **SQL setup** once again from the command line in order to skip the **Validate** process. Open a **Command** window, browse to your **SQL install directory** and type the following command:

```
Setup /SkipRules=Cluster_VerifyForErrors /Action=AddNode
/INSTANCENAME="MSSQLSERVER"
```

(**Note:** This assumes you installed the default instance on the first node)

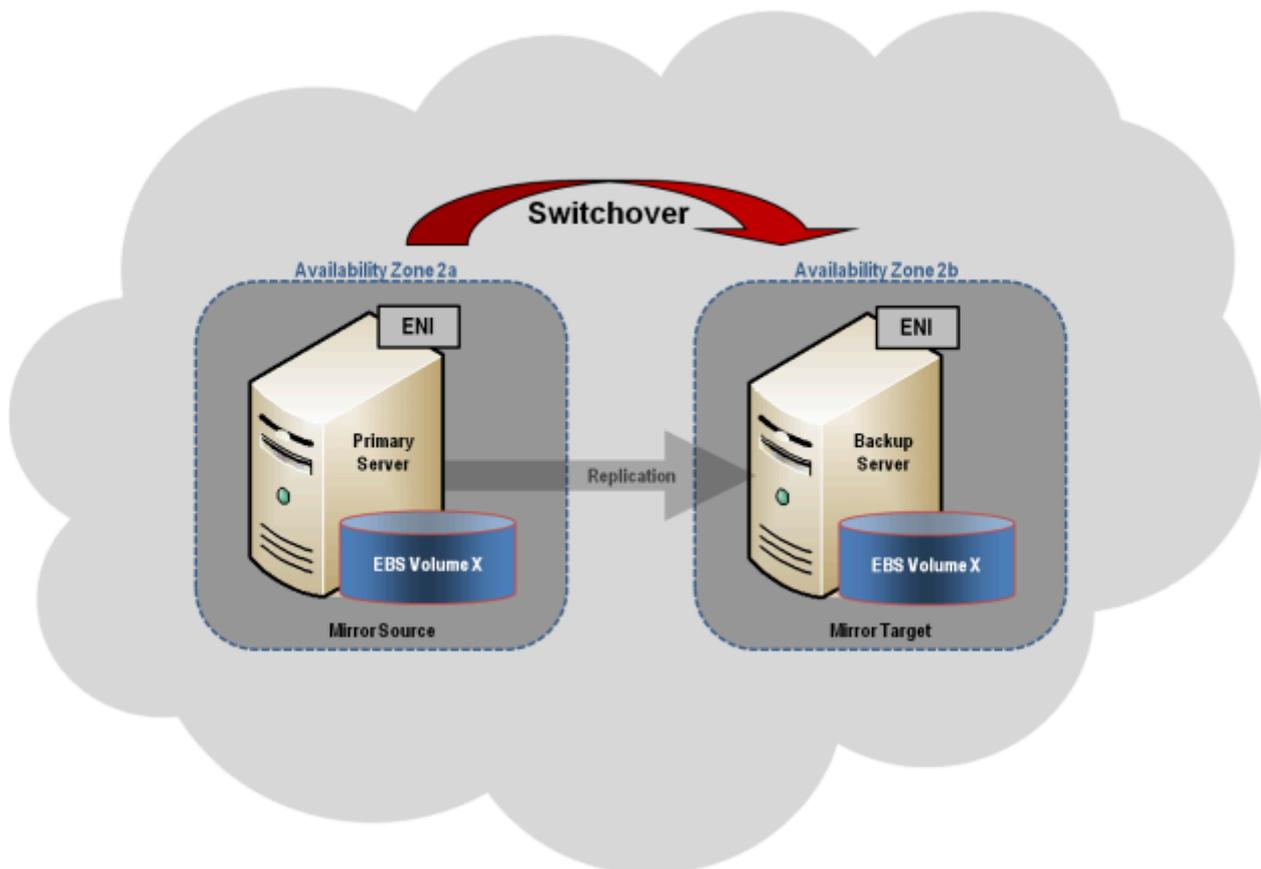
3. On **Setup Support Rules**, click **OK**.
4. On the **Product Key** dialog, enter your **product key** and click **Next**.
5. On the **License Terms** dialog, accept the **license agreement** and click **Next**.
6. On the **Product Updates** dialog, click **Next**.
7. On the **Setup Support Files** dialog, click **Install**.
8. On the **Setup Support Rules** dialog, you will receive a warning. Click **Next**, ignoring this

message, since it is expected in a multi-site or non-shared storage cluster.

9. Verify **Cluster Node Configuration** and click **Next**.
10. Configure your **Cluster Network** by adding the “third” secondary IP address for your SQL Instance and click **Next**. Click **Yes** to proceed with multi-subnet configuration.
11. Enter **passwords** for service accounts and click **Next**.
12. On the **Error Reporting** dialog, click **Next**.
13. On the **Add Node Rules** dialog, skipped operation warnings can be ignored. Click **Next**.
14. Verify features and click **Install**.
15. Click **Close** to complete the installation process.

Common Cluster Configuration

This section describes a **common 2-node replicated cluster configuration**.



1. The initial configuration must be done from the [DataKeeper UI](#) running on one of the cluster nodes. If it is not possible to run the DataKeeper UI on a cluster node, such as when running DataKeeper on a Windows Core only server, install the DataKeeper UI on any computer running Windows XP or higher and follow the instruction in the [Core Only](#) section for creating a mirror and registering the cluster resources via the command line.
2. Once the DataKeeper UI is running, [connect to each of the nodes](#) in the cluster.
3. [Create a Job](#) using the DataKeeper UI. This process creates a mirror and adds the DataKeeper Volume resource to the Available Storage.



IMPORTANT: Make sure that **Virtual Network Names** for **NIC connections** are

identical on all cluster nodes.

4. If additional mirrors are required, you can [Add a Mirror to a Job](#).
5. With the **DataKeeper Volume(s)** now in **Available Storage**, you are able to create cluster resources (SQL, File Server, etc.) in the same way as if there were a shared disk resource in the cluster. Refer to Microsoft documentation for additional information in addition to the above for step-by-step cluster configuration instructions.

Management

Once a DataKeeper volume is registered with Windows Server Failover Clustering, all of the management of that volume will be done through the Windows Server Failover Clustering interface. All of the management functions normally available in DataKeeper [will be disabled](#) on any volume that is under cluster control. Instead, the DataKeeper Volume cluster resource will control the mirror direction, so when a DataKeeper Volume comes online on a node, that node becomes the source of the mirror. The properties of the DataKeeper Volume cluster resource also display basic mirroring information such as the source, target, type and state of the mirror.

Troubleshooting

Use the following resources to help troubleshoot issues:

- [Troubleshooting](#) issues section
- For customers with a support contract – <http://us.sios.com/support/overview/>
- For evaluation customers only – [Pre-sales support](#)

Additional Resources:

Step-by-Step: Configuring a 2-Node Multi-Site Cluster on Windows Server 2008 R2 – Part 1 — <http://clusteringformeremortals.com/2009/09/15/step-by-step-configuring-a-2-node-multi-site-cluster-on-windows-server-2008-r2-%E2%80%93-part-1/>

Step-by-Step: Configuring a 2-Node Multi-Site Cluster on Windows Server 2008 R2 – Part 3 — <http://clusteringformeremortals.com/2009/10/07/step-by-step-configuring-a-2-node-multi-site-cluster-on-windows-server-2008-r2-%E2%80%93-part-3/>

5. Deploying DataKeeper Cluster Edition in Azure

DEPLOYING MICROSOFT SQL SERVER 2017 FAILOVER CLUSTERS IN AZURE RESOURCE MANAGER (ARM)

Before beginning, make sure you read the [DataKeeper Cluster Edition Release Notes](#) for the latest information. It is highly recommended that you read and understand the [DataKeeper Cluster Edition Installation Guide](#).

Steps required to deploy a 2-node SQL Server Failover Cluster in a single region using Azure Resource Manager

Note: This guide does not apply to the Azure Classic portal.

DataKeeper Cluster Edition allows you to take locally attached storage, whether it uses Premium or Standard Disks, and replicate those disks synchronously, asynchronous, or a mix of both, between two or more cluster nodes. In addition, a DataKeeper Volume resource is registered in Windows Server Failover Cluster which takes the place of a Physical Disk resource. Instead of controlling SCSI-3 reservations like a Physical Disk Resource, the DataKeeper Volume controls the mirror direction, ensuring the active node is always the source of the mirror. For SQL Server and Failover Cluster the DataKeeper volume is similar to a Physical Disk and is used the same way Physical Disk Resources would be used.

PREREQUISITES

- You have used the Azure Portal (<http://portal.azure.com>) before and are comfortable deploying virtual machines in Azure IaaS
- You have obtained a full license or [eval license of SIOS DataKeeper](#)

THE EASY WAY TO DO A PROOF-OF-CONCEPT

The Azure Resource Manager has the ability to use Deployment Templates to rapidly deploy applications consisting of interrelated Azure resources. Many of these templates are developed by Microsoft and are readily available in their community on Github as [Quickstart Templates](#). Community members are also free to extend templates or to publish their own templates on GitHub. One such template entitled “SQL Server 2014 AlwaysOn Failover Cluster Instance with SIOS DataKeeper Azure Deployment Template” published by SIOS Technology completely automates the process of deploying a 2-node SQL Server FCI into a new Active Directory Domain.

To deploy this template click on **Deploy to Azure** in the template.



Refer to <https://github.com/SIOSDataKeeper/SIOSDataKeeper-SQL-Cluster> to rapidly provision a 2-node SQL cluster.

DEPLOYING A SQL SERVER FAILOVER CLUSTER INSTANCE USING THE AZURE PORTAL

While the automated Azure deployment template is a quick and easy way to get a 2-node SQL Server FCI up and running, there are some limitations. For one, it uses a 180 Day evaluation version of SQL Server, so it cannot be used in production unless you upgrade the SQL eval licenses. Also, it builds an entirely new AD domain so if you plan to integrate it with your existing domain it will have to be rebuilt manually.

PROVISIONING THE DOMAIN CONTROLLER (DC1)

To build a 2-node SQL Server Failover Cluster Instance in Azure, you will need a basic Virtual Network based on Azure Resource Manager (not Azure Classic) and at least one virtual machine up and running configured as a Domain Controller. This guide does not cover these steps. We will refer to the domain controller as DC1 for the rest of this guide. When creating DC1 you may choose either Windows Server 2008R2 or Windows Server 2012R2. The only other requirements for DC1 are that it be the same type (Premium or Standard) as the cluster nodes, SQL1 and SQL2, and be in the same Availability Set. Once the Virtual Network and Domain Controller are configured, you will provision two more virtual machines which will act as the two nodes in the cluster.

Example:

DC1 – Our Domain Controller and File Share Witness

SQL1 and SQL2 – The two nodes of our SQL Server Cluster

PROVISIONING THE TWO CLUSTER NODES (SQL1 AND SQL2)

Using the Azure Portal, provision both SQL1 and SQL2 exactly the same way. There are numerous options to choose from including instance size, storage options, etc. This guide is not meant to be an exhaustive guide to deploying SQL Server in Azure. There are a few key things to keep in mind when creating your instances, especially in a clustered environment.

Availability Set – It is important that both SQL1, SQL2, and DC1 reside in the same Availability Set. By putting them in the same Availability Set we are ensuring that each cluster node and the File Share Witness reside in different Fault and Update Domains. This helps guarantee that during both planned maintenance and unplanned maintenance the cluster will continue to be able to maintain quorum and

avoid downtime.

1 Basics Done ✓

2 Size Done ✓

3 Settings Configure optional features >

4 Summary Windows Server 2012 R2 Datacenter >

Settings

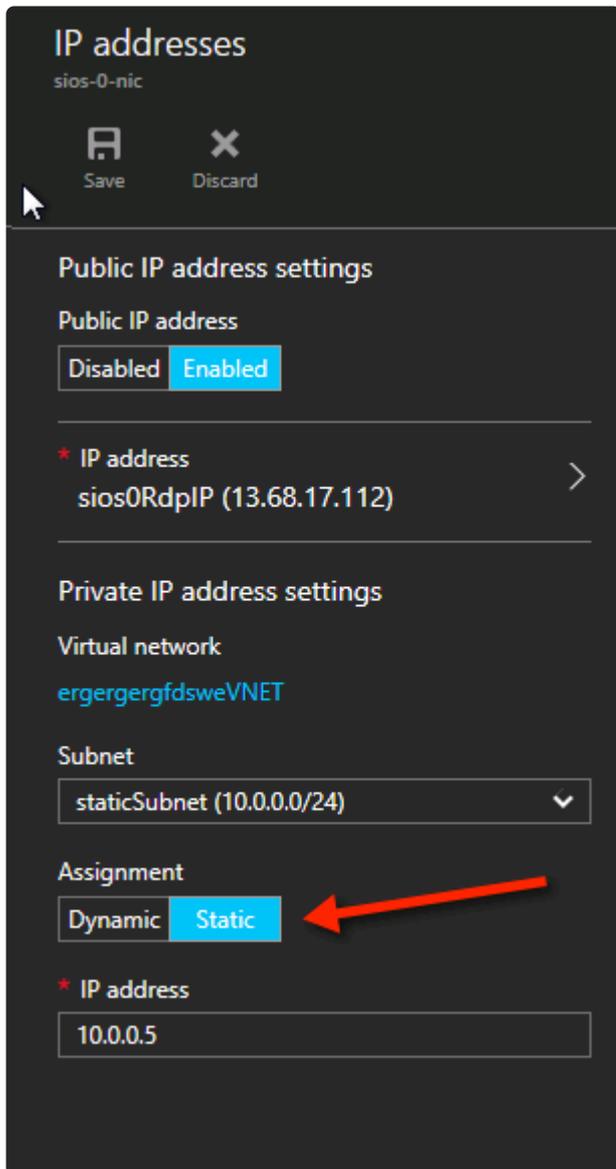
- * Storage account ⓘ (new) test226033 >
- Network**
- * Virtual network ⓘ (new) test22 >
- * Subnet ⓘ default (10.1.0.0/24) >
- * Public IP address ⓘ (new) Dave >
- * Network security group ⓘ (new) Dave >
- Extensions**
- Extensions ⓘ No extensions >
- Monitoring**
- Diagnostics ⓘ Disabled Enabled
- * Diagnostics storage account ⓘ (new) test226033 >
- Availability**
- * Availability set ⓘ None >

OK

Make sure all of your cluster nodes and your file share witness resides in the same Availability Set. You will initially have to create the Availability Set but then you can add the other servers to the Availability Set once it is created.

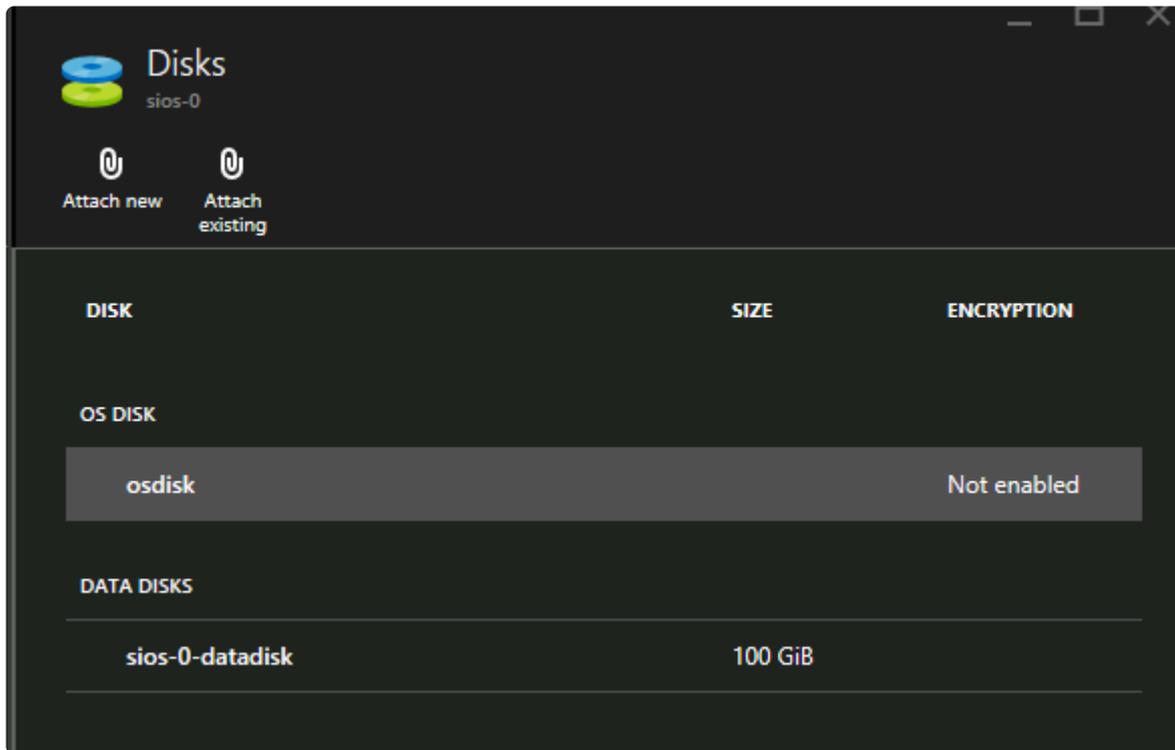
STATIC IP ADDRESS

Once each VM is provisioned, change the settings of the IP address to Static so that the IP addresses of the cluster nodes will not change.



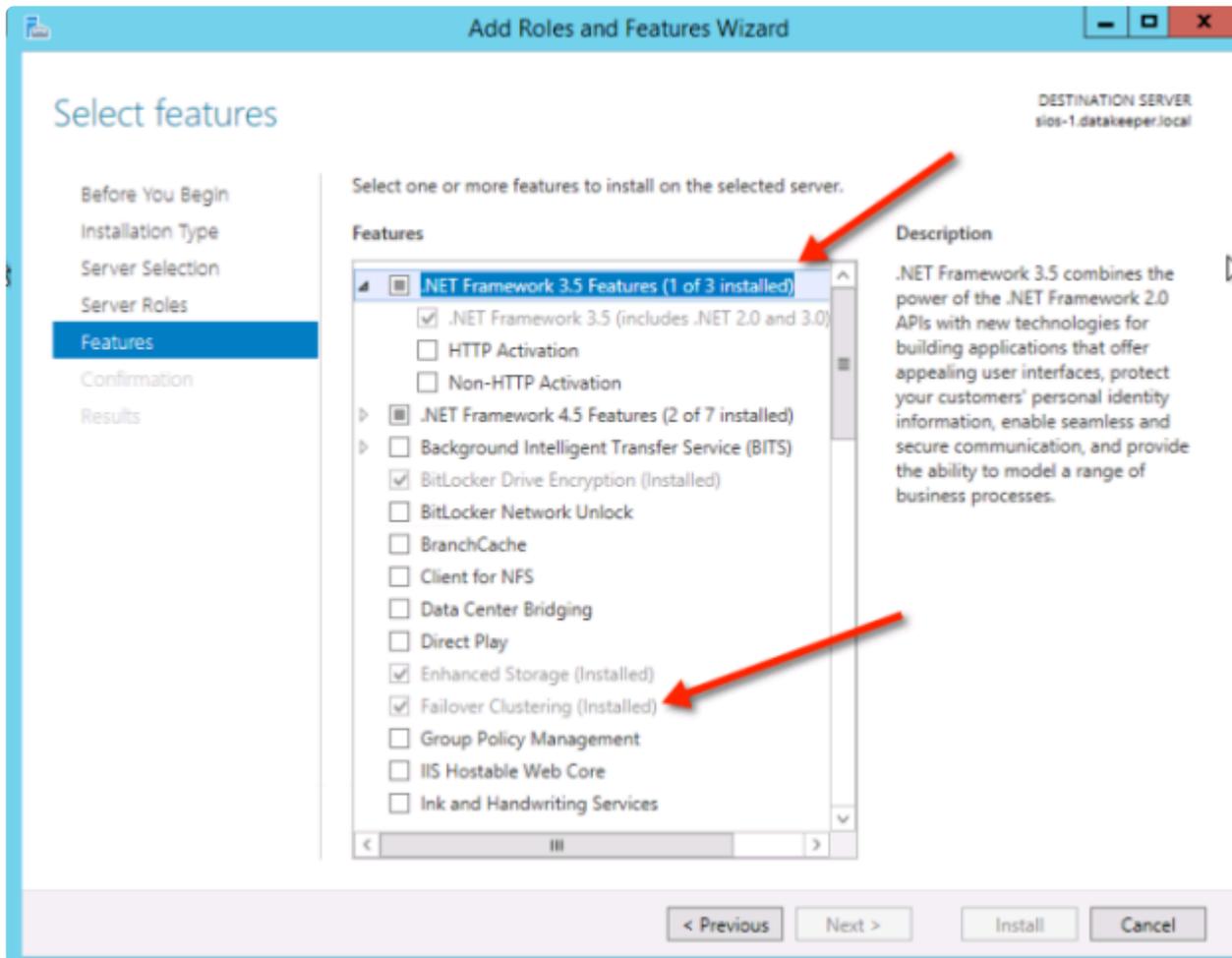
STORAGE

For Storage information refer to [Performance best practices for SQL Server in Azure Virtual Machines](#). At a minimum add at least one additional disk to each of your cluster nodes. DataKeeper can use Premium or Standard disks, but Azure requires you to configure data disks to use the same type as the OS disk. If you created VMs that reside on Premium disks, then you must attach Premium data disks as well. DataKeeper is compatible with Storage Pools so you may attach multiple data disks if your chosen VM size allows it.



CREATE THE CLUSTER

After both cluster nodes (SQL1 and SQL2) have been provisioned as described above and added to your existing domain, the cluster can be created. Before creating the cluster, both the appropriate .NET framework and Failover Clustering Features must be enabled on both cluster nodes.



Once these features have been enabled, you are ready to build your cluster. The following steps can be performed both via PowerShell and the WSFC GUI. It is recommended that PowerShell be used to create your cluster. **Note:** If the Failover Cluster Manager GUI is used, a duplicate IP address will be issued to the cluster that is not attached.

Azure VMs are required to use DHCP. By specifying a "Static IP" in the Azure portal when the VM was created, something similar to a DHCP reservation was established. It is not exactly a DHCP reservation because a true DHCP reservation removes the IP address from the DHCP pool. Instead, specifying a Static IP in the Azure portal means that if that IP address is still available when the VM requests it, Azure will issue that IP to it. However, if your VM is offline and another host comes online in that same subnet it could be issued that same IP address.

There is another side effect to the way Azure has implemented DHCP. When creating a cluster with the Windows Server Failover Cluster GUI, when a host uses DHCP (which is required), there is not an option to specify a cluster IP address. Instead it relies on DHCP to obtain an address. DHCP will issue a duplicate IP address, usually the same IP address as the host requesting it. The cluster creation will usually complete, but you may encounter errors and need to run the Windows Server Failover Cluster GUI from a different node in order to get it to run. Once it is running, change the cluster IP address to an address that is not currently in use on the network.

To avoid this scenario, create the cluster via PowerShell by specifying the cluster IP address as part of the PowerShell command.

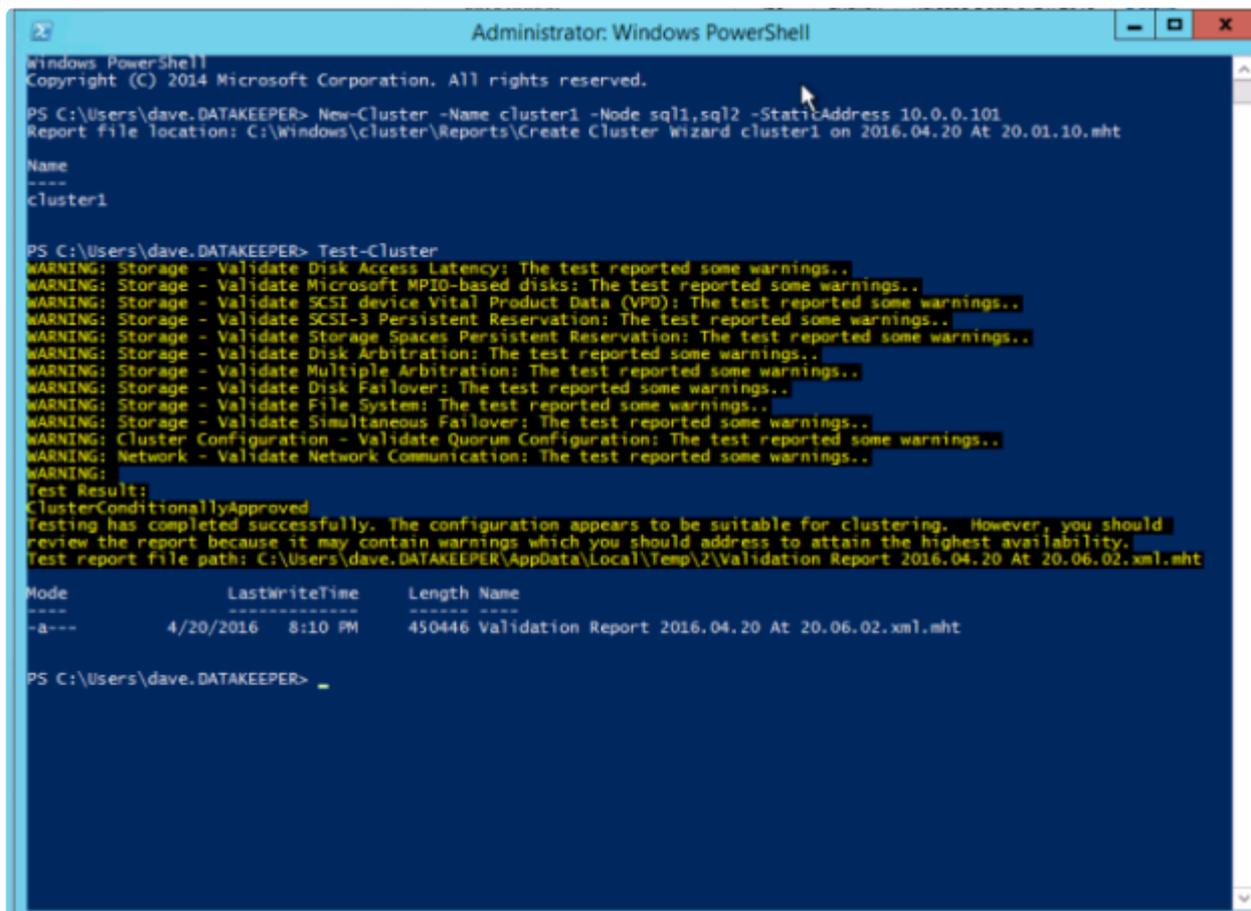
To create the cluster run the following New-Cluster command:

```
New-Cluster -Name cluster1 -Node sql1,sql2 -StaticAddress 10.0.0.101
```

Example: `New-Cluster -Name cluster1 -Node sql1,sql2 -StaticAddress 10.0.0.101 -ManagementPointNetworkType singleton`

After the cluster is created, run the following cluster validation:

```
Test-Cluster
```



```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) 2014 Microsoft Corporation. All rights reserved.

PS C:\Users\dave.DATAKEEPER> New-Cluster -Name cluster1 -Node sql1,sql2 -StaticAddress 10.0.0.101
Report file location: C:\Windows\cluster\Reports\Create Cluster Wizard cluster1 on 2016.04.20 At 20.01.10.mht

Name
----
cluster1

PS C:\Users\dave.DATAKEEPER> Test-Cluster
WARNING: Storage - Validate Disk Access Latency: The test reported some warnings..
WARNING: Storage - Validate Microsoft MPIIO-based disks: The test reported some warnings..
WARNING: Storage - Validate SCSI device Vital Product Data (VPD): The test reported some warnings..
WARNING: Storage - Validate SCSI-3 Persistent Reservation: The test reported some warnings..
WARNING: Storage - Validate Storage Spaces Persistent Reservation: The test reported some warnings..
WARNING: Storage - Validate Disk Arbitration: The test reported some warnings..
WARNING: Storage - Validate Multiple Arbitration: The test reported some warnings..
WARNING: Storage - Validate Disk Failover: The test reported some warnings..
WARNING: Storage - Validate File System: The test reported some warnings..
WARNING: Storage - Validate Simultaneous Failover: The test reported some warnings..
WARNING: Cluster Configuration - Validate Quorum Configuration: The test reported some warnings..
WARNING: Network - Validate Network Communication: The test reported some warnings..
WARNING:
Test Result:
ClusterConditionallyApproved
Testing has completed successfully. The configuration appears to be suitable for clustering. However, you should
review the report because it may contain warnings which you should address to attain the highest availability.
Test report file path: C:\Users\dave.DATAKEEPER\AppData\Local\Temp\2\Validation Report 2016.04.20 At 20.06.02.xml.mht

Mode                LastWriteTime         Length Name
----                -
-a---             4/20/2016   8:10 PM           450446 Validation Report 2016.04.20 At 20.06.02.xml.mht

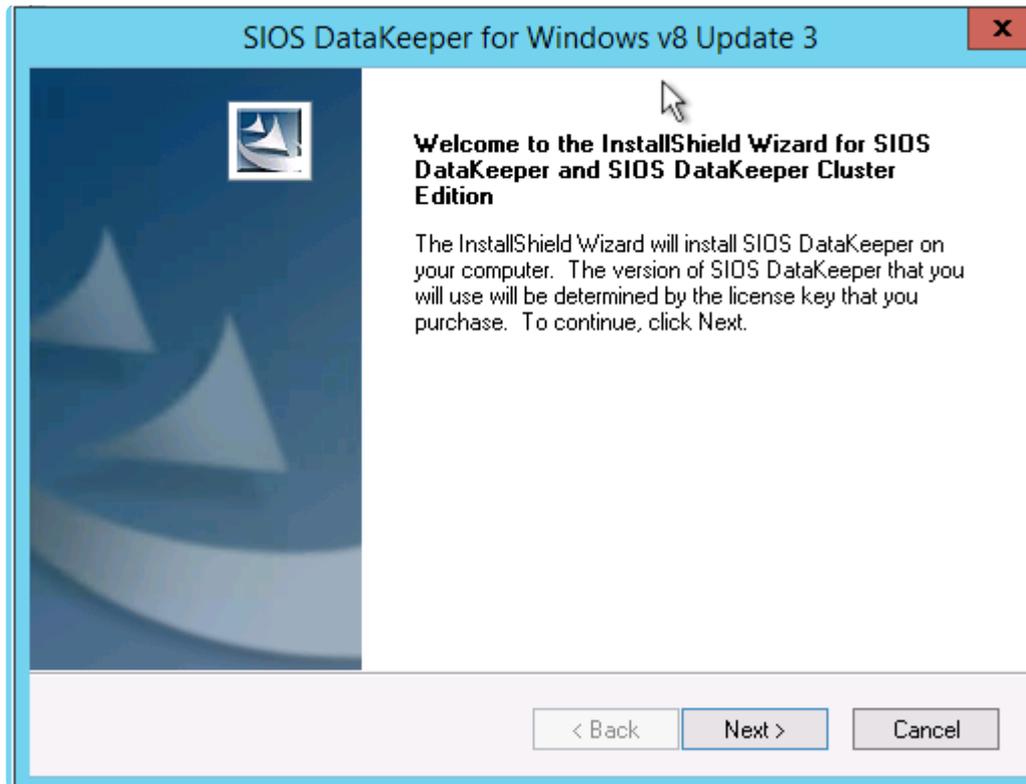
PS C:\Users\dave.DATAKEEPER> _
```

CREATE FILE SHARE WITNESS

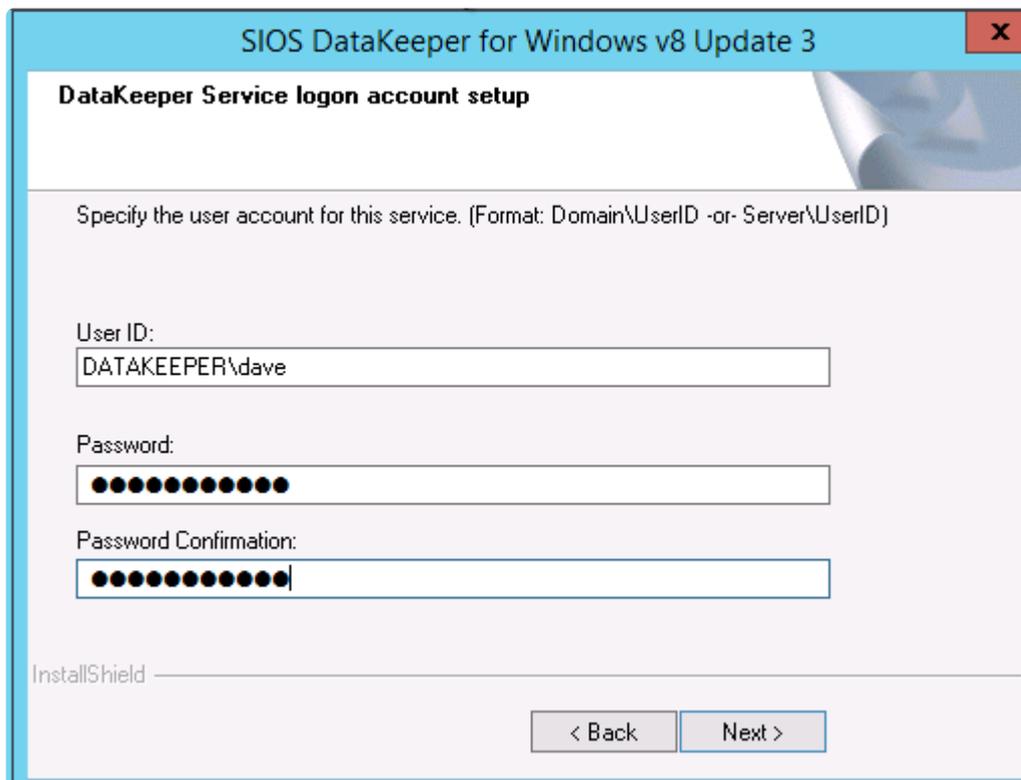
Since there is no shared storage, you must create a file share witness on another server in the same Availability Set as the two cluster nodes. Putting it in the same availability set ensures that you only lose one vote from your quorum at any given time. Refer to <http://www.howtonetworking.com/server/cluster12.htm> for information on how to create a File Share Witness. For this example, the file share witness was put on the domain controller, DC1. For more information on cluster quorums refer to https://blogs.msdn.microsoft.com/microsoft_press/2014/04/28/from-the-mvps-understanding-the-windows-server-failover-cluster-quorum-in-windows-server-2012-r2/.

INSTALL DATAKEEPER

During the installation use all of the default options.



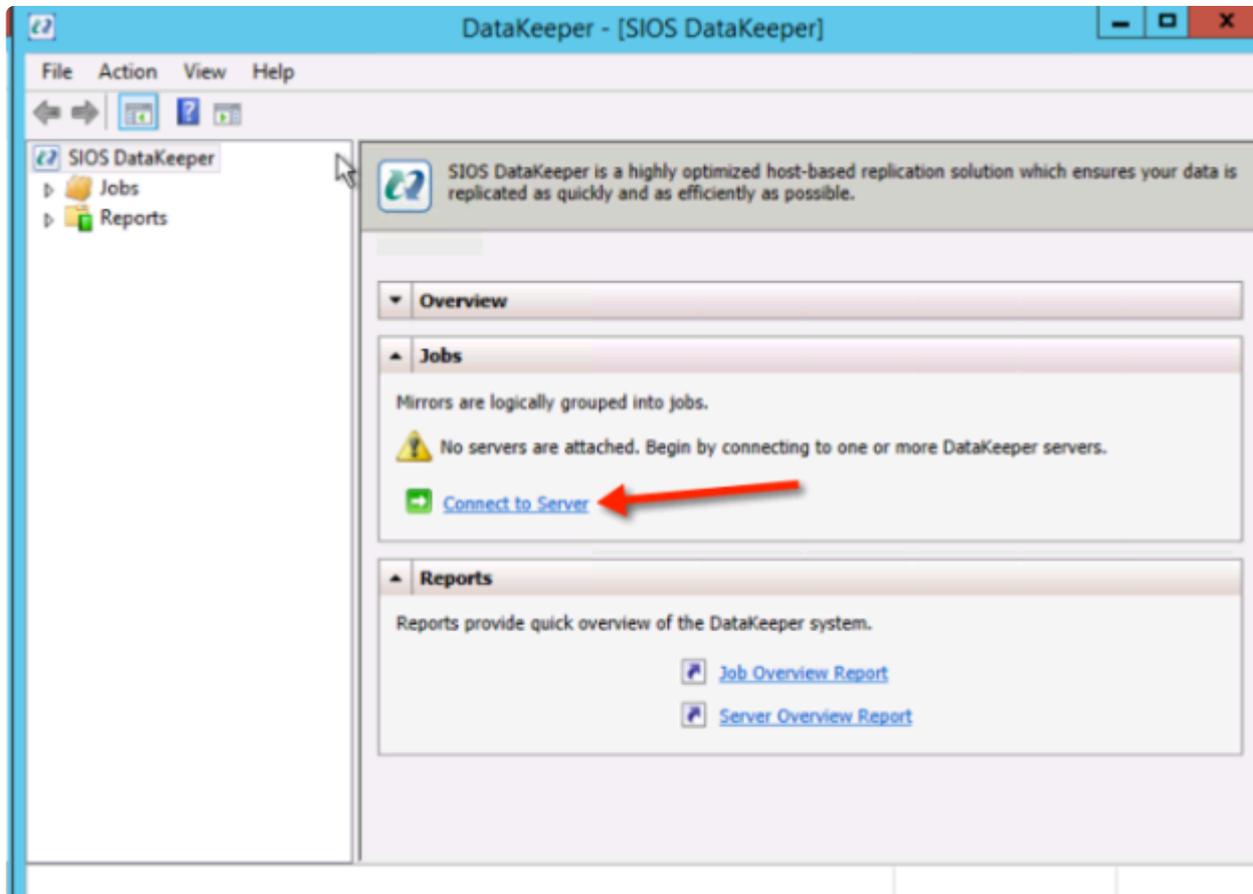
The service account used must be a domain account, and must also be in the Local Administrators group on each node in the cluster.



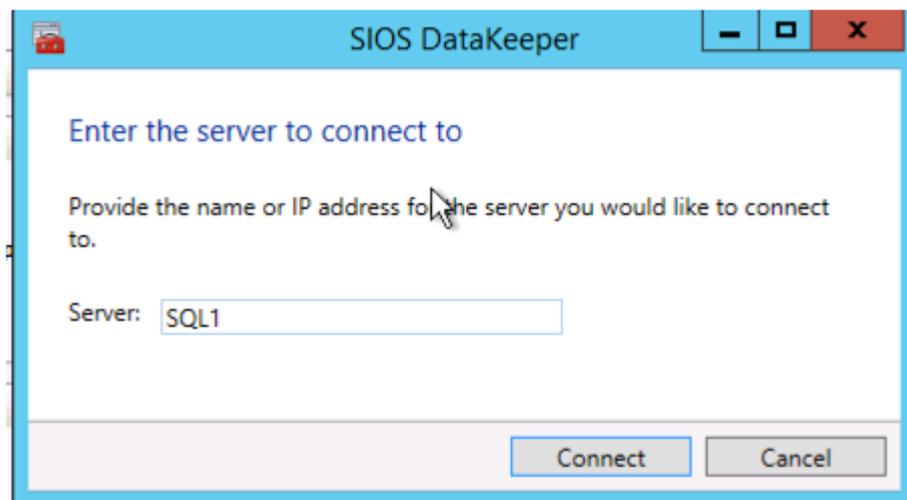
Reboot the servers once DataKeeper is installed and licensed on each node.

CREATE THE DATAKEEPER VOLUME RESOURCE

To create the DataKeeper Volume Resource start the DataKeeper UI and connect to both of the servers.



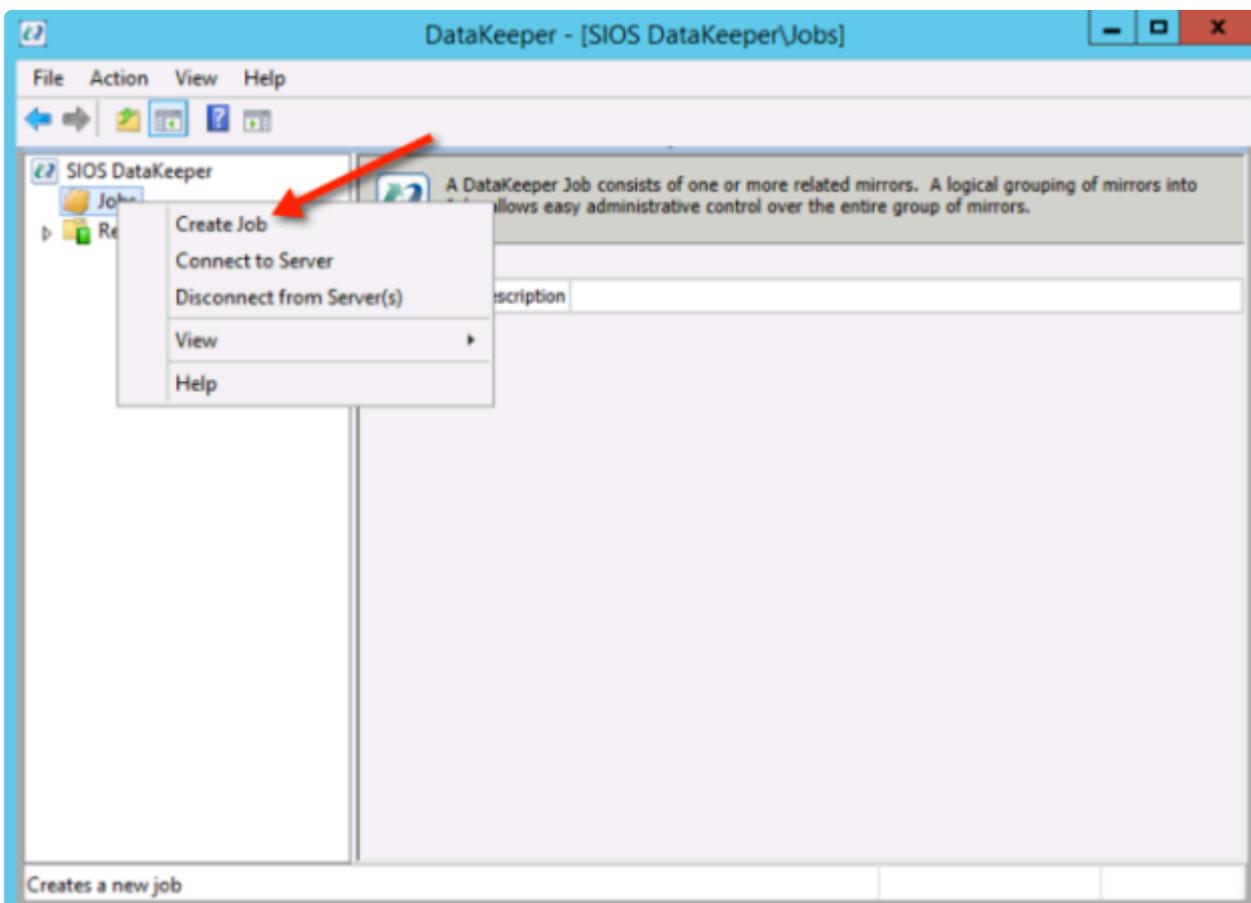
Connect to SQL1



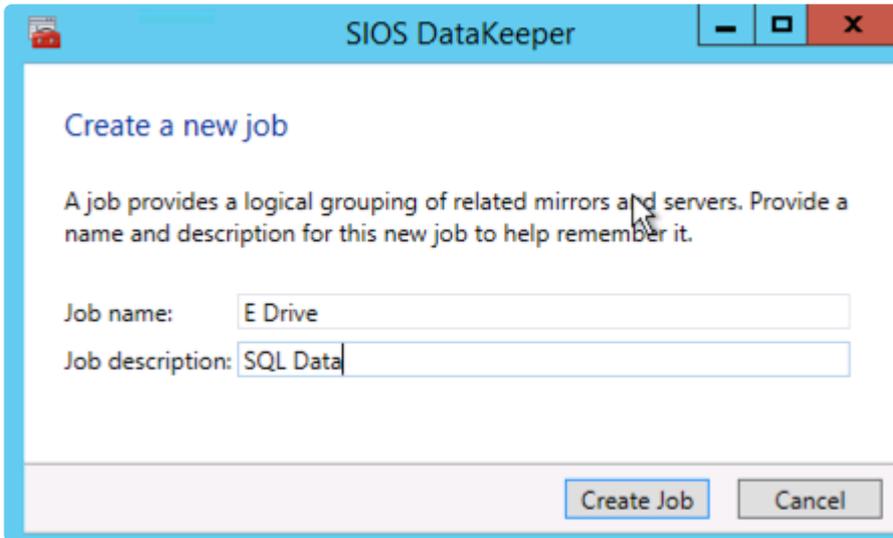
Connect to SQL2



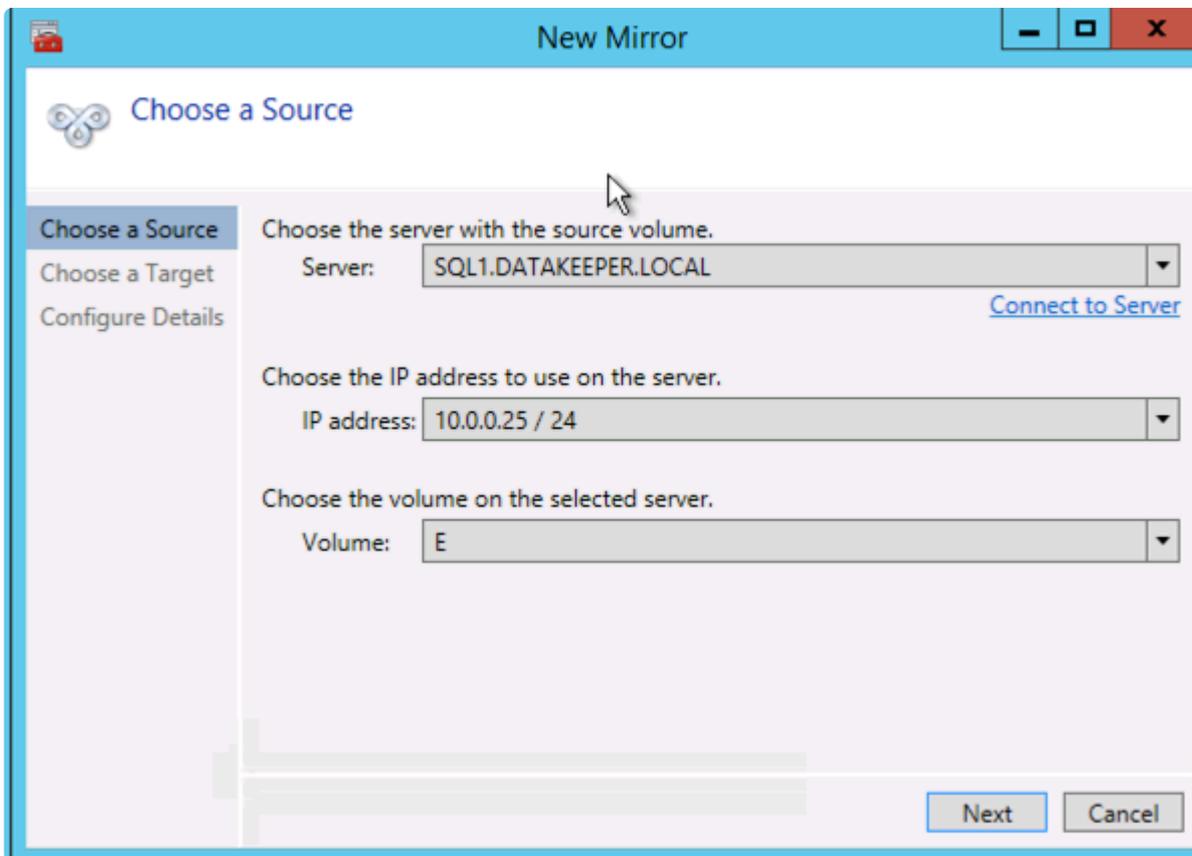
Once you are connected to each server, create your DataKeeper Volume in the Navigation Pane, right click on **Jobs** and choose **Create Job**.



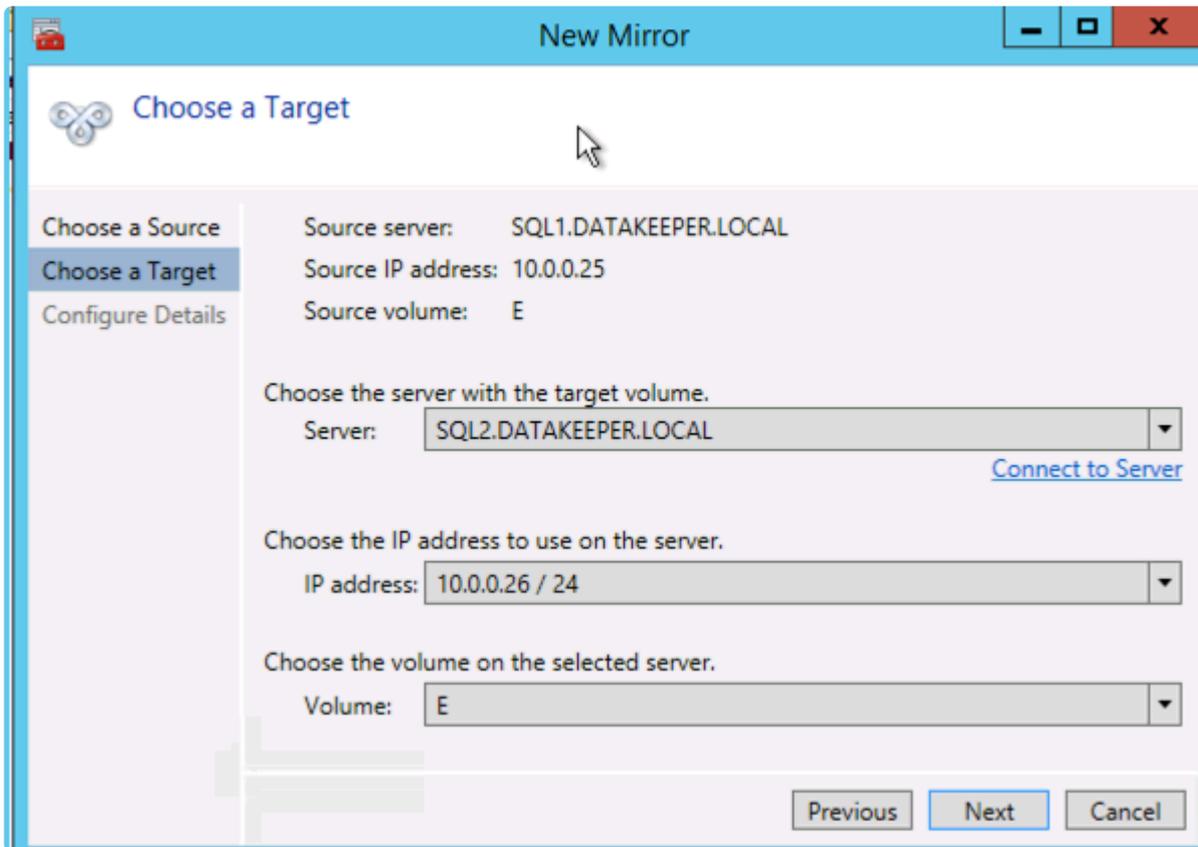
Give the Job a name and description.



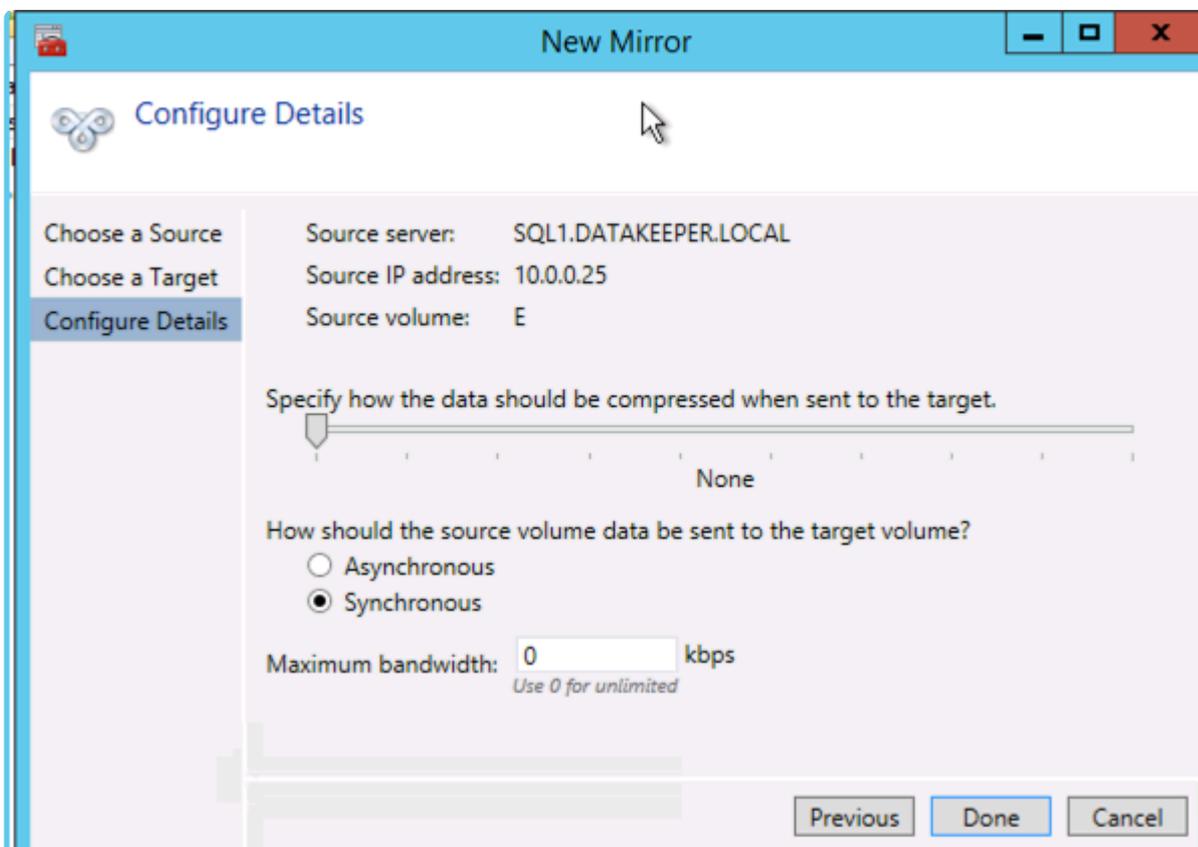
Choose your source Server, IP and Volume. The IP address chosen will determine the replication network.



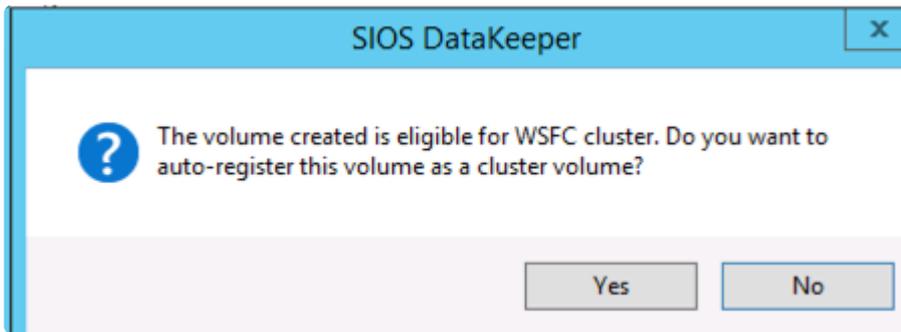
Choose your target server.



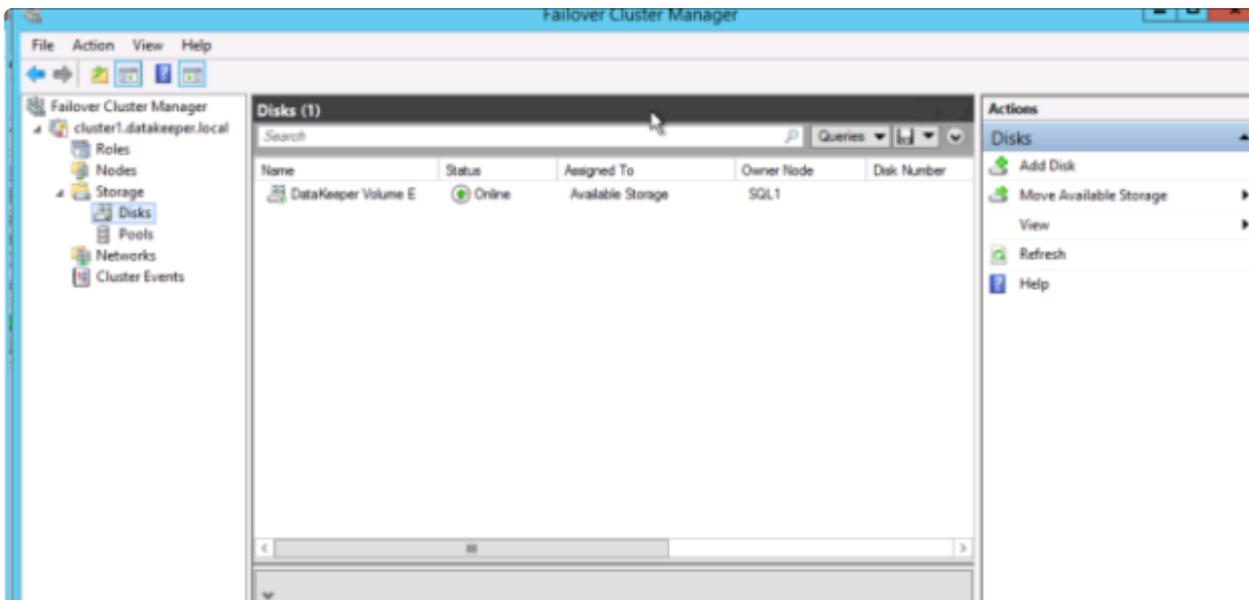
Choose your options. If two VMs are in the same geographic region we recommend using synchronous replication. For long distance replication we recommend using asynchronous replication with some level of compression. Since both SQL1 and SQL2 are in the same region, select Synchronous here.



Click **Yes** to register a new DataKeeper Volume Resource in Available Storage in Failover Clustering.

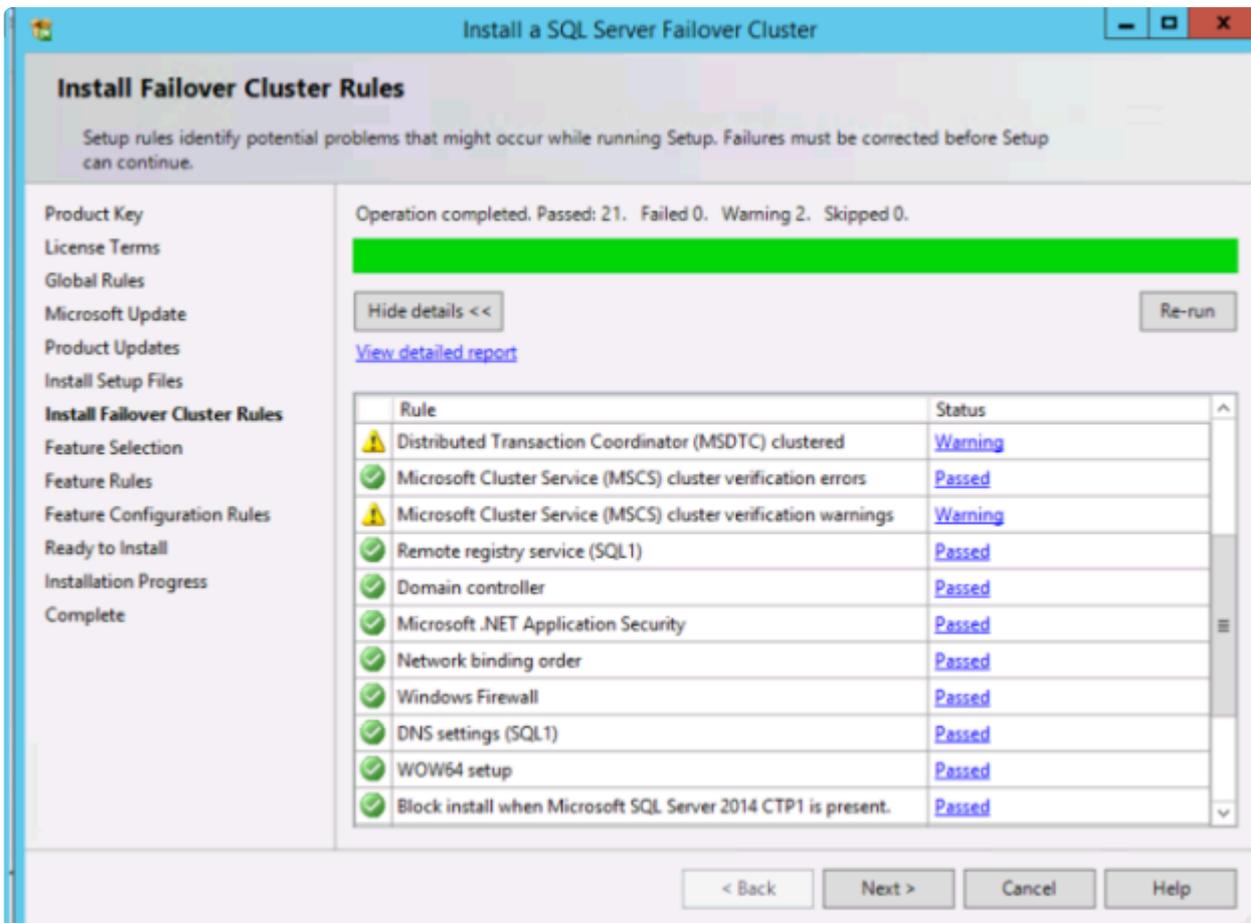
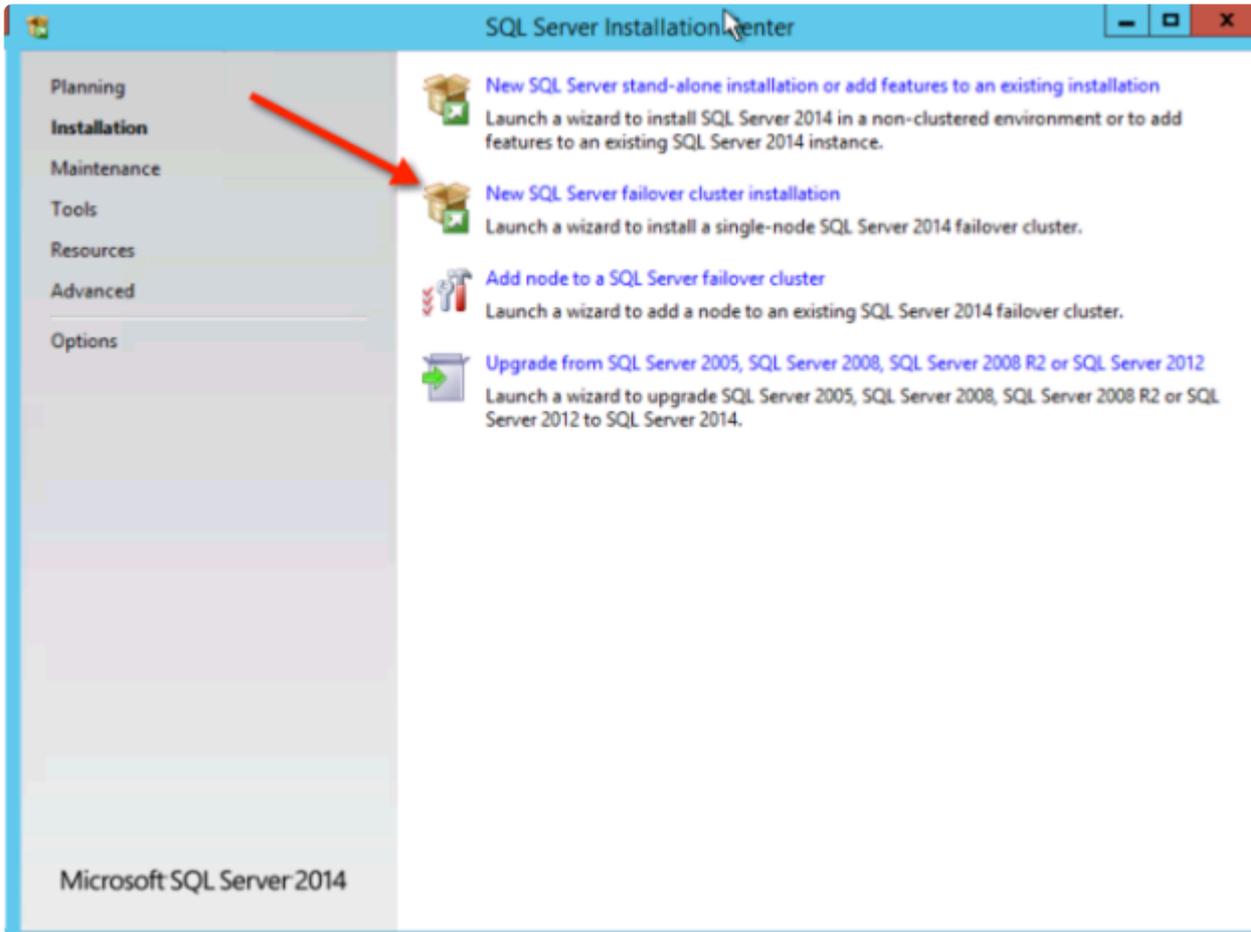


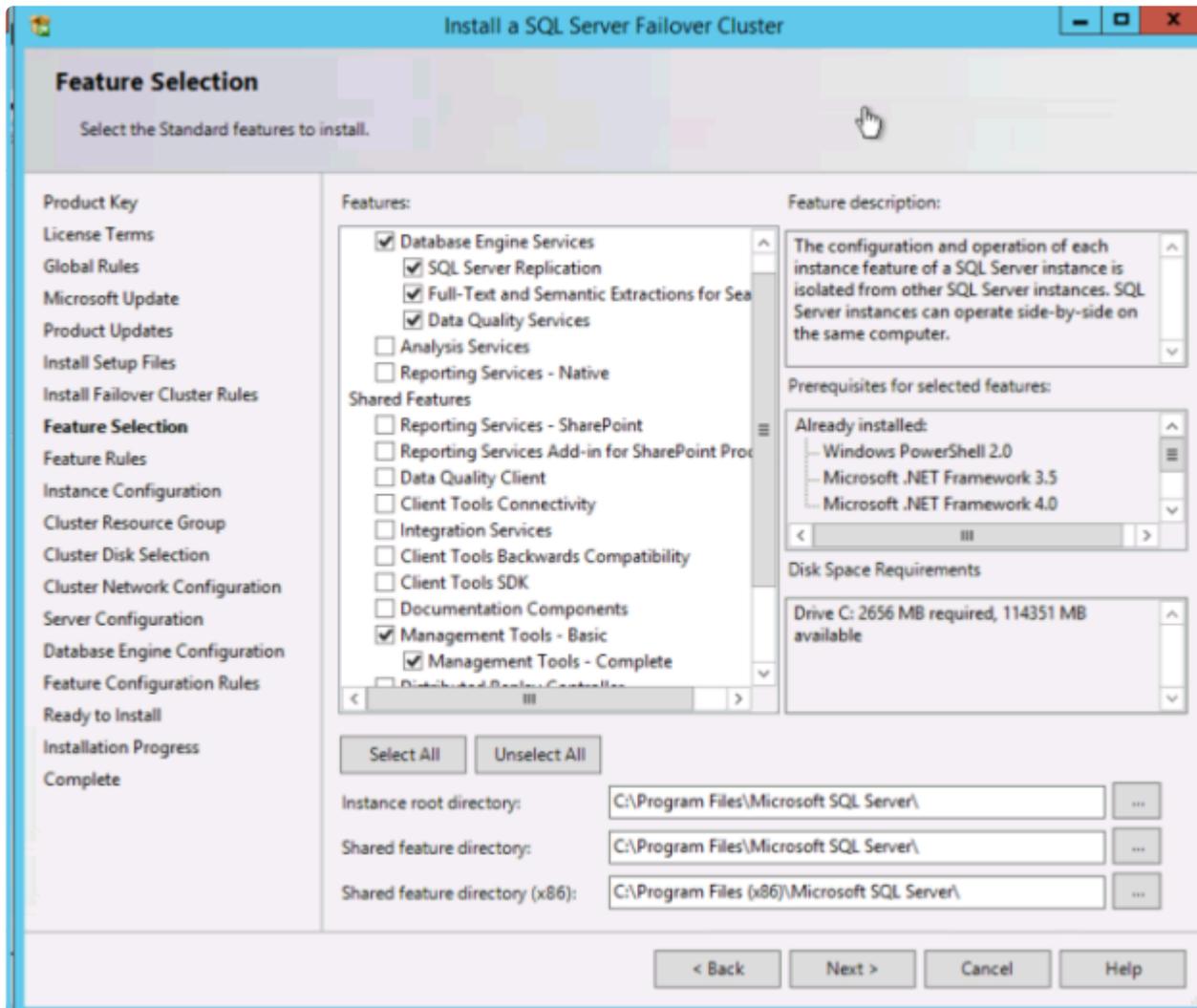
The new DataKeeper Volume Resource will appear in the Available Storage cluster group.

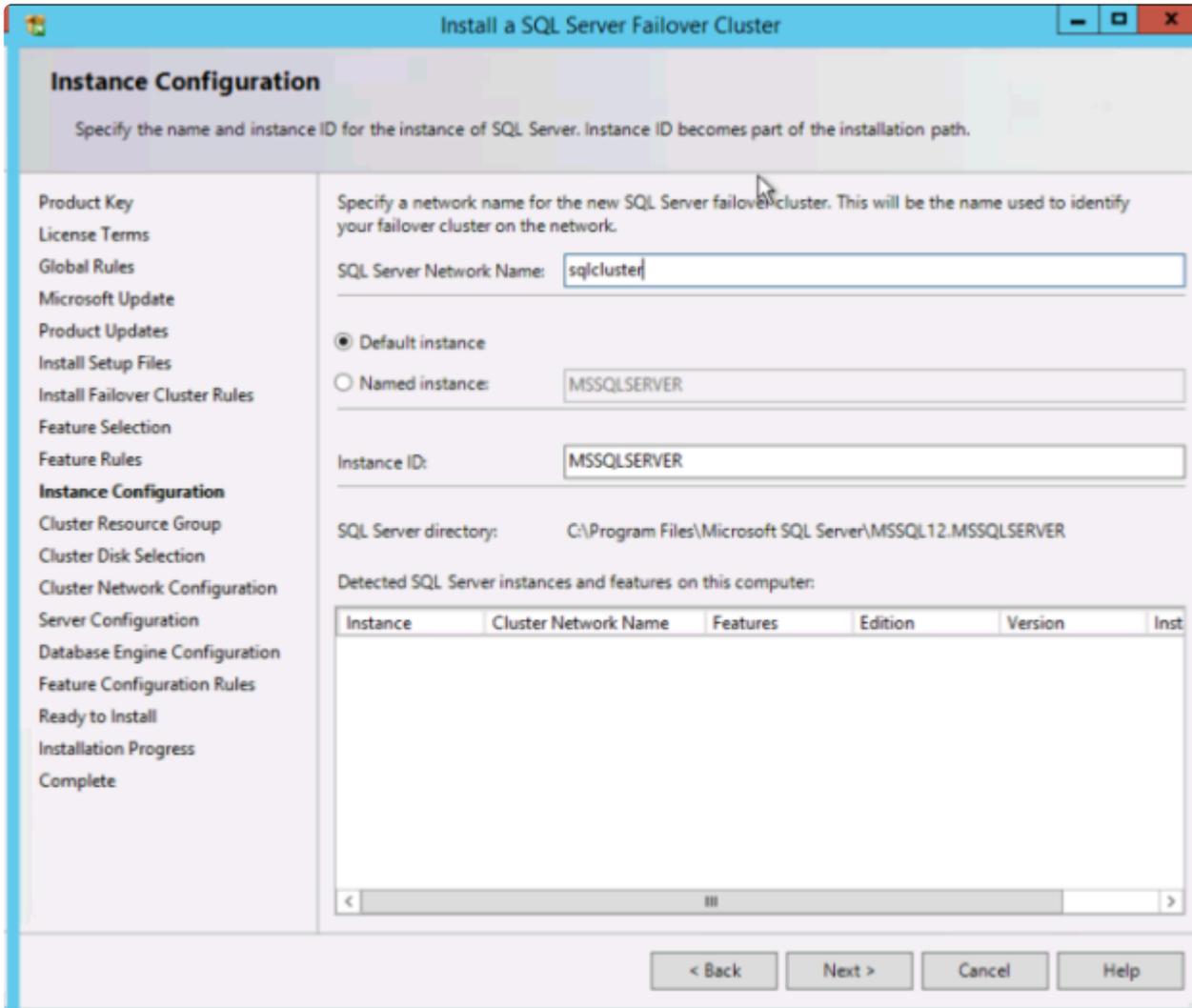


INSTALL THE FIRST CLUSTER NODE

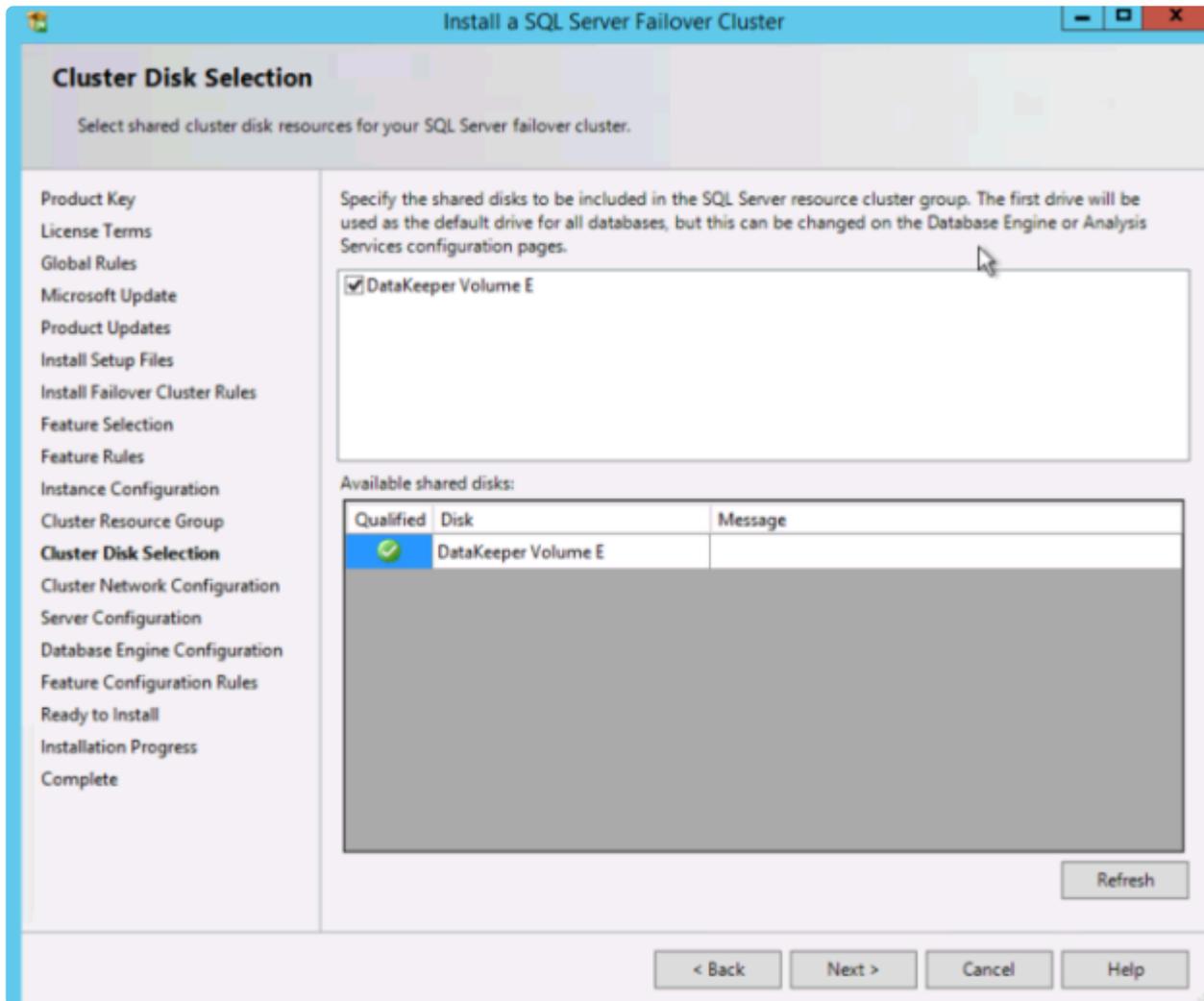
You are now ready to install your first node. The cluster installation will proceed the same as any other SQL cluster. Start the installation on the first cluster node using the **New SQL Server failover cluster installation** option.



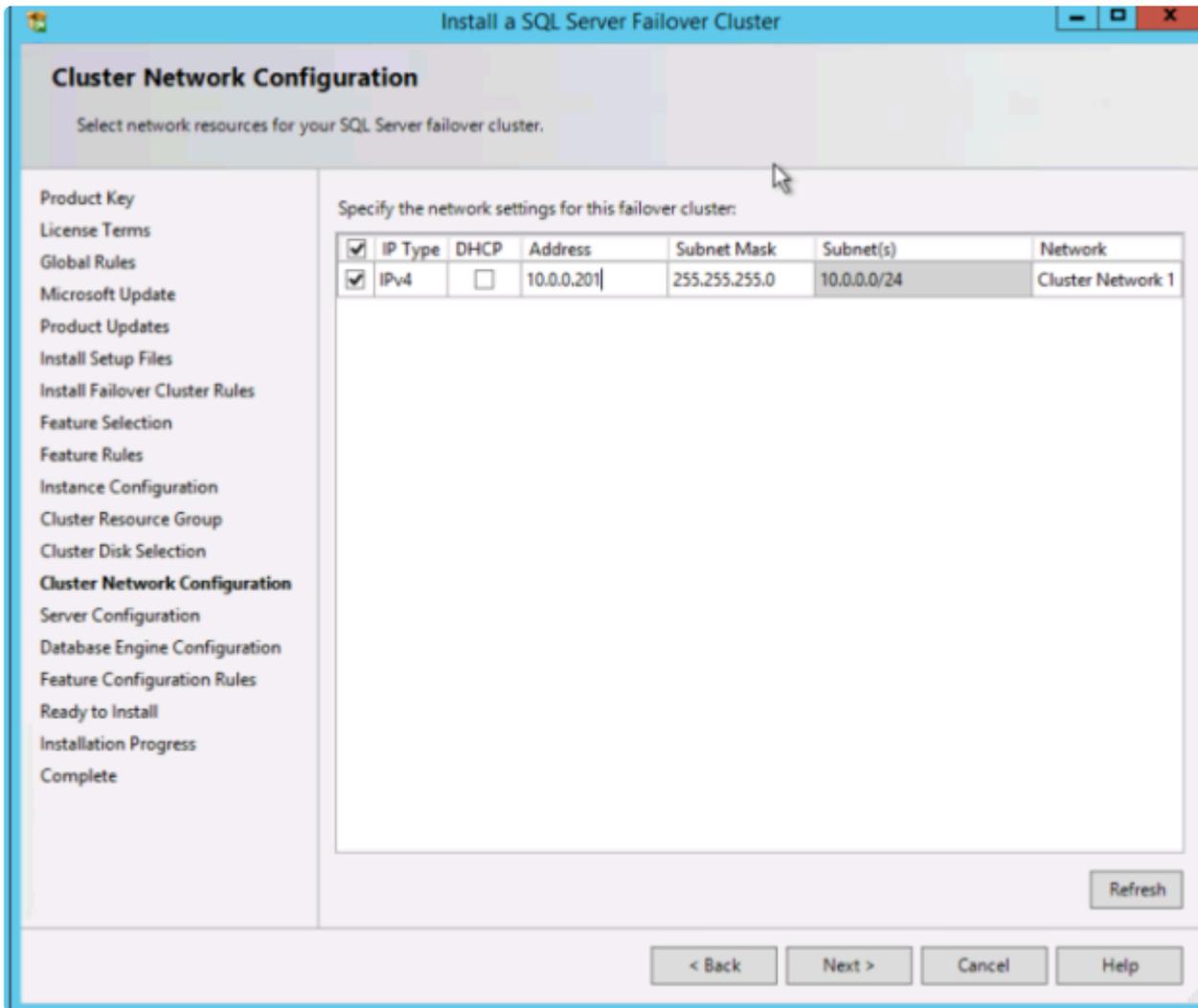




The DataKeeper Volume Resource is recognized as an available disk resource, just as if it were a shared disk.

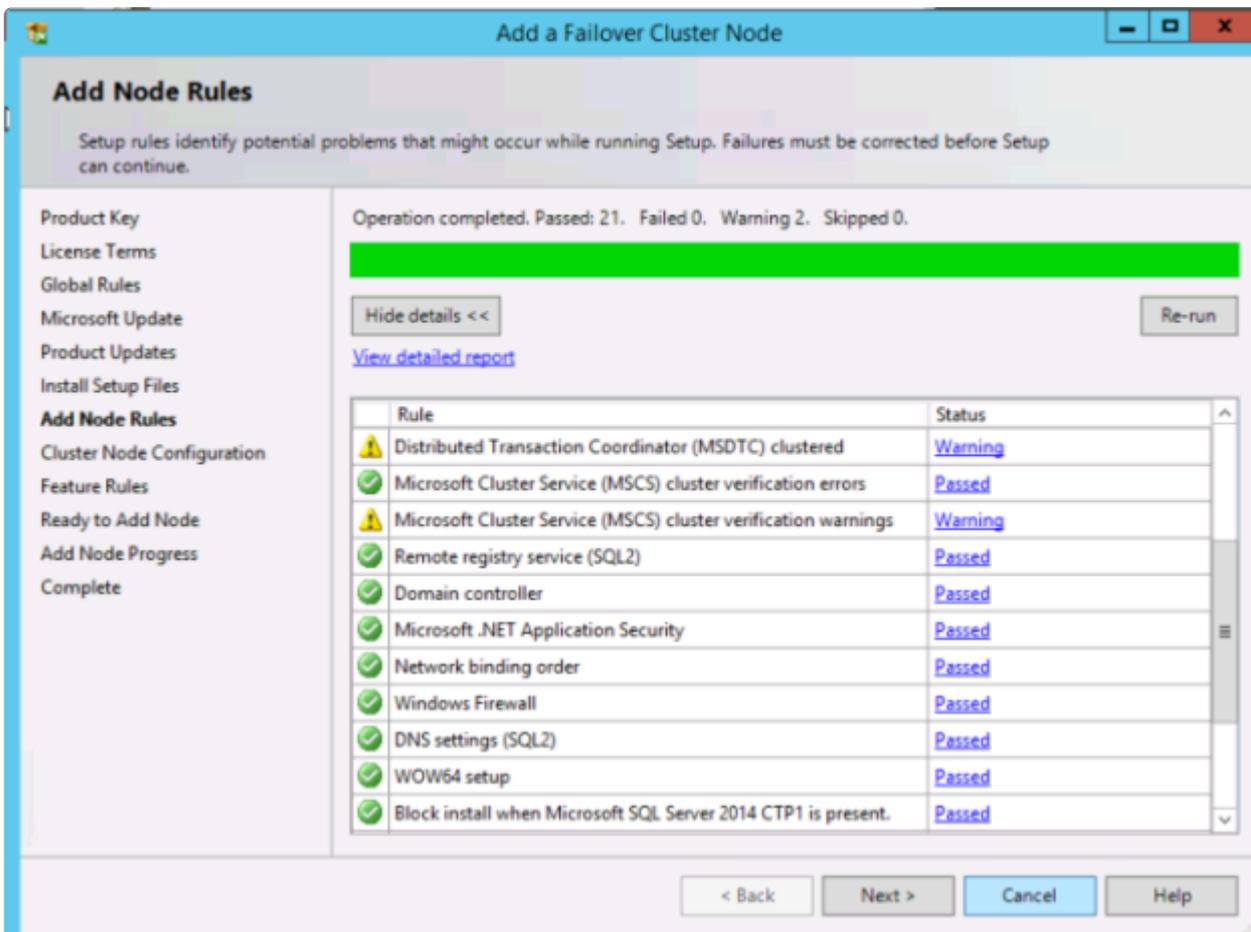
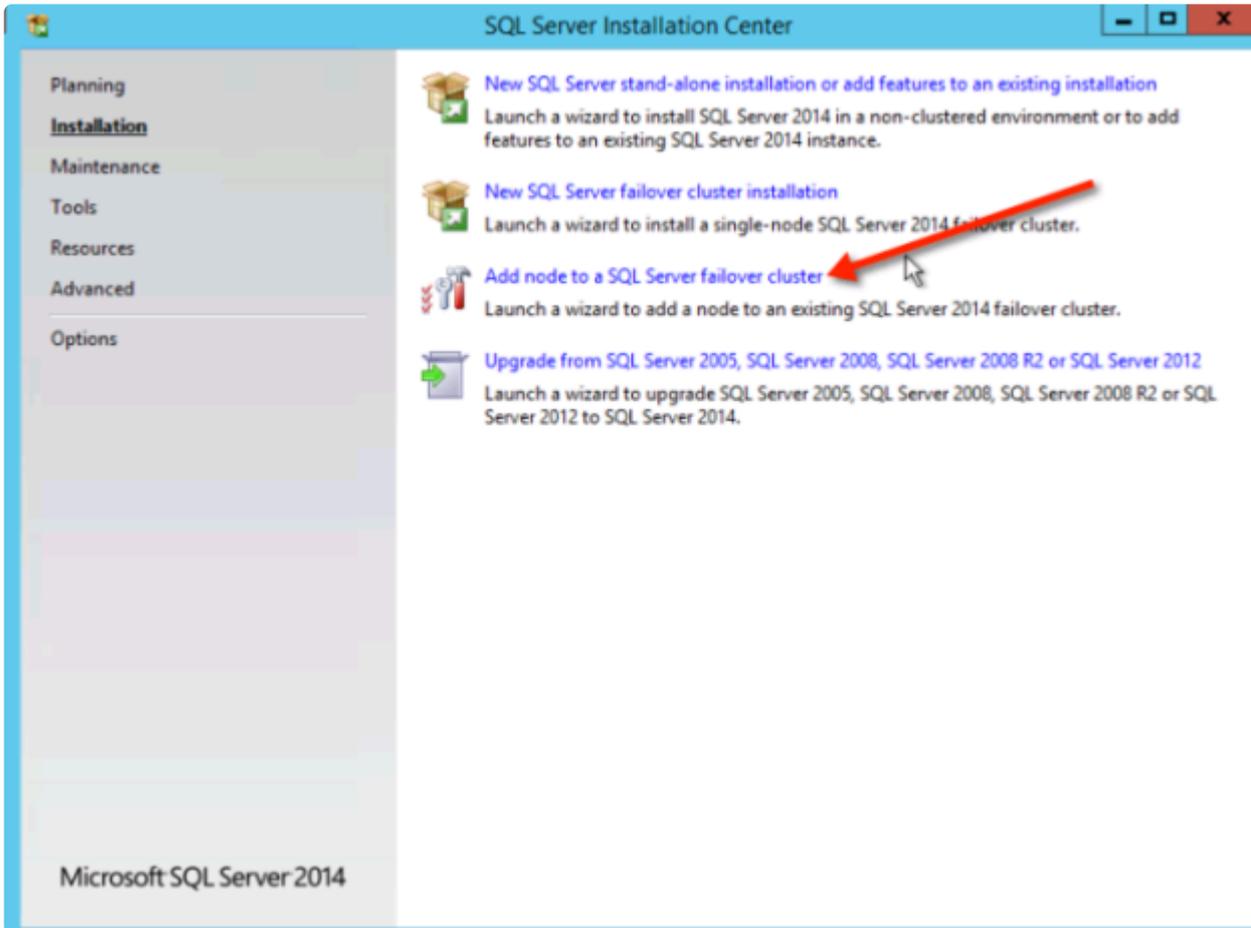


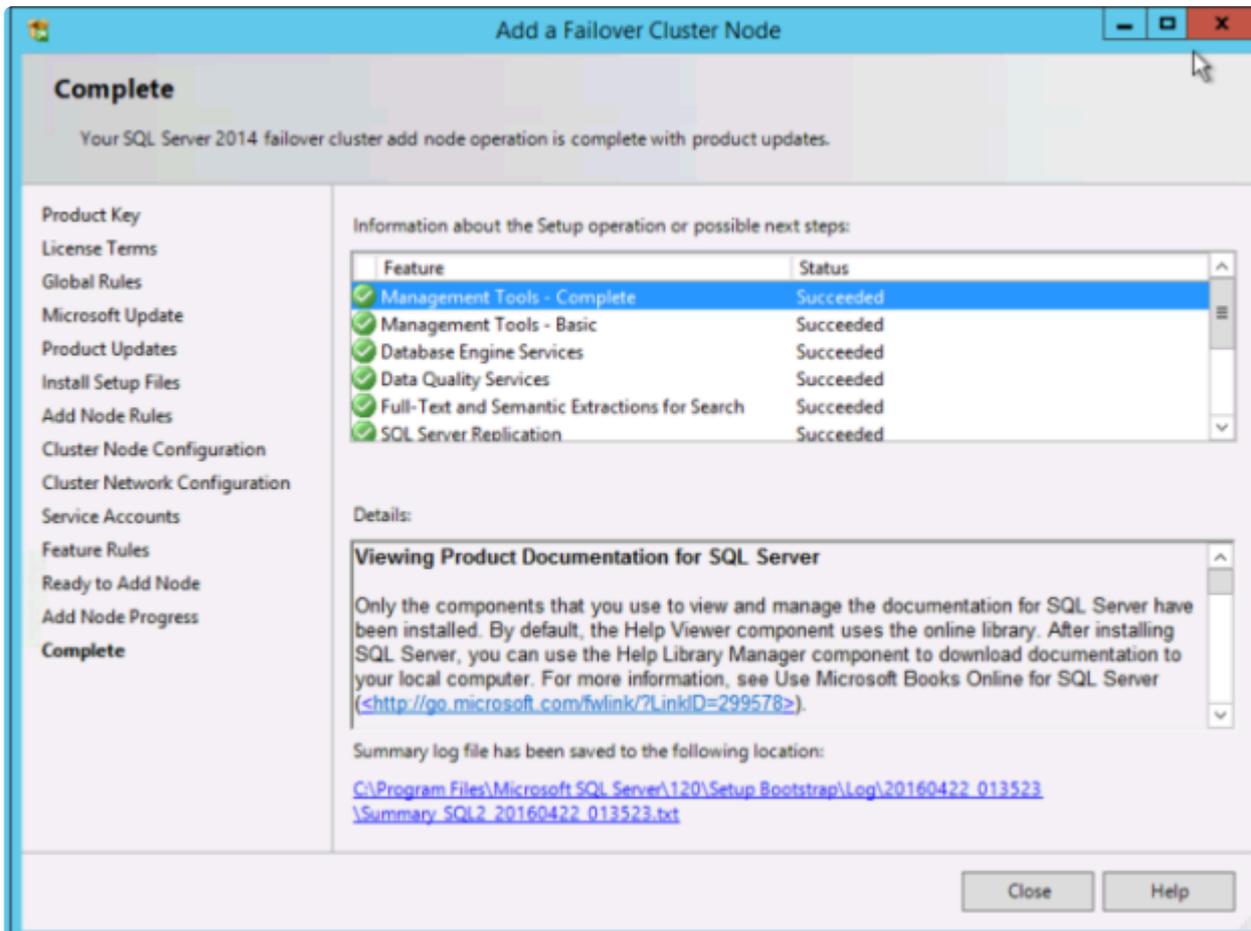
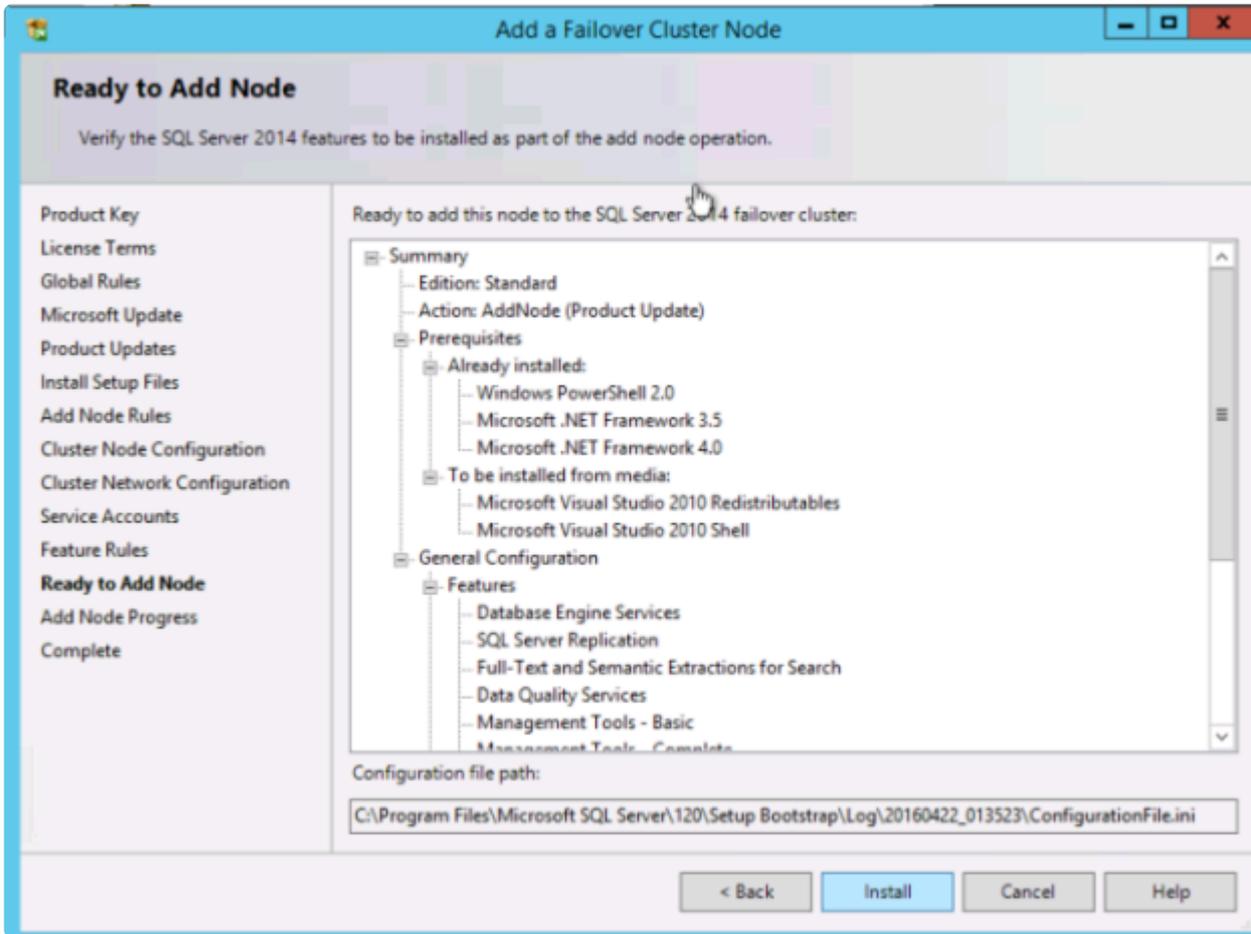
Make a note of the IP address you select here. It must be a unique IP address on your network. This IP address will be used later when creating the Internal Load Balancer.



ADD THE SECOND NODE

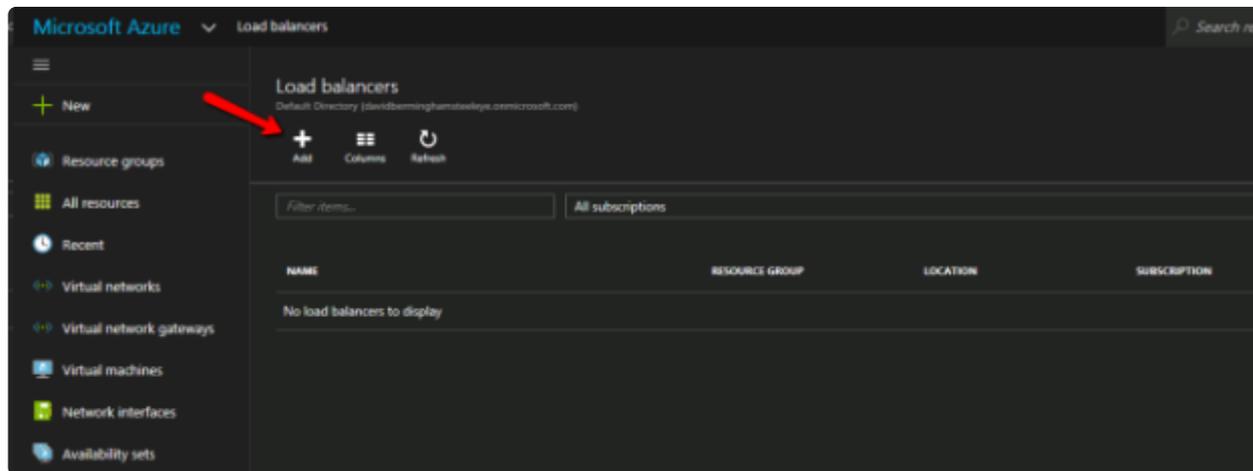
After the first node is installed successfully, start the installation on the second node using the **Add node to a SQL Server failover cluster** option.



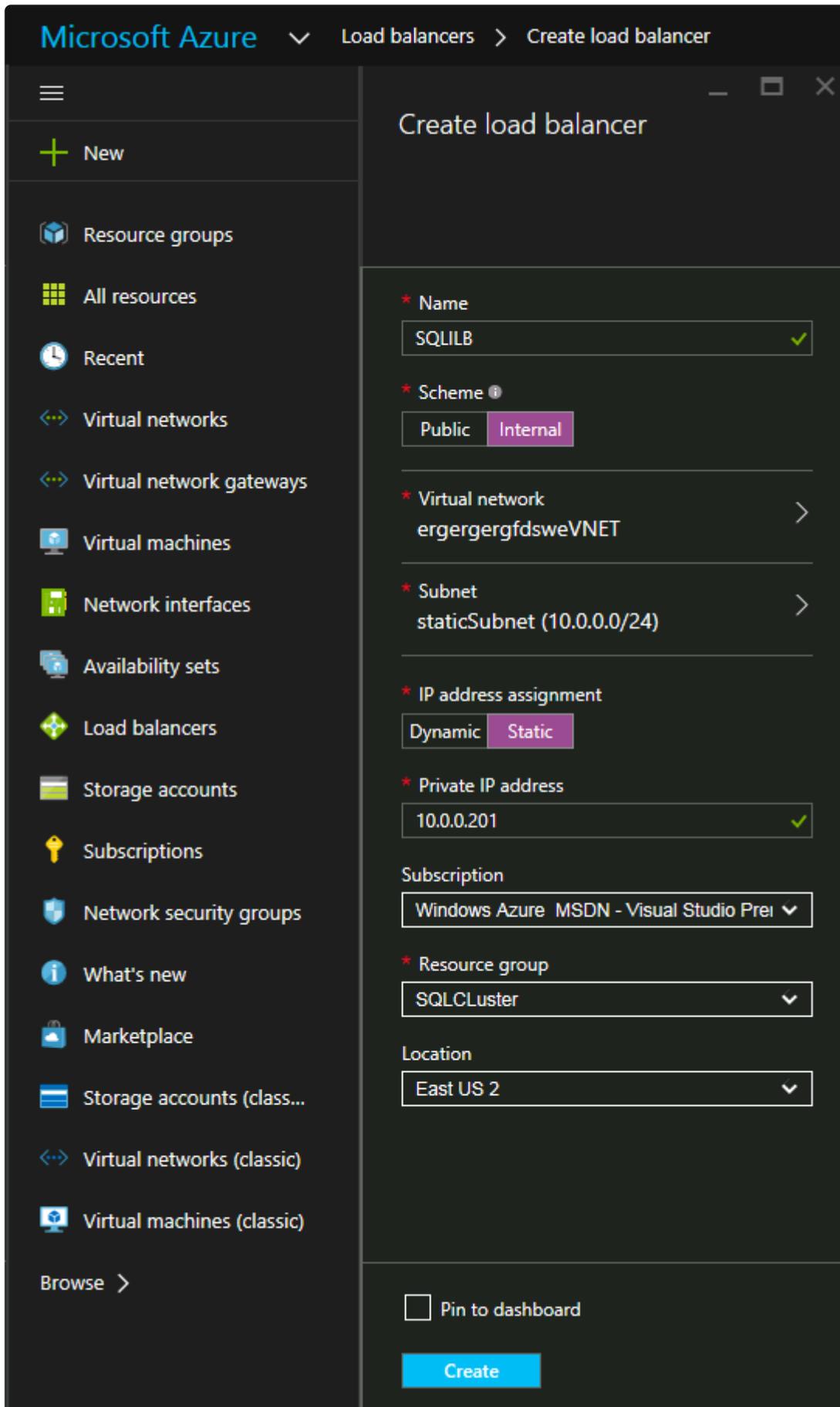


CREATE THE INTERNAL LOAD BALANCER

The failover clustering in Azure is different than traditional infrastructures. The Azure network stack does not support gratuitous ARPS, so clients cannot connect directly to the cluster IP address. Instead, clients connect via a load balancer resource which redirects them to the active cluster node. Thus an Internal Load Balancer must be created. This can all be done through the Azure Portal as shown below.

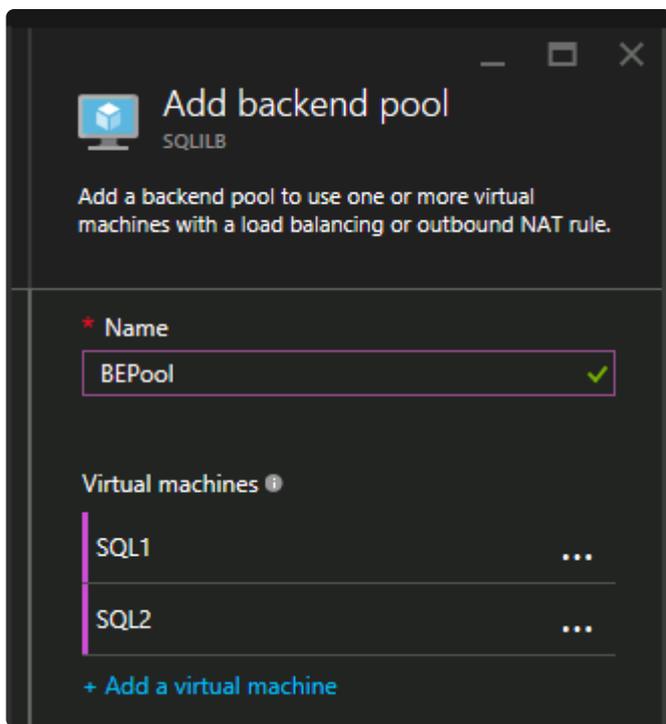
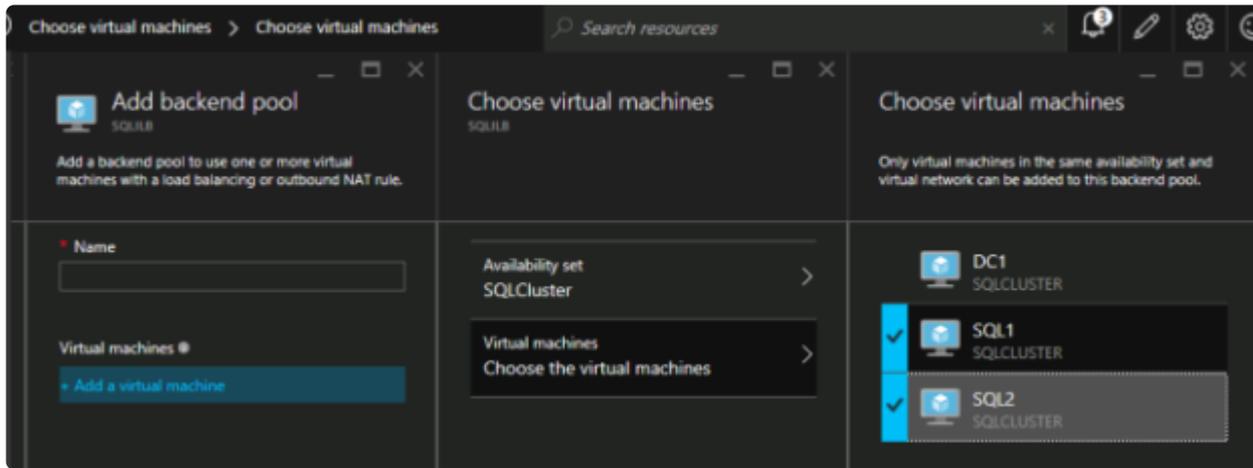


A Public Load Balancer can be used if your client connects over the public Internet. Since our clients reside in the same vNet, we will create an Internal Load Balancer. It is important that the Virtual Network is the same as the network where your cluster nodes reside. The Private IP address that you specify must be EXACTLY the same as the address you used to create the SQL Cluster Resource.



After the Internal Load Balancer (ILB) is created add a backend pool. Through this process you will choose the Availability Set where your SQL Cluster VMs reside. However, when you choose the actual VMs to add to the Backend Pool, be sure not to choose the VM hosting your file share witness, DC1.

You do **not** want to redirect SQL traffic to your file share witness.



The next step is to add a Probe. The probe we add will probe Port 59999. This probe determines which node is active in our cluster.

Add probe
SQLILB

* Name
SQLProbe ✓

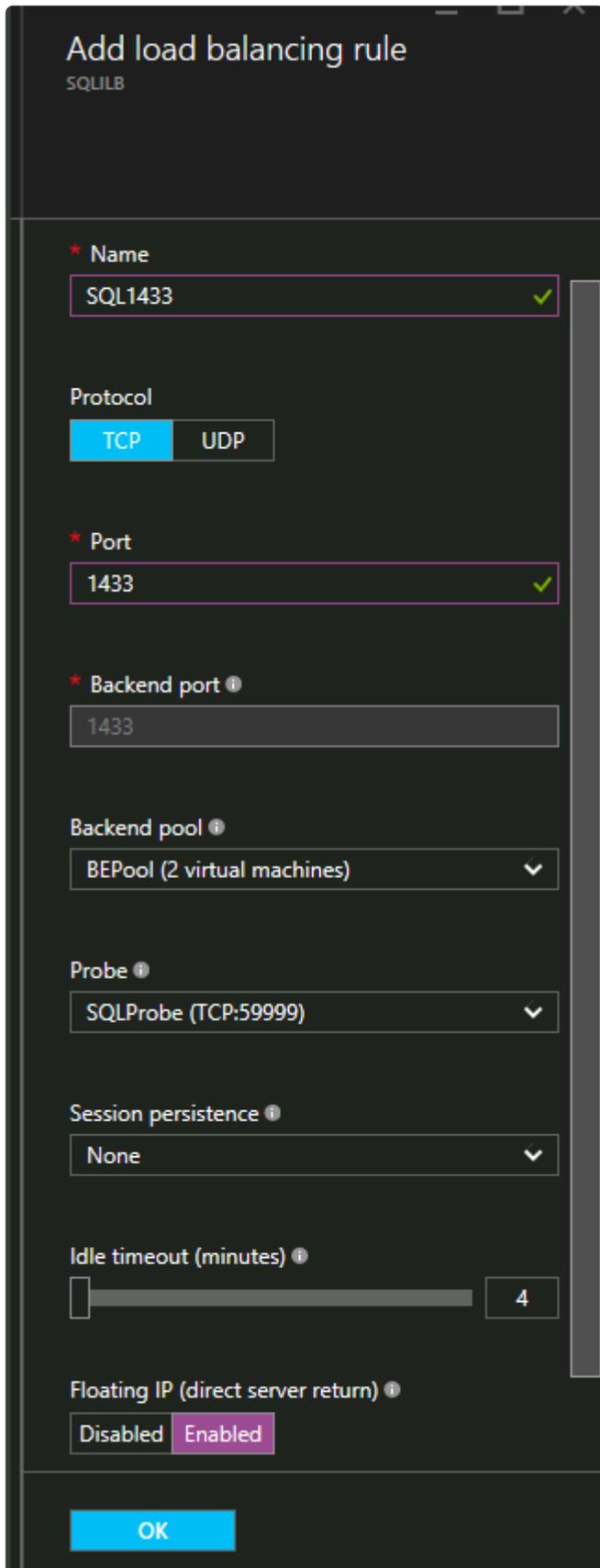
Protocol
HTTP TCP

* Port
59999

* Interval ⓘ
5 seconds

* Unhealthy threshold ⓘ
2 consecutive failures

Finally, a load balancing rule is needed to redirect the SQL Server traffic. A Default Instance of SQL uses port 1433. You can add rules for 1434 or others depending upon your application requirements. It is very important that Floating IP (direct server return) is Enabled.



FIX THE SQL SERVER IP RESOURCE

The final step in the configuration is to run the following PowerShell script on one of your cluster nodes. This will allow the Cluster IP Address to respond to the ILB probes and ensure that there is no IP address conflict between the Cluster IP Address and the ILB. **Note:** You will need to edit this script to fit

your environment. The subnet mask is set to 255.255.255.255, this is not a mistake, leave it as is. This creates a host specific route to avoid IP address conflicts with the ILB.

```
# Define variables

$ClusterNetworkName = ""

# the cluster network name (Use Get-ClusterNetwork on Windows Server 2012
of higher to find the name)

$IPResourceName = ""

# the IP Address resource name

$ILBIP = ""

# the IP Address of the Internal Load Balancer (ILB)

Import-Module FailoverClusters

# If you are using Windows Server 2012 or higher:

Get-ClusterResource $IPResourceName | Set-ClusterParameter -Multiple
@{Address=$ILBIP;ProbePort=59999;SubnetMask="255.255.255.255";Network=$ClusterNe

# If you are using Windows Server 2008 R2 use this:

#cluster res $IPResourceName /priv enabledhcp=0 address=$ILBIP
probeport=59999 subnetmask=255.255.255.255
```

5.1. ReadOnly Host Caching

According to this [Microsoft article](#), caching is **not recommended** on disks hosting SQL/Server log files. If the workload is heavily utilizing the underlying disks (any other application than SQL/Server), disk caching should also be set to none.

Please refer to <https://stackoverflow.com/questions/39623778/why-do-best-practices-tell-you-to-disable-caching-on-the-log-drive-of-sql-server> for more information.



SIOS has tested a DKCE SQL failover cluster in Azure changing the value from **None** to **Read/Only**.

To change the value:

1. Go to the specific instance
2. Select disks
3. Click on the name of the data disk
4. Change host caching to the specific value
5. Click save

When tested on both cluster nodes with large numbers of files copied onto a 100GB volume, no degradation was detected. We also performed switchovers and paused and continued the mirror and no degradation was detected.

6. Configure a File Server Cluster in Azure Spanning Multiple Availability Zones(AZ)

This step by step guide contains detailed steps that are required to deploy a 2-node File Server Failover Cluster that spans the new Availability Zones in a single region of Azure. The guide assumes that you have basic knowledge of Azure as well as Failover Clustering. The focus will be on deploying a File Server Failover Cluster in Azure across Availability Zones.

 If your Azure region doesn't support Availability Zones you will need to use Fault Domains instead.

DataKeeper Cluster Edition (DKCE) allows you to take the locally attached Managed Disks, whether Premium or Standard Disks, and replicate those disks either synchronously, asynchronously or a mix or both, between two or more cluster nodes. DataKeeper Volume resource is registered in Windows Server Failover Clustering which takes the place of a Physical Disk resource. Instead of controlling SCSI-3 reservations like a Physical Disk Resource, the DataKeeper Volume controls the mirror direction, ensuring the active node is always the source of the mirror. Failover Clustering acts like a Physical Disk and is used the same way Physical Disk Resource would be used.

Prerequisites

- The user should be comfortable using the Azure Portal and deploying virtual machines in Azure IaaS.
- The user will have obtained a DKCE license (permanent or evaluation) or running DKCE Pay-As-You-Go instances.

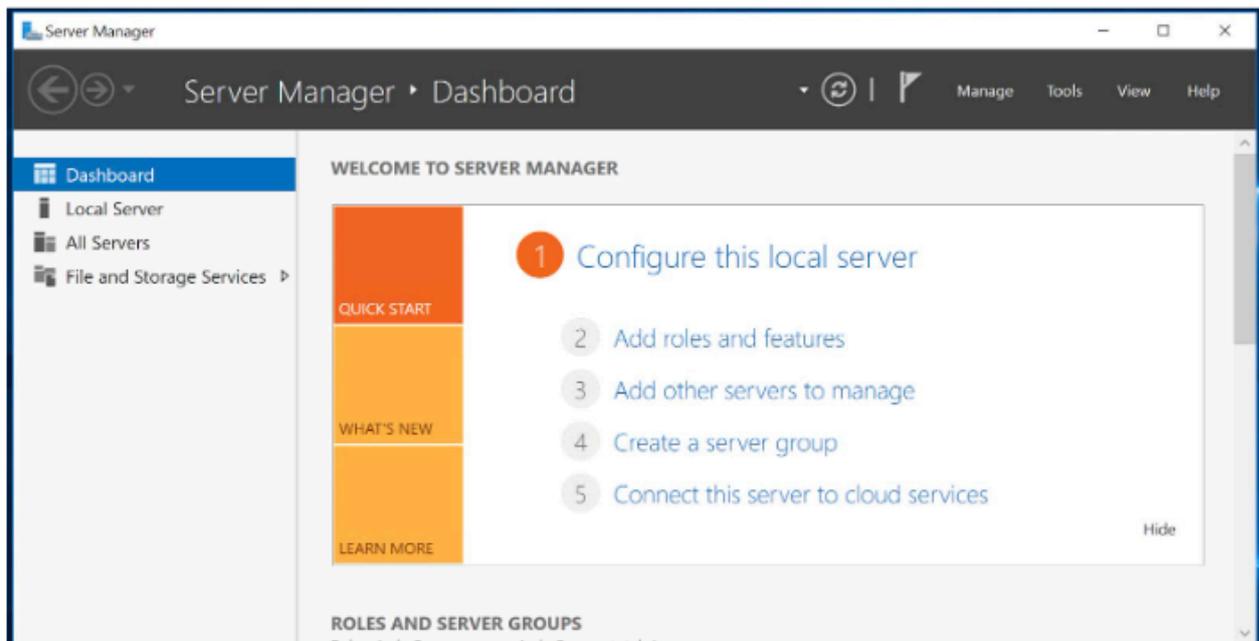
6.1. Deploy an Active Directory Domain Controller in Azure

Deploy a Virtual Machine that will work as a Domain Controller for the cluster that is going to be deployed. This step can be skipped if there is a Domain Controller already configured.

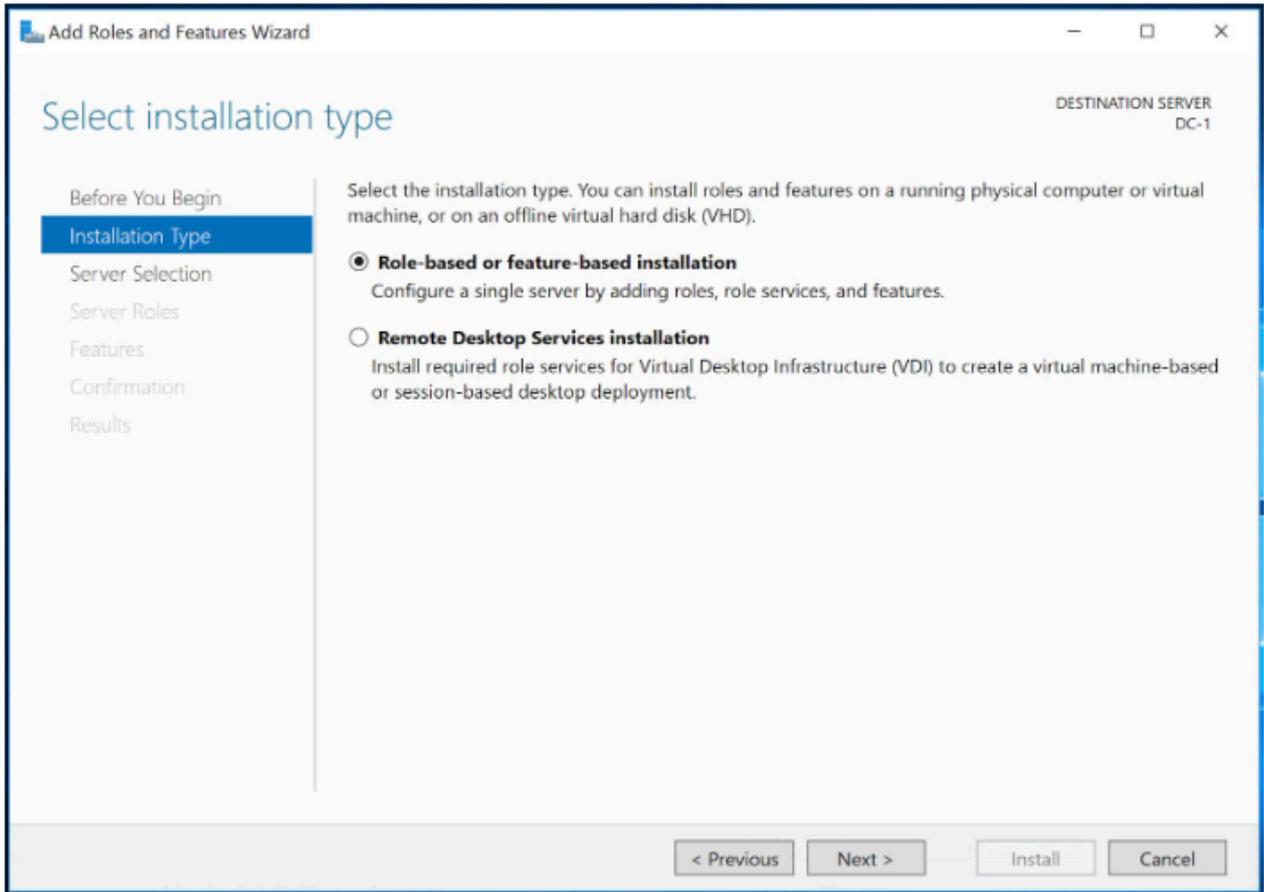
- * This Virtual Machine running a Domain Controller should be in a different Availability Zone than the other two nodes in the cluster. In the example given below, it is in Availability Zone 3.

Follow these steps to setup an Active Directory Domain Controller:

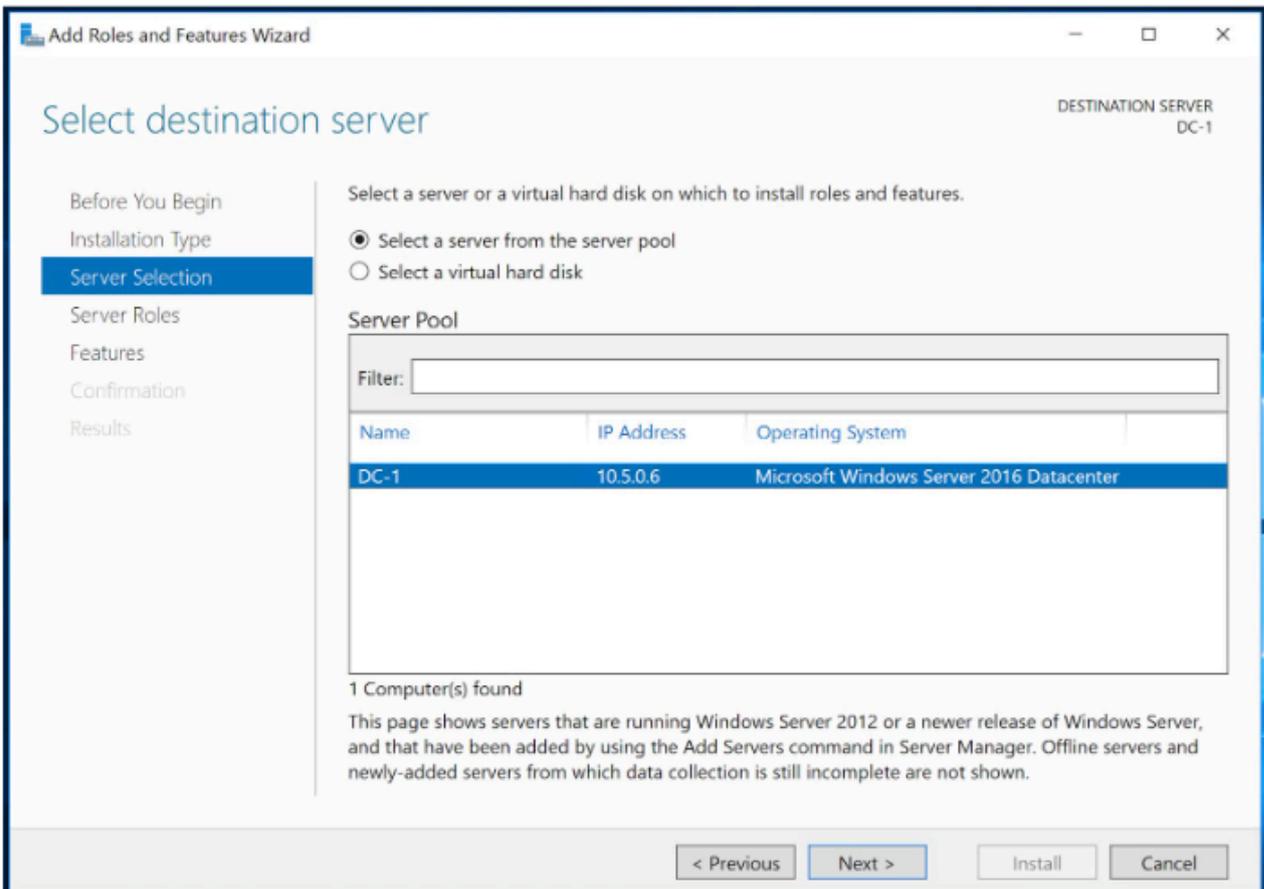
1. In Server Manager choose **Add roles and features**.



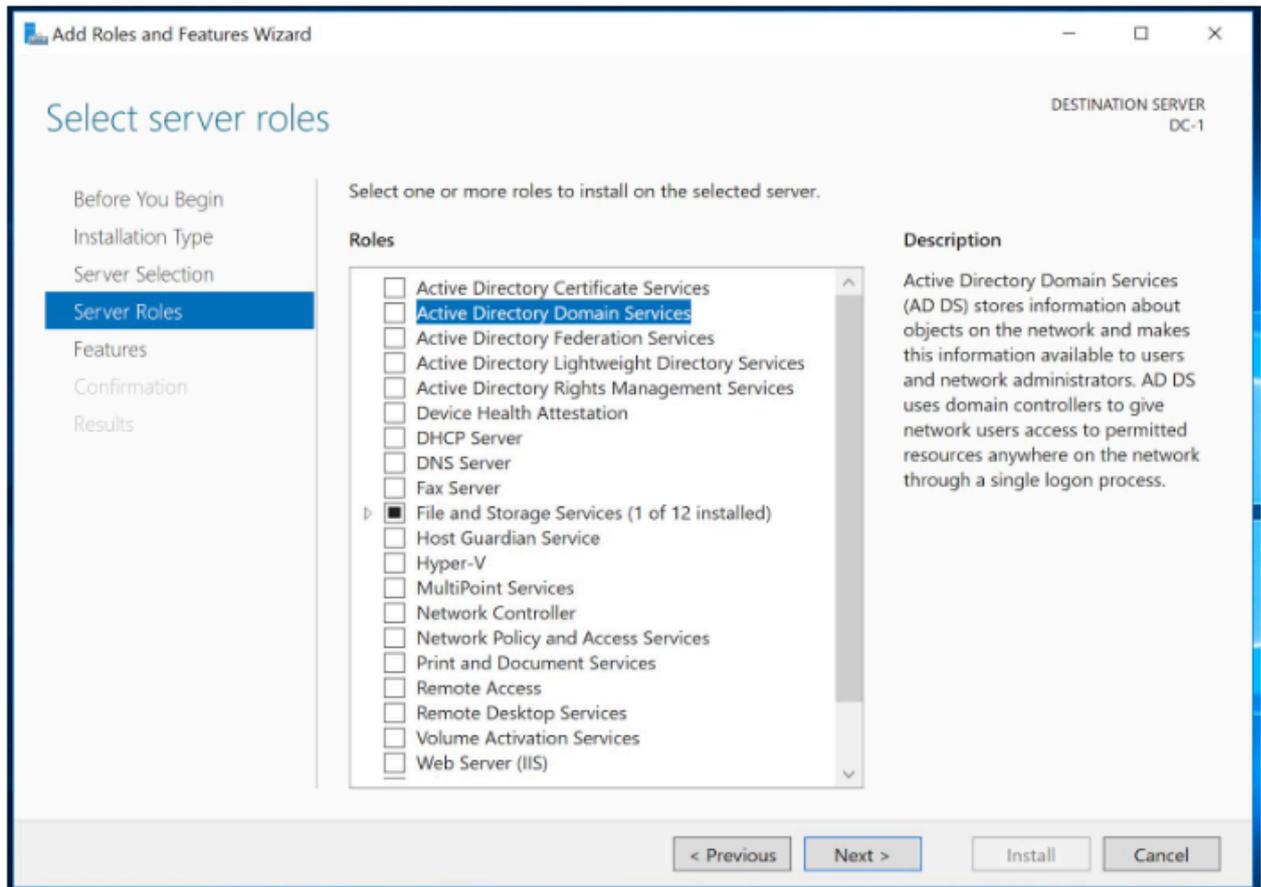
2. Choose **Role-based** or **feature-based installation**.



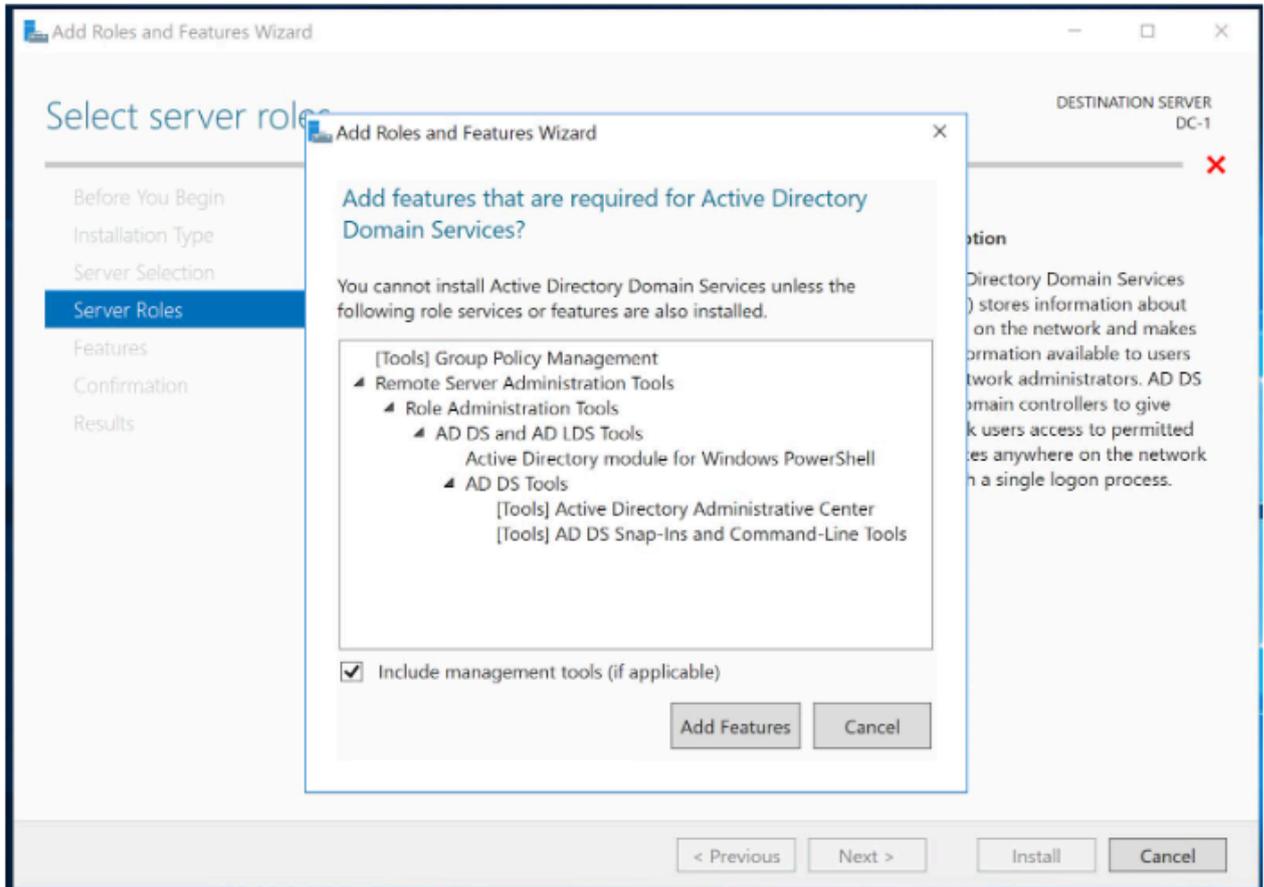
3. Select the server by highlighting it and click **Next**.



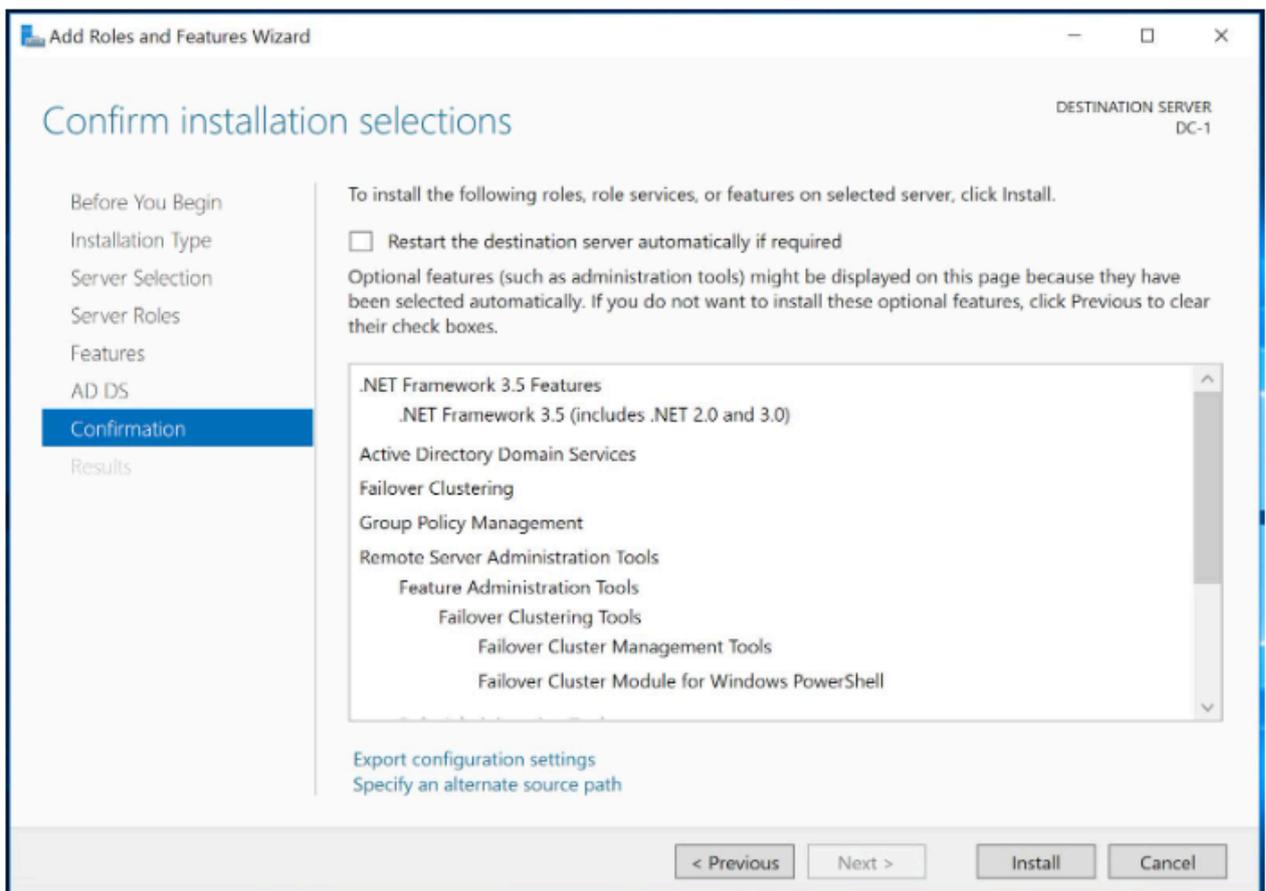
4. Choose **Active Directory Domain Services** and click **Next**.



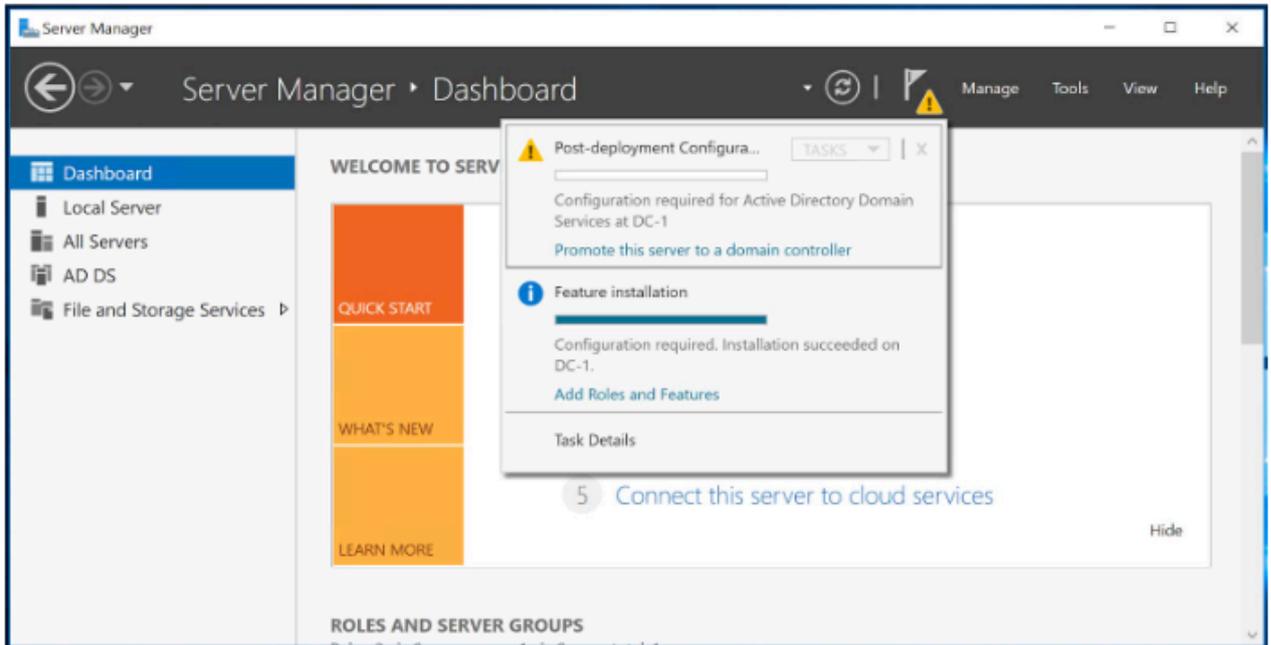
5. Click **Add Features**. This will install the Active Directory Features chosen earlier on to the server.



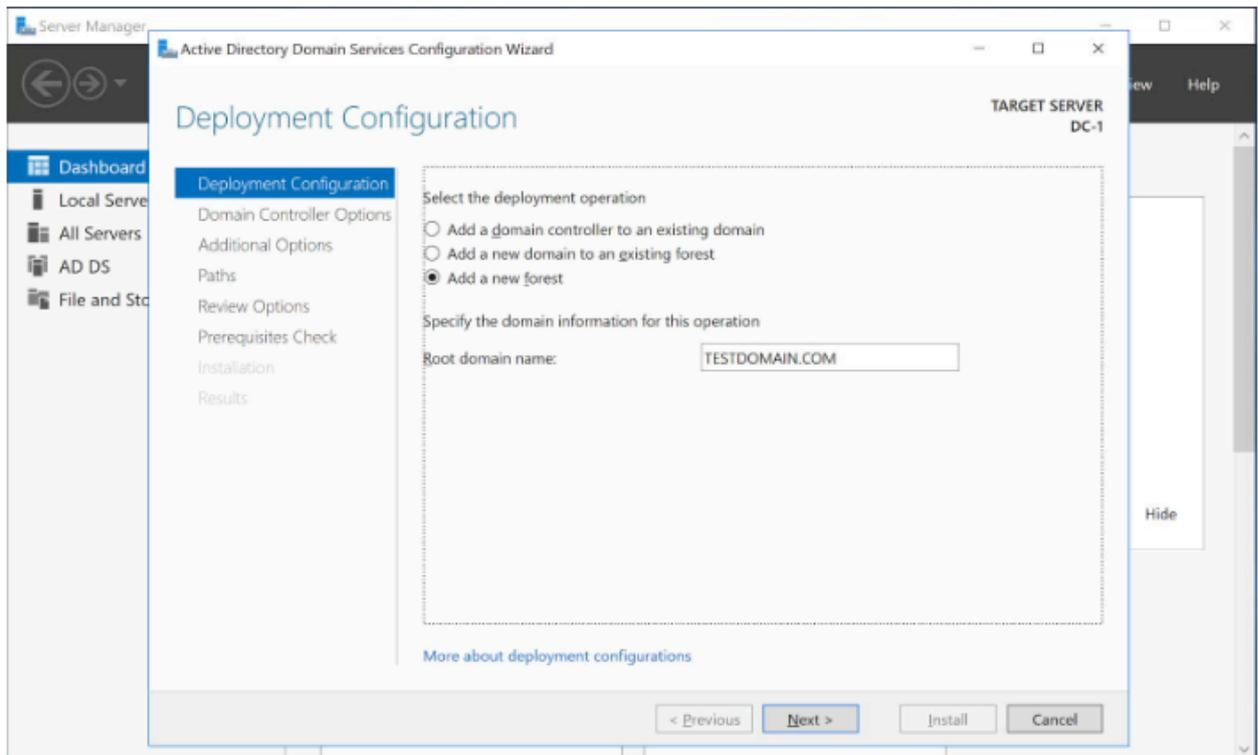
6. Click on **Next** until the last window and then click **Install**.



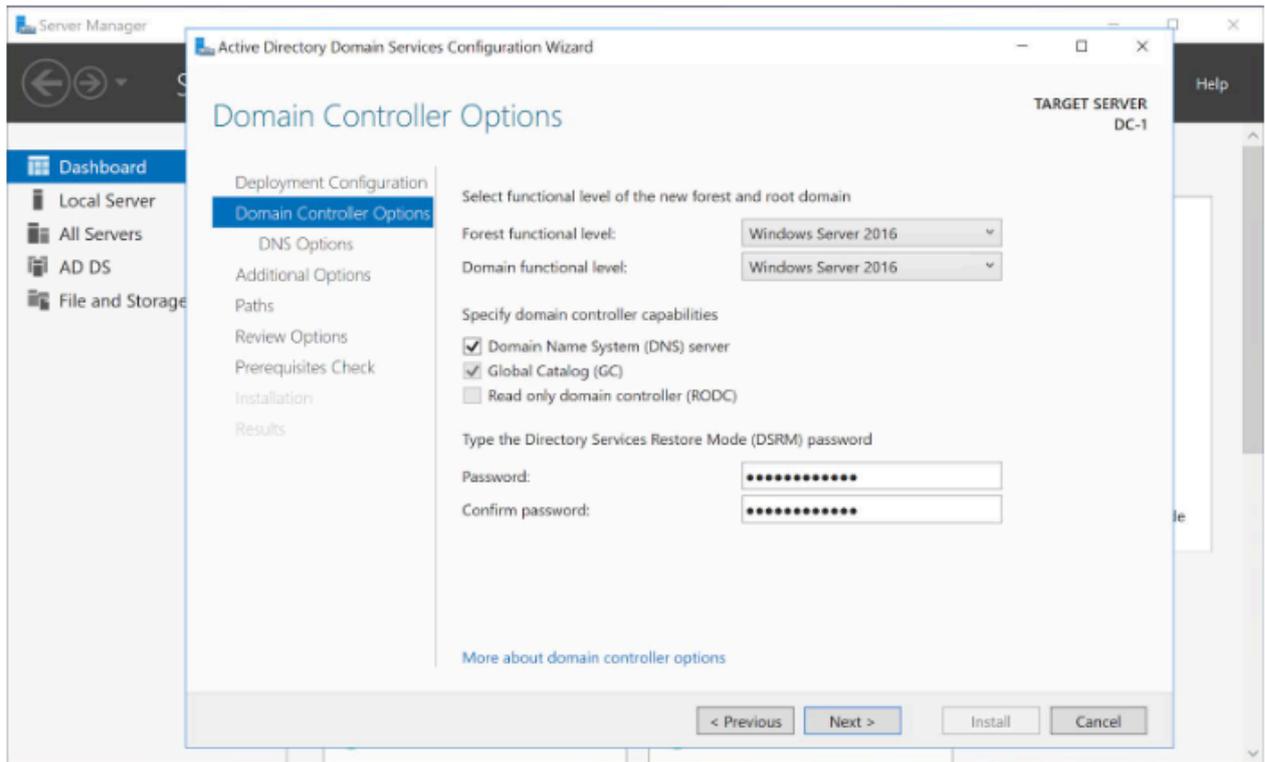
- Once the installation is complete, the server needs to be promoted to a domain controller. Click on the yellow exclamation mark in the upper-right corner of the Server Manager and click on **Promote this server to a domain controller**.



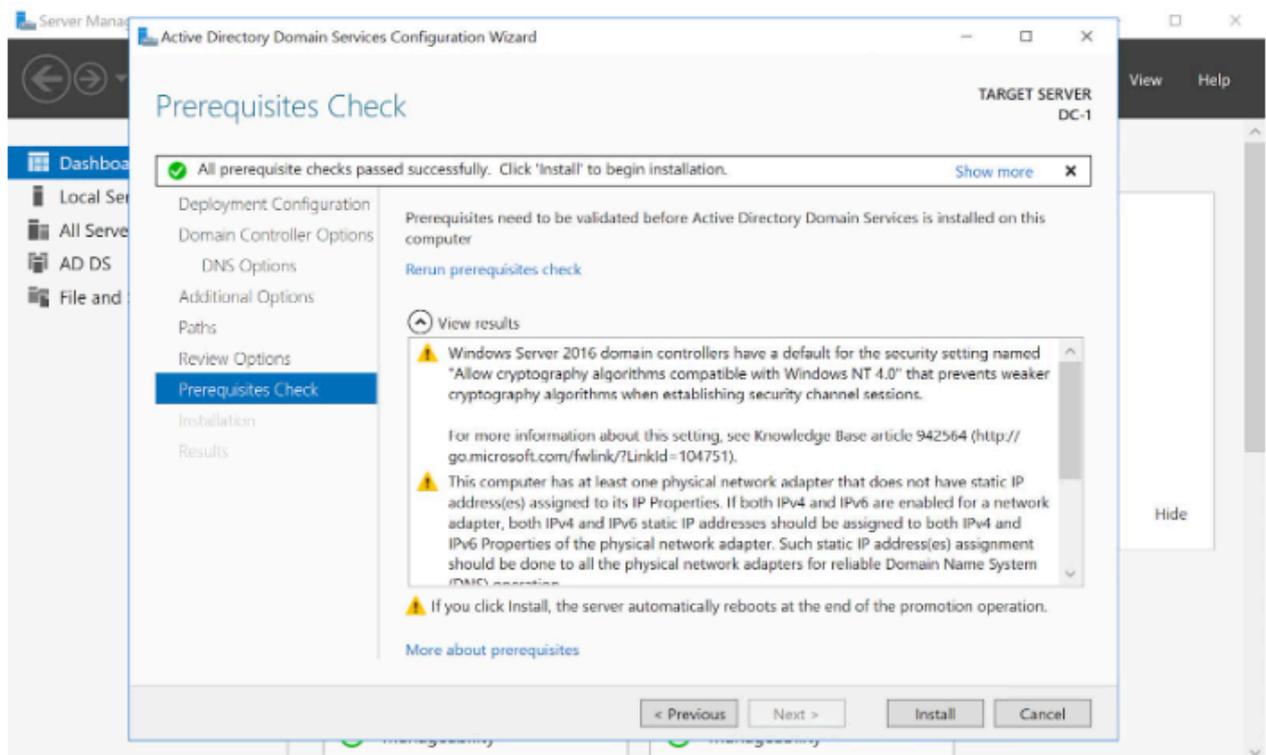
- Select **Add a new forest** and enter your custom domain name.



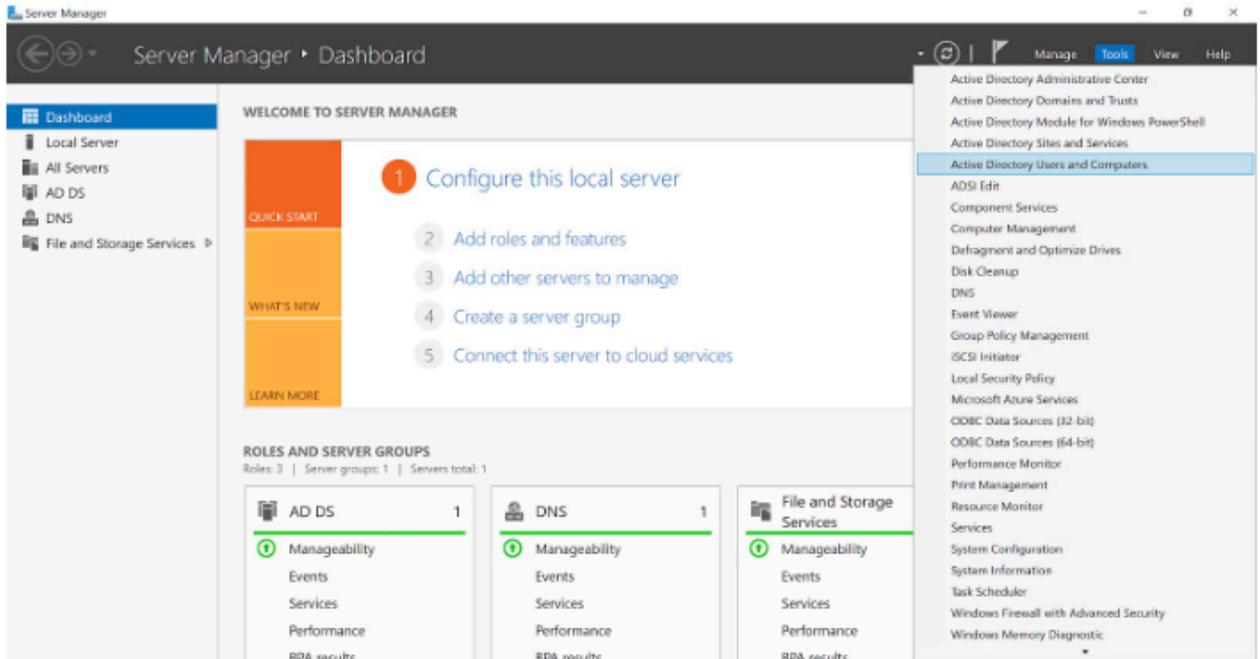
- Enter your password for DSRM then click **Next**.



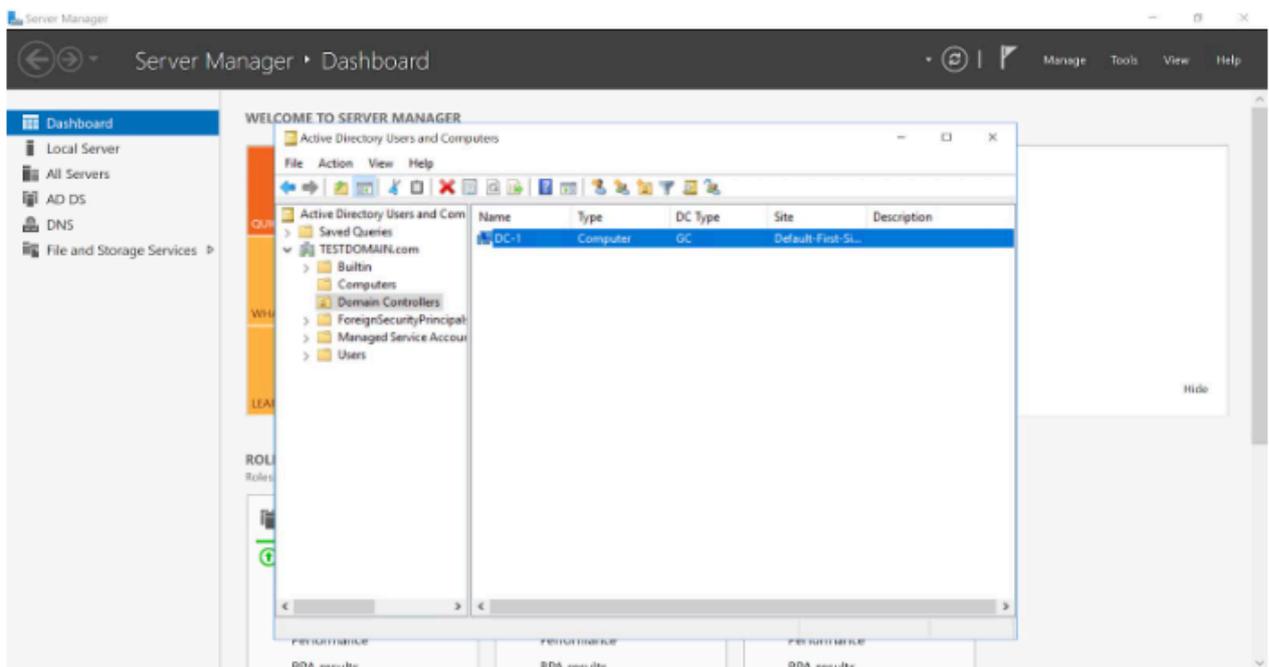
10. Click **Next** on all subsequent windows then click **Install** on Prerequisites Check screen.



11. The server will automatically reboot once the installation process is complete. Once the reboot completes, log back in with domain credentials. To verify the install, from the Server Manager select **Tools -> Active Directory Users and Computers**.



12. Click and expand **TESTDOMAIN.com** (which is the root domain) and click on **DomainControllers**.



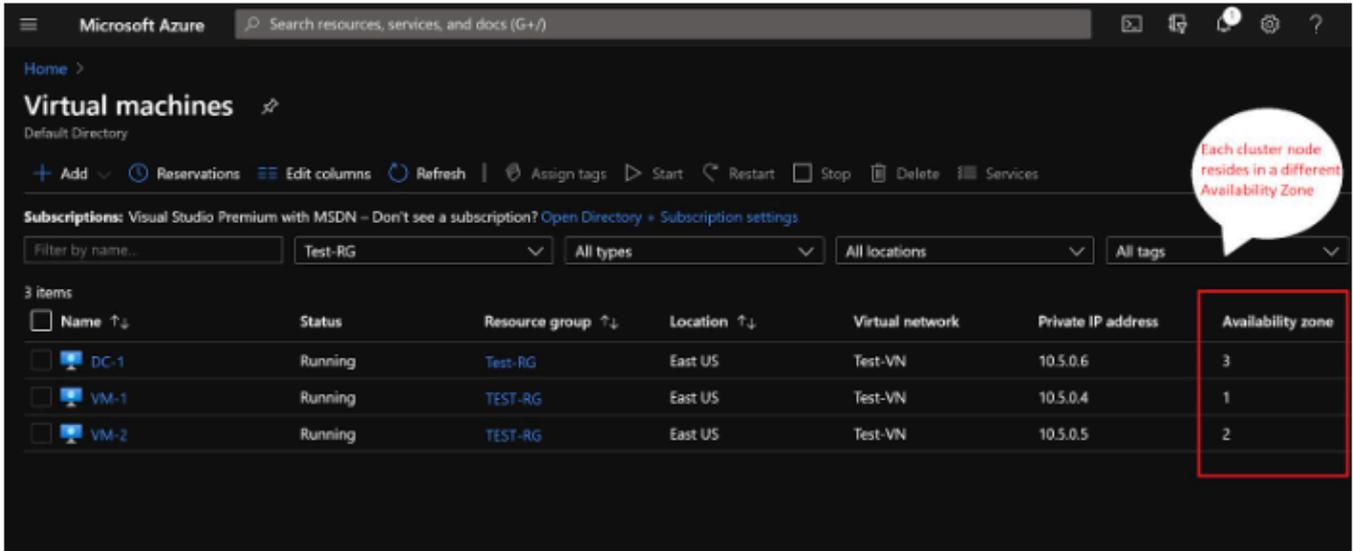
The Domain server will be displayed and is now deployed. The cluster nodes are added to the same domain controller.

Provisioning the Two Cluster Nodes

Using the Azure Portal, provision VM-1 and VM-2 in the same way. There are numerous options to choose from including instance size, storage options, etc. This guide is not meant to be an exhaustive guide to deploying Servers in Azure.Availability Zones. It is important that both VM-1,and VM-2 reside in different Availability Zones. For the sake of this guide we will assume Window 2016 and will use a Cloud Witness for the Cluster Quorum.

✿ If using Windows 2012 R2 or Windows Server 2008 R2 instead of Windows 2016, a File Share Witness in the 3rd Availability Zone has to be configured as a Cloud Witness (introduced in Windows Server 2016).

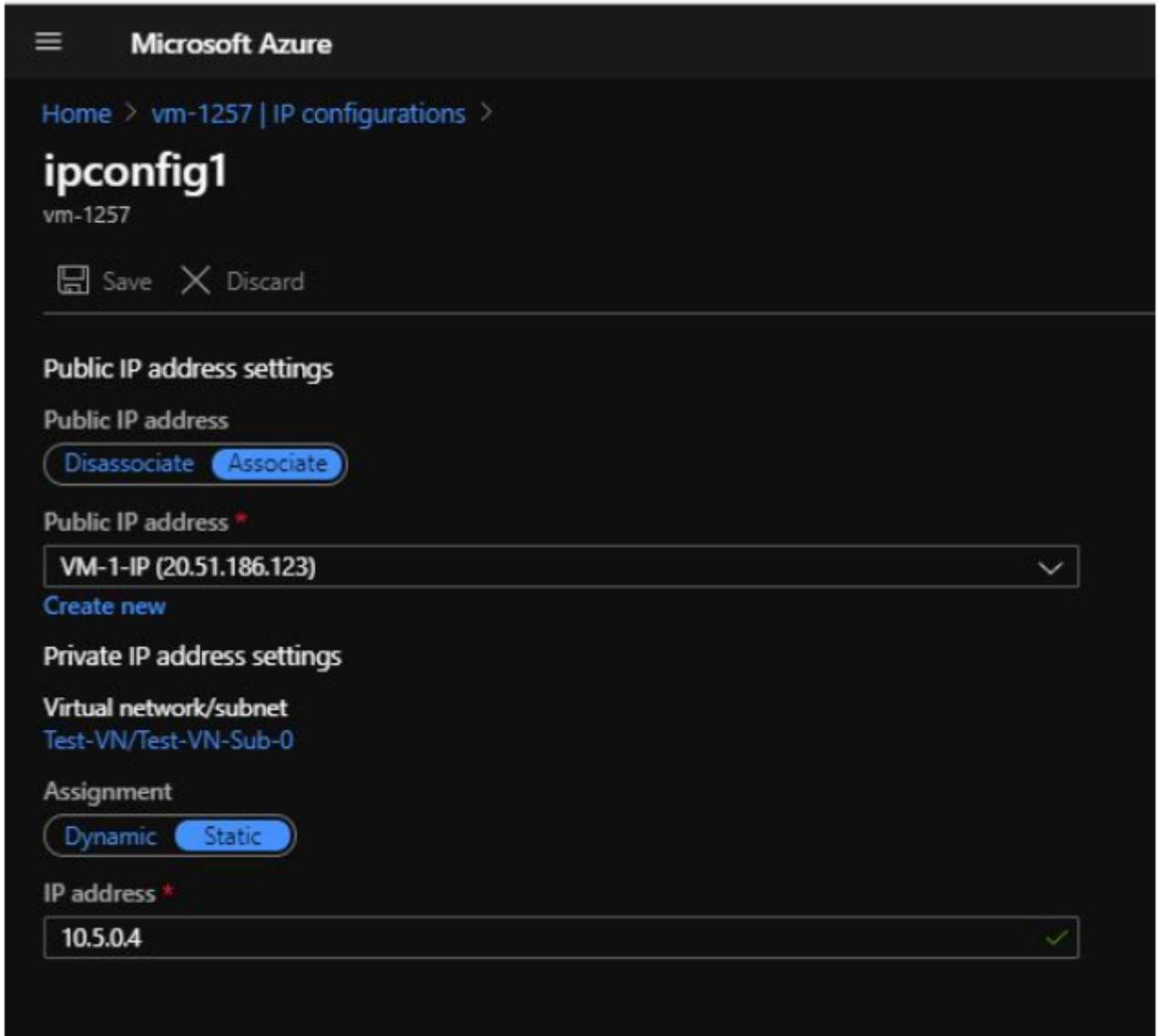
By putting the cluster nodes in different Availability Zones we are ensuring that each cluster node resides in a different Azure datacenter in the same region. Leveraging Availability Zones rather than older Fault Domains helps protect the cluster from the possible outages.



Add each cluster node to a different Availability Zone. If a File Share Witness is leveraged, it should be provisioned in the 3rd Availability Zone.

Static IP Address

While each VM is getting provisioned, make sure to change the settings so that the private IP is Static. If they are not changed to Static, the private IP addresses of the cluster nodes will change during subsequent reboots which leads to undesirable results.



Storage

Refer to [Performance best practices for SQL Server in Azure Virtual Machines](#) for more information on storage. At least one additional Managed Disk needs to be added to each of cluster nodes. DataKeeper can use Basic Disks, Premium Storage or multiple disks striped together in a local Storage Space. If a local storage space is desired, storage space should be created BEFORE any cluster configuration is done. This is due to a known issue with Failover Clustering and local Storage Spaces. All disks should be formatted NTFS.

6.2. Deploying a File Server Failover Cluster Instance using the Azure Portal

To build a 2-node File Server Failover Cluster Instance in Azure, we are going to assume you have a basic Virtual Network based on Azure Resource Manager and you have at least one virtual machine up and running and configured as a Domain Controller. Once you have a Virtual Machine and a Domain Controller configured, you are going to provision two virtual machines which will act as the two nodes in our cluster.

Our environment will look like this:

DC1 – Our Domain Controller and File Share Witness

VM-1 and **VM-2** – The two nodes of our File Server Cluster. We are building a File Server Cluster in this guide. In another step-by-step guide we will demonstrate a SQL Server cluster configuration.

Create the Cluster

Now that both cluster nodes (VM-1 and VM-2) have been provisioned as described above and added to the above provisioned domain controller, a cluster can be created. Before a cluster can be created the Failover Clustering feature needs to be enabled on all cluster nodes. Once enabled you are ready to build your cluster. Most of the steps shown can be performed both via PowerShell and the GUI. PowerShell is recommended for the first step.

If the cluster is created via the Failover Cluster Manager GUI it will be given a duplicate IP address. Azure VMs have to use DHCP. By specifying “Static IP” VMs in the Azure portal, a DHCP reservation was created. This is not exactly a DHCP reservation because a true DHCP reservation would remove that IP address from the DHCP pool. Specifying a Static IP address in the Azure portal means that if the IP address is still available when the VM requests it, Azure will assign that IP address to it. However, if the VM is offline and another host comes online in that same subnet it could be issued that same IP address.

There is an additional side effect to the way Azure implements DHCP. When creating a cluster with the Windows Server Failover Cluster GUI, there is not an option to specify a cluster IP address. Instead it relies on DHCP to obtain an address. DHCP will issue a duplicate IP address, usually the same IP address as the host requesting a new IP address. The cluster install will complete but there may be some errors and Windows Server Failover Cluster may need to be run from another node. Once it is running, the core cluster IP address must be changed to one that is not currently in use on the network.

To avoid this situation create the cluster via PowerShell and specify the cluster IP address as part of the PowerShell command to create the cluster. The cluster can be created using the New-Cluster command as follows:

```
New-Cluster -Name cluster1 -Node VM-1,VM-2 -StaticAddress 10.5.0.100  
-NoStorage
```

After the cluster creation is completed, validate the cluster by running the following command. Some storage and network warnings are expected but you can ignore the warnings.

```
Test-Cluster
```

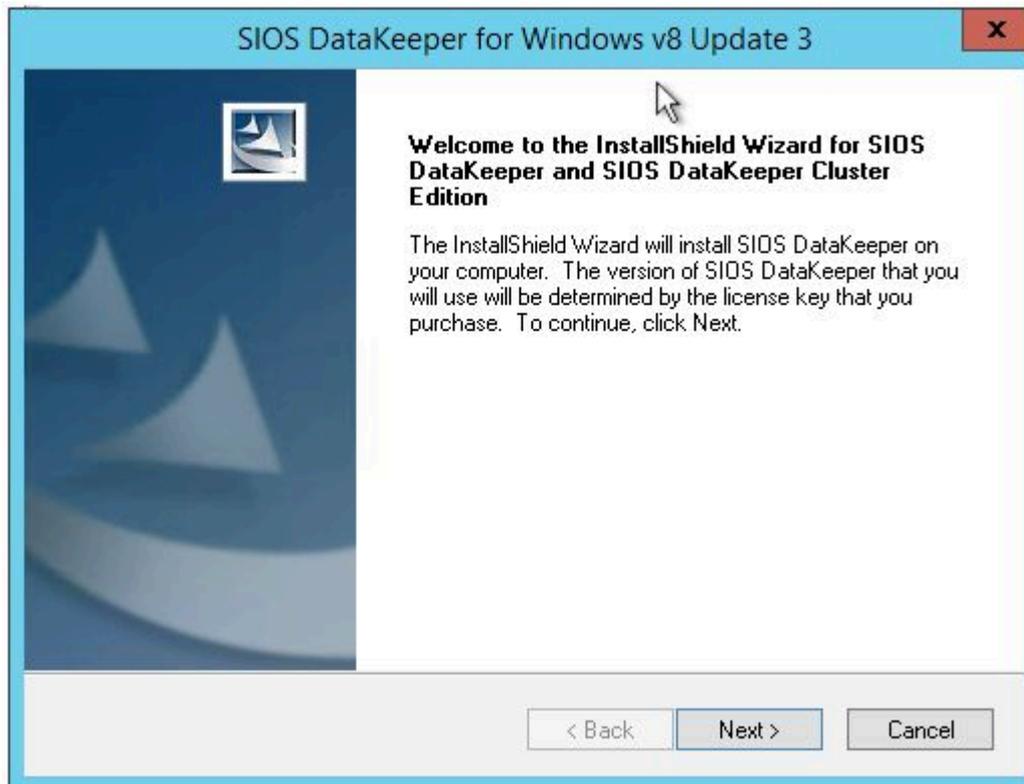
Create a Quorum Witness

As mentioned earlier, if you are using Windows 2016 or 2019, a Cloud Witness must be created for the cluster quorum. If you are using Windows Server 2012 R2 or Windows Server 2008 R2, a File Share Witness needs to be created. Instructions for creating one can be found [here](#).

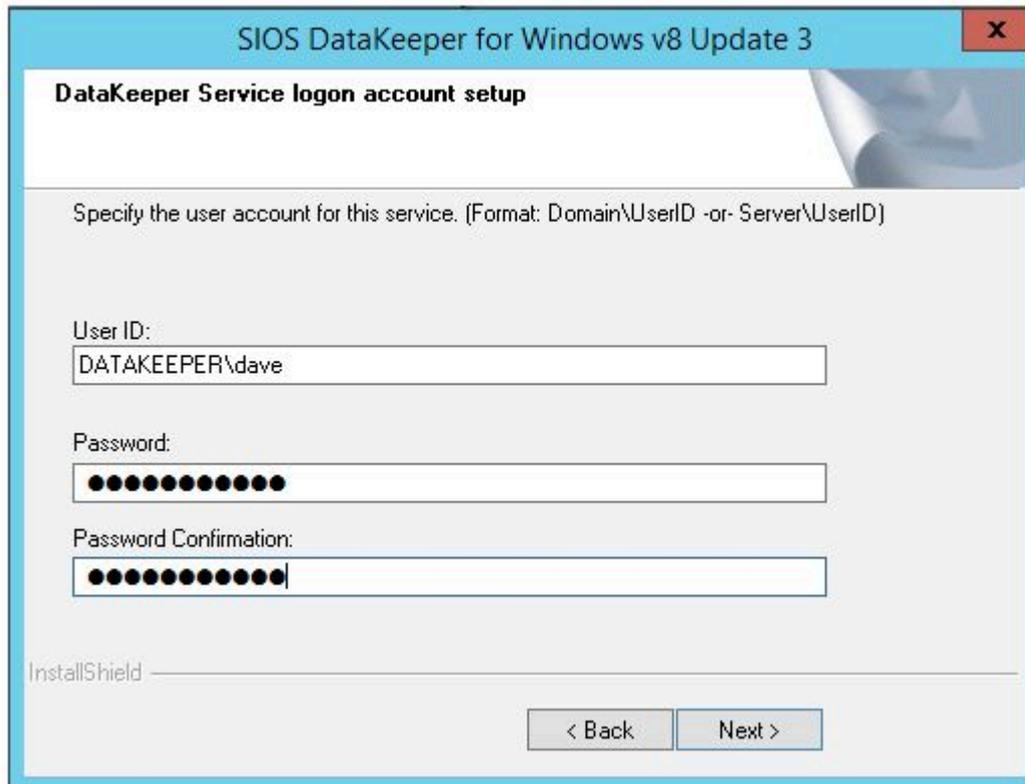
6.3. Install DataKeeper

After the cluster is created, DataKeeper is installed. It is important to install DataKeeper after the initial cluster is created so the custom cluster resource type can be registered with the cluster. If you installed DataKeeper before the cluster was created you will need to run the install again and perform a repair installation.

1. Install DataKeeper after the cluster is created. During the installation choose all the default options.



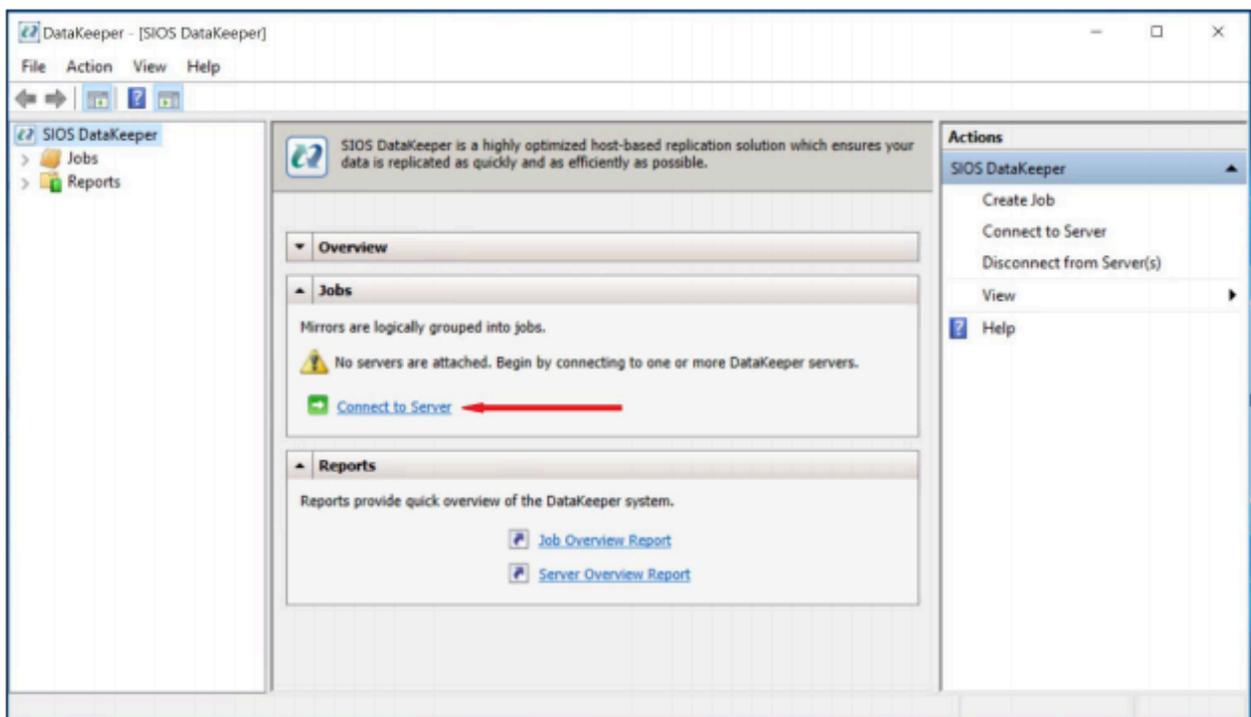
2. The service account used for the login on the VMs must be a domain account created earlier and be in the local administrators group on each node in the cluster.



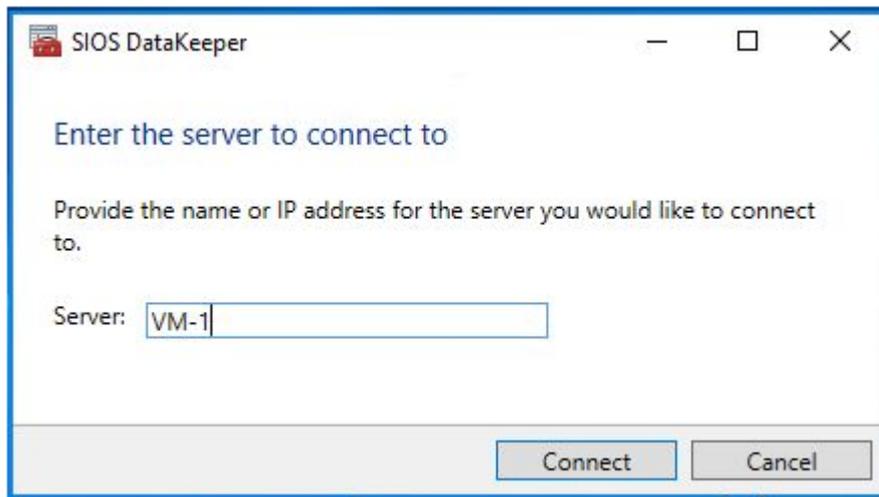
Once DataKeeper is installed and licensed on each node, reboot the servers.

Create the DataKeeper Volume Resource

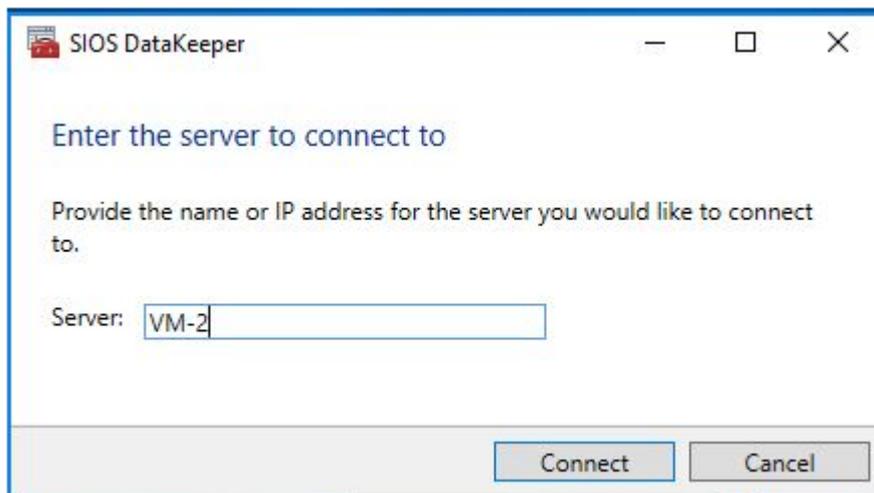
1. To create the DataKeeper Volume Resource, start the DataKeeper UI and connect to both of the servers.



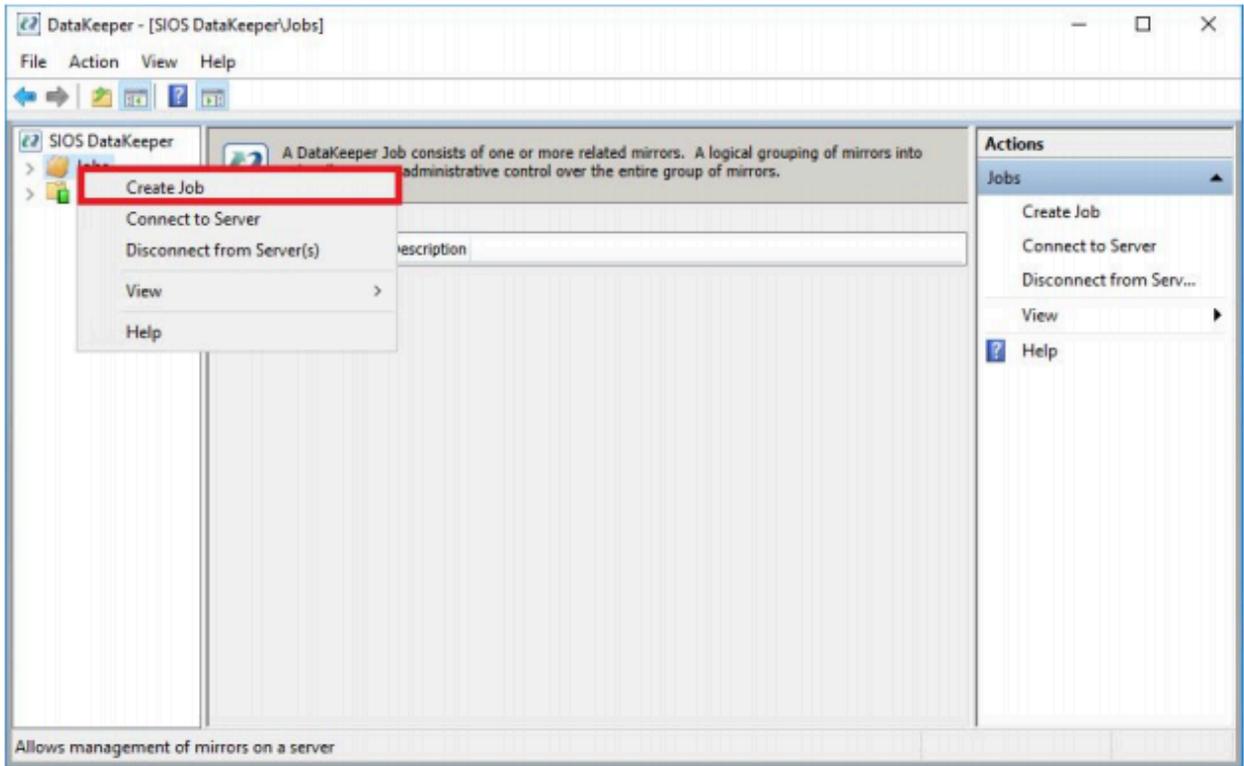
2. Connect to VM-1.



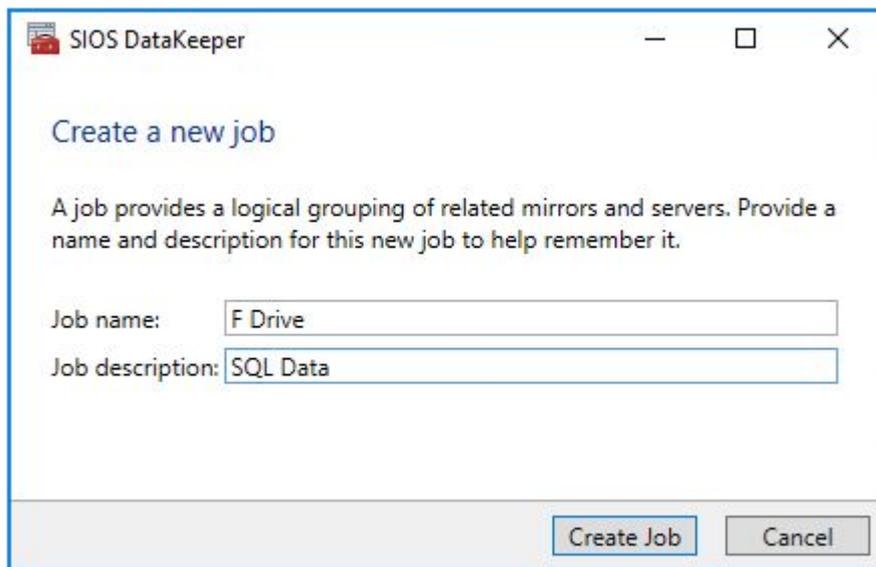
3. Connect to VM-2.



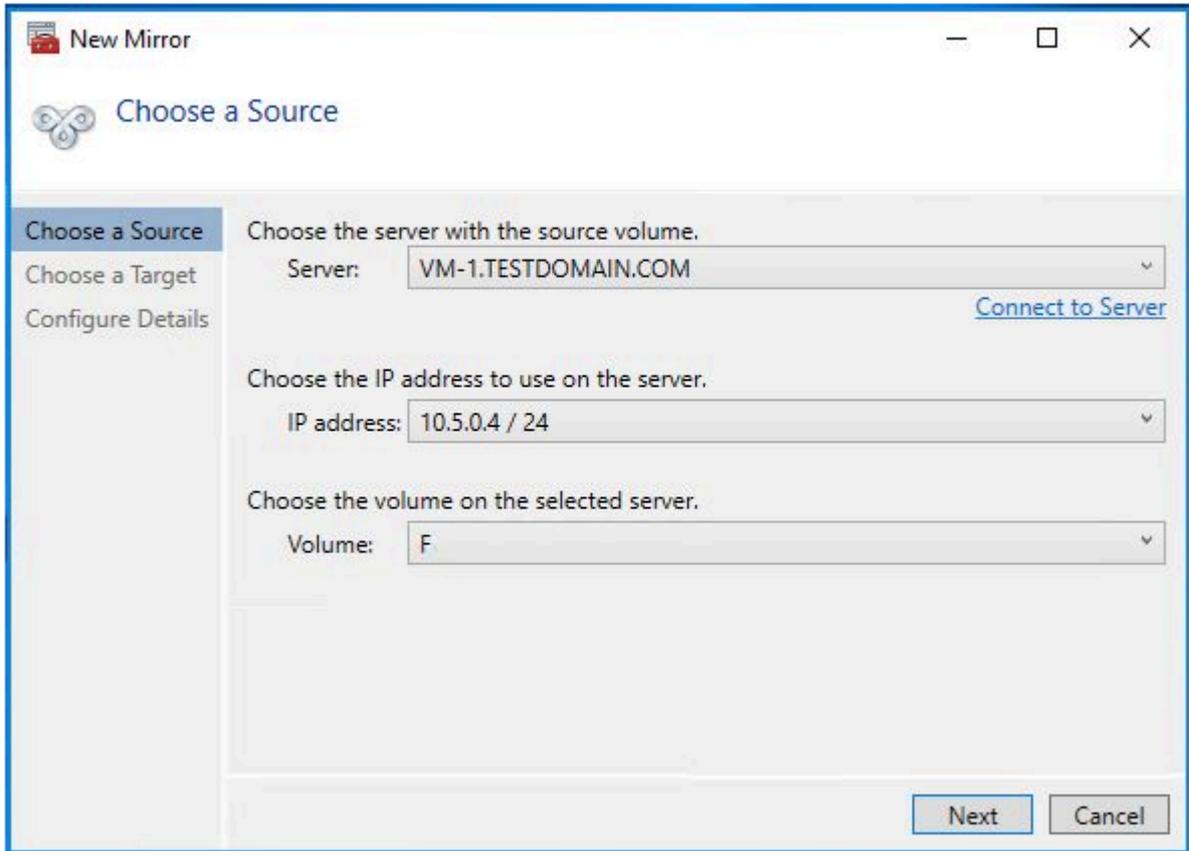
4. Once connection to each server is established, create a DataKeeper volume. Right click on Jobs and choose **Create Job**.



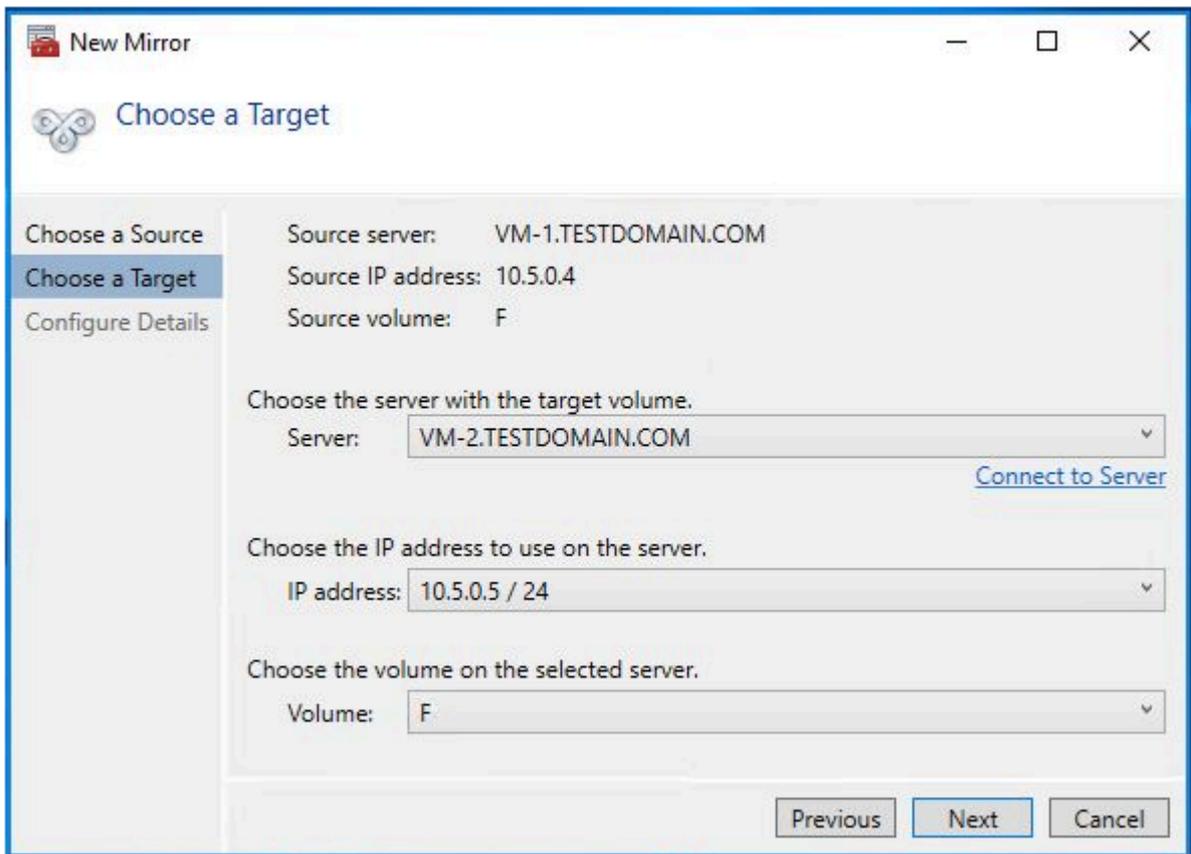
5. Add the Job name and Job description.



6. Choose the Source Server, IP address and Volume. The IP address is whether the replication traffic will travel.

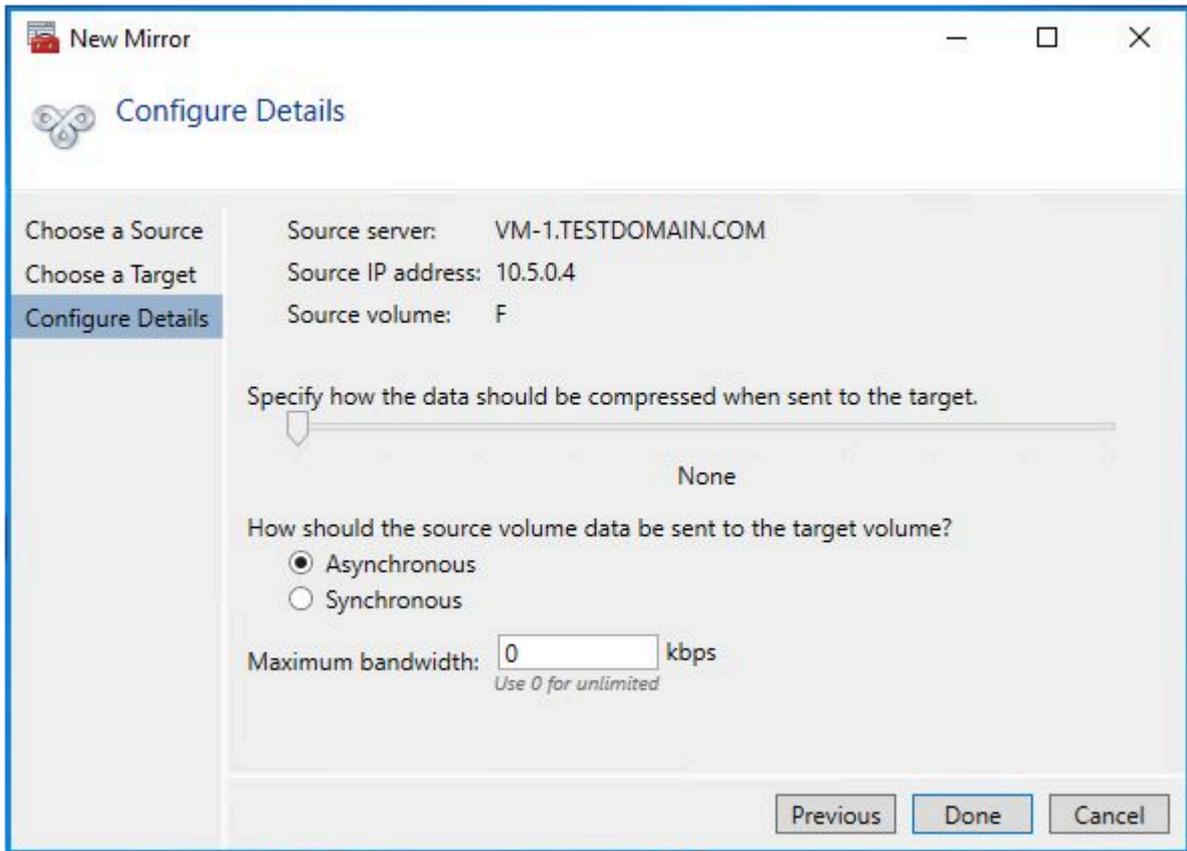


7. Choose the Target Server.

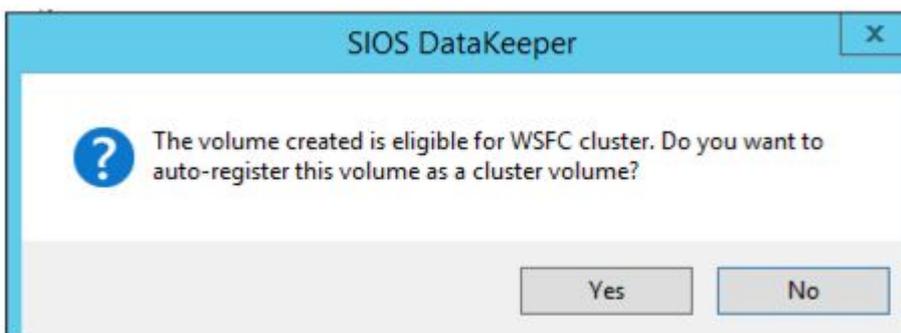


8. Choose your options. Synchronous replication should be chosen for two VMs in the same

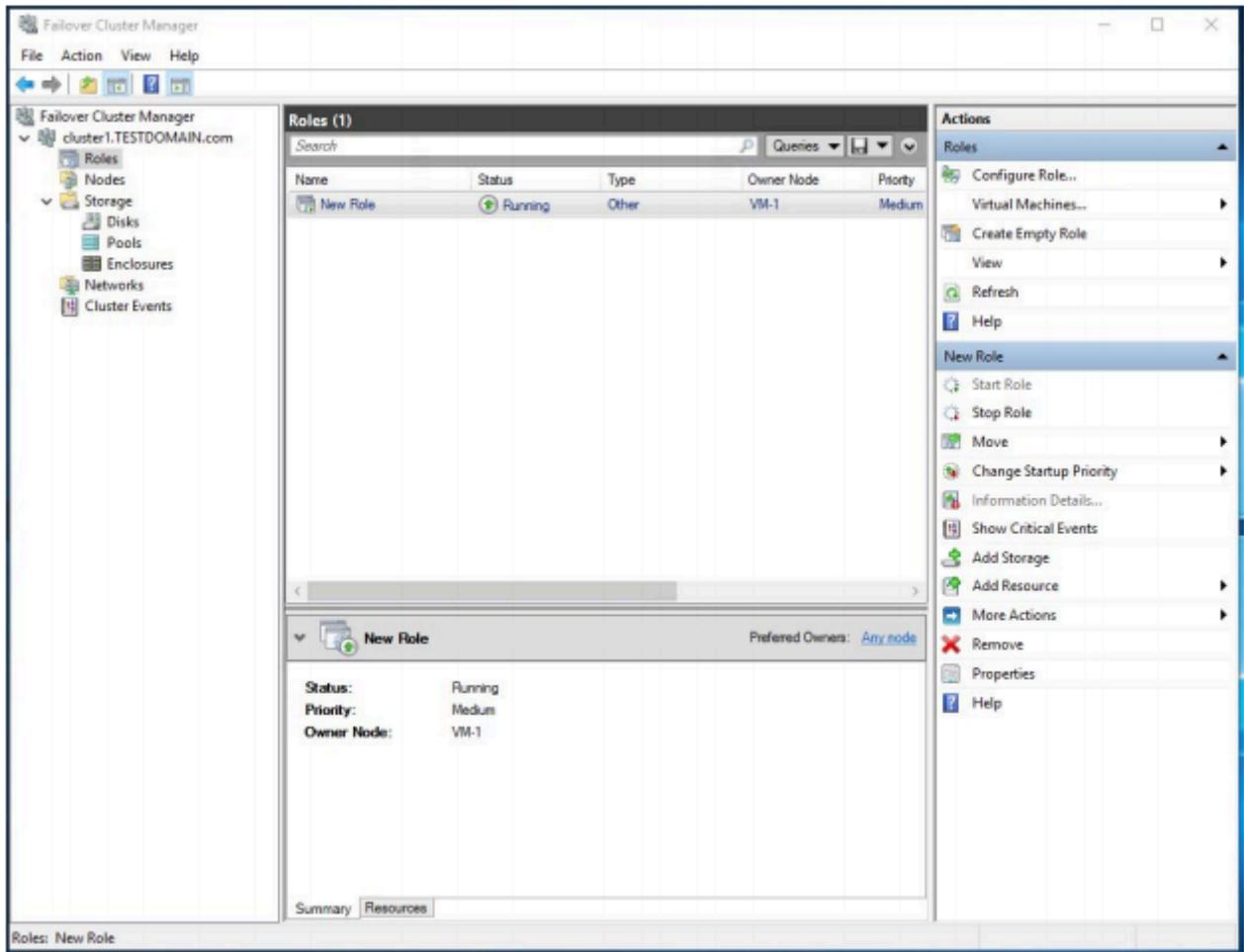
geographic region. For cross-region replication, the asynchronous option should be used. Compression can also be enabled for large distances, or when high latency is observed between the VMs.



By clicking **yes** on the last dialog, a new DataKeeper Volume Resource will be registered in Failover Cluster. By default new DataKeeper Volume resources are placed in the Available Storage group.



9. A DataKeeper Volume Resource can be seen in Available Storage.



Create the File Server Cluster Resource

Use PowerShell to create the Failover Server Cluster Resource instead of the Failover Cluster interface. The virtual machines are configured to use DHCP, and the GUI based wizard will not prompt the user to enter the cluster IP address. Instead, it will issue a duplicate IP address. Using a powershell command to create the File Server Cluster Resource and specify the IP address will avoid a duplicate IP address being issued.

```
Add-ClusterFileServerRole -Storage "DataKeeper Volume E" -Name FileServer1
-StaticAddress 10.5.0.101
```

* Make a note of the IP address specified here. It must be a unique IP address on the network. The same IP address will be assigned for the Load Balancer.

Create the Internal Load Balancer

The Azure network stack does not support gratuitous ARPS so clients cannot connect directly to the cluster IP address. Instead, clients connect to an internal load balancer and are redirected to the active cluster node. An internal load balancer can be created through the Azure Portal as shown below.

A Public Load Balancer can be used if your client connects over the public internet but assuming the clients reside in the same Virtual Network, an Internal Load Balancer can be used.

* The Virtual Network is the same as the network where the cluster nodes reside. The Private IP address specified will be EXACTLY the same as the address used to create the File Server Cluster Resource. Since multiple Availability Zones are being used, a zone redundant load balancer will be created as shown below.

* An Azure Internal Load Balancer is only required for older versions of SQL Server running on Windows 2016 or older. Starting with SQL Server 2019 CU2, SQL Server FCIs running on Windows 2016 and newer do not need to use an Azure ILB. Instead, the Distributed Network Name (DNN) Azure feature should be configured for SQL Server FCIs. This guide does not cover configuration of a DNN in Azure, but instead relies on an Azure ILB for proper routing.

Microsoft Azure Search resources, s

Home > Load balancers >

Create load balancer

Azure load balancer is a layer 4 load balancer that distributes incoming traffic among healthy virtual machine instances. Load balancers uses a hash-based distribution algorithm. By default, it uses a 5-tuple (source IP, source port, destination IP, destination port, protocol type) hash to map traffic to available servers. Load balancers can either be internet-facing where it is accessible via public IP addresses, or internal where it is only accessible from a virtual network. Azure load balancers also support Network Address Translation (NAT) to route traffic between public and private IP addresses. [Learn more.](#)

Project details

Subscription *

Resource group * [Create new](#)

Instance details

Name * ✓

Region *

Type * Internal Public

SKU * Basic Standard

i Standard Load Balancer is secure by default. This means Network Security Groups (NSGs) are used to explicitly permit and whitelist allowed traffic. If you do not have an NSG on a subnet or NIC of your virtual machine resource, traffic is not allowed to reach this resource. Please configure an NSG to ensure communication if needed. For outbound communication, an explicit outbound rule is needed. [Learn more about outbound connectivity](#)

Configure virtual network.

Virtual network *

Subnet * [Manage subnet configuration](#)

IP address assignment * Static Dynamic

Private IP address * ✓

Availability zone *

[Review + create](#) [< Previous](#) [Next : Tags >](#) [Download a template for automation](#)

To edit the load balancer after it is created:

1. Frontend IP configuration.

Page 91 of 592

The screenshot shows the Microsoft Azure portal interface for configuring a load balancer. The breadcrumb navigation is: Home > Load balancers > Test-LB | Frontend IP configuration >. The main heading is 'Add frontend IP address' for the resource 'Test-LB'. The configuration fields are as follows:

Field	Value
Name *	Test-LB-FE ✓
Virtual network	Test-VN
Subnet	Test-VN-Sub-0 (10.5.0.0/24) ▾
Assignment	<input type="radio"/> Dynamic <input checked="" type="radio"/> Static
IP address *	10.5.0.90 ✓

At the bottom left of the configuration area, there is a blue 'Add' button.

2. Add Backend pools. Here we will add two cluster nodes, VM-1 and VM-2 to our backend pool.

Microsoft Azure Search resources

Home > Load balancers > Test-LB | Backend pools >

Add backend pool

Test-LB

Name *

Virtual network

IP version IPv4 IPv6

Virtual machines

You can only attach virtual machines in eastus that have a standard SKU public IP configuration or no public IP configuration. All IP configurations must be on the same virtual network.

<input type="checkbox"/> Virtual machine ↑↓	IP Configuration ↑↓	Availability set ↑↓
<input type="checkbox"/> VM-1	ipconfig1 (10.5.0.4)	-
<input type="checkbox"/> VM-2	ipconfig1 (10.5.0.5)	-

Virtual machine scale sets

Virtual Machine Scale Sets must be in same location as Load Balancer. Only IP configurations that have the same SKU (Basic/Standard) as the Load Balancer can be selected. All of the IP configurations have to be in the same Virtual Network.

i No virtual machine scale set is found in eastus that matches the above criteria

3. Add Health probes. The probe we add will be Port 59999. This probe determines which machine is currently active in our cluster and where the Virtual IP is enabled. Using this ILB will route the traffic to the corresponding node.

Microsoft Azure

Home > Load balancers > Test-LB | Health probes >

Test-LB-HP

Test-LB

Save Discard Delete

Name *
Test-LB-HP

Protocol ⓘ
TCP

Port * ⓘ
59999

Interval * ⓘ
5
seconds

Unhealthy threshold * ⓘ
2
consecutive failures

Used by ⓘ
Not used

4. Add Load balancing rules to redirect the SMB traffic, TCP port 445. **Note:** Notice that the Floating IP (direct server return) setting is changed. Make sure this option is set to Enabled.

Home > Load balancers > Test-LB | Load balancing rules >

Add load balancing rule

Test-LB

i A load balancing rule distributes incoming traffic that is sent to a selected IP address and port combination across a group of backend pool instances. Only backend instances that the health probe considers healthy receive new traffic.

Name *

Test-LB-LBR ✓

IP Version *

IPv4 IPv6

Frontend IP address * ⓘ

10.5.0.99 (LoadBalancerFrontEnd) v

HA Ports ⓘ

Backend pool ⓘ

Test-LP-BP (2 virtual machines) v

Health probe ⓘ

Test-LB-HP (TCP:59999) v

Session persistence ⓘ

None v

Idle timeout (minutes) ⓘ

4

TCP reset

Disabled Enabled

Floating IP (direct server return) ⓘ

Disabled Enabled

Create implicit outbound rules ⓘ

Yes No

OK

Fix the File Server IP Resource

The final step in the configuration is to run the PowerShell script on one of the cluster nodes. This will allow the Cluster IP Address to respond to the ILB probes and ensure that there is no IP address conflict between the Cluster IP Address and the ILB.

- ✿ Edit the script to fit the deployed environment. The subnet mask set to 255.255.255.255 is not a mistake and must be kept as is. This creates a host-specific route to avoid IP address conflicts with the ILB.

```
# Define variables
$ClusterNetworkName = ""
# the cluster network name (Use Get-ClusterNetwork on Windows Server 2012
of higher to find the name)
$IPResourceName = ""
# the IP Address resource name
$ILBIP = ""
# the IP Address of the Internal Load Balancer (ILB)
Import-Module FailoverClusters
# If you are using Windows Server 2012 or higher:
Get-ClusterResource $IPResourceName | Set-ClusterParameter -Multiple
@{Address=$ILBIP;ProbePort=59999;SubnetMask="255.255.255.255";Network=$Clus
terNetworkName;EnableDhcp=0}
# If you are using Windows Server 2008 R2 use this:
#cluster res $IPResourceName /priv enabledhcp=0 address=$ILBIP
probeport=59999 subnetmask=255.255.255.255
```

Create File Shares

Create the file shares in Windows Explorer on the active node. Failover Clustering automatically picks up the shares and puts them in the cluster.

- ✿ The Continuous Availability option of a file share is not supported in this configuration.

A functioning WSFC File Server that spans Availability Zones in Azure is now ready for use.

For additional assistance, pre-sales customers please contact sales@us.sios.com or evalsupport@us.sios.com. If you are a post-sales customer please contact the SIOS Support team at support@us.sios.com. If you need additional assistance with this feature, please contact our Professional Services team at professional-services@us.sios.com.

7. DataKeeper Cluster Edition Installation Guide

The DataKeeper Cluster Edition Installation Guide contains information on how to install and license your Cluster Edition software.

Once you have completed the steps in this guide, you will be ready to configure your Cluster resources. The [DataKeeper Cluster Edition Technical Documentation](#) provides the information necessary to complete your DataKeeper Cluster Edition configuration.

DataKeeper Cluster Edition uses the Flexera InstallShield product to provide a standard installation interface.

7.1. Installation

Once you have downloaded the DataKeeper Cluster Edition software, the topics that follow explain the installation process.

[Core Software](#)

[Installing Core](#)

[Third Party Product Files](#)

[Application Directory Anomaly](#)

[Localized Language Supplement](#)

[Silent Installation](#)

7.1.1. Core Software

DataKeeper Cluster Edition Core Software

- DataKeeper
- DataKeeper Driver (ExtMirr.sys)
- DataKeeper Service (ExtMirrSvc.exe)
- Command Line Interface (EMCMD.exe)
- DataKeeper GUI (Datakeeper.msc)
- Packaging files, SIOS Protection Suite scripts, help files, etc.

7.1.2. Installing Core

Installing the DataKeeper Cluster Edition Core Software

SIOS DataKeeper Cluster Edition uses the Flexera InstallShield product to provide a standard installation interface. A license must be obtained and installed for each server in the cluster.

We recommend that you read the [DataKeeper Cluster Edition for Windows Release Notes](#) before installing and configuring DataKeeper Cluster Edition.

To install DataKeeper Cluster Edition software, run the setup program delivered with the DataKeeper Cluster Edition for Windows product. Follow the setup instructions on each screen. Some explanatory notes are included below.

Installation Notes

Once installation begins, you will be prompted to select the DataKeeper features to install. A typical installation includes both features.

- [DataKeeper Server Components](#)
- [DataKeeper User Interface](#)

During installation of DataKeeper Server Components:

1. [Configure firewall settings](#)
2. Select a [DataKeeper Service log on](#) account type
 - If **Domain or Server account** is selected, provide DataKeeper Service log on ID and Password.
3. [Install licensing](#) via the **License Manager**.

Reboot your server and begin using DataKeeper. See the [DataKeeper Cluster Edition Technical Documentation](#) for further information on using DataKeeper.

The **SIOS DataKeeper User Interface and Server Components Feature** can be installed independently, and the installation can be modified later to include any feature that has not previously been installed.

Exclusion list for Antivirus Software for LifeKeeper and DataKeeper for Windows

The following things should be excluded in your antivirus software for LifeKeeper and DataKeeper:

- For DataKeeper C:\Program Files (x86)\SIOS\DataKeeper\ directory (or the folder DataKeeper is installed in).
- The bitmap file location (by default on the c: drive but it may be relocated – C:\Program Files (x86)\SIOS\DataKeeper\Bitmaps).

These locations have all of the executables and sometimes the Antivirus Software can quarantine them, thus rendering LifeKeeper or DataKeeper inoperable.

The list of registry keys that LifeKeeper and DataKeeper use is located [here](#).

AND

UpperFilters registry key located at:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\  
Class\{71A27CDD-812A-11D0-BEC7-08002BE2092F}
```

The contents of the UpperFilters key contains “ExtMirr” when using DataKeeper.

7.1.3. Third Party Product Files

The following third party files were not developed by SIOS Technology Corp. but are installed during the SIOS Protection Suite/DataKeeper installation process.

Path and File Name	Provider	Purpose
<DK InstallPath>/lmdiag.exe <DK InstallPath>/lmhostid.exe <DK InstallPath>/lminstall.exe <DK InstallPath>/motdk_libFNP.dll	Flexera	License Management
<DK InstallPath>/SnapIn/IronPython.dll (.Net python language implementation) <DK InstallPath>/SnapIn/IronPython.Modules.dll (.Net python modules)	github.com/ IronLanguages/ ironpython2 (Microsoft open source)	Testing/Debugging
<DK InstallPath>/SnapIn/J832.Common.dll <DK InstallPath>/SnapIn/ J832.Wpf.BagOTricksLib.dll	Kevin Moore, http://j832.com/bagotricks/	Utilities and controls for WPF development
<DK InstallPath>/SnapIn/log4net.dll (.Net logging library)	Apache Software Foundation	Application logging
<DK InstallPath>/SnapIn/ Microsoft.Scripting.Core.dll <DK InstallPath>/SnapIn/Microsoft.Scripting.dll	github.com/ IronLanguages/ ironpython2 (part of IronPython)	
<DK InstallPath>/SnapIn/MMCFxCommon.dll <DK InstallPath>/SnapIn/ microsoft.managementconsole.dll	Microsoft	MMC managed snap-in library

<p><DK InstallPath>/VSSHelper/AlphaVSS-license.txt</p> <p><DK InstallPath>/VSSHelper/AlphaVSS.Common.dll</p> <p><DK InstallPath>/VSSHelper/AlphaVSS.Common.xml</p> <p><DK InstallPath>/VSSHelper/AlphaVSS.x64.dll</p> <p><DK InstallPath>/VSSHelper/log4net.dll</p> <p><DK InstallPath>/VSSHelper/log4net.xml</p> <p><DK InstallPath>/VSSHelper/cfg/log4net.Config.xml</p>	<p>Pete Palotas, github.com/alphaleonis/AlphaVSS</p>	<p>Alpha VSS provider</p>
<p><LK InstallPath>/Admin/kit/lpapp/bin/wpcap.dll</p> <p><LK InstallPath>/Admin/kit/lpapp/bin/packet.dll</p>	<p>CACE Technologies</p>	<p>Gratuitous ARP Update</p>
<p><LK Install>\jre-15.0.1</p>	<p>Open JDK</p>	<p>General Public License</p>
<p>%WINDIR%\system32\drivers\ExtMirr.sys</p>	<p>Zlib</p>	<p>Data Compression</p>
<p>Note: By default is C:\Program Files (x86)\SIOS\DataKeeper</p>		

7.1.4. Application Directory Anomaly

The following file is installed in a directory other than the default directory that you selected during the DataKeeper installation procedure. This exception occurs when the operating system installs [performance monitor counters](#).

Path and File Name	Purpose
<code><windows dir>/inf/ExtMirr/ ExtMirrCounters.h:</code>	Performance monitoring. This file contains counter names and definitions

7.1.5. Localized Language Supplement

For information regarding the Localized Language Supplement, please refer to [Installing LifeKeeper for Windows Localized Language Supplement](#) in the SIOS Protection Suite Documentation.

7.1.6. Silent Installation

Silent Installation of DataKeeper Cluster Edition

You can install DataKeeper Cluster Edition for Windows silently through the use of the `-silent` command line option. This option suppresses both the wizard and launcher user interfaces (UIs) resulting in what is considered a “silent installation.” This is how an installation is performed without any information displaying to or requiring any interaction with the end user. **Response files**, also known as “*options*” files, are used to pass command line options at installation. This is done as you would normally specify them on the command line to represent the responses to dialogs and/or to set the value of a property or variable. The options specified in the **response/options** file are executed after the execution of the options that were entered directly on the command line.

DataKeeper Response File

To create a response file for DataKeeper, open a command window and run the **SIOS DataKeeper setup program** using the command:

```
DK-{version}-Setup.exe /r /f1C:\setup.iss
```

The responses entered to the dialogs will be recorded into the file `setup.iss`.

Note: When creating the initial `setup.iss` file, if a local user server account is used for the DataKeeper service, you must edit the `setup.iss` file for use on other servers. This change can be made by opening the `setup.iss` file in Notepad and changing the name of the server found within the `szName` field. (i.e.- `szName=<serverName>\Administrator`). When using the **Local Service account** or a **Domain account** that is the same across all installations, changing the `setup.iss` file is not required.

To perform a silent install using the created response file, open a command window and run the **SIOS DataKeeper setup program** using the command:

```
DK-{version}-Setup.exe /s /f1C:\setup.iss /f2C:\setup.log
```

Results from the silent install are stored in the file `setup.log`. “`ResultCode=0`” indicates a successful install. A negative result code indicates failure. Please check the operating system requirements for further information regarding the cause of failure.

When the DataKeeper Cluster Edition install is finished, copy the license key(s) to the `C:\Windows\SysWOW64\LKLicense` folder or run the **License Key Installer** utility from the **Start-Programs** menu to install the license key.

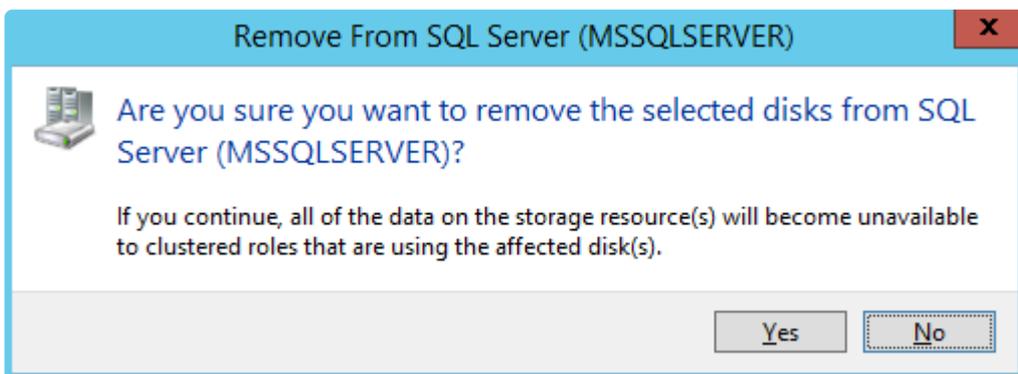
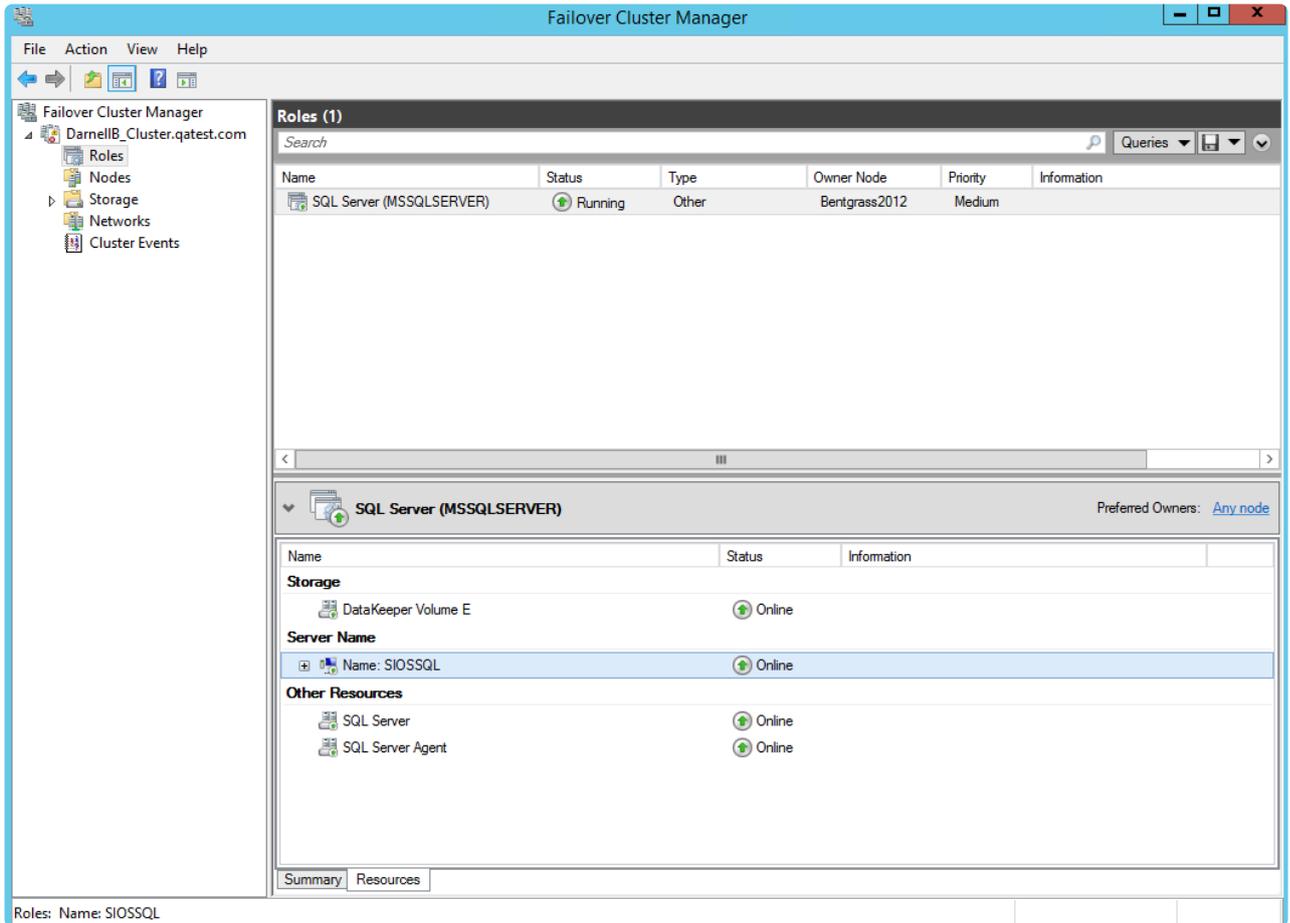
```
Start->All Programs->SIOS->DataKeeper->License Key Installer.
```

Reboot the server.

7.1.7. Removing a Clustered DataKeeper Volume

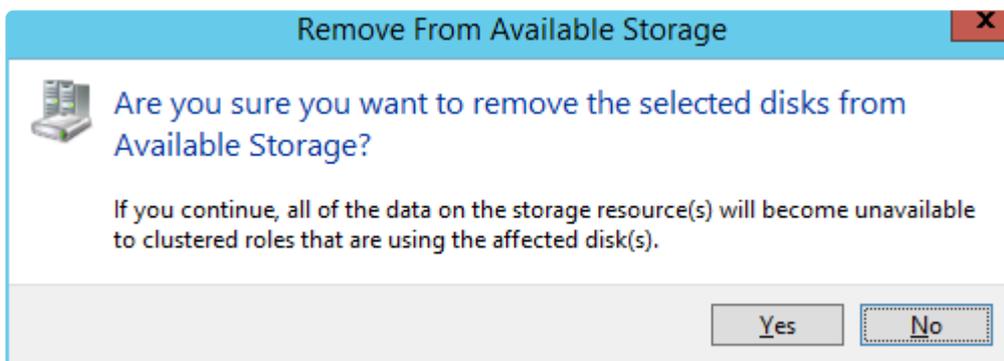
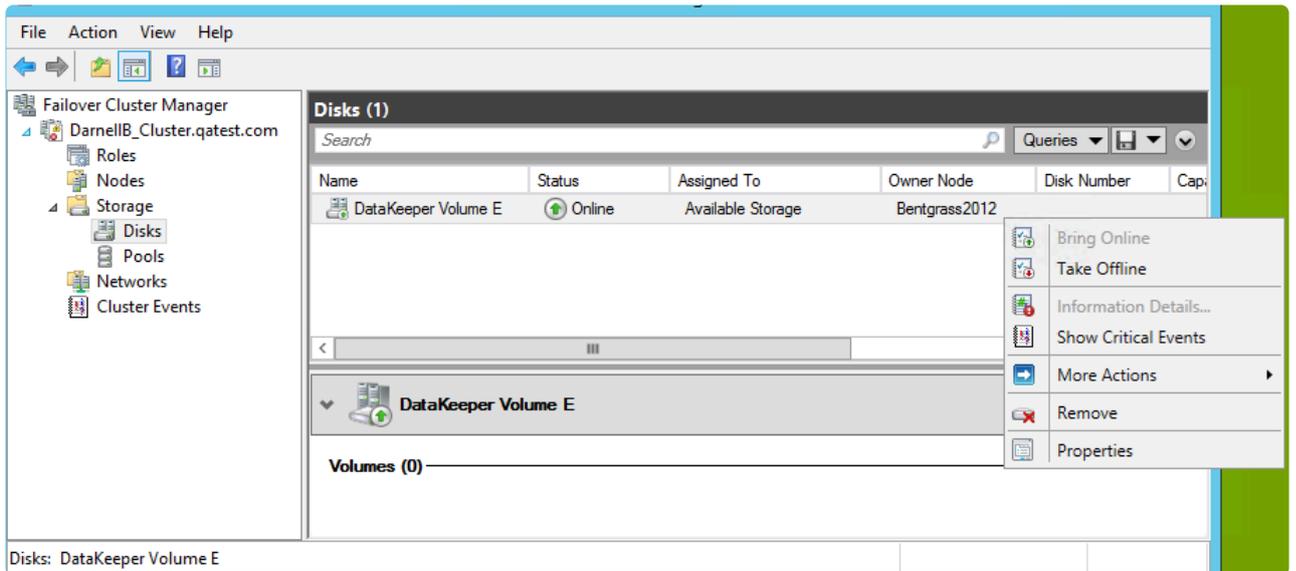
To remove a Clustered DataKeeper Volume follow these steps:

1. Launch the **Failover Cluster Manager**.
2. Select the **Role** and related **DataKeeper Storage**.
3. Remove the **DataKeeper Volume** resource from the **Role**. This will move the DataKeeper Volume resource to the "Available Storage" group.



Once the DataKeeper Resource is returned to Storage/Disk and is listed as Available Storage it can be removed.

4. Select the Storage then select **Remove**.

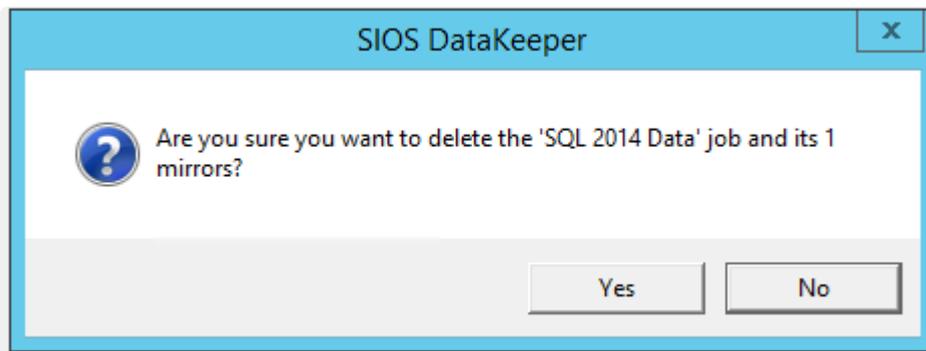
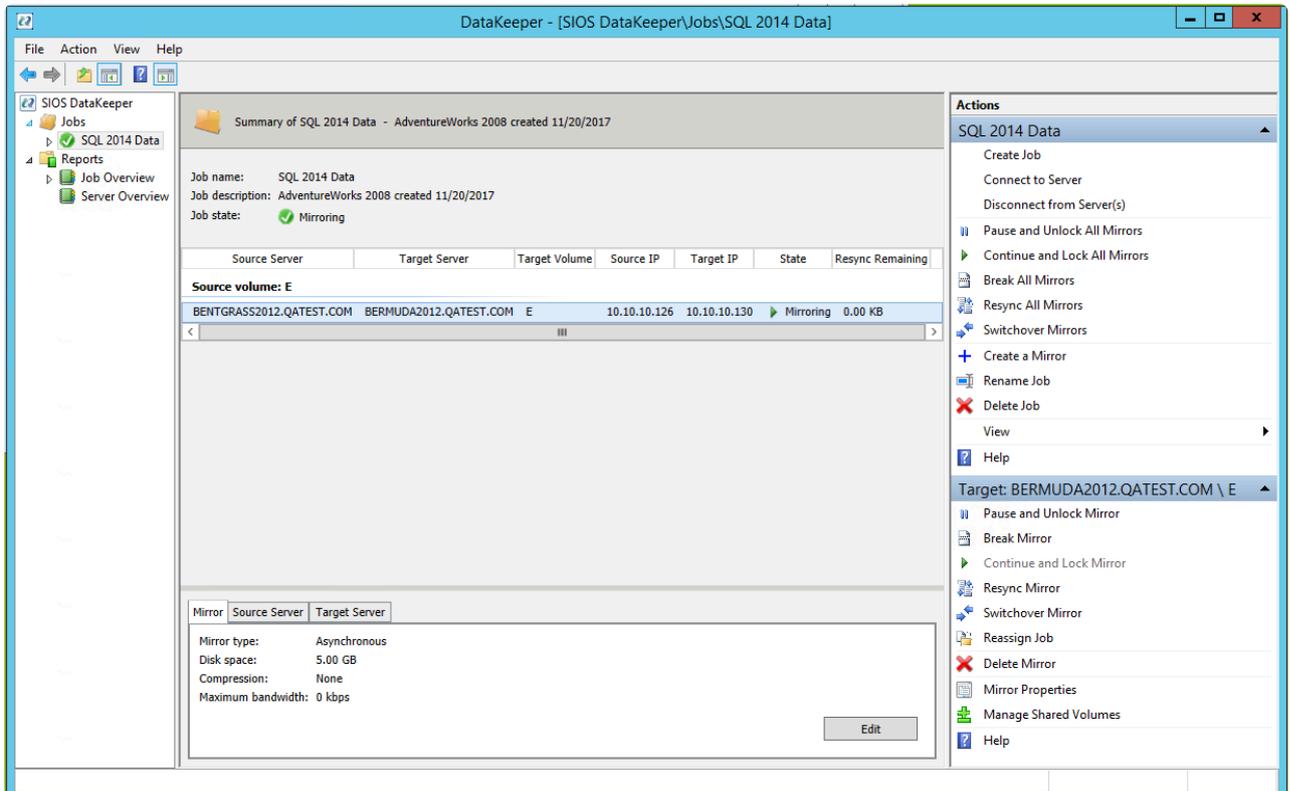


5. Launch DataKeeper.

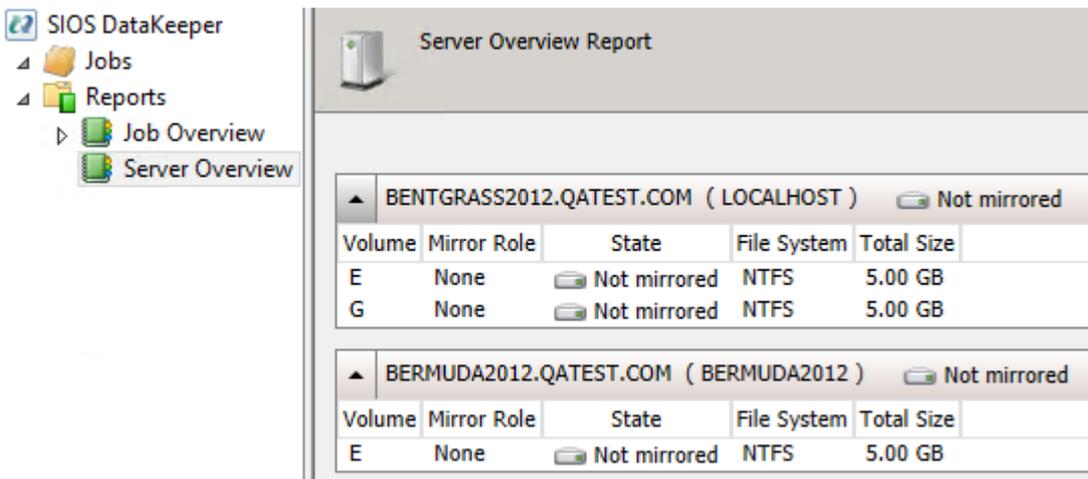


6. In the Action Pane select **Delete Job**.

* If the Job contains multiple mirrors use the **Delete Mirror** option to remove the mirrors only for the volume that is being deleted. Leave the other volumes in the job.



The Server Overview will show a **Not mirrored** state once the mirror has been successfully removed.



7.2. Licensing

Obtaining and Installing the License

Activating Your License

<https://fast.wistia.net/embed/iframe/05ucyhj7cj>

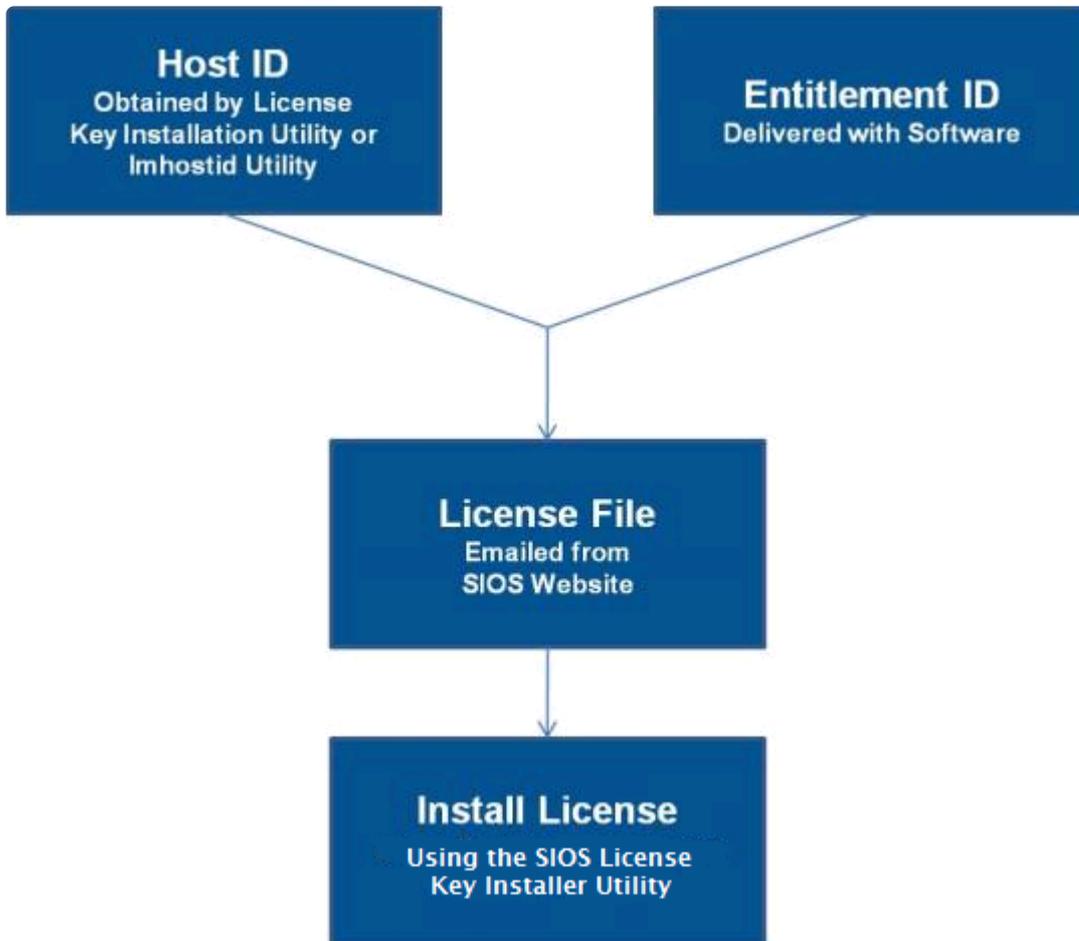
Installing Your License



<https://fast.wistia.net/embed/iframe/dvlz4cvtqx>

DataKeeper Cluster Edition requires a unique license for each server. The license is a run-time license which means that you can install it without the license, but the license must be installed before you can successfully start and run DataKeeper Cluster Edition.

The final screen of the **InstallShield installation utility** displays the Host ID of your server. The **Host ID**, along with the **Entitlement ID** (Authorization Code) that was provided with your DataKeeper Cluster Edition software, is used to obtain the license required to run DataKeeper Cluster Edition. The process is illustrated below.



License Key Manager

In addition to installing DataKeeper Cluster Edition product licenses, the **License Key Manager** allows you to perform the following functions:

- View all licenses currently installed on your system.
- View all expiration notifications (days remaining) for each time-expiring license.
- Identify invalid licenses that are currently installed.
- Delete any installed licenses (right-click on the license and select **Delete**).
- Delete all expired licenses as a group (press the **Delete Expired License** button).
- **Refresh** the Installed License list when installing software or upgrades.

Perform the following steps to obtain and install your licenses for each server in the DataKeeper Cluster Edition cluster:

1. Get your **Host ID**. At the end of the DataKeeper Cluster Edition installation, make note of the **Host ID** displayed by the **License Key Installer** utility as shown below. The Host ID may also be obtained by running `%ExtMirrBase%\bin\Imhostid` (where *ExtMirrBase* is the DataKeeper installation path, by default `C:\Program Files (x86)\SIOS\DataKeeper`) on the system(s) that you

are obtaining licenses for. (If you need to obtain your Host ID again at a later time, you may do so by running the **License Key Installer** utility from the **Start-Programs** menu **Start-All Programs-SIOS-DataKeeper-License Key Installer.**)

2. Write the **Host IDs** in a notebook or save them in a file. If saved in a file, copy that file to a system with internet access. Otherwise, take your notebook with you to the system with internet access.
3. Ensure you have your DataKeeper Cluster Edition **Entitlement ID** (Authorization Code). You should have received an email with your software containing the Entitlement ID needed to obtain the license.
4. Obtain your licenses from the [SIOS Technology Corp. Licensing Operations Portal](#).

a. Using the system that has internet access, navigate to the [SIOS Technology Corp. Licensing Operations Portal](#) and log in entering your **User Name** and **Password** (or register if you do not already have an account).

Note: New users must enter the Entitlement ID that is included in the delivery email.

b. From the **Activation and Entitlements** dropdown select **List Entitlements**.

c. Check the box to the left of the product line item(s) that you wish to license.

d. From the **Action** dropdown select **Activate** and enter the requested information (including your system HOSTNAME) then select **Next**.

e. Click on the **Gray Plus Sign** to choose an already defined host or create a new host by selecting the **Green Plus Sign**.

f. Select **ANY** for the Node Locked Host choice if it is available, otherwise select **ETHERNET MAC ADDRESS** and enter the Host ID (MAC address), click **OK** then click **Generate**.



Note: The Host ID is 12 characters with no spaces, no colons, no dashes, and no separators.

g. Check the box to the left of the **Fulfillment ID** and select **Complete**.

h. From the **License Support** dropdown select **List Licenses**. Check the box to the left of the **Fulfillment ID** and select **Email** from the **View** dropdown.

i. Enter a valid email address to send the license to and select **Send**.

j. Retrieve the email(s).

k. Copy the file(s) to the appropriate system(s).

5. Install your license(s).

- On each system, copy the license key(s) to the C:\Windows\SysWOW64\LKLicense folder.

OR

- Run the **License Key Installer** from the **Start-Programs** menu (**Start-All Programs-SIOS-DataKeeper-License Key Installer**).
 - Press the **Install License File ...** button on the main screen of the **License Key Installer**.
 - Browse to the location of the license file that you saved in **Step 4** above.
 - Click on the license file name. It will become highlighted.
 - Press the **Install License File ...** button that appears in that dialog box below the file names. A license detection confirmation popup will be displayed.
6. Repeat on all additional servers. You must install a license on the other DataKeeper Cluster Edition server(s) using the unique Host ID for each server.
 7. Restart DataKeeper Cluster Edition.

Primary Network Interface Change May Require a License Rehost

The Host ID used by the License Key Installer utility is obtained from the DataKeeper Cluster Edition server's primary network interface card (NIC). DataKeeper Cluster Edition will check for a valid license each time it starts. If your DataKeeper Cluster Edition server should require a NIC replacement in the future that would cause the Host ID to change, then the next time DataKeeper Cluster Edition is stopped, a License Rehost must be performed before starting it again. Log in to the [SIOS Technology Corp. Licensing Operations Portal](#) and select **License Support, List Licenses, Action, Rehost**.

 **Note:** A rehost can be performed four times per six-month period (per Activation ID) without contacting support.

Troubleshooting

If errors are encountered, please try the following before contacting Support:

- Review the error messages in the **Windows Event Viewer**.

7.3. Uninstalling SIOS DataKeeper Cluster Edition

Before Removing DataKeeper

If planning to uninstall DataKeeper and reinstall a previous version, all jobs/mirrors must be deleted on each node prior to uninstalling. These will need to be recreated once software is reinstalled.

Uninstall DataKeeper Cluster Edition

- In **Windows Control Panel**, find your list of installed programs and select **SIOS DataKeeper** .
- Select **Uninstall**.

Once the uninstall process is complete, rebooting the system is required.

Note: Uninstalling automatically stops the DataKeeper Cluster Edition services and clears the registry entries.

Once removed, the following files will not be removed by the uninstall procedure.

Path and File Name	Definition and Special Considerations
<code><windows dir>/SysWOW64/LKLicense</code>	<p>Common license file directory for SIOS Technology Corp. products. This is where license files are installed and licenses for multiple SIOS Technology Corp. products may be installed here at any given time. We don't remove this at uninstall so as to not disturb the installed licenses.</p> <p>Safe to remove manually, but the license will need to be reinstalled if the software is reinstalled at a later time.</p>
<code><windows dir>/SysWOW64/PerfStringBackup.ini</code>	<p>A backup file created by Windows when new performance monitor counters are installed. This is created when we install the perfmon counters.</p> <p>This should probably be left alone since it is a file created by Windows itself.</p>
<code><windows dir>/inf/ExtMirr/0011/ExtMirrCounters.ini</code>	<p>This file describes the DataKeeper performance monitor counters. This file can be removed or left alone. It is not an executable.</p>

Notes

- **Important:** Uninstallation of DataKeeper Cluster Edition software requires that the Microsoft Visual C++ 2008 Redistributable package be installed. Do not remove this package until DataKeeper Cluster Edition has been uninstalled.
- **Modify** or **Repair** must be run from the DataKeeper Cluster Edition setup program.
- Removal of DataKeeper Cluster Edition may NOT delete the DataKeeper Cluster Edition directory. This directory can be deleted manually after the **Add/Remove** operation is complete.
- A reboot of the system is required to completely remove DataKeeper Cluster Edition remnants.

7.4. Upgrading SIOS DataKeeper Cluster Edition

Upgrading DataKeeper Cluster Edition from previous versions of DataKeeper Cluster Edition is very straightforward. Simply run the installation process outlined below on all systems. The upgrade process stops the DataKeeper Service, copies the new files to the DataKeeper directory and requires a reboot at the end to load the new DataKeeper driver.

The following information applies to a DataKeeper Cluster Edition upgrade:

- Existing mirrors are not affected by the upgrade and will remain in place.
- It is not necessary to pause or manipulate the mirror(s) in any way before upgrading.
- DataKeeper Cluster Edition licensing is not affected and does not need to be redone after the upgrade.
- **IMPORTANT: Before rebooting a WSFC node that is currently the owner of DataKeeper volume resources which are online, it is recommended that all DataKeeper volume resources either be taken offline or moved to a different node/cluster owner.**

The DataKeeper Cluster Edition upgrade will be performed on the target systems first. Cluster resources will then be switched over to allow for the upgrade of the original source system.

Upgrading the Target Server

1. Using Microsoft Cluster Manager, move all resources to one node/cluster owner so that only one node is the source server.
2. Close the DataKeeper UI if it is currently running.
3. On each target system, run the setup.exe program distributed with the DataKeeper Cluster Edition product. Setup will detect that you are upgrading your existing DataKeeper product and display a confirmation dialog. Click **Yes** to continue the upgrade.
4. The DataKeeper service will be stopped during the upgrade process. After setup completes, you will be prompted to enter a new DataKeeper license key. When upgrading from a previous version of DataKeeper Cluster Edition, applying new licenses is not required and you may exit the License Manager.
5. Reboot your server.
6. Bring up the target systems and allow the mirror(s) to resync and return to the **Mirroring** state.
7. Repeat Steps 2-6 for each target system.

Upgrading the Original Source Server

1. Using Microsoft Cluster Manager, move all resources to a DataKeeper node that has been upgraded so the source server can be upgraded.
2. Once all resources are online on another node and in the mirroring state, repeat the above procedure on the original source system and reboot the server.
3. Run the DataKeeper UI to view your existing mirrors.

Reinstalling SIOS DataKeeper Cluster Edition

To reinstall DataKeeper Cluster Edition, perform the same procedures as above, the only exception being that when Setup presents a list of InstallShield options, select **Repair**.

Repair

The Install process also allows repairing the DataKeeper Cluster Edition software. Use this option if the software that was previously installed was accidentally deleted or if the user is performing a point release upgrade. This option copies all the files from the setup folder and prompts the user to reboot the system.

Considerations

Upgrading from a previous release to DataKeeper v7.6 or later [read the considerations](#) for chkdisk.

8. DataKeeper Cluster Edition Technical Documentation

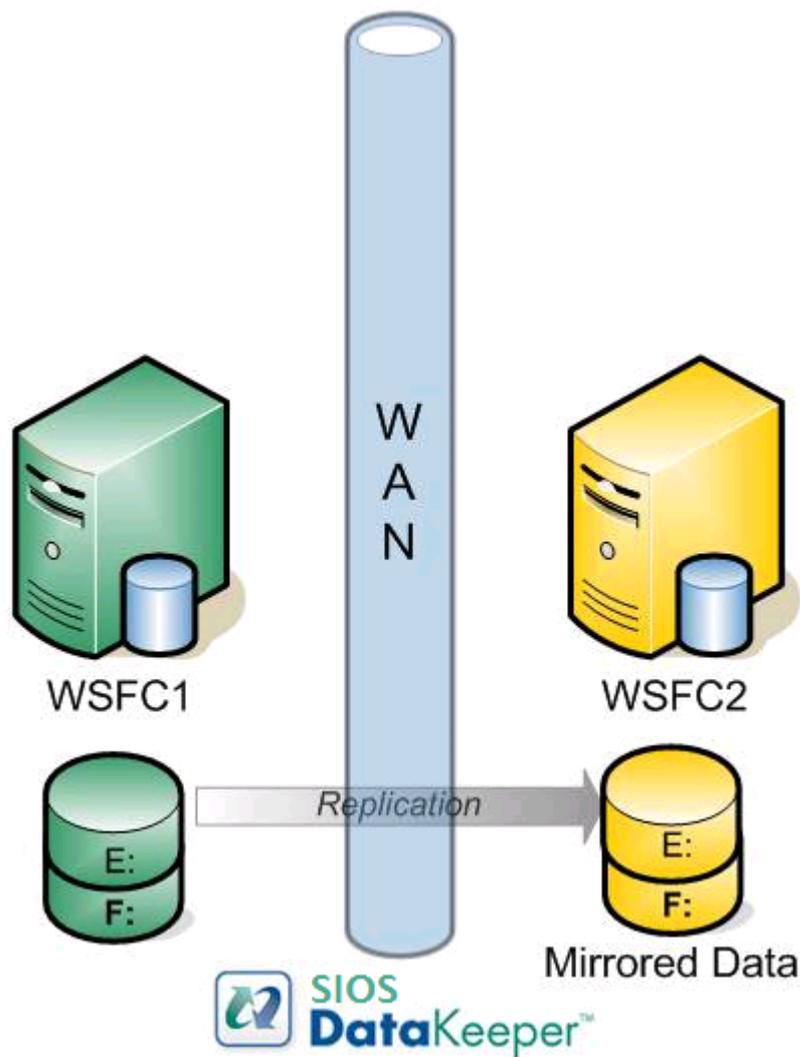
DataKeeper with High Availability – Cluster Edition Overview

SIOS DataKeeper is a highly optimized host-based replication solution which ensures your data is replicated as quickly and as efficiently as possible from your source server across the network to one or more target servers.

SIOS DataKeeper Cluster Edition is a highly optimized host-based replication solution which integrates seamlessly with Windows Failover Clustering. Windows Failover Clustering features, such as cross-subnet failover and tunable heartbeat parameters, make it possible for administrators to deploy geographically dispersed clusters. SIOS DataKeeper provides the data replication mechanism which extends Windows Server Failover Clustering, allowing administrators to take advantage of these advanced features to support high availability and disaster recovery configurations.

SIOS DataKeeper Cluster Edition is a separately licensed product. Once installed, a new storage resource type called **DataKeeper Volume** is available in Microsoft Windows Server Failover Clustering. This new SIOS DataKeeper Volume resource can be used in place of the traditional Physical Disk shared storage resource to enable geographically dispersed clusters.

Important Consideration: Prior to installing SIOS DataKeeper Cluster Edition, your Microsoft Windows Server Failover Cluster environment should be installed and created. This product requires a SIOS DataKeeper Cluster Edition License. SIOS DataKeeper resource type registration occurs 60 seconds after detecting a Failover Cluster configuration.



Features

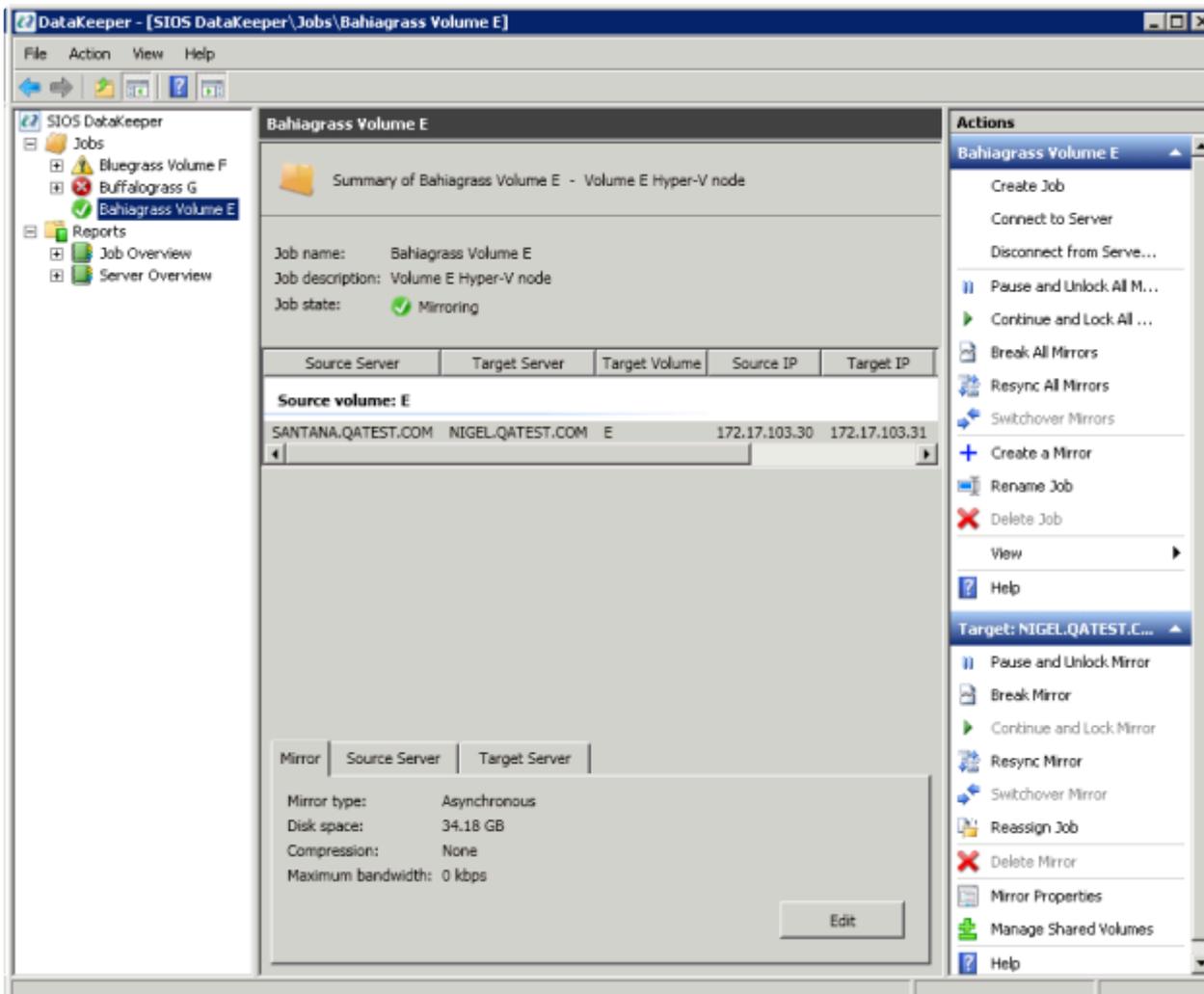
Some of the features include the following:

- Synchronous or Asynchronous block level volume replication.
- Built-in WAN optimization enabling SIOS DataKeeper to fully utilize a high speed/high latency network connection without the need for WAN accelerators.
- Efficient compression algorithms optimizing use of available bandwidth.
- Intuitive MMC 3.0 GUI.

8.1. User Interface

SIOS DataKeeper User Interface

The SIOS DataKeeper User Interface uses a standard MMC snap-in interface.



- The left pane displays the Console Tree view. This includes the **Jobs** and **Reports**. Currently, there are two reports available – **Job Overview** and **Server Overview**. The **Job Overview** report provides a summary of all the jobs on the connected servers. The **Server Overview** report provides a summary of all the mirrors on the connected servers.
- The middle pane is the **Summary** view. This includes information about the selected item.
- The right column is the **Actions** view. This pane appears when activated through the **View** menu. The options available from this pane are the same options available from the **Action** menu. This column is divided into two sections. The **Actions** in the top section apply to the job and every mirror within the job. The **Actions** in the bottom section apply only to the selected mirror.
- At the bottom of the main window, three tabs appear: **Mirror**, **Source Server** and **Target Server**. These tabs provide information on the mirror that has been selected.

- The icon shows the state of the mirror, which provides more information than the icons and states provided in the Failover cluster UI.

8.2. Components

DataKeeper Components

SIOS DataKeeper for Windows is comprised of the following components:

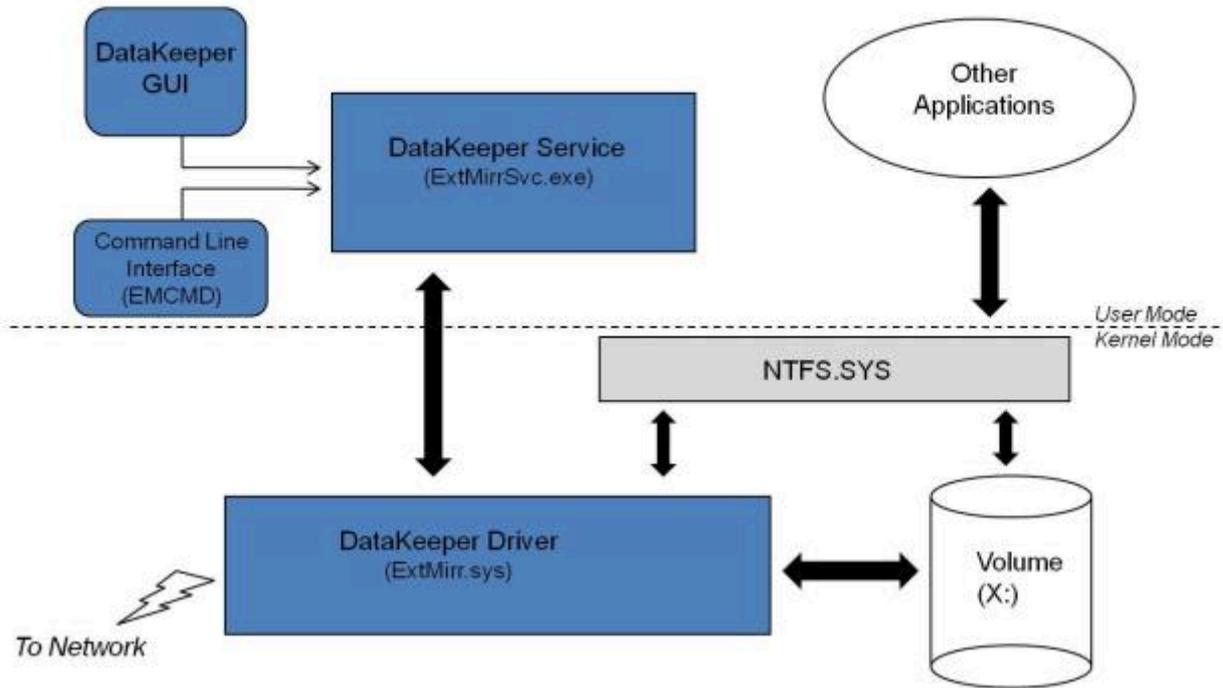
- **DataKeeper Driver (ExtMirr.sys)** – The DataKeeper Driver is a kernel mode driver and is responsible for all mirroring activity between the mirror endpoints.
- **DataKeeper Service (ExtMirrSvc.exe)** – The DataKeeper Service links the DataKeeper GUI and Command Line Interface to the DataKeeper Driver. All commands to manipulate the mirror are relayed through the DataKeeper Service to the DataKeeper Driver.

Important: Stopping the DataKeeper Service does not stop mirroring. Sending the driver a PAUSE mirror, BREAK mirror or DELETE mirror command is the only way to interrupt mirroring.

- **DataKeeper Service Log On ID and Password Selection** – The [DataKeeper Service Log On ID and Password Selection](#) allows you to select the type of account to be used to start the service. Domain and Server account IDs with administrator privileges allow improved disaster recovery when network disruptions occur.
- **Command Line Interface (EMCMD.exe)** – There is an entire suite of [EMCMD command options](#) that can be used to operate DataKeeper.
- **DataKeeper GUI (Datakeeper.msc)** – The [DataKeeper GUI](#) is an MMC 3.0 (Microsoft Management Console) based user interface which allows you to control mirroring activity and obtain mirror status.
- **Packaging files, SIOS Protection Suite scripts, help files, etc.**

The following diagram displays how the DataKeeper components interface with the NTFS file system and each other to perform data replication.

DataKeeper Architecture



8.3. DataKeeper Service Log On ID and Password Selection

During a new DataKeeper installation setup, the user will be prompted for a DataKeeper Service Log On ID and Password.

The DataKeeper Service uses authenticated connections to perform volume switchovers and make mirror role changes across multiple servers. The Log On ID account chosen to run the DataKeeper Service will determine how much authority and permission is available to establish connections between servers and perform volume switchovers, especially when server or network disruptions occur.

Several types of Service Log On ID accounts are available as follows:

- A **Domain Account** with administrator privileges, valid on all connected servers in the domain (*recommended*)

 Ensure that the domain account being used to start the DK Service is in the **SAME** domain that the systems are in. Start the DK Service on each system with an account that is in the same domain that the systems are in. Further information can be found [here](#).

- A **Server Account** with administrator privileges, valid on all connected servers
- The **Local System Account** (*not recommended*)

Note: For Workgroups, use the **Server Account** option and use the server name \ administrator on each system as the Service Account for DataKeeper. **You should also log on to all servers using this same Log On ID and Password** (see related [Known Issue](#)).

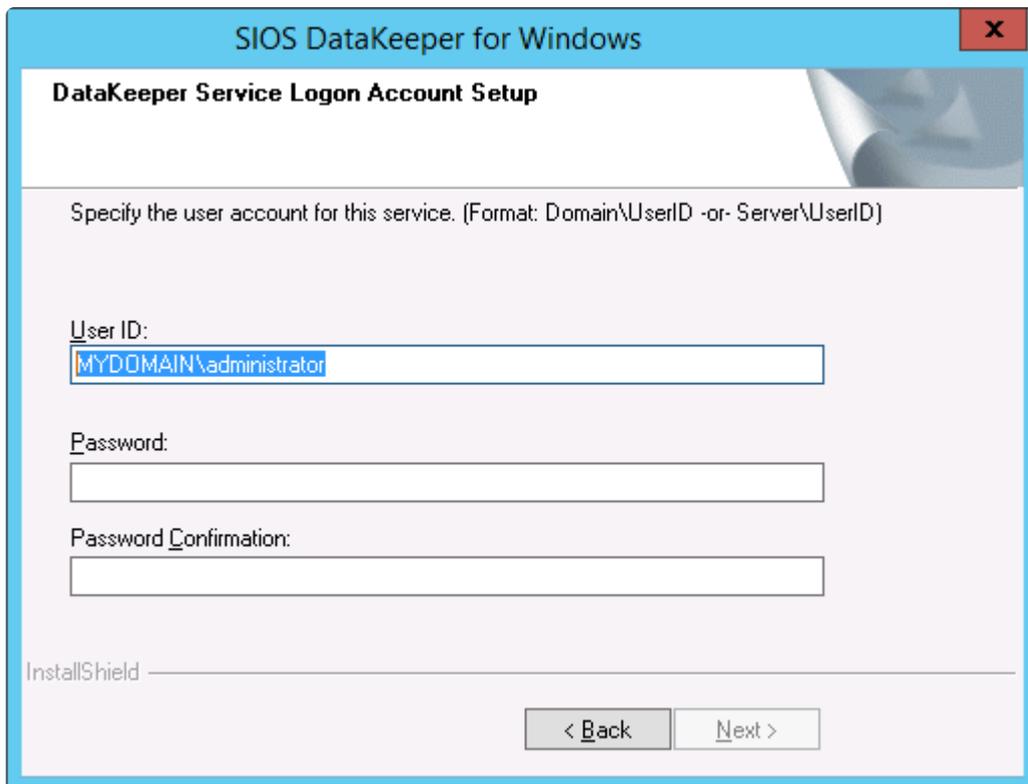
Note: The domain or server account used must be added to the Local System Administrators Group. The account must have administrator privileges on each server that DataKeeper is installed on.

Please note that the Local System account cannot be authenticated properly in a domain when network connectivity with Active Directory is lost. In that situation, connections between servers cannot be established with the Local System account causing DataKeeper volume switchover commands, via the network, to be rejected. IT organizations requiring fault tolerance during a disaster recovery, including network disruptions, should not use the Local System account.

DataKeeper Installation – Service Logon ID Type Selection:



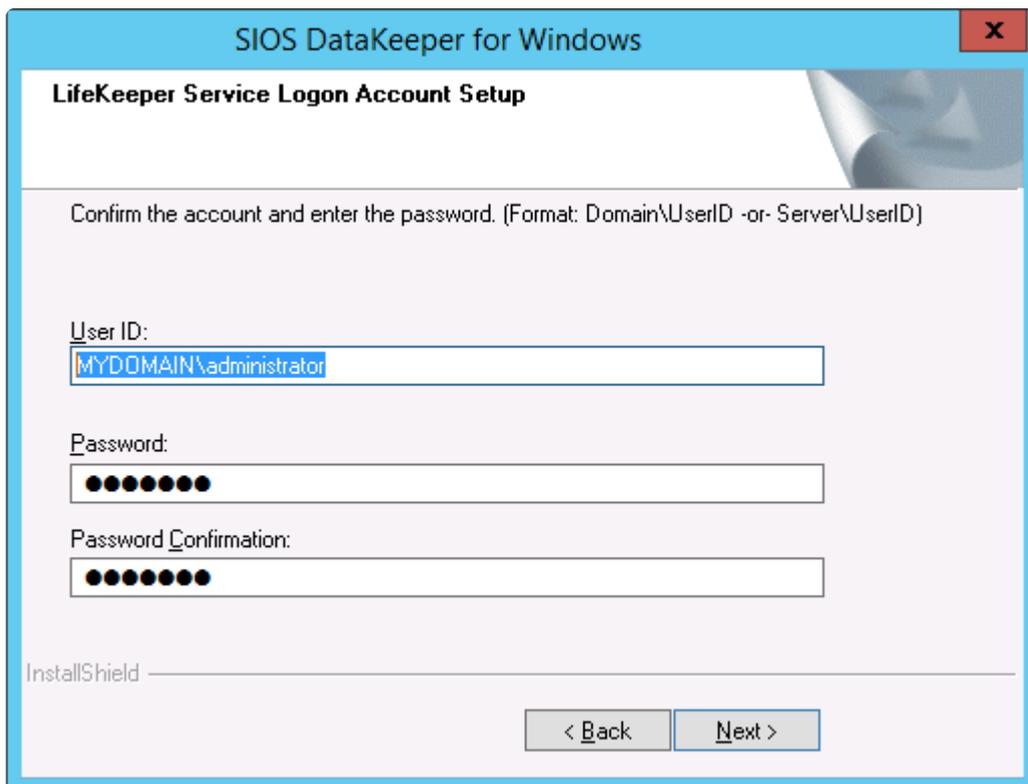
If a Domain or Server account is selected above, the DataKeeper Service Log On ID and Password Entry Form is displayed to enter that information.



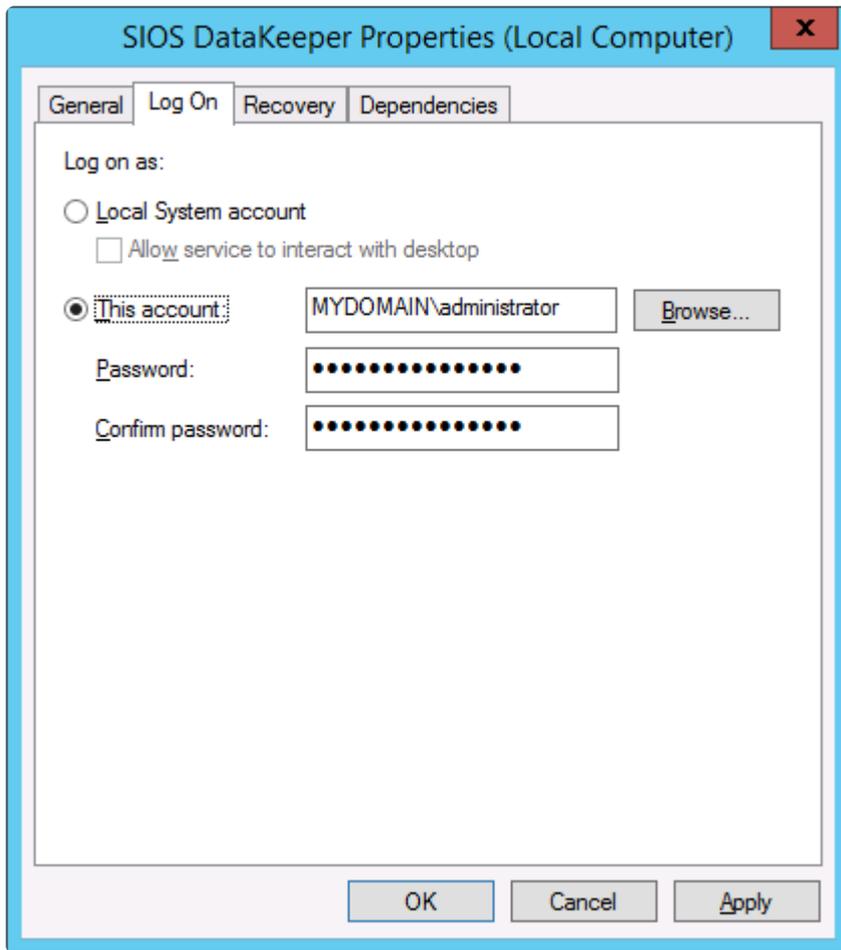
It is recommended that the LifeKeeper and DataKeeper service accounts are synchronized on each system to ensure more reliable switchovers and failovers.



LifeKeeper Service Logon:



If the DataKeeper Service has previously been configured with a Service Log On ID and Password, the setup program will omit the Service ID and Password selection dialogs. However, at any time, an administrator can modify the DataKeeper Service Log On ID and Password using the Windows Service Applet. Be sure to restart the DataKeeper Service after changing the Log On ID and/or Password.



The following table outlines these requirements:

Environment	DataKeeper Service Requirements	DataKeeper UI Requirements
Same Domain or Trusted Domain Environment	<ul style="list-style-type: none"> Run the DK Service on all systems as the same account with the same credentials Okay to use the default = Local System Account 	<ul style="list-style-type: none"> Log in as a domain admin and run the DK GUI Or use “run as” Administrator option to run DK GUI
Mixed Environment Servers in a Mixture of Domain and WorkGroup or Servers in Separate	<ul style="list-style-type: none"> Create a local account on each system with same account name and password Add this local account to the Administrator Group 	<ul style="list-style-type: none"> Log in using the local account you created to run the DK Service Run the DK GUI <p>You should also log on to all servers using this same Log On ID</p>

Domains	<ul style="list-style-type: none"> • Run the DK Service on all systems with the local account 	<p>and Password (see related Known Issue).</p>
DataKeeper Cluster Edition Environment	<ul style="list-style-type: none"> • Create or use a domain account for use by the DataKeeper Service (preferred) <p>or</p> <ul style="list-style-type: none"> • Create a local account on each system with same account name and password • Add this local account to the Administrator Group • Run the DK Service on all systems with this local administrator account 	<ul style="list-style-type: none"> • Log in using the local administrator account you created to run the DK Service • Run the DK GUI

Error 1265 when running DataKeeper Takesnapshot

PROBLEM:

Taking a snapshot when running the command on the target system with DataKeeper fails with error 1265.

```
C:\Program Files (x86)\SIOS\DataKeeper>emcmd (target-server-name) TAKESNAPSHOT (volume-letter of mirrored volume)
```

```
Status = 1265
```

```
emcmd (target system name) takesnapshot E
```

Running `net helpmsg 1265` from a command line: Error 1265 means that the server cannot reach the Domain Controller.

The location of the snapshot is on one volume (example: Volume D:). The location of the snapshot is setup BEFORE running the takesnapshot command by setting the location in the DK GUI or by running the `emcmd setsnapshot` command.

The location of the snapshot can be verified by running `emcmd . getsnapshotlocation E`

The location of the snapshot is on one volume (example: Volume D:).

The mirrored volume is on another volume (example: Volume E:).

DEBUG/SOLUTION:

Use the `emcmd` command with `getserviceinfo` and `-proxy` to debug this issue (where error 1265 is seen when running `emcmd takesnapshot`).

From the **source system** (where the mirror that you are trying to create the snapshot on is the source of the mirror) run the following:

```
emcmd (NetBIOS/Hostname of the target system where the snapshot is going to reside)
getserviceinfo -proxy .
```

EXAMPLE:

Target system's **NetBIOS/Hostname** = node2

Source system's **NetBIOS/Hostname** = node1

From a command prompt on **node1** run the following commands:

```
cd %extmirrbase%
```

```
emcmd node2 getserviceinfo -proxy .
```

This also fails with error code 1265 (which means that the server cannot reach the Domain Controller).

This means that name resolution is not working correctly on the target system (where you want to have the snapshot).

To further debug this, try using the local system account to start the DataKeeper service on ALL of the systems in the cluster.

Takesnapshot works in this situation (when the local system account is used to start the DK service).

In this case, the domain that the user accounts are in that was used to start the DataKeeper service is a DIFFERENT domain than the domain that the servers themselves are in.

This can be seen in two different dksupport files:

- `sys_name` – in this file find the entry for Logon domain and make sure it is the same domain that is used in the `dk_state` file for the `SERVICE_START_NAME`
- `dk_state` – in this file find the entry for `SERVICE_START_NAME` and make sure they are not only the same on all 3 systems, but they are in the same domain that is shown in the LOGON DOMAIN in the `sys_name` file.

EXAMPLE:

Domain the DK servers reside in = Domain1

Domain used for the DK Service account = Domain2

Customer was using a DK Service account from a domain “different “ from the servers (Domain2) to run datakeeper services.

The error 1265 indicated unable to communicate to the domain controller, so Domain2 was not able to resolve on the DK systems (which are in Domain1).

Summary: There are 2 solutions to this issue:

- Start the DK service on all systems in the cluster with the Local System account.

OR

- Ensure that the domain account being used to start the DK Service is in the **SAME** domain that the

systems are in. Start the DK Service on each system with an account that is in the same domain that the systems are in.

8.4. Understanding Replication

How SIOS DataKeeper Works

At the highest level, DataKeeper provides the ability to mirror a volume on one system (source) to a different volume on another system (target) across any network. When the mirror is created, all data on the source volume is initially replicated to the target volume, overwriting it. When this initial synchronization (also referred to as a full resync of the data) of the volumes is complete, the target volume is an exact replica of the source volume in terms of size and data content. Once the mirror is established, DataKeeper intercepts all writes to the source volume and replicates that data across the network to the target volume.

Replication is performed at the block level in one of two ways:

- [Synchronous replication](#)
- [Asynchronous replication](#)

In most cases, asynchronous mirroring is recommended on WANs and synchronous mirroring is recommended on LANs.

8.4.1. SIOS DataKeeper Intent Log

SIOS DataKeeper uses an intent log (also referred to as a bitmap file) to track changes made to the source, or to target volume during times that the target is unlocked. This log is a persistent record of write requests which have not yet been committed to both servers.

The intent log gives SIOS DataKeeper the ability to survive a source or target system failure or reboot without requiring a full mirror resync after the recovery of the system.

There is a performance overhead associated with the intent log, since each write to the volume must also be reflected in the intent log file. To minimize this impact, it is recommended that the intent logs be stored on a physical disk that is not involved in heavy read or write activity. See [Relocation of Intent Log](#) for more information.

DataKeeper Bitmap File Size Calculation

- One bit per block (each block is 64KB)
- One bit represents 64KB of volume space/

Example: For a 640GB volume the bitmap is 1,310,720 bytes

$$640 \times 1073741824 / 65536 / 8$$

That is 1,310,720 bytes for the bitmap.

Non-Shared Volumes

By default, this intent log feature is enabled, and the intent log files are stored in a subdirectory called “Bitmaps” under the directory where SIOS DataKeeper was installed.

To create the intent log file in a directory other than the default location, set the [BitmapBaseDir](#) registry entry to a directory where SIOS DataKeeper will create the file. See [Relocation of Intent Log](#) for more information.

To disable the intent log feature, clear the [BitmapBaseDir](#) registry entry (set it to an empty string) on all current and potential mirror endpoint servers. **Disabling the intent log requires a reboot on each of these systems in order for this setting to take effect.** Keep in mind that if this feature is disabled, a full resync will be performed in the event of a source system failure.

Shared Volumes

When replicating shared volumes, the intent log files are stored in a subdirectory called “ReplicationBitmaps” on the replicated volume itself. This is necessary to allow switchover to the other shared source servers without resulting in a full resync of the data.

SIOS does not recommend relocating intent logs from their default locations.

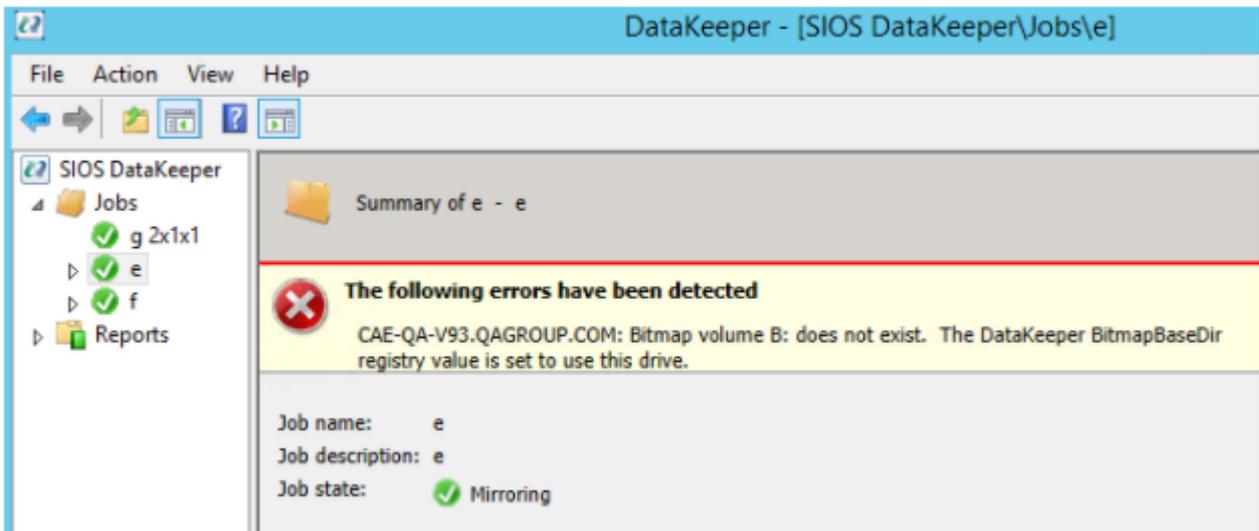
Configuration Issue

When configuring a [BitmapBaseDir](#) registry entry, make sure that the folder and drive letter specified exist. If configured with a drive letter that does not exist, DataKeeper will use a number of mechanisms to inform the user that BitmapBaseDir is not configured correctly. These mechanisms include the following:

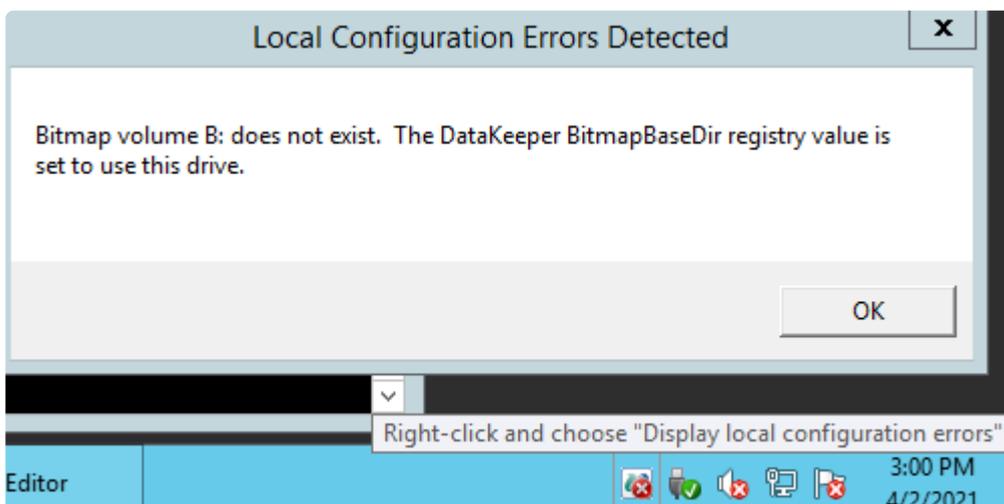
- The DataKeeper driver (ExtMirr) will log event ID 292 to the System event log every 2 minutes. This event says:

The volume which contains DataKeeper bitmap files has not been registered yet. DataKeeper mirrors will not function until the bitmap volume is present. BitmapBaseDir is set to <setting string>.

- The DataKeeper GUI running on any system connected to the misconfigured system, will display an error message as shown here:



- The [DataKeeper Notification Icon](#) on the misconfigured node EMTray will display an error icon and will describe the issue in its Local Configuration Errors dialog box.



- The DKHealthCheck utility will display the error message.

In addition to warning the user with these mechanisms, DataKeeper will create its bitmap files in the default location (the Bitmaps folder in the DataKeeper install folder) if the volume specified by `BitmapBaseDir` does not get configured within the timeout specified by the [WaitForBitmapBaseDirMs](#) registry parameter. This value, specified in milliseconds, defaults to 180000 (i.e. 3 minutes). Mirrors will be operational when bitmaps are stored in the DataKeeper install folder, but performance may be impacted.

8.4.2. Relocation of Intent Log

To relocate the Intent Log (bitmap file), please perform the following on all servers involved:

* LEAVE THE MIRROR IN THE MIRRORING STATE! Do not pause it and then move the bitmap file.

* **Note:** DataKeeper only supports bitmaps on NTFS filesystems. If the bitmaps are on a different filesystem DataKeeper will not recognize it.

* Please refer to [SIOS DataKeeper Intent Log](#) for more information, including information about possible configuration errors when changing this value.

1. If you have more than one DataKeeper mirror, all mirrors must be moved to be the source on the **SAME** system **BEFORE** you relocate the bitmap file.

* **Note:** This applies to all cluster configurations (2, 3, 4... node configurations).

2. On all systems, create the directory for the new location of the bitmap files (*i.e.* `R:\Bitmaps`).
Important: If you choose to relocate the bitmap file from the default location (`%EXTMIRRBASE%\Bitmaps`), you must first create the new directory before changing the location in the registry and rebooting the system.
3. Modify the [BitmapBaseDir](#) registry value on all systems other than the mirror source system to reflect the new location. This includes mirror targets and any systems that share the volume with the mirror source or share with any of the targets.

Edit Registry via regedit:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\  
Parameters
```

Modify the "BitmapBaseDir" parameter, change to the new location (*i.e.* `R:\Bitmaps`)

4. Reboot each of the non-source systems. If this volume is part of a Windows cluster, be sure that you do not shut down too many nodes simultaneously or you may lose the cluster quorum and cause the cluster to shut down on the remaining nodes.
5. Switch any volumes on the source system over to another system (target or shared source). Repeat Steps 2 and 3 on the system that was previously source.

6. After rebooting the original source system, all volume resources can be switched back to that system.

8.4.3. Resynchronization

SIOS DataKeeper Resynchronization

SIOS DataKeeper performs resynchronization through the use of a bitmap file ([intent log](#)). It allocates memory that is used to keep track of “dirty” or “clean” blocks. When a full resync begins, SIOS DataKeeper initializes the bit for each block that is in use by the file system to 1 (“dirty”), indicating that it needs to be sent to the target system. A full resync occurs at the initial creation of a mirror and during the resync operation after a mirror is broken. It then starts at the beginning of the bitmap, finds the first block whose bit is set to 1 or dirty, reads the corresponding block from the local hard disk, and sends it to the remote system. After this has completed successfully, it sets the block to 0 (“clean”). SIOS DataKeeper then finds the next dirty bit and repeats this process.

As new writes come in during a resync, the corresponding blocks are set to 1 or dirty.

Once resync gets to the end of the bitmap, it looks to see if there are still any dirty blocks. It does this through a counter that is incremented when one is made dirty and decremented when cleaned. If any blocks are dirty, it resets its pointer to the beginning of the bitmap and starts again, only sending the dirty blocks to the remote system.

This process continues for multiple passes until all blocks are clean. When this happens, the mirror will go from the **Resynchronizing** state to the **Mirroring** state, and at that point, every write is mirrored (the bitmap is no longer necessary at that point).

You can follow the resynchronization process by viewing the resynchronization control counters in Performance Monitor.

This same resynchronization mechanism is used when you CONTINUE a PAUSED mirror.

Initial Creation of a Mirror

When the mirror is created, DataKeeper must perform an [initial synchronization](#) of the data from the source volume to the target volume. This is referred to as a full resync. However, prior to this initial full resync of the data, DataKeeper first performs a process called “**whitespace elimination**” where all blocks of currently unused space on the source volume are eliminated from the initial synchronization and those blocks do not have to be replicated to the target volume.

Example: Whitespace Elimination

Source Volume Capacity	80 GB
Source Volume Free Space	35 GB
Amount of data to be resynced from source volume to target volume during initial creation of the mirror.	55 GB

8.4.4. Synchronous and Asynchronous Mirroring

SIOS DataKeeper employs both asynchronous and synchronous mirroring schemes. Understanding the advantages and disadvantages between synchronous and asynchronous mirroring is essential to the correct operation of SIOS DataKeeper.

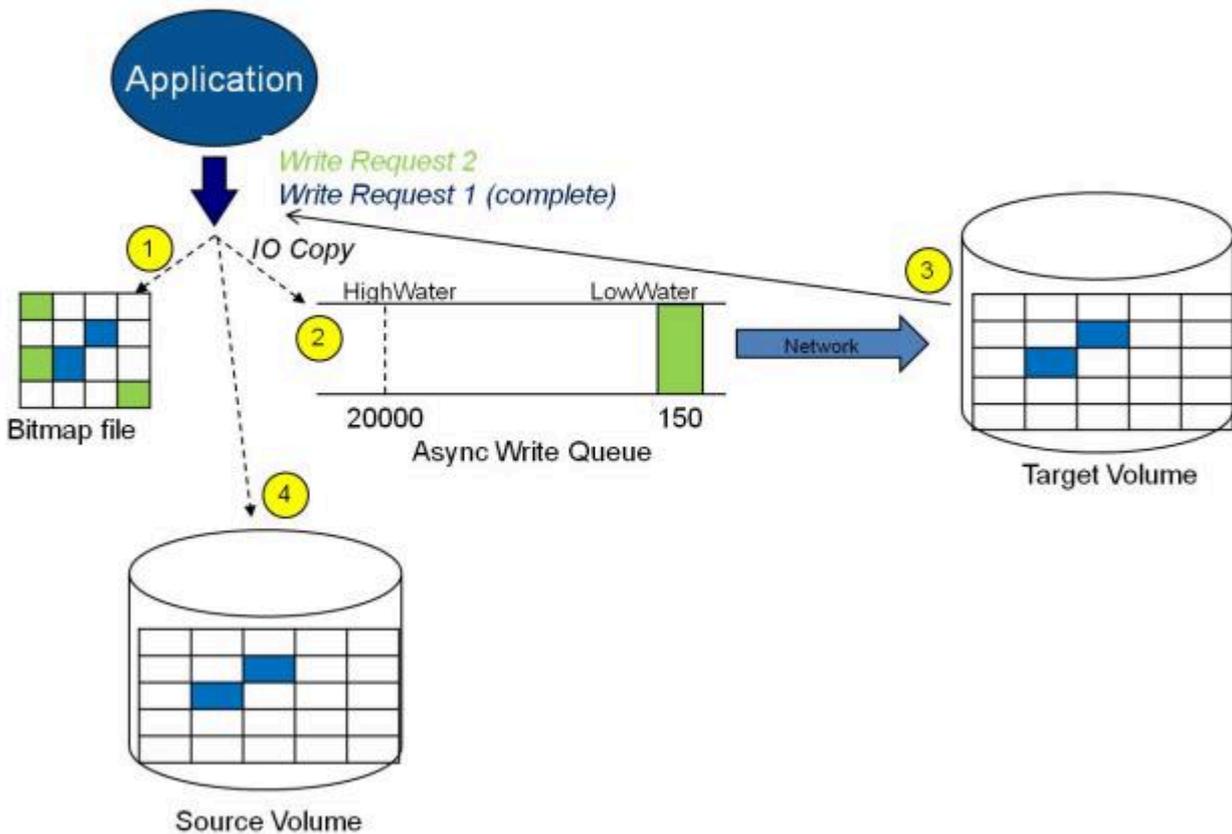
Synchronous Mirroring

With synchronous mirroring, each write is intercepted and transmitted to the target system to be written on the target volume at the same time that the write is committed to the underlying storage device on the source system. Once both the local and target writes are complete, the write request is acknowledged as complete and control is returned to the application that initiated the write. Persistent bitmap file on the source system is updated.

The following sequence of events describes what happens when a write request is made to the source volume of a synchronous mirror.

1. The following occur in parallel.
 - a. A copy of the write is put on the mirror Write Queue.
 - b. The write is sent to the local volume for completion.
2. The write returns a completion status to the caller after both operations above complete.
 - a. If any condition prevents the write from completing on the Target (network transmission error or write error on the target system), the mirror state is changed to Paused. However, the status of the volume write which is returned to the caller is not affected.
 - b. The status of the local volume write is returned to the caller.

Synchronous Replication



In this diagram, Write Request 1 has already completed. Both the target and the source volumes have been updated.

Write Request 2 has been sent from the application and the write is about to be written to the target volume. Once written to the target volume, DataKeeper will send an acknowledgment that the write was successful on the target volume, and in parallel, the write is committed to the source volume.

At this point, the write request is complete and control is returned to the application that initiated the write.

While synchronous mirroring insures that there will be no data loss in the event of a source system failure, synchronous mirroring can have a significant impact on the application’s performance, especially in WAN or slow network configurations, because the application must wait for the write to occur on the source and across the network on the target.

Asynchronous Mirroring

With asynchronous mirroring, each write is intercepted and a copy of the data is made. That copy is queued to be transmitted to the target system as soon as the network will allow it. Meanwhile, the original write request is committed to the underlying storage device and control is immediately returned to the application that initiated the write.

To maintain data consistency across multiple volumes (such as database Log and Data files), some

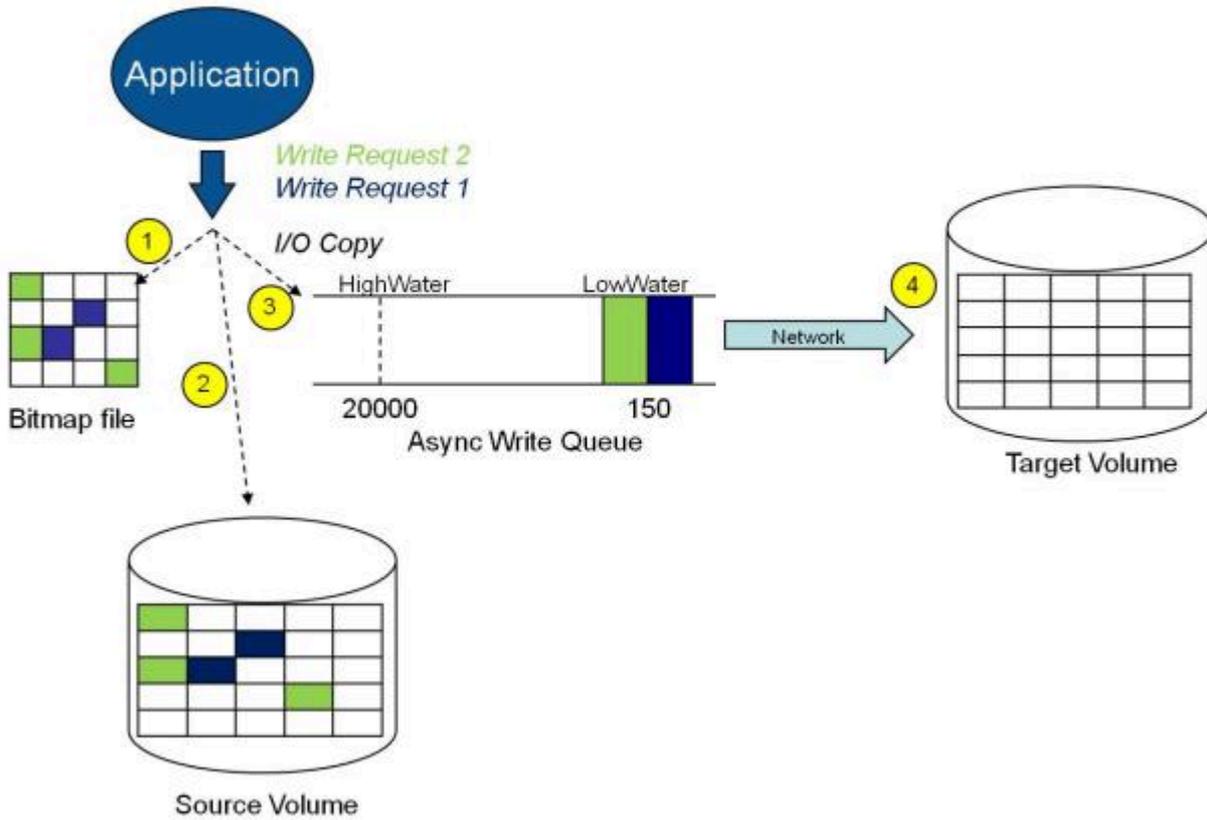
applications send Flush requests to the volume. DataKeeper honors Flush requests on a volume with a mirror in the Mirroring state by waiting for all writes in the queue to be sent to the target system and acknowledged. To prevent performance from being impacted in such cases, the registry entry "[DontFlushAsyncQueue](#)" may be set, or you may consider locating all files on the same volume.

At any given time, there may be write transactions waiting in the queue to be sent to the target machine. But it is important to understand that these writes reach the target volume in time order, so the integrity of the data on the target volume is always a valid snapshot of the source volume at some point in time. Should the source system fail, it is possible that the target system did not receive all of the writes that were queued up, but the data that has made it to the target volume is valid and usable.

The following sequence of events describes what happens when a write request is made to the source volume of an asynchronous mirror.

1. Persistent bitmap file on the source system is updated.
2. Source system adds a copy of the write to the mirror Write Queue.
3. Source system executes the write request to its source volume and returns to the caller.
4. Writes that are in the queue are sent to the target system. The target system executes the write request on its target volume and then sends the status of the write back to the primary.
5. If the mirror's write queue reaches a configured limit (WriteQueueHighWater or WriteQueueByteLimit reached), the mirror's "BlockWritesOnLimitReached" setting will be used to determine what the behavior should be. If BlockWritesOnLimitReached is "0", the mirror is paused and a partial resync starts a short time later. If BlockWritesOnLimitReached is "1", the incoming write is delayed until there is space on the write queue for it. The mirror remains in the Mirroring state, but the application throughput slows down to match the speed of the network and the remote node's volume.
6. Should an error occur during network transmission or while the target system executes its target volume write, the write process on the secondary is terminated. The state of the mirror then changes from **Mirroring** to **Paused**.

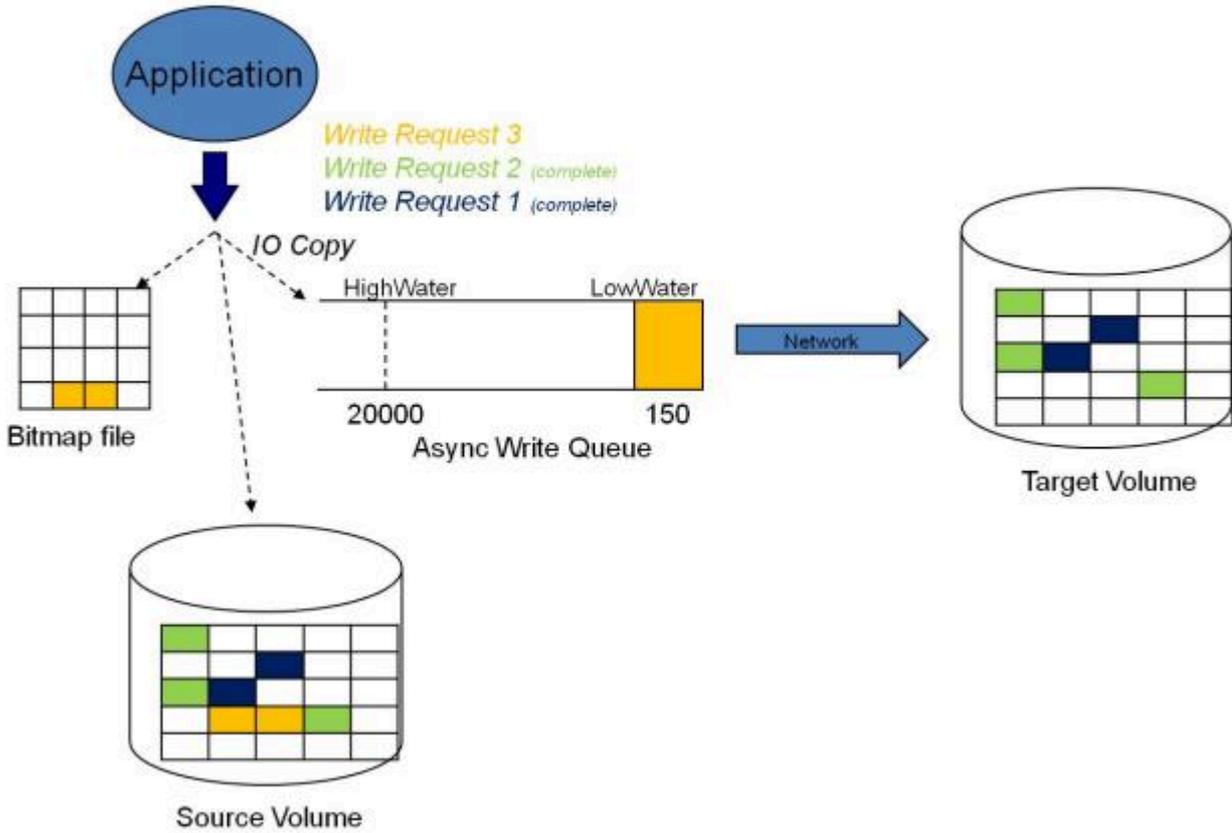
Asynchronous Replication: Mirroring



In the diagram above, the two write requests have been written to the source volume and are in the queue to be sent to the target system. However, control has already returned back to the application who initiated the writes.

In the diagram below, the third write request has been initiated while the first two writes have successfully been written to both the source and target volumes. While in the mirroring state, write requests are sent to the target volume in time order. Thus, the target volume is always an exact replica of the source volume at some point in time.

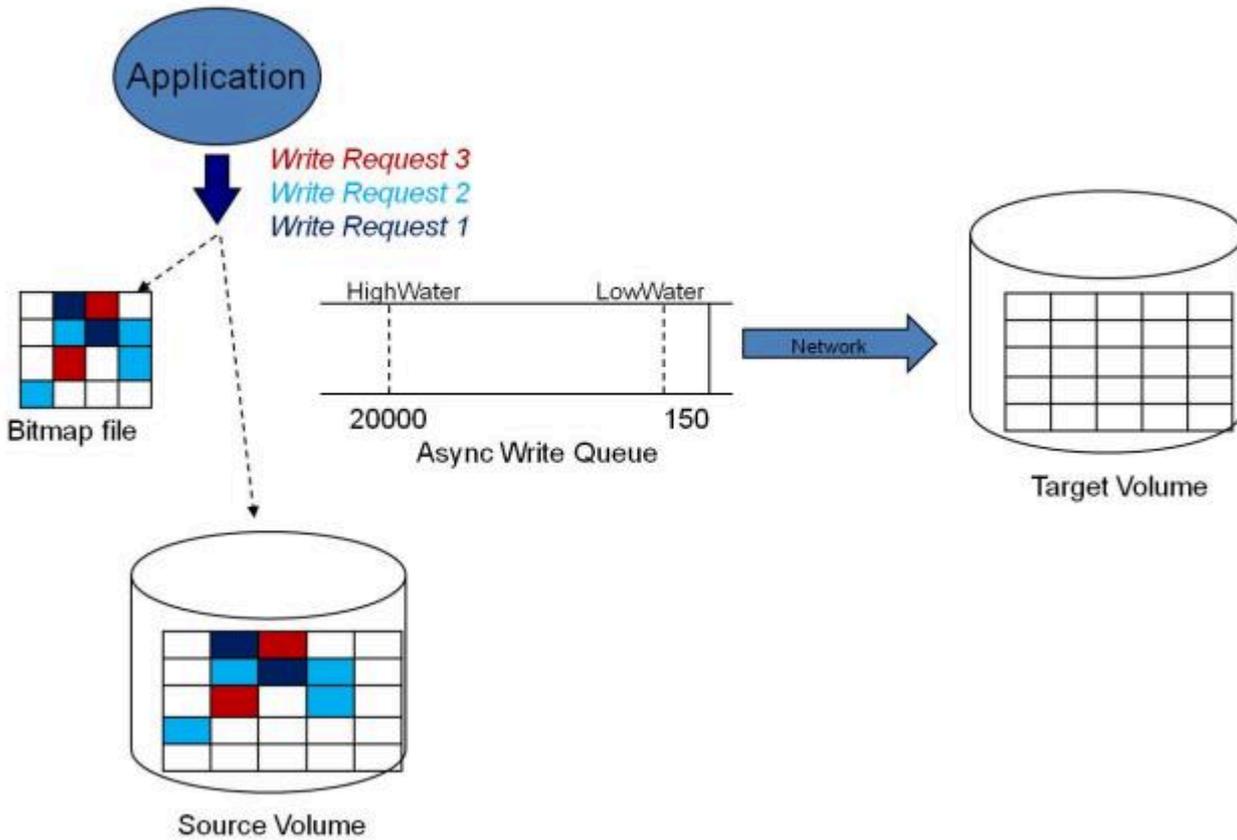
Asynchronous Replication: Mirroring



Mirror PAUSED

In the event of an interruption to the normal mirroring process as described above, the mirror changes from the **MIRRORING** state to a **PAUSED** state. All changes to the source volume are tracked in the persistent bitmap file only and nothing is sent to the target system.

Replication: Mirror Paused



Mirror RESYNCING

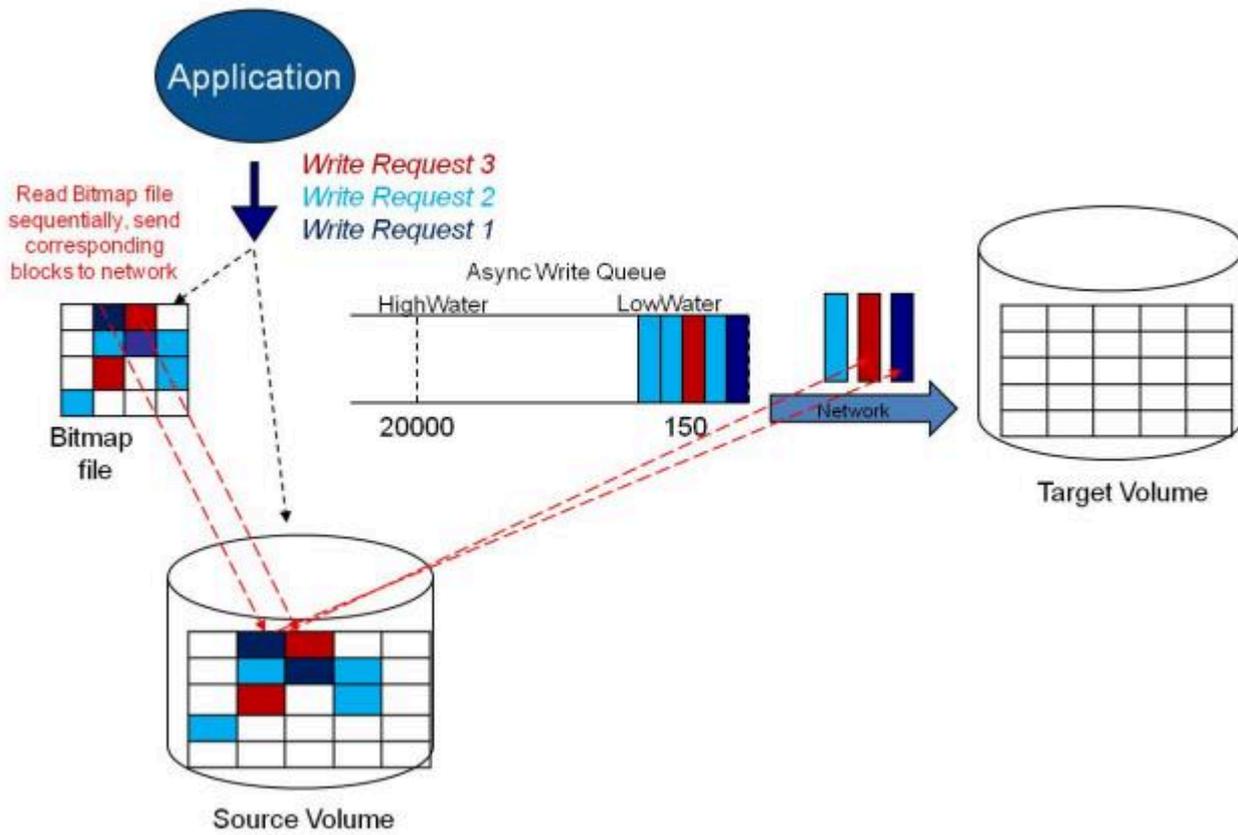
When the interruption of either an Asynchronous or Synchronous mirror is resolved, it is necessary to resynchronize the source and target volumes and the mirror enters into a **RESYNC** state.

DataKeeper reads sequentially through the persistent bitmap file to determine what blocks have changed on the source volume while the mirror was **PAUSED** and then resynchronizes only those blocks to the target volume. This procedure is known as a partial resync of the data.

The user may notice a **Resync Pending** state in the GUI, which is a transitory state and will change to the **Resync** state.

During resynchronization, all writes are treated as Asynchronous, even if the mirror is a Synchronous mirror. The appropriate bits in the bitmap are marked dirty and are later sent to the target during the process of partial resync as described above.

Replication: Resynchronization



8.4.5. Read and Write Operations

After the volume mirror is created and the two drives on the primary and secondary servers are synchronized, the following events occur:

- The system locks out all user access to the target volume; reads and writes are not allowed to the target volume. The source volume is accessible for both reads and writes.
- Both mirrored and non-mirrored volume read operations arriving at the driver on the primary server are passed on and allowed to complete normally without intervention. Reads of a mirrored volume on the secondary system are not allowed, i.e., the secondary has not assumed the role of a failed primary.
- Whenever the primary server receives a write request, the system first determines whether the request is for a mirrored volume. If not, the write is allowed to complete normally without any further intervention. If the write request is for a mirrored volume, the request is handled depending on the mirroring type:
 - If the type is [synchronous](#), then the write request is put on the mirror Write Queue for transmission to the target system, and simultaneously sent to the local source volume. The write operation is not acknowledged as complete to the process that issued the write until the source disk write completes **and** notification from the target is received (success or failure). Should an error occur during network transmission or while the target system executes its write, the write process on the target is terminated and the state of the mirror is changed to **Paused**. The source volume completes the write regardless of the target write status.

If the type is [asynchronous](#), then the primary executes the write request to its source volume, puts a copy of the write on the asynchronous write queue and returns to the caller. Writes that are in the queue are sent to the target volume. The secondary system executes the write request on the target volume and then sends the status of the write back to the primary. Should an error occur during network transmission or while the secondary executes its mirrored volume write, the write process on the secondary is terminated. The state of the mirror then changes from **Mirroring** to **Paused**.

To ensure uninterrupted system operation, SIOS DataKeeper momentarily pauses the mirror and automatically continues it (i.e., performs a partial resync) in the following cases:

- When the mirror's `BlockWritesOnLimitReached` settings is 0, and the mirror write queue length reaches the `WriteQueueHighWater` limit, or the number of bytes in the queue reaches the `WriteQueueByteLimitMB` limit, due to a large number of writes to the volume in a short period of time (e.g., database creation). The user can monitor the mirroring behavior using the SIOS DataKeeper Performance Monitor counters and adjust the `WriteQueueHighWater` and/or the `WriteQueueByteLimitMB` value if necessary. See [Registry Entries](#) for more details.
- When transmission of a write to the target system times out or fails due to resource shortage (e.g., source system resource starvation due to a flood of writes/network transmissions in a short period

of time).

8.4.6. Volume Considerations

SIOS DataKeeper primary and secondary systems have three types of volumes: system, non-mirrored and mirrored. During mirroring operations, system and non-mirrored volumes are not affected and the user has full access to all applications and data on these volumes.

What Volumes Cannot be Mirrored

The SIOS DataKeeper service filters out the following types of disk partitions:

- Windows system volume
- Volume(s) that contain the Windows pagefile
- Non-NTFS formatted volumes (e.g. FAT, FAT32, Raw FS, ReFS)
- Non-fixed drive types (e.g. CD-ROMs, diskettes)
- Target volumes that are smaller than the source volume

Volume Size Considerations

The source and target systems are not required to have drives of the same physical size. When the mirror is established, the target volume must be the same size, or larger than the source volume.

There is no limit on the size of volumes that can participate in a SIOS DataKeeper mirror. However, you should be aware that on initial mirror creation, all data that is in use by the file system on the source volume must be sent to the target. For instance, on a 20 GB volume with 2 GB used and 18 GB free, 2 GB of data must be synchronized to the target. The speed of the network connection between the two systems, along with the amount of data to be synchronized, dictates how long the initial mirror creation will take.

8.4.7. Specifying Network Cards for Mirroring

SIOS DataKeeper allows the administrator to specify which IP addresses should be used as mirror endpoints. This allows the replicated data to be transmitted across a specific network which permits the user to segment mirrored traffic away from the client network if desired.

Dedicated LAN for Replication

While it is not required, a dedicated (private) network between the two servers will provide performance benefits and not adversely affect the client network.

8.4.8. Performance Monitor Counters

SIOS DataKeeper provides counters that extend Performance Monitor with statistics about the status of mirroring on volumes. The counters are installed during the full installation of SIOS DataKeeper software.

To access the counters, do the following:

1. On a **Microsoft Windows 2008 R2** system, start the **Windows Performance Monitor** through the **Start** menu in the **Reliability and Performance** group.

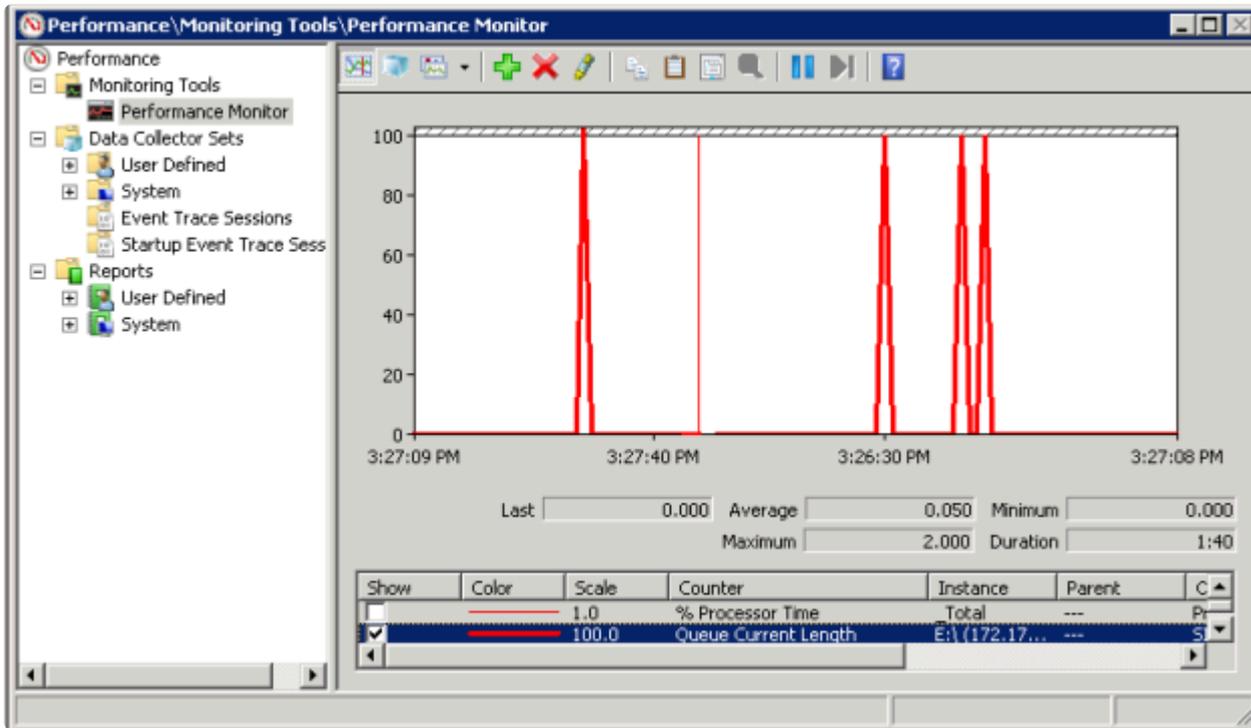
On a **Microsoft Windows 2012** system, start the **Windows Performance Monitor** through the **Performance Monitor** option in the **Administrative tools**.

On all versions of Windows, you can start performance monitor through entering **perfmon.msc** using the command line.

2. Select **Monitoring Tools, Performance Monitor**.
3. Click the **+** button in the chart pane to open the **Add Counters** dialog box.
4. Select the **SIOS Data Replication** object.

 The Performance Monitor Counters for DataKeeper (DK) and DataKeeper Cluster Edition (DKCE) are only accessible for a system that is in the **source** role for the mirror. On a system with a mirror in the source role, there will be one instance of the specified counter available for each target of that mirror. SIOS DataKeeper performance counters are not available on a system where the mirror is in the target role.

SIOS DataKeeper provides 17 counters that allow the monitoring of various operations related to the product. These counters allow the monitoring of such things as status, queuing statistics and general mirror status.



Mirror State Counters

Mirror Elapsed Time

Default Value: 0

Range: 0 – MAX_ULONGLONG

This value represents the amount of time, in seconds, that the volume has been in Mirror state. This value will be 0 for volumes that are not currently involved in a mirror, volumes that are currently undergoing mirror creation (and synchronization), and volumes for which a mirror has been broken or deleted.

Mirror State

Default: 0

Range: 0 – 5

This value represents the current mirroring state of a volume. The following values are defined:

0 None – The volume is not currently involved in a mirror.

1 Mirroring – The volume is currently mirroring to a target.

2 Resynchronizing – The volume is currently being synchronized with its target.

3 Broken – The mirror exists but the source and target volumes are not in sync. New writes to the

volume are not tracked.

4 Paused – The mirror exists but the source and target volumes are not in sync. The source server keeps track of any new writes.

5 Resync Pending – The source volume is waiting to be resynchronized.

Mirror Type

Default: 0

Range: 0-2

This value represents the type of mirroring this volume is engaged in. The following values are defined for this release:

0 None – The volume is not currently involved in a mirror.

1 Synchronous – Data is put on the Write Queue to be sent to the target, and written to the local volume, simultaneously. The write is not acknowledged as complete until both operations complete.

2 Asynchronous – Data is put on the Write Queue to be sent to the target, and written to the local volume, simultaneously. The write is acknowledged when the local volume write completes.

Network Number of Reconnects

Default: 0

Range: 0 – MAX_ULONGLONG

This value is the number of network reconnections that have been made while the volume has been mirrored. A network reconnection occurs when communication is lost with the target.

Write Queue Counters

Queue Byte Limit

Default Value: 0

This value displays the write queue byte limit as set in the WriteQueueByteLimitMB registry value. This value is displayed in bytes, and is therefore 1048576 times the value set in the registry.

Queue Current Age

Default Value: 0

Range: 0 -

This value is the age (in milliseconds) of the oldest write request in the write queue.

Queue Current Bytes

Range: 0 –

This value displays the number of bytes allocated for the given mirror's Write Queue.

Queue Current Length

Default Value: 0

Range: 0 –

This value represents the current length, in terms of number of writes, of the write queue for the selected mirror.

Queue High Water

Default: 20000

This counter displays the write queue high water mark as set in the mirror WriteQueueHighWater registry value.

Resynchronization Control Counters

Resync Reads

Default: 20

This value represents the maximum number of disk blocks that can be in the process of being read and sent to the target system during mirror resynchronization.

Resync Current Block

Default: 0

Range: 0 –

During the synchronization process, this value represents the current block that is being sent to the target. At other times (i.e. when mirror state is not EmMirrorStateResync), this value will be 0.

During synchronization, a given block may be sent to the target multiple times if writes are ongoing to the volume. This is based on the number of resync passes that are required.

Resync Dirty Blocks

Default Value: 0

Range: 0 –

This value is the number of total blocks that are dirty during mirror resynchronization. “Dirty” blocks are those that must be sent to the target machine before synchronization is complete. This value will be 0 for all states other than EmMirrorStateResync.

When a mirror synchronization is begun, this value will be initially equal to the value of Resync Total Blocks. Please note that during a mirror synchronization, Resync Dirty Blocks may actually increase if a large number of incoming writes are made to the volume.

NOTE: This counter can be used to view the amount of data remaining to be resync’ed. The amount of data remaining is “Resync Dirty Blocks” X 65536 (where 65536 is the number of bytes in a block).

Resync Elapsed Time

Default Value: 0

Range: 0 – MAX_ULONG

While the mirror is being synchronized, this value represents the elapsed time in seconds that the synchronization has been occurring. After a mirror is successfully resynchronized, the value represents the total amount of time the previous synchronization operation took since the last system boot. The value will be 0 for volumes that either never have been synchronized or volumes that were not synchronized during the last boot.

Resync New Writes

Default: 0

Range: 0 – MAX_ULONG

This value represents the number of writes that have occurred on the volume since a synchronization operation has begun. This value will directly affect the number of dirty blocks, the number of passes required to synchronize the mirror and the amount of time the synchronization takes to complete.

Resync Pass

Default Value: 10

Range: 0 – MaxResyncPasses (Registry)

This value is the number of passes that have currently been made through the volume during the

resynchronization process to update the target. The number of passes required to complete the synchronization process will increase based on the amount of writing that is being performed during synchronization. While writing to the source volume is allowed during synchronization, heavy writes will cause the synchronization to take longer, thus resulting in a much longer time until it is finished.

Resync Total Blocks

Default Value: 0

Range: 0 – MAX_ULONGLONG

This value represents the number of 64k blocks used for resynchronization of the mirrored volume. The value is approximately equal to the file system size of the volume divided by 64K. Please note that the file system size is less than the partition size of the volume that is shown in the Windows Disk Management program. To see the file system size, type CHKDSK X: (where X is the drive letter).

Resync Phase

Default Value: 0

Range: 0 – 3

This value has been deprecated and is no longer used.

8.5. Configuration

Requirements/Considerations

The topics in this section identify several prerequisites to be aware of before implementing your DataKeeper configuration.

[Sector Size](#)

[Network Bandwidth](#)

[Network Adapter Settings](#)

[DataKeeper Service Log On ID and Password Selection](#)

[Firewall Configurations](#)

[High-Speed Storage Best Practices](#)

[Configuration of Data Replication From a Cluster Node to External DR Site](#)

[WAN Considerations](#)

[Initial Synchronization of Data Across the LAN/WAN](#)

[Compression](#)

[Bandwidth Throttle](#)

8.5.1. Sector Size

Beginning with DataKeeper Version 7.2.1, disks with sector size not equal to 512 bytes are supported. However, DataKeeper requires that the mirror source volume be configured on disk(s) whose sector size is the same as the disk(s) where the mirror target is configured. NTFS Metadata includes the disk sector size. DataKeeper replicates the entire NTFS file system from source to target, so the sector sizes must match.



Note: For DataKeeper Version 7.2 and prior, only disk devices whose sector size is the standard 512 bytes are supported.

8.5.2. Network Bandwidth

Because DataKeeper can replicate data across any available network, special consideration must be given to the question, “Is there sufficient bandwidth to successfully replicate the volume and keep the mirror in the **mirroring** state as the source volume is updated throughout the day?”

Keeping the mirror in the **mirroring** state is critical, because a switchover of the volume is not allowed unless the mirror is in the **mirroring** state.

Determine Network Bandwidth Requirements

Prior to installing SIOS DataKeeper, you should determine the network bandwidth requirements for replicating your data. Use the method below to measure the rate of change for the data that you plan to replicate. This value indicates the amount of network bandwidth that will be required to replicate that data.

After determining the network bandwidth requirements, ensure that your network is configured to perform optimally. If your network bandwidth requirements are above your current available network capacity, you must consider one or more of the following options:

- Enable compression in DataKeeper, or in the network hardware, if possible
- Create a local, non-replicated storage repository for temporary data and swap files if you are replicating Hyper-V virtual machines
- Reduce the amount of data being replicated
- Increase your network capacity

If the network capacity is not sufficient to keep up with the rate of change that occurs on your disks, DataKeeper mirrors will remain in a resynchronizing state for considerable periods of time. During resynchronization, data on the target volume is not guaranteed to be consistent.

Measuring Rate of Change

Use [Performance Monitor](#) (perfmon) to measure the rate of change that occurs on your volumes that are to be replicated. The best way to do this is to create a log of disk write activity for some period of time (one day, for instance) to determine what the peak disk write periods are.

To track disk write activity,

- use perfmon to create a user-defined data collector set on Windows 2008 or Windows 2012.
- add the counter “Disk Write Bytes/sec” for each volume – the volume counters can be found in the logical disks group.

- start the log and let it run for the predetermined amount of time, then stop and open the log.

An alternative to creating a log of disk writes is to use perfmon to track disk write bytes/sec interactively, in the Performance Monitor tool, and to observe the maximum and average values there.

SIOS DataKeeper handles short bursts of write activity by adding that data to its async queue. However, make sure that over any extended period of time, the disk write activity for all replicated volumes combined remains, on average, below the amount of change that DataKeeper and your network can transmit.

 A data change of 100GB requires approximately 154 hours to replicate on a T1 network (1.5 Mbps), 23 hours to replicate on a 10Mbps network, 5 hours on a T3 network (45 Mbps), 2 hours on a 100Mbps network and 14 minutes on a Gigabit network.

Tabled below are the approximate replication times in accordance to **Network Bandwidth** and its **Rate of Change** with a data change of **100GB**:

Network Bandwidth	Rate of Change (Approximately)	Replication Time (Approximately)
1.5 Mbps (T1)	180,000 Bytes/sec	154 hours
10 Mbps	1,200,000 Bytes/sec	23 hours
45 Mbps (T3)	5,400,000 Bytes/sec	5 hours
100 Mbps	12,000,000 Bytes/sec	2 hours
1000 Mbps (Gigabit)	120,000,000 Bytes/sec	14 minutes

 If DataKeeper is unable to reach the replication output(s) as listed in the table above, the most likely reason would be an issue with latency in network or disk access. For information on best practices for optimal performance click the following topics on [High-Speed Storage Best Practices](#) or [Best Practices](#).

8.5.3. Network Adapter Settings

DataKeeper requires that “**File and Printer Sharing for Microsoft Networks**” be enabled on the network interfaces to make a NAMED PIPE connection and be able to run DataKeeper’s command line tool (EMCMD).

To test if you can make a Named Pipe connection, try to map a network drive on the TARGET system. If that fails, you have a Named Pipe issue.

DataKeeper also requires that **NetBIOS over TCP/IP** and **SMB** protocols be enabled. If the GUI does not operate correctly, make sure the following network configurations are enabled:

- Enable **NetBIOS over TCP/IP** and **SMB** protocols as in the following example:

```
My Computer->Manage->System Tools->Device Manager->View->Show Hidden  
Devices->Non-Plug and Play Drivers->NetBIOS over Tcpi (Enable)
```

- Enable **NetBIOS over TCP/IP** on each network adapter carrying mirror traffic as in the following example:

```
Start->Settings->Network and Dial-up Connections->->Properties-  
>Internet Protocol (TCP/IP)->Properties->Advanced...button->WINS tab-  
>Enable NetBIOS over TCP/IP radio button (Checked)
```

- Enable the Microsoft “**Client for Microsoft Networks**” component on each system where the DataKeeper Administrator GUI will be used. This must be on the same adapter with **NetBIOS over TCP/IP** enabled (above). For example:

```
Start->Settings->Network and Dial-up Connections->->Properties-  
>Client for Microsoft Networks (checked)
```

- Enable the Microsoft “**File and Printer Sharing for Microsoft Networks**” component on each system which the DataKeeper Administrator GUI will connect to locally and remotely. This must be on the same adapter with **NetBIOS over TCP/IP** enabled (above). For example:

```
Start->Settings->Network and Dial-up Connections->->Properties->File  
and Printer Sharing for Microsoft
```

8.5.4. DataKeeper Service Log On ID and Password Selection

During a new DataKeeper installation setup, the user will be prompted for a DataKeeper Service Log On ID and Password.

The DataKeeper Service uses authenticated connections to perform volume switchovers and make mirror role changes across multiple servers. The Log On ID account chosen to run the DataKeeper Service will determine how much authority and permission is available to establish connections between servers and perform volume switchovers, especially when server or network disruptions occur.

Several types of Service Log On ID accounts are available as follows:

- A **Domain Account** with administrator privileges, valid on all connected servers in the domain (*recommended*)
- A **Server Account** with administrator privileges, valid on all connected servers
- The **Local System Account** (*not recommended*)

Note: For Workgroups, use the **Server Account** option and use the server name \ administrator on each system as the Service Account for DataKeeper. **You should also log on to all servers using this same Log On ID and Password** (see related [Known Issue](#)).

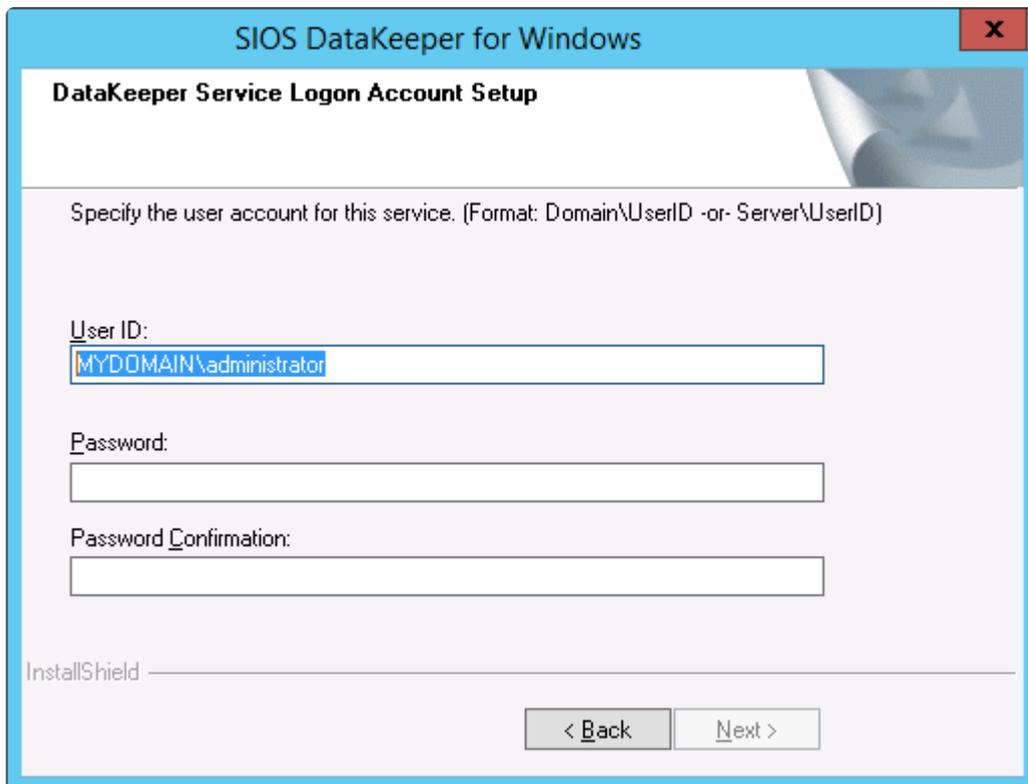
Note: The domain or server account used must be added to the Local System Administrators Group. The account must have administrator privileges on each server that DataKeeper is installed on.

Please note that the Local System account cannot be authenticated properly in a domain when network connectivity with Active Directory is lost. In that situation, connections between servers cannot be established with the Local System account causing DataKeeper volume switchover commands, via the network, to be rejected. IT organizations requiring fault tolerance during a disaster recovery, including network disruptions, should not use the Local System account.

DataKeeper Installation – Service Logon ID Type Selection:



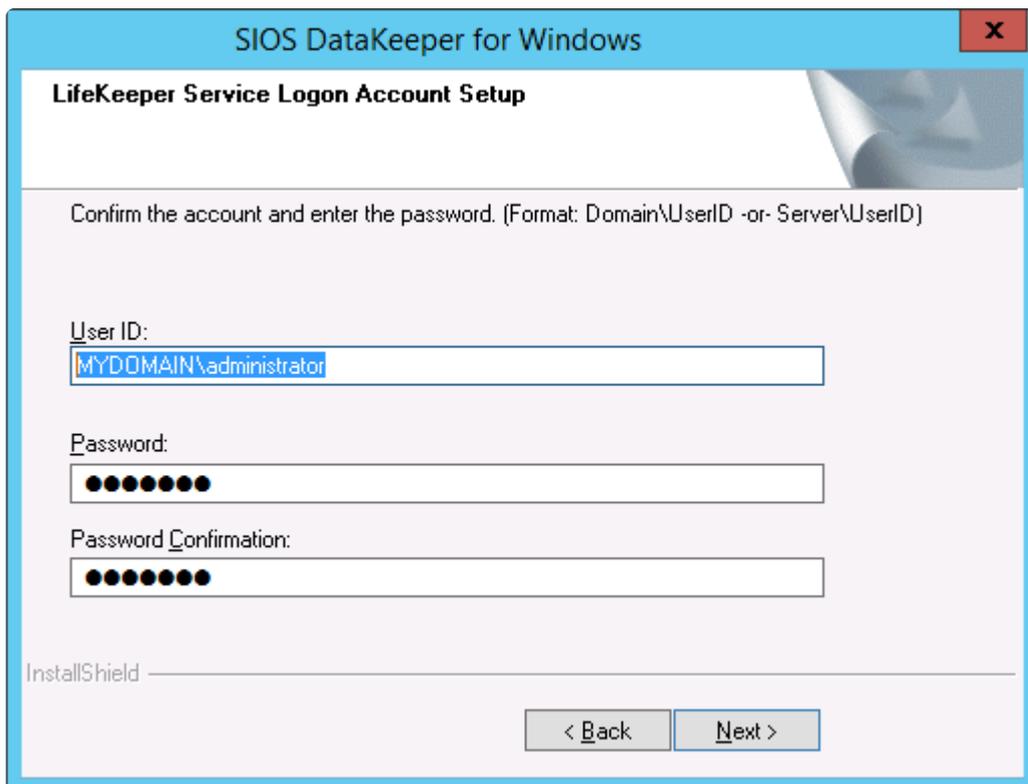
If a Domain or Server account is selected above, the DataKeeper Service Log On ID and Password Entry Form is displayed to enter that information.



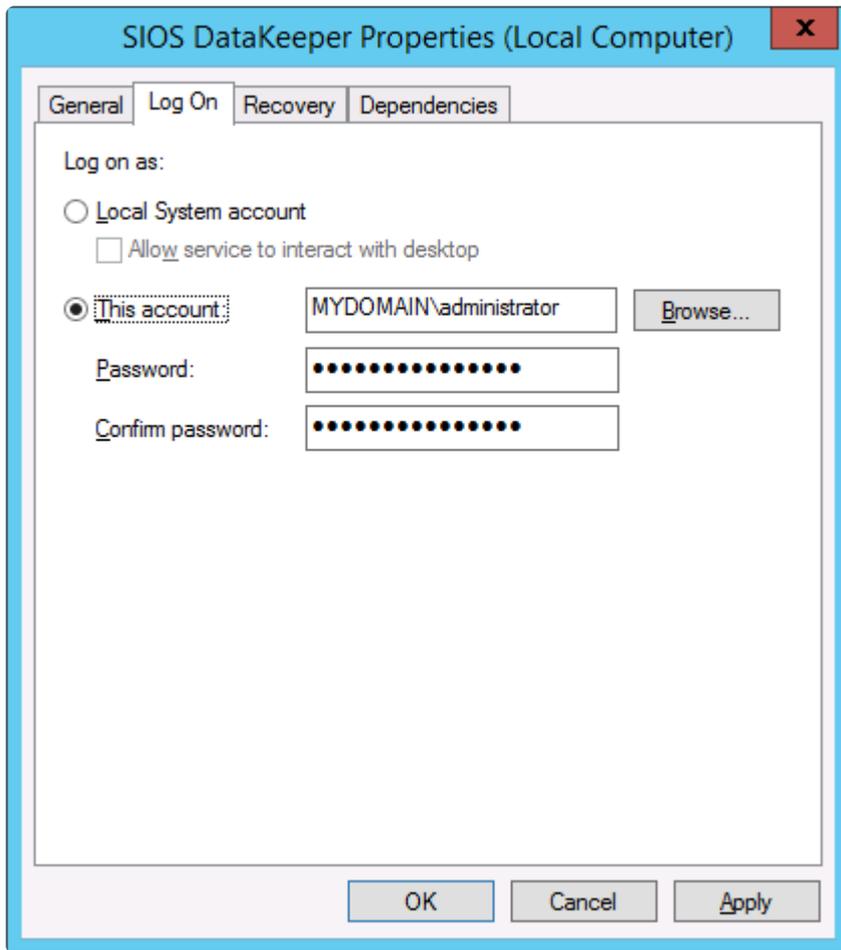
It is recommended that the LifeKeeper and DataKeeper service accounts are synchronized on each system to ensure more reliable switchovers and failovers.



LifeKeeper Service Logon:



If the DataKeeper Service has previously been configured with a Service Log On ID and Password, the setup program will omit the Service ID and Password selection dialogs. However, at any time, an administrator can modify the DataKeeper Service Log On ID and Password using the Windows Service Applet. Be sure to restart the DataKeeper Service after changing the Log On ID and/or Password.



The following table outlines these requirements:

Environment	DataKeeper Service Requirements	DataKeeper UI Requirements
Same Domain or Trusted Domain Environment	<ul style="list-style-type: none"> Run the DK Service on all systems as the same account with the same credentials Okay to use the default = Local System Account 	<ul style="list-style-type: none"> Log in as a domain admin and run the DK GUI Or use “run as” Administrator option to run DK GUI
Mixed Environment Servers in a Mixture of Domain and WorkGroup or Servers in Separate Domains	<ul style="list-style-type: none"> Create a local account on each system with same account name and password Add this local account to the Administrator Group Run the DK Service on all systems with the local account 	<ul style="list-style-type: none"> Log in using the local account you created to run the DK Service Run the DK GUI <p>You should also log on to all servers using this same Log On ID and Password (see related Known Issue).</p>

DataKeeper Cluster Edition Environment	<ul style="list-style-type: none">• Create or use a domain account for use by the DataKeeper Service (preferred) <p style="text-align: center;">or</p> <ul style="list-style-type: none">• Create a local account on each system with same account name and password• Add this local account to the Administrator Group• Run the DK Service on all systems with this local administrator account	<ul style="list-style-type: none">• Log in using the local administrator account you created to run the DK Service• Run the DK GUI
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8.5.5. Firewall Configurations

SIOS DataKeeper cannot function properly if the firewall settings for the source and target machines are not configured correctly. This means you will need to configure a rule for inbound and outbound connections on each server running SIOS DataKeeper as well as any network firewalls that replication traffic must traverse.

During installation of SIOS DataKeeper, you will be prompted to allow the installer to configure your firewall rules needed by DataKeeper on Windows 2008 and Windows 2012. If you choose to allow the installer to make these changes, you will not need to configure your firewall manually. If you choose not to allow the installer to make these changes, you will need to configure your system manually as described in this section.

The ports that are required to be open for replication are as follows: 137, 138, 139, 445, 9999, plus ports in the 10000 to 10025 range, depending upon which volume letters you plan on replicating. The chart below shows the additional ports which must be open depending upon which drive letters you plan on replicating.

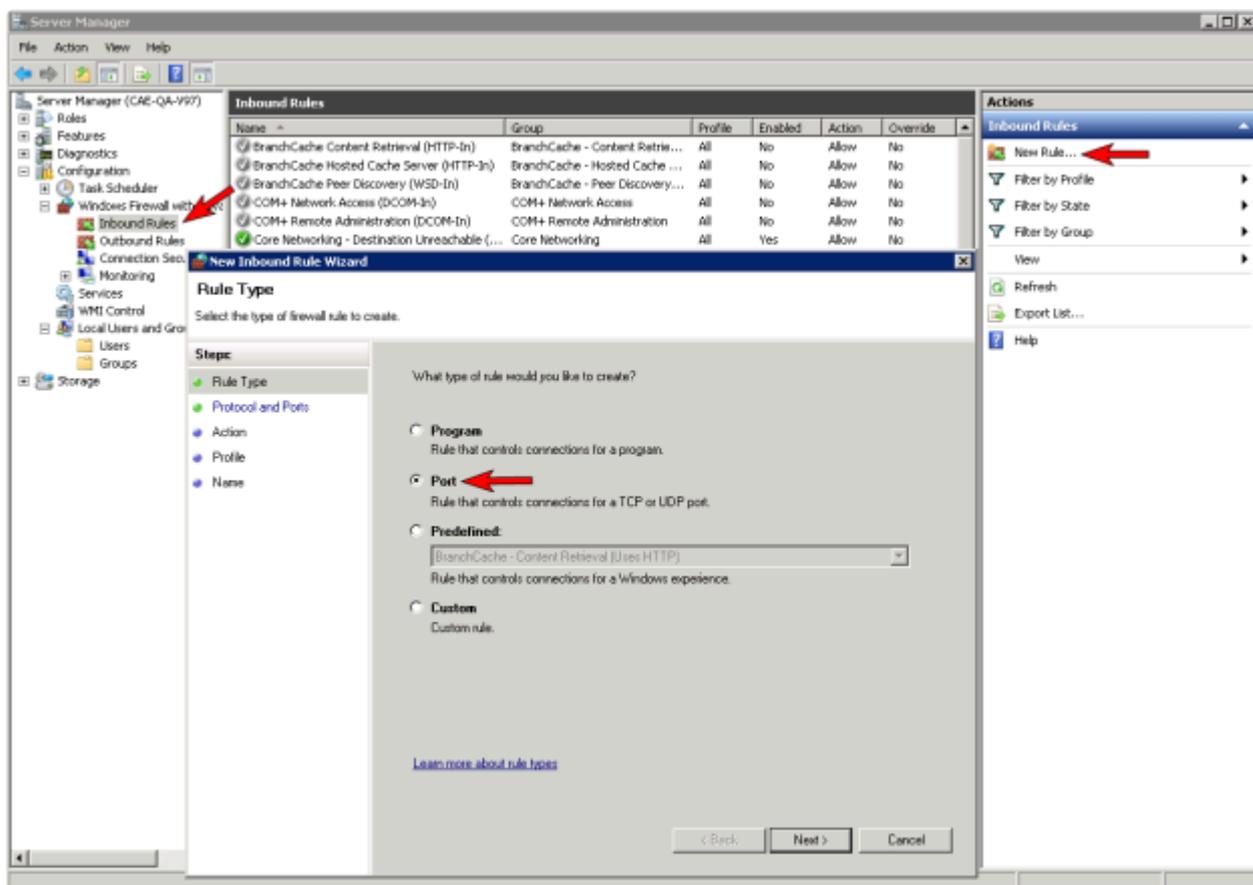
! **For AWS:** Ensure a Security Group has been created to reflect port 137, 138, 139, 445, 9999 and the drive letter(s) required for replication or "Allow All Traffic" to ensure DataKeeper is functioning properly.

Port #	Volume Letter	Port #	Volume Letter
10000	A	10013	N
10001	B	10014	O
10002	C	10015	P
10003	D	10016	Q
10004	E	10017	R
10005	F	10018	S
10006	G	10019	T
10007	H	10020	U
10008	I	10021	V
10009	J	10022	W
10010	K	10023	X
10011	L	10024	Y
10012	M	10025	Z

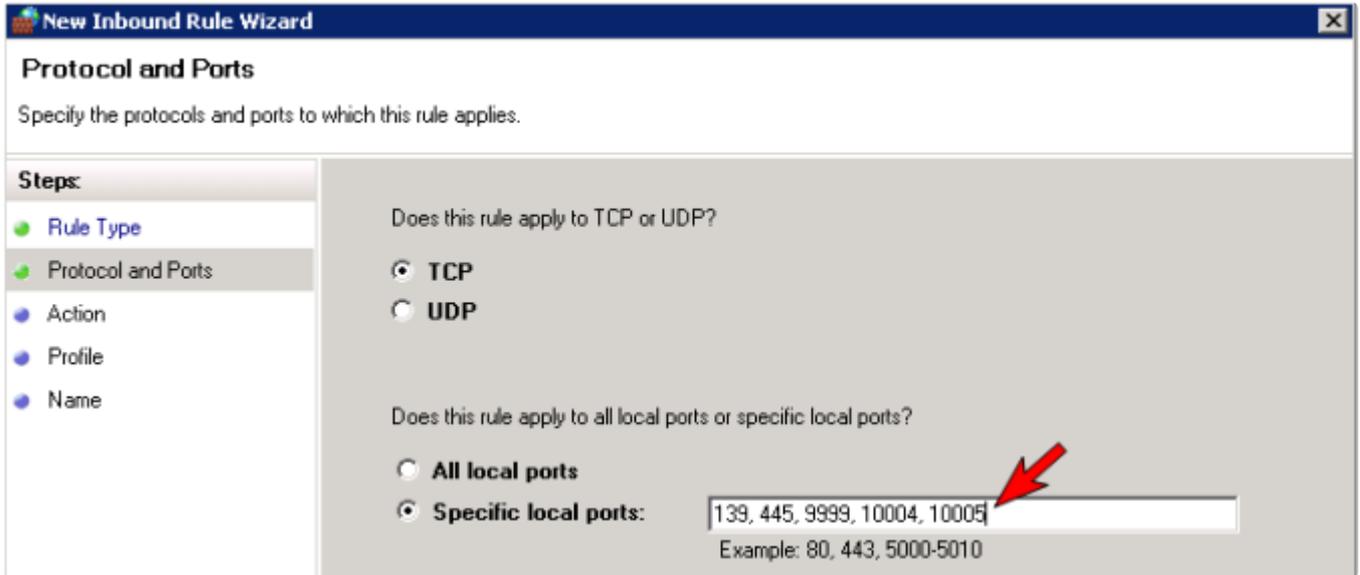
Configuring Microsoft’s Windows Firewall with Advanced Security – Example

The exact steps required to configure the firewall for each cluster is as varied as each possible cluster configuration, but the following procedure and screen shots will give you one example to follow when using SIOS DataKeeper to replicate the E: and F: volumes. Note the Port # and Volume Letter table listings in the previous section.

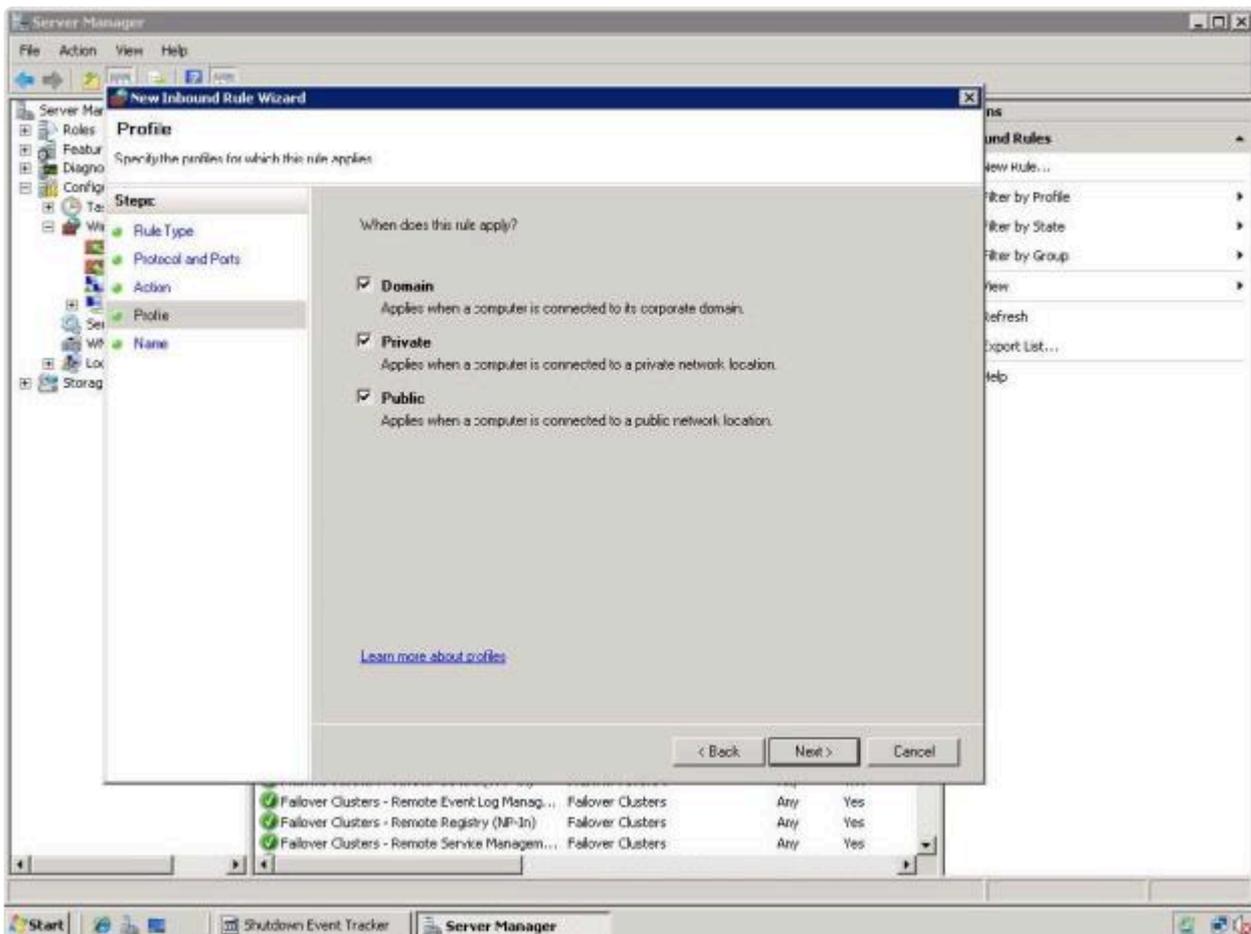
1. Open Microsoft’s **Defender Firewall with advanced security** and select **Inbound Rules** to create a rule for the TCP protocol as well as the UDP protocol.
2. Select **New Rule** from the **Actions** panel in the right column of the window. Select **Port** as the type of rule to be created. Select **Next**.



3. Select **TCP** for the type of protocol impacted by this rule. Select the **Specific local ports** button and enter the following ports: **139, 445, 9999, 10004** (for the E drive) and **10005** (for the F drive). Select **Next**.



- For the action, select **Allow the Connection**. Select **Next**.
- For the profile, select **Domain**, **Private** and **Public** for the conditions when this rule applies. Select **Next**.



- Enter a **Name** and **Description** for the new **Inbound Rule** and select **Finish**.

New Inbound Rule Wizard

Name
Specify the name and description of this rule.

Steps:

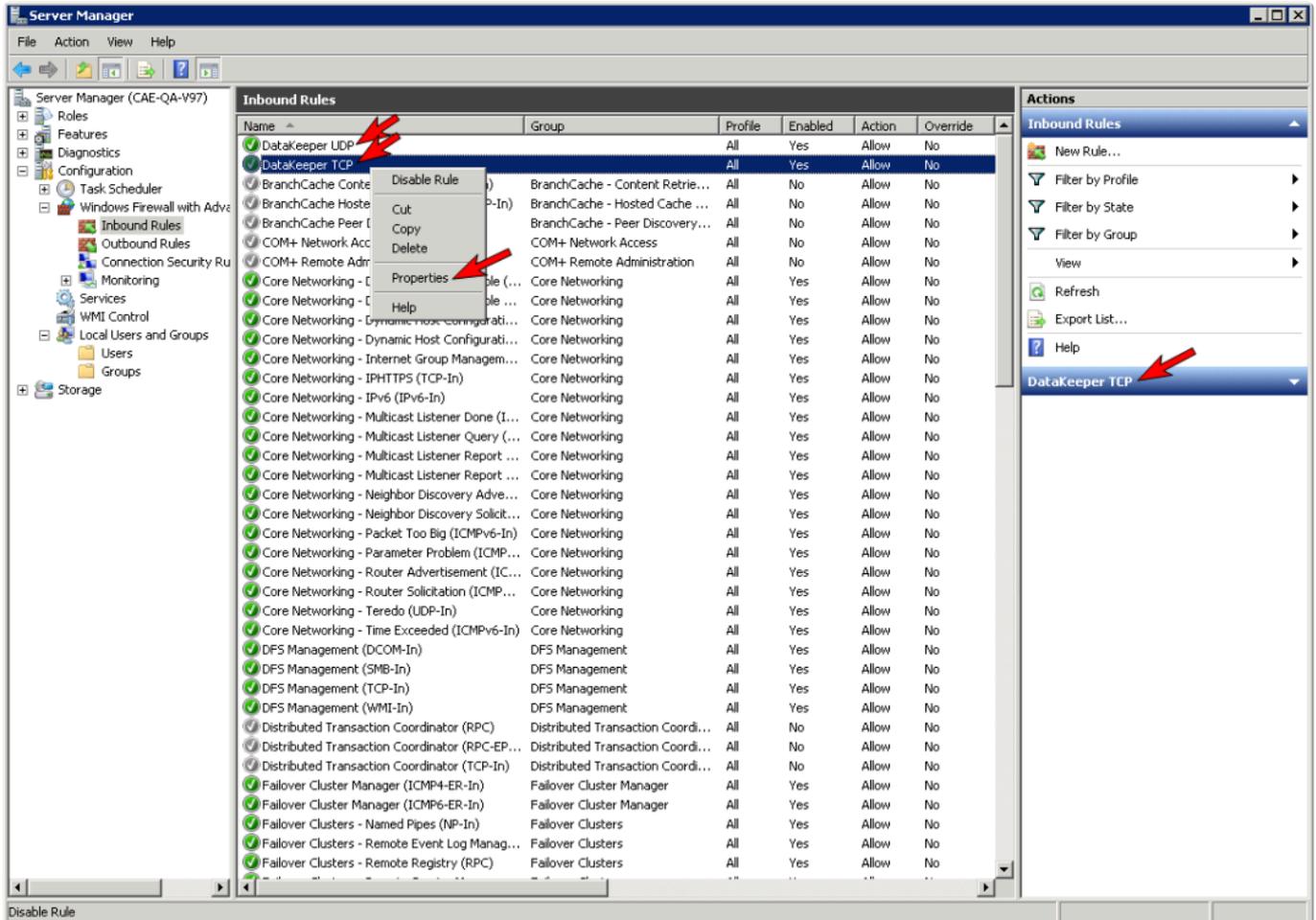
- Rule Type
- Protocol and Ports
- Action
- Profile
- **Name**

Name:
DataKeeperTCP

Description (optional):
DataKeeper TCP Inbound Rule

< Back Finish Cancel

7. Select **New Rule** again to create the rule for **UDP protocol**. Select **Port** as the type of rule to be created. Select **Next**.
8. Select **UDP** for the type of protocol impacted by this rule. Select the **Specific local ports** button and enter the following ports in the Specific local ports field: **137, 138**. Select **Next**.
9. For the action, select **Allow the Connection**. Select **Next**.
10. For the profile, select **Domain, Private** and **Public** for the conditions when this rule applies. Select **Next**.
11. Enter a **Name** and **Description** for the new **Inbound Rule** and select **Finish**.
12. Your new DataKeeper rules will appear in the **Inbound Rules list** and the **Action** panel column. You can select the DataKeeper rule in the center panel and click the right mouse button to view the rule **Properties**.



8.5.6. High-Speed Storage Best Practices

Configure Bitmaps

If the DataKeeper default bitmap location (`%ExtMirrBase%\Bitmaps`) is not located on high-speed storage, you should move the bitmaps to a high-speed storage device in order to eliminate I/O bottlenecks with bitmap access. To do this, allocate a small disk partition, located on the high-speed storage drive, on which to place the bitmap files. Create the folder in which the bitmaps will be placed, and then [Relocate the bitmaps](#) (intent logs) to this location.

Disk Partition Size

The disk partition size must be big enough to contain all bitmap files for every mirror that will exist on your system. Each bit in the DataKeeper bitmap represents 64 KB of space on the volume, so to determine the bitmap size for a bitmap file, use the following formula:

$$\langle \text{volume size in bytes} \rangle / 65536 / 8$$

Example:

For a 765 GB volume, convert the 765 GB to bytes

$$765 * 1,073,741,824 = 821,412,495,360 \text{ bytes}$$

Divide the result by 64K (65,536 bytes) to get the number of blocks/bits

$$821,412,495,360 / 65,536 = 12,533,760 \text{ blocks/bits}$$

Divide the resulting number of blocks/bits by 8 to get the bitmap file size in bytes

$$12,533,760 / 8 = 1,566,720$$

So a mirror of a 765 GB volume would require 1,566,720 bytes for its bitmap file, or approximately 1.5 MB.

A simple rule of thumb to use is that each GB of disk space requires 2 KB of bitmap file space.

Remember to reserve room for all mirror targets (if you have multiple target systems, each one needs a bitmap file). Also remember to reserve room for all mirrored volumes.

Handling Unmanaged Shutdown Issues

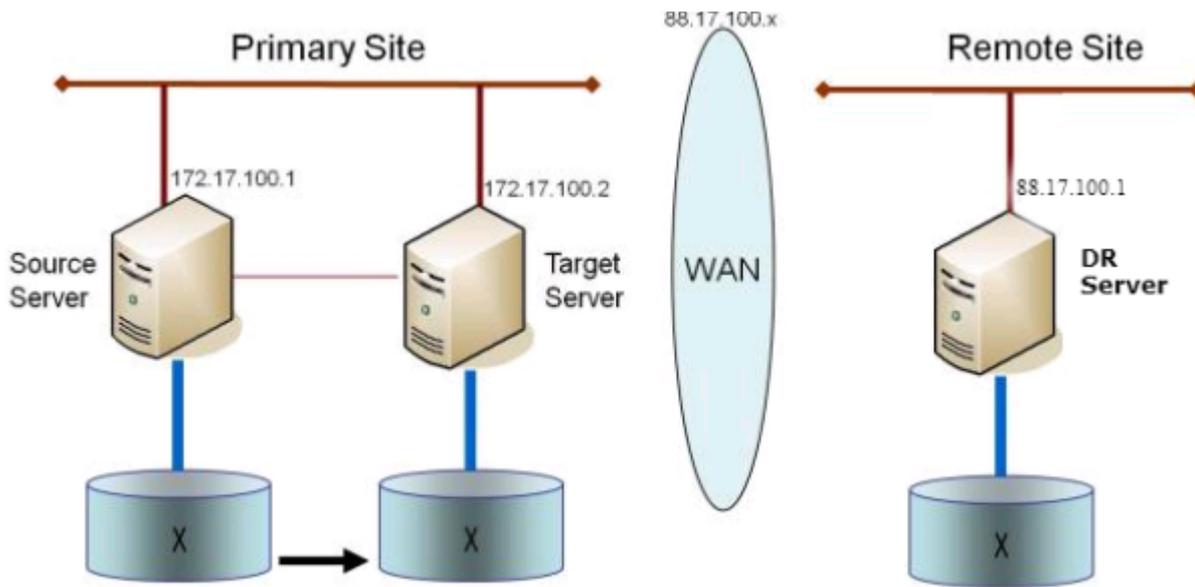
Unmanaged shutdowns due to power loss or other circumstances force a consistency check during the reboot. This may take several minutes or more to complete and can cause the drive not to reattach and can cause a dangling mirror. Use the ioAdministrator console to re-attach the drives or reboot the

system again and make sure the check runs. For further information, refer to the ioXtreme User Guide for Windows.

Other Recommendations/Suggestions

- Check the Network Interface configuration settings. Increasing the Receive and Transmit buffers on the interfaces often improves replication performance. Other settings that may also affect your performance include: Flow Control, Jumbo Frames and TCP Offload. In certain cases, disabling Flow Control and TCP Offload can result in better replication performance. Enabling larger ethernet frames can also improve throughput.
- Check the location of the NICs on the bus (the slot that they're physically plugged into) as this can also affect the speed.
- Use iometer, an I/O subsystem measurement and characterization tool available free on the internet, to test network throughput. Iometer can be set up in a client/server configuration and can test network throughput directly. Another alternative is to set up a file share using the replication IP address, and then copy large amounts of data over that share while monitoring the network throughput using Perfmon (Network Interface / Bytes Sent Per Second) or the Task Manager "Networking" tab.
- Make sure you have the latest drivers and firmware for the network adapters.

8.5.7. Configuration of Data Replication From a Cluster Node to External DR Site



8.5.8. Performance Tuning

Please refer to the following topics for ways to improve SIOS DataKeeper performance.

[SIOS DataKeeper Intent Log](#) – SIOS DataKeeper uses an intent log (also referred to as a bitmap file) to track changes made to the source, or to the target volume when the target is unlocked. This log is a persistent record of write requests which have not yet been committed to both servers. The intent log gives SIOS DataKeeper the ability to survive a source or target system failure or reboot without requiring a full mirror resync after the recovery of the system. There is a performance overhead associated with the intent log, since each write to the volume must also be reflected in the intent log file. To minimize this impact, it is recommended that the intent logs be stored on a physical disk that is not involved in heavy read or write activity. See [Relocation of Intent Log](#) for more information.

[High-Speed Storage Best Practices](#) – If the DataKeeper default bitmap location (%ExtMirrBase%\Bitmaps) is not located on high-speed storage, you should move the bitmaps to a high-speed storage device in order to eliminate I/O bottlenecks with bitmap access. To do this, allocate a small disk partition, located on a high-speed storage drive, on which to place the bitmap files. Create the folder in which the bitmaps will be placed, and then [Relocate the bitmaps](#) (intent logs) to this location.

 **Note:** Ephemeral storage is recommended when the system is in Azure or AWS.

8.5.9. Disable “Automatically manage paging file size for all drives”

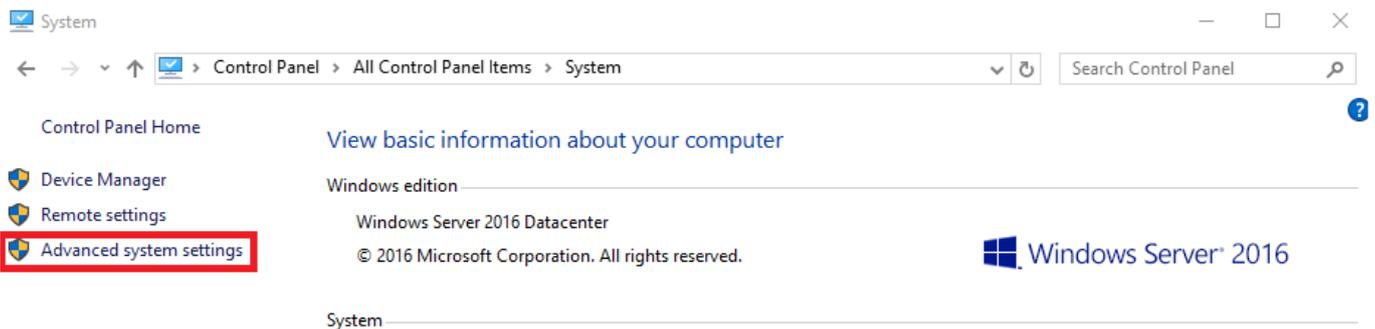
By default, Windows configures virtual memory so that page files are automatically created on volumes as the Operating System determines is best. This Virtual Memory setting is called “Automatically manage paging file size for all drives”.

When this setting is enabled, page files sometimes are created by the Operating System on volumes that are part of DataKeeper mirrors. When this occurs, DataKeeper is not able to perform operations on the volume that are necessary for full protection. This setting needs to be disabled on all systems that have DataKeeper mirrors.

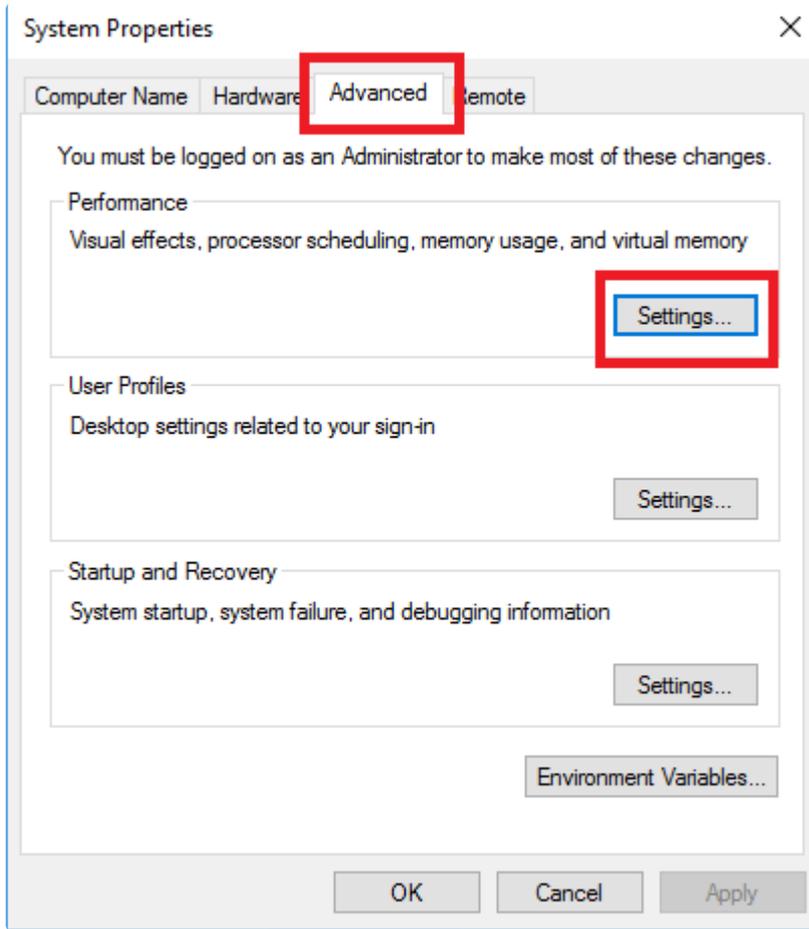
How to disable “Automatically manage paging file size for all drives”

This setting can be found in Control Panel “System” dialog.

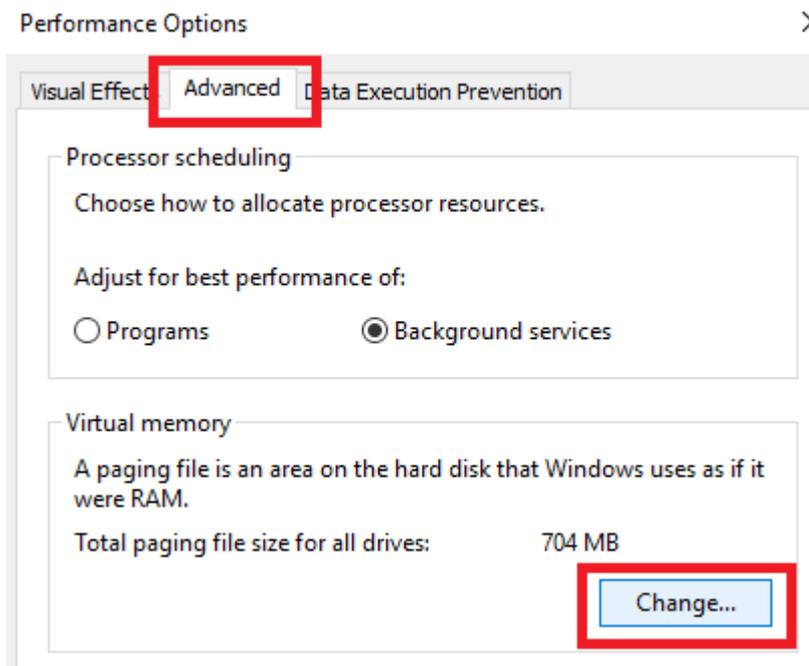
First, click the **Advanced system settings** option:



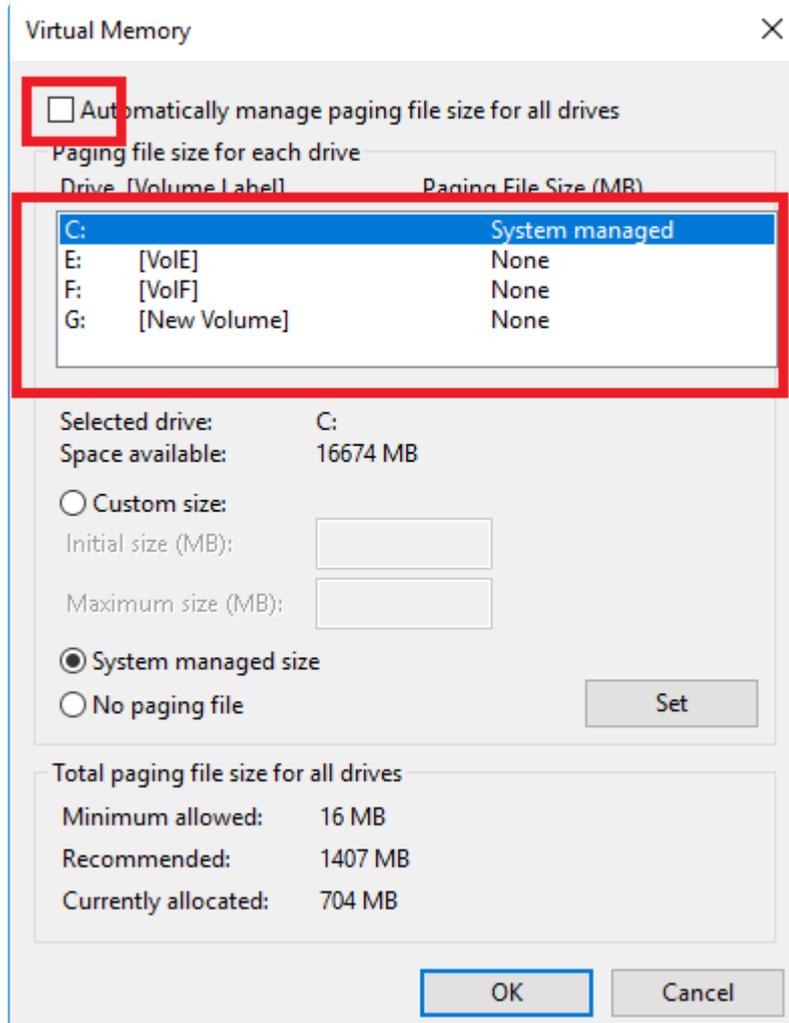
From the **System Properties** dialog, choose the **Advanced** tab and click the **Settings** button in the **Performance** section.



Choose the **Advanced** tab in the Performance Options dialog, and click the **Change...** button in the Virtual Memory section.



In the Virtual Memory dialog, **uncheck** the “Automatically manage paging file size for all drives”. Then configure pagefiles so that any DataKeeper-protected volumes have no page file configured.



 **Note:** Adjusting Windows Virtual Memory configuration can affect system performance. Be sure to consult Microsoft documentation on recommendations regarding these modifications.

8.5.10. WAN Considerations

Replicating data across the network to a remote server located miles away from the source server is the most common use of DataKeeper. Typically, this configuration relies on a WAN of some sort to provide the underlying network that DataKeeper uses to replicate the data. If the bandwidth of the WAN is limited, there are a number of additional factors to consider including:

[Initial Synchronization of Data Across the LAN/WAN](#)

[Compression](#)

[Bandwidth Throttle](#)

8.5.10.1. Initial Synchronization of Data Across the LAN or WAN

When replicating large amounts of data over a WAN link, it is desirable to avoid full resynchronizations which can consume large amounts of [network bandwidth](#) and time. DataKeeper avoids almost all full resyncs by using its bitmap technology. However, the initial synchronization of the data, which occurs when the mirror is first created, cannot be avoided.

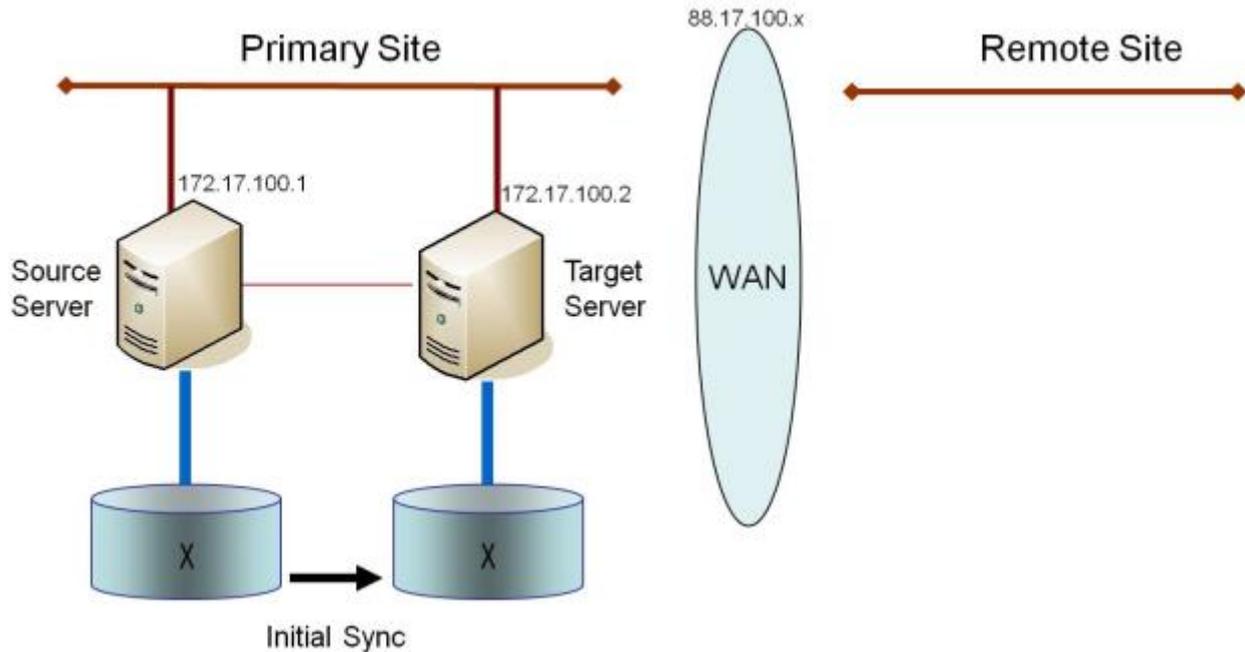
In WAN configurations, one way to avoid the initial full synchronization of data across the WAN is to configure both systems on a LAN, create the mirror and allow the initial full synchronization to occur across the LAN. Once the initial synchronization is complete, update the IP addresses for the source and target, which will place the mirror in the **Paused** state. Move the target system to its new location. Once the target system is in place, power it on and verify all network settings, including the IP address that was updated. On the source system, run the **CHANGEMIRRORENDPOINTS** command. The mirror will be **CONTINUED** and only a [partial resync](#) (the changes that have occurred on the source volume since the mirror was **PAUSED**) of the data is necessary to bring the TARGET volume in sync with the SOURCE.

 **Note:** This command supports changing the endpoints of a mirrored volume that is configured on 3 nodes or fewer. For configurations greater than three nodes, create mirrors with the final endpoint at the local site and use route adds to get the mirrors created and resynced before moving the server to the final location/address/DR site.

Example:

In the example below, a mirror is created locally in the primary site, and then the target will be moved to remote site. The source server is assigned the IP address 172.17.100.1, and the target server is assigned the IP address 172.17.100.2. The WAN network IP is 88.17.100.x,

- Using the DataKeeper UI, create a mirror on Volume X from 172.17.100.1 to 172.17.100.2. **Note:** Connecting to the target by name is recommended so DNS name resolution later will automatically resolve to the new IP address.



Once the initial sync of the data is complete,

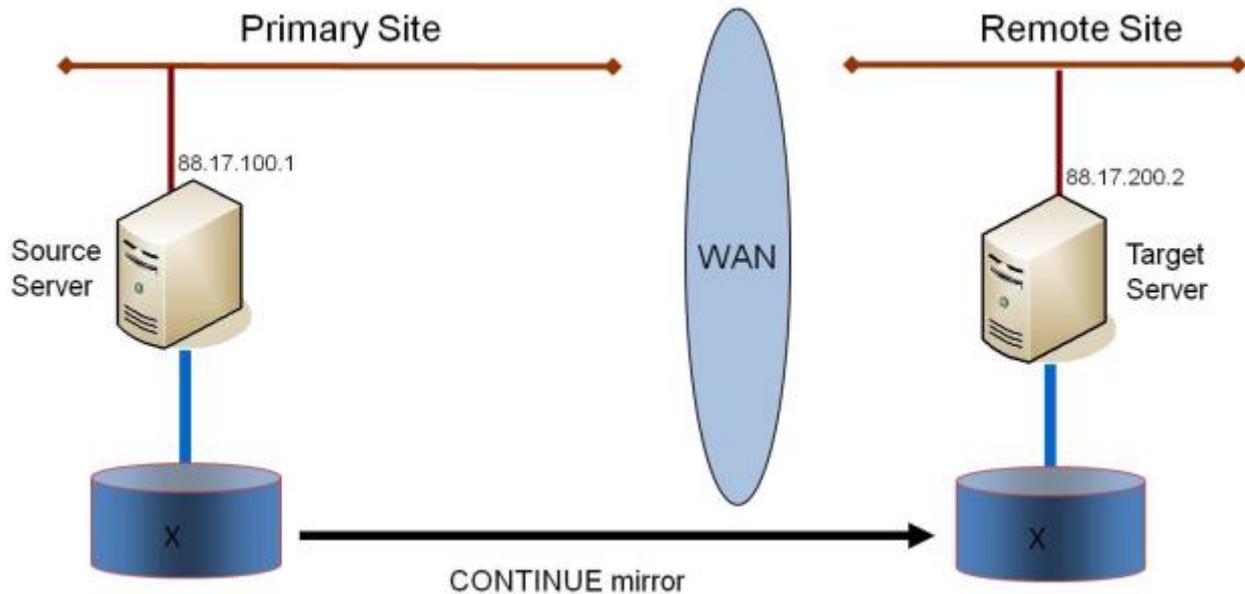
- Update the IP address for the network adapter for the source to 88.17.100.1 and update the IP address for the network adapter on the target to 88.17.200.2. This will place the mirror on the source side into the PAUSED state.
- Ship the target machine to its new location.
- Power on the target machine and verify all network settings, including the IP address updated above.
- On the source system, open a DOS command window and change directory to the DataKeeper directory by executing the following command:

```
cd EXTMIRRBASE
```

- Run the following command to update the existing mirror endpoints to the new IP addresses:

```
EMCMD 172.17.100.1 CHANGEMIRRORENDPOINTS X 172.17.100.2 88.17.100.1  
88.17.200.2
```

- DataKeeper will resync the changes that have occurred on the source server while the target server was unreachable.
- When this partial resync is complete, the mirror will change to the **MIRRORING** state.



Verifying Data on the Target Volume

By design, DataKeeper locks the target volume. This prevents the file system from writing to the target volume while the replication is occurring. However, DataKeeper does provide a mechanism to unlock the target volume and allow read/write access to it while the mirror is still in place. There are two methods to do this:

1. Pause the mirror and unlock the target volume via the [Pause and Unlock](#) mirror option in the DataKeeper UI.
2. Use the DataKeeper command line interface (EMCMD) to pause the mirror ([PAUSEMIRROR](#)) and unlock the target volume ([UNLOCKVOLUME](#)).

Once unlocked, the target volume is completely accessible. When finished inspecting the target volume, be sure to continue the mirror to re-lock the target volume and allow DataKeeper to resync any changes that occurred on the source volume while the mirror was paused. Any writes made to the target volume while it was unlocked will be lost when the mirror is continued.

! If a reboot is performed on the target system while the target volume is unlocked, a full resync will occur when the target system comes back up.

8.5.10.2. Compression

DataKeeper allows the user to choose the compression level associated with each mirror. Enabling compression can result in improved replication performance, especially across slower networks. A compression level setting of 3-5 represents a good balance between CPU usage and network efficiency based on the system, network and workload.

 **Note:** The compression level of a mirror can be changed after the mirror is created. See [Changing the Compression Level of an Existing Mirror](#).

8.5.10.3. Bandwidth Throttle

In bandwidth constrained networks, DataKeeper attempts to utilize all of the available network bandwidth. If DataKeeper is sharing the available bandwidth with other applications, you may wish to limit the amount of bandwidth DataKeeper is allowed to use. DataKeeper includes a feature called **Bandwidth Throttle** that will do this. The feature is set and edited via the DataKeeper GUI.

 **Note:** For additional information on both **Compression** and **Bandwidth Throttle**, see the topics below.

- [Registry Entries](#)
- [Changing the Compression Level of an Existing Mirror](#)

8.6. Administration

The topics in this section provide detailed instructions for performing DataKeeper administration tasks.

[DataKeeper Event Log Notification](#)

[Primary Server Shutdown](#)

[Secondary Server Failures](#)

[Extensive Write Considerations](#)

[CHKDSK Considerations](#)

[DKHEALTHCHECK](#)

[DKSUPPORT](#)

[Event Log Considerations](#)

[Using Disk Management](#)

[Registry Entries](#)

[Using EMCMD with SIOS DataKeeper](#)

[Using DKPwrShell with SIOS DataKeeper](#)

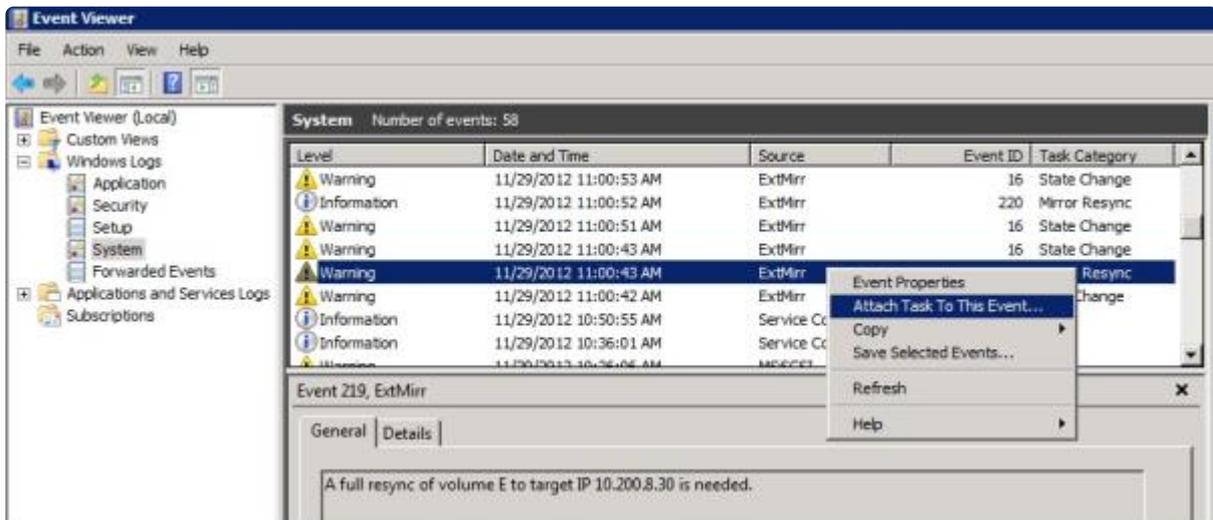
8.6.1. DataKeeper Event Log Notification

The **Event Log notification** is a mechanism by which one or more users may receive email notices when certain events occur. The **Windows Event Log** can be set up to provide notifications of certain DataKeeper events that get logged.

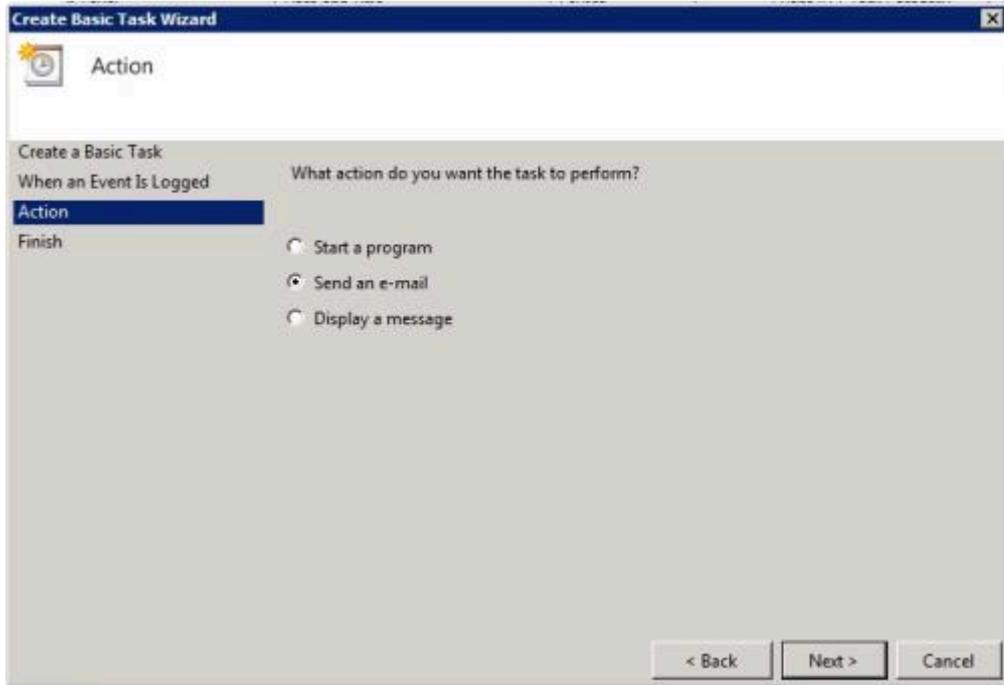
✿ **Note:** This option is only available for Windows Server 2008 R2.

To set up the **Windows Event Log email task** for DataKeeper events, perform the following steps:

1. Open Event Viewer, go to the System or Application log and highlight the event in which you want to be notified.
2. Right-click the event and select Attach Task To This Event...



3. Follow the **Task Wizard** directions, choosing the **Send an e-mail** option when prompted and filling in the appropriate information.



4. When you click **Finish** at the end of the **Task Wizard**, the new task will be created and added to your Windows schedule.

 **Note:** These email tasks will need to be set up on each node that will generate email notification.

8.6.2. Primary Server Shutdown

On a graceful shutdown of the source server, all pending writes to the target are completed. This ensures that all data is present on the target system.

On an unexpected source server failure, the [Intent Log](#) feature eliminates the need to do a full resync after the recovery of the source server. If the Intent Log feature is disabled or if SIOS DataKeeper detected a problem accessing the volume's Intent Log file, then a full resync will occur after the source server is restored to service.

8.6.3. Secondary Server Failures

In the event there is a failure affecting the secondary (target) system, the affected mirror is marked **Paused**. It is necessary to correct the condition that caused the secondary to fail and then resync the volumes. There are no write attempts made to the target after the secondary server fails.

When the secondary server comes back online after a failure, the source side of the mirror will automatically reconnect to the target side of the mirror. A partial resync follows.

8.6.4. Extensive Write Considerations

SIOS DataKeeper allows a volume that is being resynced to be accessed and written to. During Resync, DataKeeper makes multiple passes through the bitmap, synchronizing the data corresponding to each dirty bit found. While this is happening, writes that occur on the volume can dirty blocks that have already been synchronized. Under certain conditions, a resync can fail to complete due to constant write activity on the source volume.

In order to allow a resync to complete while writes are occurring on the source volume, DataKeeper may temporarily delay incoming writes in order to allow the last dirty blocks to be synchronized. The [ResyncLowWater](#) registry value specifies the maximum number of dirty blocks that can be present in the bitmap in order for DataKeeper to delay writes. The [ResyncBlockWritesTimeoutMs](#) registry value specifies the maximum amount of time that writes will be delayed (in milliseconds).

Note that DataKeeper will not delay writes until resync has attempted several resync passes – specifically, 10% of the value specified in the [MaxResyncPasses](#) registry value. For example, if MaxResyncPasses is set to the default of 200, DataKeeper will not delay writes until the 21st pass through the bitmap, and will only delay writes if the number of dirty blocks is less than or equal to ResyncLowWater.

If writes are delayed but resync does not complete within the amount of time specified by ResyncBlockWritesTimeoutMs, the resync fails, writes are permitted to complete, and the mirror goes into the Paused state.

To disable write delay completely, set ResyncLowWater to 0.

8.6.5. CHKDSK Considerations

If you must run CHKDSK on a volume that is being mirrored by SIOS DataKeeper, it is recommended that you first **pause** the mirror. After running CHKDSK, **continue** the mirror. A partial resync occurs (updating those writes generated by the CHKDSK) and mirroring will continue.

Failure to first **pause** the mirror may result in the mirror automatically entering the **Paused** state and performing a **Resync** while CHKDSK is in operation. While this will not cause any obvious problems, it will slow the CHKDSK down and result in unnecessary state changes in SIOS DataKeeper.

SIOS DataKeeper automatically ensures that volumes participating in a mirror, as either source or target, are not automatically checked at system startup. This ensures that the data on the mirrored volumes remains consistent.

Note: The bitmap file (for non-shared volumes) is located on the C drive which is defined by [BitmapBaseDir](#) as the default location. Running CHKDSK on the C drive of the Source system will cause an error due to the active bitmap file. Therefore, a switchover must be performed so that this Source becomes Target and the bitmap file becomes inactive. The CHKDSK can then be executed on this system as the new target (original source).

8.6.6. CLEANUPMIRROR

```
C:\Program Files (x86)\SIOS\DataKeeper\Support>cleanupmirror
<volume_letter>
```

This command can only be run locally on a node and will remove all remnants of the mirror.

When to use:

- For mirrors that were not removed from WSFC or the DataKeeper GUI
- To remove mirror remnants without impacting WSFC as the mirror will be recreated i.e. emcmd . createmirror command

The parameters are:

<root>\Program Files (x86)\SIOS\DataKeeper\Support>	The location of the \DataKeeper\Support Directory
<volume_letter>	Mirror volume letter. Valid values: A – Z

- Launch an Administrator command prompt
- Type “cd extmirrbase”
- You will now be placed in the DataKeeper directory or c:\Program Files (x86) \SIOS\DataKeeper
- From the aforementioned directory type “cd support”
- From within the support directory, execute the following command “cleanupmirror <volume_letter>”
- Run this command on all systems that are participating in DataKeeper mirroring

8.6.7. DKHEALTHCHECK

DKHealthCheck.exe, found in the \DKTools directory, is a tool that can provide basic mirror status and problem detection of mirror issues. SIOS Support may request that you run this tool as part of the Support process.

Note: DKHEALTHCHECK output is captured by DKSupport automatically and does not need to be run separately if you are already running DKSupport.

You can run this tool by right clicking the [DataKeeper Notification Icon](#) and then clicking on 'Launch Health Check' or by following the below procedure.

Open a command prompt

- Type `cd extmirrbase`
- You will now be placed in the DataKeeper directory or `c:\Program Files (x86) \SIOS\DataKeeper`
- From the aforementioned directory type `cd DKTools`
- From within the DKTools directory, execute the following command `DKHealthCheck.exe`

The results of the tool can be copied and pasted from the command prompt and emailed to support@us.sios.com.

Alternatively, you may direct the output to a file, by running this command inside of the DKTools directory.

- `DKHealthCheck.exe > HealthCheck.txt`

This file can then be attached and sent as part of an email.

Note: This command may take some time to execute.

8.6.8. DKSUPPORT

DKSUPPORT .cmd, found in the <DataKeeper Installation Path>\SUPPORT directory, is used to collect important configuration information and event log files and put them in a zip file. SIOS Support Engineers will commonly request this zip file as part of the support process. To run this utility, double-click the file DKSUPPORT from the explorer window or right click the [DataKeeper Notification Icon](#) and then click on 'Gather Support Logs'.

This utility may also be executed from the command prompt using the following procedure.

- Launch an Administrator command prompt
- Type "cd extmirrbase"
- You will now be placed in the DataKeeper directory or c:\Program Files (x86) \SIOS\DataKeeper
- From the aforementioned directory type "cd support"
- From within the support directory, execute the following command "dksupport.cmd"
- Run this command on all systems that are participating in DataKeeper mirroring

The zip file will be created in the same Support directory, and can either be emailed to support@us.sios.com or File transferred (FTP) to support engineering

Note: This command may take some time to execute.

8.6.9. Event Log Considerations

It is important that SIOS DataKeeper be able to write to the Event Log. You should ensure that the Event Log does not become full. One way to accomplish this is to set the Event Log to overwrite events as needed:

1. Open the **Event Log**.
2. Right-click on **System Log** and select **Properties**.
3. Under **Log Size**, select **Overwrite Events as Needed**.

8.6.10. Using Disk Management

When using the Windows Disk Management utility to access SIOS DataKeeper volumes, please note the following:

- Using Disk Management to delete partitions that are being mirrored is not supported. Deleting a partition that is part of a SIOS DataKeeper mirror will yield unexpected results.
- Using Disk Management to change the drive letter assigned to a partition that is a part of a SIOS DataKeeper mirror is not supported and will yield unexpected results.
- The Windows Disk Management utility will take longer to start on the target node based on the number of drives. Because the Windows operating system has error condition retries built in when a volume is locked, the speed with which it starts on the “locked” target node is affected.

8.6.11. Registry Entries

The following registry entries are associated with the SIOS DataKeeper service or driver and can be viewed and edited using Regedt32.

 No values in any DataKeeper registry key should be modified unless listed they are listed here.

Registry Entries that MAY be Modified

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters

The SIOS DataKeeper driver uses the Parameters key and those below it. The values within the Parameters key (denoted with *) are global for all volumes on the system. The values under each of the Target IP registry keys (denoted with †) are specific to a mirror only. Values denoted with both * and † appear under both keys. (The target-specific value overrides the global value in this case.)

BandwidthThrottle †

Location: <i>HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\BandwidthThrottle</i>		
Name	Type	Default Data
BandwidthThrottle	REG_DWORD	0
Specifies the maximum amount of network bandwidth (in kilobits per second) that a particular mirror is allowed to use. A value of 0 means unlimited.		

BitmapBaseDir *

Location: <i>HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\BitmapBaseDir</i>		
Name	Type	Default Data
BitmapBaseDir	REG_SZ	<i>C:\%EXTMIRRBASE%\Bitmaps</i> (usually <i>C:\Program Files\SIOS\DataKeeper\Bitmaps</i> but may be different when upgrading a system or if you install SIOS DataKeeper to a different path)
Specifies a directory where SIOS DataKeeper stores its Intent Log files. (Note: The drive letter must be in uppercase.) To disable the intent log feature, clear this registry entry (set it to an empty string) on all current and potential mirror endpoint servers. Disabling the intent log requires a reboot on each of these systems in order for this setting to take effect.		

BitmapBytesPerBlock * †

Locations:

For New Mirrors: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\BitmapBytesPerBlock*

For Existing Mirrors: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\BitmapBytesPerBlock*

Note:* If editing this entry under **Parameters**, all NEW mirrors created will inherit this value. If editing this entry under a **{Target IP}**, the value pertains to that one Target only. **{Target IP} values override Parameter values.**

Name	Type	Default Data
BitmapBytesPerBlock	REG_DWORD	65536 (0x10000)

Specifies the number of bytes that are represented as dirty in a [DataKeeper Intent](#) Log bitmap when a write request occurs. A single bit in the bitmap represents 65536 bytes, and the BitmapBytesPerBlock indicates the effective block size, which may be represented as multiple bits. Increasing this value can improve replication performance in some environments – in particular with workloads that perform sequential writes, on systems with relatively high-latency Bitmap storage. A larger block size means that fewer writes to the bitmap file will occur with sequential writes that are smaller than the adjusted block size. A larger block size will not noticeably help performance in environments where writes are primarily random, and may not help on systems with fast, low-latency bitmap storage. Also, a larger block size may result in larger amounts of data to resync in the event of a system failure.

Note: The minimum value of BitmapBytesPerBlock is 65536 – any value less than this is treated as 65536. There is no maximum value enforced.

Note: BitmapBytesPerBlock does not affect the rate of mirror resync.

BlockWritesOnLimitReached * †

Locations:

For New Mirrors: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\BlockWritesOnLimitReached*

For Existing Mirrors: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\BlockWritesOnLimitReached*

Note: If editing this entry under **Parameters**, all NEW mirrors created will inherit this value. If editing this entry under a **{Target IP}**, the value pertains to that target only. **Any {Target IP} values override the global Parameter values.**

Name	Type	Default Data
BlockWritesOnLimitReached	REG_DWORD	0

This value determines what the behavior of a mirror is when the mirror’s Write Queue reaches a defined limit (WriteQueueHighWater or WriteQueueByteLimit reached). If BlockWritesOnLimitReached is “0”, the mirror is paused and a partial resync starts a short time later. If BlockWritesOnLimitReached is “1”, the incoming write is delayed until there is space on the write queue for it. The mirror remains in the Mirroring state, but the application throughput slows down to match the speed of the network and the remote node’s volume. After updating this registry value, execute the [READREGISTRY](#) command so that DataKeeper immediately starts using the new value.

BlockWritesOnNDLGTimeoutReached *

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\BlockWritesOnNDLGTimeoutReached*

Name	Type	Default Data
BlockWritesOnNDLGTimeoutReached	REG_DWORD	1

This value determines how DataKeeper handles a timeout when setting a cluster TargetState value for a Synchronous mirror. To avoid potential data loss, DataKeeper will normally lock the volume and fail any outstanding writes when such a timeout is detected. This is the default behavior that occurs when this value is set to “1”.

To prevent the volume from being locked, and writes from being failed, set this value to “0”. The node must be rebooted for the changed setting to take effect.

Note: Setting this value to “0” introduces the possibility of application data loss and is not recommended.

Compression Level †

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\CompressionLevel*

Name	Type	Default Data
CompressionLevel	REG_DWORD	0

Specifies the compression level for the given mirror. Valid values are 0 to 9. Level 0 is “no compression”. Values from 1 to 9 specify increasingly CPU-intensive levels of compression. Compression level 1 is a “fast” compression – it does not require as much CPU time to compress the data, but results in larger (less compressed) network packets. Level 9 is the maximum amount of compression – it results in the smallest network packets but requires the most CPU time. The level can be set to somewhere in between, to balance CPU usage and network efficiency based on your system, network and workload.

DontFlushAsyncQueue *

Location: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\DontFlushAsyncQueue		
Name	Type	Default Data
DontFlushAsyncQueue	REG_SZ	empty <drive letter>> [<drive letter>]
<p>Allows the user to specify a volume or volumes that should not flush their async queues when the driver receives a flush request. This value should contain the drive letter(s) of the volume(s) to which this applies. Drive letters may be adjacent to each other (i.e. XY), or space separated (i.e. X Y), with no colons. After updating this registry value, execute the READREGISTRY command so that DataKeeper immediately starts using the new value. (Note: When setting DontFlushAsyncQueue, data and database logs should be on the same partition.)</p>		

MaxResyncPasses *

Location: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\MaxResyncPasses		
Name	Type	Default Data
MaxResyncPasses	REG_DWORD	200 (0xc8)
<p>Specifies the maximum number of resync passes before SIOS DataKeeper temporarily interrupts the resync process while there is constant write activity on the source volume. Resync will be automatically resumed after this interruption, typically after 60 seconds. In every pass, SIOS DataKeeper marks the volume blocks that were written to during the pass. In the next pass, it will send to the target only the marked blocks.</p> <p>Note: In order for any changes to take effect a system reboot is required.</p>		

NotificationIconUpdateStatus *

Location: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\NotificationIconUpdateStatus		
Name	Type	Default Data
NotificationIconUpdateStatus	REG_SZ	true
<p>Allows the user to turn off status update checks performed by all instances of the DataKeeper Notification Icon on a machine. This value should contain either true or false. Disabling the Notification Icon via its context menu will set this entry to false.</p>		

PingInterval *

Location: HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\PingInterval		
Name	Type	Default Data
PingInterval	REG_DWORD	3000 (0xBB8)

Specifies the interval in milliseconds between pings. Use a higher value for Wide Area Networks (WANs) or unreliable networks. Along with the **MaxPingMisses**, you may customize them to adjust mirroring to the network performance.

The [keep-alive](#) packet function is a feature the Source sends every 3 seconds by default for each mirror if there has not been any data transmitted. It keeps the pipe open and helps detect down systems / networks. DataKeeper does not change the mirror state due to a missed ping and doesn't have much of an effect on mirroring activities. It is only from Source to Target.

The default can be changed in the registry on the source system.

ResyncBlockWritesTimeoutMs *†

Locations:

For New Mirrors:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\ResyncBlockWritesTimeoutMs

AND

For Existing Mirrors:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\ResyncBlockWritesTimeoutMs

Note: If editing this entry under **Parameters**, all NEW mirrors created will inherit this value. If editing this entry under **{Target IP}**, the value pertains to that target only. **Any {Target IP} values override the global Parameter values.**

Name	Type	Default Data
ResyncBlockWritesTimeoutMs	REG_DWORD	15000 (0x3a98)

Specifies the maximum amount of time that DataKeeper will delay writes during resync. See the [Extensive Write Considerations](#) topic for more information.

ResyncLowWater *†

Locations:

For New Mirrors:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\ResyncLowWater

AND

For Existing Mirrors:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\ResyncLowWater

Note: If editing this entry under **Parameters**, all NEW mirrors created will inherit this value. If editing this entry under **{Target IP}**, the value pertains to that target only. **Any {Target IP} values override the global Parameter values.**

Name	Type	Default Data
ResyncLowWater	REG_DWORD	150 (0×96)

Specifies the maximum number of dirty blocks that can remain during resync before DataKeeper delays writes to allow the resync to complete. See the [Extensive Write Considerations](#) topic for more information.

ResyncReads *

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\ResyncReads*

Name	Type	Default Data
ResyncReads	REG_DWORD	20 (0×14)

This value represents the maximum number of disk blocks that can be in the process of being read and sent to the target system during mirror resynchronization. Changing this value may change the speed of mirror resynchronizations.

Note: This tunable applies to synchronous and asynchronous mirrors.

SetSvcNullSessionPipes *

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\SetSvcNullSessionPipes*

Name	Type	Default Data
SetSvcNullSessionPipes	REG_DWORD	1

DataKeeper uses a Named Pipe named “DkSvcPipe” to communicate between system and between client programs and the DataKeeper service. This pipe is, by default, created with permission to allow

Anonymous connections (i.e. it is added to the NullSessionPipes list). To remove DkSvcPipe from NullSessionPipes, change this value to "0", and edit the registry value HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\LanManServer\Parameters\NullSessionPipes – remove DkSvcPipe from the list of pipes that are found in that value.

SnapshotLocation †

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\SnapshotLocation*

Name	Type	Default Data
SnapshotLocation	REG_SZ	<drive letter>

Specifies the folder where the target snapshot file for this volume will be stored.

TargetDispatchPort *

Locations:

On Target System:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\TargetDispatchPort

On Source System Creating Mirror to Above Target:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Targets\{Target IP} (i.e. create a key whose name is the IP Address of the target system, or update the TargetDispatchPort value in that key if it already exists.)

Name	Type	Default Data
TargetDispatchPort	REG_DWORD	9999

There are two places where this should be set if you are changing the dispatch port from 9999. On the target system, place it in the *ExtMirr\Parameters* key. The new setting will apply to all existing and new targets on that server. **A target reboot is required when the target Parameters key has been changed for this setting to take effect.** On any source system that will be creating the mirror to this target, place it in the *ExtMirr\Parameters\Targets\{Target IP}* key if the mirror already exists. Create that key if it does not already exist. **Note:** Make sure the ports are the SAME on both the source and the target.

A firewall port must also be opened manually on all source and target servers for the new dispatch port to work.

TargetPortBase *

Location: <i>HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\TargetPortBase</i>		
Name	Type	Default Data
TargetPortBase	REG_DWORD	10000
<p>Specifies the base TCP port number for target volume connections. This number may need to be adjusted if the default port is used by another service or is blocked by a firewall. The actual port that the target listens on is calculated as follows:</p> <p>Port = TargetPortBase + (Volume Letter – A:)</p> <p>For example:</p> <p>TargetPortBase = 10000</p> <p>Volume Letter = H</p> <p>Port = 10000 + (H: -A:) = 10007</p>		

TargetPortIncr *

Location: <i>HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\TargetPortIncr</i>		
Name	Type	Default Data
TargetPortIncr	REG_DWORD	256
<p>Specifies the increment to the base TCP port number. This is used only when a TCP port is found to be in use. For example, if the target is attempting to listen on port 10005 and that port is in use, it will retry listening on port 10005 + TargetPortIncr.</p>		

TargetSnapshotBlocksize *

Location: <i>HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\TargetSnapshotBlocksize</i>		
Name	Type	Default Data
TargetSnapshotBlocksize	REG_DWORD	None
<p>DataKeeper target snapshot uses a default block size of 64KB for all entries that are written to the snapshot file. This block size can be modified by creating this TargetSnapshotBlocksize registry key.</p>		

The value should always be set to a multiple of the disk sector size, which is usually 512 bytes. Certain workloads and write patterns can benefit from changing the block size. For example, a volume that is written in a sequential stream of data (e.g. SQL Server log files) can benefit from a larger block size. A large block size results in fewer reads from the target volume when consecutive blocks are written. But a volume that is written in a random pattern may benefit from a smaller value or the default 64KB. A smaller block size will result in less snapshot file usage for random write requests.

VssQuiesceWaitTimeoutMs *

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\VssQuiesceWaitTimeoutMs*

Name	Type	Default Data
VssQuiesceWaitTimeoutMs	REG_DWORD	60000

Specifies the amount of time (in milliseconds) the DataKeeper service will wait for a VSS Snapshot Source Initiate request to complete. The VSS Snapshot Source Initiate request uses VSS to quiesce the data on snapshot volumes.

WaitForBitmapBaseDirMs *

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\WaitForBitmapBaseDirMs*

Name	Type	Default Data
WaitForBitmapBaseDirMs	REG_DWORD	180000

Specifies the amount of time after the system boots up that DataKeeper will wait for the volume specified in BitmapBaseDir to be registered with the Operating System. DataKeeper enforces a minimum wait of 60,000 ms – any value less than 60,000 will result in a 60,000 ms wait regardless of the setting.

WriteQueueByteLimitMB †

Location: *HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\WriteQueueByteLimitMB*

Name	Type	Default Data
WriteQueueByteLimitMB	REG_DWORD	0

Specifies the maximum number of bytes that can be allocated for the write queue of this mirror (expressed in megabytes – multiples of 1048576 bytes). The value “0” means “no limit”. During periods of high disk write activity, if this mirror’s write queue grows to a level which reaches the WriteQueueByteLimitMB, the SIOS DataKeeper driver momentarily pauses the mirror, drains the queue and automatically starts a partial resync. After updating this registry value, execute the

[READREGISTRY](#) command so that DataKeeper immediately starts using the new value.

This value is used during transmission of volume data to the target, when the mirror is in the Mirroring state as well as when the mirror is in the Resync state. You should ensure that the ResyncReads value (see below), which specifies the number of 64KB (65536 byte) blocks that can be put on the Write Queue during resync, does not exceed the limit specified by WriteQueueByteLimitMB. Multiply ResyncReads by 65536, then divide by 1048576 – the resulting value must not exceed WriteQueueByteLimitMB if WriteQueueByteLimitMB is not set to 0.

This value can be used in conjunction with WriteQueueHighWater (see below). If both limits are set to nonzero values, then the mirror will be paused if either of them is reached. If one is set to 0 and one is not, then the nonzero limit is the only one that is enforced. If both are set to 0, then the mirror’s write queue is not limited at all (this is not recommended – the WriteQueue uses Nonpaged memory).

Note: This tunable applies to synchronous and asynchronous mirrors. You can monitor the mirroring behavior using the SIOS DataKeeper Performance Monitor counters – specifically the Queue Current Bytes value – and set this limit accordingly.

WriteQueueHighWater * †

Locations:

For New Mirrors:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\WriteQueueHighWater

AND

For Existing Mirrors:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Volumes\{Volume GUID}\Targets\{Target IP}\WriteQueueHighWater

Note: If editing this entry under **Parameters**, all NEW mirrors created will inherit this value. If editing this entry under **Target**, the value pertains to that one Target only. **Any Target values override Parameter values.**

Name	Type	Default Data
WriteQueueHighWater	REG_DWORD	20000 (0x4e20)

Specifies the maximum number of write requests – not the number of bytes – that can be stored in this mirror’s write queue. The value “0” means “no limit”. During periods of high disk write activity, if this

mirror's write queue length reaches this value, the SIOS DataKeeper driver momentarily pauses the mirror, drains the queue and automatically starts a partial resync. After updating this registry value, execute the [READREGISTRY](#) command so that DataKeeper immediately starts using the new value.

This value is used during transmission of volume data to the target, when the mirror is in the Mirroring state as well as when the mirror is in the Resync state. You should ensure that the ResyncReads value (see below), which specifies the number of blocks that can be put on the Write Queue during resync, does not exceed the limit specified by WriteQueueHighWater if WriteQueueHighWater is not set to 0.

This value can be used in conjunction with WriteQueueByteLimitMB. If both limits are set to nonzero values, then the mirror will be paused if either of them is reached. If one is set to 0 and one is not, then the nonzero limit is the only one that is enforced. If both are set to 0, then the mirror's write queue is not limited at all (this is not recommended – the WriteQueue uses Nonpaged memory).

Note: This tunable applies to synchronous and asynchronous mirrors. You can monitor the mirroring behavior using the SIOS DataKeeper Performance Monitor counters – specifically the Queue Current Length value – and set this limit accordingly.

8.7. Using EMCMD with SIOS DataKeeper

The EMCMD utility that ships with SIOS DataKeeper provides users with a command line method to manipulate the mirror. Because these scripts run in situations where the “normal” validation rules may not apply, EMCMD does not perform the same kinds of sanity checks that the user would experience using the SIOS DataKeeper User Interface. EMCMD simply passes commands to the SIOS DataKeeper Replication service allowing the service to make any decisions. It is this lack of checks that also makes this a useful diagnostic and support tool – though it is potentially dangerous for someone not very experienced with the inner workings of SIOS DataKeeper.

The following sections detail the operation of the EMCMD SIOS DataKeeper Command Line.

- Launch an Administrator command prompt
- Type “`cd %extmirrbase%`”
- You will now be placed in the DataKeeper directory or `c:\Program Files (x86) \SIOS\DataKeeper`

Note: The following style conventions will be utilized throughout.

<system>	Use the system’s NetBIOS name, IP address or fully qualified domain name to attach to a given system. You can also use a period (.) to attach to the local system where emcmd is being executed.
<drive>	Refers to the drive letter that is being referenced. EMCMD parses out everything after the first character, therefore, any “:” (colon) would be extraneous.

In some cases a series of EMCMD commands should be run to perform a function.

Example: To clean up a deleted mirror the following three commands should be run on each cluster node.

- `emcmd . deletelocalmirroronly <volume letter of mirror to clean up>`
- `emcmd . clearswitchover <volume letter of mirror to clean up>`
- `emcmd . updatevolumeinfo <volume letter of mirror to clean up>`

Then, you can recreate the mirror by using the `emcmd createmirror` command (example: `emcmd <address of source of mirror> createmirror <volume letter> <address of target of mirror> <Type of Mirror – either S for sync or A for async>`). This command will recreate the mirror and connect it to the existing DataKeeper Job.

Note: Run these commands with caution. If you have any questions please contact Support at support@us.sios.com.

[Mirror State Definitions](#)[BREAKMIRROR](#)[CHANGEMIRRORENDPOINTS](#)[CHANGEMIRRORTYPE](#)[CLEARBLOCKTARGET](#)[CLEARSNAPSHOTLOCATION](#)[CLEARSWITCHOVER](#)[CONTINUEMIRROR](#)[CREATEJOB](#)[CREATEMIRROR](#)[DELETEJOB](#)[DELETELOCALMIRRORONLY](#)[DELETEMIRROR](#)[DROPSNAPSHOT](#)[GETBLOCKTARGET](#)[GETCOMPLETEVOLUMELIST](#)[GETCONFIGURATION](#)[GETEXTENDEDVOLUMEINFO](#)[GETJOBINFO](#)[GETJOBINFOFORVOL](#)[GETMIRRORTYPE](#)[GETMIRRORVOLINFO](#)[GETREMOTEBITMAP](#)[GETRESYNCSTATUS](#)

[GETSERVICEINFO](#)

[GETSNAPSHOTLOCATION](#)

[GETSOURCEMIRROREDVOLUMES](#)

[GETTARGETMIRROREDVOLUMES](#)

[GETVOLUMEDRVSTATE](#)

[GETVOLUMEINFO](#)

[ISBREAKUSERREQUESTED](#)

[ISPOTENTIALMIRRORVOL](#)

[LOCKVOLUME](#)

[MERGETARGETBITMAP](#)

[PAUSEMIRROR](#)

[PREPARETOBECOMETARGET](#)

[READREGISTRY](#)

[REGISTERCLUSTERVOLUME](#)

[RESTARTVOLUMEPIPE](#)

[RESYNCMIRROR](#)

[SETBLOCKTARGET](#)

[SETCONFIGURATION](#)

[SETSNAPSHOTLOCATION](#)

[STOPSERVICE](#)

[SWITCHOVERVOLUME](#)

[TAKESNAPSHOT](#)

[UNLOCKVOLUME](#)

[UPDATEJOB](#)

[UPDATEVOLUMEINFO](#)

8.7.1. Mirror State Definitions

The following numbers are used by the system to internally describe the various states. They are used by EMCMD, and they are also the state numbers found in event log entries.

-1: Invalid State

0: No Mirror

1: Mirroring

2: Mirror is resyncing

3: Mirror is broken

4: Mirror is paused

5: Resync is pending

8.7.2. Using the `-proxy` option with EMCMD

All EMCMD requests can be routed through a “proxy” DataKeeper service. To do this, append the options

```
-proxy <proxy_system>-
```

to the end of the EMCMD command line. The `<proxy_system>` should be given using the same format as the `<system>` option. EMCMD will open a connection to the `<proxy_system>` first, and will request that it forward the EMCMD to `<system>`. The DataKeeper Service on `<proxy_system>` opens a connection to `<system>`, and sends the requested EMCMD to `<system>`, returning the response to the user.

The `-proxy <proxy_system>` option allows you to verify that DataKeeper communication between nodes is working.

Example

```
EMCMD DK_NODE_2 GETSERVICEINFO -proxy DK_NODE_1
```

Opens a connection to the DataKeeper service running on DK_NODE_1, which in turn opens a connection to DK_NODE_2, forwards the `GETSERVICEINFO` request, and returns the service information from DK_NODE_2. This can be used to validate that the DataKeeper service on DK_NODE_1 is able to communicate with the DataKeeper service on DK_NODE_2.

8.7.3. BREAKMIRROR

EMCMD <system> BREAKMIRROR <volume letter> [<target system>]

This command forces the mirror into a **Broken** state. Breaking the mirror will cause a full resync to occur when the mirror is continued or resynced.

The parameters are:

<system>	This is the source system of the mirror to break. Running the BREAKMIRROR command on the target has no effect.
<volume letter>	The drive letter of the mirror that you want to break.
<target system>	This is the IP address of the target system of the mirror to break. This optional parameter may be used if multiple targets are associated with the mirror. If not specified, the mirror will be broken to all targets.

8.7.4. CHANGEMIRRORENDPOINTS

Required actions to be taken before executing the changemirrorendpoints command

- **Display job information** for the volume
- **Pause the Mirror** using the following EMCMD command via the command line.
emcmd . pausemirror <drive>
- **Change the IP address** on the system(s) (if necessary)

! **IMPORTANT:** If you haven't already done so, prior to performing the **CHANGEMIRRORENDPOINTS** command, update the IP addresses for the Source and Target. This will automatically place the mirror into the Paused state.

Note: The required DataKeeper Ports are available via Windows Firewall, AWS Security Groups or other Stateful Packet Inspections devices. Click [here](#) to view the required ports for Datakeeper.

- **Run EMCMD . CHANGEMIRRORENDPOINTS** to change to the new IP address(es)

[Changing only the Source IP address](#)

[Changing only the Target IP address](#)

[Changing the Source and Target IP addresses](#)

- **Run EMCMD . CONTINUEMIRROR** <drive> to resume mirroring

! If the Source system is rebooted before the mirrors are continued a full resync will occur on the mirrored volumes.

CHANGEMIRRORENDPOINTS COMMAND

- This command is used to change the replication IP addresses within systems that are already part of a DataKeeper job for the given volume.

```
emcmd <NEW source IP> CHANGEMIRRORENDPOINTS <volume letter> <ORIGINAL target IP> <NEW source IP> <NEW target IP>
```

- If changing the IP address of the **Source ONLY**, the syntax is as follows:

```
emcmd <NEW source IP> CHANGEMIRRORENDPOINTS <volume letter> <ORIGINAL target IP> <NEW source IP> <ORIGINAL target IP>
```

- If changing the IP address of the **Target ONLY**, the syntax is as follows:

```
emcmd <ORIGINAL source IP> CHANGEMIRRORENDPOINTS <volume letter>
<ORIGINAL target IP> <ORIGINAL source IP> <NEW target IP>
```

 This command supports changing the endpoints of a mirrored volume that is configured on 3 nodes or fewer. If your configuration consists of more than three nodes, the mirrors must be deleted and recreated.

Refer to the examples below:

See [WAN Considerations](#) and [Initial Synchronization of Data Across the LAN/WAN](#) in the [Configuration](#) section.

<system name> This is the system that has the new source IP address available for the mirror.

<volume letter> The drive letter of the mirror to be changed.

<original target IP> The previous IP address of the target system.

<new source IP> The new IP address of the source system.

<new target IP> The new IP address of the target system.

Notes:

- A job may contain multiple volumes and multiple mirrors. The CHANGEMIRRORENDPOINTS command will modify endpoints on one mirror each time it is used. For a 1×1 mirror (1 source, 1 target), only one command is required. For a 2×1 mirror (2 nodes with a shared volume with one target node) or a 1×1×1 (1 source, two target nodes), two commands are required to change the necessary mirror endpoints.
- If an existing mirror whose endpoints are being changed is currently an active mirror, it must be put into the [Paused](#), [Broken](#) or **Resync Pending** state before the endpoints can be changed.

 Using the Break command will cause a **full resync**. It is recommended that the mirror be [Paused](#) instead.

Before making changes, it will be helpful to display **Job Information** for the volume. For example, `emcmd . getJobInfoForVol D.`

While making endpoint changes, the **Job** icon in the DataKeeper GUI may turn red. However, it will return to green after the `ContinueMirror` command is performed.

In the following examples, we move mirrors from the 172.17.103 subnet to the 192.168.1 subnet.

The basic steps are as follows:

- **Display job information** for the volume
- **Pause the Mirror** using the EMCMD command line
- **Change the IP address** on the system(s) (if necessary)

! **IMPORTANT:** If you haven't already done so, prior to performing the **CHANGEMIRRORENDPOINTS** command, **update the IP addresses** for the source and target. This will automatically place the mirror into the **Paused** state.

- Run **EMCMD CHANGEMIRRORENDPOINTS** to change to the new IP address
- Run **EMCMD CONTINUEMIRROR** to resume mirror If the source system is rebooted before the mirrors are continued a full resync will occur on the mirrored volumes.

1×1 Mirror CHANGEMIRRORENDPOINTS Command Example

- For a 1×1 mirror (source and target only), one command is required.

```
emcmd SYS1.MYDOM.LOCAL getJobInfoForVol D
```

```
ID = caa97f9f-ac6a-4b56-8f25-20db9e2808a8
```

```
Name = Mirr Vol D
```

```
Description = Mirror Volume D
```

```
MirrorEndPoints =
```

```
SYS3.MYDOM.LOCAL;D;172.17.103.223;SYS1.MYDOM.LOCAL;E;172.17.103.221;A
```

```
emcmd SYS1.MYDOM.LOCAL PauseMirror D
```

```
emcmd SYS1.MYDOM.LOCAL ChangeMirrorEndPoints D 172.17.103.223
```

```
192.168.1.221 192.168.1.223
```

```
emcmd SYS1.MYDOM.LOCAL getJobInfoForVol D
```

```
. . .
```

```
MirrorEndPoints =
```

```
SYS3.MYDOM.LOCAL;D;192.168.1.223;SYS1.MYDOM.LOCAL;D;192.168.1.221;A
```

```
emcmd SYS1.MYDOM.LOCAL ContinueMirror D
```

2×1 Mirror CHANGEMIRRORENDPOINTS Command Example

- For a 2×1 mirror that includes a shared source volume and a target volume, two commands

are required.

```
emcmd SYS1.MYDOM.LOCAL getJobInfoForVol E
```

```
ID = caa97f93e-ac6a-4b56-8f25-20db9e2808a8
```

```
Name = Mirr Vol E
```

```
Description = Mirror Volume E
```

```
MirrorEndPoints = SYS1.MYDOM.LOCAL;E;0.0.0.0;SYS2.MYDOM.LOCAL;E;0.0.0.0;D
```

```
MirrorEndPoints =
SYS3.MYDOM.LOCAL;E;172.17.103.223;SYS2.MYDOM.LOCAL;E;172.17.103.222;A
```

```
MirrorEndPoints =
SYS3.MYDOM.LOCAL;E;172.17.103.223;SYS1.MYDOM.LOCAL;E;172.17.103.221;A
```

```
emcmd SYS1.MYDOM.LOCAL PauseMirror E
```

```
emcmd SYS1.MYDOM.LOCAL ChangeMirrorEndPoints E 172.17.103.223
192.168.1.221 192.168.1.223
```

```
emcmd SYS2.MYDOM.LOCAL ChangeMirrorEndPoints E 172.17.103.223
192.168.1.222 192.168.1.223
```

```
emcmd SYS1.MYDOM.LOCAL getJobInfoForVol E
```

```
. . .
```

```
MirrorEndPoints =
SYS1.MYDOM.LOCAL;E;0.0.0.0;SYS2.MYDOM.LOCAL;E;0.0.0.0;D
```

```
MirrorEndPoints =
SYS3.MYDOM.LOCAL;E;192.168.1.223;SYS2.MYDOM.LOCAL;E;192.168.1.222;A
```

```

MirrorEndPoints =
SYS3.MYDOM.LOCAL;E;192.168.1.223;SYS1.MYDOM.LOCAL;E;192.168.1.221;A

emcmd SYS1.MYDOM.LOCAL ContinueMirror E

```

1×1×1 Mirror CHANGEMIRRORENDPOINTS Command Example

- For a 1×1×1 mirror that includes 2 Target volumes, 2 commands are required.

```

emcmd SYS1.MYDOM.LOCAL getJobInfoForVol J

ID = caa97f93j-ac6a-4b56-8f25-20db9j2808a8

Name = Mirr Vol J

Description = Mirror Volume J

MirrorEndPoints =
SYS1.MYDOM.LOCAL;J;172.17.103.221;SYS3.MYDOM.LOCAL;J;172.17.103.223;A

MirrorEndPoints =
SYS3.MYDOM.LOCAL;J;172.17.103.223;SYS2.MYDOM.LOCAL;J;172.17.103.222;A

MirrorEndPoints =
SYS1.MYDOM.LOCAL;J;172.17.103.221;SYS2.MYDOM.LOCAL;J;172.17.103.222;A

```

In this example the system “SYS3.MYDOM.LOCAL” will be moved to another site.

SYS1 and SYS2 will now use a new subnet (192.168.1.*) to communicate with SYS3.

However, SYS1 and SYS2 will continue using 172.17.103.* to communicate with each other.

```

emcmd SYS1.MYDOM.LOCAL PauseMirror J

emcmd SYS1.MYDOM.LOCAL ChangeMirrorEndPoints J 172.17.103.223
192.168.1.221 192.168.1.223

```

```
emcmd SYS2.MYDOM.LOCAL ChangeMirrorEndpoints J 172.17.103.223  
192.168.1.222 192.168.1.223
```

```
emcmd SYS1.MYDOM.LOCAL getJobInfoForVol J
```

```
...
```

```
    MirrorEndpoints =  
SYS1.MYDOM.LOCAL;J;192.168.1.221;SYS3.MYDOM.LOCAL;J;192.168.1.223;A
```

```
    MirrorEndpoints =  
SYS3.MYDOM.LOCAL;J;192.168.1.223;SYS2.MYDOM.LOCAL;J;192.168.1.222;A
```

```
    MirrorEndpoints =  
SYS1.MYDOM.LOCAL;J;172.17.103.221;SYS2.MYDOM.LOCAL;J;172.17.103.222;A
```

```
emcmd SYS1.MYDOM.LOCAL ContinueMirror J
```

8.7.5. CHANGEMIRRORTYPE

EMCMD <system> CHANGEMIRRORTYPE <volume letter> <remote ip> <A/S>

This command is used to change the mirror type of a mirror that is part of a DataKeeper job.

Note: The volume must be online.

Refer to the examples below.

See [Synchronous and Asynchronous Mirroring](#) for information about the supported DataKeeper mirror types.

<system>	The source or target system on which to initiate the changing of the mirror type.
<volume letter>	The drive letter of the mirror to be changed.
<remote IP>	The IP address of the remote system.
<A/S>	The new mirror type (Asynchronous or Synchronous).

Notes:

- A job may contain multiple volumes and multiple mirrors. The CHANGEMIRRORTYPE command will modify the type of one mirror each time it is used.
- The volume must be online on each system in the mirror to change the mirror type of an existing mirror.
- The mirror type of an existing mirror can be changed while the mirror is in the active Mirroring state. The type change takes effect immediately.
- The mirror type of non-existing mirrors can be changed. See the 1×1×1 example below.
- The mirror type of a mirror that is in the Split-Brain state cannot be changed – the Split Brain must be resolved first.
- If a job contains multiple mirrors, individual mirror types can be modified. Having mixed mirror types within a job, and within the mirrors for an individual volume in the job, is supported.

1×1 Mirror CHANGEMIRRORTYPE Command Example

```
emcmd SYS1.MYDOM.LOCAL getJobInfoForVol D
```

```
ID = caa97f9f-ac6a-4b56-8f25-20db9e2808a8
```

```
Name = Mirr Vol D
```

```

Description = Mirror Volume D

MirrorEndPoints =
SYS3.MYDOM.LOCAL;D;172.17.103.223;SYS1.MYDOM.LOCAL;E;172.17.103.221;A

emcmd SYS1.MYDOM.LOCAL ChangeMirrorType D 172.17.103.223 S

```

The above example changes the mirror of D: between SYS1 and SYS3 to Synchronous.

1×1×1 Mirror CHANGEMIRRORTYPE Command Example

```

emcmd SYS1.MYDOM.LOCAL getJobInfoForVol J

ID caa97f93j-ac6a-4b56-8f25-20db9j2808a8

Name = Mirr Vol J

Description = Mirror Volume J

MirrorEndPoints =
SYS1.MYDOM.LOCAL;J;172.17.103.221;SYS2.MYDOM.LOCAL;J;172.17.103.222;A

MirrorEndPoints =
SYS1.MYDOM.LOCAL;J;172.17.103.221;SYS3.MYDOM.LOCAL;J;172.17.103.223;A

MirrorEndPoints =
SYS3.MYDOM.LOCAL;J;172.17.103.223;SYS2.MYDOM.LOCAL;J;172.17.103.222;A

emcmd SYS1.MYDOM.LOCAL GetMirrorVolInfo J

J: 1 SYS1.MYDOM.LOCAL 172.17.103.222 1

J: 1 SYS1.MYDOM.LOCAL 172.17.103.223 1

emcmd SYS1.MYDOM.LOCAL ChangeMirrorType J 172.17.103.222 S

emcmd SYS1.MYDOM.LOCAL ChangeMirrorType J 172.17.103.223 S

emcmd SYS2.MYDOM.LOCAL ChangeMirrorType J 172.17.103.223 S

```

In this example, all mirror types will be changed to Synchronous. The third command changes the mirror type of the non-existing mirror between SYS2 and SYS3.

8.7.6. CLEARBLOCKTARGET

EMCMD <system> CLEARBLOCKTARGET <volume letter>

This command sets the state of the block target flag to FLASE. The block target flag when set to FALSE will allow that system to become a target for the selected volume. This command is for internal use only. No output is produced when running this command.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume for which you want to set the state of the block target flag to FALSE.

8.7.7. CLEARSNAPSHOTLOCATION

EMCMD <system> CLEARSNAPSHOTLOCATION <volume letter>

This command clears the snapshot location (directory path) for the given volume on the given system. Once this command executes successfully, snapshots will be disabled for the given volume.

The parameters are:

<system>	This is the system name/IP address of snapshot location.
<volume letter>	This is the drive letter of the volume to be snapshotted.

Sample output:

```
Status = 0
```

When the command is successful, it will return a status of 0. Otherwise, it will report a non-zero status.

8.7.8. CLEARSWITCHOVER

EMCMD <system> CLEARSWITCHOVER <volume letter>

This command should be run on a target system where a mirror has been previously deleted with the [DELETELOCALMIRRORONLY](#) command and now needs to be re-established. This command clears the SIOS DataKeeper switchover flag that is set for a volume that has been deleted from the Target role using DELETELOCALMIRRORONLY. If you delete a target using DELETELOCALMIRRORONLY and do not run CLEARSWITCHOVER, you will not be able to re-establish a mirror target unless you reboot the system.

<system>	This is the target system where you just ran DELETELOCALMIRRORONLY.
<volume letter>	The drive letter of the mirror.

8.7.9. CONTINUEMIRROR

EMCMD <system> CONTINUEMIRROR <volume letter> [<target system>]

This command forces a paused or broken mirror to resume mirroring. On successful completion of the resync (full or partial), the mirror state is changed to **Mirroring**. This command will not automatically relock the target volume if it is unlocked.

Note: If target volume is unlocked, it must be [relocked](#) prior to running this command.

The parameters are:

<system>	This is the source system of the mirror to resume mirroring.
<volume letter>	The drive letter of the mirror that you want to resume mirroring.
<target system>	This is the IP address of the target system of the mirror to resync. This optional parameter may be used if multiple targets are associated with the mirror. If not specified, a resync will be performed to all targets.

8.7.10. CREATEJOB

```
EMCMD . CREATEJOB <JobName> <Description> <FQDN Source>  
<DrvLetter1> <IP SourceReplication> <FQDN Target> <DrvLetter2> <IP Target  
for Replication><MirrorType> . . .
```

This command is for internal use only.

8.7.11. CREATMIRROR

EMCMD <system> CREATMIRROR <volume letter> <target system> <type> [options]

This command creates a mirror between two machines, using the same drive letter on each.

* If the CREATMIRROR command is executed in a shared storage configuration, the configuration mask must be updated using the [SETCONFIGURATION](#) command.

The parameters are:

<system>	This is the IP address of the source system (see Note below).
<volume letter>	This is the drive letter that is being mirrored. This will be both the source and target drive letter.
<target system>	This is the IP address of the target system (see Note below).
<type>	This is the type of mirror, where type is a single character: A – Create an Asynchronous Mirror S – Create a Synchronous Mirror
[options]	Optional arguments that specify behavior deviant from the norm. These can be OR'd together to create a set of options (add decimal values – for example, for option 1 + option 4, place a 5 in the command). They are: 1: Create the mirror without doing a full resync operation. 2: Do not wait for the target side of the mirror to be created before returning. 4: Create with boot-time restrictions in place – essentially treat the create as you would a mirror re-establishment as part of the boot process. This option will check to see if the remote system is already a source and fail the creation if it determines that it was a source.

* **NOTE:** Disk sector size must match on both source and target volumes. See [Sector Size](#) for more information.

* **NOTE:** Both source and target IP addresses must be of the same protocol. A mirror can only be created using two IPV4 or two IPV6 addresses. DataKeeper does not currently support mirror endpoints with different protocols.

IPv4 Example:

```
EMCMD 192.168.1.1 CREATEMIRROR E 192.168.1.2 A 5
```

IPv6 Example:

```
EMCMD 2001:5c0:110e:3304:a6ba:dbff:feb2:f7fd CREATEMIRROR F  
2001:5c0:110e:3304:a6ba:dbff:feb2:afd7 A 5
```

8.7.12. DELETEJOB

EMCMD <system> DELETEJOB <JobId>

This command is for internal use only.

8.7.13. DELETELOCALMIRRORONLY

EMCMD <system> DELETELOCALMIRRORONLY <volume letter> [<target system>]

This command deletes the mirror only on the <system> it is issued on. It handles the case when a mirror ends up with a target and no source or source and no target.

The parameters are:

<system>	This can be either the source or the target system.
<volume letter>	The drive letter of the mirror that you want to delete.
<target system>	This is the IP address of the target system of the mirror to delete. This optional parameter may be used if multiple targets are associated with the mirror.

8.7.14. DELETEMIRROR

EMCMD <system> DELETEMIRROR <volume letter> [<target system>]

This command deletes the mirror from both the source and the target if <system> is a source. If <system> is a target, it will delete the target side of the mirror only if the source system is down.

The parameters are:

<system>	This can be either the source or the target system.
<volume letter>	The drive letter of the mirror that you want to delete.
<target system>	This is the IP address of the target system of the mirror to delete. This optional parameter may be used if multiple targets are associated with the mirror. If not specified, the mirror will be deleted for all targets.

8.7.15. DROPSNAPSHOT

EMCMD <system> DROPSNAPSHOT <volume letter> [<volume letter> ...]

This command will notify DataKeeper to lock the volume and clean up the snapshot files that it created.

The parameters are:

<system>	This is the IP address of the system containing the snapshot.
<volume letter>	This is the drive letter of the snapshotted volume on the target server. If dropping multiple snapshots, the drive letters should be separated by spaces.

8.7.16. GETBLOCKTARGET

EMCMD <system> GETBLOCKTARGET <volume letter>

This command provides the current state of the block target flag, either TRUE or FALSE. The block target flag if set to TRUE will prevent that system from ever becoming a target for the selected volume. This command is for internal use only.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume for which you want to retrieve the state of the block target flag.

Sample output:

```
C:> EMCMD . GETBLOCKTARGET E
```

```
FALSE
```

8.7.17. GETCOMPLETEVOLUMELIST

EMCMD <system> GETCOMPLETEVOLUMELIST

This command displays information on all volumes eligible to be mirrored or already in a mirror. Sample output:

Volume 1 information:

Volume Root	= F:
Volume Label	= New Volume
Volume File System	= NTFS
Volume Total Space	= 2151608320
Mirror Role	= 01
Number of targets	= 2
Target 0 information:	
Volume State	= 0001
Target System	= 10.1.1.133
Target Drive Letter	= F
Target 1 information:	
Volume State	= 0002
Target System	= 10.1.1.134
Target Drive Letter	= F

8.7.18. GETCONFIGURATION

EMCMD <system> GETCONFIGURATION <volume letter>

This command retrieves and displays the net alert settings (also referred to as “volume attributes”) for the volume.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume you want information on.

Sample output:

** Calling GetConfiguration [Volume F] **

All Net Alert bit	IS NOT enabled
Net Alert	IS NOT enabled
Broken State Alert	IS NOT enabled
Resync Done Alert	IS NOT enabled
Failover Alert	IS NOT enabled
Net Failure Alert	IS NOT enabled
LK Config	IS NOT enabled
Auto Resync	IS NOT enabled
MS Failover Cluster Config	IS NOT enabled
Shared Volume	IS NOT enabled

8.7.19. GETEXTENDEDVOLUMEINFO

EMCMD <system> GETEXTENDEDVOLUMEINFO <volume letter>

This command returns extended volume information about the selected volume such as disk signature, physical disk offset and internal disk id.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume you want information on.

Sample output:

—————EXTENDED INFO———

Physical Disk Signature = {217abb5a-0000-0000-0000-000000000000}

Physical Disk Offset = 32256

Internal Disk ID = 0xf2fa

8.7.20. GETJOBINFO

EMCMD <system> GETJOBINFO [<JobId>]

This command displays job information for a specific JobId or all defined jobs.

8.7.21. GETJOBINFOFORVOL

EMCMD <system> GETJOBINFOFORVOL <DrvLetter>[<FullSysname>|<IP>]

This command displays job information related to a specific volume on a specific system.

8.7.22. GETMIRRORTYPE

EMCMD <system> GETMIRRORTYPE <volume letter>

This command provides a numeric output of the type of mirror.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The driver letter of the volume you want information on.

Output format:

```
c:> EMCMD . GETMIRRORTYPE F
```

Target system 10.1.1.133, Type 2

Target system 10.1.1.134, Type 2

Mirror Type:

-1: Invalid Type (EMCMD cannot get the requested information.)

0: No mirror

1: Synchronous Mirror

2: Asynchronous Mirror

8.7.23. GETMIRRORVOLINFO

EMCMD <system> GETMIRRORVOLINFO <volume letter>

This command provides a very terse output of the state of mirror. The command GETMIRRORVOLINFO can return multiple lines of output (one per target). It provides essentially the same information as the [GETVOLUMEINFO](#) command does.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The driver letter of the volume you want information on.

Sample output:

```
C:> EMCMD . GETMIRRORVOLINFO F
```

```
F: 1 CARDINAL10.1.1.133 1
```

```
F: 1 CARDINAL10.1.1.134 1
```

Output format:

[Volume Letter] {Mirror Role} [Source System] [Target System] [Mirror State]

Mirror Role: 1 = source; 2 = target

Mirror State:

-1: Invalid State

0: No mirror

1: Mirroring

2: Mirror is resyncing

3: Mirror is broken

4: Mirror is paused

5: Resync is pending

8.7.24. GETREMOTEBITMAP

EMCMD <system> GETREMOTEBITMAP <volume letter> <targetsystem> <local file>

This command is for internal use only.

8.7.25. GETRESYNCSTATUS

EMCMD <system> GETRESYNCSTATUS <volume letter>

This command returns information indicating the overall status of a resync operation.

The parameters are:

<system>	This can only be performed on the Source system.
<volume letter>	The drive letter of the volume you want to set the configuration on.

Sample output:

Resync Status for Volume F:

Target 0 (Target System 10.1.1.133)

ResyncPhase : 3

BitmapPass : 1

NumberOfBlocks : 32831

DirtyBlocks : 0

CurrentBlock : 0

NewWrites : 1803

ResyncStartTime : Fri Nov 05 13:57:51 2008

LastResyncTime : Fri Nov 05 13:57:51 2008

Target 1 (Target System 10.1.1.134)

ResyncPhase : 2

BitmapPass : 0

NumberOfBlocks : 32831

DirtyBlocks : 2124

CurrentBlock : 29556

NewWrites : 0

ResyncStartTime : Fri Nov 05 15:09:47 2008

LastResyncTime : Fri Nov 05 15:09:47 2008

The **ResyncPhase** is used internally and has little meaning outside of the development environment.

The values are: 0 (unknown), 1 (initial), 2 (update), and 3 (done).

The **BitmapPass** is the number of times we have passed through the bitmap indicating the number of dirty blocks. We count from zero. If we do a resync in one pass, then this never increments.

The **NumberOfBlocks** is the number of 64K data blocks on the volume.

The **DirtyBlocks** parameter is the number of blocks that the bitmap indicates need to be updated (and have not already been).

The **CurrentBlock** parameter indicates the current location in the bitmap.

The **NewWrites** parameter indicates the number of writes that have occurred on the volume since we have been resyncing.

The **ResyncStartTime** and **LastResyncTime** parameters describe the time that the resync was begun and the last time a resync write operation was sent across the network.

8.7.26. GETSERVICEINFO

EMCMD <system> GETSERVICEINFO

This command retrieves version and other information about the SIOS DataKeeper service and driver that is running on the specified machine.

The parameters are:

<system>	This can be either the source or the target systems.
----------	--

Sample output:

Service Description: = SIOS DataKeeper Service

Service Build Type: = Release

Service Version = 7.0

Service Build = 1

Driver Version = 7.0

Driver Build = 1

Volume Bit Map = 1000070h

Service Start Time = Fri Oct 06 11:20:45 2008

Last Modified Time = Fri Oct 06 15:11:53 2008

8.7.27. GETSNAPSHOTLOCATION

EMCMD <system> GETSNAPSHOTLOCATION <volume letter>

This command retrieves the currently configured snapshot location (directory path) for the given volume on the given system. It will return an empty result if the snapshot location is not configured on the given volume.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	This is the drive letter of the volume to be snapshotted

Sample output:

C:\Temp

When the command is successful, it will report the snapshot directory path on stdout, which will be empty if snapshot location is not yet configured.

8.7.28. GETSOURCEMIRROREDVOLUMES

EMCMD <system> GETSOURCEMIRROREDVOLUMES

This command displays information about the volumes on the system that are currently the source in a mirror.

Sample output:

Status = 0

Source Volume = F:

Source Label = New Volume

Source #Targs = 2

Target 0

Target System = 10.1.1.133

Mirror State = 0001

Target 1

Target System = 10.1.1.134

Mirror State = 0001

8.7.29. GETTARGETMIRROREDVOLUMES

EMCMD <system> GETTARGETMIRROREDVOLUMES

This command displays information about the volumes on the system that are currently the target in a mirror.

Sample output:

```
** Calling GetTargetMirroredVolumes **
```

```
Returned 1 Target Volumes
```

```
Target Volume 1 information:
```

```
Volume Root = F:
```

```
Volume State = 1
```

```
Source = 10.1.1.132
```

```
Target = BLUEJAY
```

8.7.30. GETVOLUMEDRVSTATE

EMCMD <system> GETVOLUMEDRVSTATE <volume letter>

This command retrieves the current state of the SIOS DataKeeper device driver.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume you want to get the configuration on.

The output is a number indicating the state. The output is purposely terse as it is designed to be parsed in a DataKeeper recovery script. The output is one of the following mirror states:

- 1:** Invalid State
- 0:** No mirror
- 1:** Mirroring
- 2:** Mirror is resyncing
- 3:** Mirror is broken
- 4:** Mirror is paused
- 5:** Resync is pending

The output also provides the address of the mirror end point (source or target).

8.7.31. GETVOLUMEINFO

EMCMD <system> GETVOLUMEINFO <volume letter> <level>

This command returns information about the selected volume.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume you want information on.
<level>	A number between 1-3 indicating the amount of detail you want.

Sample output:

----- LEVEL 1 INFO -----

Volume Root = F:

Last Modified = Fri Nov 05 15:24:14 2008

Mirror Role = SOURCE

Label = New Volume

FileSystem = NTFS

Total Space = 2151608320

Num Targets = 2

Attributes : 20h

----- LEVEL 2 INFO -----

>> Remote [0] = 10.1.1.133, F:

Mirror State = MIRROR

Mirror Type = ASYNCHRONOUSLY

>> Remote [1] = 10.1.1.133, F:

Mirror State = MIRROR

Mirror Type = ASYNCHRONOUSLY

LEVEL 3 INFO

>> Remote [0] = 10.1.1.133, F:

No Resync or CompVol Statistics to report

>> Remote [1] = 10.1.1.134, F:

No Resync or CompVol Statistics to report

8.7.32. ISBREAKUSERREQUESTED

EMCMD <system> ISBREAKUSERREQUESTED <volume letter>

This command checks whether a broken mirror is a result of a user request.

The parameters are:

<system>	This can be either the source or the target system.
<volume letter>	The drive letter of the volume that you want to check.

Output:

<TRUE>	The mirror was broken because of a user request.
<FALSE>	The mirror was broken by SIOS DataKeeper (e.g., network failure, failure to write data on target side, etc). The volume is not in a BROKEN (3) state.

8.7.33. ISPOTENTIALMIRRORVOL

EMCMD <system> ISPOTENTIALMIRRORVOL <volume letter>

This command checks to determine if a volume is a candidate for mirroring. The command may only be run on the local system.

The parameters are:

<system>	This should be the local system.
<volume letter>	The drive letter of the volume that you want to check.

Output:

TRUE – The volume is available for mirroring.

Otherwise, the output may be some combination of the following:

System Drive

RAW filesystem

FAT filesystem

ACTIVE partition

Contains PageFile

GetDriveType not DRIVE_FIXED

Contains DataKeeper bitmap files

If the drive letter points to a newly created volume (i.e. SIOS DataKeeper driver not attached yet), or a non-disk (network share, CD-ROM), the output will be:

Unable to open – SIOS DataKeeper driver might not be attached (you may need to reboot) or this might not be a valid hard disk volume.

If there is an internal error getting volume information, you may see the message:

Unable to retrieve the volume information for use in determining the potential use as a mirrored volume. The volume may be locked by another process or may not be formatted as NTFS.

8.7.34. LOCKVOLUME

EMCMD <system> LOCKVOLUME <volume letter>

This command forces an exclusive lock on the volume specified. This call will fail if a process owns open handles into the volume.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume you want to lock.

8.7.35. MERGETARGETBITMAP

EMCMD <system> MERGETARGETBITMAP <volume letter> <target system>

This command is for internal use only.

8.7.36. PAUSEMIRROR

EMCMD <system> PAUSEMIRROR <volume letter> [<target system>]

This command forces the mirror into a **Paused** state.

The parameters are:

<system>	This is the source system of the mirror to pause. Running the PAUSEMIRROR command on the target has no effect.
<volume letter>	The drive letter of the mirror that you want to pause.
<target system>	This is the IP address of the target system of the mirror to pause. This optional parameter may be used if multiple targets are associated with the mirror. If not specified, the mirror to all targets will be paused.

8.7.37. PREPARETOBECOMETARGET

EMCMD <system> PREPARETOBECOMETARGET <volume letter>

This command should only be used to recover from a [Split-Brain](#) condition. It should be run on the system where the mirror is to become a target and is only valid on a mirror source. This command causes the mirror to be deleted and the volume to be locked.

To complete split-brain recovery, run [CONTINUEMIRROR](#) on the system that remains as the mirror source.

Example Scenario

If volume F: is a mirror source on both SYSA and SYSB, you can use emcmd to resolve this split-brain situation. Choose one of the systems to remain a source – for example, SYSA. Make sure there are no files or modifications on SYSB that you want to save – if so, these need to be copied manually to SYSA. To re-establish the mirror, perform the following steps:

```
EMCMD SYSB PREPARETOBECOMETARGET F
```

The mirror of F: on SYSB will be deleted and the F: drive will be locked.

```
EMCMD SYSA CONTINUEMIRROR F
```

Mirroring of the F: drive from SYSA to SYSB will be established, a partial resync will occur (overwriting any changes that had been made on SYSB), and the mirror will reach the **Mirroring** state.

8.7.38. READREGISTRY

EMCMD <system> READREGISTRY <volume letter>

This command tells the SIOS DataKeeper driver to re-read its registry settings.

The parameters are:

<system>	This can be either the source system or the target system.
<volume letter>	The drive letter of the mirror for which you want to re-read settings.

This command causes the following registry settings to be re-read and any changes to take effect.

Source system (changes to these parameters take effect immediately):

BandwidthThrottle

BitmapBytesPerBlock

BlockWritesOnLimitReached

CompressionLevel

ResyncReads

WriteQueueByteLimitMB

WriteQueueHighWater

WriteQueueLowWater (This value is deprecated and no longer used.)

DontFlushAsyncQueue

Target system (changes take effect the next time the source and target systems reconnect):

TargetPortBase

TargetPortIncr

8.7.39. REGISTERCLUSTERVOLUME

EMCMD <system> REGISTERCLUSTERVOLUME <volume letter>

This command is used to register a DataKeeper protected volume in a WSFC cluster.

The parameters are:

<system>	This is the source system of the mirror.
<volume letter>	The drive letter of the volume you want registered.

8.7.40. RESTARTVOLUMEPIPE

EMCMD <system> RESTARTVOLUMEPIPE <volume letter>

This command is for internal use only.

8.7.41. RESYNCMIRROR

EMCMD <system> RESYNCMIRROR <volume letter> [<target system>]

This command forces the mirror to be fully resynced.

The parameters are:

<system>	This is the source system name.
<volume letter>	This is the drive letter of the mirror that should be resynced.
<target system>	This is the IP address of the target system of the mirror to resync. This optional parameter may be used if multiple targets are associated with the mirror. If not specified, a resync to all targets will be performed.

8.7.42. SETBLOCKTARGET

EMCMD <system> SETBLOCKTARGET <volume letter>

This command sets the state of the block target flag to TRUE. The block target flag when set to TRUE will prevent that system from ever becoming a target for the selected volume. This command is for internal use only. No output is produced when running this command.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume for which you want to set the state of the block target flag to TRUE.

8.7.43. SETCONFIGURATION

EMCMD <system> SETCONFIGURATION <volume letter> <configuration mask>

This command sets the net alert settings (also referred to as “volume attributes”) for the volume.

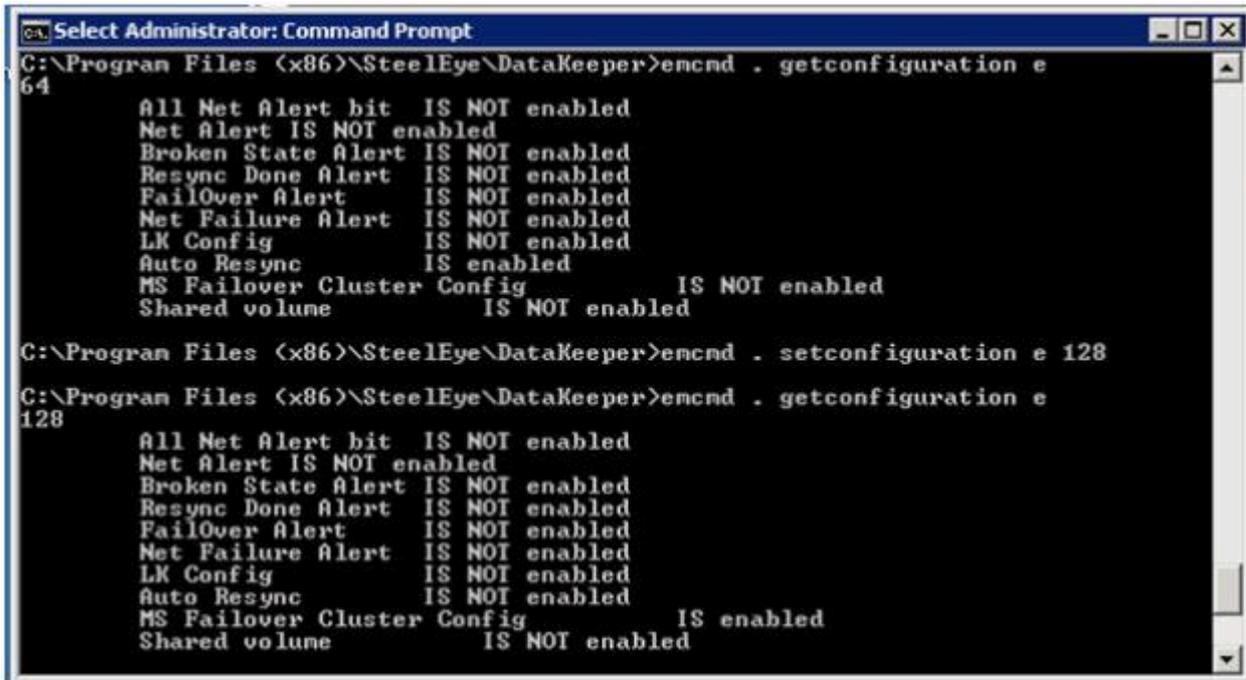
The parameters are:

<system>	This can be either the source or the target system.
<volume letter>	The drive letter of the volume you want to set the configuration on.
<configuration mask>	<p>This is a bitmask indicating the net alert settings. These bits are defined:</p> <ul style="list-style-type: none"> 1 — 0×01: All Net Alerts is enabled 2 — 0×02: Broken State Alert is enabled 4 — 0×04: Resync Done Alert is enabled 8 — 0×08: Failover Alert is enabled 16 — 0×10: Net Failure Alert is enabled 32 — 0×20: LifeKeeper Config is enabled 64 — 0×40: Auto Resync is enabled 128 — 0×80: MS Failover Cluster Config is enabled 256 — 0×100: Shared Volume is enabled

 In a 2 × 1 configuration, set the configuration mask to 384 on shared storage systems and 128 on the non-shared storage system.

Example to enable MS Failover Cluster Config:

```
EMCMD . SETCONFIGURATION E 128
```



```

C:\Program Files (x86)\SteelEye\DataKeeper>emcmd . getconfiguration e
64
    All Net Alert bit   IS NOT enabled
    Net Alert           IS NOT enabled
    Broken State Alert IS NOT enabled
    Resync Done Alert  IS NOT enabled
    FailOver Alert     IS NOT enabled
    Net Failure Alert   IS NOT enabled
    LK Config           IS NOT enabled
    Auto Resync         IS enabled
    MS Failover Cluster Config IS NOT enabled
    Shared volume       IS NOT enabled

C:\Program Files (x86)\SteelEye\DataKeeper>emcmd . setconfiguration e 128

C:\Program Files (x86)\SteelEye\DataKeeper>emcmd . getconfiguration e
128
    All Net Alert bit   IS NOT enabled
    Net Alert           IS NOT enabled
    Broken State Alert IS NOT enabled
    Resync Done Alert  IS NOT enabled
    FailOver Alert     IS NOT enabled
    Net Failure Alert   IS NOT enabled
    LK Config           IS NOT enabled
    Auto Resync         IS NOT enabled
    MS Failover Cluster Config IS enabled
    Shared volume       IS NOT enabled

```

Example to clear all flags:

```
EMCMD . SETCONFIGURATION E 0
```

Multiple Configuration Example to enable Shared Volume and MS Failover Cluster Config (add decimal values 256 + 128):

```
EMCMD . SETCONFIGURATION E 384
```

8.7.44. SETSNAPSHOTLOCATION

EMCMD <system> SETSNAPSHOTLOCATION <volume letter> “<directory path>”

This command sets the snapshot location (directory path) for the given volume on the given system. The directory must be valid on the system in question, must be a local drive/path, must be an absolute path and cannot be left blank (see [CLEARSNAPSHOTLOCATION](#)). If no snapshot location is currently configured, executing this command will have the effect of enabling target snapshots on the given volume.

The parameters are:

<system>	This is the system name/IP address containing volume to be snapshotted.
<volume letter>	This is the drive letter of the volume to be snapshotted.
<directory path>	This is the absolute directory path, local to <system>, for the snapshot file location. Note that this value must be enclosed in quotes if the path contains a space character.

Sample output:

```
Status = 0
```

When the command is successful, it will return a status of 0. Otherwise, it will report a non-zero status.

8.7.45. STOPSERVICE

EMCMD <system> STOPSERVICE

This command stops the DataKeeper service.

8.7.46. SWITCHOVERVOLUME

EMCMD <system> SWITCHOVERVOLUME <volume letter> [-f]

This command attempts to make the given system become the source for the requested volume. **This command is for internal use only.**

The parameters are:

<system>	This is the IP address of the system to become source. Note: Use the system's NetBIOS name, IP address or fully qualified domain name to attach to a given system. You can also use a period (.) to attach to the local system where emcmd is being executed.
<volume letter>	This is the drive letter of the requested volume.
[-f]	This option may be used for a fast (unsafe) switchover. This option should only be used if the status of the current source is known. Incorrect usage of this can result in a split-brain condition.

8.7.47. TAKESNAPSHOT

EMCMD <target system> TAKESNAPSHOT <volume letter> [<volume letter>...]

This command, run on the target system, will notify DataKeeper to establish a snapshot of the given volume(s) on the given system. If no snapshot location has been configured, the command will fail.

The parameters are:

<target system>	This is the target system name/IP address containing the volume to be snapshotted.
<volume letter>	This is the drive letter(s) of the volume(s) to be snapshotted on the target server. If multiple volumes are to be snapshotted, the drive letters should be separated by spaces.

Note: All target volumes must have the same source system.

8.7.48. UNLOCKVOLUME

EMCMD <system> UNLOCKVOLUME <volume letter>

This command forces the volume specified to unlock.

The parameters are:

<system>	This can be either the source or the target systems.
<volume letter>	The drive letter of the volume you want to unlock.

8.7.49. UPDATECLUSTERTARGET STATEPROPERTIES

EMCMD <system> UPDATECLUSTERTARGET STATEPROPERTIES

This command will update the TargetState private properties for all clustered DataKeeper volumes for which the given system is the source.

<system>	This is the system whose volume states will be checked.
----------	---

For more information on the TargetState properties, please see [DataKeeper Volume Resource Private Properties](#).

8.7.50. UPDATEJOB

EMCMD <system>UPDATEJOB <JobId> <Name> <Descr> [<SysName1>
<DrvLetter1> <IP1> <SysName2> <DrvLetter2> <IP2> <MirrorType>]...

This command is for internal use only.

8.7.51. UPDATEVOLUMEINFO

EMCMD <system> UPDATEVOLUMEINFO <volume letter>

This command causes the SIOS DataKeeper service to query the driver for the correct mirror state. This command is useful if the DataKeeper GUI displays information that appears to be incorrect or not up-to-date.

Note: The SIOS DataKeeper service updates the volume information automatically based on new messages in the system [Event Log](#).

The parameters are:

<system>	This can be either the source or the target system.
<volume letter>	The drive letter of the volume that you want to update its info.

If there is an internal error updating volume information, you may see the message:

Unable to update the volume information. The volume may be locked by another process or may not be formatted as NTFS.

8.8. Using DKPwrShell with SIOS DataKeeper

SIOS DataKeeper includes a powershell module (DKPwrShell) that allows a user to manipulate a DataKeeper mirror using Microsoft Powershell. Commands are passed to a SIOS DataKeeper service and will fail if the service is not running.

With Microsoft Powershell v3 or later the SIOS DataKeeper powershell module is loaded automatically when starting Powershell. For Microsoft Powershell versions prior to 3.0 the SIOS DataKeeper powershell module must be loaded via the import-module command by using the following syntax:

```
import-module "<DK InstallPath>\DKPwrShell"
```

Note: By default <DK InstallPath> is C:\Program Files (x86)\SIOS\DataKeeper

[New-DataKeeperMirror](#)

[New-DataKeeperJob](#)

[Remove-DataKeeperMirror](#)

[Remove-DataKeeperJob](#)

[Add-DataKeeperJobPair](#)

[Get-DataKeeperVolumeInfo](#)

8.8.1. New-DataKeeperMirror

This cmdlet is used to create a new DataKeeper mirror. Mirrors created with this cmdlet will be visible in the DataKeeper SnapIn (Reports > Server Overview). If a job exists that includes information that matches this mirror (systems, IP Addresses, Volumes, and Sync Type), the mirror will be displayed in the DataKeeper SnapIn as part of that job.

Parameters

Parameter	Type	Required	Position	Notes
SourceIP	String	Yes	0	IP address on the source to be used for DataKeeper mirror data.
SourceVolume	String	Yes	1	The source volume to mirror.
TargetIP	String	Yes	2	IP address on the target to be used for DataKeeper mirror data.
TargetVolume	String	Yes	3	The target volume to become the mirror target. If not specified it will be the same volume indicated by the SourceVolume parameter.
SyncType	String	Yes	4	Valid options are: Sync – A synchronous mirror Async – An asynchronous mirror
CreateFlags	uint	No	5	Optional arguments that specify behavior deviate from the norm. These can be OR'd together to create a set of options (<i>add decimal values. Example: for option 1 + option 2, place a 3 in the command</i>). 1. Create the mirror without doing a full resync operation. 2. Do not wait for the target side of the mirror to be created before returning.

Inputs

None

Outputs

An integer value representing the status of the command. 0 means that the command succeeded, any other value is a Windows error code.



NOTE: Both source and target IP addresses must be of the same protocol. A mirror can only be created using two IPV4 or two IPV6 addresses. DataKeeper does not currently support mirror endpoints with different protocols.

Example:

```
New-DataKeeperMirror -SourceIP 10.200.8.55 -SourceVolume E -TargetIP 10.200.8.56 -TargetVolume E
-SyncType Async
```

New-DataKeeperMirror 10.200.8.55 E 10.200.8.56 E Async



NOTE: Disk sector size must match on both source and target volumes. See [Sector Size](#) for more information.

8.8.2. New-DataKeeperJob

This cmdlet is used to create a DataKeeper job consisting of two nodes. Jobs created using this cmdlet will be added to the DataKeeper SnapIn the next time it is loaded.

Parameters

Parameter	Type	Required	Position	Notes
JobName	String	Yes	0	The name of the job.
JobDescription	String	Yes	1	A brief description of the job.
Node1Name	String	Yes	2	The FQDN of the first node.
Node1IP	String	Yes	3	The IP address of the first node that is used for DataKeeper Replication.
Node1Volume	String	Yes	4	The volume of the first node that is involved in replication.
Node2Name	String	Yes	5	The FQDN of the second node.
Node2IP	String	Yes	6	The IP address of the second node that is used for DataKeeper Replication.
Node2Volume	String	Yes	7	The volume of the second node that is involved in replication.
SyncType	String	Yes	8	Valid options are: Sync – A synchronous mirror Async – An asynchronous mirror Disk – These two volumes are a single shared disk

Inputs

None

Outputs

On success, an object representing the created job. On failure, an exception containing a Windows error code.



NOTE: Both IP addresses must be of the same protocol (IPv4 or IPv6). DataKeeper does not currently support mirror endpoints with different protocols.

Example:

```
New-DataKeeperJob -JobName "name" -JobDescription "desc" -Node1Name example1.domain.com
-Node1IP 10.200.8.55 -Node1Volume E -Node2Name example2.domain.com -Node2IP 10.200.8.56
-Node2Volume F -SyncType Async
```

```
New-DataKeeperJob "name" "desc" example1.domain.com 10.200.8.55 E example2.domain.com
10.200.8.56 F Async
```

8.8.3. Remove-DataKeeperMirror

This cmdlet will remove a DataKeeper mirror. It will attempt to remove the mirror from all nodes for this mirror. This command will not remove the mirror from any down or network inaccessible node.

Parameters

Parameter	Type	Required	Position	Notes
Source	String	Yes	0	The source node of the mirror.
Volume	String	Yes	1	The mirror volume letter (on the source node) that you want removed.
Target	String	No	2	The IP address of the target system of the mirror. If this parameter is left empty all targets of the source volume will be removed.

Inputs

None

Outputs

An integer value representing the status of the command. 0 means that the command succeeded, any other value is a Windows error code.

Example:

```
Remove-DataKeeperMirror -Source example1.domain.com -Volume E -Target 10.200.8.56
```

```
Remove-DataKeeperMirror -Source 10.200.8.55 -Volume E -Target 10.200.8.56
```

```
Remove-DataKeeperMirror 10.200.8.55 E
```

8.8.4. Remove-DataKeeperJob

This cmdlet will remove a DataKeeper job of a given ID. It will remove this job from all systems contained within the job.

Parameters

Parameter	Type	Required	Position	Notes
JobID	String	Yes	0	The unique job GUID assigned to it when the job was created.
Node	String	Yes	1	The FQDN or IP address of a node containing the job specified by JobID.

Inputs

None

Outputs

An integer value representing the status of the command. 0 means that the command succeeded, any other value is a Windows error code.

Example:

```
Remove-DataKeeperJobPair -JobID a1f1ecc6-649e-476b-bbff-286b815fdd30 -Node
example1.domain.com
```

```
Remove-DataKeeperJobPair a1f1ecc6-649e-476b-bbff-286b815fdd30 10.200.8.55
```

8.8.5. Add-DataKeeperJobPair

This cmdlet will add a node pair to an existing DataKeeper Job. It is used to expand the nodes and volumes contained within an existing job. For example, if a job exists for a volume between nodes A and B, and you want to add node C, run AddDataKeeperJobPair twice:

- for the new relationship definition between node A and node C
- for the new relationship definition between node B and node C

Parameters

Parameter	Type	Required	Position	Notes
JobID	String	Yes	0	The unique job GUID assigned to it when the job was created.
Node1Name	String	Yes	1	The FQDN of the first node
Node1IP	String	Yes	2	The IP address of the first node that is used for DataKeeper Replication.
Node1Volume	String	Yes	3	The volume of the first node that is involved in replication.
Node2Name	String	Yes	4	The FQDN of the second node.
Node2IP	String	Yes	5	The IP address of the second node that is used for DataKeeper Replication.
Node2Volume	String	Yes	6	The volume of the second node that is involved in replication.
SyncType	String	Yes	7	Valid options are: Sync – A synchronous mirror Async – An asynchronous mirror Disk – These two volumes are a single shared disk

Inputs

None

Outputs

An integer value representing the status of the command. 0 means that the command succeeded, any other value is a Windows error code.

Example:

```
Add-DataKeeperJobPair -JobID a1f1ecc6-649e-476b-bbff-286b815fdd30 -Node1Name
example1.domain.com -Node1IP 10.200.8.55 -Node1Volume E -Node2Name example2.domain.com
-Node2IP 10.200.8.56 -Node2Volume F -SyncType Async
```

```
Add-DataKeeperJobPair a1f1ecc6-649e-476b-bbff-286b815fdd30 example1.domain.com 10.200.8.55 E
example2.domain.com 10.200.8.56 F Async
```

8.8.6. Get-DataKeeperVolumeInfo

This cmdlet is used to fetch information about a volume used in DataKeeper. It reports DataKeeper volume information.

Parameters

Parameter	Type	Required	Position	Notes
Node	String	Yes	0	Use the Node parameter to specify the system containing the volume being replicated. This parameter can take the form of an IPv4 address, FQDN, or simply '.' for the local system.
Volume	String	Yes	1	The mirror volume letter (on the system node).

Inputs

None

Outputs

VolumeInfo object

Example:

```
Get-DataKeeperVolumeInfo -Node example.domain.com -Volume E
```

```
Get-DataKeeperVolumeInfo 10.200.8.55 E
```

```
Get-DataKeeperVolumeInfo . E
```

8.9. User Guide

The topics in this section are designed to be a reference for you as you get started using SIOS DataKeeper Cluster Edition, helping you identify the type of configuration you are interested in implementing and providing detailed instructions for effectively using your SIOS DataKeeper Cluster Edition software.

[Getting Started](#)

[Configuring Mirrors](#)

[Working With Jobs](#)

[Working With Mirrors](#)

[Working With Shared Volumes](#)

[Using Microsoft iSCSI Target With DataKeeper on Windows 2012](#)

[DataKeeper Notification Icon](#)

[DataKeeper Target Snapshot](#)

[Using SIOS DataKeeper Standard Edition To Provide Disaster Recovery For Hyper-V Virtual Machines](#)

[Clustering](#)

8.9.1. Getting Started

Choose Your Configuration

DataKeeper can be utilized in a number of different configurations to facilitate a number of different functions including:

- Provide a second physical copy of your data
- Extend an existing WSFC cluster to a remote DR site
- Eliminate the Single Point of Failure associated with traditional WSFC clusters

Review the following replication configurations and their example USE CASES to familiarize yourself with just some of DataKeeper's capabilities. Then use the topics associated with the configuration you are interested in to obtain detailed information about that configuration.

[Disk-to-Disk](#)

[One-to-One](#)

[One-to-Many](#)

[Many-to-One](#)

[N-Shared-Disk Replicated to One](#)

[N-Shared-Disk Replicated to N-Shared-Disk](#)

[N-Shared-Disk Replicated to Multiple N-Shared-Disk Targets](#)

[Setting Up SIOS DataKeeper](#)

[Connecting to a Server](#)

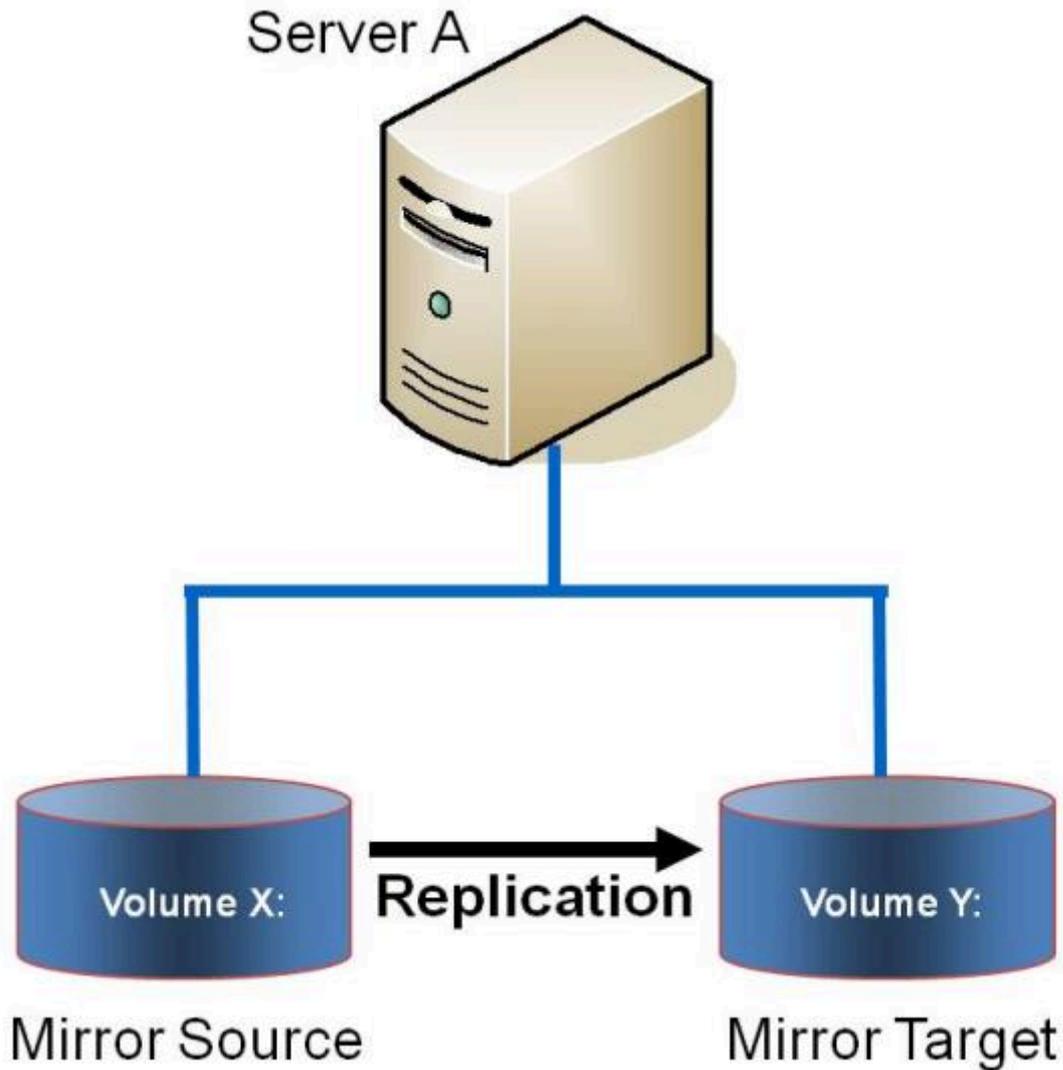
[Disconnecting from a Server](#)

[Creating a Job](#)

8.9.1.1. Disk-to-Disk

This is a simple one server, two disks configuration, mirroring Volume X on Server A to Volume Y on Server A. The volumes that are used for Disk-to-Disk replication can't also be configured to replicate to another system.

* Disk to Disk does not support mirrors with multiple targets.



Example: USE CASE	Replicate data from one volume on a server to another volume on the same server. These disks can be different storage arrays, protecting against data loss should the primary SAN fail.
----------------------------------	---

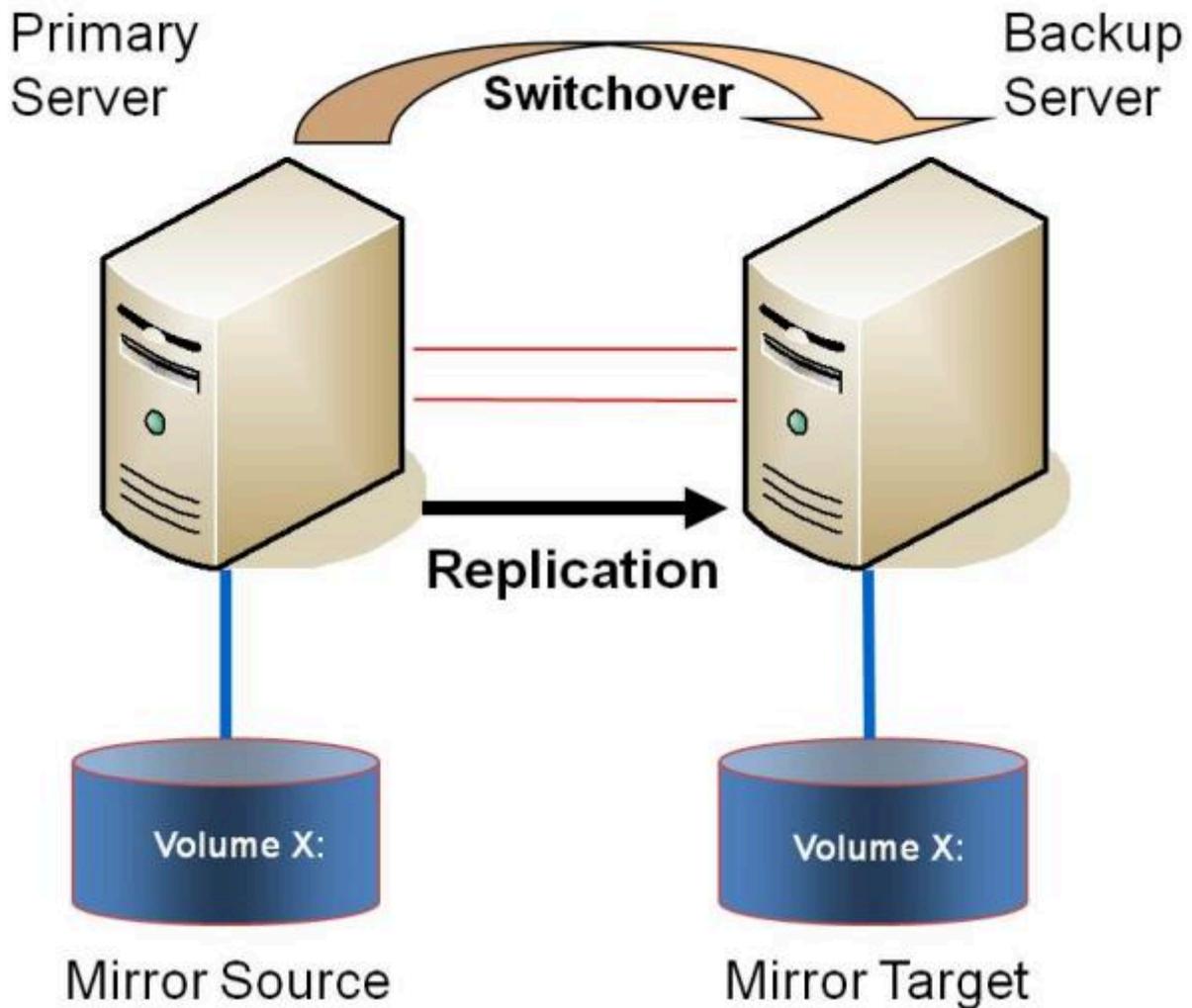
Additional topics of interest include:

- [Creating Mirrors](#)
- [Managing Mirrors](#)

- [Extensive Write Considerations](#)
- [Frequently Asked Questions](#)

8.9.1.2. One-to-One

This is a simple one source, one target configuration, mirroring Volume X across the network. In addition to providing a second physical copy of the data, DataKeeper also provides the ability to switch over the mirror which allows the data to become active on the backup server.



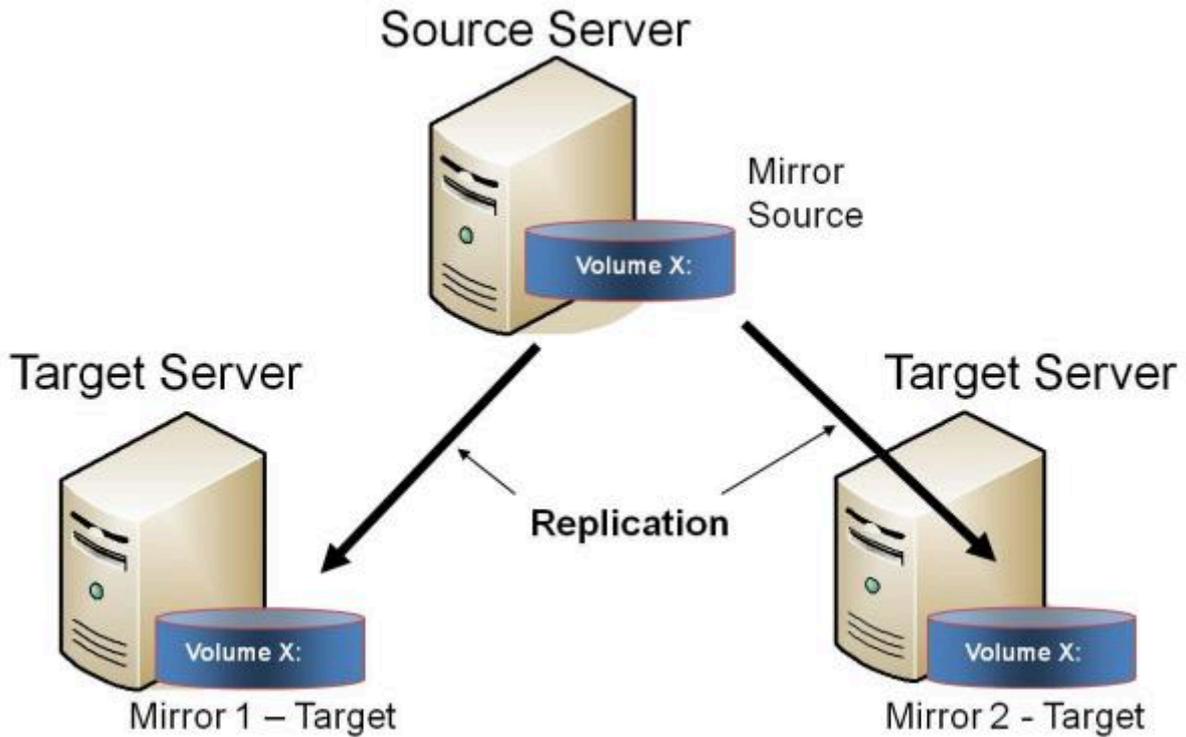
Example: USE CASE	Replicate data on one or more volumes from a server in one city to another server in another city.
----------------------------------	--

Additional topics of interest include:

- [Primary Server Shutdown](#)
- [Secondary Server Failures](#)
- [Using DataKeeper Standard Edition To Provide Disaster Recovery For Hyper-V Virtual Machines](#)
- [Frequently Asked Questions](#)

8.9.1.3. One-to-Many (Multiple Targets)

This configuration involves one primary (source) system replicating one (or more) volume(s) to two different target systems across the network. This is referred to as a multiple target configuration.



Note that there are two mirrors that are completely independent of each other. The mirrors might be using different networks, they may have different compression or bandwidth throttle settings and they may be in completely different states (e.g. Mirror 1 — Mirroring, Mirror 2 — Resyncing).

Example: USE CASE	Replicate data to one target server that resides locally in the same site with the primary server and replicate another copy of the data to a remote site for disaster recovery purposes should something happen to the first site.
Example: USE CASE	To periodically replicate or “push” data to multiple target systems from a single source system.

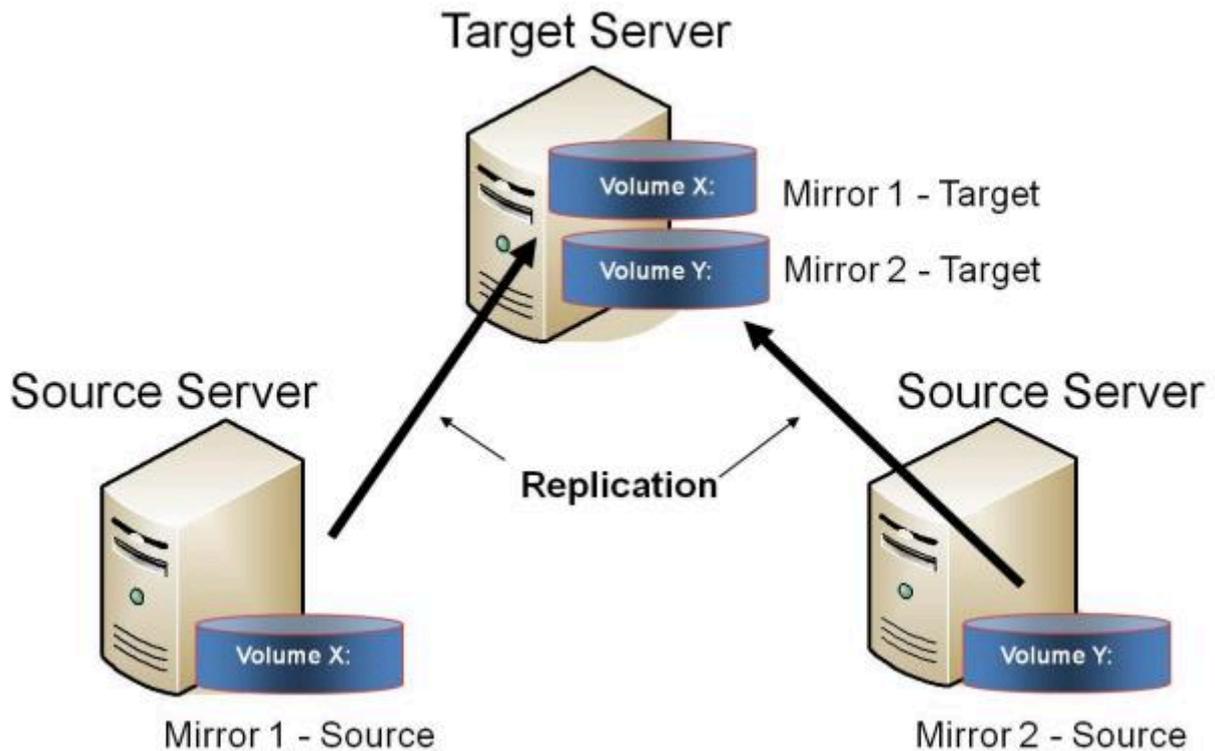
Additional topics of interest include:

- [Primary Server Shutdown](#)
- [Secondary Server Failures](#)
- [Creating Mirrors with Multiple Targets](#)
- [Switchover and Failover with Multiple Targets](#)

- [Using DataKeeper Standard Edition To Provide Disaster Recovery For Hyper-V Virtual Machines](#)
- [Frequently Asked Questions](#)

8.9.1.4. Many-to-One

This configuration involves multiple source servers replicating one (or more) volumes to the same target system. In this configuration, each volume being replicated to the target server must have a unique drive letter.



Note: This is actually two One-to-One mirrors.

**Example:
USE
CASE**

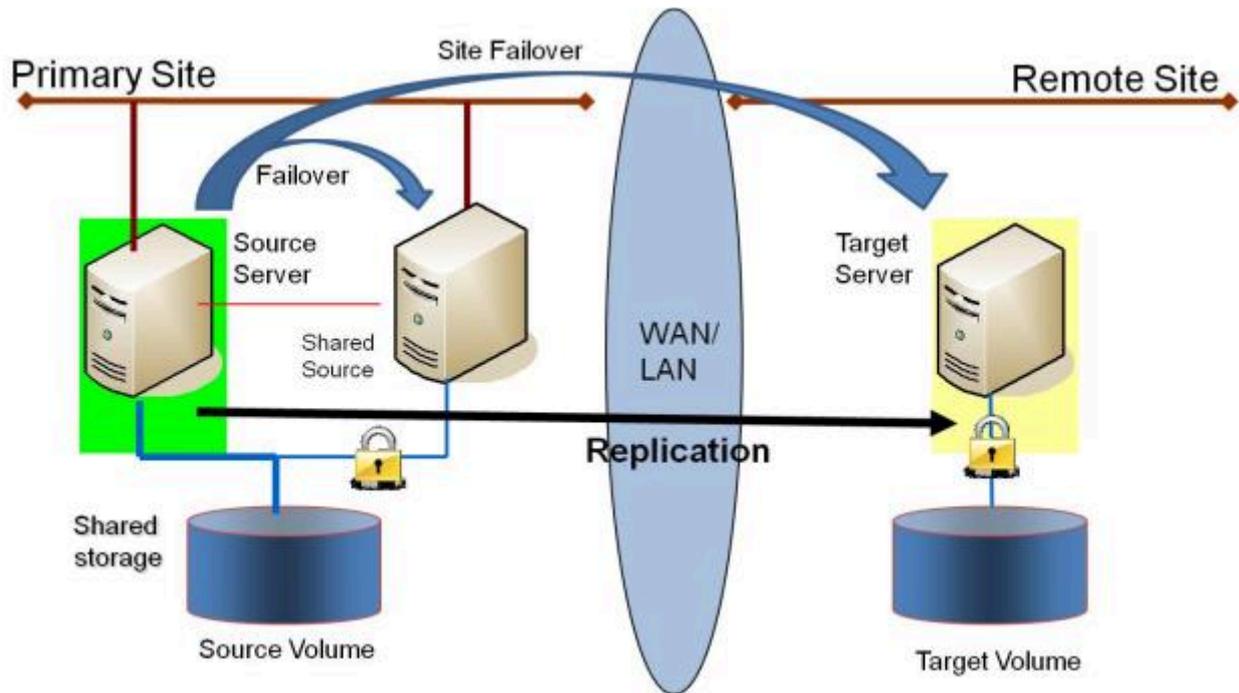
Users may wish to replicate multiple branches back to a single data center for backup consolidation and disaster recovery purposes.

Additional topics of interest include:

- [Primary Server Shutdown](#)
- [Secondary Server Failures](#)
- [Using DataKeeper Standard To Provide Disaster Recovery For Hyper-V Virtual Machines](#)
- [Frequently Asked Questions](#)

8.9.1.5. N-Shared-Disk Replicated to One

This configuration allows you to replicate the shared volume(s) of the primary site to a remote system across the network.



This configuration is ideal for providing local failover within the Primary Site and disaster recovery protection should the entire Primary Site go down.

Example: USE CASE

Extend your WSFC cluster to a DR site by replicating the shared volume to a remote target. In the event of a primary site outage, the remote server becomes the active server.

Additional topics of interest include:

DataKeeper Standalone

- [Creating Mirrors with Shared Volumes](#)
- [Managing Shared Volumes](#)
- [Adding a Shared System](#)
- [Removing a Shared System](#)
- [Frequently Asked Questions](#)

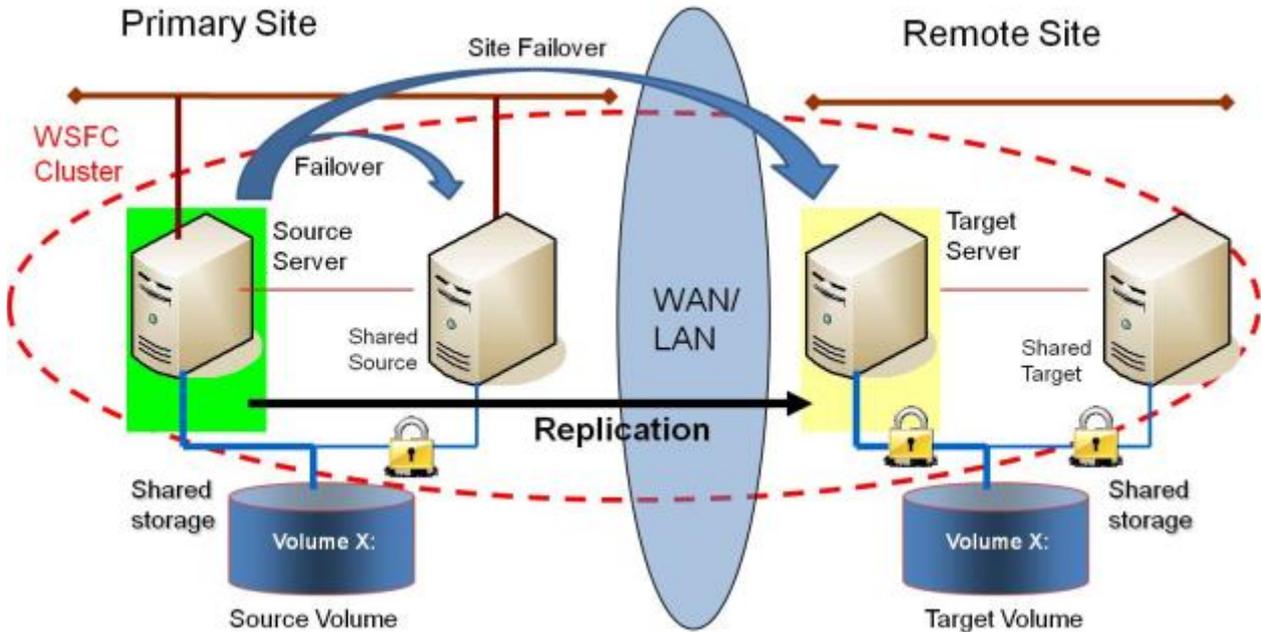
DataKeeper & Failover Clustering

- [DataKeeper Cluster Edition Overview](#)

- [Creating a DataKeeper Volume Resource in WSFC](#)
- [Switchover in an N-Shared x N-Shared Configuration](#)
- [Split Brain Issue and Recovery](#)
- [Using DataKeeper Cluster Edition to Enable Multi-Site Hyper V Clusters](#)

8.9.1.6. N-Shared-Disk Replicated to N-Shared-Disk

This configuration replicates data between sites where each site utilizes shared storage.



Note that the number of systems in the Primary Site does not have to equal the number of systems in the Remote Site.

Also note that only the Source Server has access to the Source Volume. Shared Source systems and all systems on the target side cannot access the volume and are locked from the file system’s perspective.

Example: USE CASE	Users who wish to provide the same level of availability in their DR site will deploy this configuration to ensure that regardless of what site is in service, the availability level stays the same.
Example: USE CASE	Where Hyper-V clusters are configured with virtual machines distributed across many cluster nodes, it is important to have a similar number of cluster nodes available in the disaster recovery sight to ensure that the resources are available to run all of the virtual machines in the event of a disaster.

Additional topics of interest include:

DataKeeper Standalone

- [Creating Mirrors with Shared Volumes](#)
- [Managing Shared Volumes](#)
- [Adding a Shared System](#)
- [Removing a Shared System](#)

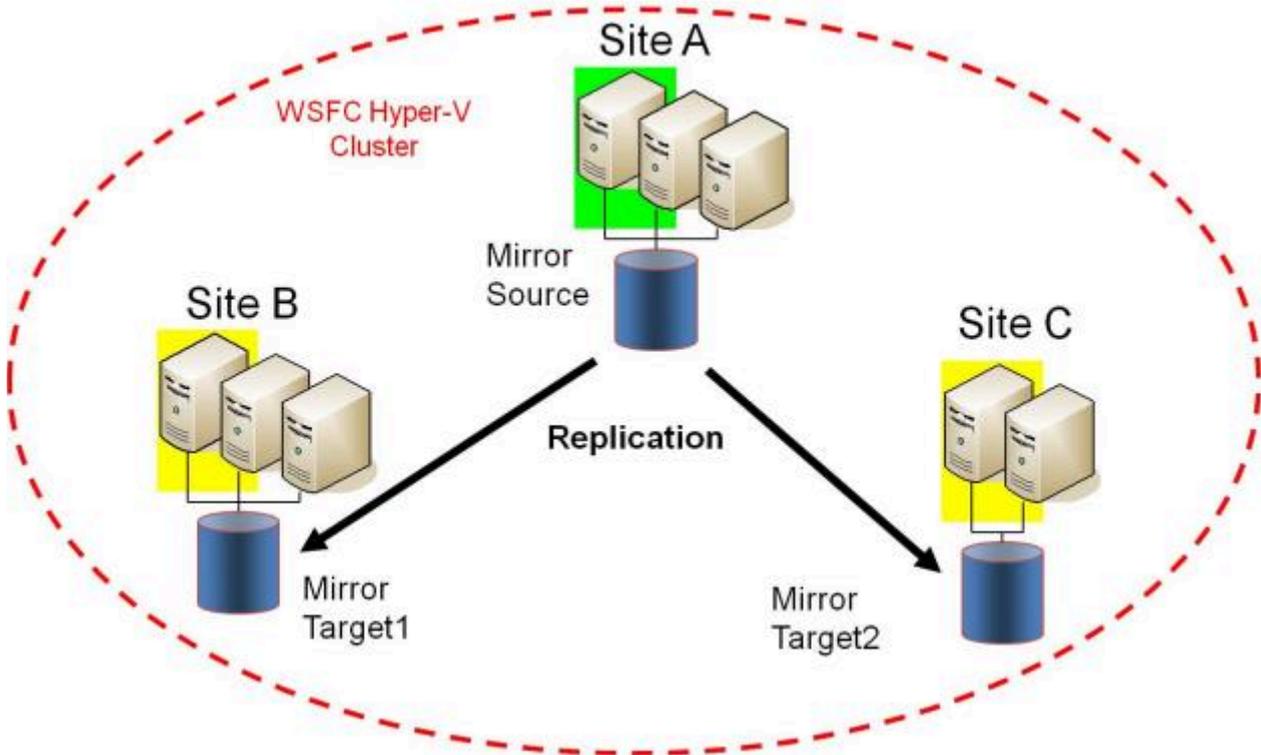
- [Frequently Asked Questions](#)

DataKeeper & Failover Clustering

- [DataKeeper Cluster Edition Overview](#)
- [Creating a DataKeeper Volume Resource in WSFC](#)
- [Switchover in an N-Shared x N-Shared Configuration](#)
- [Split Brain Issue and Recovery](#)
- [Using DataKeeper Cluster Edition to Enable Multi-Site Hyper V Clusters](#)

8.9.1.7. N-Shared-Disk Replicated to Multiple N-Shared-Disk Targets

This is a complex configuration which combines the aspects of replicating a shared storage environment to multiple shared targets.



Note that the number of systems in the Primary Site does not have to equal the number of systems in the Remote Site.

Also note that only the Source Server has access to the Source Volume. Shared Source systems and all systems on the target side cannot access the volume and are locked from the file system’s perspective.

Example: USE CASE	Users who wish to provide the same level of availability in their DR site will deploy this configuration to ensure that regardless of what site is in service, the availability level stays the same.
Example: USE CASE	Where Hyper-V clusters are configured with virtual machines distributed across many cluster nodes, it is important to have a similar number of cluster nodes available in the disaster recovery sight to ensure that the resources are available to run all of the virtual machines in the event of a disaster.

Additional topics of interest include:

DataKeeper Standalone

- [Creating Mirrors with Shared Volumes](#)
- [Managing Shared Volumes](#)

- [Adding a Shared System](#)
- [Removing a Shared System](#)
- [Frequently Asked Questions](#)

DataKeeper & Failover Clustering

- [DataKeeper Cluster Edition Overview](#)
- [Creating a DataKeeper Volume Resource in WSFC](#)
- [Switchover in an N-Shared x N-Shared Configuration](#)
- [Split Brain Issue and Recovery](#)
- [Using DataKeeper Cluster Edition to Enable Multi-Site Hyper V Clusters](#)

8.9.1.8. Setting Up SIOS DataKeeper

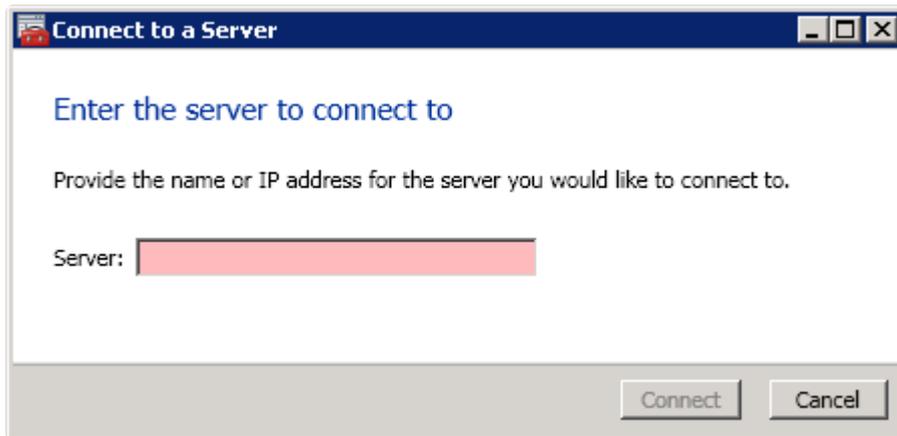
Setting Up SIOS DataKeeper

Follow these steps to start using SIOS DataKeeper:

1. [Connect to the servers](#) you wish to configure for replication. You can select **Connect to Server** from the **Action** pull down menu, right-click on the job folder in the left panel tree display and select **Connect to Server** or choose **Connect to Server** from the **Actions** pane.
2. [Create a Job](#). From the right **Actions** pane, select **Create Job** or you can right-click on the job folder in the left panel tree and select **Create Job**.
3. [Create a mirror](#) for the new job.

8.9.1.9. Connecting to a Server

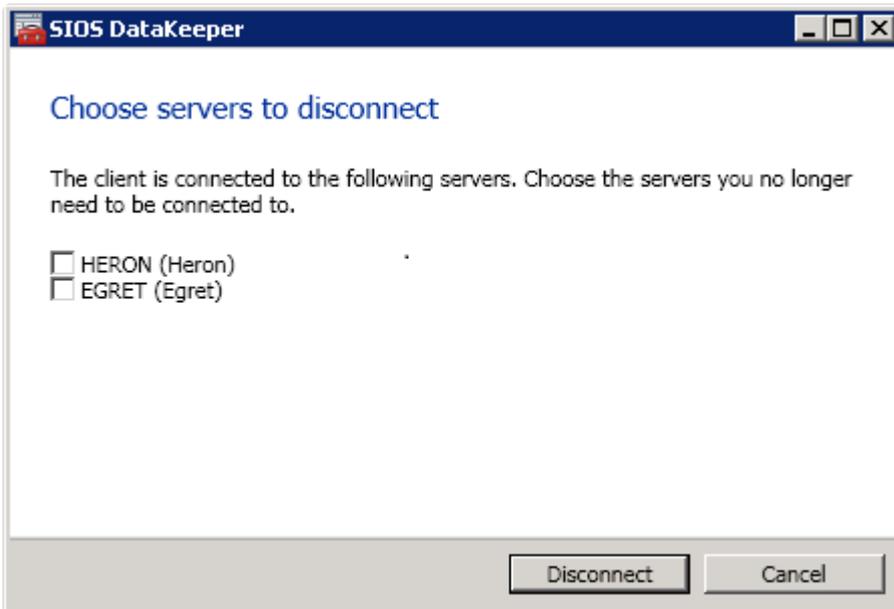
Use this dialog to connect to the server of your choice. You may enter the IP address, system NetBIOS name or the full system domain name for the server. Click **Connect** to select it.



8.9.1.10. Disconnecting from a Server

Use this dialog to disconnect from a server. You may use this option if you no longer wish to view the server in the Administration Window.

From the list of servers, select the server(s) that you wish to disconnect from and click **Disconnect**.



8.9.1.11. Creating a Job

1. If not already connected, [connect to the server](#) where you want to create a [job](#).
2. From the right **Actions** pane, select **Create Job**. The **Job Wizard** will prompt you for a **Job Name** and **Description**.
3. Enter the appropriate information and select **Create Job** to finish.
4. You will immediately be prompted to [Create a Mirror](#) for this job.

8.9.2. Configuring Mirrors

[Creating a Mirror](#)

[Creating Mirrors With Shared Volumes](#)

[Safe Creation of a Shared-Storage Volume Resource](#)

[Creating Mirrors With Multiple Targets](#)

[Switchover and Failover with Multiple Targets](#)

8.9.2.1. Creating a Mirror

Before creating a mirror, ensure the following:

- You have [created a job](#) to hold the mirror.
- The volume on both the source and target systems must be of the **NTFS** file system type.
- The target volume must be greater than or equal to the size of the source volume.
- If the volume will be configured on a **Dynamic Disk**, create the dynamic volume first, then reboot the system before continuing with mirror creation (see the [Mirroring with Dynamic Disks](#) Known Issue for further information).
- See [Volume Considerations](#) for more information, including what volumes cannot be mirrored.
- You must be connected to both the source and target server before creating the mirror. Use the [Connect to Server](#) link in the **Actions** pane or in the **Mirror Create** dialog box.

Creating the Mirror

1. Select **Create a Mirror** from the right column **Actions** task pane. The **Choose a Source** dialog box appears.
2. Enter or choose the **Server Name** for the source volume. You can select the **Connect to Server** link below this field to connect to the server at this time.
3. Choose the **IP address** that is on the subnet you wish to use for the replication traffic. The IP address that you choose must not be used for replication by any other node that is part of this job (see [Duplicate IP Addresses Disallowed Within a Job](#) for further information).
4. Enter or choose the **Volume** to be used on the selected server. Select **Next**. The **Choose a Target** dialog box appears.
5. Enter or choose the server with the **Target Volume**. If necessary, you can select the **Connect to Server** link at this time.
6. Choose the **IP address** that is on the subnet you wish to use for the replication traffic. The IP address that you choose must not be used for replication by any other node that is part of this job (see [Duplicate IP Addresses Disallowed Within a Job](#) for further information).
7. Enter or choose the **Volume** to be used on the selected server. Press **Next** to continue. The **Configure Details** dialog box will display.
8. Use the slide bar to set the **data compression level** for data sent from the source to the target system. **Note:** Compression is only recommended to be used when replicating across WAN

connections.

9. Select how ([Asynchronously or Synchronously](#)) the source volume data should be sent to the target volume.
10. If you wish to limit the amount of bandwidth used by replication, enter the **maximum bandwidth** for transmission; otherwise, leave the default setting. Select **Done**. The job with the new mirror will appear in the left tree pane and the main window displays.

Note: After creating a mirror, its initial state may be displayed as **Resync Pending** in the **Summary** pane. When the initial mirror resynchronization completes, its state will automatically switch to the **Mirror** state.

8.9.2.2. Creating Mirrors With Shared Volumes

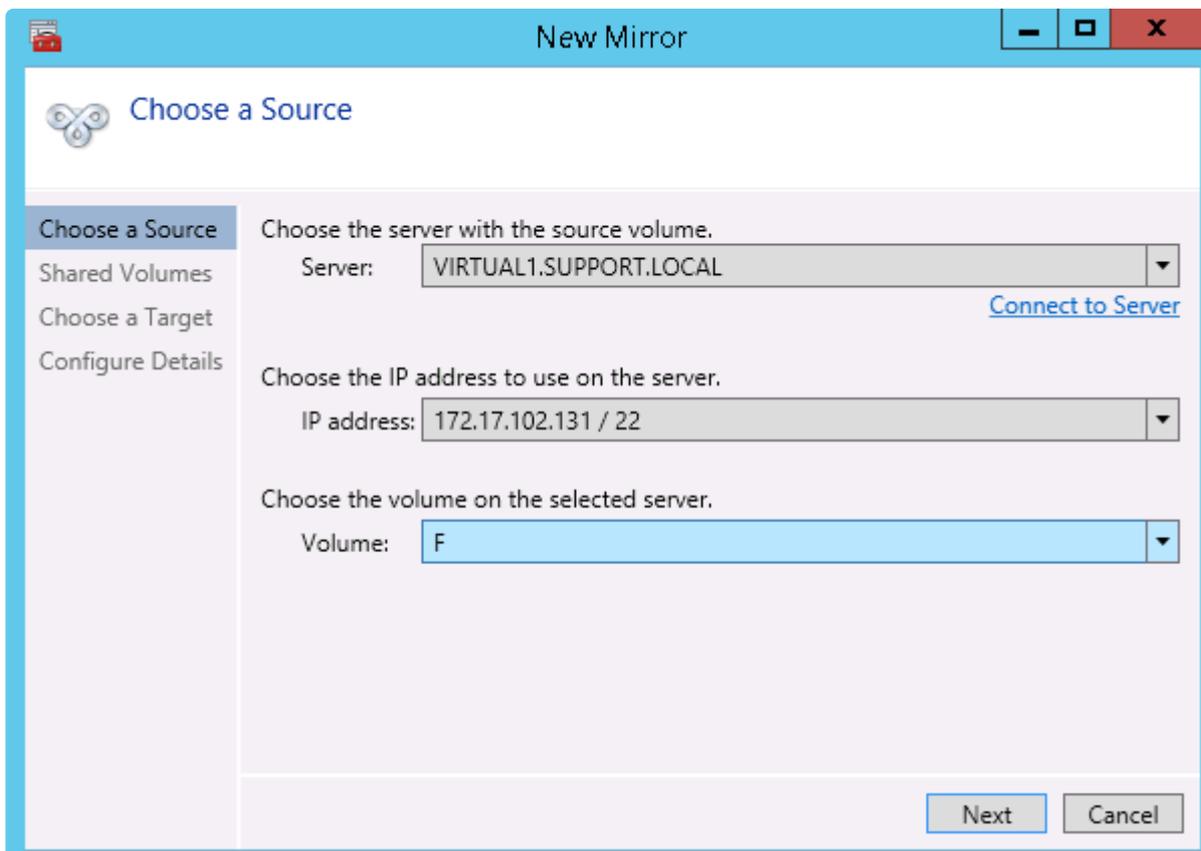
In order to properly configure DataKeeper in a shared volume configuration, use the **DataKeeper GUI** to connect to all systems where the shared volumes are configured. When connected, the DataKeeper GUI uses hardware signatures to automatically detect which volumes are shared and which are not.

Important: If the GUI is not connected to a system, the GUI cannot detect shared volumes on that system.

Note: Dynamic disks are not supported with Shared Storage because the dynamic disk configuration is stored somewhere (undocumented) on each system, not on the disks themselves. There is currently no way to replicate that configuration between the two systems.

Note: DataKeeper allows mirrors to be created on shared volumes where more than one system has access to the same physical storage. To prevent simultaneous access, see [Safe Creation of a Shared-Storage Volume Resource](#) prior to performing the following steps.

1. Connect to all systems via the **DataKeeper GUI**.
2. Choose [Create Job](#).
3. Define a job name and job description and select **Create Job**. The **Choose a Source** dialog box appears.

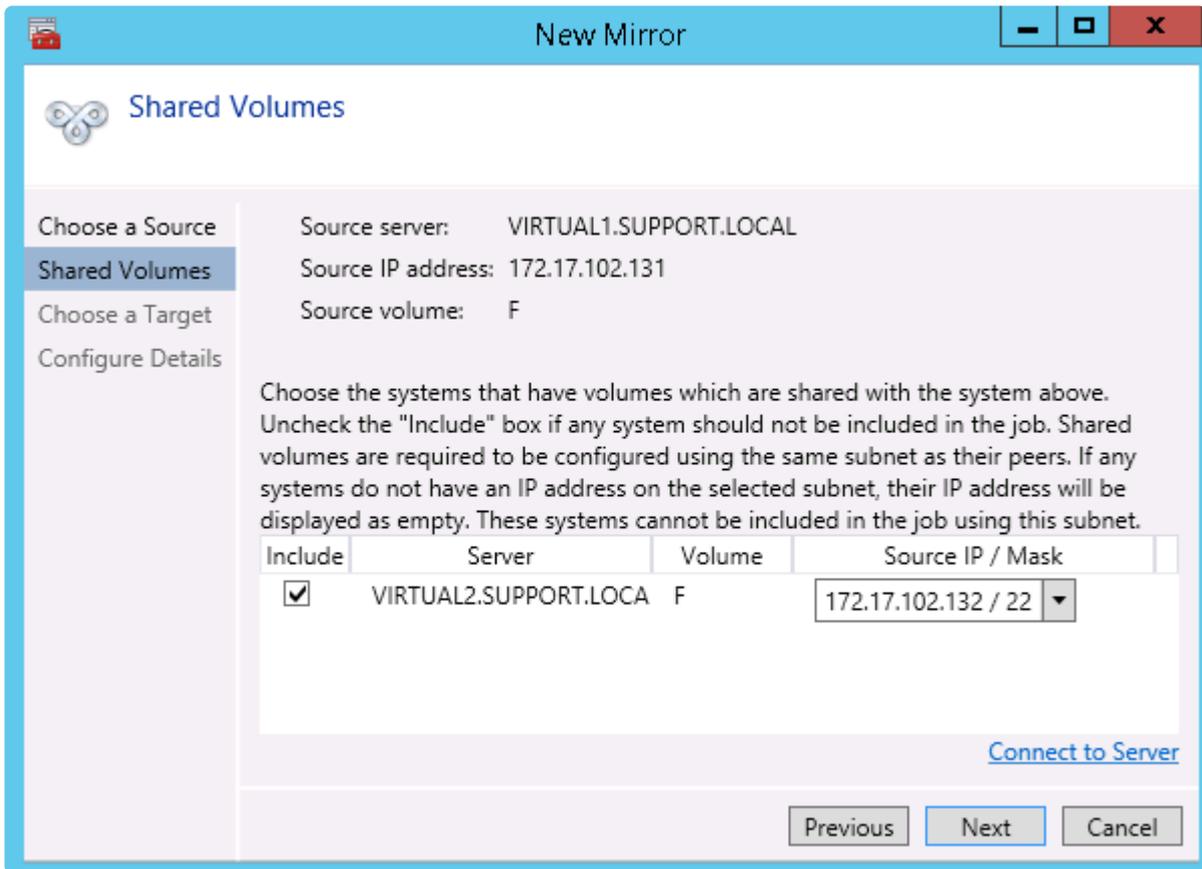


The screenshot shows a Windows-style dialog box titled "New Mirror" with a blue header bar. The main content area is titled "Choose a Source" and features a sidebar on the left with three options: "Choose a Source" (selected), "Shared Volumes", and "Choose a Target". The main area contains three sections for configuration:

- Choose the server with the source volume.** A dropdown menu labeled "Server:" is set to "VIRTUAL1.SUPPORT.LOCAL". A blue link "Connect to Server" is positioned to the right.
- Choose the IP address to use on the server.** A dropdown menu labeled "IP address:" is set to "172.17.102.131 / 22".
- Choose the volume on the selected server.** A dropdown menu labeled "Volume:" is set to "F".

At the bottom right of the dialog, there are two buttons: "Next" and "Cancel".

4. Choose a **Source System, IP Address** and **Volume**.
5. Select **Next**. The **Shared Volumes** dialog box appears.



6. Choose the systems that have volumes which are shared with the source system.

Note: All systems connected to the shared volumes must be configured with IP addresses on the same subnet. The **Next** button will not be enabled until all included systems have a valid IP address.

While it is possible to uncheck the **Include** box for a given system, the user should be very careful to make sure that the volume listed really is not a shared volume. It is possible (although unlikely) that the hardware signatures of two volumes will match even if they are not shared. In this case, it is valid for the user to uncheck the **Include** box.

7. Select **Next**. The **Choose a Target** dialog box appears.
8. Choose a **Target System, IP Address** and **Volume**.
9. Select **Next**.

Note: If there are volumes on other systems that are shared with this target volume, the **Shared Volumes** dialog will appear next. Configure these shared target volumes as you would for shared source volumes, described above.

10. Select **Next** to continue. The **Configure Details** dialog box appears.
11. Use the slide bar to set the **data compression level** for data sent from the source to the target system.

Note: Compression is only recommended to be used when replicating across WAN connections.

12. Select how ([Asynchronously or Synchronously](#)) the source volume data should be sent to the target volume.
13. If you wish to limit the amount of bandwidth used by replication, enter the [maximum bandwidth](#) for transmission; otherwise leave the default setting.
14. Select **Done**. The job with the new mirror will appear in the left tree pane and the main window displays.

8.9.2.3. Safe Creation of a Shared-Storage Volume Resource

DataKeeper allows mirrors to be created on shared volumes where more than one system has access to the same physical storage. The shared volume can be on the source side of the mirror or on the target side.

Note: Dynamic disks are not supported with Shared Storage because the dynamic disk configuration is stored somewhere (undocumented) on each system, not on the disks themselves. There is currently no way to replicate that configuration between the two systems.

In order to safely create a shared-storage volume resource, the user must ensure that only one system has write access to the volume at any time. This includes the time prior to the creation of the DataKeeper mirror. Since DataKeeper doesn't know that the volume is shared before a mirror is created, manual steps must be taken to ensure that the volume is never writable on two or more systems at the same time.

To protect the volume from simultaneous write access, use the following procedure. In this example, two systems – *SYSA* and *SYSB* – are connected to shared storage, then replicated to a third system, *SYSC*, the target system. This storage is configured with two volumes which should be assigned drive letters *E:* and *F:* on all three systems.

1. Power on *SYSA*, while leaving *SYSB* powered off.
2. Install DataKeeper if it has not been installed.
3. Assign drive letters *E:* and *F:* to the volumes; format with NTFS if not formatted yet.
4. Power off *SYSA*.
5. Power on *SYSB*.
6. Install DataKeeper if it has not been installed and reboot the system after the installation.
7. Assign drive letters *E:* and *F:* to the shared volumes.
8. In a command prompt, run the following commands to set the “shared” config flag:

```
"%ExtMirrBase%\emcmd" . setconfiguration E 256
```

```
"%ExtMirrBase%\emcmd" . setconfiguration F 256
```

9. Reboot *SYSB*. It will come up with the *E:* and *F:* drives locked.
10. Power on *SYSA*. It will come up with the *E:* and *F:* drives writable.

11. Use the DataKeeper GUI to [create a job and mirror](#) from *SYSA E:* (source) to *SYSC E:* (target) and from *SYSA F:* (source) to *SYSC F:* (target). DataKeeper will detect that *SYSB* is a shared source system.

Note: If using WSFC, see [Creating a DataKeeper Volume Resource in WSFC](#).

An alternative to powering the systems off is to use **Disk Management** to take the shared physical disk offline.

This procedure can also be used to safely create a mirror on a shared target volume. In the example above, the mirror could have been created from *SYSC* to *SYSA* – in that case, the volume **SYSB** would be a shared target.

If you have more than two shared systems at a site, this same procedure can be used to lock the volume on all systems that will not be part of the initial mirror.

8.9.2.4. Creating Mirrors With Multiple Targets

SIOS DataKeeper provides the ability to replicate data from a single source volume to one or more target volumes. In addition, DataKeeper also allows you to switch over control and make any of the target volumes become the source. Assuming you have already created a job with a mirror using the [Create a Mirror](#) procedure, use the following procedure to create a second mirror from the same source volume to a different target volume:

1. Right-click on an existing job.
2. Choose the **Create a Mirror** action.
3. Choose the **source** of the existing mirror (as this will also be the source of the new mirror).
4. Choose the **target** for the new mirror.
5. Select **Done**.

The next dialog displayed prompts you for additional information that DataKeeper requires to be able to properly switch over the source volume to one of the target volumes. You already specified the network endpoints between the source system and the first target system when you created the first mirror. You also specified the network endpoints between the source system and the second target system when you created the second mirror.

The final piece of information DataKeeper requires is the network endpoints of a (potential) mirror between the first target system and the second target system so that no matter which system becomes the source of the mirrors, mirrors can be properly established between all three systems.

6. On the **Additional Information Needed** dialog, choose the **network endpoints** that will be used to create a mirror between the first target system and the second target system.

This mirror will not be created now. DataKeeper is simply storing these mirror endpoints for future use.

7. Select **OK**.

Note: If you are replicating a single source volume to more than two target volumes, you will have to provide network endpoints for mirrors between all of the systems involved.

Examples:

3 Nodes (A,B,C) – Define Endpoints for Mirrors	
Created Mirrors	Additional Mirror Relationships

3 Nodes (A,B,C) – Define Endpoints for Mirrors	
A → B	B → C
A → C	

4 Nodes (A,B,C,D) – Define Endpoints for Mirrors	
Created Mirrors	Additional Mirror Relationships
A → B	B → C B → D C → D
A → C	
A → D	

8.9.2.5. Switchover and Failover with Multiple Targets

In a multiple target configuration, it is important to understand how DataKeeper mirrors will work in the following scenarios:

- Manual switchover to a target server
- Source server failure followed by a manual switchover to a target server

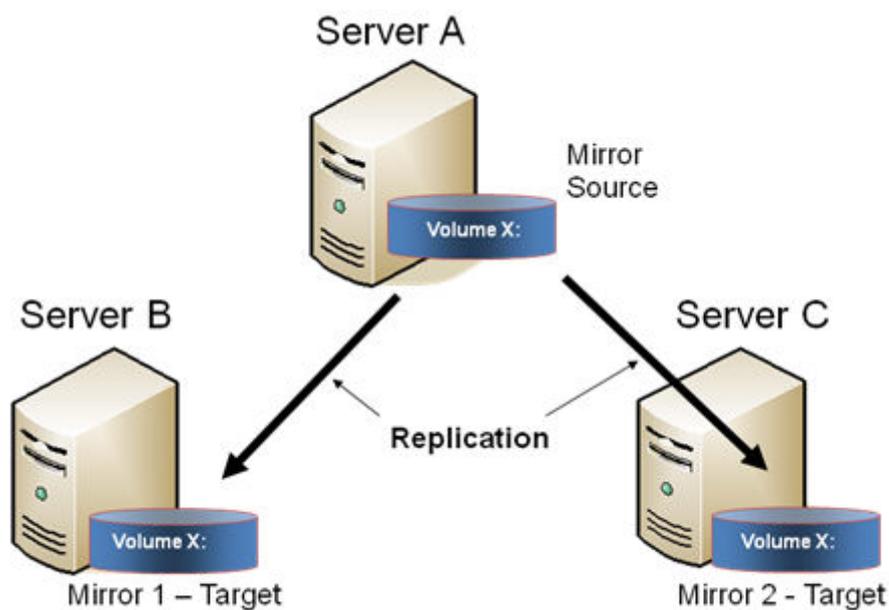
Example:

In the following scenario, there are three servers:

- Server A (source)
- Server B (target 1)
- Server C (target 2)

Note that there are two separate mirrors and Server A is replicating to two different target volumes.

- Mirror 1: Server A → B
- Mirror 2: Server A → C



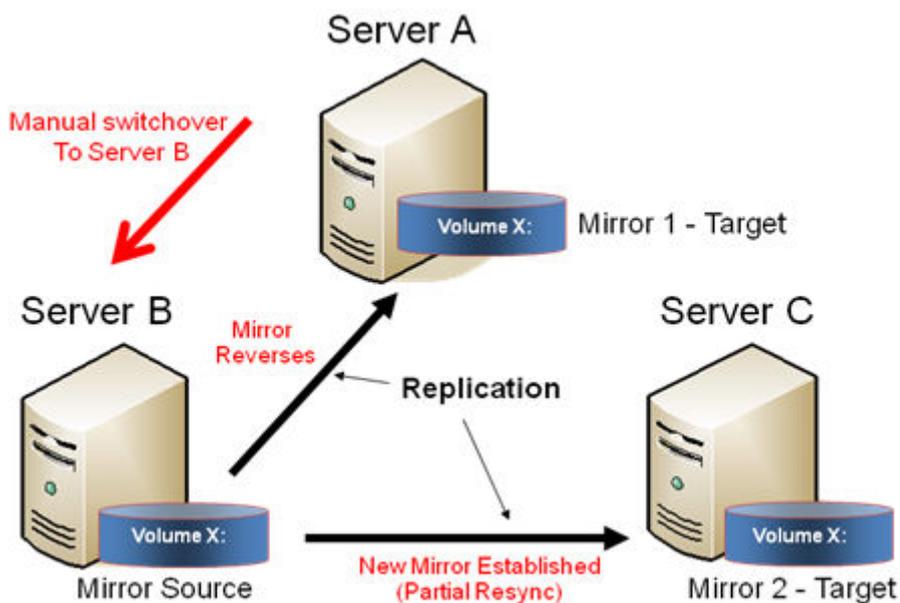
Manual Switchover to a Target Server

In the event the administrator wants to make Server B become the active (source) server, the following actions will occur:

1. Administrator initiates a switchover to Server B via the **Switchover Mirror** option in the DataKeeper UI.
2. Server A flushes its data to the source volume.
3. Mirror 1 is automatically deleted and recreated from Server B to Server A.
4. The mirror between Server A and Server C is also automatically deleted. (**Note:** There will be a few seconds delay noticed in the DataKeeper GUI; this delay can take some time based on [network bandwidth](#) and server performance.)
5. A new mirror is established between Server B and Server C. The [intent log](#) from Server A is copied to Server B. Only a partial resync of the data between Server B and Server C is required to bring them in sync. (A partial resync is the resynchronization of only the necessary data to establish the new end points and is usually much quicker than a full resync.)

RESULT

- Mirror 1: Server B → A (partial resync)
- Mirror 2: Server B → C (copy intent log from Server A, partial resync)



Source Server Failure – Manual Switchover to a Target

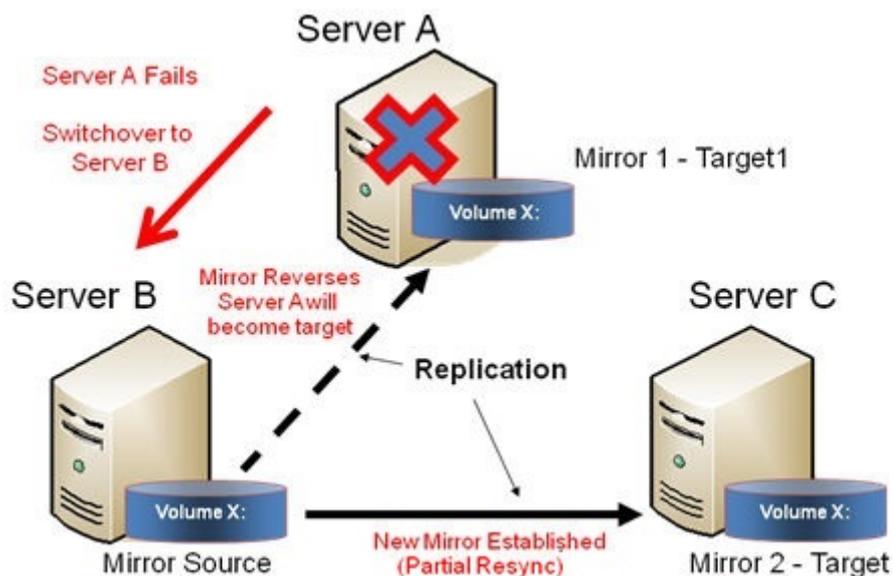
Server

In the event the active (source) server fails, DataKeeper allows you to make Server B become the active (source) server. The following actions will occur:

1. Server A fails.
2. Administrator initiates a switchover to Server B via the “Switchover Mirror” option in the DataKeeper UI.
3. Server B deletes the local side of the mirror and creates a new mirror from Server B to Server A.
4. The mirror between Server A and Server C is deleted.
5. A new mirror is established between Server B and Server C.
6. When Server A comes back up, Server A detects that Server B became the source of the mirror while Server A was down and Server A automatically becomes the target of the mirror.

RESULT

- Mirror 1: Server B → A (partial resync when Server A comes back up)
- Mirror 2: Server B → C (partial resync)



8.9.3. Working With Jobs

[Jobs](#)

[Renaming a Job](#)

[Deleting a Job](#)

[Reassigning a Job](#)

[Switching Over a Mirror](#)

8.9.3.1. Jobs

For ease of use and configuration, SIOS DataKeeper does much of its management of mirrors through an entity called a job. A job is a logical grouping of related mirrors and servers. This feature allows you to create a job for complex repetitive tasks and run them quickly from the SIOS DataKeeper user interface.

Mirrors that are related should be placed in a single job. For instance, multiple mirrors protecting an application like SQL Server should be placed in the same job. Mirrors that are unrelated should be placed in separate jobs.

Note: Mirrors created in previous versions of SIOS Data Replication will be imported as individual jobs. The administrator must take care to edit these jobs to ensure that mirrors are logically grouped together.

 Summary of Test 1 - Creating Mirrors
Test 1 has 1 mirrors

Job name: Test 1
 Job description: Creating Mirrors
 Servers: HERON, EGRET
 Job state: ✔ Mirroring

Source System	Target System	Target Volume	Source IP	Target IP	State	Resync Remaining
Source volume Y						
EGRET	HERON	Y	172.17.108.164	172.17.108.163	▶ Mirroring	0.00 KB

Mirror type: Asynchronous
 File system: NTFS
 Disk space: 146.68 GB
 Compression: None
 Maximum bandwidth: 0 kbps

8.9.3.2. Renaming a Job

1. Select the job in the left **Console Tree** pane of the main DataKeeper window.
2. You can select **Rename Job** from the **Actions** pane or right-click on the selected job and choose **Rename Job** from the menu that displays.
3. Enter the new **Job Name** and new **Job Description**.

8.9.3.3. Deleting a Job

1. Select the job in the left **Console Tree** pane of the main DataKeeper window.
2. You can select **Delete Job** from the **Actions** pane or right-click on the selected job and choose **Delete Job** from the menu that displays.
3. Select **Yes** to delete the selected job and associated mirror(s).

8.9.3.4. Reassigning a Job

Use the **Reassign Job** function to move an existing mirror from one job to another without deleting the mirror.

1. Select the job from the middle **Summary** panel.
2. Right-click and select **Reassign Job** or select **Reassign Job** from the **Actions** panel.
3. Select an existing job from the **Existing Jobs** dropdown list and press the **Assign Job** button.
The new job assignment will display in the middle **Summary** panel.

Note: You can also choose to **Create a New Job** from this dialog if you do not want to use an existing job.

8.9.3.5. Switching Over a Mirror

The Switchover Mirror function enables you to switch over all the mirrors in a job or just one of the mirrors in a job. A “mirror” includes all variants for mirrors such as standard single-target replication and complex geometries such as multi-target replication and shared node sources and targets. These complex mirror configurations and geometries actually implement a related collection of individual mirrors working as a single unit.

Note: Before switching over a mirror to the current target system, the mirror must be in the **Mirroring** state. Please see the **Requirements for Switchover** table below to understand switchover requirements in multiple target and shared source/target configurations. Please use the DataKeeper GUI to view the state of the mirror; the WSFC GUI will not provide that level of detail and will state that the resources are on-line (Green) even when the mirrors are not in the mirroring state.

1. Select the job in the left column tree pane.
2. Right-click on the selection and select **Switchover Mirrors**.
3. A dialog displays allowing you to designate which node/host(s) in the selected job or mirror should become the new mirror source.

In the case of complex mirrors, it is valid to choose either a shared peer of the current mirror source or any one of the active targets that are currently in the mirroring state. Choosing a shared peer of an active target or one that is not currently mirroring will result in an error and leave the current mirror status and configuration unchanged.

4. An hour glass will appear over the mirror icon in the left tree panel.
5. You can confirm the switchover is complete by checking the mirror status in the **Summary** panel.

Note: If the **Switchover** option is grayed out (not available), this could mean the volume is under clustering protection (Microsoft clustering or SIOS Protection Suite clustering).

Requirements for Switchover

Configuration Type	Example Configuration	Switchover Action	Requirements for Switchover
Single Target	A → B	Switchover to B	Allowed if mirror is in MIRRORING STATE
Multiple Target	A → B (mirroring)	Switchover to B	Allowed because A→B mirror is in MIRRORING state
	A → C (paused)	Switchover to C	Not allowed

Shared Source/ Target	*S1,S2,S3 → *T1,T2 (S1 is current source) (T1 is current target)	Switchover to shared source (S2 or S3)	Always allowed
		Switchover to current target (T1)	Only allowed if mirror in MIRRORING state
		Switchover to shared target (T2)	Not allowed — Switchover will fail

8.9.4. Working With Mirrors

[Managing Mirrors](#)

[Pause and Unlock](#)

[Continue and Lock](#)

[Partial Resync](#)

[Break](#)

[Resync](#)

[Deleting a Mirror](#)

[Replacing a Target](#)

[DataKeeper Volume Resize](#)

[Mirror Properties](#)

[Changing the Compression Level of an Existing Mirror](#)

8.9.4.1. Managing Mirrors

From the **Actions** pane, you can select a job and manage all the mirrors in a job, or you can perform an action on a single mirror in a job.

After selecting a job, you can:

- [Pause and Unlock](#) All Mirrors
- [Continue and Lock](#) All Mirrors
- [Break](#) All Mirrors
- [Resync](#) All Mirrors
- [Switchover](#) All Mirrors

The target-level actions (at the bottom of the **Actions** pane) are for individual mirrors. For example, if you have a job with two mirrors and you select one of the mirrors then choose the target **Pause and Unlock Mirror** action, only the selected mirror would be paused.

8.9.4.2. Pause and Unlock

This command pauses the mirror and unlocks the volume on the target system. You may wish to unlock the target volume in order to make a backup of the volume.

Warning: Any writes to the target volume while it is unlocked will be lost when the mirror is continued.

Note: If replacing the target volume, either [break the mirror](#) or [delete the mirror](#) in order to ensure a full resync of the data from the source volume to the new target volume when the new target volume is in place. See [Replacing a Target](#) for further information.

The [Continue and Lock](#) command will relock the target volume, perform a partial resync.

1. Select the job that contains the mirror you want to unlock.
2. Right-click on the job selection and choose **Pause and Unlock All Mirrors** or select **Pause and Unlock All Mirrors** from the **Actions** task pane.
3. Select **Yes** to pause and unlock all mirrors in the selected job.

8.9.4.3. Continue and Lock

This action locks the volume on the target system and then resumes the mirroring process.

While the mirror is paused, writes on the source system are recorded in the SIOS DataKeeper [Intent Log](#). When the **Continue and Lock** operation occurs, these changed blocks – along with any blocks that also changed on the target volume – are sent from the source to the target, and the mirror is resynchronized in what is called a [Partial Resync](#).

Warning: Any writes to the target volume while unlocked are lost when the mirror is continued.

Note: If *replacing* the target volume, either [Break](#) the mirror or [Delete the Mirror](#), which requires either a **Resync** or **Recreate** instead of Continue and Lock. See [Replacing a Target](#) for further information.

1. Select the job that contains the mirror you want to continue.
2. Right-click on the job selection and choose **Continue and Lock All Mirrors** or select **Continue and Lock All Mirrors** from the **Actions** task pane.
3. Select **Yes** to continue and lock all mirrors in the selected job.
4. The mirror state will change to **Mirroring** in the **Mirror Summary** window.

8.9.4.4. Partial Resync

A partial resync is the resynchronization of only the necessary data to establish the new end points and is usually much quicker than a full resync.

8.9.4.5. Break

Breaking a mirror is similar to the **Pause and Unlock** function. It suspends mirror operation and unlocks the target volume for read/write access. The difference is that the **Break** operation marks all bits in the DataKeeper [Intent Log](#) as dirty, which forces a full resync to occur when the mirror is resync'ed to resume mirroring.

Warning: Do not write to the target volume while the mirror is broken. Any writes to the target while the mirror is broken will be lost when the mirror is resynchronized.

1. Select the job that contains the mirror you want to break.
2. Right-click on the job selection and choose **Break All Mirrors** or select **Break All Mirrors** from the **Actions** task pane.
3. Select **Yes** to break all mirrors in the selected job.
4. The mirror state will change to **Broken** in the **Mirror Summary** window.

Note: The **Resync** command will relock the Target volume, perform a **full resync** and resume the mirroring process.

8.9.4.6. Resync

Use this command to re-establish a broken mirror. A full resync will be performed.

1. Select the job that contains the mirror you want to resync.
2. Right-click on the job selection and choose **Resync All Mirrors** or select **Resync All Mirrors** from the **Actions** task pane.
3. Select **Yes** to resync all mirrors in the selected job.
4. The mirror state will change to **Mirroring** in the **Mirror Summary** window.

8.9.4.7. Deleting a Mirror

This action discontinues replication and removes the mirror from the associated job. The target volume is unlocked and made fully accessible.

1. Select the job that contains the mirror you want to delete.
2. Right-click on the mirror and choose **Delete Mirror** or select **Delete Mirror** from the **Actions** task pane.
3. Select **Yes** to delete the mirror.
4. The mirror will be deleted and removed from the associated job.

Note: If the **Delete Mirror** option is grayed out (not available), this could mean the volume is under clustering protection (Microsoft clustering or SIOS Protection Suite clustering).

8.9.4.8. Replacing a Target

When replacing the target volume, you must [delete the mirror](#) in order to ensure a full resync of the data from the source volume to the target volume when the target volume is back in place. Deleting the mirror discontinues replication altogether removing the mirror from the job so that when your mirror is recreated with the new target, a full resync will be performed.

Using the DELETE Command

1. Select the mirror that contains the target you want to replace.
2. Right-click on the mirror and choose **Delete Mirror** or select **Delete Mirror** from the **Actions** task pane.
3. Select **Yes** to delete the mirror.
4. Once new target is in place, [recreate the mirror](#).

Note: If an entire Server/Target is being replaced, please ensure the following registry key from the Source node is exported and merged to the new Target.

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Jobs\
```

This will ensure that the configurations for the mirrors are identical on the Source/Target(s) and are available for switchover in Windows Server Failover Cluster (WSFC).

8.9.4.9. DataKeeper Volume Resize

DataKeeper allows users to extend and shrink their DataKeeper volumes dynamically while retaining mirror settings. Once the resize is complete, a partial resync will be performed.

Note: This resize procedure should be performed on only one volume at a time.

! **WARNING** Do NOT attempt to perform the resize in releases prior to DataKeeper for Windows v7.4.

Restrictions

- DataKeeper does not support changing the disk type of the physical disk where a mirrored volume is located (for example, **Basic Disk** to **Dynamic Disk** — mirror must be deleted prior to creating your dynamic disk).
- DataKeeper does not support third-party partition resizing products.
- DataKeeper does not support volume resizing on shared volumes configured on **Dynamic Disks**. Windows cannot reliably use a shared Dynamic Disk.

Non-Shared Volume Procedure

Example configurations for using this procedure include the following:

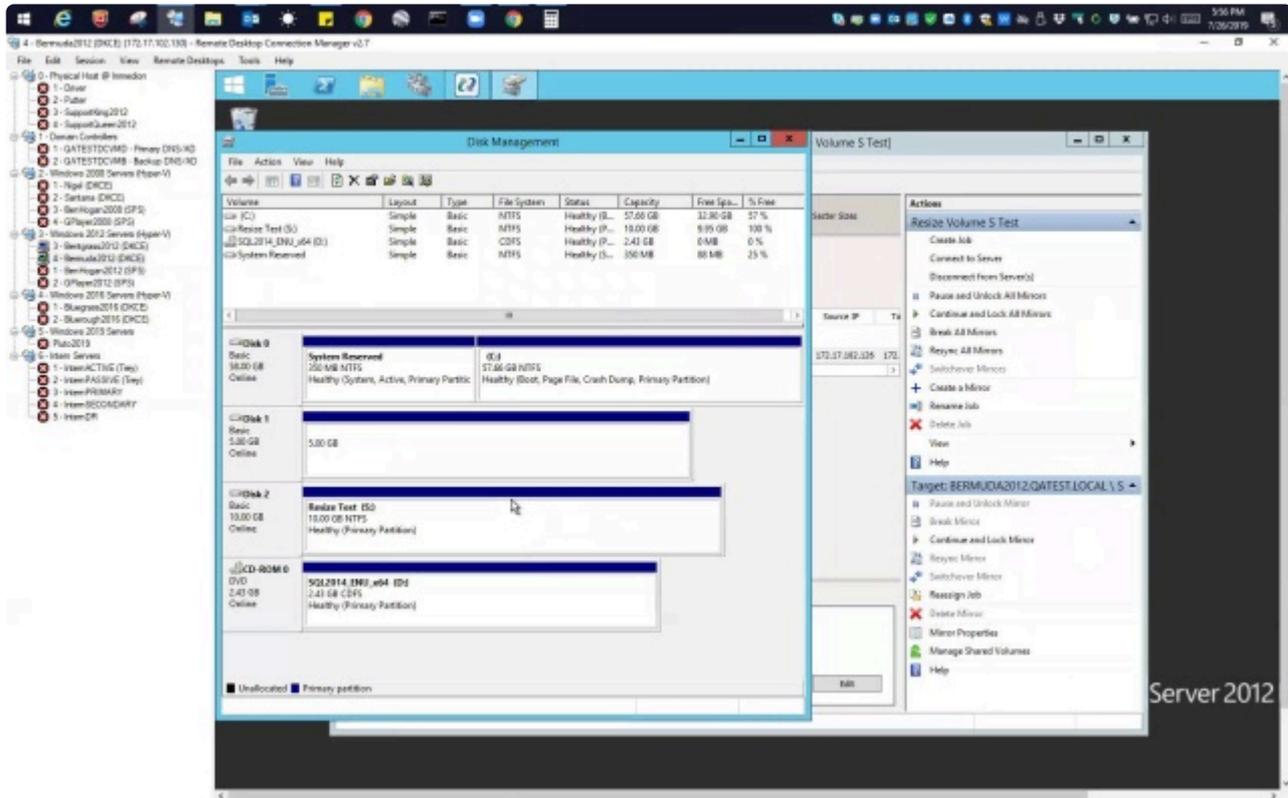
[Disk-to-Disk](#)

[One-to-One](#)

[One-to-Many 'Multiple Targets'](#)

[Many-to-One](#)

To resize your DataKeeper volume in a non-shared volume configuration, perform the following steps.



<https://fast.wistia.net/embed/iframe/ryp1be5r8l>

✿ Starting in v8.7.2, DataKeeper will automatically pause mirrors that are being resized if you do not manually pause them.

1. Pause all mirrors and unlock all target volumes via the [Pause and Unlock](#) mirror option in the DataKeeper UI.

Note: A mirror must be in a “mirroring” state in order to Pause or Unlock it.

2. Using the **Windows Disk Management** utility, increase (or decrease if allowed by the Operating System) the volume size on the source system by selecting “**Extend Volume**” or “**Shrink Volume**” in the *Resizing Wizard*. **Once that resize is complete and verified, resize the target system(s). Make sure that the raw volume size of each target is greater than or equal to the size of the source volume.**

Note: The Windows Disk Management utility will take longer to start on the target node based on the number of drives. Because the Windows operating system has error condition retries built in when a volume is locked, the speed with which it starts on the “locked” target node is affected.

Note: After the resizes on the source and target you will need to run a Rescan in Disk Management. Then, you will need to run the following on each system in the cluster so that DataKeeper sees the new volume size:

- Go to a command prompt (run as administrator)
- cd extmirrbase

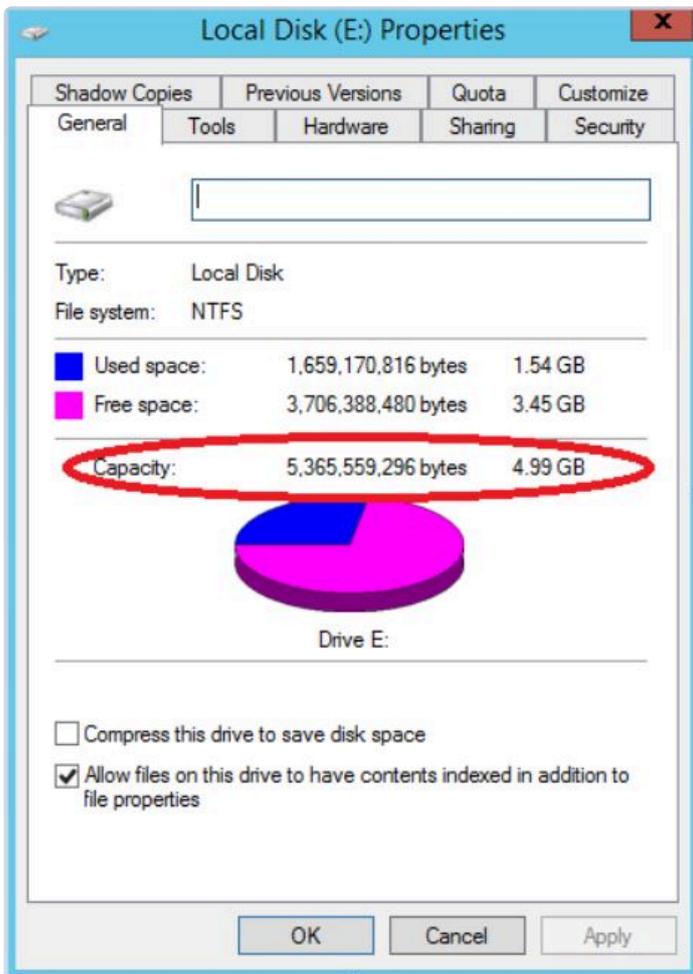
- emcmd . updatevolumeinfo <enter-volume-letter>

3. Verify the **Source and Target** are the same size or the Target is larger using one of the following methods.

Method 1

Review the Total Capacity of the Source/Target in Disk Management.

- View the “unlocked” drives in Disk Management. The Total Capacity (in bytes) **must be equal** on the Source and Target **or the Target must be larger**.
- Select the drive, choose Properties and view Capacity. Capacity equals Total Capacity as also reflected in the `emcmd . getvolumeinfo` output.



If any of the aforementioned steps are NOT yielding the proper sizes after resizing, please perform any of the following:

- In Disk Management, Offline the Disk in question (e.g. Disk 1, Disk 2), then Online the Disk. This will update the partition tables to reflect the correct sizes.

! If performing this on the Source, you may not be able to access an Offline Disk.

- Reboot the Target to reflect the size changes.
- Use **DISKPART** to ensure the resize changes get accurately propagated:

From an elevated Administrator command prompt:

- type **DISKPART**
- DISKPART> **list volume**
- DISKPART> **select volume #**

Note: # is the number of the affected volume which can be found with **list volume**.

- DISKPART> **extend filesystem**

Now the file system size should match the new partition size.

- Type “**Exit**” to return to your command prompt

Upon completion, from the DataKeeper UI, select “**Continue and Lock All Mirrors**”.

Method 2

To ensure that the Source and Target are the same size or the Target is larger, **perform the following**:

Use the *getvolumeinfo* command:

```
emcmd <system> getvolumeinfo <volume letter> 1
```

 The “1” at the end of this command is used to display “level 1” information including the **total space** of the volume.

Example: C:\Program Files (x86)\SIO\DataKeeper>emcmd Sourceservername
getvolumeinfo e 1

Output:

--- LEVEL 1 INFO ---

Volume Root = E:

Last Modified = Sun Jan 10 23:21:40 2021

Mirror Role = SOURCE

Label = SQL Data

FileSystem = NTFS

Total Space = 4291817472

Num Targets = 1

Attributes : 0h

In order to filter the other Volume attributes and only display “**total space**” for the source use “findstr Total”

Please refer to the following example:

Filter for the Source Example

```
C:\Program Files (x86)\SIOS\DataKeeper>emcmd Sourceservername  
getvolumeinfo e 1 |findstr Total
```

Output:

Total Space = 4291817472

Filter for the Target Example

```
C:\Program Files (x86)\SIOS\DataKeeper>emcmd Targetservername  
getvolumeinfo e 1 |findstr Total
```

Output:

Total Space = 4291817472

 These examples will display the Total Space/Total Capacity.

If the Target is Locked, Access is Denied or Not Available then your output will reflect:

Output:

Total Space = N/A

Note: The Total Space will sometimes yield a Total Space value when locked.

Method 3

From an elevated Administrator command prompt, execute the following:

```
emcmd . updatevolumeinfo <volume letter>
```

- * This command causes the SIOS DataKeeper service to query the driver for the correct mirror state. This command is useful if the DataKeeper GUI displays information that appears to be incorrect or not up-to-date and is also useful with updating the Disk Management UI.

4. [Continue and Lock](#) the mirrors after volumes have been resized. The mirroring process should resume and a partial resync should occur.

Shared Volume Procedure – Basic Disk

This resizing procedure will work on shared volumes if the shared volume is configured on a **Basic Disk**. Example configurations for using this procedure include the following:

- * Shared Volume – More than one system has access to the same physical storage. This shared volume can be either on the source side of the mirror or on the target side.

[N-Shared-Disk Replicated to One](#)

[N-Shared-Disk Replicated to N-Shared-Disk](#)

[N-Shared-Disk Replicated to Multiple N-Shared-Disk Targets](#)

If there is free space on the disk, the volume can be extended to use the additional space.

1. Pause all mirrors and unlock all target volumes via the [Pause and Unlock](#) mirror option in the DataKeeper UI.
2. Shut down (power off) all shared source and/or shared target systems. (**Note:** Current source and current target systems should not be shut down.)
3. Change the volume sizes as noted above in the Non-Shared Volume procedure.
4. [Continue and Lock](#) the mirrors after resizing has completed.
5. Power on all shared systems. The new volume configuration will automatically be recognized.

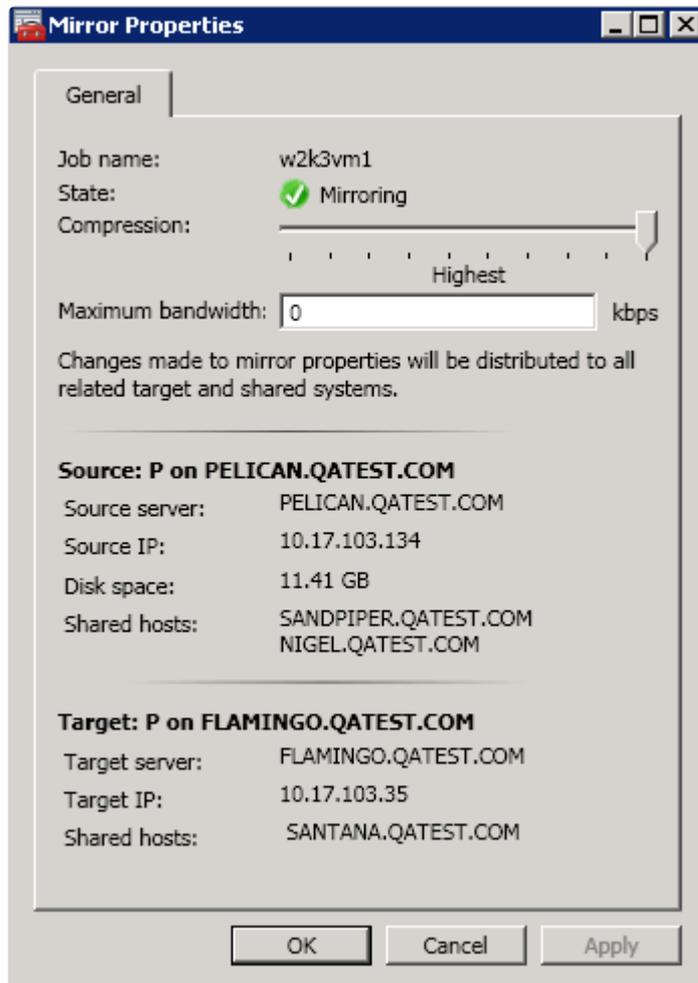
Error Handling:

1. After performing the **Continue and Lock**, if the GUI abnormally maintains the **“Paused”** mirror state, check the system logs on both source and target nodes.
2. DataKeeper will prevent a mirror resync from starting if the target volume is smaller than the source volume. If the system logs show such an error, the target volume must be unlocked manually via the [UNLOCKVOLUME](#) command, and the volume must again be resized making sure that the volume size of the target is greater than or equal to the size of the source volume. Then proceed with the Continue and Lock step above.

3. DataKeeper, upon continuing the mirror, will reallocate the bitmap file and in-memory bitmap buffer using the new volume size. In the event DataKeeper is unsuccessful in reallocating the bitmap buffer – due to insufficient memory resources on the source or target – the mirror will be placed into a '**Broken**' state which will require a FULL resync.
4. Once resizing a volume has begun, there is no way to back out of the resizing feature and the associated error handling as DataKeeper will have to reallocate the bitmap file and in-memory bitmap buffer. Any failure of this reallocation procedure will break the mirror and force a FULL resync.

8.9.4.10. Mirror Properties

Select a job in the **Job Summary** pane and right-click to choose **Mirror Properties**.



This dialog displays the following information about the job, source and target systems:

- **Job Name**
- **State** (current state of the job; for example, Active)
- **Source System**
 - Server – name of source server
 - Source IP – IP address of source server
 - Disk Space – capacity of the source volume
 - Shared Hosts – other systems that have access to this volume via shared storage
- **Target System**
 - Server – name of target server
 - Target IP – IP address of target server

You can modify the following settings through the **Mirror Properties** dialog:

- [Compression Level](#) – specifies the compression level for the given mirror. The value can be set from lowest to highest. We recommend a level of “**Medium low**”, but users should test several different settings to see what level works best in their specific environment. Compression is typically not required for LAN connections > 100 Mbps.

Note: Any changes made to the compression level setting are automatically propagated to all the systems listed in the **Mirror Properties** display.

- [Maximum Bandwidth](#) – Specifies the maximum amount of network bandwidth (in kilobits per second) that a particular mirror is allowed to use. A value of 0 means unlimited.

Note: In a multi-target configuration where A is mirroring to B and C, the properties of the mirror between B and C cannot be set until B or C becomes the source.

8.9.4.11. Changing the Compression Level of an Existing Mirror

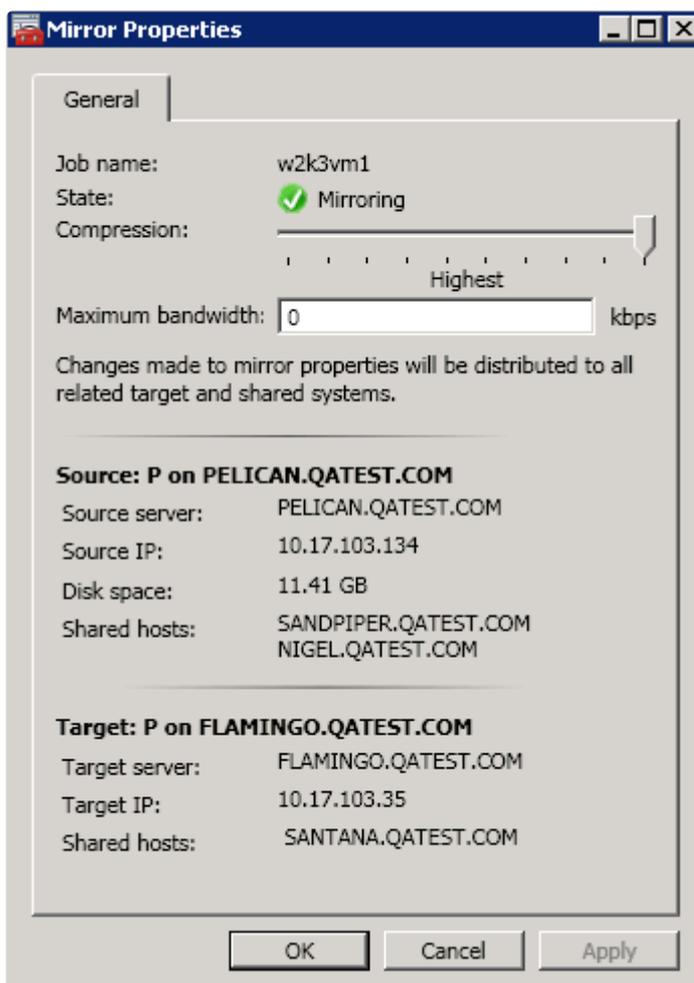
The compression level of the mirror is set during mirror creation and applies to that specific mirror only.

To change the compression level of an existing the mirror, edit the properties of the mirror from within the DataKeeper GUI.

1. Select the mirror and click on **Edit**.
2. Change the compression level by dragging on the slider button.

The values change from lowest to the highest. We recommend a level of “Medium low”, but users should test several different settings to see what level works best in their specific environment.

Also note that by changing the parameter as the comment suggests in the dialog, the compression properties will be propagated to all the systems listed in the [Mirror Properties](#) display.



8.9.5. Working With Shared Volumes

[Managing Shared Volumes](#)

[Adding a Shared System](#)

[Removing a Shared System](#)

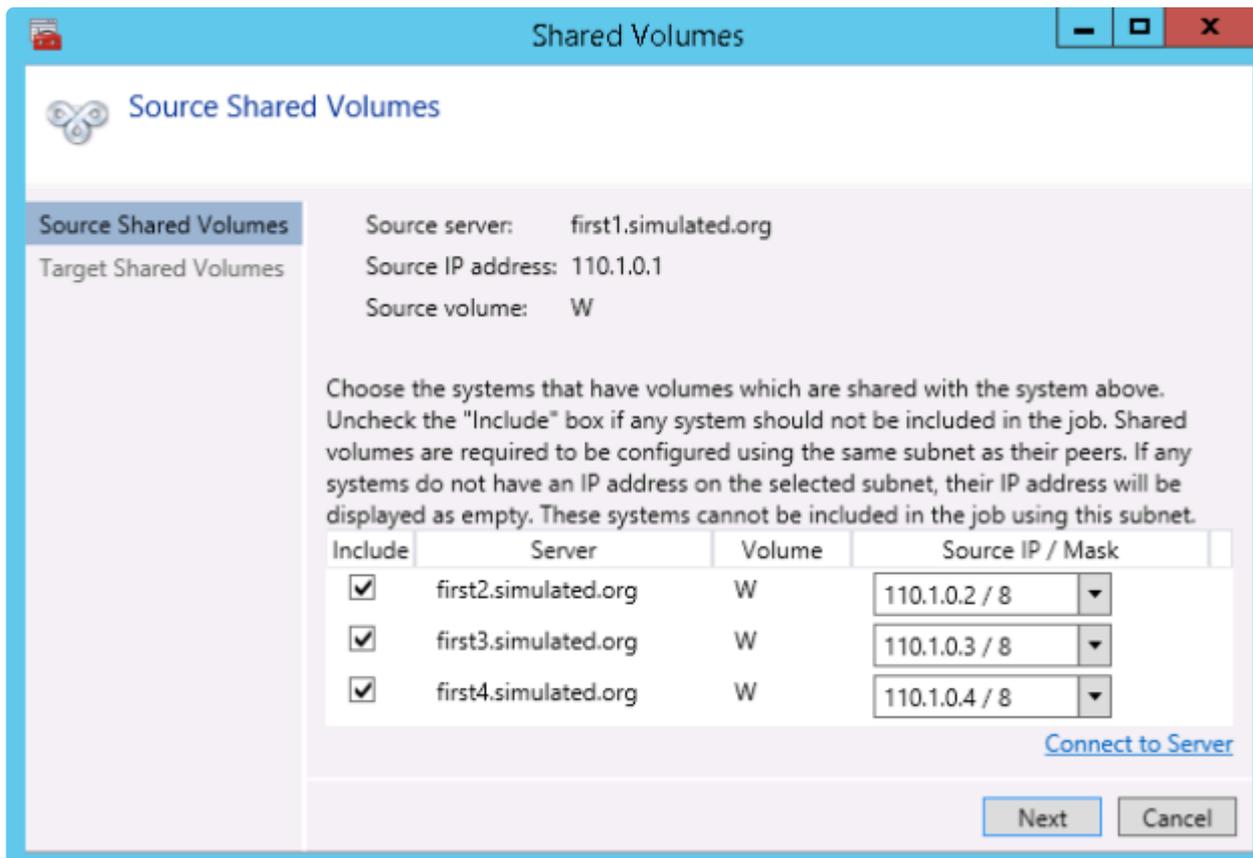
8.9.5.1. Managing Shared Volumes

Once your mirrors have been created, DataKeeper allows you to manage your shared volumes. By choosing **Manage Shared Volumes** from the DataKeeper GUI, you can [add another system](#), which is sharing a mirrored volume, to a job. It also allows you to [remove a shared system](#) from a job. These systems can exist on either the source side or the target side of the mirror.

To add or remove a system that is sharing a mirrored volume on either the source or target end of a mirror, select the job that you want to manage and highlight the mirror that contains the volume that is to be edited.

If a volume is mirrored to more than one target and you want to add or remove a shared system on the source side of the mirror, you can choose any of the mirrors, since they all refer to the same source volume. Choose the **Manage Shared Volumes** action for that mirror, and the **Shared Volumes** dialog will appear.

If you want to add or remove a shared system on the target side of the mirror, you must select that specific mirror.



8.9.5.2. Adding a Shared System

To add a shared system to either the source or target side of a mirror, you must be connected to that system. You can connect to the system prior to starting the **Manage Shared Volumes** dialog, or you can click **Connect to Server** from within the dialog. In either case, if there are shared volumes that exist on that system that match either the source or target volume, the system and its matching IP address will be displayed in the correct page of the dialog. Leave the **Include** box checked to include the system in the job configuration and choose the correct IP address to be used for that system.

If a shared system does not have an IP address whose subnet matches the existing mirrored systems, the IP Address field will be blank and the **Include** box will be unchecked. You must reconfigure the system so that it has an IP address on that subnet. Then try adding the shared volume again.

When you click **Done** after adding a new shared system, it will be added to the job. If there are multiple mirrors in place, you will be asked to provide the network addresses to be used between the newly-added system and all other targets.

8.9.5.3. Removing a Shared System

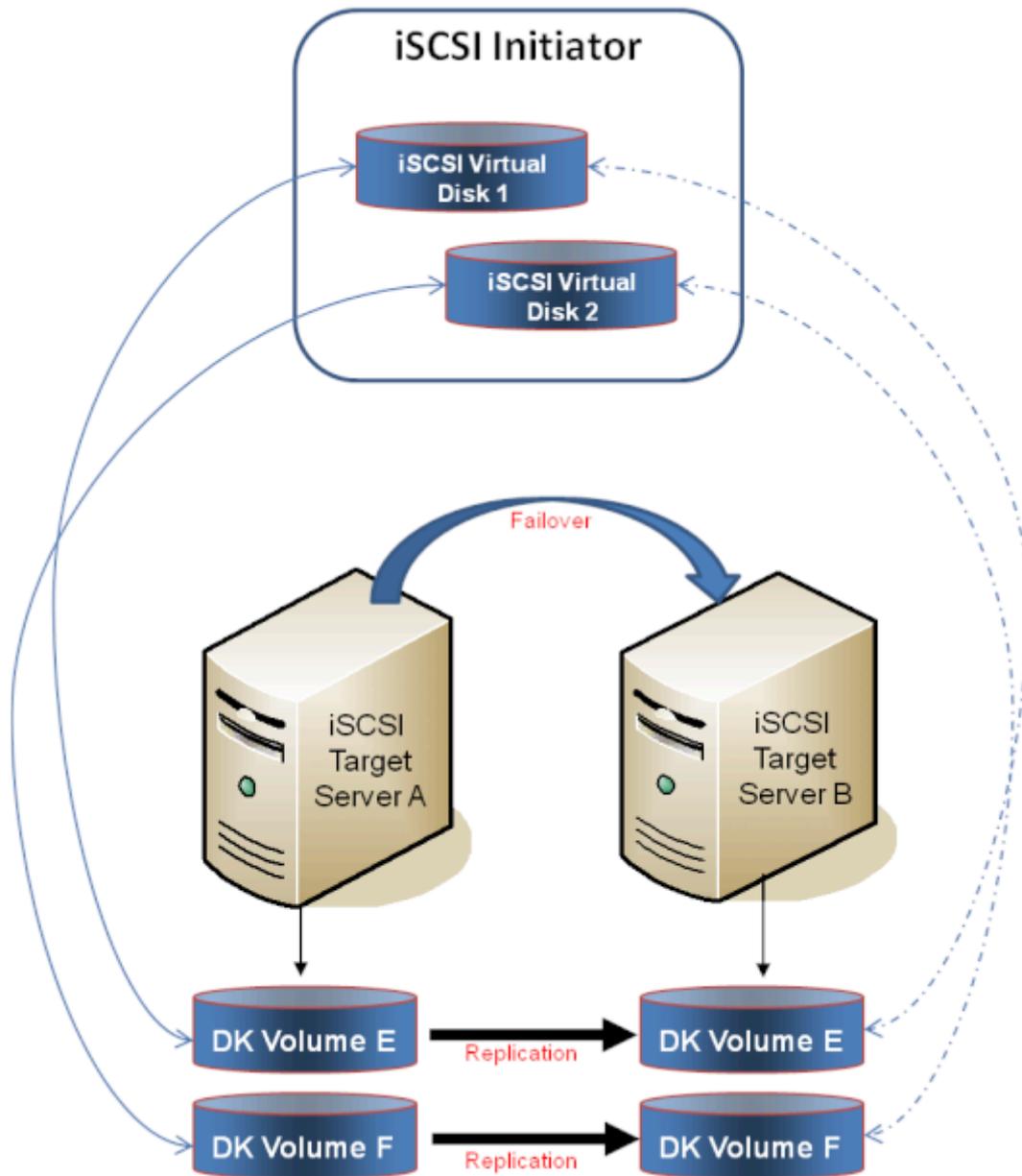
To remove a shared system from either side of the mirror, bring up the **Manage Shared Volumes** dialog and uncheck the **Include** box for the system to be removed. When you click **Done**, the job will be updated so that the system is not part of the job.

Warning: If a shared system is removed from the source side of the mirror, the source volume is now accessible on multiple systems and simultaneous access of the source volume could result in data corruption.

8.9.6. Using Microsoft iSCSI Target With DataKeeper on Windows 2012

The following topics will guide you in setting up Microsoft iSCSI Target with DataKeeper via the user interface.

* NOTE: This configuration is not supported in a VMware ESX environment.



[Installation of the iSCSI Target](#)

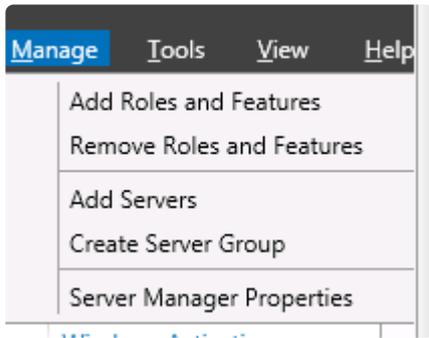
[Creation of Mirror and Configuration of Cluster](#)

[Creation of iSCSI Virtual Disks](#)

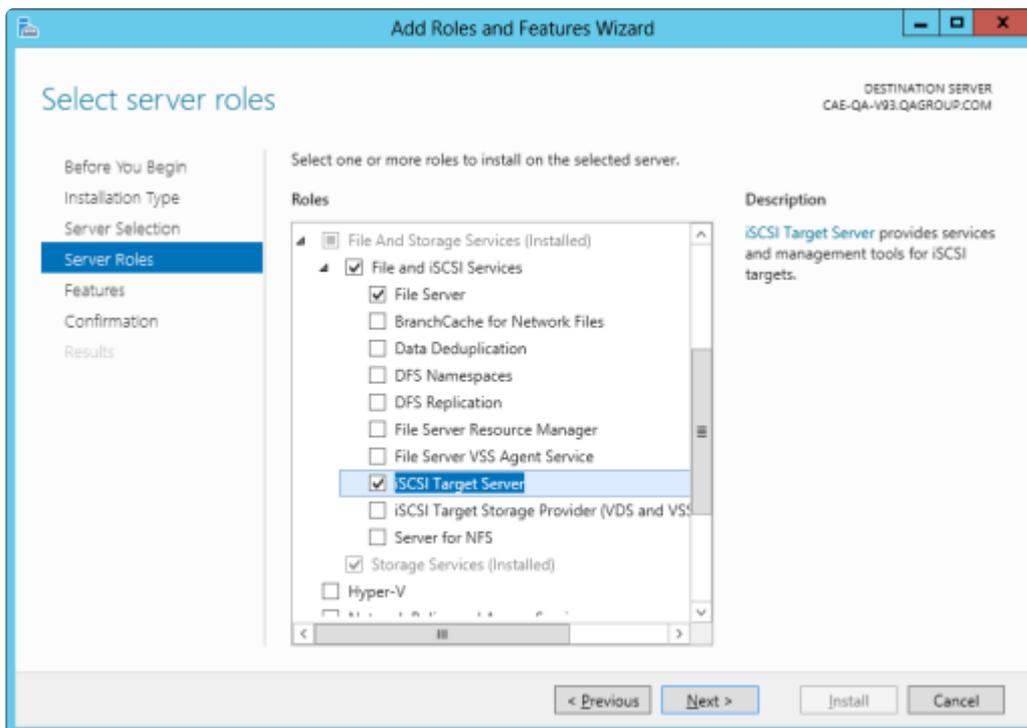
[Setup of iSCSI Initiator on Windows 2012](#)

8.9.6.1. Installation of the iSCSI Target

1. From the **Server Manager** menu, select “**Add Roles and Features**” from the “**Manage**” drop-down.



2. Select the “**Role-based or feature-based installation**” option.
3. From the list of servers presented, select the appropriate server.
4. On the “**Select Server Roles**” screen under “**Server Roles**”, navigate to and select “**File and iSCSI Services**” / “**iSCSI Target Server**”. **Note:** “**File and iSCSI Services**” is in the tree hierarchy under “**File and Storage Services**” which is typically shaded and difficult to find.



5. Click “**Next**” twice to get to the “**Install**” button to be able to install the role.
6. The feature will install and the progress will be shown.
7. Upon completion, the message “**Installation succeeded**” will be displayed.

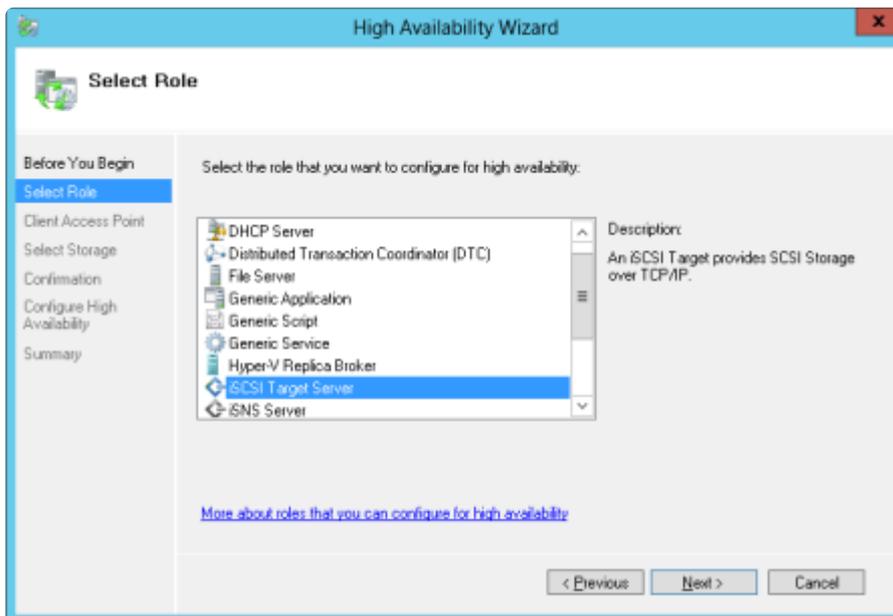
8. Repeat these steps for all servers in the cluster.

8.9.6.2. Mirror Creation and Cluster Configuration

1. Create your **DataKeeper volumes** and your **cluster**. See [Creating a DataKeeper Volume Resource in WSFC](#) for reference.

*** IMPORTANT:** The iSCSI Target Role only supports DataKeeper Volumes that are mirrors of **Simple Volumes** placed on **Basic Disks**. If any of your mirrors are using volumes such as Striped or Spanned volumes on a Dynamic Disk on either the source or target system, then you cannot create an iSCSI Target role that uses those DataKeeper Volume resources for storage.

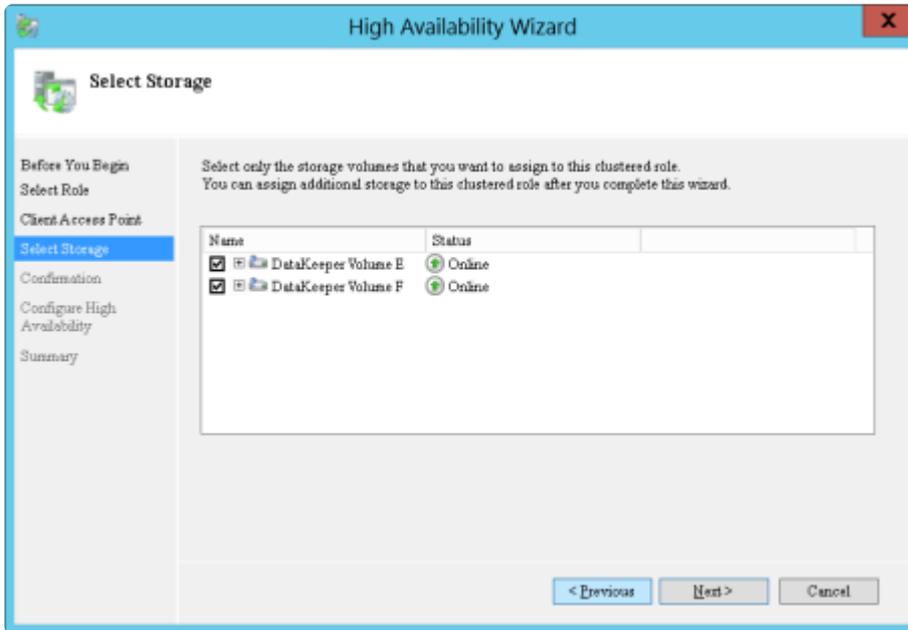
2. From the **Windows Failover Cluster Manager UI** (cluadmin.msc), select **Configure Role** and navigate to the screen to select the **iSCSI target role**.



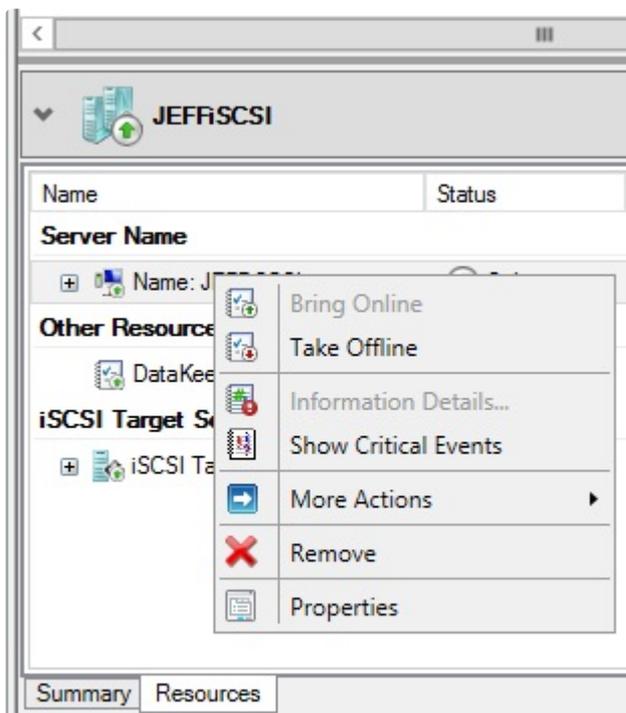
3. Select **iSCSI Target Server** role and select **Next**.
4. The **Client Access Point** page appears. Type the **Client Access Point name** and **IP address** for the iSCSI Target Server instance.

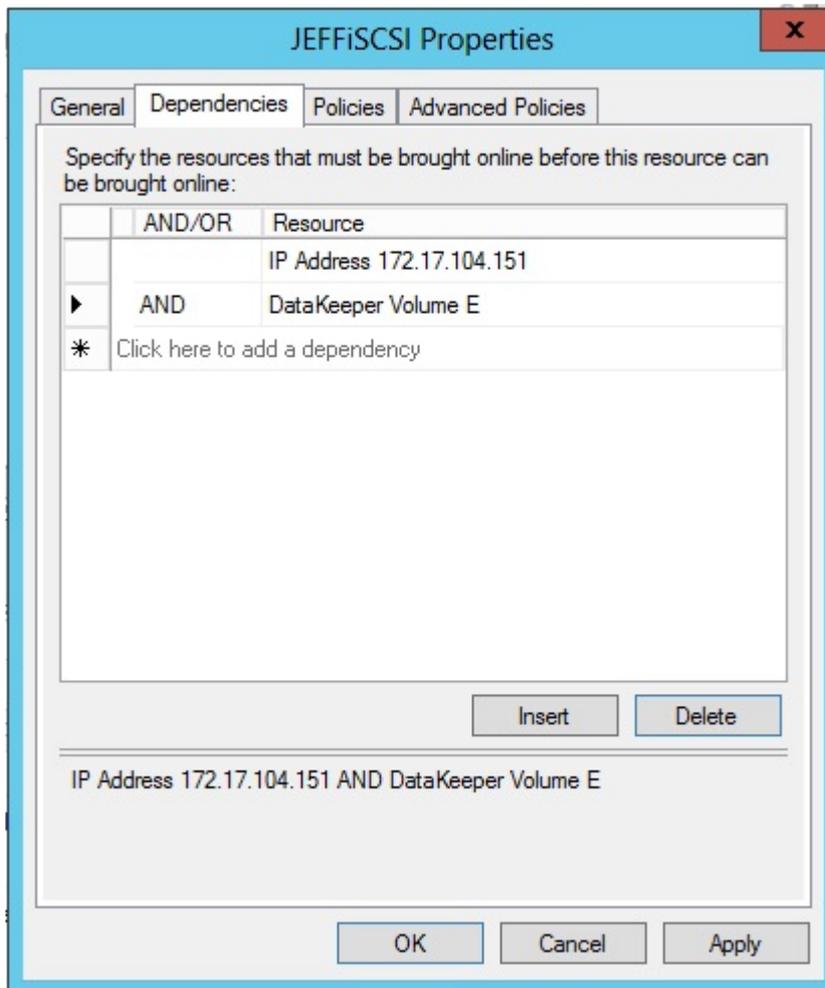
*** IMPORTANT:** This name and IP address will be used later by clients to access the server address, so it should be recorded in DNS. This is very important for the servers to be able to resolve these names.

5. On the **Select Storage** dialog, select your **DataKeeper volume(s)**.



6. With the next set of screens, you should be able to complete the configuration.
7. Following setup, from the **Failover Cluster UI**, add dependencies for the DataKeeper volume(s).
 - a. Click on **Roles** in the left pane, then click on the **iSCSI Target Server** resource in the top center pane.
 - b. In the lower center pane, select the **Resources** tab, then right-click on the **Name: <client access point name>** under the **Server Name** heading and select **Properties**.
 - c. Select the **Dependencies** tab and add the appropriate DataKeeper volume(s) as dependencies.



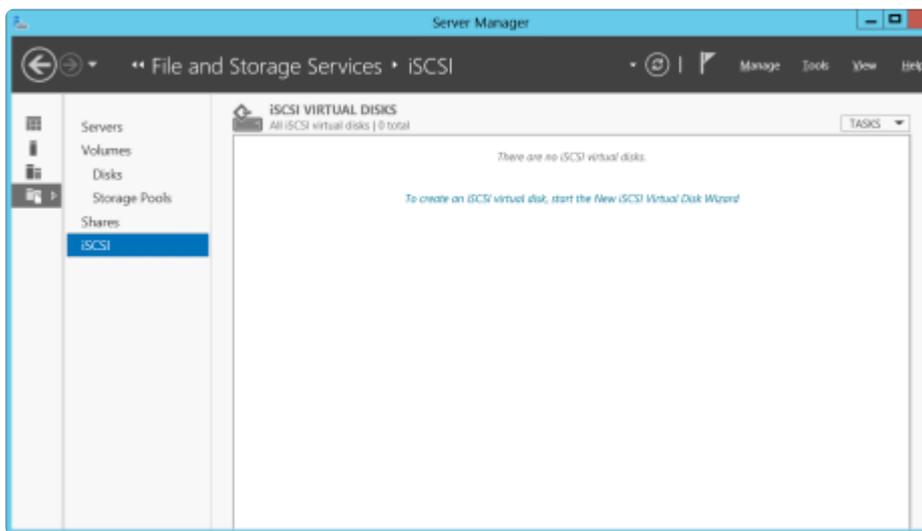


8. Setup is complete. Proceed to the [iSCSI Virtual Disks](#) configuration.

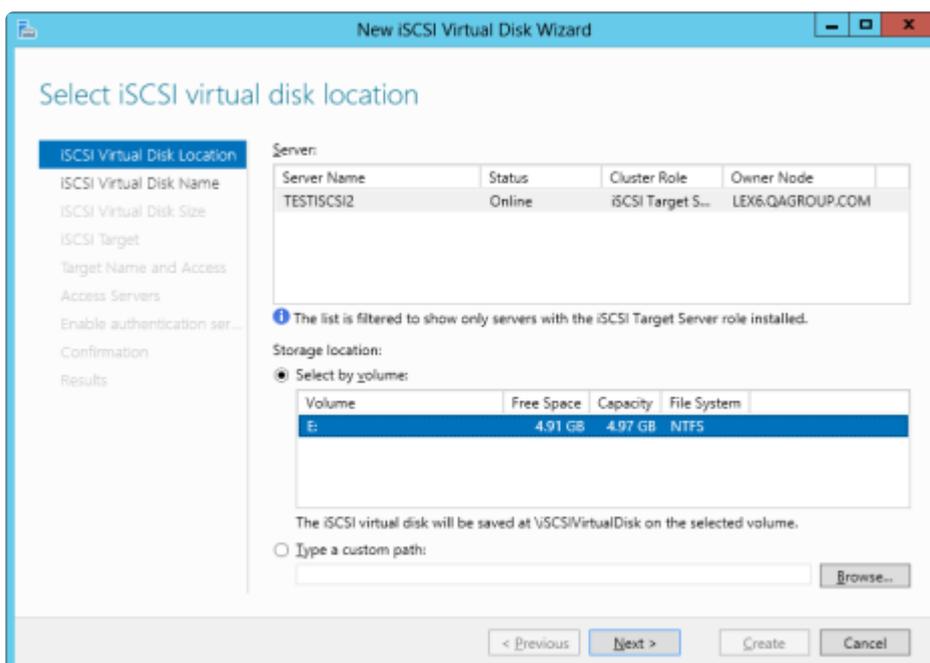
8.9.6.3. Creation of iSCSI Virtual Disks

Perform the following on the **primary server**, wherever the **iSCSI Target server is online at the moment**.

1. From **Server Manager**, navigate to **File and Storage Services** and select **iSCSI**. Click on the link **“To create an iSCSI virtual disk, start the *New iSCSI Virtual Disk Wizard*”**. (Alternatively, select **New iSCSI Virtual Disk** from the **TASKS** drop-down menu on the upper right of the screen.) **Note:** Windows Server 2012 **Server Manager** inherently takes some time to display or update the information presented to the user.



2. On the ***New iSCSI Virtual Disk Wizard***, you will see the server and the volume. Select the **DataKeeper volume** and click **Next**. (**Note:** The server name is the name created in the [previous step](#) and the volume is the DataKeeper volume exposed.)



3. Follow the next panel to configure the **iSCSI Virtual Disk**.
 - a. Specify **iSCSI Virtual Disk Name**.
 - b. Specify **iSCSI Virtual Disk Size**. (**Note:** Multiple files can be created. If file size spans the entire disk, the OS may warn that disk is low since the VHD file(s) created can consume the entire disk.)
 - c. Designate whether the iSCSI Virtual Disk will be assigned to an **Existing iSCSI Target** or a **New iSCSI Target** on the **Assign iSCSI Target** screen. (See [below](#) for an explanation on when to select **Existing iSCSI Target**.)
 - d. Specify **iSCSI Target Name**.
 - e. On the **Access Servers** screen, select **Add**. Add the **iSCSI Initiators** that will be accessing this **iSCSI Virtual Disk**. **Note:** The iSCSI Initiators should be added one at a time.
4. Once all the answers have been provided, the iSCSI virtual disk/target creation is complete. Proceed to configuration of the [iSCSI Initiator](#).

Setting Up Multiple Virtual Disks Within the Same Target Name

It is also possible to set up multiple iSCSI virtual disks within the same iSCSI target name. Whenever an iSCSI initiator connects to such a target, it will connect to all of the virtual disks that have been assigned to that name.

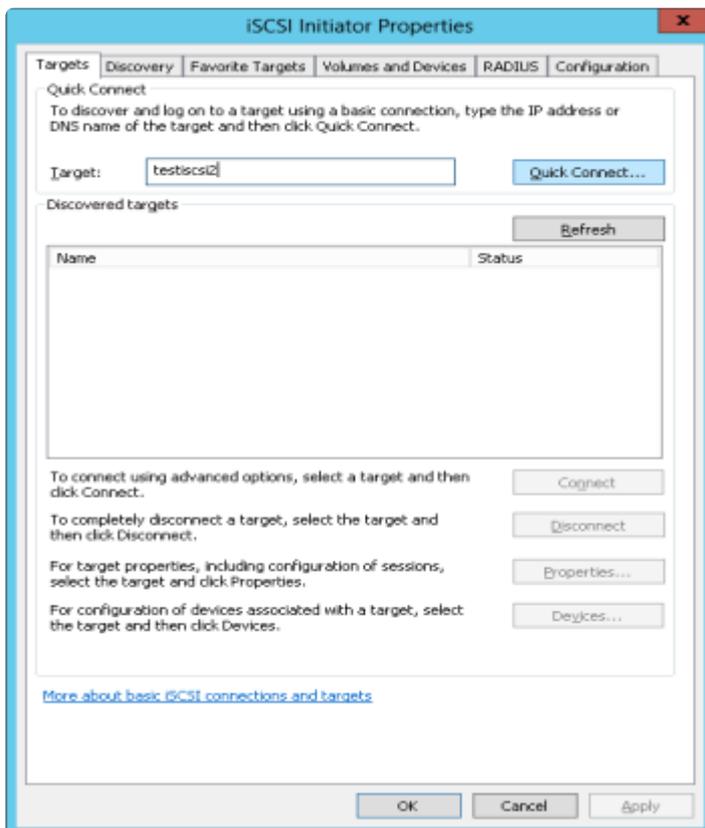
You need to have a plan ahead of time that describes which files you want to create and whether those files should all be accessed simultaneously or if the disks need to be accessed separate from one another.

To set up multiple virtual disks within the same target name, on Step 3c, instead of selecting **New iSCSI Target** on the **Assign iSCSI Target** screen, select **Existing iSCSI Target** and specify the iSCSI target name that was created previously. This target name will appear in the list of “targets” when an iSCSI Initiator connects to the iSCSI Target Server. If a target has more than one virtual disk associated with it, then the initiator will get a connection to each of those disks (they will appear as a new Disk in Disk Management).

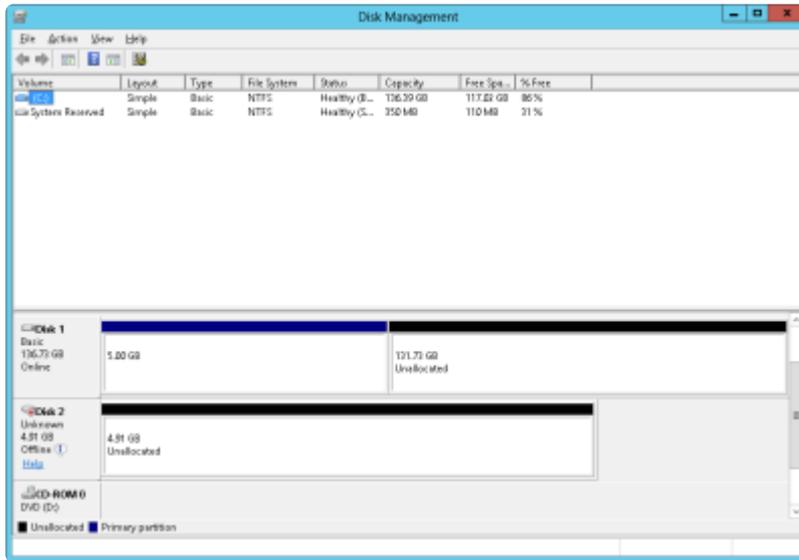
8.9.6.4. Setup of iSCSI Initiator on Windows 2012

Once the virtual disks/targets are created, each of the cluster servers must initiate a connection to them via Microsoft's iSCSI Initiator.

1. From “**Administrator Tools**” in “**Server Manager**”, start “**iSCSI Initiator**”.
2. Select the “**Targets**” tab and enter the **Network Name** or **IP address** of the **clustered iSCSI Target** created in the [previous step](#). Select “**Quick Connect**”.



3. New panel should indicate that “**Login has succeeded**”. Click **OK** to hide the panel.
4. Start “**Disk Manager**”. The new iSCSI virtual disk will be displayed and can be initialized.



5. Right-click on the disk(s) to bring it online.
6. Initialize the disk(s).
7. Create the new volume and assign the drive letter.
8. Configuration is now complete.

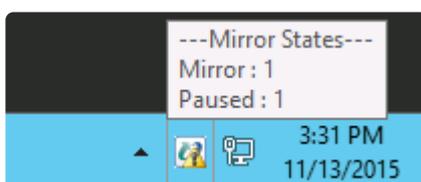
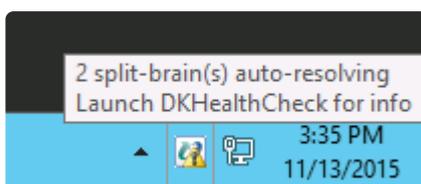
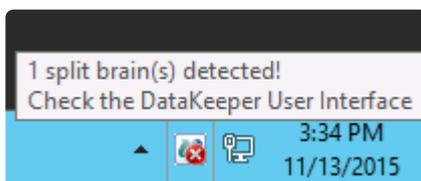
8.9.7. DataKeeper Notification Icon

Mirror Status Notification

The DataKeeper Notification Icon is an application that will show a summary of your DataKeeper mirrors in the Windows Notification Tray. The icon displayed indicates what conditions have been detected, with the following priority.

-  Error: An error condition, such as split brain (requiring manual intervention), has been detected.
-  Warning: This indicates that there is a condition that may require administrative intervention, such as a mirror being paused or broken, or a transient split-brain condition.
-  Resync: This indicates that a mirror is in the resync or resync pending state.
-  Mirroring: This indicates that all mirrors are in the mirroring state.
-  Disabled: This indicates that status updates are no longer occurring. During this state none of the other status conditions will be displayed.

More details about these conditions can be found by hovering over the DataKeeper Notification Icon, such as how many mirrors are in each state, or the nature of the detected error condition. Some examples are shown below.



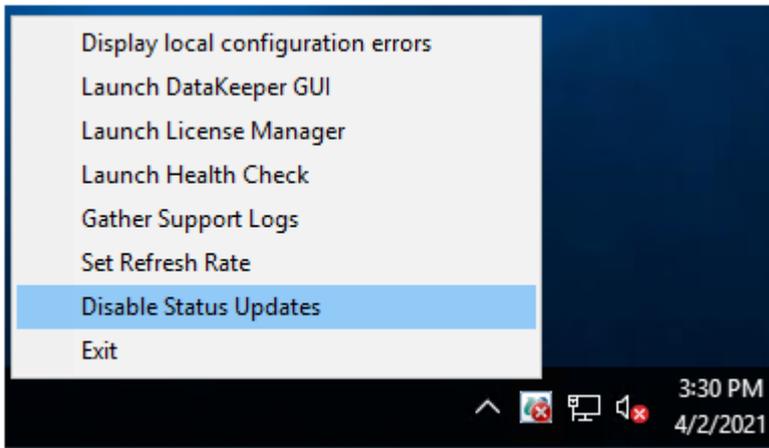
Note: The DataKeeper Notification Icon uses DataKeeper jobs to determine which remote systems to poll for information. Only the status of mirrors in jobs that contain the node on which the DataKeeper Notification Icon is running will be reported.

Local Configuration Errors

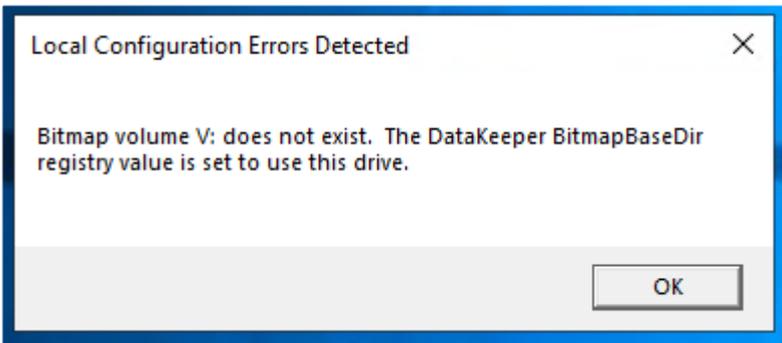
The DataKeeper Notification Icon also checks the local system for certain configuration errors. If any are detected, the icon changes to an Error and the hover-over text says to Right-click and choose “Display Local Configuration Errors”.



Right-clicking the EMTray icon will show the following menu:



Choosing “Display local configuration errors” will display the configuration error dialog:



Mirror Management

In addition to the display functions, the DataKeeper Notification Icon also serves as a shortcut to managing your DataKeeper mirrors. Double clicking on the DataKeeper Notification Icon will launch the DataKeeper GUI.

Right clicking will bring up a menu with the following options:

- Launch DataKeeper GUI – Launches the DataKeeper GUI.

- Launch License Manager – Launches the SIOS License Manager.
- Launch Health Check – Opens a command prompt and runs [DKHealthCheck](#).
- Gather Support Logs – Runs [DKSupport](#) and opens an explorer window to the location containing the new archive.
- Set Refresh Rate – Will allow you to set how often the icon refreshes its state information.
- Disable/Enable Status Updates – Disables and Enables Status Updates. Requires EmTray to be run with administrator permissions.
- Exit – Stops and closes the DataKeeper Notification Icon.

Auto-Start at Login

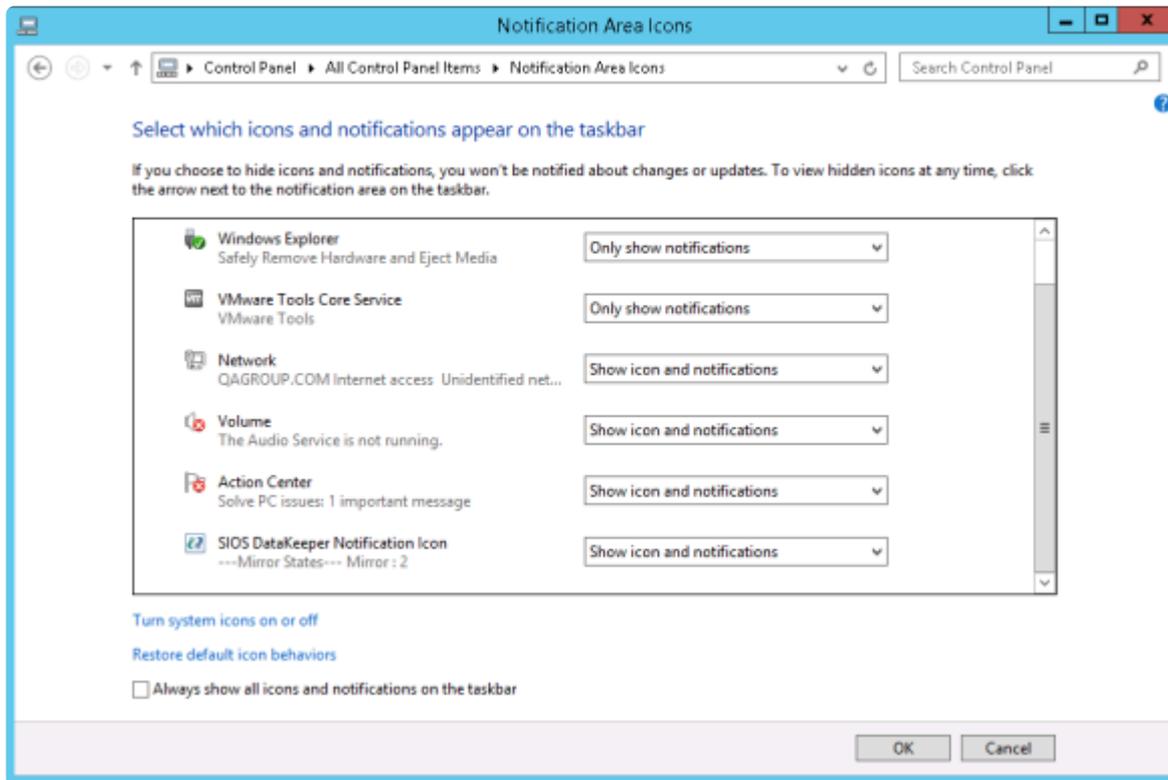
The Notification Icon should automatically appear in the Windows Notification Tray upon logging in to the node.

To disable this functionality, delete the shortcut to EmTray.exe from the following location:

- C:\ProgramData\Microsoft\Windows\Start Menu\Programs\StartUp

To re-enable this functionality, simply create a shortcut from the EmTray.exe (located at \DKTools) to the same location above.

Note: By default, Microsoft Windows will hide Notification Tray Icons. You can change this by going to the 'Notification Area Icons' option in Control Panel and changing the settings for the DataKeeper Notification Icon to 'Show icon and notifications'



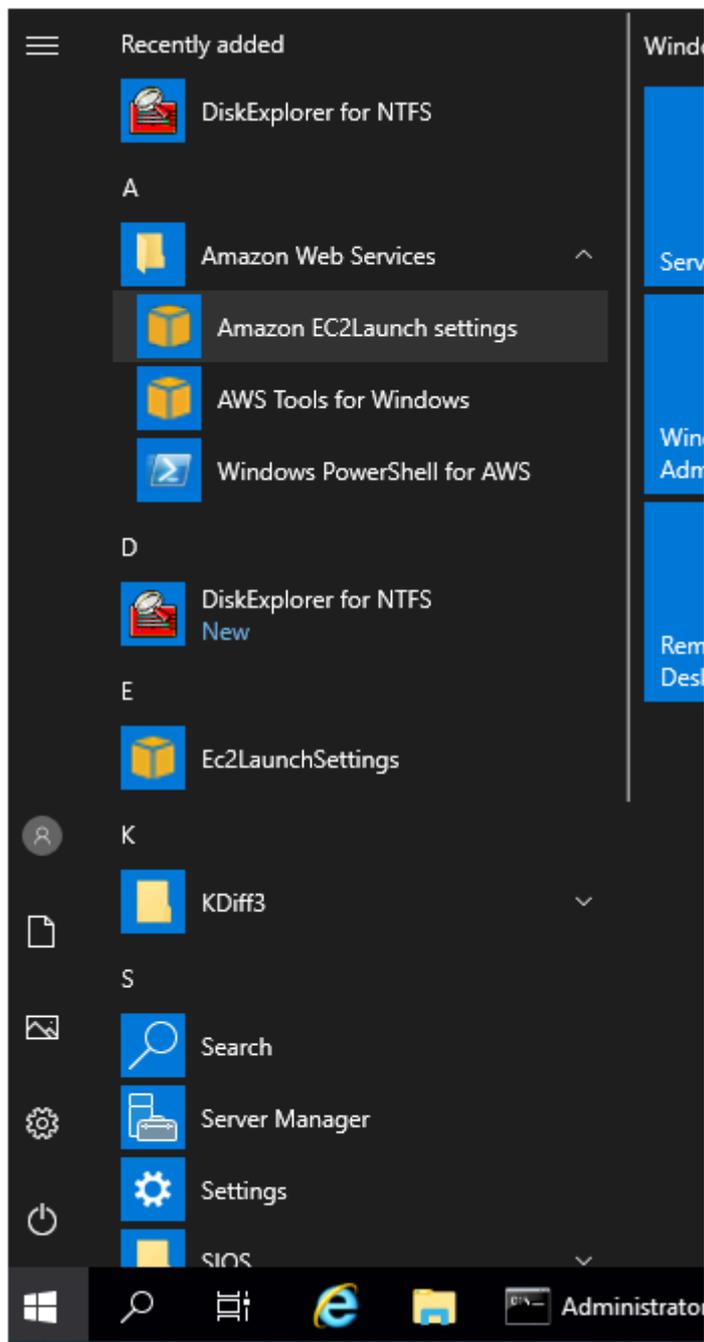
8.9.8. DataKeeper Intent Log files on AWS Ephemeral Storage

DataKeeper systems that are running on AWS instances which are configured with local instance storage (i.e. ephemeral disks) can use the instance storage to store DataKeeper intent log files (i.e. bitmap files). It is important to be sure that when using AWS ephemeral storage, the instance is configured to automatically initialize that storage at boot time. If not, the ephemeral drive will not be registered if the instance is ever powered off and then restarted and DataKeeper will not be able to find its bitmap files.

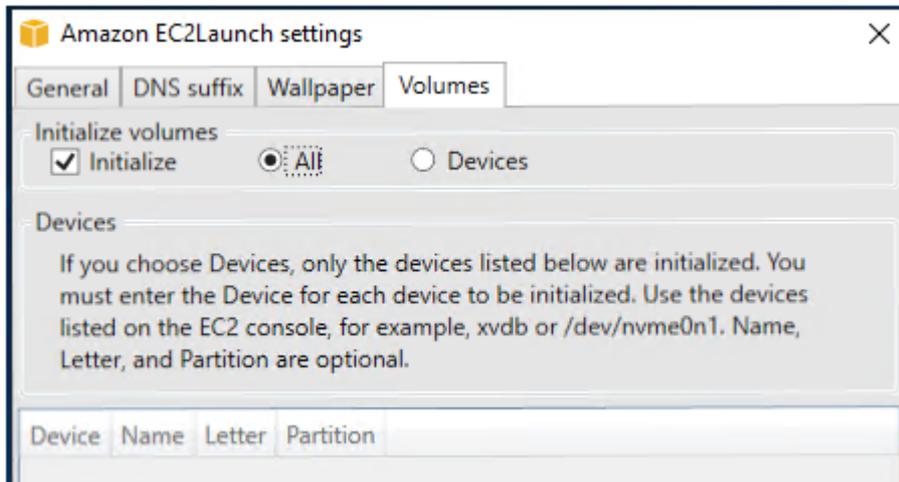
All SIOS-provided Windows AMI's in the Amazon Marketplace are already configured to automatically initialize ephemeral disks at startup. However, some AMI's do not have disk initialization configured by default.

Windows systems running in AWS have several ways to initialize ephemeral disks. These mechanisms are:

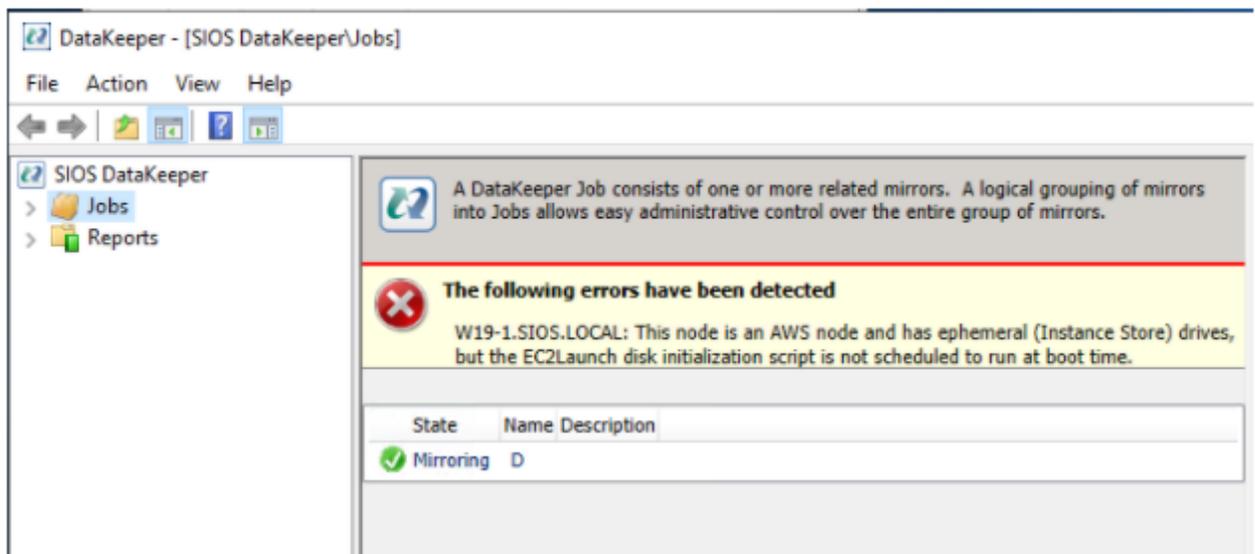
1. **EC2Config Service:** This service is installed on Windows 2012R2 and earlier versions of Windows. EC2Config automatically initializes ephemeral disks, there is no extra configuration that needs to be performed.
2. **EC2Launch Scripts:** For Windows 2016 and later versions of Windows, Amazon provides a set of tools called EC2Launch. The script that initializes ephemeral disks is found at `C:\ProgramData\Amazon\EC2-Windows\Launch\Scripts\InitializeDisks.ps1`. To schedule it to be run at boot time, run the script with the “-Schedule” option. To initialize ephemeral disks immediately, run the script without any options.
3. **EC2Launch V2 Service:** For Windows 2016 and later versions of Windows, Amazon also makes available the EC2Launch V2 service. This service comes with a configuration tool named “Amazon EC2Launch Settings” which is found in the Amazon Web Services program group:



This tool has a “Volumes” tab which allows you to choose to initialize the disks at the start of the EC2Launch V2 service (at boot time).



DataKeeper will detect whether your system is running in AWS, if it has ephemeral disks attached, and whether one of the 3 methods above have been used to initialize the disks. If not, a local configuration error will be displayed in EMTray, the DK GUI and DKHealthCheck.



8.9.9. DataKeeper Target Snapshot

Overview

DataKeeper's target snapshot feature, integrated with both DataKeeper and DataKeeper Cluster Edition, is the process of creating point in time copies of replicated volumes allowing access to data on a standby cluster node without interrupting data replication from the source system. Data protection is not lost for any period of time. Enabling target snapshot allows data to be used on an otherwise idle target node without negatively impacting the performance of the source.

Without target snapshot, DataKeeper and DataKeeper Cluster Edition are able to maintain a real-time replica of their source system's data on the target system. However, this replica cannot be accessed without pausing the mirror and unlocking the target system. Mirror failover and switchover cannot occur while in this paused and unlocked state, making the protected application less highly available. Application-consistent target snapshot allows access to data on the target system while maintaining high availability of the running application on the source system. The mirror remains in the **mirroring state** and continues to update the target volume with all writes from the source. Target snapshot integrates with Volume Shadow Copy Service (VSS) to ensure that the data which is exposed on the target system is in an application-consistent state.

When To Use Target Snapshot

DataKeeper Target Snapshot is an alternative to using the "Pause and Unlock" command to access data on your target system. Target Snapshot provides the following benefits that Pause and Unlock does not:

- The mirror remains in the Mirroring state, and data continues to be replicated from the source system with no interruption.
- Multiple volumes can be snapshotted simultaneously.
- VSS-aware applications (like MS SQL Server) that are running on the source system are briefly quiesced using VSS in order to ensure that the data exposed on the Target system is in an application-consistent state.

How To Use Target Snapshot

Define Snapshot Location on Target system

In order to use the Target Snapshot feature, a Snapshot Location must be defined on the target system for each volume you plan to access. The Snapshot Location can be defined in the DataKeeper GUI, in the Mirror Properties dialog. It can also be defined by running the [EMCMD SETSNAPSHOTLOCATION](#) on the target system.

```
EMCMD <system> SETSNAPSHOTLOCATION <volume letter> "<directory path>"
```

Enable SIOS VSS Provider on Source system

DataKeeper target snapshot uses VSS to quiesce data on the mirror source system. DataKeeper has a VSS Provider component which is used to accomplish this. However, due to reported interference of the SIOS VSS Provider with some backup products, the provider is shipped in a disabled state. In order to take a snapshot, the VSS Provider on the mirror source system must be activated.

To activate the SIOS VSS Provider, run the script "install-siosprovider.cmd" which is located in "%ExtMirrBase%\VSSProvider".

After you have taken a Target Snapshot, you may choose to de-activate it on the mirror source system by running the command "uninstall-siosprovider.cmd" in the same folder. If you are using a backup product that is incompatible with the SIOS VSS Provider, you should de-activate it using this command (see [Known Issues](#) below for incompatible products). However, if you are not using a product with such an incompatibility, you can leave the VSS Provider activated. **Note:** Any DataKeeper update will disable the provider, it must be re-enabled in order to take a target snapshot after this occurs.

The SIOS VSS Provider is only needed at the time that a snapshot is taken. The snapshot can be left in place on the target system after the provider has been deactivated, and the snapshot can be dropped while the provider is deactivated.

Execute the TAKESNAPSHOT command

After the Snapshot Location has been defined for each mirrored volume, and the SIOS VSS Provider is activated on the source system, the volumes can be made accessible on the target system by running the [EMCMD TAKESNAPSHOT](#) command:

```
EMCMD <target_system> TAKESNAPSHOT <volume letter> [<volume letter>...]
```

where <target_system> is the name or IP address of the target system, <volume letter> is the drive letter of one of the volumes to be snapshotted, [<volume letter>...] is the (optional) drive letter of another drive to be snapshotted at the same time, etc.



This command/syntax can be run on any source or target system in the cluster. It is recommended to run the command/syntax on the target system.

How Target Snapshot Works

DataKeeper target snapshot uses a copy-on-write strategy to maintain and expose a view of the volume at a particular point in time. A snapshot file is used to store the volume information. Configuring the location of this snapshot file is the first step toward enabling target snapshot.

When the EMCMD TAKESNAPSHOT command is run, DataKeeper will create and mount a snapshot file in the configured snapshot folder. A request is then sent to the source system telling it to use VSS to quiesce any VSS writers on the given volume and notify the target when all write operations to the disk are stopped and the volumes are in a well-defined state.

Quiescing the Database/Application

The application-consistent capabilities of this feature integrate with Volume Shadow Copy Service (VSS) to ensure that the data that is exposed on the target system is in an application-consistent state. Once a snapshot is requested, the VSS service pauses the systems and ensures that all applications modifying data on disk bring all their files into a consistent state prior to the creation of the snapshot. This is called quiescing the database/application. Rather than shutting down the database and reopening it in restricted mode, quiescing temporarily freezes application write I/O requests (read I/O requests are still possible) for the short time required to create the snapshot. Once in the quiesced state, the snapshot on each volume is initiated by adding the snapshot message to the driver mirror write queue(s). VSS will then unfreeze the applications and the volume is unlocked, thus minimizing the amount of time the apps are quiesced. The user can now perform actions on the target system while the mirror remains in the **Mirroring** state and the application on the source system remains highly available.

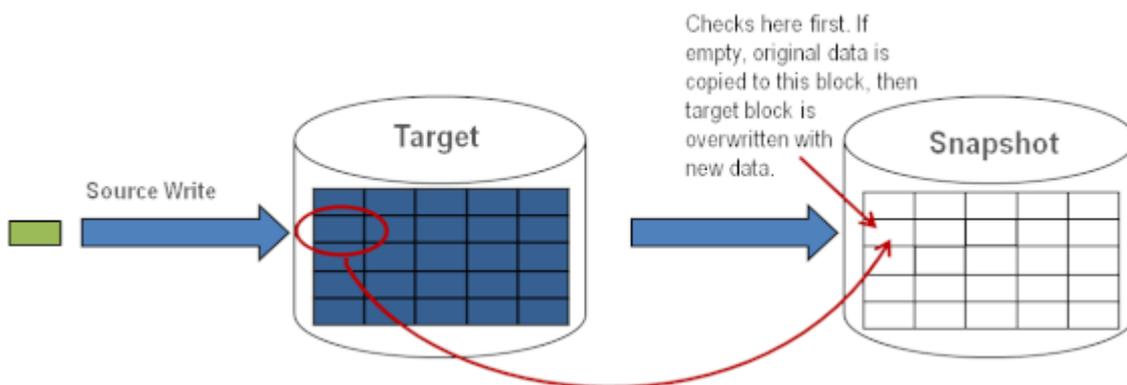
Read and Write I/O Requests

The snapshot exists in parallel with the live copy of the volume to be backed up, so except for the brief period of the snapshot’s preparation and creation, an application can continue its work. Writes to the target, however, will now be processed differently while the target is in this state.

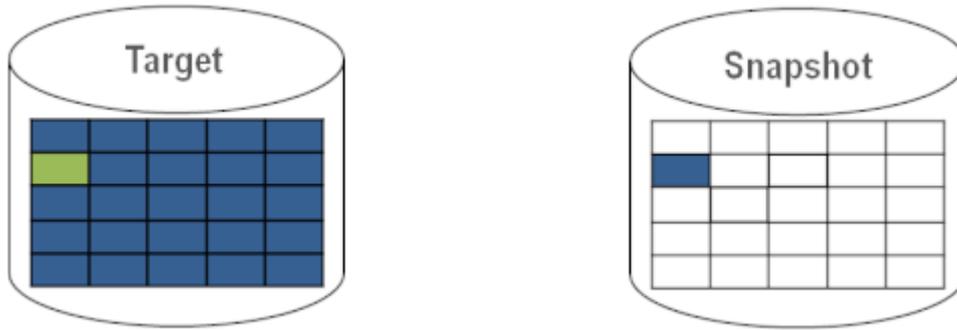
Data mirroring from the source system will continue uninterrupted, but any new data from the source that is received after the snapshot is taken will not be visible on the target system until the snapshot is dropped. This allows an application on the target system to run, using (and updating) data that represents the source system’s data at the point in time that the snapshot was taken.

Source Write

In order to accomplish source writes, when new data comes from the source, DataKeeper first determines if that particular block of data has already been written to the snapshot file.



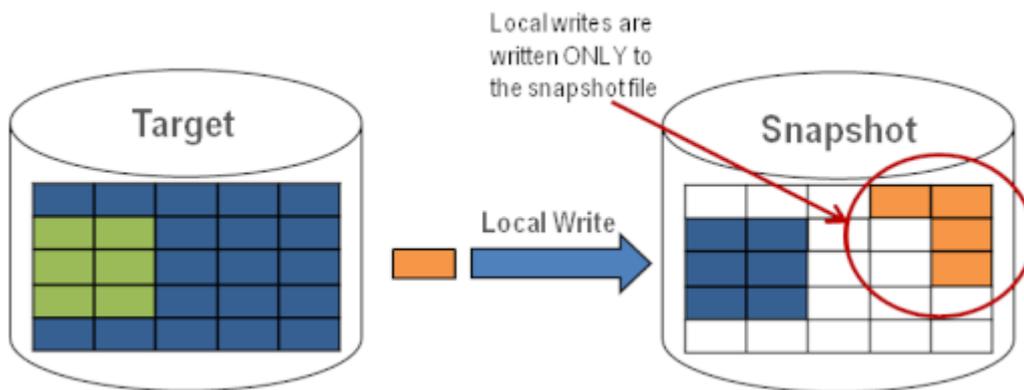
If the block has not been written to, as shown above, that **original** block is written to the snapshot file in order to preserve the snapshot data, then the new data is written to the target. The result is shown below.



If DataKeeper determines that this block has already been written to the snapshot file, then this step is skipped and the block is just written to the target. For blocks on the source volume that are overwritten frequently, the snapshot file only has to be updated once, the first time that block is written after the snapshot is taken.

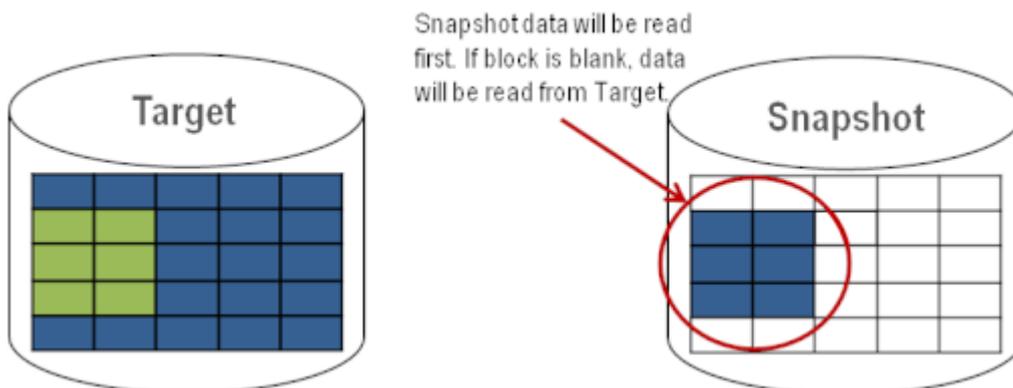
Local Write

If local writes are performed on the target (from applications on the target system), these writes are stored in the snapshot file and do not overwrite any blocks on the replicated volume itself. **(Note: Any local writes stored in the snapshot file will be lost when snapshot is dropped.)**



Target Read Request

Read requests on the target volume will return snapshot data. This is accomplished by first reading data from the blocks written in the snapshot file. Any blocks that have not been saved to the snapshot file will be read from the target volume.



Using Target Snapshot

There are three tasks that must be performed when using target snapshot. The [snapshot location must be configured](#), the [snapshot must be initiated](#), then once target reporting actions are complete, the [snapshot must be dropped](#).

Configuring the Snapshot Location

When target snapshot is initiated, DataKeeper creates and mounts a file in the snapshot location to hold the snapshot data. This location must be configured prior to initiating a snapshot. See [Files / Disk Devices / Registry Entries](#) below for more information about the mounted snapshot disk(s).

When configuring the snapshot location, make sure it meets the following criteria:

- Is only used when a snapshot is requested.
- Cannot be stored on a DataKeeper mirrored volume.
- Can store multiple snapshot files for different volumes.
- Must have enough free space to create and accommodate a file that will grow depending on the source mirrored volume size and writes during snapshot use.

Note: Do not change the snapshot location during a snapshot.

Snapshot Location Size

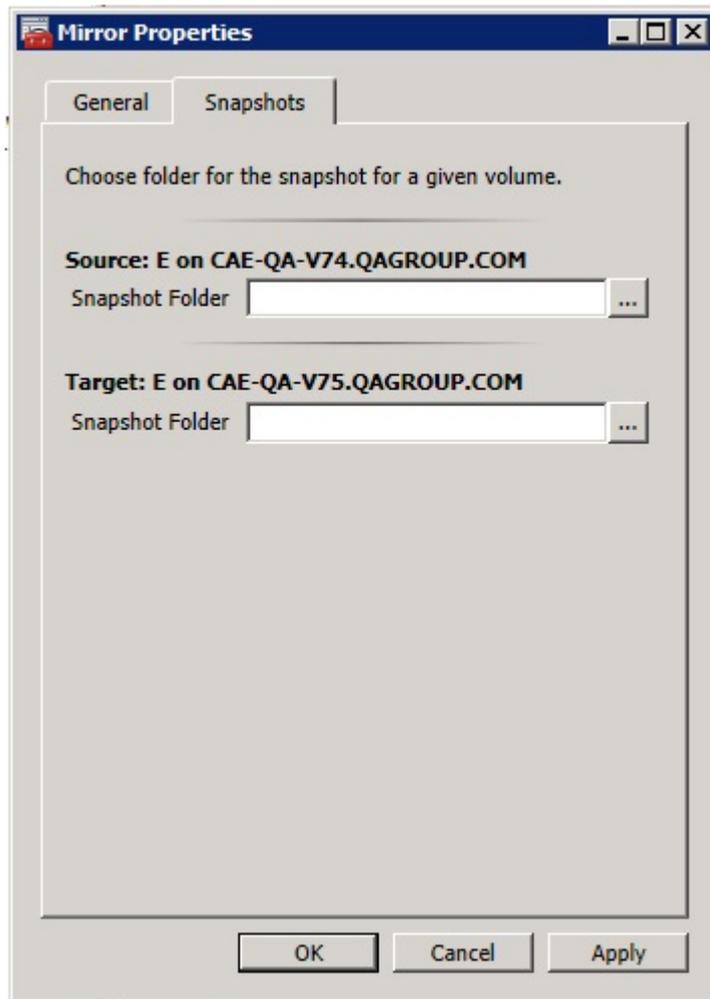
The size of the snapshot location should be determined on an individual basis based on several criteria. In practice, the size required for the snapshot file will be far less than the size of the volume being snapshotted. The storage required needs to be big enough to contain any data that changes on the source system while the snapshot is being used. All snapshot files will be zeroed out each time a snapshot is initiated and will incrementally grow in size during use. The files will be deleted when the snapshot is dropped. Given that the copy on write process only writes “changed” blocks to the snapshot file, consideration should be given to the duration of the snapshot as well as the rate of change in the volume being mirrored. Once an historical view can be established of snapshots from past activity, the size can be re-evaluated.

 **BEST PRACTICE:** Be conservative in your estimate, assuring that there is excess space available. If enough space is not allocated and the limit is reached, your snapshot will be dropped.

Snapshot Location Selection

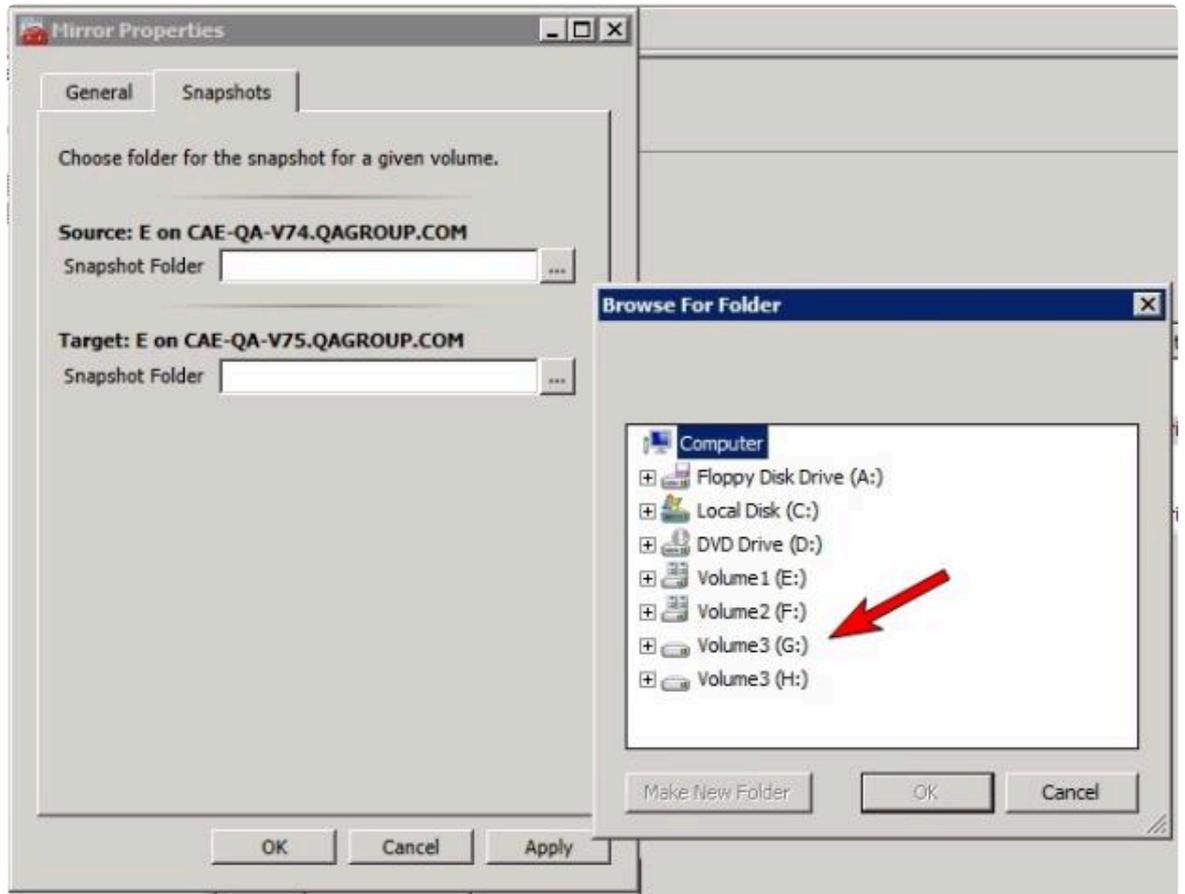
1. Right-click on the appropriate mirror and select **Mirror Properties**.

2. From the **Mirror Properties** dialog, select the **Snapshots** tab.



* **NOTE:** DataKeeper will use the snapshot location configured on the target node; however, since either node in the mirror can become target, the snapshot location may be configured on both the source and the target.

3. Use the **browse**  button to choose the location for the snapshot or type the **path** into the text box.



When clicking the **browse** button that corresponds to the system where the GUI is running, the **Browse for Folder** dialog will appear. When clicking the **browse** button that corresponds to a system that is not the system where the GUI is running, the **Browse for Folder On Remote** dialog will appear.

4. Select your **snapshot location** for the source and the target. Make sure this volume has sufficient free space in order for the operation to complete successfully. Refer back to [Snapshot Location Size](#) for further details when estimating the volume size for your snapshot. Click **Apply**.

Note: Each volume on a given system can either use the same location or a different location can be selected.

	<p>In order to Bypass the GUI*, the location of the snapshot file can be set via command line using the SETSNAPSHOTLOCATION command. In order to view the current snapshot location of a given volume, use the GETSNAPSHOTLOCATION command</p>
--	--

Taking a Snapshot

Once a **snapshot location** has been configured on the target system, a snapshot can be taken. From the target node, run the EMCMD command [TAKESNAPSHOT](#).

Dropping a Snapshot

When the snapshot is no longer needed, volume snapshots must be dropped in order to return to normal processing. Run the EMCMD command [DROPSNAPSHOT](#) which will lock the volume and clean up the snapshot files that were created. The volume will then return to a normal target where writes from the source will go directly to the volume with no copy-on-write storage.

Note: In Windows 2012R2, you will see the warning message “Disk # has been surprise removed.”

Disabling Target Snapshot for a Given Volume

To disable target snapshot for a given volume, the snapshot location must be cleared. This can be accomplished via the GUI.

1. Right-click on the appropriate mirror and select **Mirror Properties**.
2. From the **Mirror Properties** dialog, select the **Snapshots** tab.
3. Remove the snapshot folder of the volume you would like target snapshot disabled on.
4. Click **Apply**.

	<p>The snapshot file location can also be cleared via command line by executing the CLEARSNAPSHOTLOCATION command.</p>
---	--

Once successfully executed, a snapshot location will have to be reconfigured in order to initiate another snapshot of that volume.

Target Snapshot Notes

Supported Configurations

DataKeeper target snapshot is currently supported in non-shared (1×1 and 1×1×1) environments on all Windows OS versions supported by DKCE.

Source Out of Service

DataKeeper target snapshot cannot be initiated when the source is out of service. However, if the source is taken out of service after snapshot is initiated, the snapshot will continue to work as expected. You can continue to use the snapshot, and drop it when you are done, while the source is out of service.

Switchovers and Failovers

If a snapshot is in progress, the volume being snapshotted cannot become the mirror source until the

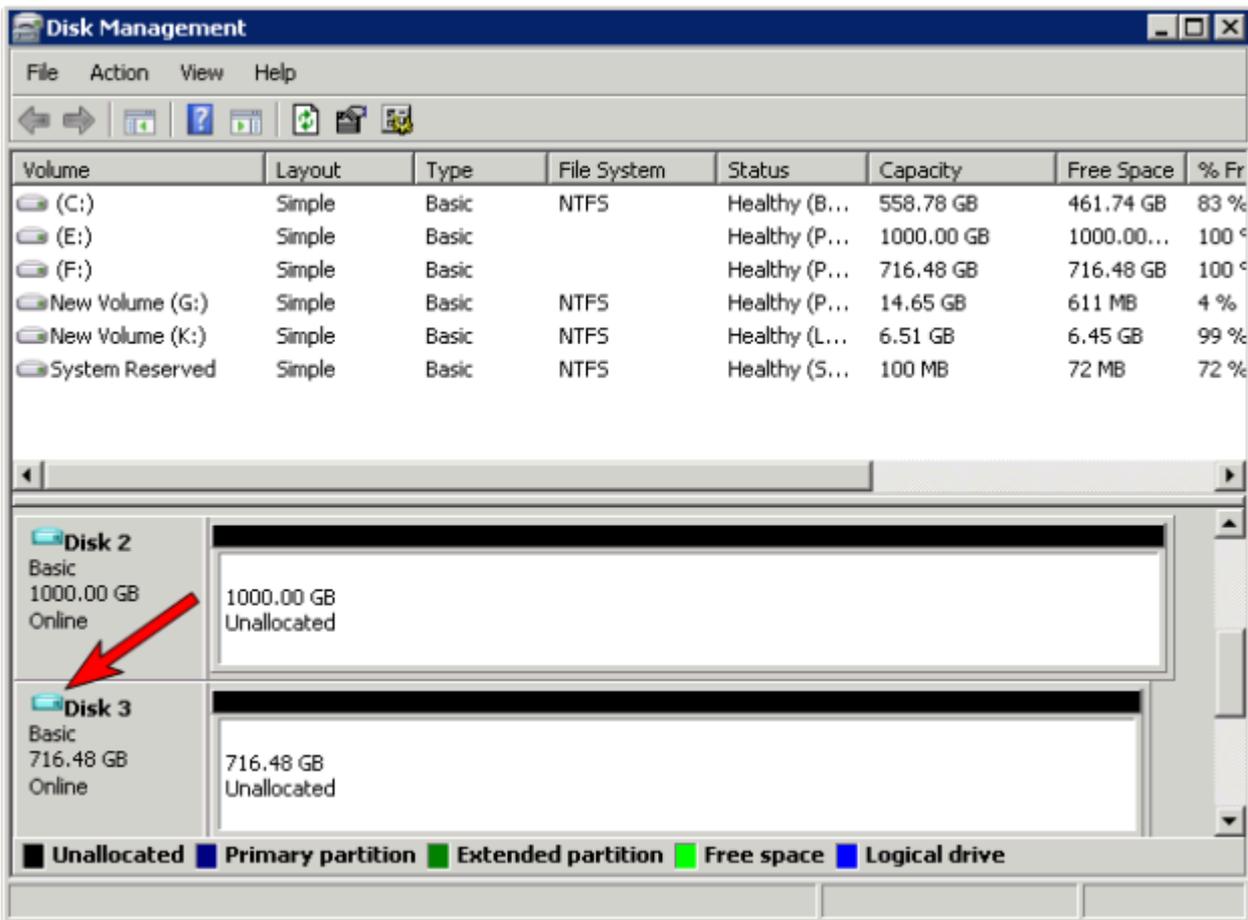
snapshot has been dropped. You must perform a [DROPSNAPSHOT](#) in order to allow a switchover or failover of the volume to the local node. Any processes that access data on the snapshotted volume will have their handles invalidated when the snapshot is dropped. However, if the volume is subsequently unlocked, you must make sure that those processes do not re-open their handles. At this point the data will be “live” application data and not the snapshotted data.

Note: To provide protection during SQL Server recovery we provide a generic script that needs to be added to stop the reporting SQL instance on the target node. Instructions are located in DKSnapshotCleanup.vbs script located in “\support”. Please review the script code on how to add to your WSFC hierarchy.

Files / Disk Devices / Registry Entries

When a snapshot is taken, a snapshot file is created for each snapshotted volume in that volume’s snapshot location. The name of the file that is created is datakeeper_snapshot_vol<X>.vhd, where <X> is the drive letter. This VHD file gets attached as a virtual disk device which can be seen in Windows Disk Management.

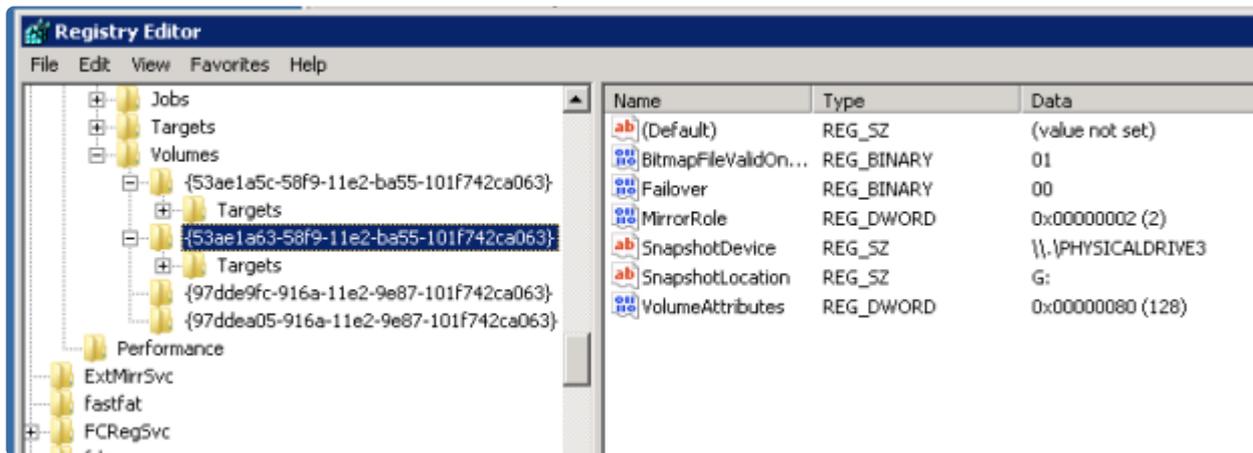
NOTE: The colored icon next to the disk number represents this disk as a VHD.



CAUTION: The virtual disk devices that are created will appear as unpartitioned Basic

disks. They should be used for **snapshot data only** and should not be detached or partitioned while snapshots are in progress. Doing so may result in corruption of the snapshot data. **Make sure that they are not mistaken for available disks to be partitioned and formatted.**

Once these virtual disk devices are attached, a registry entry named SnapshotDevice is created in the volume's key. The value is set to \\.\PHYSICALDRIVE<x> where <x> is the disk number, as shown below:



TargetSnapshotBlocksize Registry Value

DataKeeper target snapshot uses a default block size of 64KB for all entries that are written to the snapshot file. This block size can be modified by creating a REG_DWORD value named [TargetSnapshotBlocksize](#) in the Volume registry key.

The value should always be set to a multiple of the disk sector size, which is usually 512 bytes. Certain workloads and write patterns can benefit from changing the block size. For example, a volume that is written in a sequential stream of data (e.g. *SQL Server log files*) can benefit from a larger block size. A large block size results in fewer reads from the target volume when consecutive blocks are written. But a volume that is written in a random pattern may benefit from a smaller value or the default 64KB. A smaller block size will result in less snapshot file usage for random write requests.

SQL Server Notes

If you are using DataKeeper target snapshot with SQL Server in a SIOS Protection Suite environment, it is recommended that you use a separate SQL Server instance to attach database(s) to the snapshot.

For a clustered SQL Server environment, you must use a separate SQL Server instance to attach database(s) to the snapshot.

Known Issues

SIOS VSS Provider Incompatible with some backup products

The SIOS VSS Provider component has been reported to cause backups to fail when using the following backup products:

- IBM Tivoli Storage Manager
- Microsoft Data Protection Manager

NTFS File System Message

If an internal snapshot error occurs after target snapshot is initiated (such as the snapshot file running out of space or being detached by the user), snapshot will be disabled, the volume will be locked and snapshot files for any failed volumes will be deleted. While the snapshot error is being handled, you may receive NTFS file system errors. These messages are normal and can be ignored.

Application Data Using Snapshot

When using target snapshot data with your application, if the target snapshot is refreshed, you may need to close and reopen your application(s) to refresh the data.

Volume Shadow Copy Service (VSS) Free Disk Space Requirements

If your target snapshot volume has insufficient disk space, VSS operations involving that volume may fail with an “unexpected error”. To avoid this, your snapshot volume should follow the guidelines from the Microsoft article [Troubleshoot VSS issues that occur with Windows Server Backup \(WBADMIN\) in Windows Server 2008 and Windows Server 2008 R2](#).

This article provides the following requirements for free disk space:

For volumes less than 500 megabytes, the minimum is 50 megabytes of free space. For volumes more than 500 megabytes, the minimum is 320 megabytes of free space. If the volume size is more than 1 gigabyte, a minimum of at least 1 gigabyte of free disk space on each volume is recommended.

8.9.10. Using SIOS DataKeeper Standard Edition To Provide Disaster Recovery For Hyper-V Virtual Machines

Considerations

When preparing a Hyper-V environment that spans subnets, subnetting may need to be taken into consideration for any applications that are running inside the virtual machine. Some applications “hard code” IP addresses into their configurations. When these types of applications are loaded in a virtual machine that is replicated (via a DataKeeper replicated volume) to a target server on a different subnet, they may not operate as expected due to the difference in the network settings.

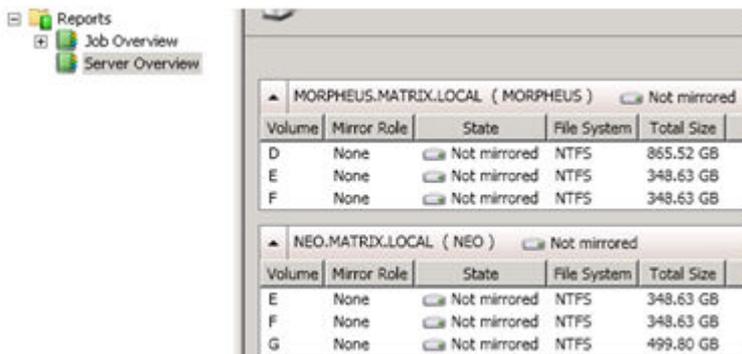
Preparing the Environment

1. Install Windows on two servers with at least two partitions, one for the OS and one for the Hyper-V virtual machine (VM) files. The partition for the files on the target server must be of equal or greater size to the source server’s “data” partition. Install and configure the Hyper-V role on each server as described in Microsoft’s [“Hyper-V Planning and Deployment Guide”](#) and the [“Hyper-V Getting Started Guide”](#), but wait to create your virtual machine until the DataKeeper replicated volume has been created.
2. Complete the installation requirements for the SIOS DataKeeper software.
3. [Connect to the Servers.](#)

Once you connect, new options will appear in the center pane.

You can also optionally review the **Server Overview** report to see the status of your volumes.

When you connect to multiple servers that have DataKeeper installed and licensed, you will see multiple servers and volumes listed here.

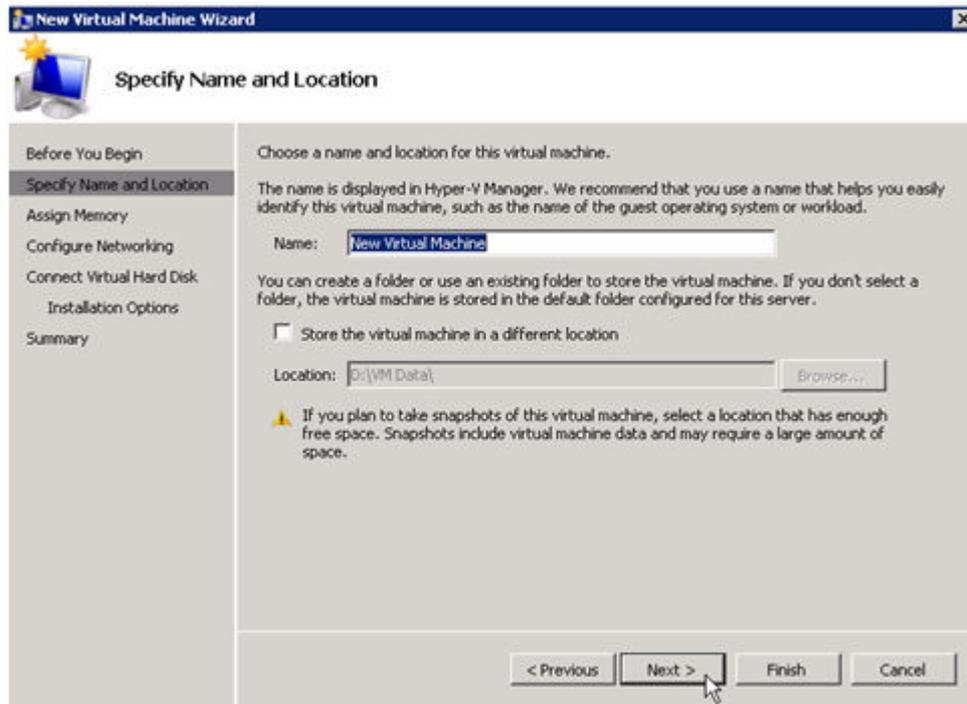


4. [Create a Job / Mirrored Volume.](#)

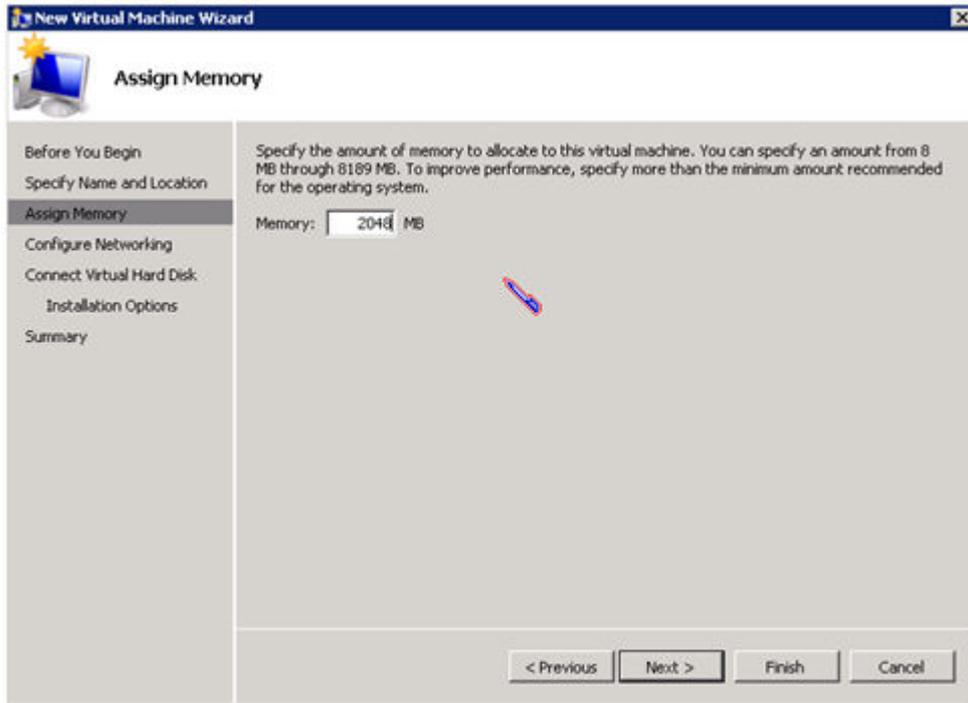
Note: When you select your source server, ensure you select the server whose volume you want to replicate from. Reversing the source and target in these steps will completely overwrite your source volume with whatever is on the target server's volume, even if it is empty, causing you to lose any and all data stored on the source volume.

Create and Configure a Hyper-V Virtual Machine

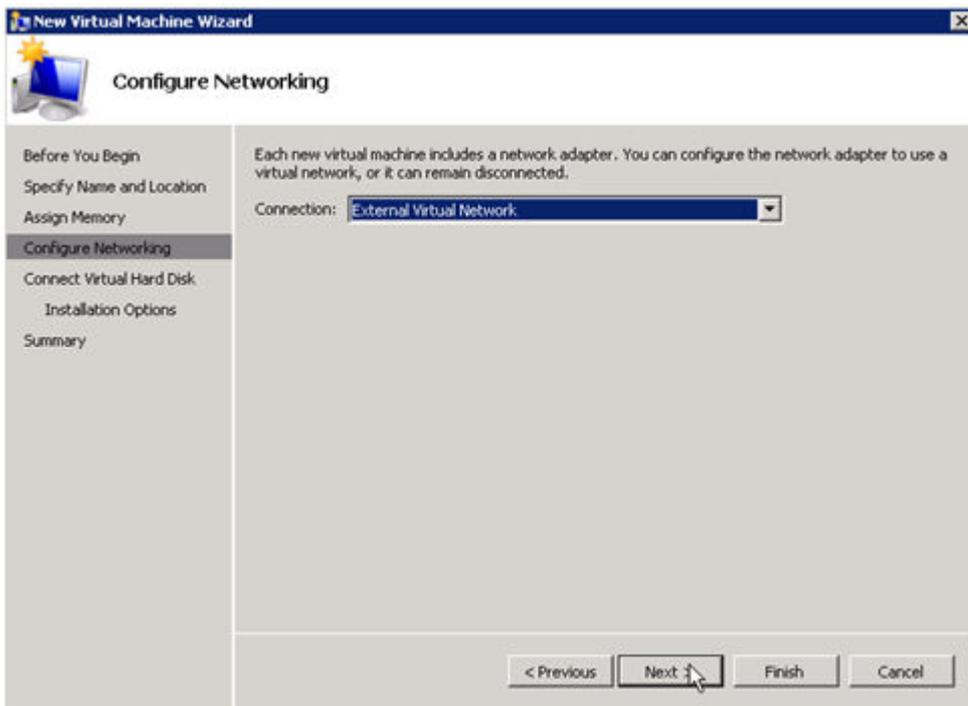
1. Launch the **Hyper-V Console** from **Start – Administrative Tools – Hyper-V Manager**.
2. Start the **New Virtual Machine Wizard**.



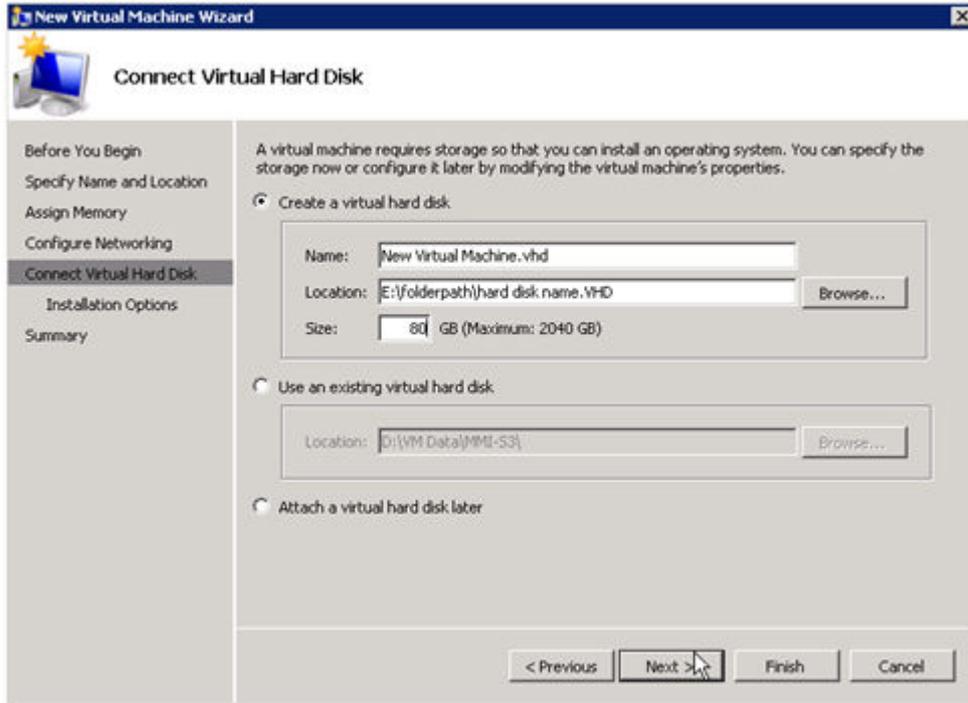
3. Specify the amount of **RAM** to use.



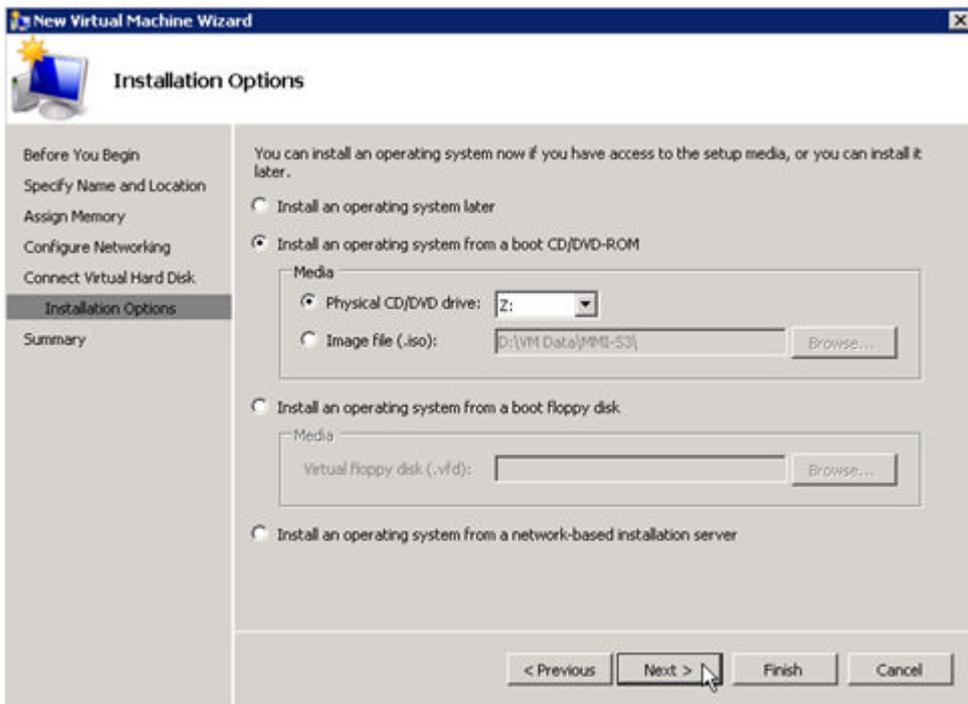
4. Select a **network adapter** to use.



5. Create a new **Virtual Hard Disk** on the replicated volume (or copy an existing VHD onto the replicated source volume and point the creation wizard at it to use as the virtual disk).



6. Specify the **operating system installation options**.



7. **Finish** the wizard and start the **virtual machine**.

Install an Operating System and Any Required Applications in the Virtual Machine

1. Load the operating system into the virtual machine as dictated by industry or vendor specified best practices.

2. Configure the networking within the virtual machine to use DHCP addresses. Use DHCP reservations and name resolution (DNS or WINS) records as well if necessary for address consistency for client connections.
3. Install any necessary applications in the virtual machine.

Configure the Target Server to Run the Virtual Machine

1. On the source Hyper-V host server, open **Hyper-V Manager**, connect to the virtual machine and do a full shutdown of the virtual machine. These actions will quiesce the data on the disk and will maintain data integrity on the target server.
2. Start the **DataKeeper console** as described previously.
3. Ensure the volume has been fully mirrored by checking the mirror status. The status must indicate **Mirroring** with the zero **KB Resync Remaining**.

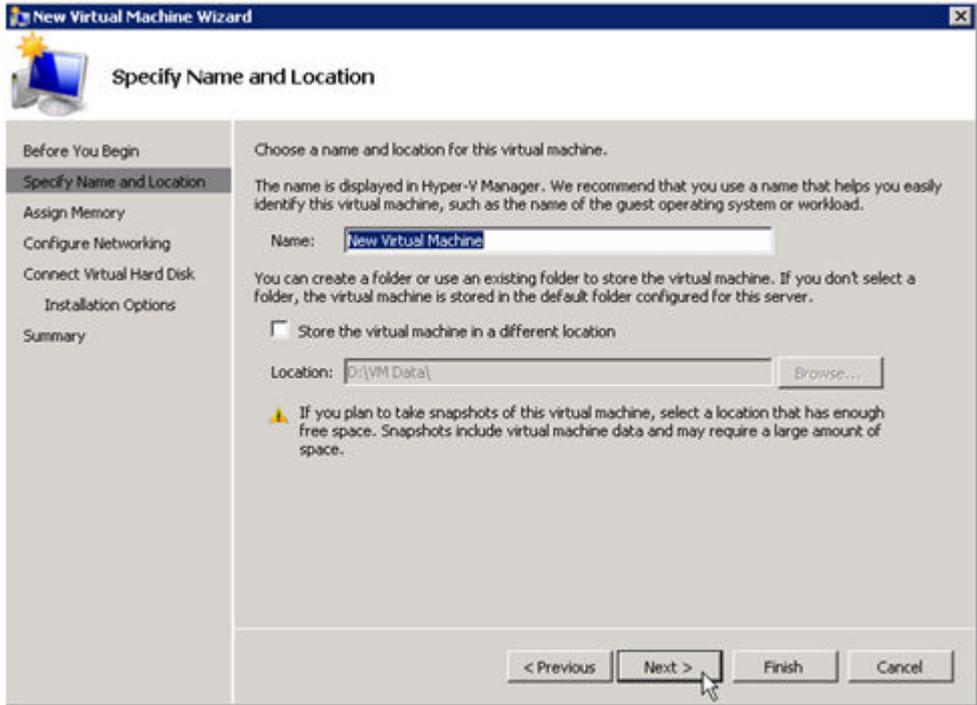
State	Resync Remaining
Mirroring	0.00 KB

4. Select the mirror and click **Switchover** in the **Actions pane**.

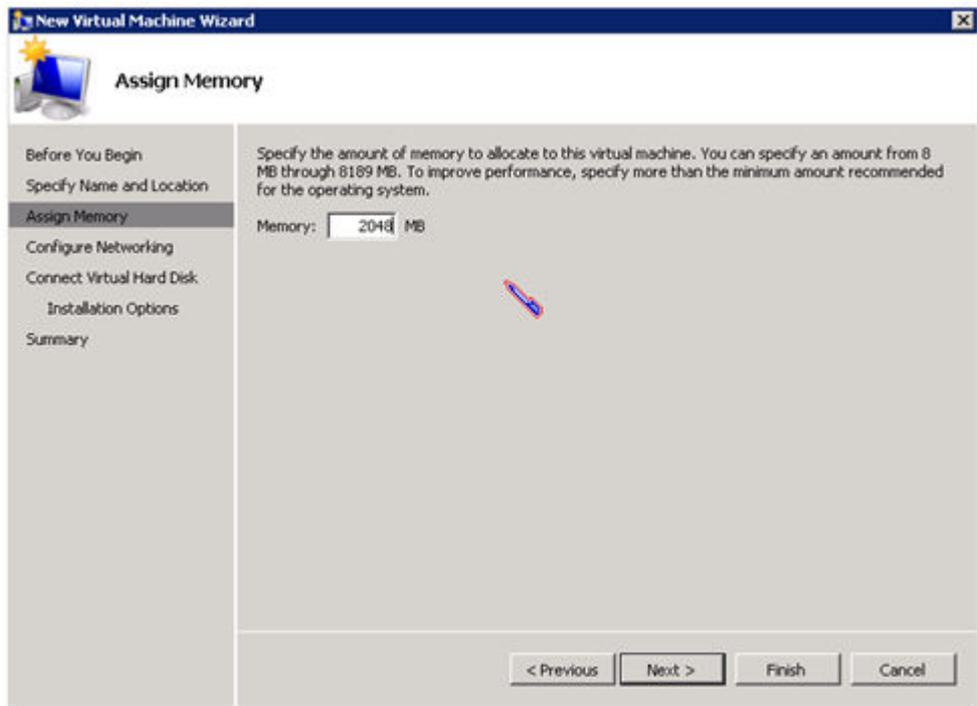


This will reverse the source and target and allow you to provision the virtual machine on the target server.

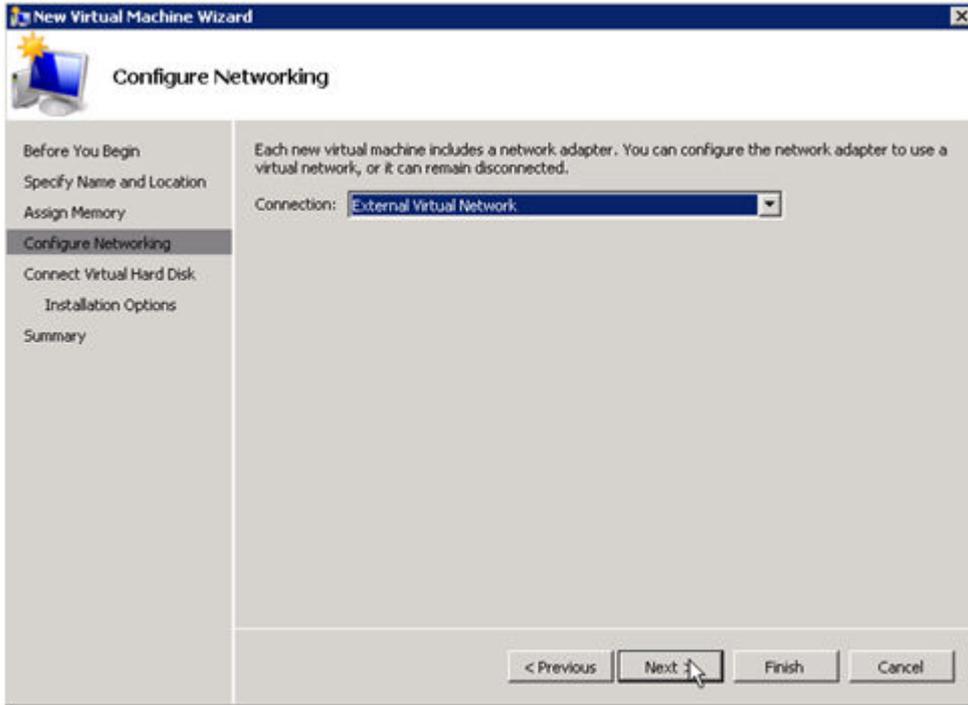
5. On the target server, start the **Hyper-V Manager**.
6. Start the **New Virtual Machine Wizard**.



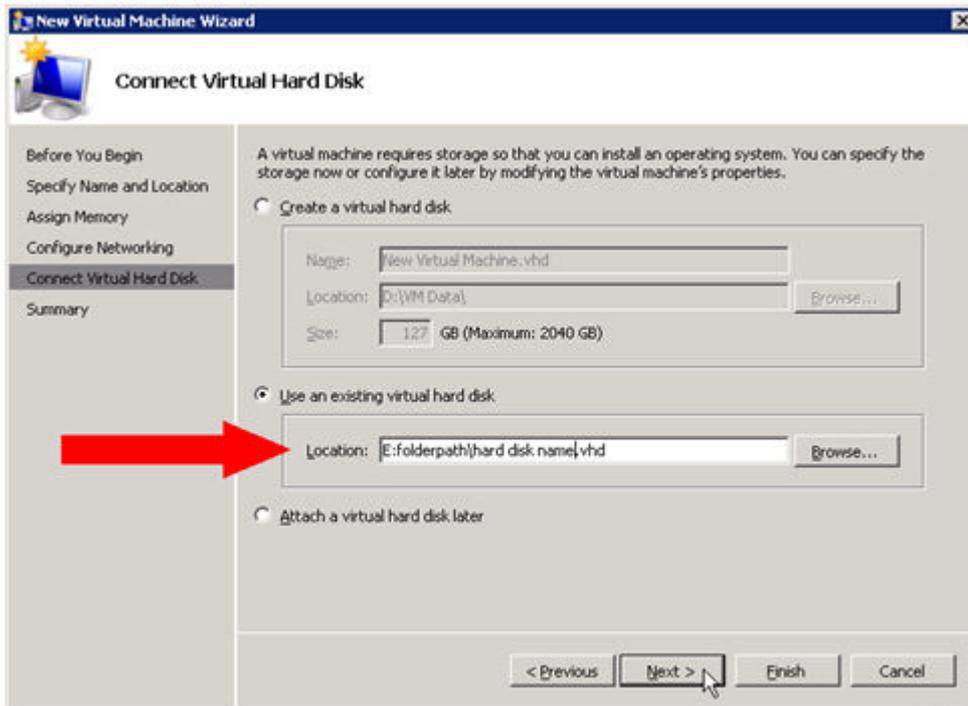
7. Specify the amount of **RAM** to use.



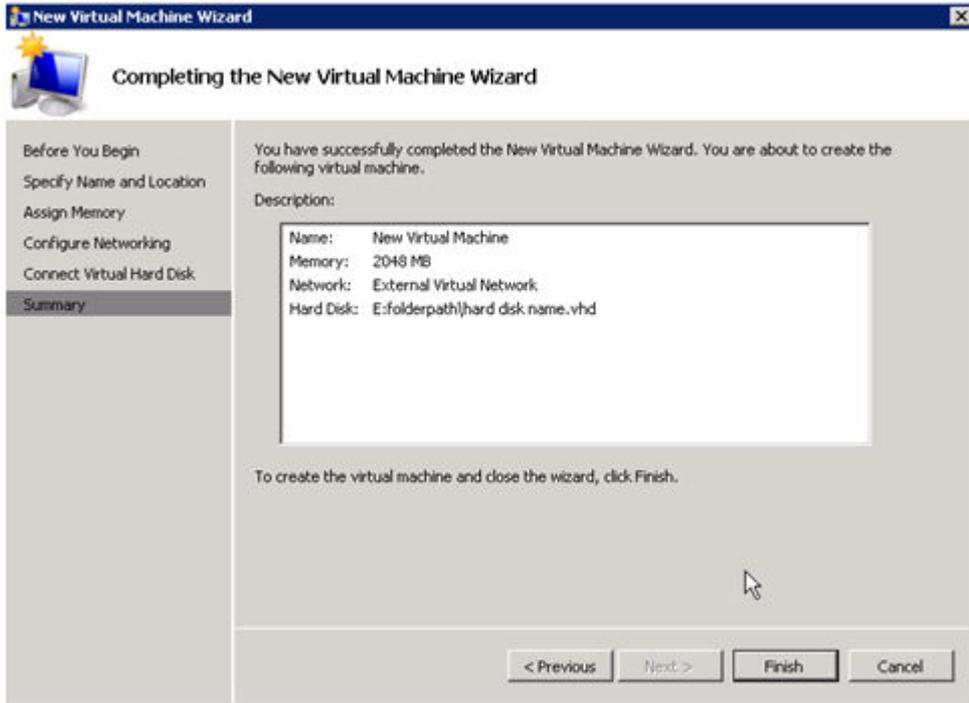
8. Select a **network adapter** to use.



IMPORTANT: Use the existing virtual hard disk on the replicated volume.



9. Click **Finish** to finalize the virtual machine creation process.



Start your virtual machine and test it to make sure it operates as expected.

Planned/Unplanned Switchover

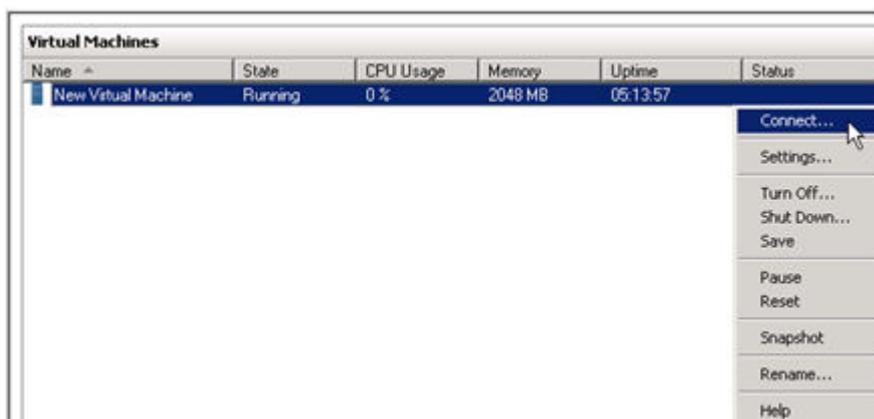
Initiate a **Planned Switchover** to migrate the virtual machine back to your source server.

Initiating a switchover for testing or in the event of an actual outage on the primary server can be completed simply by doing a **Planned Switchover**. There are two types of switchovers, **planned** and **unplanned**.

Planned Switchover

A planned switchover is typically done in a maintenance window when the user community can be advised of planned downtime.

1. On the server on which the virtual machine is running, start **Hyper-V Manager**, as previously described, and connect to the **virtual machine**.



- From inside the virtual machine, **Shut Down** the virtual machine.



- On the same server, start the **DataKeeper console** as described previously.

Ensure the volume is in **mirroring** state by checking the **mirror status**. The status must indicate **Mirroring** with the **zero KB Resync Remaining** before switchover occurs.

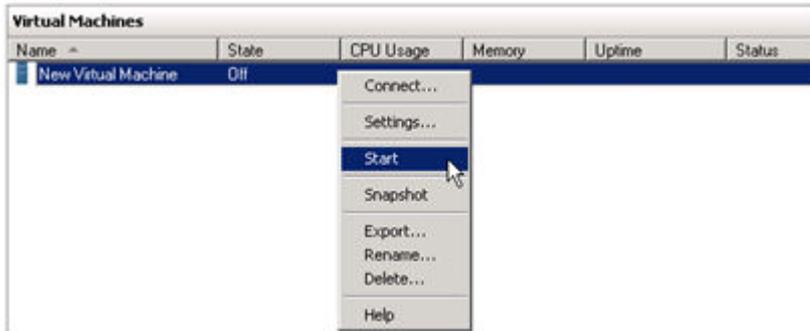
State	Resync Remaining
Mirroring	0.00 KB

- Select the mirror and click **Switchover** in the **Actions** pane.



Wait until the mirror has completely switched over and the DataKeeper user interface (UI) indicates the roles have been reversed properly.

5. Log into the **Hyper-V host server** that just became the source server in the DataKeeper interface.
6. Start **Hyper-V Manager** as described previously.
7. Start the virtual machine.



Unplanned Switchover

An unplanned switchover is necessary when a failure of some sort occurs and either the source system is unavailable or the connection between the systems is broken and requires that the virtual machine be brought online on the target server.

Since, in this scenario, the source server is unavailable for some reason, quiescing the data on the source server is not possible and as such, only the following steps are necessary on the target server to bring the virtual machine online.

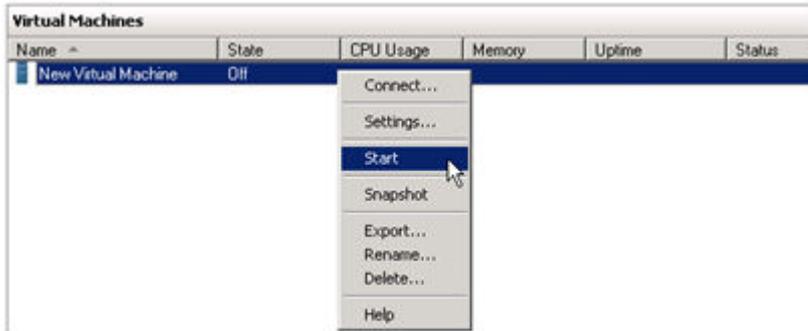
1. On the target server, start the **DataKeeper console** as described previously.
2. Select the mirror and click **Switchover** in the **Actions** pane.



Wait until the mirror has completely come into service on the server and the DataKeeper user interface (UI) indicates the functional server is the source server.

3. On the same server, start **Hyper-V Manager** as described previously.

Start the virtual machine.



Switchback

Switchback is a planned event which transfers the virtual machine from the target server back to the source server and, in process, is exactly the same as the planned switchover process. Please refer to the steps previously listed in the [Planned Switchover](#) section to affect a switchback.

8.9.11. Clustering

[Running chkdsk on Cluster Volumes during Cluster Volume Online](#)

[Creating a DataKeeper Volume Resource in WSFC](#)

[Manual Creation of a Mirror in WSFC](#)

[DataKeeper Volume Resource Health Check](#)

[DataKeeper Volume Resource Private Properties](#)

[Extending a Clustered DataKeeper Volume to a Node Outside the Cluster](#)

[Extending a Single SQL Server Node to a Cluster](#)

[Extending a Traditional 2-Node WSFC Cluster to a Third Node via DataKeeper](#)

[Extending a Traditional 2-Node WSFC SQL Server Cluster to a Third Node via DataKeeper](#)

[Extending a Traditional 2-Node Cluster to a Shared-Replicated Configuration](#)

[Using DataKeeper Cluster Edition to Enable Multi-Site Hyper-V Clusters](#)

[Split-Brain Issue and Recovery](#)

[Switchover in an N-Shared x N-Shared Configuration](#)

[Installing and Using DataKeeper Cluster Edition on Windows Server 2008 R2 / 2012 Core Platforms](#)

[Non-mirrored Volume Resource](#)

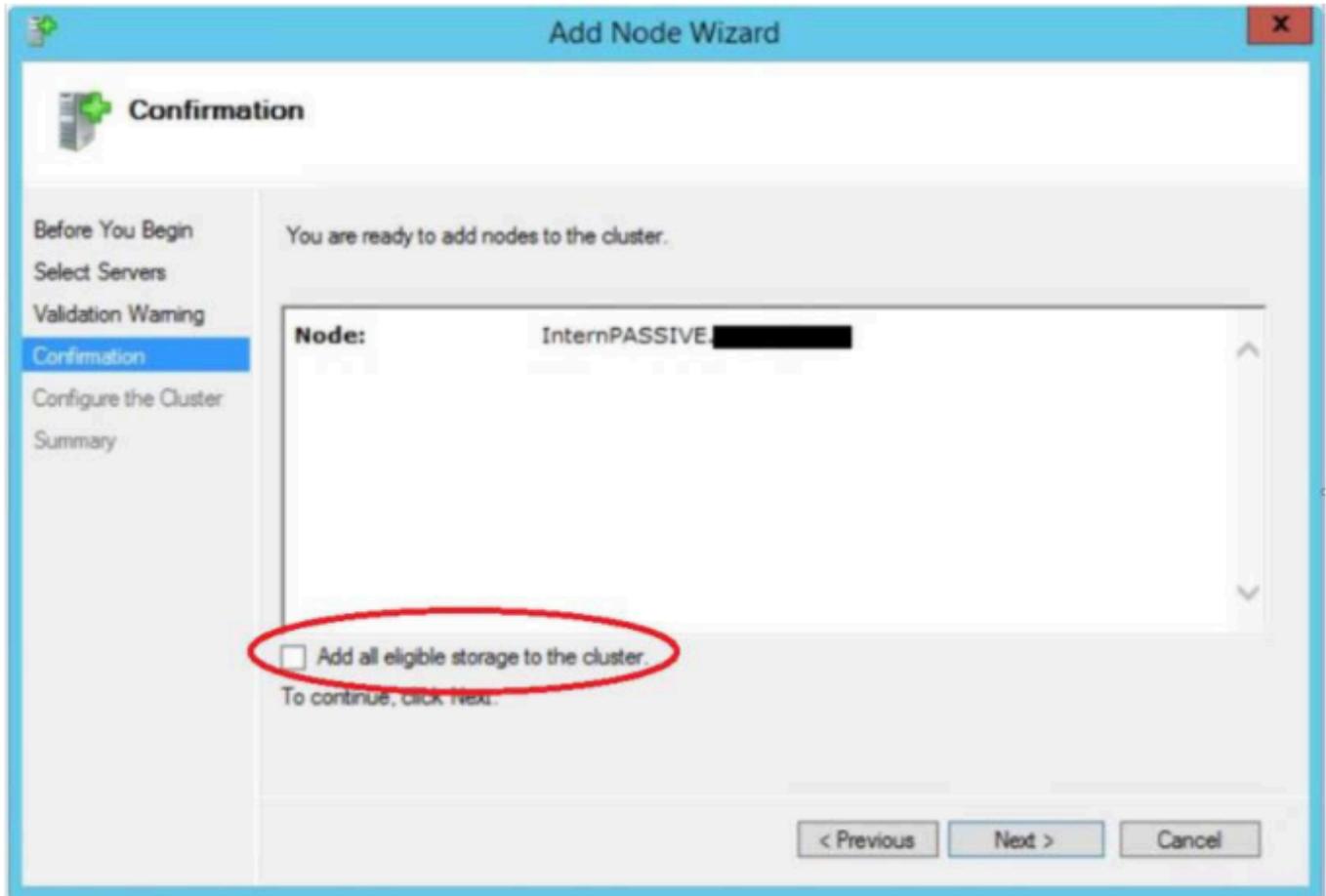
[Using DKCE to Enable Multi-Site File Share Resources with Windows Server 2008R2 WSFC](#)

[Creating Other Server Resource in WSFC](#)

8.9.11.1. Add a Node to the Cluster

When adding a node to a cluster, uncheck the **Add all eligible storage to the cluster** checkbox. It is checked by default.

If it is **not unchecked** it will cause all of the storage that is configured with DataKeeper to be turned into Cluster storage and all roles in Failover Cluster will not come on line.



8.9.11.2. Running chkdsk on Cluster Volumes during Cluster Volume Online

As of version 7.6 DataKeeper now runs chkdsk on all mirrored volumes prior to the volume being available for use. DataKeeper now creates a new flag DiskRunChkDsk in Windows Failover Clustering for each DataKeeper volume. The flag determines how chkdsk runs on each volume during disk check operations.

Volume Commands:

Flag value 0 means chkdsk is enabled and the entire volume will be checked

Flag value 4 means chkdsk is skipped for the entire volume

The volume command performed depends on the argument located in the DiskRunChkDsk flag for each DataKeeper volume. The location of this flag is in HKEY_LOCAL_MACHINE/Cluster/Resources/{DataKeeper Volume GUID}/Parameters.

The complete list of values are numeric and are documented in the Microsoft article [http://msdn.microsoft.com/en-us/library/windows/desktop/bb309232\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/desktop/bb309232(v=vs.85).aspx)

Running chkdsk before a volume is brought online is recommended to ensure that the volume is healthy.

 Large volumes may take a long time to complete the check; therefore, it is recommended that the chkdsk be done during planned maintenance by setting the flag to 0 for each DataKeeper volume.

It is highly recommended to change the flag on all nodes in such circumstances. Please refer to the Microsoft blog on this specific issue <http://blogs.technet.com/b/askcore/archive/2012/03/05/understanding-diskskipchkdsk-in-2008.aspx>

The following messages will be logged in the Application Event log:

Message that disk is being checked

Event ID 101: Checking the dirty flag on volume <volume>

Message that volume is dirty and needs to be checked

Event ID 102: Volume <volume> dirty flags is <error number>

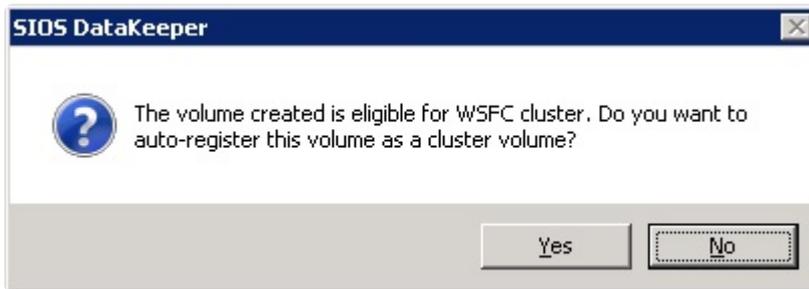
Message that an error occurred during volume online

Event ID 80: A failure occurred during the check of volume <volume>. Error: <error number>. The volume <volume> may be marked as failed.

8.9.11.3. Creating a DataKeeper Volume Resource in WSFC

Automatic Creation of a Mirror in WSFC

1. Use the SIOS DataKeeper GUI to configure a mirror.
2. At the completion of the mirror creation operation, the following dialog box will pop up which will allow you to automatically add the mirror as a DataKeeper volume resource into WSFC.



If **Yes** is selected, then the DataKeeper mirror will be added as a **DataKeeper volume resource** to **“Available Storage”** in WSFC. However, if **No** is selected or an error is encountered, follow the steps in the section [Manual Creation of a Mirror in WSFC](#), to create the mirror manually.

Note: When the DataKeeper Volume is listed as Available Storage, it does **NOT** make DataKeeper Highly Available. The DataKeeper Volume resource(s) only becomes Highly Available after it has been assigned to a Windows Server Failover Cluster role (i.e. SQL, Oracle, SAP, File Server, Hyper-V or Generic Service).

If you need to perform a switchover of the Available Storage resource (before it is added to a Role), remove the Available Storage from WSFC. In the DataKeeper GUI, the Switchover Mirrors option in the Action Panel will then be bold and available for switchover.

Whether the mirror is created automatically or manually, the DataKeeper volume resource(s) is placed in **“Available Storage.”** The DataKeeper volume resource(s) can now be utilized just as if it were a physical disk resource. While clustering some applications (SQL for example), the DataKeeper volume resource is recognized and treated exactly the same as a physical disk resource. This means that during the cluster create process, the DataKeeper volume resource will be pulled automatically into the cluster resource and the dependencies will be created automatically. Other applications, notably the Hyper-V “Virtual Machine” resource, are hard-coded to look for a physical disk resource and will not automatically pull the DataKeeper resource into the cluster configuration. In these circumstances, the DataKeeper volume resource can be easily added to the cluster resource and the dependencies can be created manually through the WSFC GUI.

Use the DataKeeper GUI to monitor the mirroring states. It provides more information than the Failover Cluster manager UI.

8.9.11.3.1. Manual Creation of a Mirror in WSFC

BEFORE STARTING, CHECK: Once Verified, click [here](#) to start “Creating An Empty Role”.

If your mirrors are NOT Highly Available (e.g. listed in **Failover Cluster Manager\Storage\Disk as “Available Storage”**)

Return to an elevated command prompt (on the Source) and proceed with the following:

1. **cd %extmirrbase%** (Shortcut to the DataKeeper Directory)
2. `emcmd . registerclustervolume (drive letter)`
3. Your output should reflect “`Status = 0`”

Upon completion, **return** to Failover Cluster Manager\Storage\Disk as now the mirror should be listed as “*Available Storage*”

Now you’re in a position to **Create an Empty Role**.

1. **Launch** Failover Cluster Manager
2. **Right click** on Roles and select “*Create Empty Role*”
 - A default role called “*New Role*” will be created
3. **Rename** “New Role” to “*DataKeeper Service*”
4. **Return** to Storage\Disks...Available Storage
5. **Right click** the Volume/Available Storage, More Actions, Assign to Another Role...
6. **Select the Role** that you’ve created in Step 4 or in this instance, DataKeeper Service

Note: The DataKeeper Mirror has been assigned to the role you have created, thus the DataKeeper Volume(s) are now Highly Available.

This can be tested by:

1. **Right clicking** the role/DataKeeper Service\Move\Move Cluster Role.
2. **Select** any other servers available in your cluster, then OK.

Perform another Move to ensure the Role and its related resources/DataKeeper, switch back successfully.

8.9.11.4. DataKeeper Volume Resource Health Check

A DataKeeper Volume resource provides two functions that are used by the Microsoft Cluster service to check for availability and health of the DataKeeper Volume resource. A simple check LooksAlive and a more rigorous check IsAlive.

LooksAlive

The Cluster service calls the LooksAlive function based on the specified interval. The default is every 20 seconds on a freshly installed system, or 60 seconds after upgrading DataKeeper Cluster Edition from a version prior to 8.4.0. The LooksAlive function performs a quick check of the volume device. When the LooksAlive test fails, the cluster service will call the IsAlive test immediately.

IsAlive

Performs a thorough check to determine if the specified resource is online (available for use). The default is 120 seconds on a freshly installed system, or 300 seconds after upgrading DataKeeper Cluster Edition from a version prior to 8.4.0. If the device for the mirror becomes unreachable by DataKeeper, the IsAlive check will detect this condition and will mark the resource as Failed.

8.9.11.5. DataKeeper Volume Resource Private Properties

A DataKeeper Volume resource includes several private properties that are used by DataKeeper Cluster Edition. Among these properties are:

- VolumeLetter (REG_SZ) – the volume letter that is replicated by DataKeeper and associated with this DataKeeper Volume Resource.
- LastSource (REG_SZ) – name of the cluster node that was most recently the source of the mirror.
- SourcePending (REG_SZ) – If a node is currently performing a mirror switchover as part of an Online operation, the node name is stored in the SourcePending private property. The property is set to an empty string when Online completes. This property is used to resolve situations where the cluster service is stopped while a switchover is in progress.
- NonMirrored (REG_DWORD) – This optional property can be used to configure a non-mirrored storage location for things like SQL tempdb. This private property does not normally exist – it must be manually configured. See [Non-mirrored Volume Resource](#) for more information.
- TargetState_<node> (REG_DWORD) – For each <node> in the system that has at some point been a mirror target, this private property will exist. Its value is the current state (the internal DataKeeper mirror state) of the Owner node’s mirror to the given node. Values include:

0 = Node is not currently a target (may be source or shared with a source or target)

1 = Mirroring

2 = Resync

3 = Broken

4 = Paused

5 = Resync Pending

Below is a sample screenshot of the Private Properties of a DataKeeper Volume.

Use the following command in powershell to generate the output:

```
Get-ClusterResource "<DataKeeper Resource Name>" | Get-ClusterParameter
```

Object	Name	Value	Type
DataKeeper Volume E	VolumeLetter	E	String
DataKeeper Volume E	LastSource	CAE-QA-U46.QAGROUP.COM	String
DataKeeper Volume E	DiskSignature	0x45	UInt32
DataKeeper Volume E	DiskRunChkDisk	0	UInt32
DataKeeper Volume E	NonMirrored	0	UInt32
DataKeeper Volume E	TargetState_CA-E-QA-U47	1	UInt32

Implications of the TargetState_ <node> value on Failover

DataKeeper Cluster Edition maintains the TargetState_<node> property value, and updates it whenever the mirror state changes. The cluster networks provide multiple paths for a mirror's state to be available on a target system. This enhances the reliability of DataKeeper, and reduces the chance of Split Brain occurrences in the cluster for both synchronous and asynchronous mirrors. The DataKeeper Volume Online method tests to make sure that a node is in a Mirror State which allows Online to proceed. For a mirror target node, that state is "1" (Mirroring). All other states will cause the Online to fail and the DataKeeper Volume resource to be marked as Failed on this node.

In some cases, for instance the catastrophic failure of a previous Owner node that is not going to be recovered for a long period of time, it may be necessary to remove the TargetState_<node> private property in order to force a DataKeeper Volume resource to come online on a node. However, because the node may not have been in a mirroring state with the previous Owner, some Data Loss could occur.

The TargetState_<node> property can be removed using the following command in powershell:

```
Get-ClusterResource "<DataKeeper Resource Name>" | Set-ClusterParameter -Name "TargetState_<node>" -Delete
```

Note: Servers running Windows 2008 R2 will need to import the 'failoverclusters' module before running these commands. Use the following command in powershell:

```
import-module failoverclusters
```

Behavior of a Synchronous Mirror after Cluster Integration

The purpose of a synchronous mirror is to ensure data consistency between the source and the target at all times. When a synchronous mirror is integrated as a cluster resource, DataKeeper will begin using the cluster to further ensure data consistency.

When the state of a synchronous mirror changes from a mirroring to a non-mirroring state (such as mirrored to paused), DataKeeper will attempt to set the TargetState_<node> private property to ensure data consistency in the event of a failover.

DataKeeper, to ensure the consistency of the source's local volume with the targets, will hold all writes that come down to that volume until it has set the TargetState_<node> private property to the appropriate value. The writes will then be allowed to continue.

Should DataKeeper be unable to properly set the TargetState_<node> private property, it will fail those

writes and lock the volume. This ensures that the mirrored volume has the same data consistency as when it was last in the mirroring state.

8.9.11.6. Evicting a Node from a Cluster

Evict the node using Windows Failover Cluster user interface. When a node is evicted the mirror will remain intact and will continue mirroring outside of the cluster. The evicted node will no longer be on the list of possible owners.

8.9.11.7. Extending a Clustered DataKeeper Volume to a Node Outside the Cluster

DataKeeper Volume cluster resources can be extended to a DR Node for Disaster Recovery purposes. In the event of a complete failure of all systems in the cluster, data will be accessible on the DR Node (referred to as the “DR Node”). Here you will find instructions on how to set up this configuration, how to access your data on the DR Node, and how to bring your data back into service in the cluster after the cluster nodes have been restored.

Configuration Tasks

Configuring a non-clustered DataKeeper target node

Recommended configuration for the DR Node

- If possible, the DR Node should be a member of the same domain that the clustered nodes are a member of. Refer to [DataKeeper Service Log On ID and Password Selection](#) for more information about configuring the DataKeeper Service account settings.
- Firewalls (Windows as well as any other firewall devices / software on the DR or cluster site) must allow access to DataKeeper-specified ports on the DR Node from all cluster nodes, and vice-versa. See [Firewall Configurations](#) for more information.
- Configure a volume on the DR Node for each clustered DataKeeper Volume that is to be extended to the DR Node. The volume should be at least as big as the clustered volume.

Scenario 1 – Extending existing DataKeeper Volume resources

If you have already configured DataKeeper Volume resources in your cluster, you can extend these volumes to a DR Node using the DataKeeper MMC GUI by following these steps:

1. Connect the DataKeeper GUI to the DR Node using the “Action / Connect To Server” option.
2. Connect the DataKeeper GUI to the cluster node where the DataKeeper Volume resource is online.
3. For each DataKeeper volume that you are extending to the DR Node:
 - a. In the Jobs view, choose the job that contains the volume to be extended.
 - b. Choose “Create a Mirror”.
 - c. Select the mirror Source Node, Volume, and source IP address.

- d. Select the DR Node as Target, along with the Volume and IP Address.
- e. Choose the mirror parameters and click “OK” to create the mirror.
- f. Configure any additional mirror information needed

See [Creating Mirrors with Multiple Targets](#) for more information.

Scenario 2 – Creating a new DataKeeper Volume resource, and extending it to the DR Node.

If you do not have a DataKeeper Volume resources in your cluster that represents the volume that you want to extend to the DR Node, first create the clustered resource, then use the steps in “Scenario 1” above to extend it to the DR Node.

Scenario 3 – Extending a traditional shared-volume cluster to a DR Node using DataKeeper

See [Extending a Traditional 2-node WSFC cluster to a third node using DataKeeper](#) for detailed steps that will guide you through extending a shared-volume Microsoft clustered volume to another cluster node.

In this case, we are extending to a **non-clustered** node. This makes it unnecessary to perform step 2 (configure cluster Quorum settings) and step 7 (add the node to the cluster). Otherwise, the steps remain the same.

Configuration Summary

After you have extended your clustered volume(s) to a DR Node, you will be able to bring the volumes Online and Offline in the cluster as before. The DR Node will remain the mirror target under normal operating conditions.

If you wish, you can check the data on the non-mirrored system by using the “Pause and Unlock Target” option for the mirror whose target is the DR Node. See [Pause and Unlock](#) for more information.

Accessing Data on the Non-Clustered Disaster Recovery Node

In the event that all of your clustered nodes are unavailable (possibly due to a disaster of some sort at your primary cluster site), you may need to be able to access the data that has been replicated to a DR Node. Use the following procedure to accomplish this.

Note: Please refer to [Switching Over a Mirror](#) guidelines.

Option 1 – using the DataKeeper GUI

1. Start the DataKeeper GUI and connect to the DR Node.
2. Choose the Job that contains the mirror to be made accessible on the DR Node.
3. Choose “Switchover Mirror” to make the DR Node the mirror source, and to make the data on that node accessible.

 **NOTE:** If any of the cluster nodes are still running and accessible over the network from the DR Node, the “Switchover Mirror” option will not be available. The DataKeeper GUI will see that the volume is part of a cluster that is still operational, and will prevent a switchover from being selected.

Option 2 – using EMCMD

On the DR Node, start a command prompt and run the commands:

1. `cd ExtMirrBase`
2. `EMCMD . SWITCHOVERVOLUME`

 **NOTE:** Use this command with caution; if any cluster nodes are still operational and accessible over the network from the DR Node, EMCMD will NOT prevent the switchover from occurring. This will cause resource failures in the cluster, and the results will be undetermined.

Repeat these actions for all volumes that you need to access on the DR Node. DataKeeper will keep track of all changes that occur while the volume is accessible on this node, and will automatically resync these changes to the cluster nodes when they are brought back up and are accessible from the DR Node. However, the volume resources will not automatically come Online in the cluster – manual steps as outlined in the next section must be taken to move the DataKeeper volumes back into the cluster.

Restoring Data Access to the Cluster

When a cluster node is powered back up after a failure, there are several states that its mirrors can be put into, depending on the mirror state at the time of the original failure, the current network conditions, and the state of other nodes in the cluster. The volume may be in the Source, Target, or None role after all cluster nodes have been restored. You should use the DataKeeper GUI on any of the cluster nodes to determine the mirror role, and to resolve any possible Split-Brain conditions that may exist. See [Split Brain Issue and Recovery](#) for more information. If you are resolving Split-Brain, you should choose the DR Node to be the node that remains source, since it is the one that has the most up-to-date data.

As long as the DR Node is accessible from the cluster node, and the non-cluster node’s mirror is in the

Source role, any Online request on that cluster node will fail.

Steps to bring the clustered DataKeeper Volume resource back Online

In order to bring the DataKeeper Volume resource Online on a cluster node, the mirror must be switched over to the cluster node where that volume was last Online before the outage (the “Last Source” node for that volume), and the DR Node’s volume must be made a Target of the clustered volume. At that point, the DataKeeper Volume resource can be brought Online on the cluster node.

To determine which cluster node is the Last Source node for a particular volume, run either of the following commands on any of the cluster nodes:

- (to use cluster.exe) – cluster res “<DataKeeper Volume Resource name>” -priv
- (to use powershell) – get-clusterresource -Name “<DataKeeper Volume Resource name>” | get-clusterparameter
The output produced should include a line with the value “LastSource” listed. The name of the Last Source node is given on that line.

Follow these steps to bring the resource Online:

1. If any DataKeeper Volume resources are already Online in the cluster, take them Offline. This is necessary in order to resolve Split Brain conditions in the next step.
2. Start the DataKeeper GUI on one of the cluster nodes. Resolve any Split Brain conditions, choosing the DR Node as the mirror source.
3. Monitor the state of the mirrors that have been created from the DR Node (Mirror Source) to the clustered nodes (Targets). If any clustered nodes are shared, only one of them will be a mirror target.
4. Once the mirror from the DR Node (Mirror Source) to the LastSource cluster node has reached the Mirroring state, the LastSource node can be made Source.
 - a. Open a command prompt on that cluster node
 - b.. Run the command `cd ExtMirrBasep(((((((`
 - c. Run the command `EMCMD .`
`SWITCHOVERVOLUME`

Repeat these steps for each volume. If multiple volumes are part of the same resource group, be sure to switch each of them over to their Last Source node.

Then, using Failover Cluster Manager, bring the volumes and associated applications / roles Online.

8.9.11.8. Extending a Single SQL Server Node to a Cluster

This guide explains how to install a single SQL Server node and extend it to a clustered node. Please read this document carefully prior to installation.

Planning Steps:

- Start with a Microsoft SQL Server standalone node, where data resides on the C drive.

Note: It is recommend that similar hardware be used for the standalone node (for the purpose of this guide, we will call this node the backup node).
- On the new backup node setup Windows failover cluster and setup a one node cluster (setup alongside a file share quorum).
- Setup Datakeeper Cluster Edition on the new node.
- Create empty DataKeeper Volume resource(s) using the Failover Clustering UI. Provide a name(s) that best describes its intended use (Example: "DataKeeper Volume F (NonMirrored)").

The following steps explain how to manually create this resource:

- a. In the Failover Cluster Manager, create an empty role, right-click on **Role** and select **Create Empty Role**.
- b. Right-click the empty role and select **Add a Resource, More Resources**, then select **Add DataKeeper Volume**.
- c. Right-click the **new DataKeeper Volume** resource and select **Properties**.
- d. Enter the Resource Name you chose earlier (Example: "DataKeeper Volume F (NonMirrored)") then select **Done**. No other properties changes are needed at this time. Follow the steps below for setting the Properties needed for the non-mirrored resource.
- e. Repeat the steps a – d for the E drive.

Assign the following properties using Powershell:

```
VolumeLetter = "F" (if the drive letter is F, otherwise whatever the drive letter is)
```

```
NonMirrored = 1 (there is no space between Non and Mirrored)
```

Assign the following properties using Powershell:

```
Get-ClusterResource "DataKeeper Volume F (Non-Mirrored)" | Set-
```

```
ClusterParameter -Name VolumeLetter -Value "F"

Get-ClusterResource "DataKeeper Volume F (Non-Mirrored)" | Set-
ClusterParameter -Name NonMirrored -Value 1
```

After the storage is created, right-click and select **Remove from empty role**. This will move the storage to **Available Storage** which can now be used by SQL Server installation in the following steps.

- Run SQL Server setup, choose the SQL Server Cluster edition to install. Select the same features that are installed on the primary node. (**Note:** Use the domain user ID and password to start SQL Server services instead of local account.)
- During installation setup will prompt you for failover cluster storage, select the storage you created earlier.
- Copy the database from the primary server to the new backup node the use the **BACKUP DATABASE** command to make a backup of the database.
- Connect to the Cluster database on the backup node and use the **RESTORE DATABASE** command to restore the database.

It is highly recommend using the **MOVE** option of the **RESTORE** option to move the files to separate drives (separate DATA and LOG file). The following example shows how to move a sample Sales database to different drives. (**Note:** The data and the log files are moved to different volumes.)

```
RESTORE DATABASE sales
```

```
FROM DISK = 'C:\Backup\Sales.bak'
```

```
WITH RECOVERY,
```

```
MOVE 'Sales_Dat' TO
```

```
'E:\MSSQL11.MSSQLSERVER\MSSQL\Data\Sales.mdf',
```

```
MOVE 'Sales_Log' TO
```

```
'F:\MSSQL11.MSSQLSERVER\MSSQL\Data\Sales.ldf';
```

- Users can now be moved to the new database and the new backup server. Also, the original primary server can now be reconfigured. It is recommend that the entire Windows operating system be re-installed. Once you have re-installed the operating system, setup failover clustering and join the cluster created earlier. (**Note:** When joining the cluster,select "**No, I do not require support from Microsoft**". The cluster can be verified later in the process.)
- Setup Datakeeper Cluster Edition on this server.

- Remove both non-mirrored DataKeeper volume resources from the MS SQL Server cluster group.
- Delete both non-mirrored DataKeeper Volume resources from Storage.
(**Note:** It is important to remove the resource from both the cluster group and available storage. The resource should be deleted from failover clustering before proceeding.)
- Use the DataKeeper GUI to create jobs that contain the E and F volume mirrors for all nodes in the cluster. Choose the node that is currently running Microsoft SQL Server as the source. After creation choose **Yes** to add the volumes to Failover clustering
- Add the DataKeeper Volume E and DataKeeper Volume F storage to the SQL cluster group. Right-click on the resource and select **Add Storage**.
- Setup SQL Server using the cluster edition **Add Node to a SQL Server Cluster** option.
- Finish by adding dependencies to the Microsoft SQL Server resource for both the DataKeeper volume resources.

The single node database has now been converted to a clustered highly available database and is ready for failover testing.

8.9.11.9. Extending a Traditional 2-Node WSFC Cluster to a Third Node via DataKeeper

When replicating from a WSFC 2-node cluster to a third node via DataKeeper, the following tasks are required:

- Replace the existing WSFC physical disk resource with a DataKeeper volume resource that supports data replication.
- Change the quorum type to Node Majority.
- Add the third node into the cluster for failover.
- Reestablish any/all resource dependencies to the new DataKeeper volume resource.

The following example details the steps necessary to extend a cluster resource group from a 2-node cluster to a third node via DataKeeper.



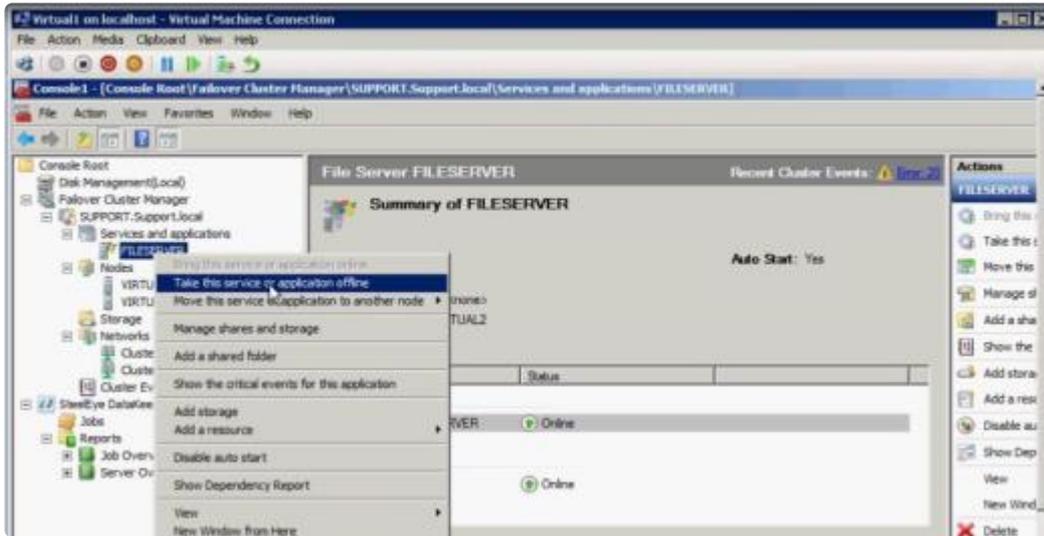
1. Remove physical disk resources from WSFC.

This also removes any dependencies on these physical disk resources. These dependencies will need to be reestablished to the new DataKeeper volume resource, so please take note of what these dependencies are before completing this first step by viewing the **Dependency Report**. Highlight your resource and select **Show Dependency Report**.

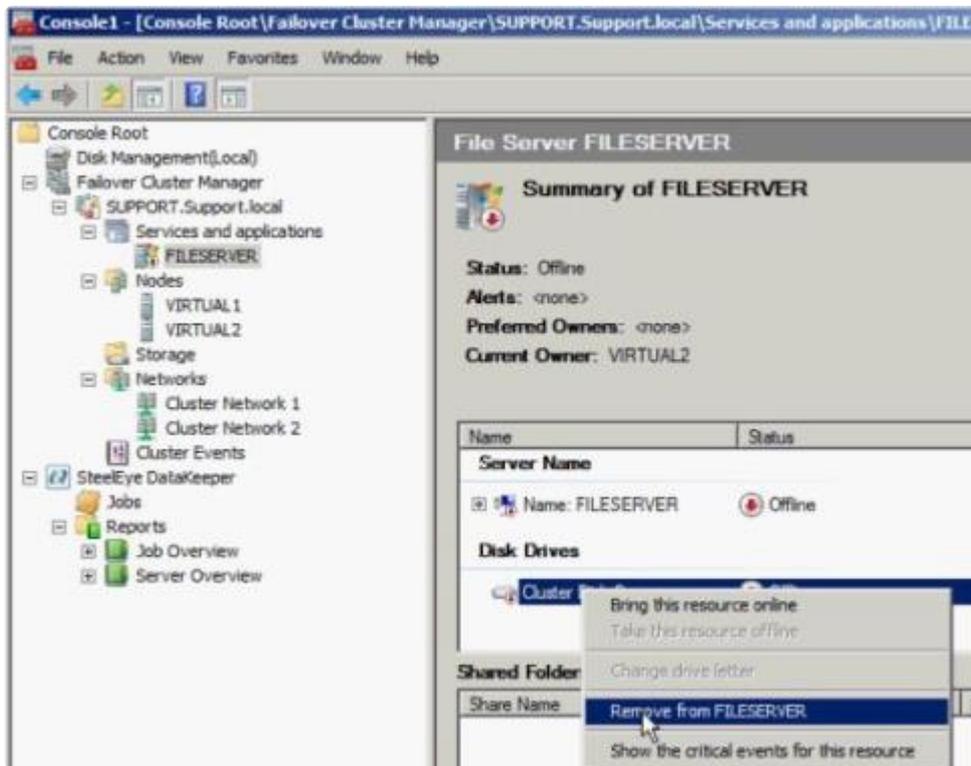
Use **Failover Cluster Manager MMC** to perform the following steps:

- a. Offline the cluster resource group by right-clicking and selecting **Take this service or**

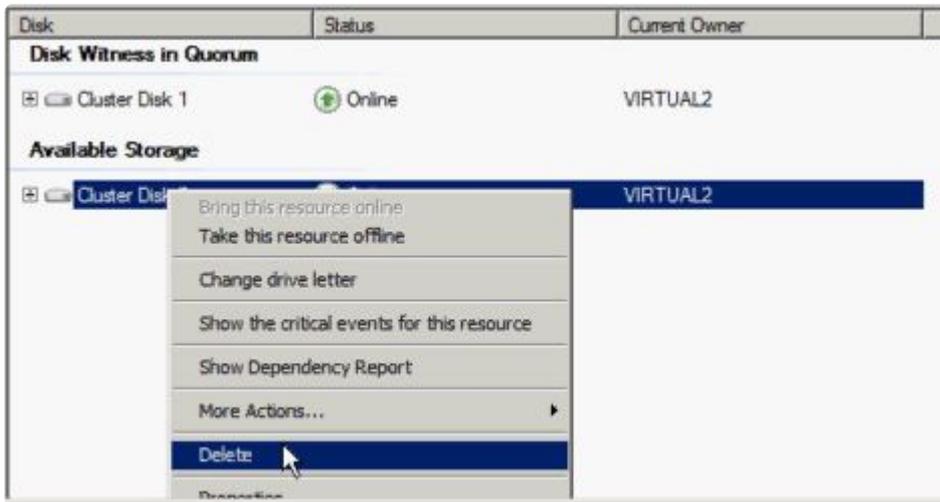
application offline.



b. Remove the physical disk from cluster resource group (moves to Available Storage).



c. Remove the physical disk resource from the cluster configuration by deleting the resource from the **Available Storage** group.



2. Configure cluster quorum settings.

Because there will now be a third node in a remote site, the **Disk Witness in Quorum** is no longer valid, therefore, the **Node Majority** configuration should be selected.

- a. Right-click the cluster and select **More Actions / Configure Cluster Quorum Settings...**



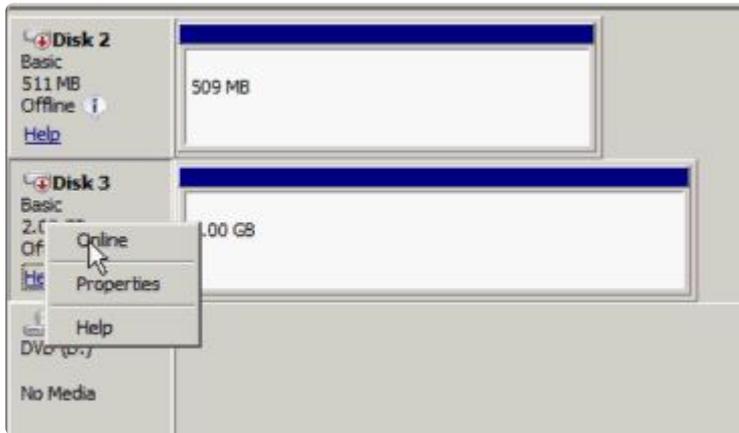
- b. Select **Node Majority**. **Note:** Change the quorum type to **Node Majority** if the final number of nodes is odd as in a 3-node cluster, or **Node and File Share Witness Majority** if the final number of nodes will be even as in a 4-node cluster.

- c. Delete disk witness from **Available Storage**.

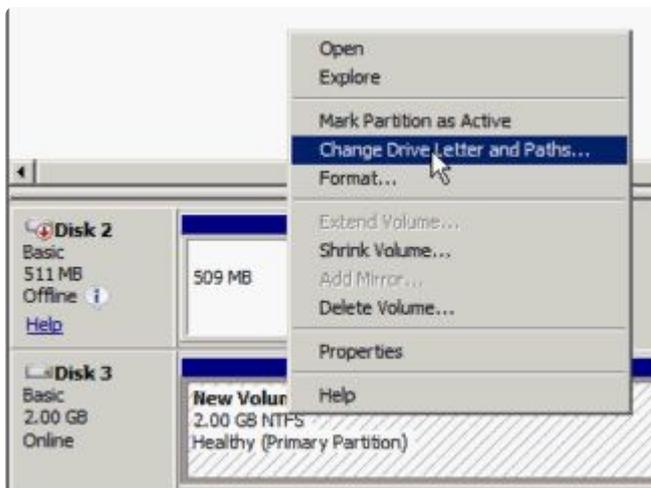
3. Online Disk.

Use **Disk Management MMC** to perform the following steps:

a. Online physical disk.



b. Change drive letter to match previous configuration (if needed).

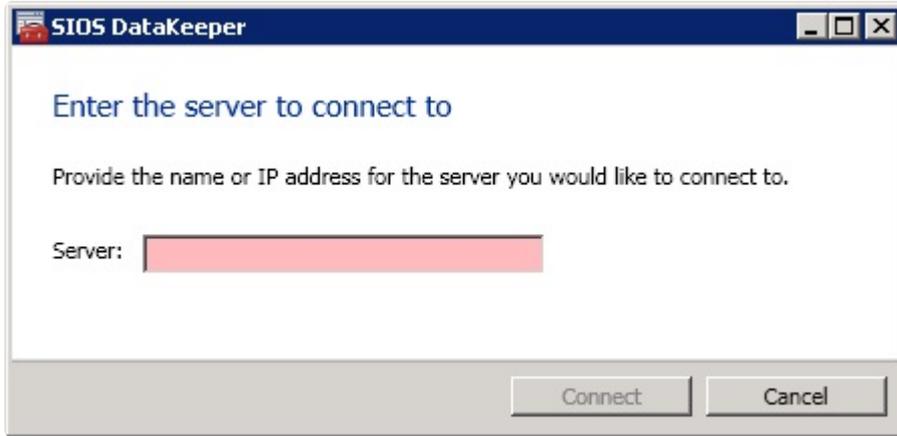


c. Repeat the above steps, 2a and 2b, on all shared nodes in the cluster.

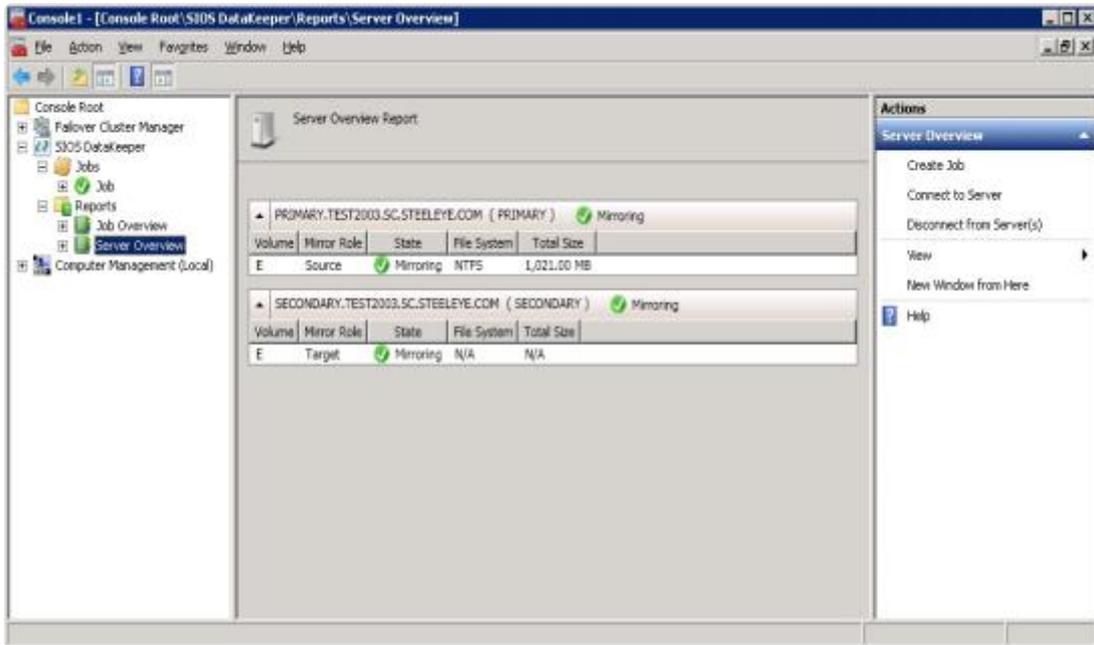
4. Make sure the volume of the third node is available to become a target. It should be formatted and online, and it should be at least as big or bigger than the source volume.
5. [Create Mirror](#).

Use the DataKeeper UI to perform the following steps (make sure DataKeeper Service is running on all servers):

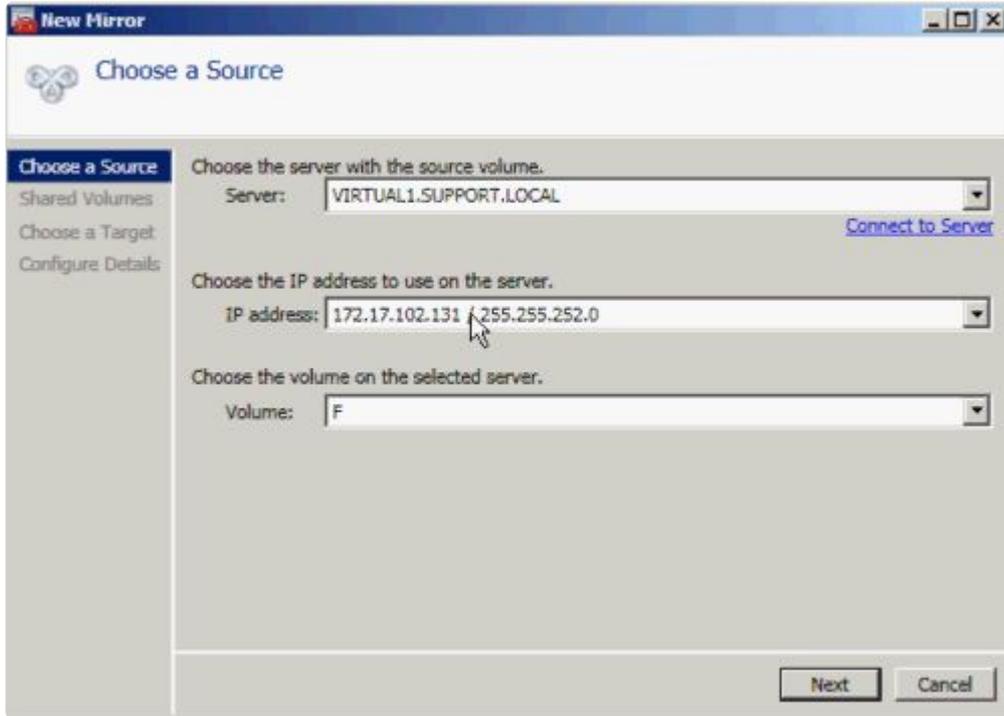
a. Connect to all shared nodes and the third node.



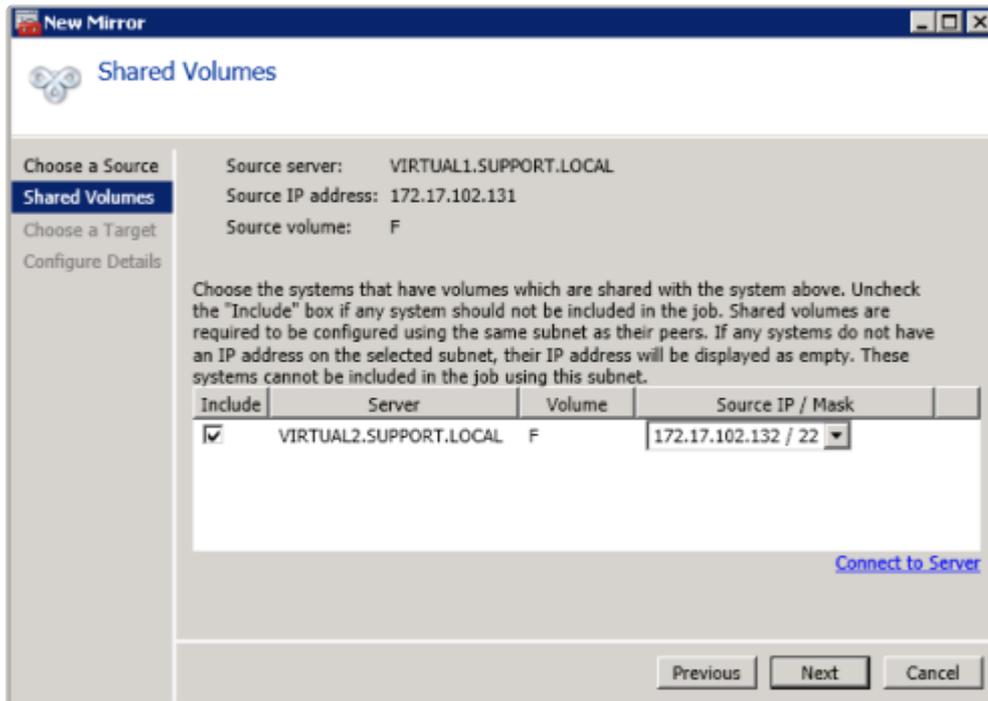
The **Server Overview Report** will show connection to all three nodes:



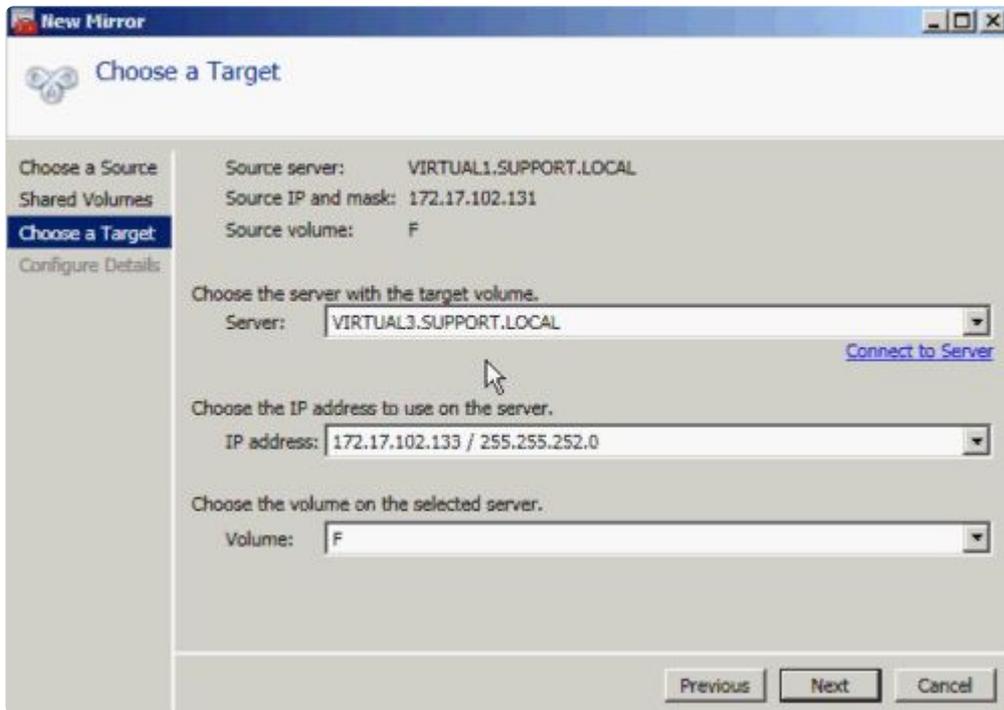
- b. Create a job containing a mirror to the third node.
- c. Select a **Source**.



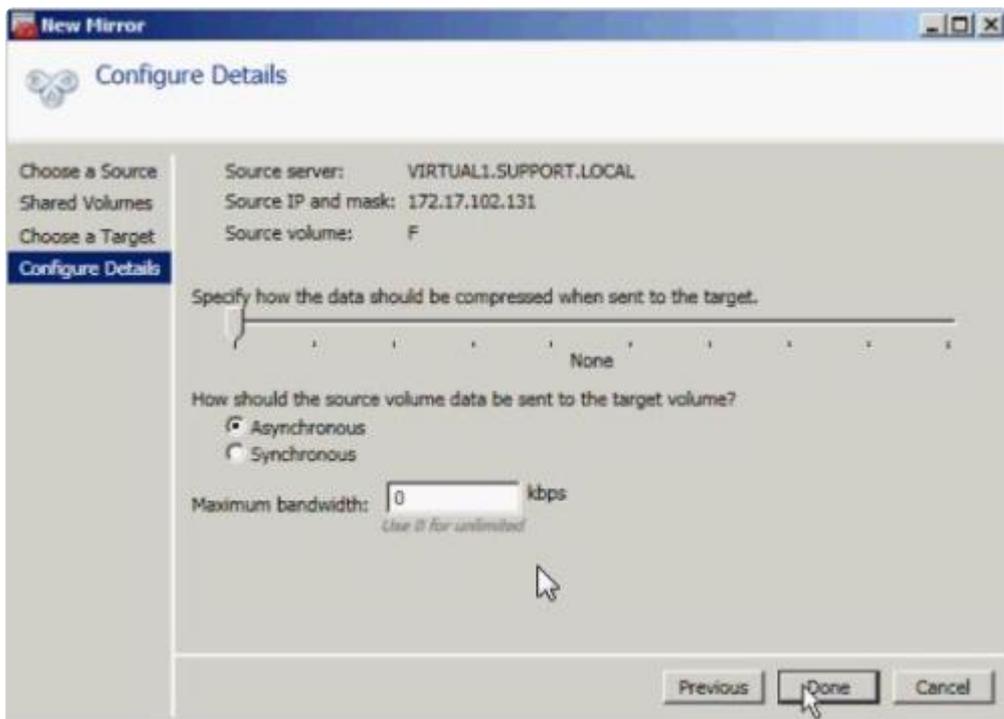
d. Select **Shared Volumes**.



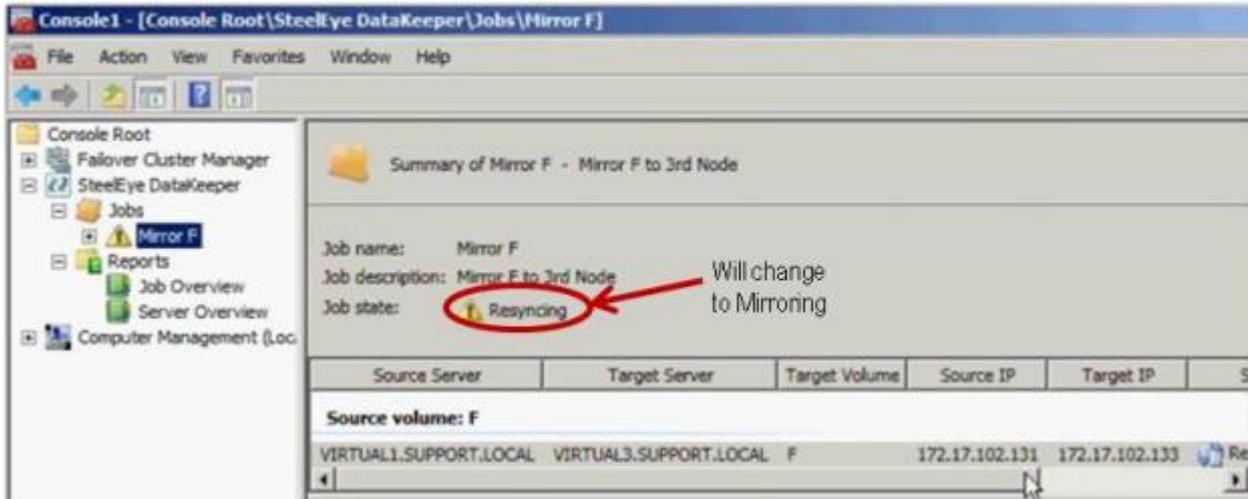
e. Select a **Target**.



f. **Configure Details.** Choose compression settings, if applicable, and choose mirror type, [asynchronous or synchronous](#). Select **Done**.



The mirror will then begin resyncing to the third node. After resyncing is complete, the **Job State** will change to **Mirroring**.



6. Add DataKeeper Volume Resource.

To add the DataKeeper Volume Resource in WSFC, perform one of the following:

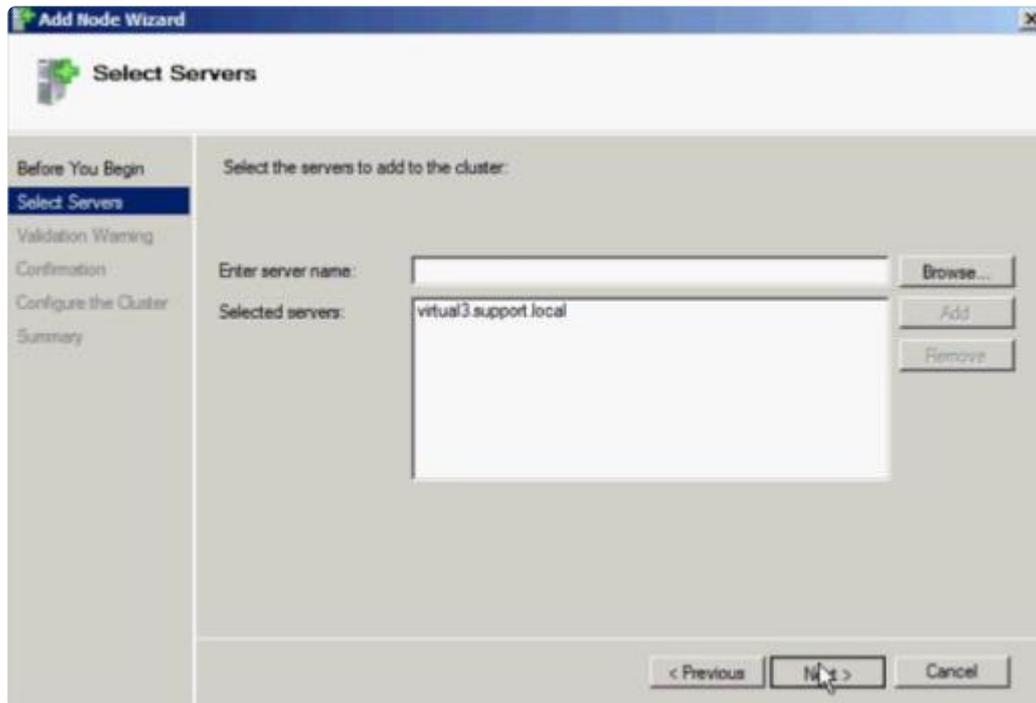
[Automatic Creation of a Mirror in WSFC](#)

[Manual Creation of a Mirror in WSFC](#)

7. Add third node into the cluster.

Use Failover Cluster Manager MMC to perform the following steps (**Note:** Make sure the Failover Clustering feature is installed on the third node prior to adding into the cluster):

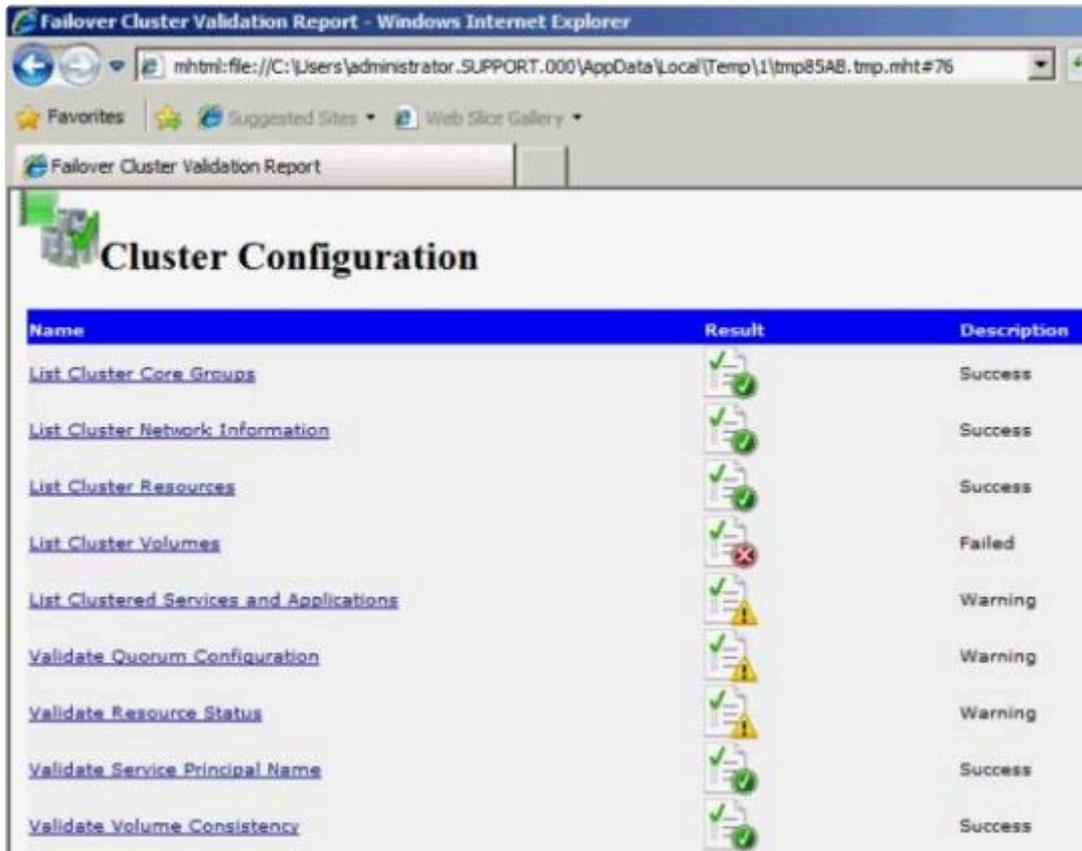
- a. Right-click **Nodes**.
- b. Select **Add Node**.
- c. In the **Add Node Wizard**, enter name of server to be added, click **Add** and select **Next**.



d. **Yes** may be chosen to perform **Validation Testing**, but be aware that some errors are expected due to the disk being locked on the target side. **Note:** When performing validation testing, select **Run only the tests I select**, then deselect the **Storage** tests from the **Test Selection** screen.



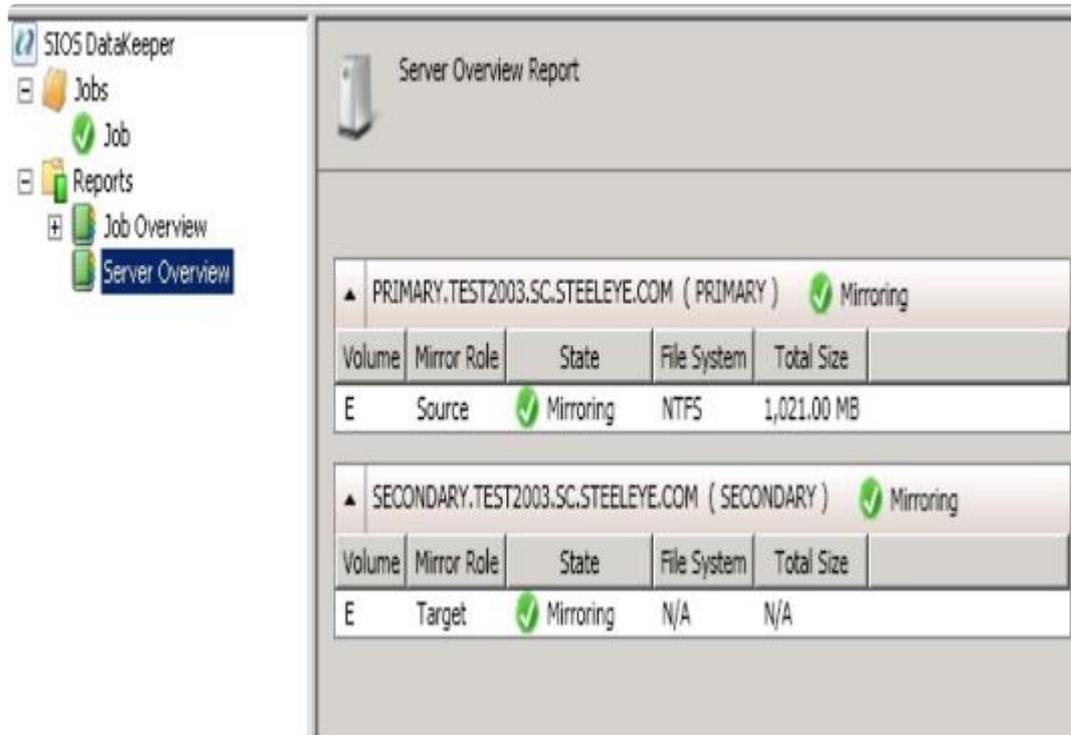
Even though the Storage tests were deselected, the **Failover Cluster Validation Report** will still report a **List Cluster Volumes failure** in the **Cluster Configuration Test**. This, along with a few other warnings, is expected due to the third node and its volume not being shared with the first two nodes.



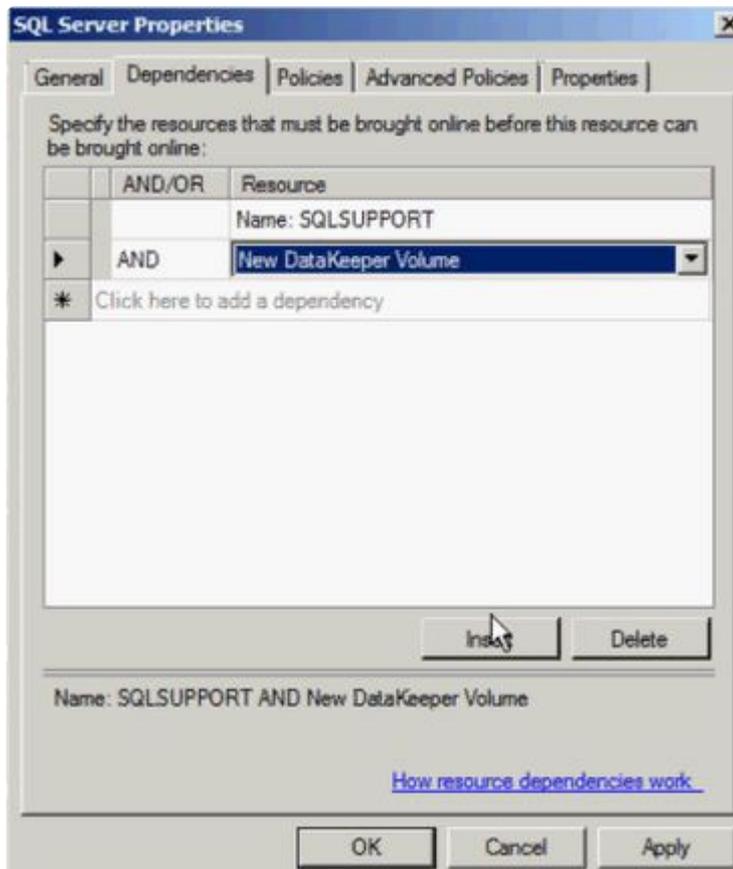
Name	Result	Description
List Cluster Core Groups		Success
List Cluster Network Information		Success
List Cluster Resources		Success
List Cluster Volumes		Failed
List Clustered Services and Applications		Warning
Validate Quorum Configuration		Warning
Validate Resource Status		Warning
Validate Service Principal Name		Success
Validate Volume Consistency		Success

- e. After viewing the **Validation Report**, select **Finish**. The **Validation Warning** screen will reappear. Select **No** to add the node without performing the tests again.
- f. Select **Next** on the **Confirmation** screen.
- g. The **Summary** screen will appear indicating that the node was added successfully.

At this point, the cluster resource group is defined across all three nodes in the cluster.



8. Reestablish any/all resource dependencies to the new DataKeeper volume resource.
 - a. Right-click application resource and select **Properties**.

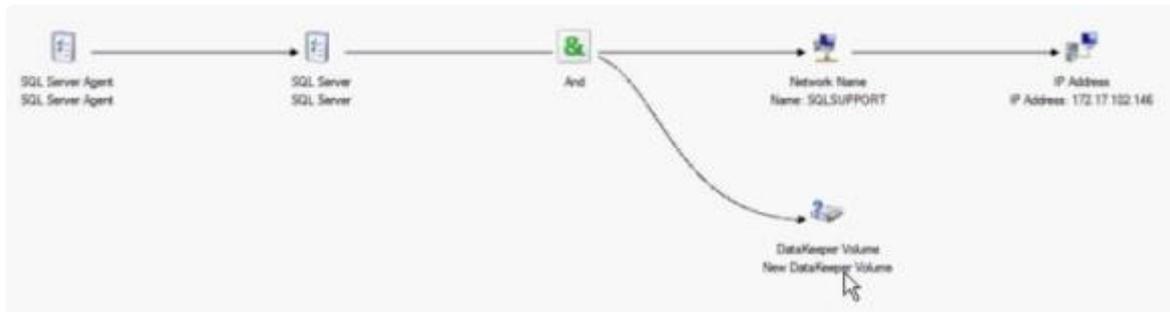


- b. Select the **Dependencies** tab.
 - c. Click on the **Click here** to add a dependency tab.

d. Enter the new DataKeeper volume

e. Select **Apply** and then **Okay**.

Dependencies should now be reestablished.



8.9.11.10. Extending a Traditional 2-Node WSFC SQL Server Cluster to a Third Node via DataKeeper

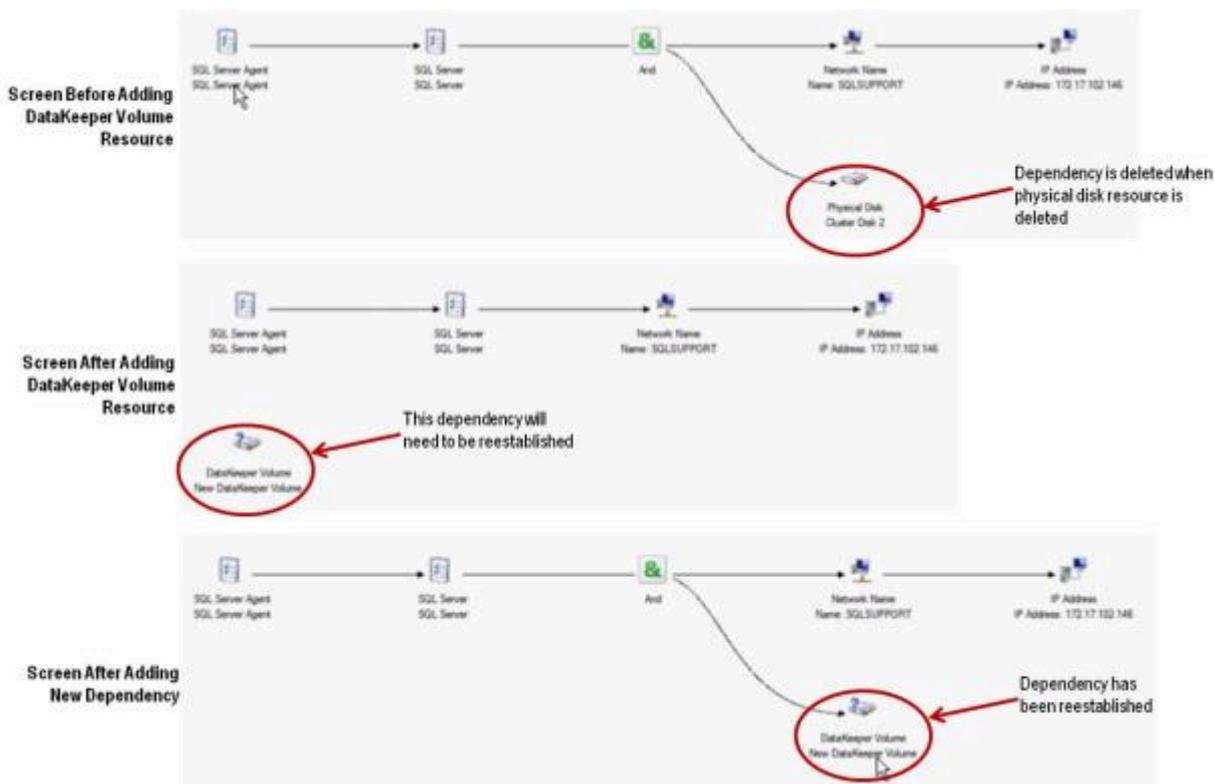
When replicating from a WSFC SQL Server 2-node cluster to a third node via DataKeeper, the following tasks are required:

- Replace the existing WSFC physical disk resource with a DataKeeper volume resource that supports data replication.
- Change the quorum type to **Node Majority**.
- Add the third node into the SQL Server cluster for failover.
- Reestablish any/all resource dependencies to the new DataKeeper volume resource.

The following example details the steps necessary to extend a SQL Server cluster resource group from a 2-node cluster to a third node via DataKeeper.

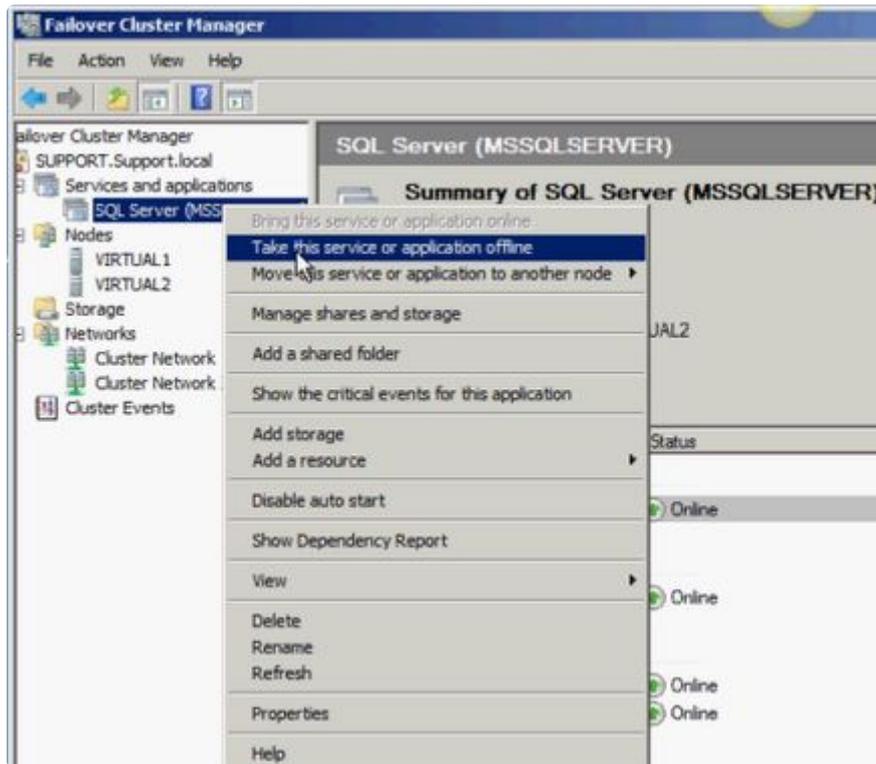
1. Remove physical disk resource from WSFC.

This also removes any dependencies on these physical disk resources. These dependencies will need to be reestablished to the new DataKeeper volume resource, so please take note of what these dependencies are before completing this first step by viewing the **Dependency Report**. Highlight your resource and select **Show Dependency Report**.

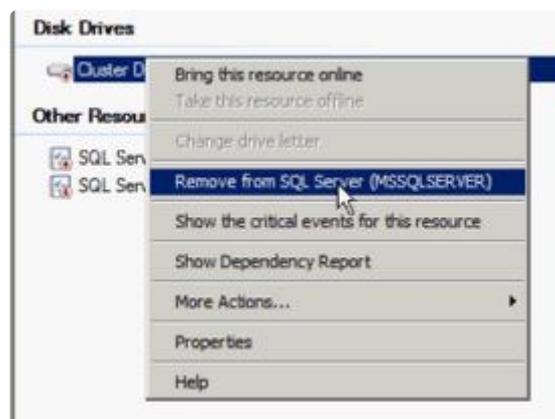


Use Failover Cluster Manager MMC to perform the following steps:

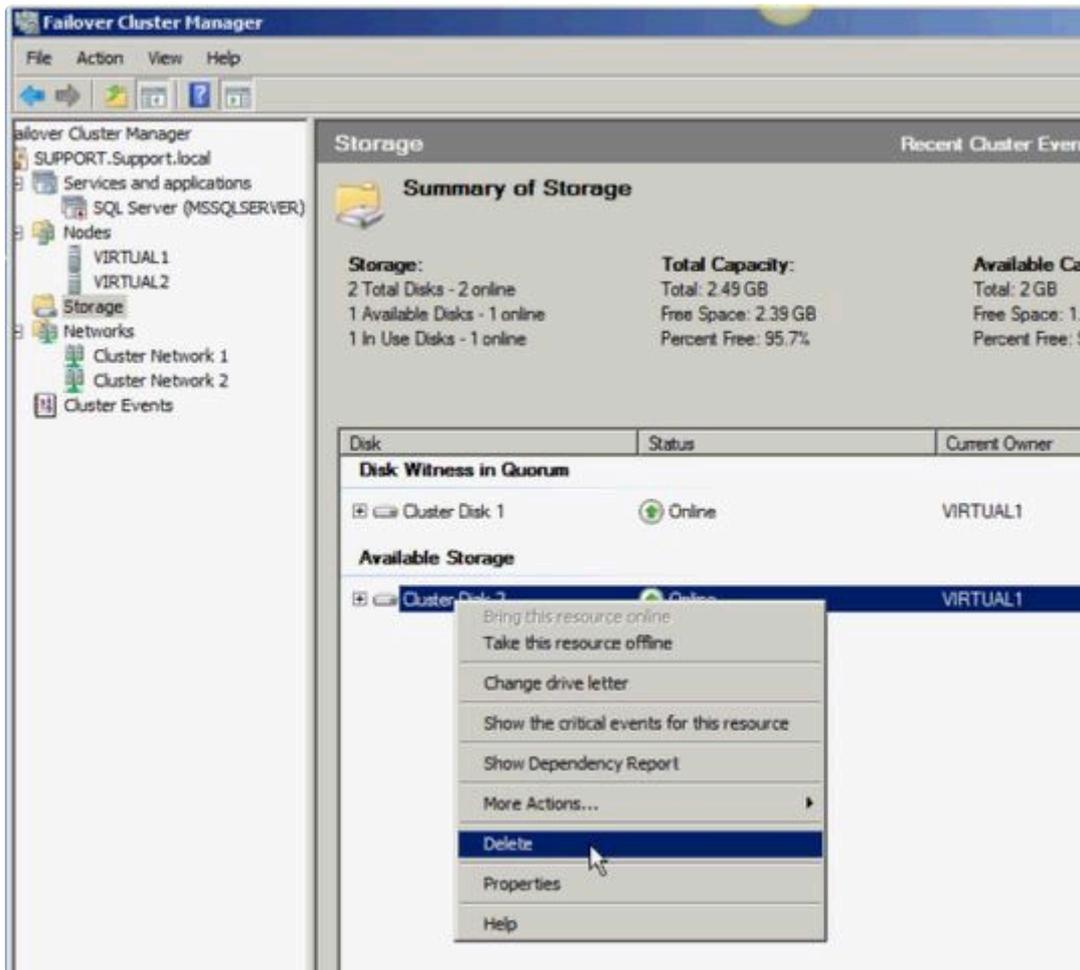
- a. Offline the SQL Server cluster resource group by right-clicking and selecting **Take this service or application offline**.



- b. Remove the physical disk from the SQL Server cluster resource group (*moves to Available Storage*).



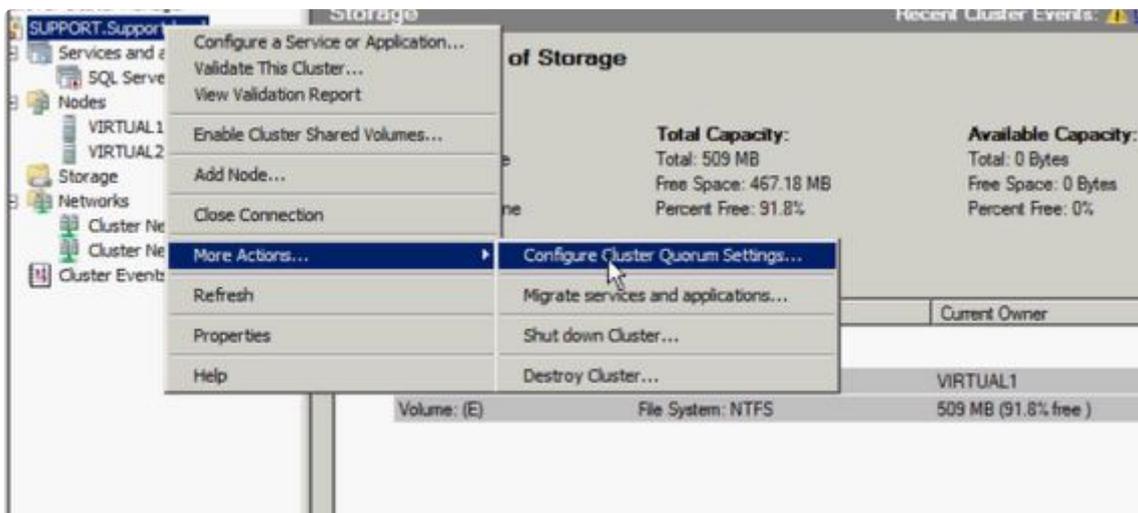
- c. Remove the physical disk resource from the SQL Server cluster configuration by deleting the resource from the **Available Storage** group.



2. Configure cluster quorum settings.

Because there will now be a third node in a remote site, the **Disk Witness in Quorum** is no longer valid; therefore, the **Node Majority** configuration should be selected.

- a. Right-click the cluster and select **More Actions / Configure Cluster Quorum Settings...**



- b. Select **Node Majority**. **Note:** Change the quorum type to **Node Majority** if the final number of nodes is odd as in a 3-node cluster, or **Node and File Share Witness Majority** if

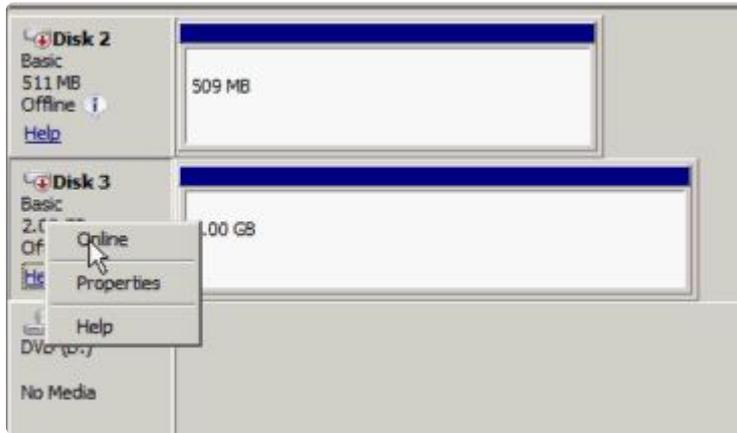
the final number of nodes will be even as in a 4-node cluster.

c. Delete disk witness from **Available Storage**.

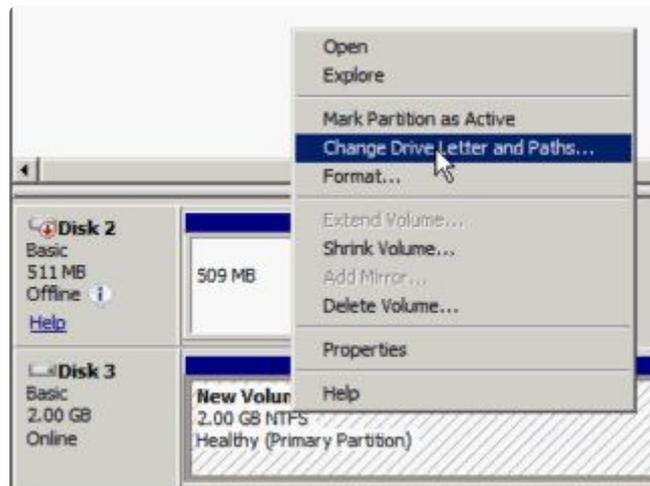
3. Online Disk.

Use Disk Management MMC to perform the following steps:

a. Online the physical disk.



b. Change the drive letter to match the previous SQL Server configuration (if needed).



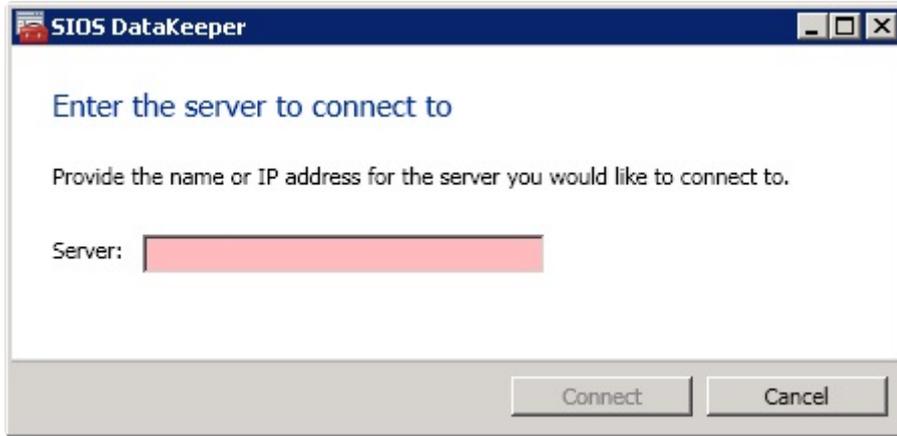
c. Repeat the above steps, 2a and 2b, on all shared nodes in the cluster.

4. Make sure the volume of the third node is available to become a target. It should be formatted and online, and it should be at least as big or bigger than the source volume.

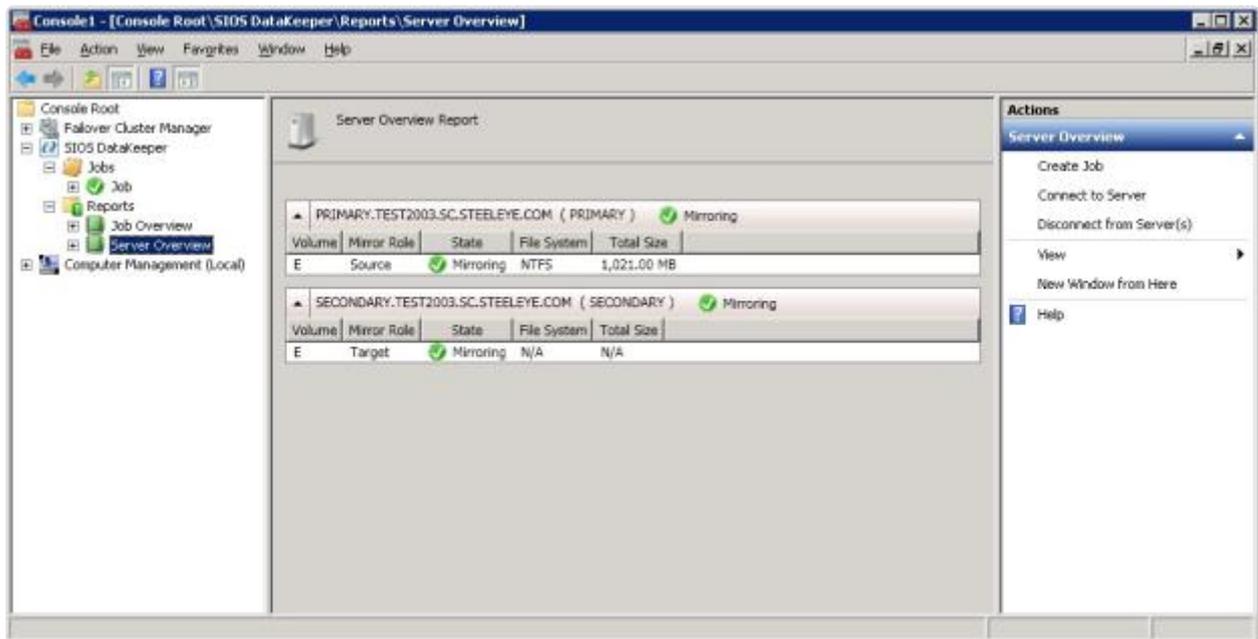
5. **Create Mirror.**

Use the DataKeeper UI to perform the following steps (**Note:** Make sure DataKeeper is running on all servers):

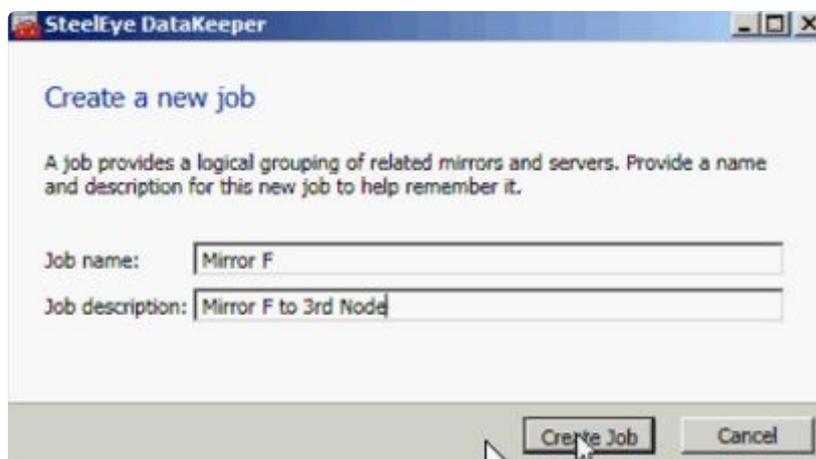
a. Connect to all shared nodes and the third node.



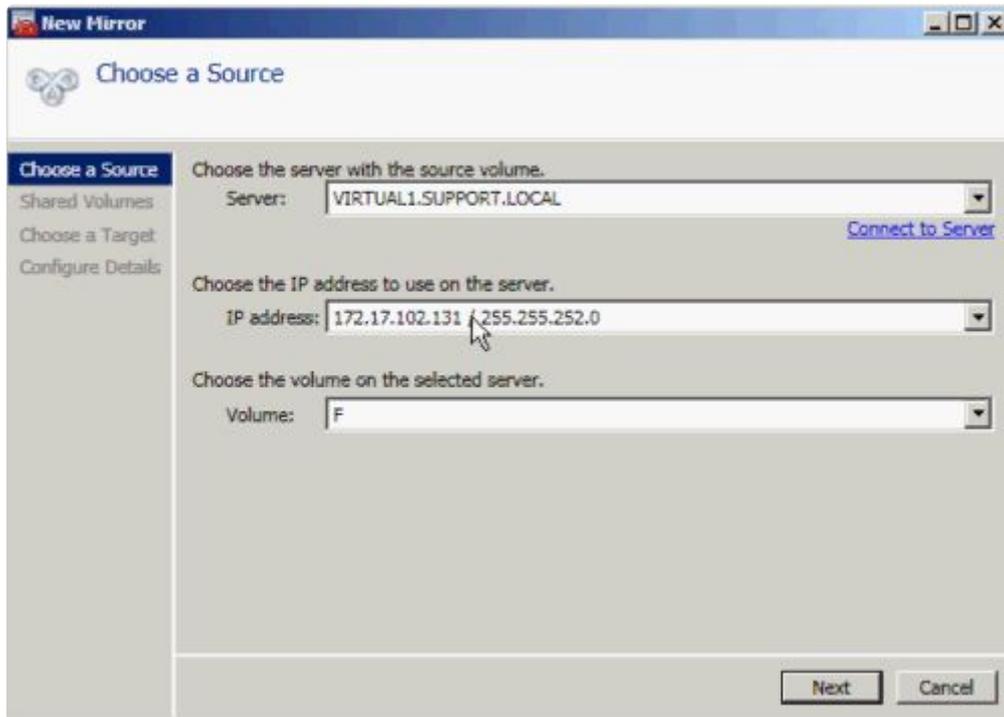
The Server Overview Report will show connection to all three nodes:



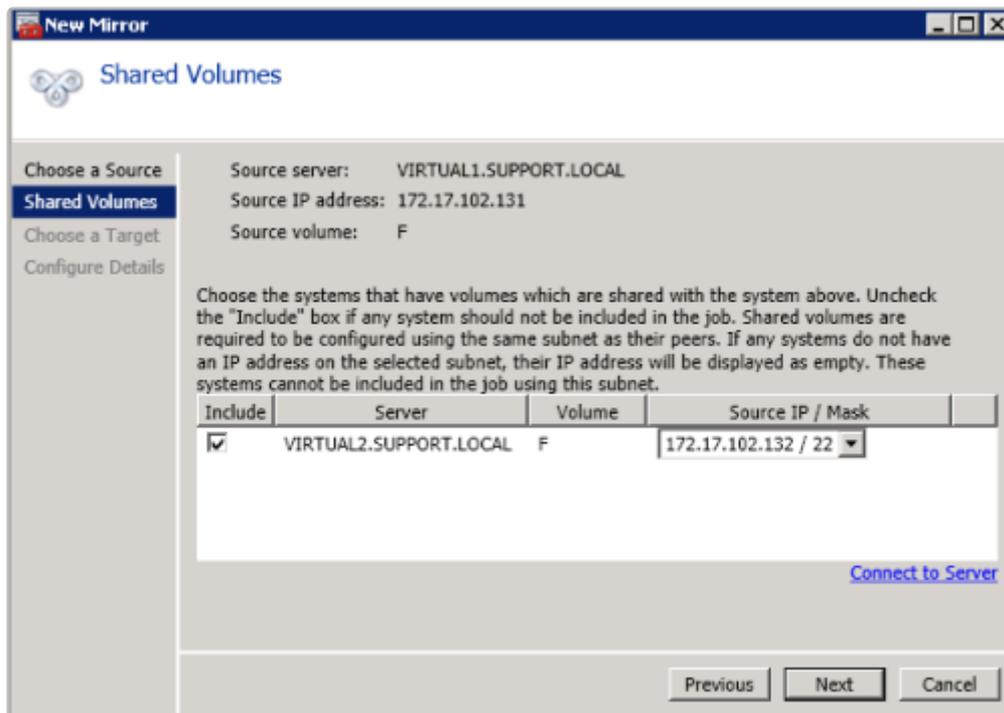
b. Create a job containing a mirror to the third node.



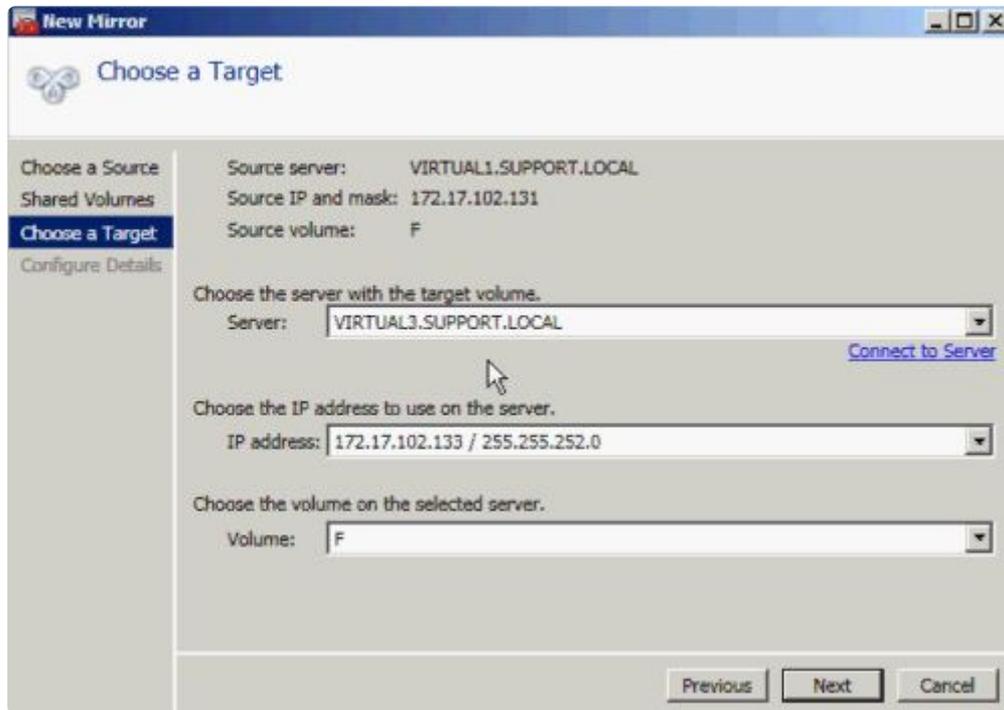
c. Select a **Source**.



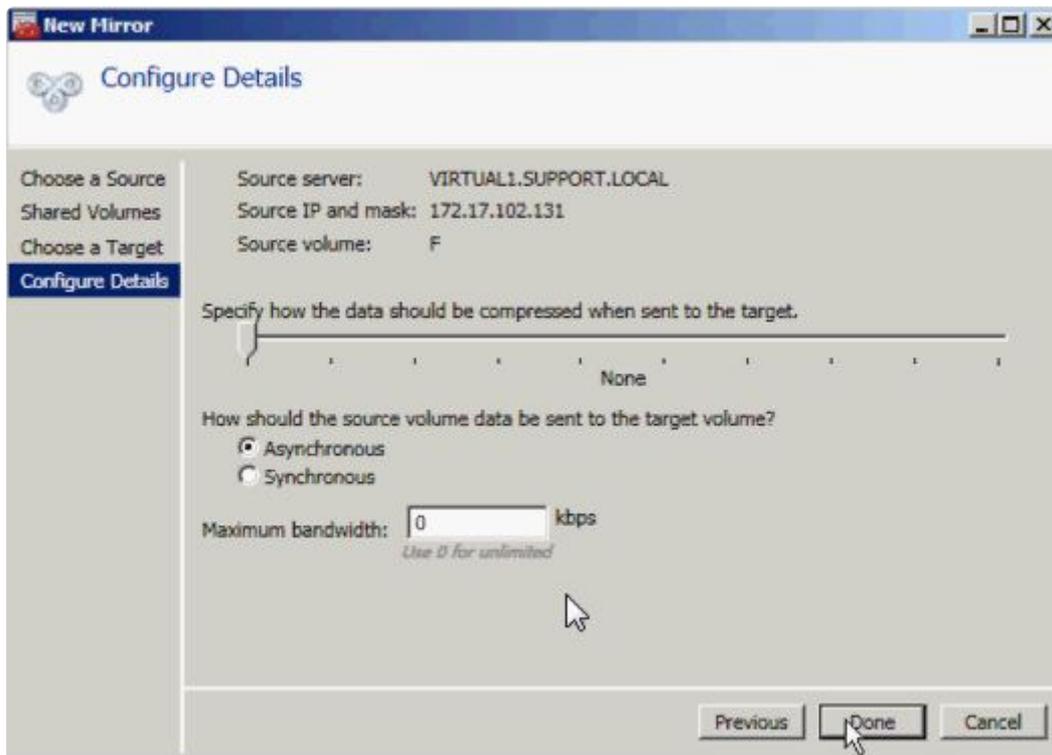
d. Select **Shared Volumes**.



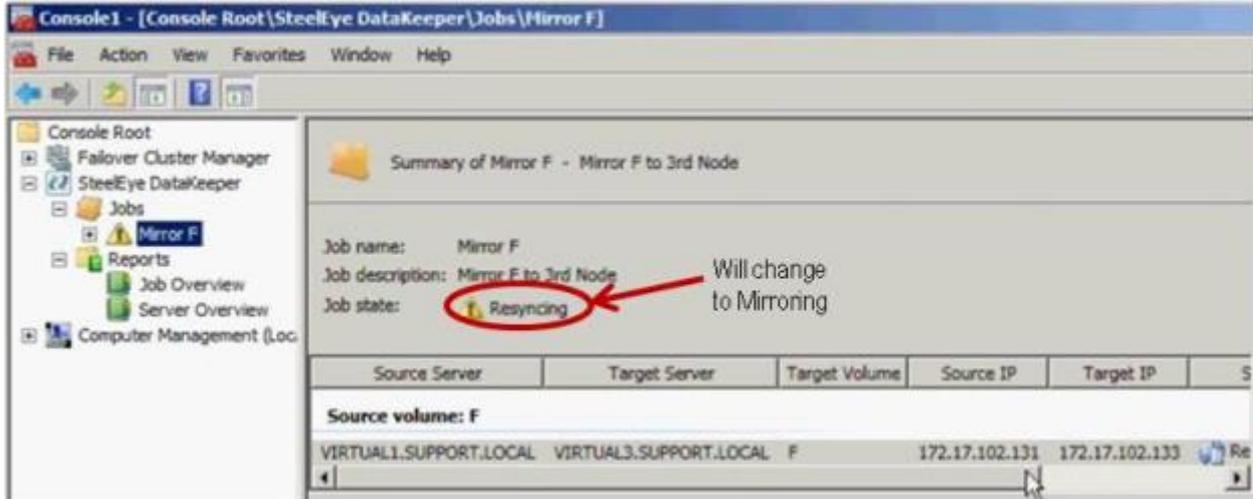
e. Select a **Target**.



f. **Configure Details.** Choose **compression settings**, if applicable, and choose **mirror type**, [Asynchronous](#) or [Synchronous](#). Select **Done**.



The mirror will then begin resyncing to the third node. After resyncing is complete, the **Job State** will change to **Mirroring**.



6. Add DataKeeper Volume Resource.

To add the DataKeeper Volume Resource to the SQL Server cluster resource group, perform one of the following:

- [Automatic Creation of a Mirror in WSFC](#)
- [Manual Creation of a Mirror in WSFC](#)

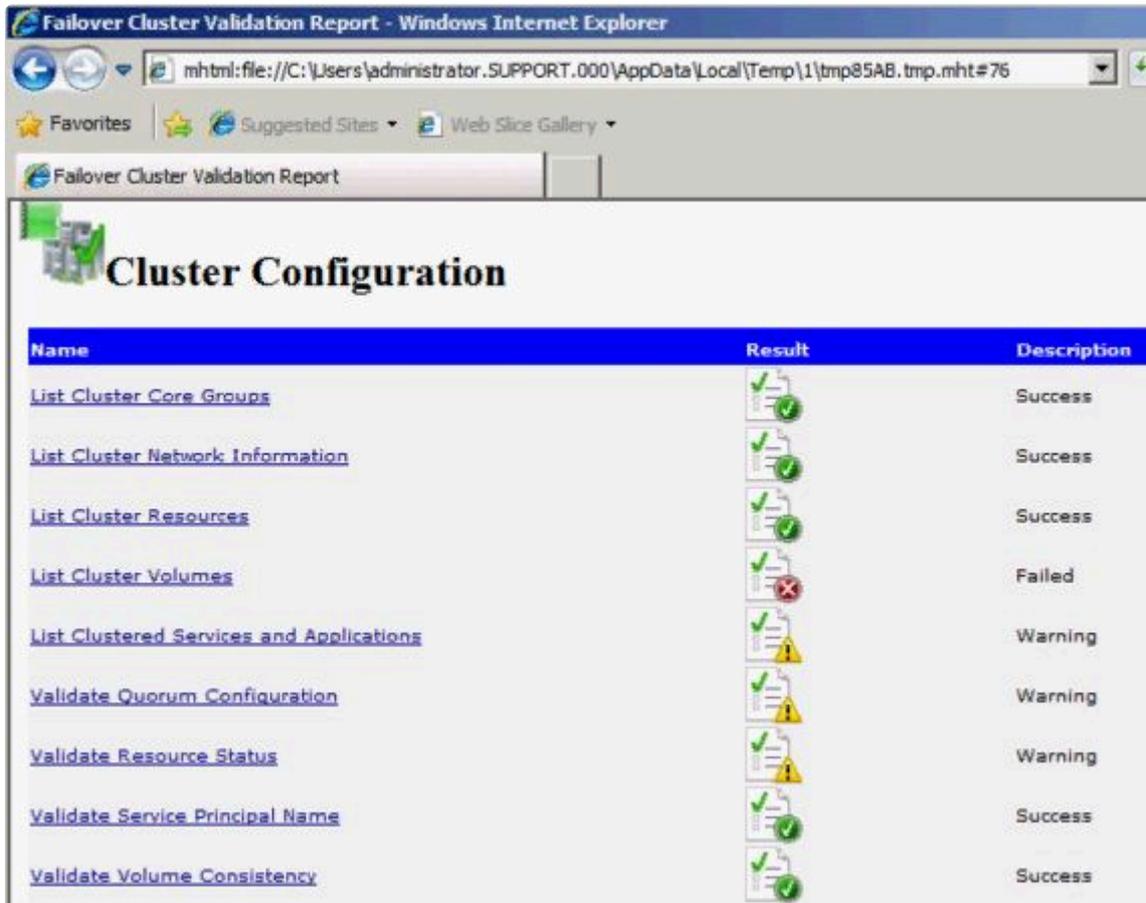
7. Add third node into the cluster.

Use **Failover Cluster Manager MMC** to perform the following steps (**Note:** Make sure the Failover Clustering feature is installed on the third node prior to adding into cluster):

- a. Right-click **Nodes**.
- b. Select **Add Node**.
- c. In the **Add Node Wizard**, enter name of server to be added, click **Add** and select **Next**.
- d. **Yes** may be chosen to perform **Validation Testing**, but be aware that some errors are expected due to the disk being locked on the target side. **Note:** When performing validation testing, select **Run only the tests I select**, then deselect the **Storage tests** from the **Test Selection** screen.



Even though the Storage tests were deselected, the **Failover Cluster Validation Report** will still report a **List Cluster Volumes failure** in the Cluster Configuration Test. This, along with a few other warnings, is expected due to the third node and its volume not being shared with the first two nodes.



e. After viewing the **Validation Report**, select **Finish**. The **Validation Warning** screen will reappear. Select **No** to add the node without performing the tests again.

f. Select **Next** on the **Confirmation** screen.

g. The **Summary** screen will appear indicating that the node was added successfully. A **Warning** may appear on this screen because SQL Server has not yet been installed on the third node. This installation will be performed in the next step.

8. Install SQL Server on the third node.

a. On third node, run the following command:

```
Setup /SkipRules=Cluster_VerifyForErrors /Action=AddNode
/INSTANCENAME="MSSQLSERVER"
```

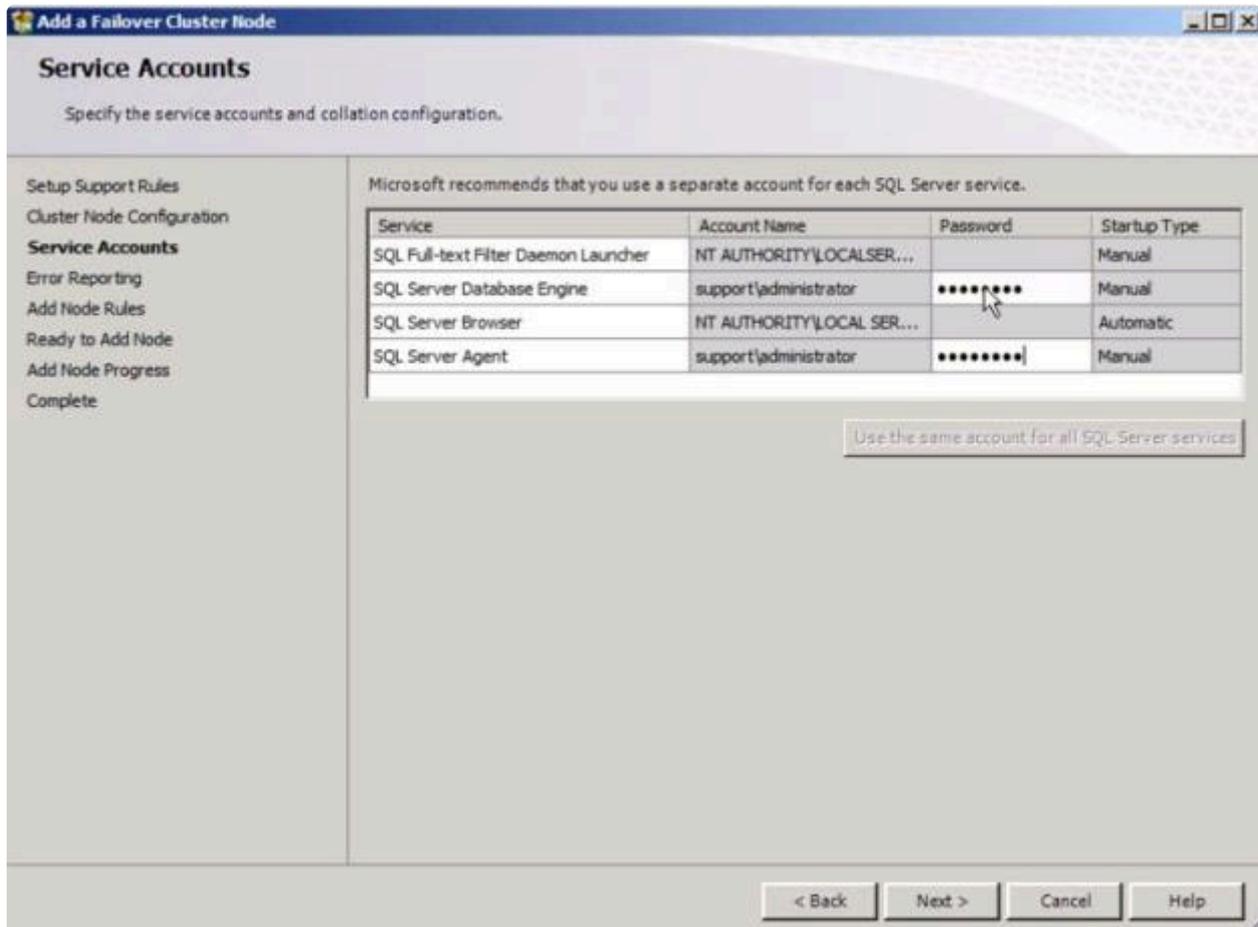
b. On **Setup Support Rules** screen, select **Okay**.

c. When prompted, enter **Product Key** and select **Next**.

d. **Accept License Terms** and select **Next**.

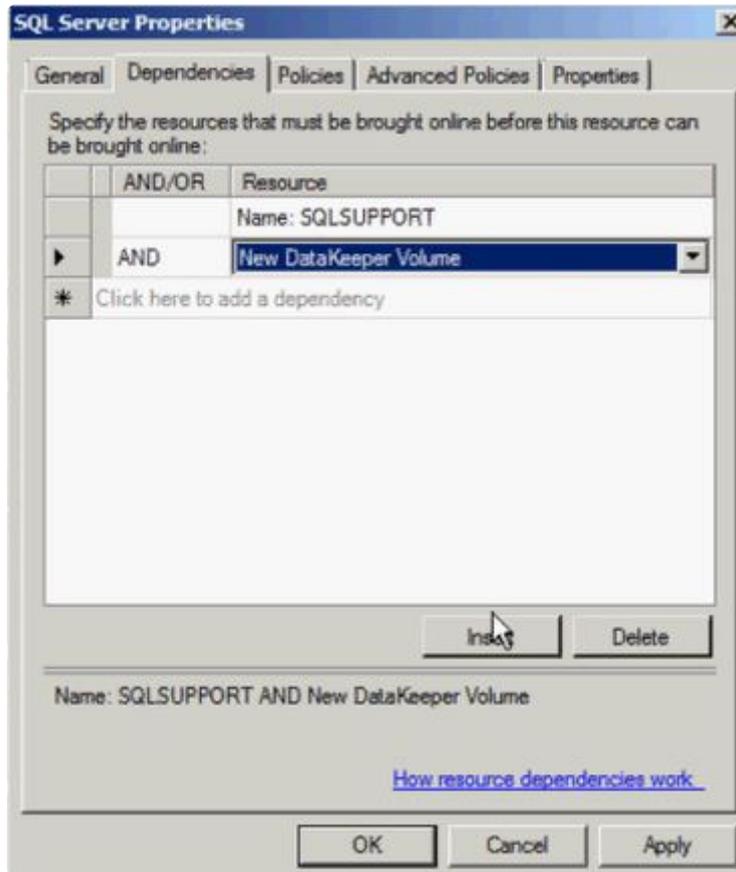
e. On the **Setup Support Files** screen, select **Install**.

- f. The **Setup Support Rules** screen will appear. Review the **System Configuration Check Report** for any failures, then select **Next**.
- g. Select **Next** when the **Cluster Node Configuration** screen appears.
- h. On the **Service Accounts** screen, enter **Passwords** for SQL Server services based on setup of the first nodes. Select **Next**.



- i. When the **Error Reporting** screen appears, select **Next**.
 - j. When the **Add Node Rules** screen appears, select **Next**.
 - k. Once the **Ready to Add Node** screen appears, select **Install**.
 - l. The **Complete** screen will appear notifying that the **Failover Cluster Add Node** operation is complete. Select **Close**.
9. The final step is to reestablish any/all resource dependencies between the SQL Server service resource and the new DataKeeper volume resource.
 - a. Right-click the application resource and select **Properties**.
 - b. Select the **Dependencies** tab.

- c. Click on the **Click here to add a dependency** tab.
- d. Enter the new DataKeeper volume
- e. Select **Apply** and then **Okay**.



Dependencies should now be reestablished. The **Dependency Report** may be viewed again to make sure.



8.9.11.11. Extending a Traditional 2-Node Cluster to a Shared-Replicated Configuration

Add a Shared Node Using Windows Server 2008R2 or 2012

When using Windows Server 2008R2 or 2012, a 1×1 2-Node replicated cluster using DataKeeper Volumes can be extended to a 2×1 shared and replicated 3-Node cluster by using either of the following methods:

- WSFC GUI
- WSFC command line tool: “cluster /add /node:<standby node name>”
- powershell -command : “Add-ClusterNode -Name <host name>”

In Windows Server 2008R2 or 2012, DataKeeper shared disks will remain DataKeeper Volume Resources in the cluster when additional nodes with shared disks are added. This is because the shared disk is never accessible on every node in the cluster — only two systems in a 3-node cluster. It is very important that the DataKeeper Volume Resource not be converted to a WSFC Physical Disk Resource.

Add a Shared Node Using Windows Server 2008R2 “SP1”

! WARNING – The WSFC mmc GUI behavior on Windows Server 2008R2 “SP1” has changed!

Starting with WSFC 2008R2SP1, Microsoft has changed the behavior of the WSFC mmc GUI when adding nodes to a cluster. If the new node is hosting a disk that is shared by one or more other systems already in the cluster, the shared disk on the new node and the existing DataKeeper Volume Resource will automatically be converted to a WSFC Physical Disk Resource when the node is added to the cluster! The transformation process includes a volume letter change that will break the DataKeeper Volume Resource and the associated replication mirror. Clustered applications will likely be impacted.

When using Windows Server 2008R2SP1, do not use the WSFC GUI to add a node to the cluster if the new node is hosting a DataKeeper shared disk.

When using Windows Server 2008R2SP1, additional nodes with DataKeeper shared volumes can be safely added to a WSFC cluster using only the WSFC command line tool as follows:

- WSFC command line tool: “cluster /add /node:<standby node name>”

8.9.11.12. Using DataKeeper Cluster Edition to Enable Multi-Site Hyper-V Clusters

Prerequisite

Familiarity with Microsoft Windows Server, Microsoft Windows Failover Cluster Server Management and Hyper-V Virtual Management procedures and commands is highly recommended.

Note: DataKeeper Cluster Edition does not support Cluster Shared Volumes; therefore, when configuring Hyper-V with DataKeeper Cluster Edition, you must have one volume per virtual machine.

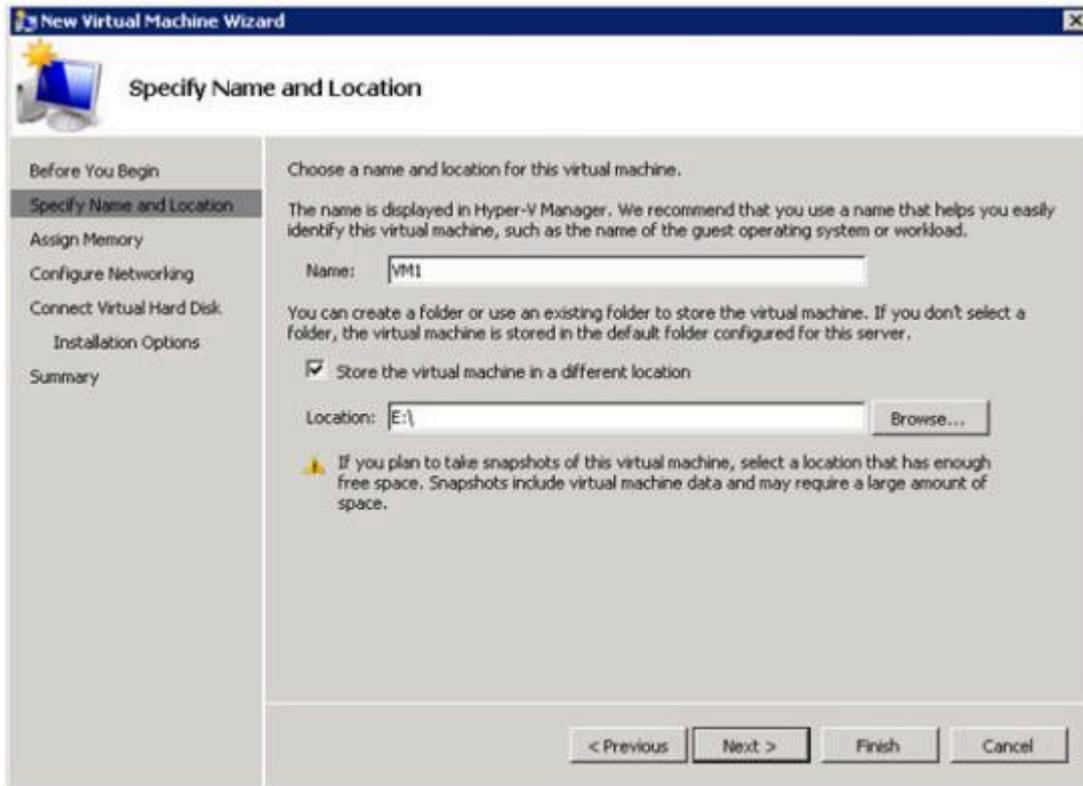
1. Before you begin, all the Microsoft Windows Servers in your cluster must be installed and configured as outlined in other topics for this product (refer to "[Creating a DataKeeper Volume in WSFC](#)"). In addition, the following products must be installed and configured on each server in your cluster.

Operating Systems	Microsoft Windows Server 2008 R2 or Later
Hardware Platform	64-bit environment and supports hardware-assisted virtualization (Intel VT) technology
Virtual Management Software	Hyper-V role and all Hyper-V updates
SIOS DataKeeper License	A DataKeeper Cluster Edition license key is required for every server on which DataKeeper runs. This applies to both physical and virtual servers
Network Configuration	A high speed WAN link between the primary data center and the DR site (see performance benchmark on bandwidth configuration)  IMPORTANT: Make sure that Virtual Network Names for NIC connections are identical on all cluster nodes.
Cluster Server Software	Windows Server 2008 R2, Server 2012, or later Failover Cluster Management

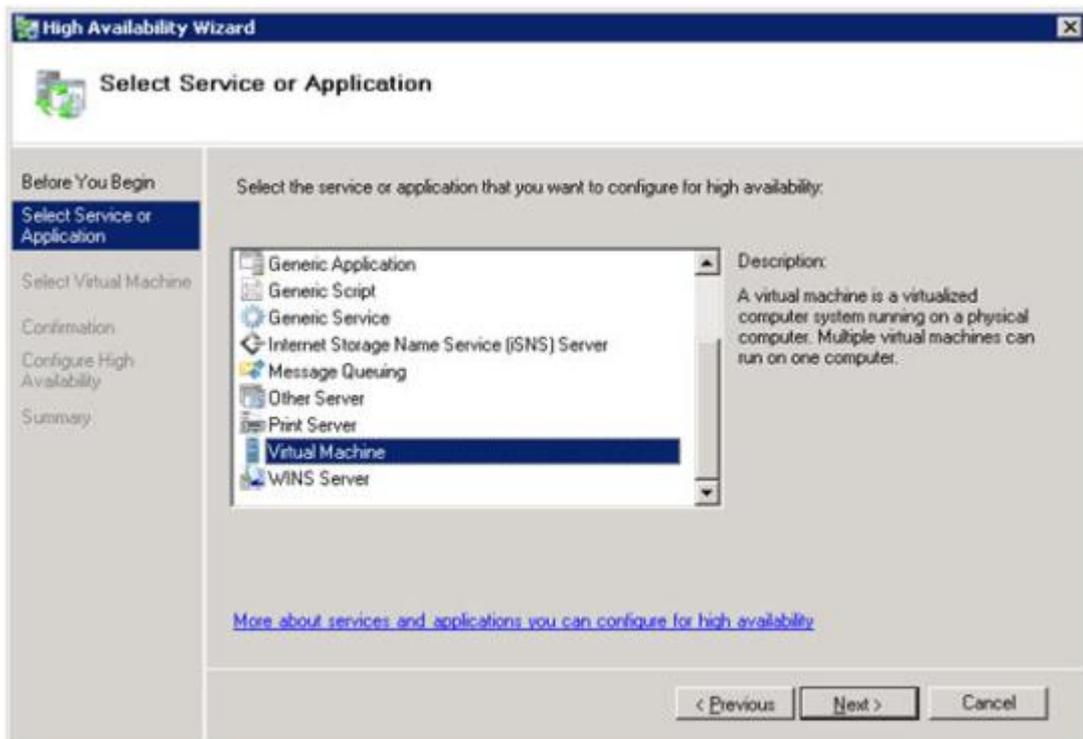
 **IMPORTANT:** DataKeeper Cluster Edition registration with Failover Cluster is automatic and occurs 60 seconds after detecting a Failover Cluster configuration on each node.

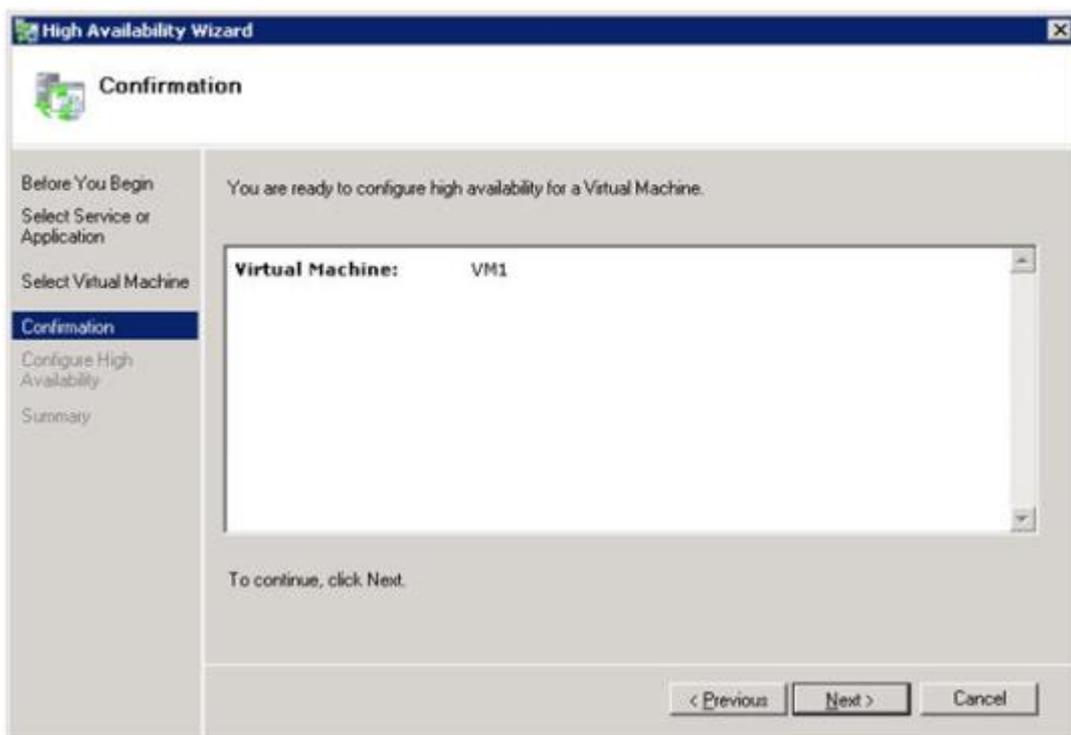
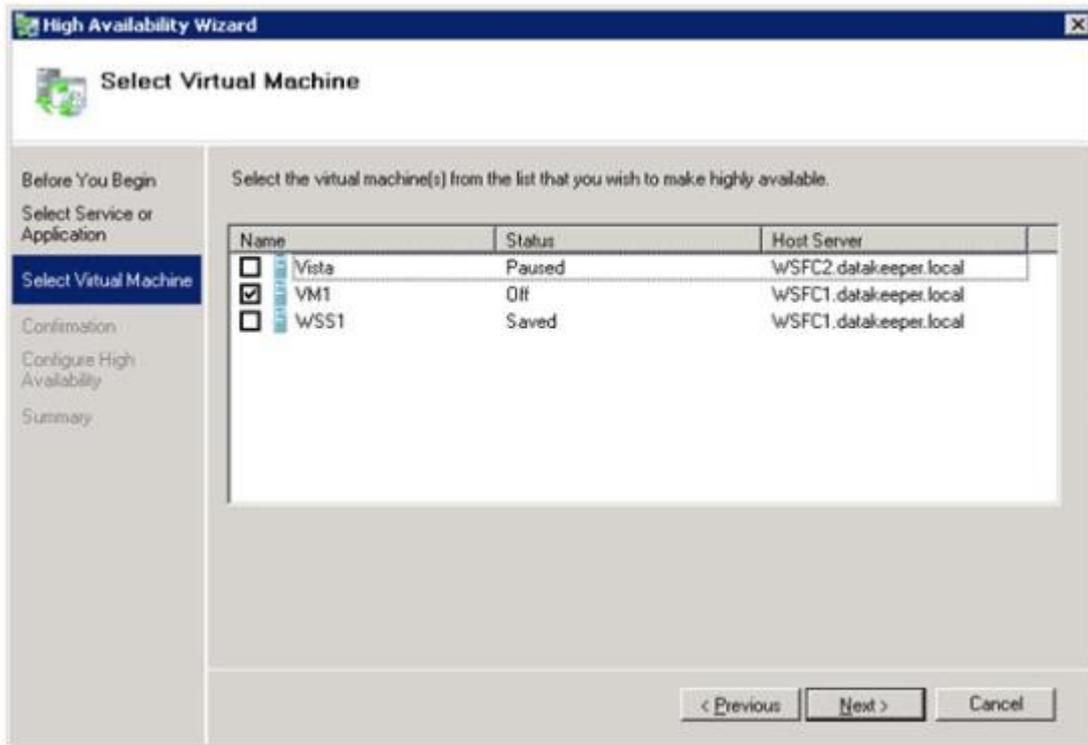
2. Use the SIOS DataKeeper GUI to configure a job that includes all mirrors and shared relationships for the nodes that are part of the cluster. Wait until the mirrors are in the **Mirroring** state. For more information about setting up your SIOS DataKeeper environment, see the [Getting Started](#) topic.

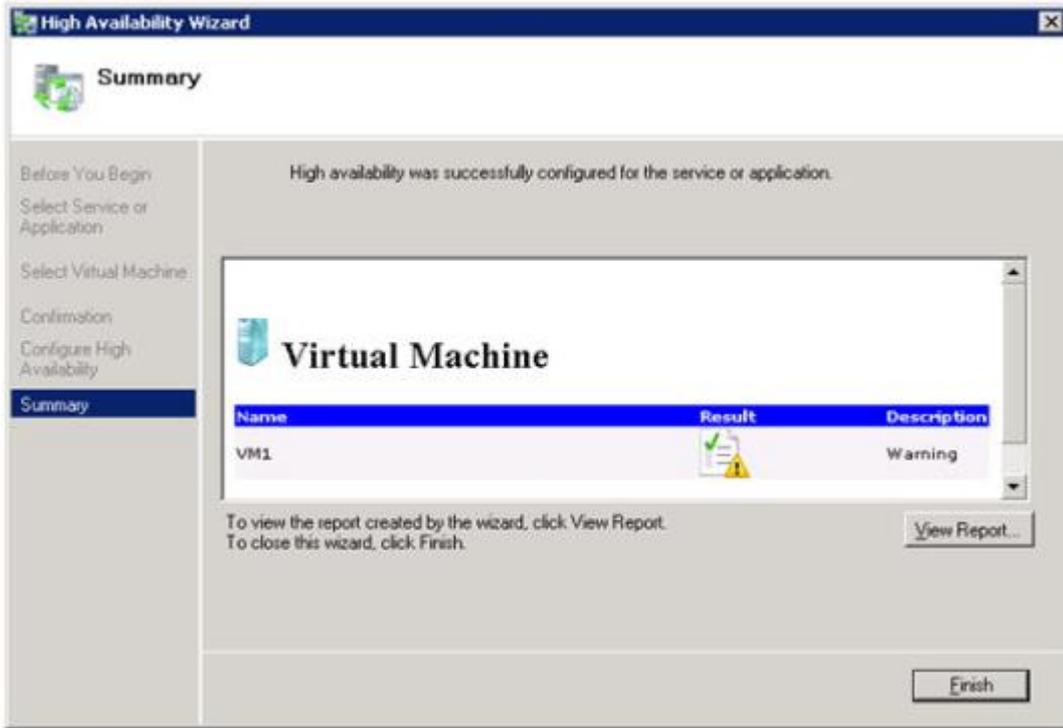
- Using Hyper-V, configure the first virtual machine and make sure to specify E:\ in the **Store the virtual machine in a different location** text box. This setting is in the **Specify Name and Location** window.



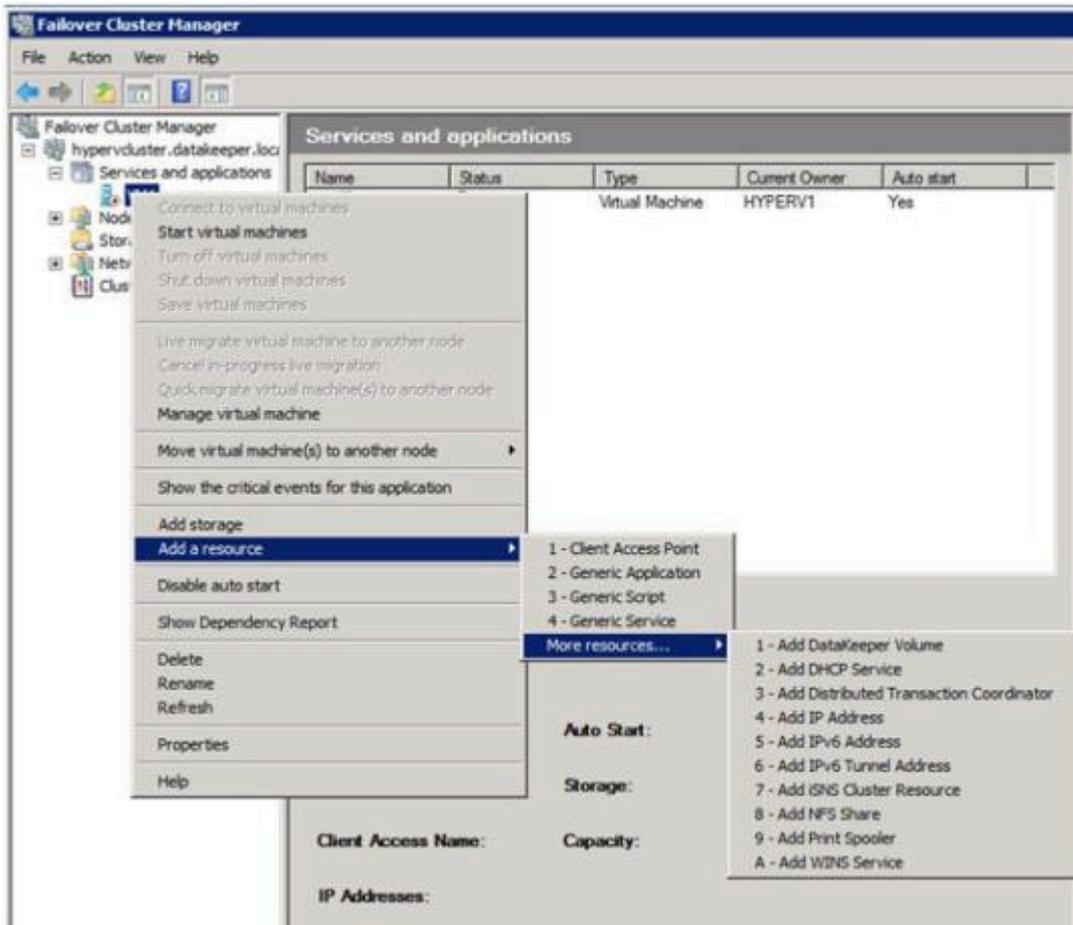
- Select **Finish** and then shut down the virtual machine.
- Use **WSFC** to create a Virtual Server resource choosing to protect the first virtual machine. This option is available under **Configure a Service or Application**.





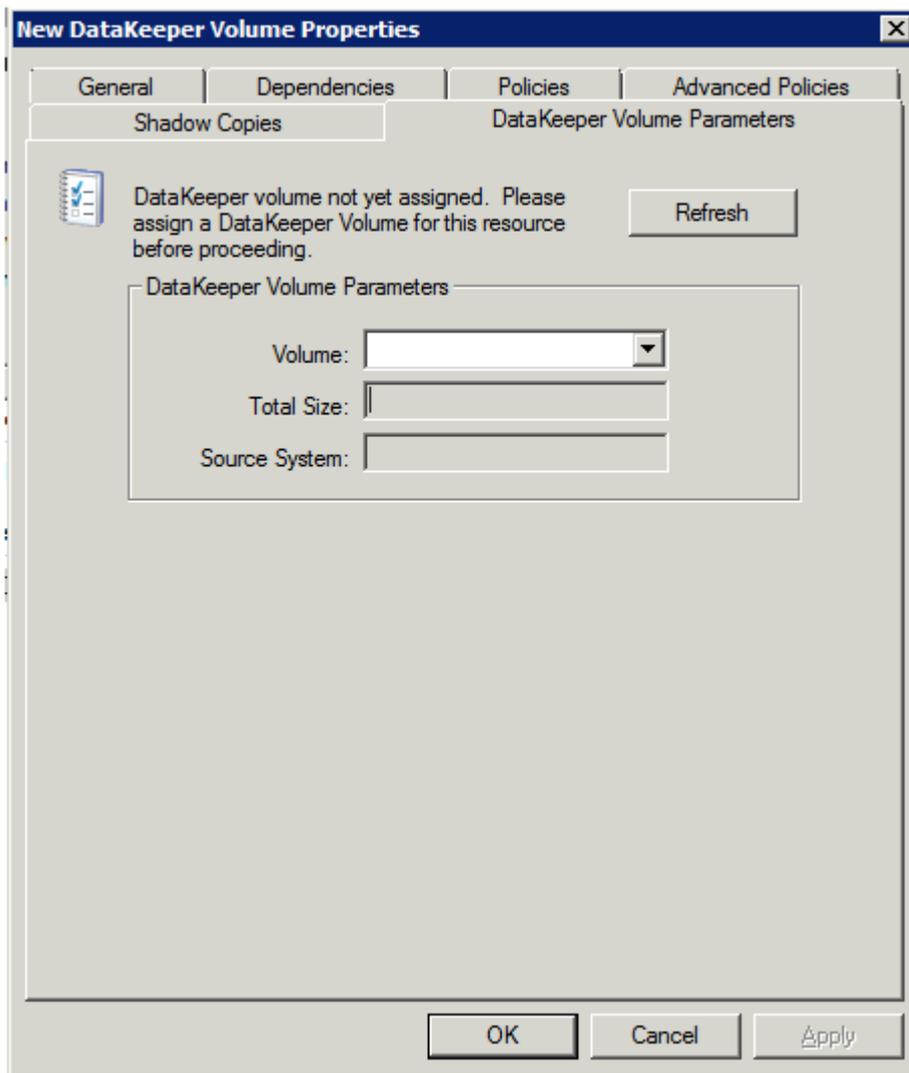


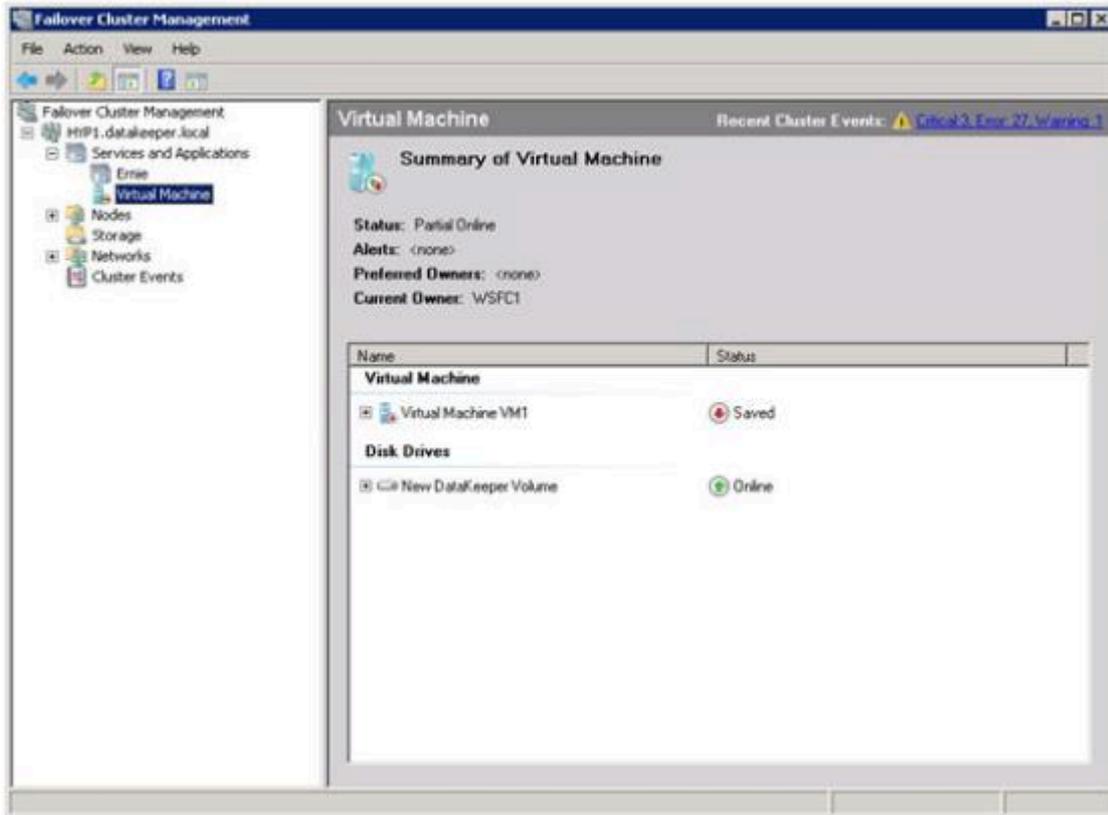
6. Add a **SIOS DataKeeper volume resource**. Right-click on the virtual server resource created in Step #5 and choose **Add a Resource**, then **More Resources -> Add DataKeeper Volume** from the context menu.



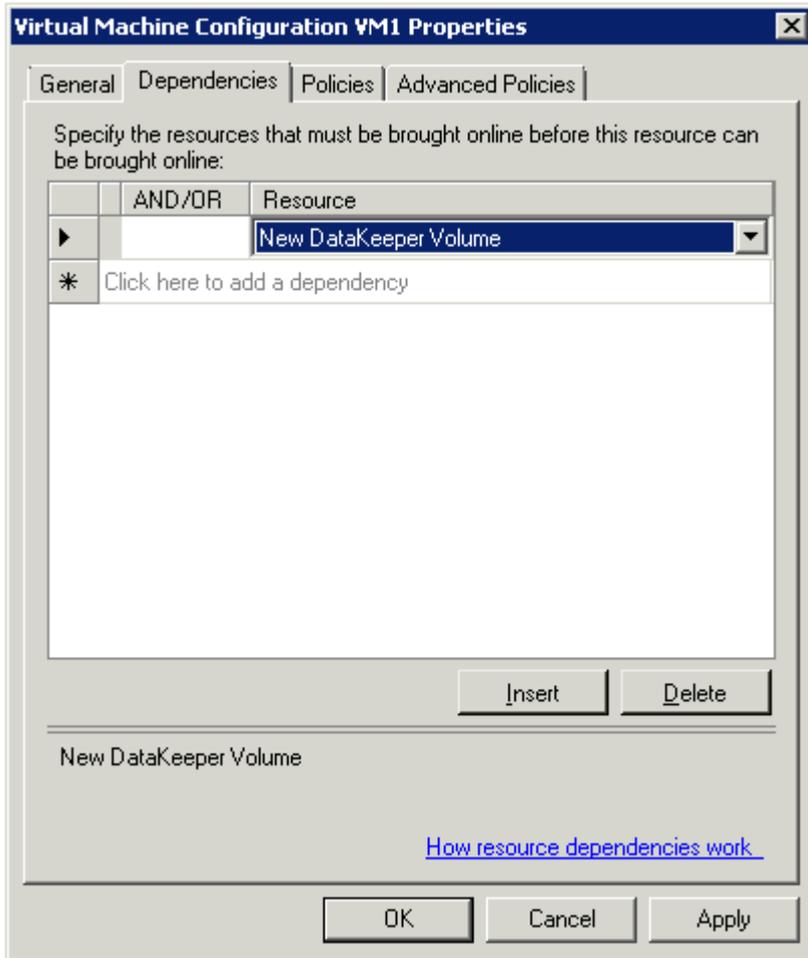
7. Right-click on the **SIOS DataKeeper volume resource** and choose **Properties – DataKeeper**

Volume Parameters. Denote which drive letter it is associated with the DK resource (e.g. Volume E)

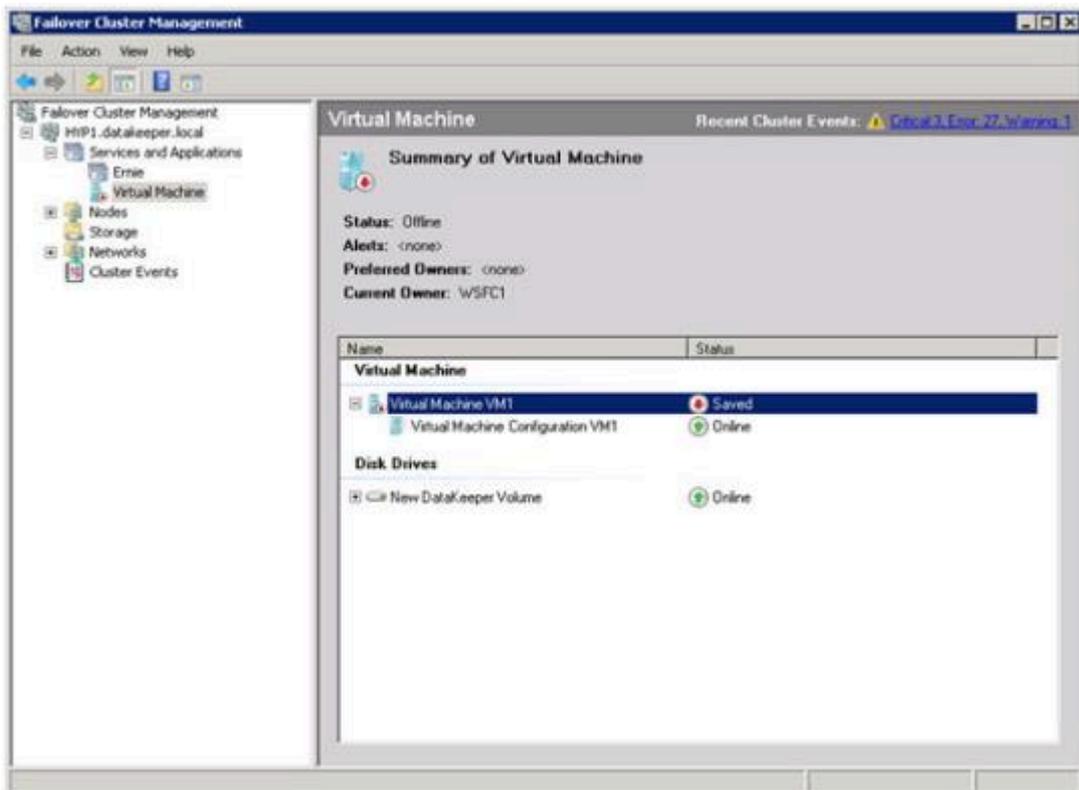




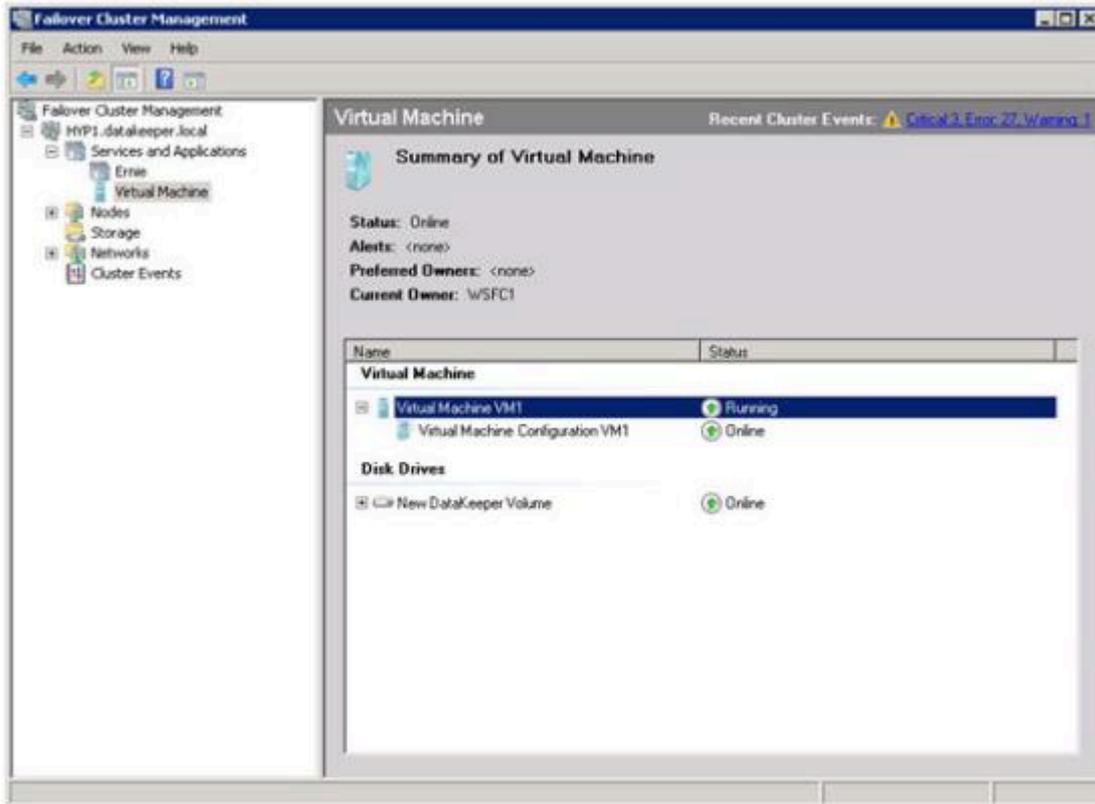
- Use **Microsoft WSFC Manager**, right-click on the **Virtual Machine Configuration VM1** and choose **Properties**. In the **Properties** window, choose the **Dependencies** tab and add the **New DataKeeper Volume** as a dependency. Click **OK**.



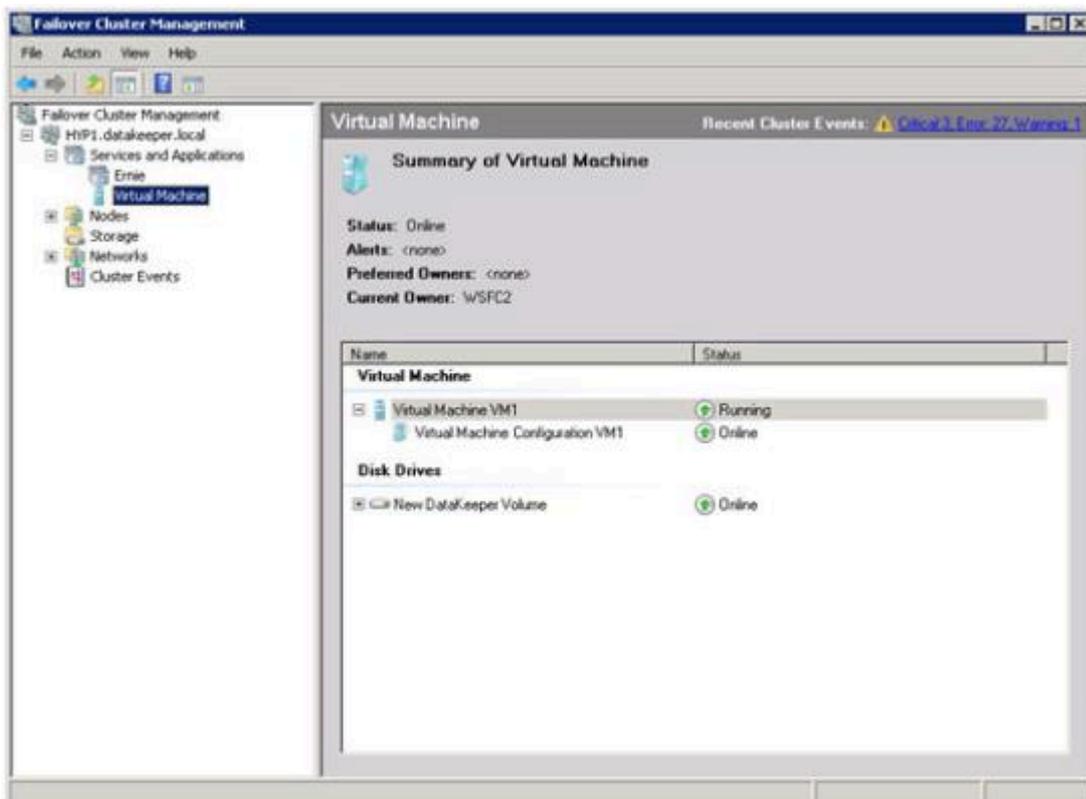
9. Right-click on the **Virtual Machine VM1** resource and choose **Start**.



10. The virtual machine is now online and highly available.



11. Verify that **Quick Migration** works by right-clicking on the virtual machine resource and choose **Move Virtual Machine(s) to Another Node**.
12. Verify that the virtual machine is now running on the secondary server.



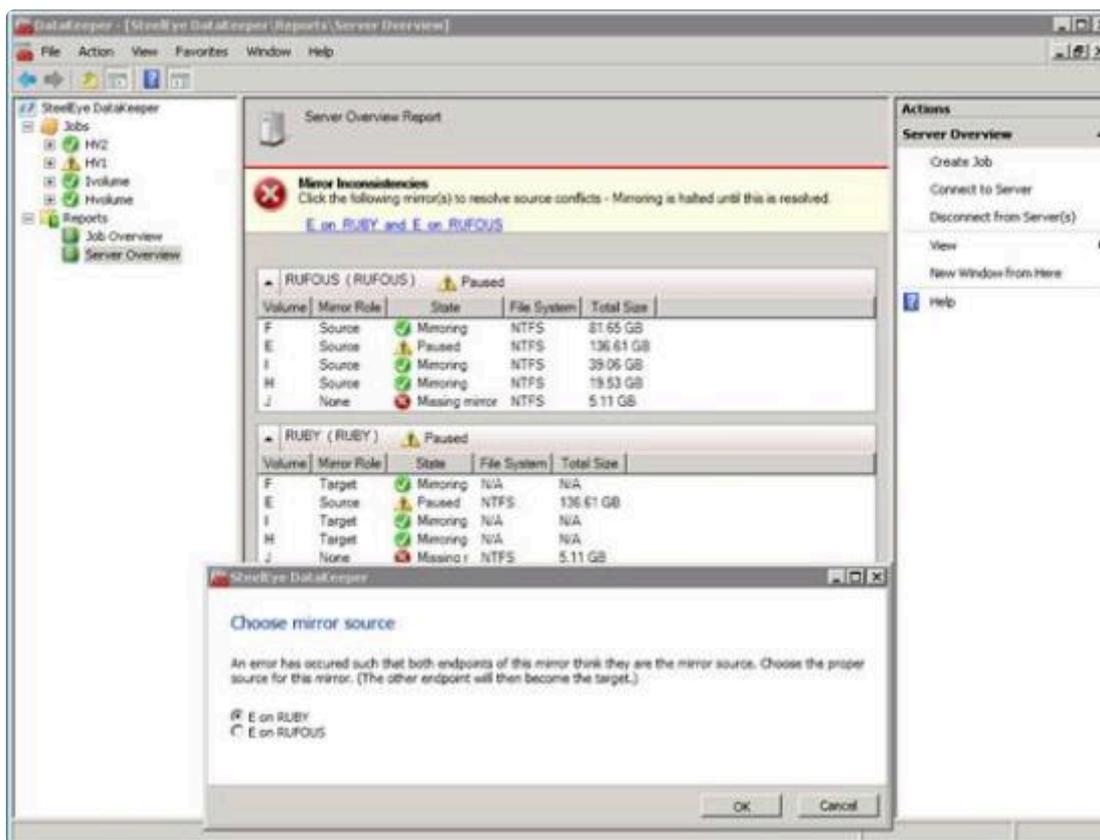
13. Simulate a catastrophic failure by pulling the power cord on secondary server and verify that the

virtual machine automatically restarts on primary server.

8.9.11.13. Split-Brain Issue and Recovery

When protecting DataKeeper volume resources in Microsoft WSFC, if all nodes are included in the cluster split-brain recovery should occur automatically.

However, in a [Node Outside the Cluster](#) scenario a split-brain may occur if network connectivity is lost to the DR Node. The user might choose to manually switchover the volume to the DR node while WSFC maintains the source on the original cluster node. When network connectivity to the DR node is restored there will be a conflict known as a split-brain condition where both systems assume the ownership role over the volume. The SIOS DataKeeper user interface will display the error **“Mirror Inconsistencies - Click the following mirror(s) to resolve source conflicts - Mirroring is halted until this is resolved”** (as shown in the diagram below).



In addition, the following error is logged to the **System Event log**:

An invalid attempt to establish a mirror occurred. Both systems were found to be Source.t

Local Volume: F

Remote system: 192.168.1.212

Remote Volume: F

The mirror has been paused or left in its current non-mirroring state.

Refer to [Extending a Clustered DataKeeper Volume to a Node Outside the Cluster](#) for the recovery procedure.

Resolving a Split-Brain Issue via the Command Line Interface

EMCMD <system> PREPARETOBECOMETARGET <volume letter>

This command should only be used to recover from a Split-Brain condition. It should be run on the system where the mirror is to become a target and is only valid on a mirror source. This command causes the mirror to be deleted and the volume to be locked.

To complete split-brain recovery, run [CONTINUEMIRROR](#) on the system that remains as the mirror source.

Example Scenario

If volume F: is a mirror source on both SYSA and SYSB, you can use emcmd to resolve this split-brain situation. Choose one of the systems to remain a source – for example, SYSA. Make sure there are no files or modifications on SYSB that you want to save – if so, these need to be copied manually to SYSA. To re-establish the mirror, perform the following steps:

```
EMCMD SYSB PREPARETOBECOMETARGET F
```

The mirror of F: on SYSB will be deleted and the F: drive will be locked.

```
EMCMD SYSA CONTINUEMIRROR F
```

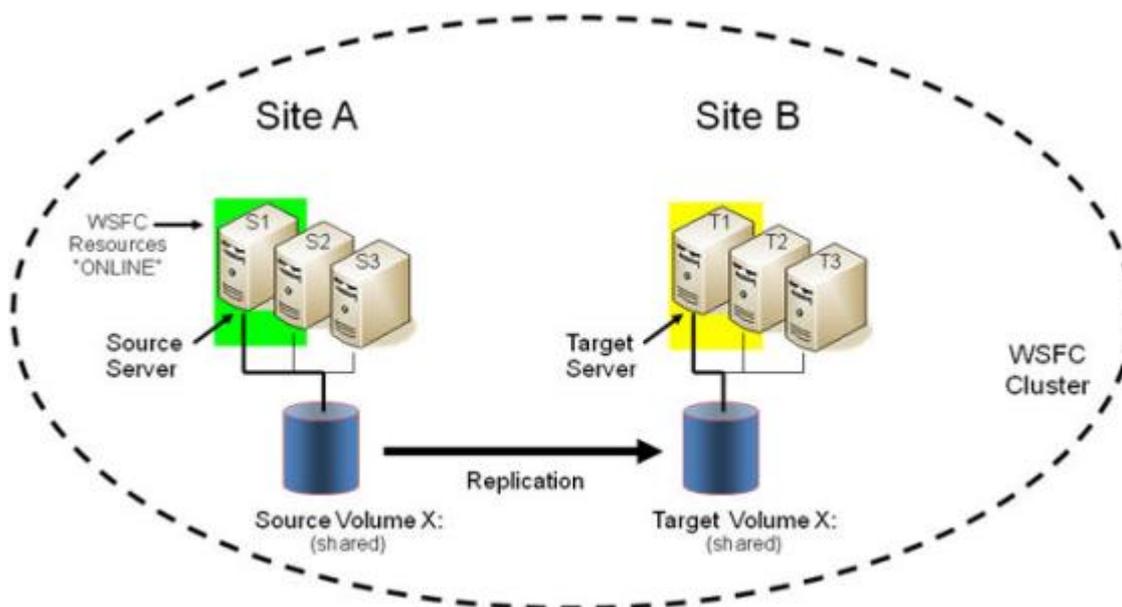
Mirroring of the F: drive from SYSA to SYSB will be established, a partial resync will occur (overwriting any changes that had been made on SYSB), and the mirror will reach the **Mirroring** state.

8.9.11.14. Switchover in an N-Shared x N-Shared Configuration

In a multi-shared storage environment between two sites (as shown in the diagram below), each server in each site has access to the storage being shared between the servers at that site. When a DataKeeper mirror is created, one server in each site will be designated as the mirror endpoints of the mirror.

(**Note:** N represents a number from 1 to N; e.g. 4×1 represents 4 servers sharing a disk replication to another site with 1 server.)

In the following example (3×3), a DataKeeper mirror has been created to replicate the X: volume from Site A to Site B.



Note that there are three servers sharing storage in Site A. Those servers are:

- S1 – Currently the SOURCE of the mirror
- S2 – Shared Source (locked)
- S3 – Shared Source (locked)

Because S1 is the SOURCE of the mirror, we refer to S2 and S3 as shared source systems. This implies that these servers currently share access to the volume on the SOURCE side of the mirror, but they cannot currently access the volume because they are not defined as the source of the mirror. (**Note:** A user on S2 will see “**access denied.**”)

There are three other servers sharing storage in Site B.

- T1 – Currently the TARGET of the mirror (locked as the primary target)

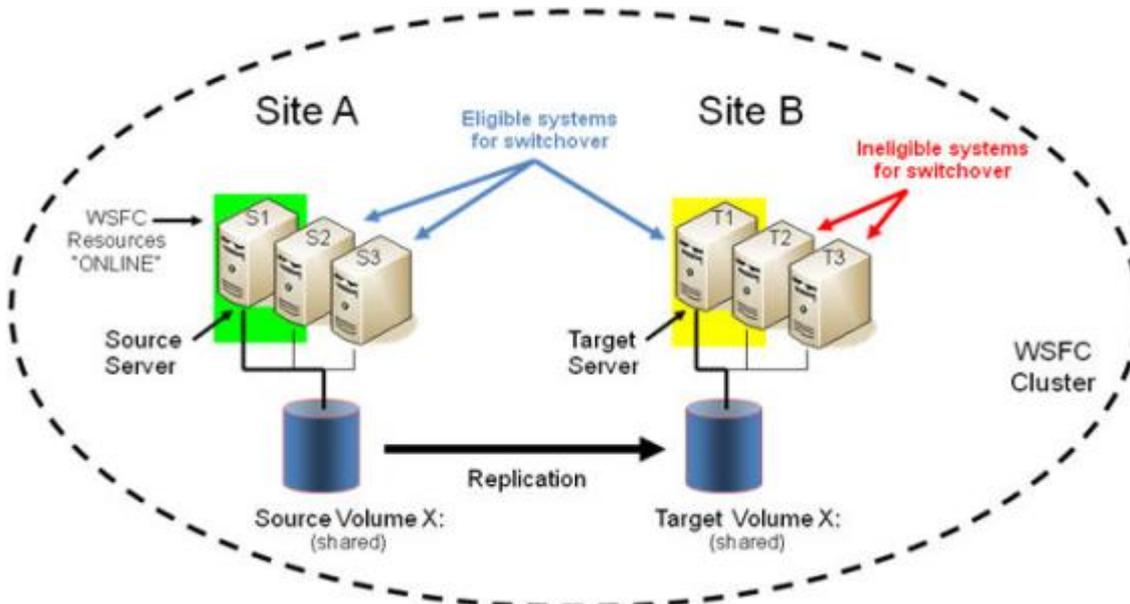
- T2 – Shared Target (locked)
- T3 – Shared Target (locked)

They share access to the Target volume currently defined to T1. T2 and T3 are referred to as shared target systems. File system access to the target volume is locked on all three systems.

All six servers are part of the WSFC cluster, and all of the WSFC protected resources are currently active or “ONLINE” on S1.

Given this initial replicated configuration, it is important to understand which servers are eligible to “take over” and become the ACTIVE server. With a DataKeeper mirror in place, the following rules apply:

1. Switchover to a Shared Source server (S2, S3) is allowed.
2. Switchover to the current Target server (T1) is allowed.
3. Switchover to a Shared Target server (T2, T3) is not allowed; however, there is a two-step process to switch over to these servers.
 - First, switch over to the target T1.
 - Then you can switch over to either T2 or T3 server.



Switchover to a Shared Source Server

In our example, either S2 or S3 is eligible to become the ACTIVE server and source of the mirror. If we switch the protected resources to S2, S2 will become the new SOURCE of the mirror and T1 will remain the Target of the mirror.

1. Initial Mirror Configuration: S1 → T1

2. Action: Switchover to S2 (Bring resources ONLINE in WSFC)
3. Final Result: S2 → T1

Switchover to the Current Target System

In our example, switching the protected resources to T1 will effectively reverse the mirror direction making T1 the new SOURCE of the mirror and S1 will become the Target of the mirror.

1. Initial Mirror Configuration: S1 → T1
2. Action: Switchover to T1 (Bring resources ONLINE in WSFC)
3. Final Result: T1 → S1

Switchover to a Shared Target System

This is not allowed. The switchover operation will fail, but as noted above, a two-step process can be used.

1. Initial Mirror Configuration: S1 → T1
2. Action: Switchover to T1 (Bring resources ONLINE in WSFC)
3. Intermediate Configuration: T1 → S1
4. Action: Switchover to T2 (Bring resources ONLINE in WSFC)
5. Final Result: T2 → S1

Failover

In a failover scenario where the current source system fails or a resource failure triggers a group failure, Failover Clustering attempts to fail over the resource group to another node in the cluster. Factors affecting the failover include the following:

- Node Failure vs Resource Failure
- Preferred Owner List is set for the Resource Group vs Preferred Owner List is not set
- Possible Owners

The following article describes how Failover Clustering determines which node to fail over to.

<http://blogs.msdn.com/b/clustering/archive/2009/08/11/9863688.aspx>

Important: In an N x N configuration, DataKeeper supports failover to any one of the shared source

systems or to the target system. If Failover Clustering tries to online the group on an ineligible system (one of the shared target systems), that online will fail. Failover Clustering will continue trying to online the group on different nodes and eventually succeeds when a system that is eligible for failover is tried.

8.9.11.15. Installing and Using DataKeeper Cluster Edition on Windows Server 2008 R2 / 2012 Core Platforms

1. Prepare the servers.

Install Windows Server 2008 R2/2012 Core on two servers, configure IP, join a domain, configure firewall for remote administration, configure the server for remote access and install the Failover Cluster feature.

[Server Core Installation Option Getting Started Guide](#)

[Configuring a Server Core Installation of Windows Server 2008 R2 with Sconfig.cmd](#)

[Install and Deploy Windows Server 2012](#)

2. Install SIOS DataKeeper.

Run the SIOS DataKeeper (DK) setup.exe from the command line on both servers. Make sure you choose to install the DataKeeper core services only, not the DataKeeper GUI.

3. An email should have been received containing the license file(s). It is recommended that this file be renamed to the YYYYMMDD.lic format to distinguish the day the license was activated. Once received, copy the license file(s) to the appropriate directory.

- On each system, copy the file(s) to:

`%windir%\sysWOW64\LKLicense` (ex. `c:\windows\SysWOW64\LKLicense`)

Note: If the LKLicense directory does not already exist, it will need to be created prior to copying the files.

4. On a management server (or Vista workstation with “Remote Server Admin Tools” installed), install the DataKeeper GUI console only.
5. Using the management server’s DataKeeper GUI, connect to the new core only servers and create a “job” with a mirror of the data volumes.
6. Using the management server, create the WSFC cluster.
7. Change the quorum mode to **Node Majority** if deploying an odd number of nodes or **Node and File Share Majority** if deploying an even number of nodes. Refer to the appropriate Microsoft documentation for official guidance on quorum configurations in a multi-site environment.

<http://download.microsoft.com/downlo...Clustering.doc>

Configuring the Quorum in a Failover Cluster

8. Add the DataKeeper Cluster Edition resource to the cluster.

Note: The example below assumes you want to add the E drive mirror to your Hyper-V resource.

Start Powershell on the primary core only server and enter the following commands:

```
• Import-Module FailoverClusters

• Add-ClusterResource -Name "DataKeeper Volume E" -ResourceType
  "DataKeeper Volume" -Group "<name of Hyper-V resource>"

• Get-ClusterResource "DataKeeper Volume E" | Set-
  ClusterParameter VolumeLetter E
```

9. Add your resource to Windows Server Failover Clustering to make it highly available (HA)

To make a Hyper-V VM HA – Hyper-V: Using Hyper-V and Failover Clustering

10. Finally, if not already done in the previous step, add the DataKeeper replicated storage to your resource to complete the dependency creation and setup.

8.9.11.16. Non-mirrored Volume Resource

A non-mirrored volume resource is a DataKeeper resource **where no data is replicated to any node in the cluster**. This resource type should only be used where the data is temporary and/or non-critical such as MS SQL Server tempdb space. In this case, when MS SQL restarts on another node after a failover or switchover, the tempdb space is automatically recreated so replication of the data is not necessary.

This non-mirrored volume resource will be able to come Online and go Offline on all cluster node without ever affecting the configured volume. Additionally, the volume will remain unlocked and writable at all times on all nodes in the cluster.

To configure a non-mirrored volume resource:

- Configure a volume on all cluster nodes using the same drive letter (all nodes must use the same drive letter).
- Create any directories that are required for the volume on all cluster nodes.
- Create a DataKeeper Volume resource using the Failover Clustering UI. Provide a name that best describes its intended use – (Example: “DataKeeper Volume F (Non-Mirrored)”). The following steps will set the Properties needed for the non-mirrored resource:
 - In the Failover Cluster Manager, right-click the **Cluster Group** or the **Role** that will contain the non-mirrored DataKeeper Volume Resource. If a role has **NOT** been defined, an [Empty Role](#) must be created.
 - Select **Add a Resource, More Resources**, then select **DataKeeper Volume**.
 - Right-click on the new **DataKeeper volume resource** and select **Properties**.
 - Enter the **Resource Name** you selected earlier (Example: “DataKeeper Volume F (Non-Mirrored)”) then click **OK**. You do not need to change any other properties at this time.

The following steps will set the Properties needed for the non-mirrored resource:

- Assign the following properties using Powershell:

VolumeLetter =F (if the drive letter is F, otherwise whatever the drive letter is)

NonMirrored =1 (there is no space between Non and Mirrored)

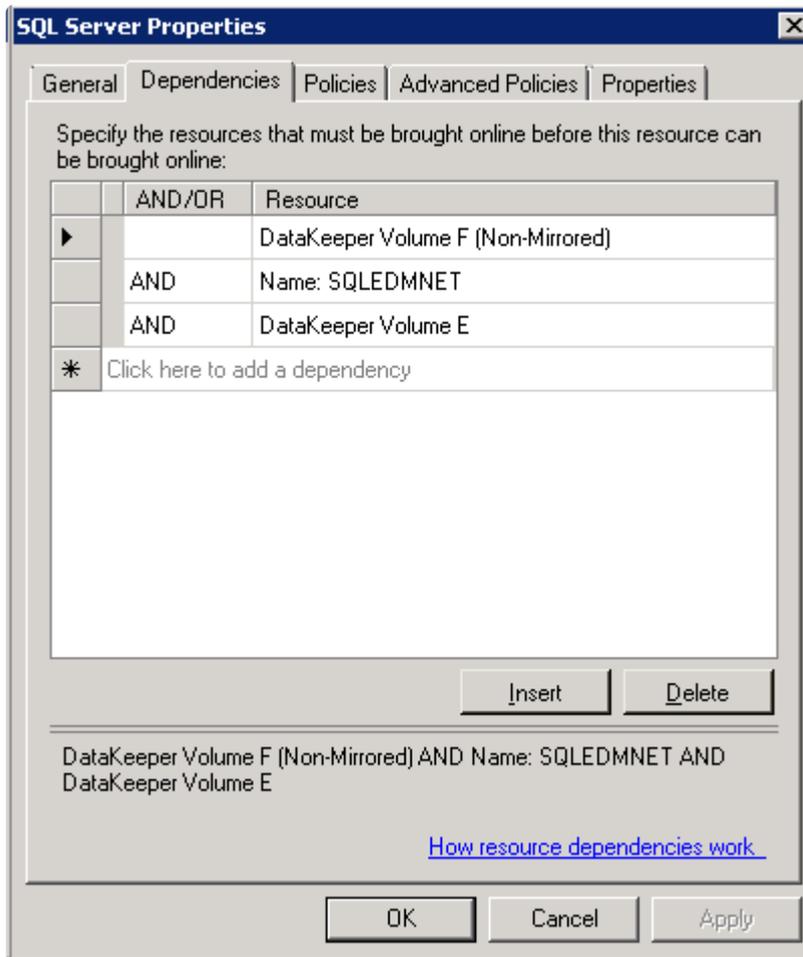
- Add the properties using **Powershell**:

```
Get-ClusterResource "DataKeeper Volume F (Non-Mirrored)" | Set-ClusterParameter -Name VolumeLetter -Value "F"
```

```
Get-ClusterResource "DataKeeper Volume F (Non-Mirrored)" | Set-ClusterParameter -Name NonMirrored -Value 1
```

If this non-mirrored volume resource is to be used with MS SQL Server for tempdb space the following configurations steps are needed:

- Ensure that the volume security settings for the user account that is chosen to run SQL Server services has full access to the volume on all nodes in the cluster.
- Ensure that the "SQL Server" resource in the Failover Clustering group has a dependency on the new DataKeeper Volume resource.

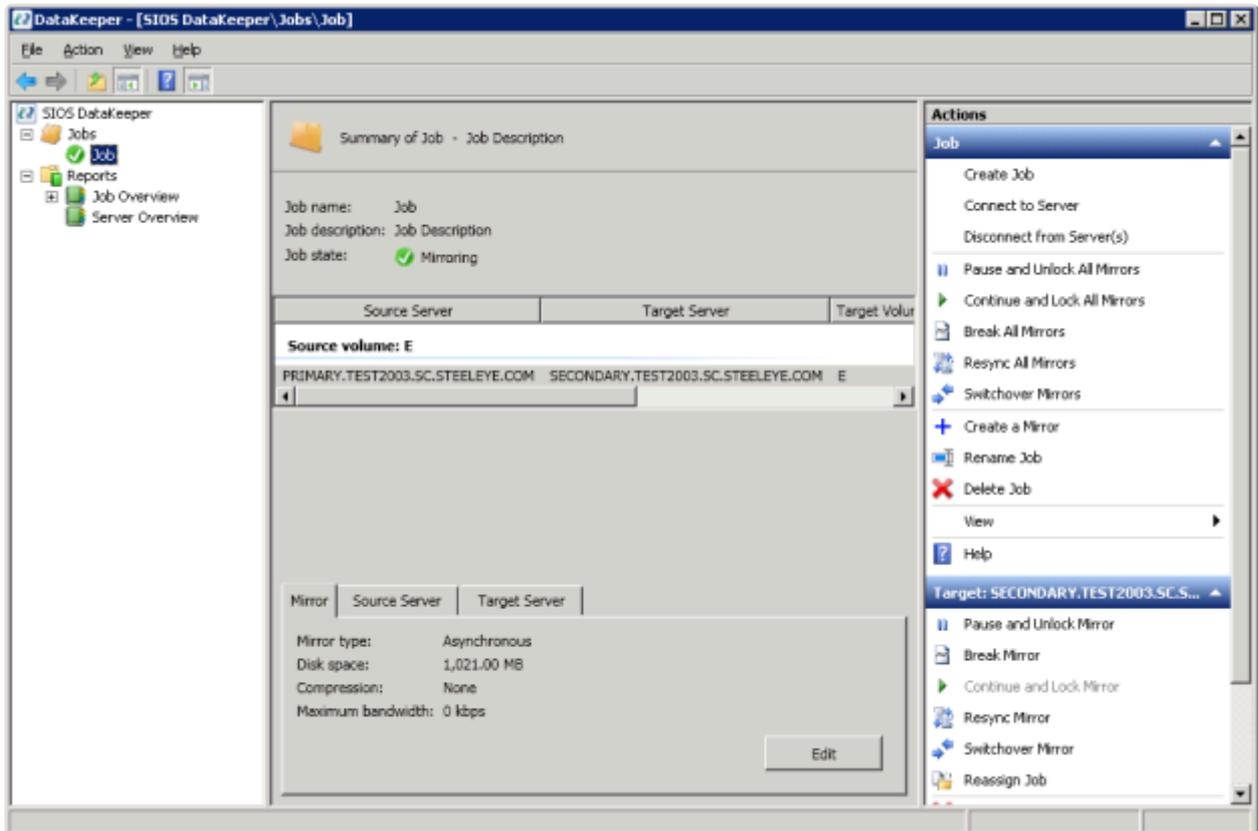


8.9.11.17. Using DKCE to Enable Multi-Site File Share Resources with Windows Server 2008R2 WSFC

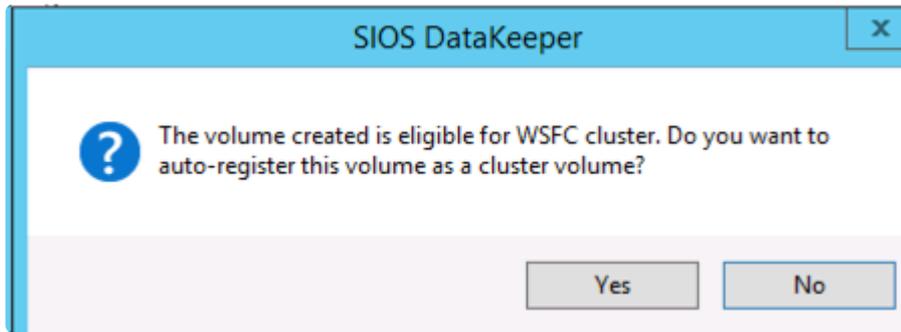
Use the following procedure to protect File Share resources using SIOS DataKeeper and Microsoft Failover Cluster (WSFC).

✿ IMPORTANT NOTE: DataKeeper Cluster Edition registration with Failover Cluster is automatic and occurs 60 seconds after detecting a Failover Cluster configuration on each node.

1. [Create a mirror](#) for the volume using the SIOS DataKeeper user interface. Make sure the mirror is in **“Mirroring”** state before protecting in WSFC.

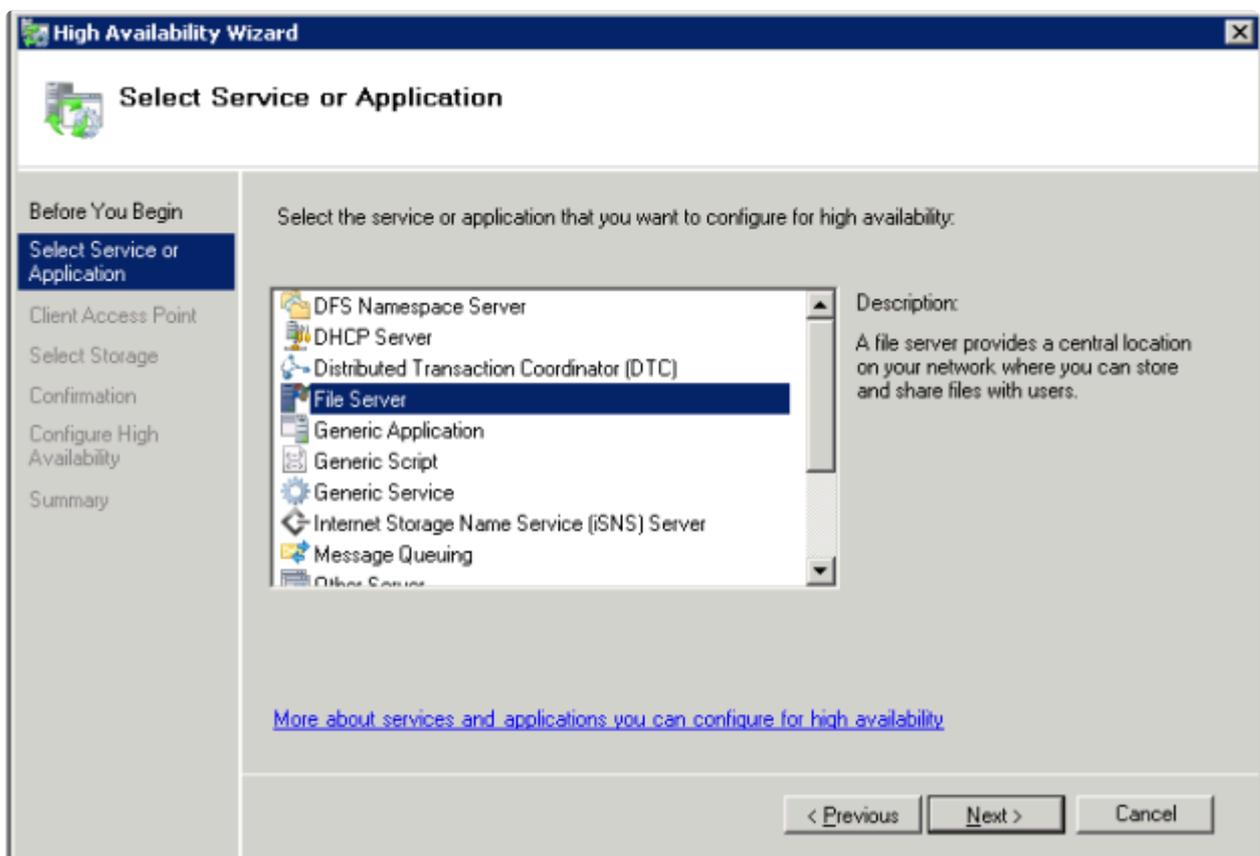


2. Use the DataKeeper Auto-register Pop-up to quickly register the replicated volume with WSFC. Select **YES** to auto-registration. The DataKeeper replicated volume will automatically be added to cluster Available Storage.



Open the **WSFC Failover Cluster Manager**

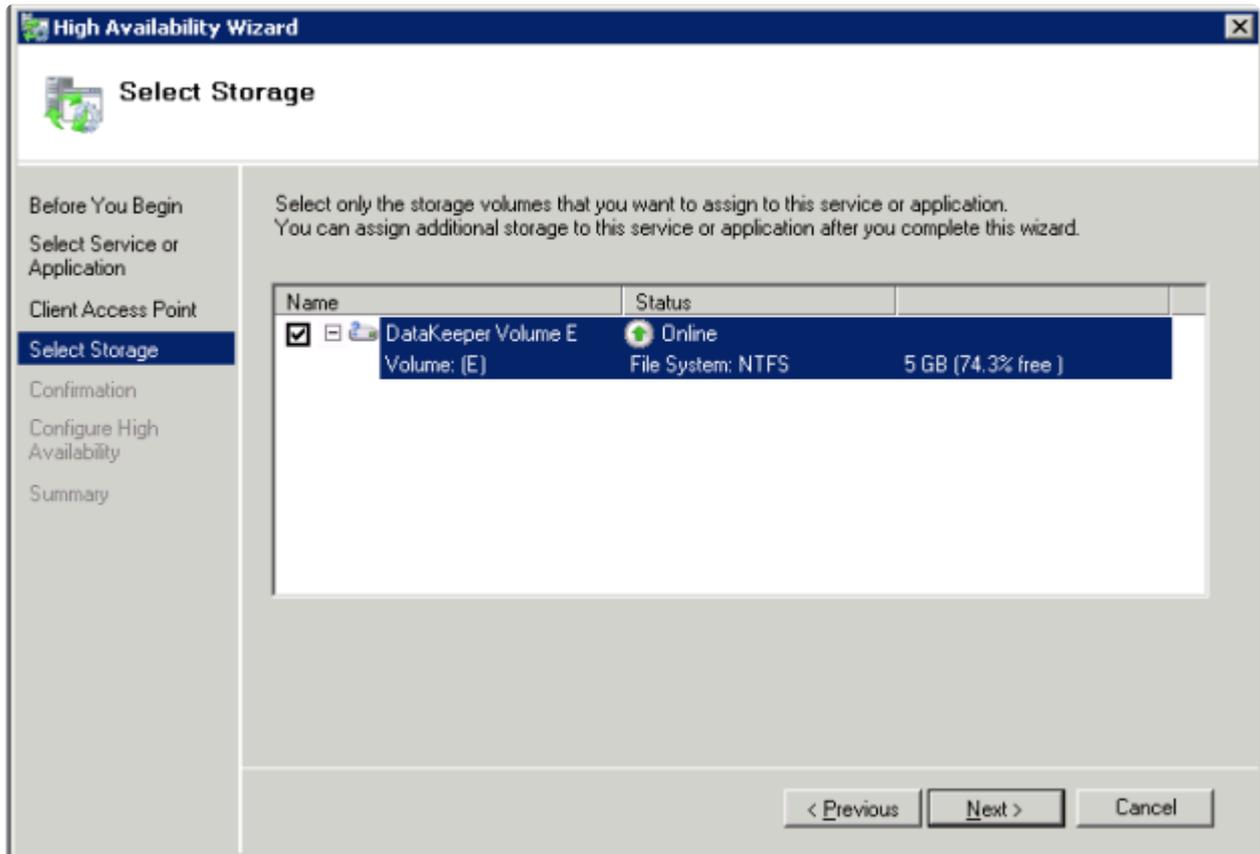
3. Right click on “Services or Application” and create a File Server resource. The File Server Role must already be installed on all the nodes in your cluster. If not, an error will be displayed.



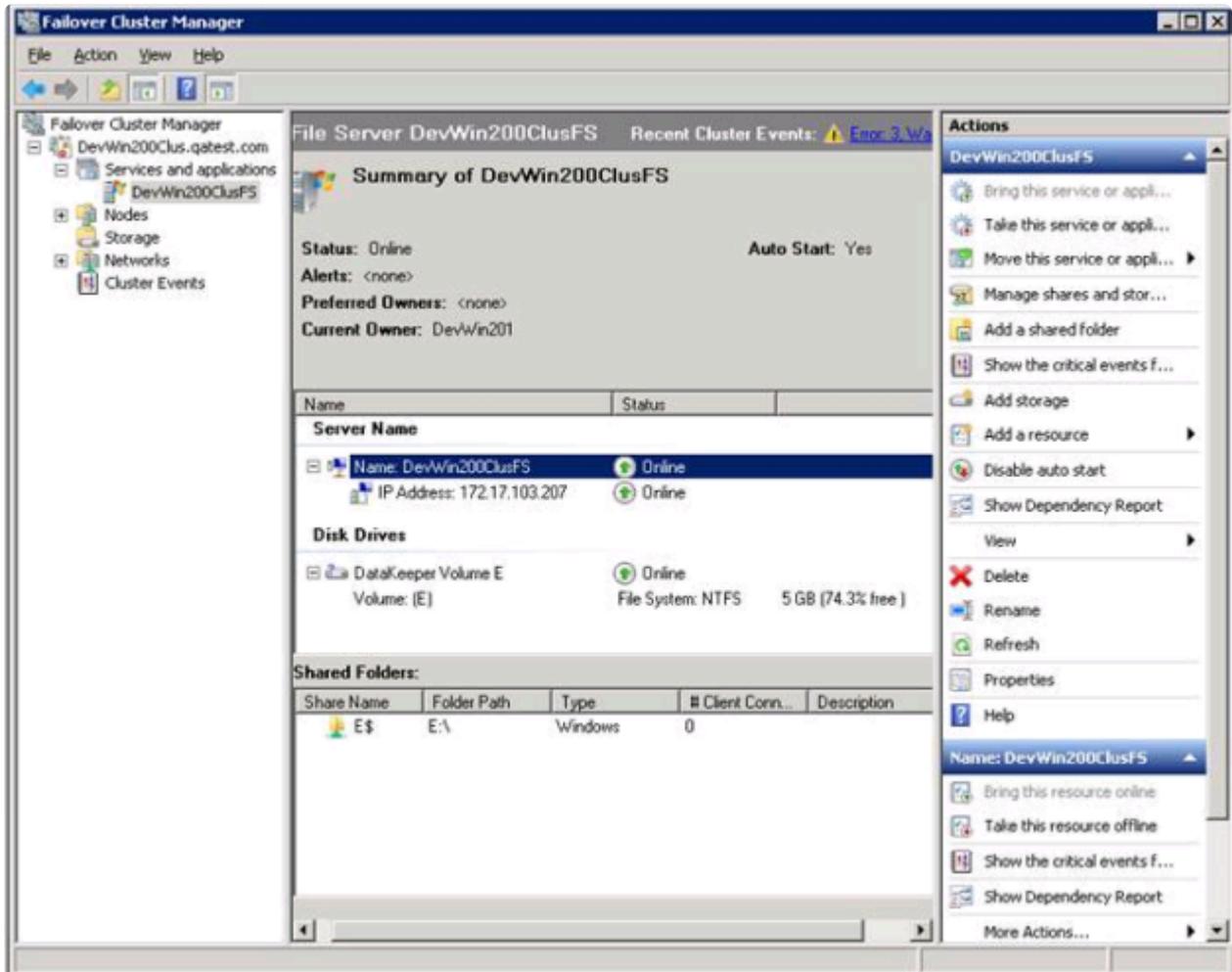
a. Click **Next**.

b. On the next screen fill in the **File Server resource name** and provide an **IP address**. Click **Next**.

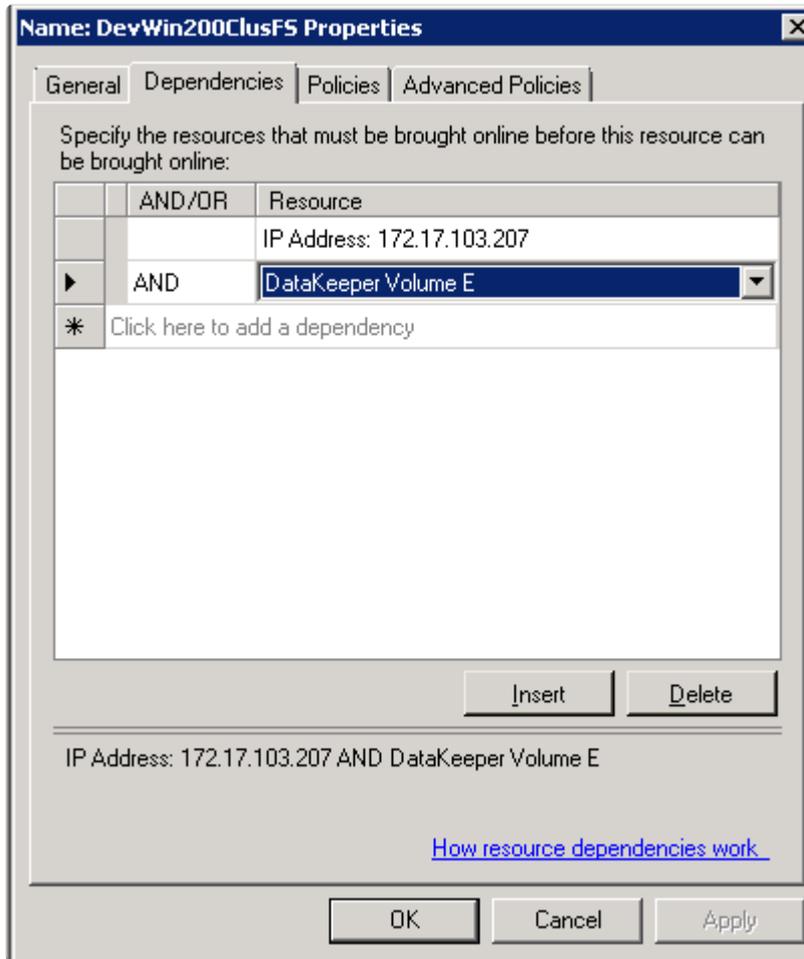
4. Add DataKeeper Storage to the File Server resource.



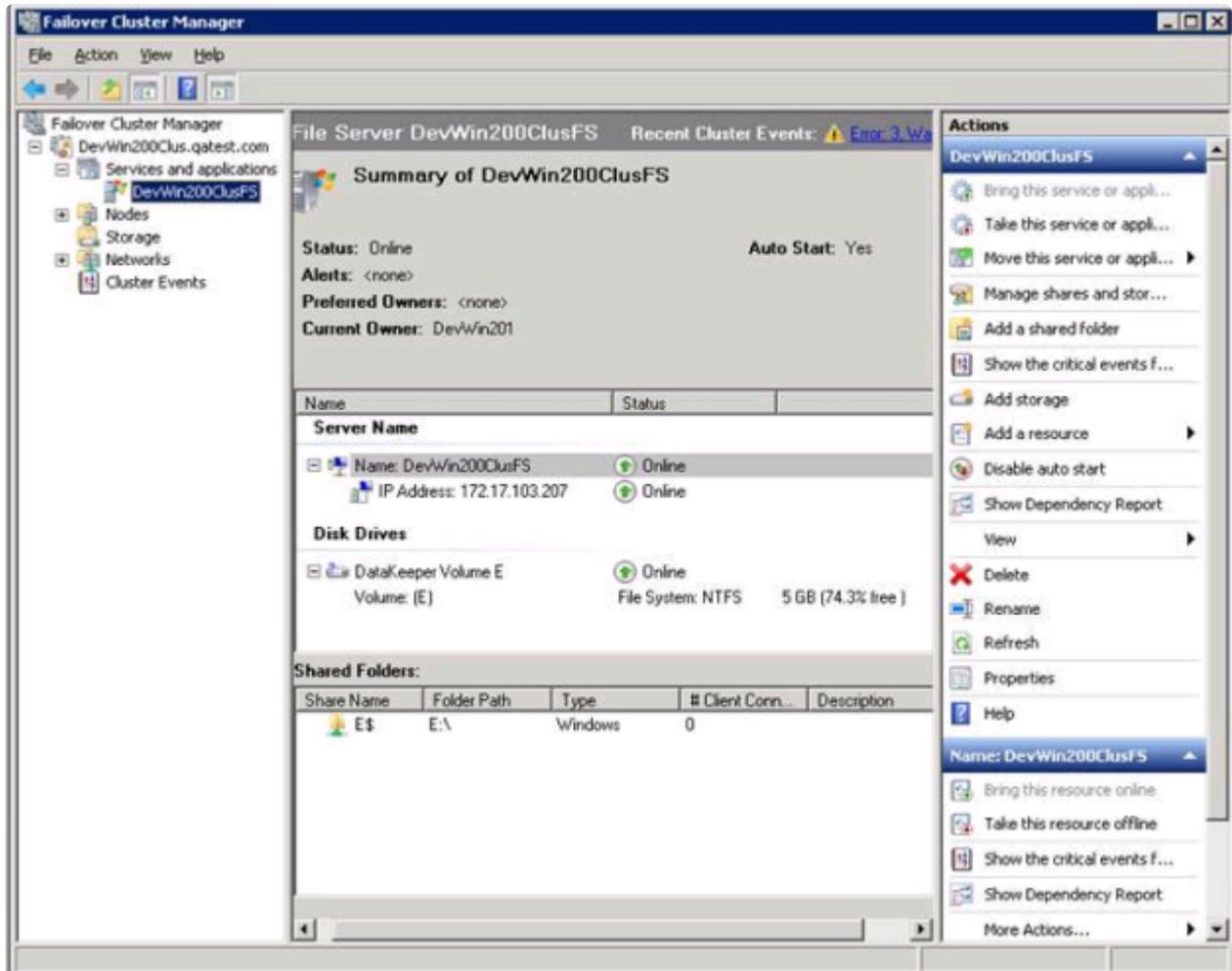
- Select the **DataKeeper Volume** check box above and click **Next**.
- The **File Server** Confirmation screen will be displayed, confirm it and click **Next**.
- The **File Server** Configuration Summary will be displayed, Click **Finish**.
- The **File Server** resource will be created with the DataKeeper volume root path as shown below.



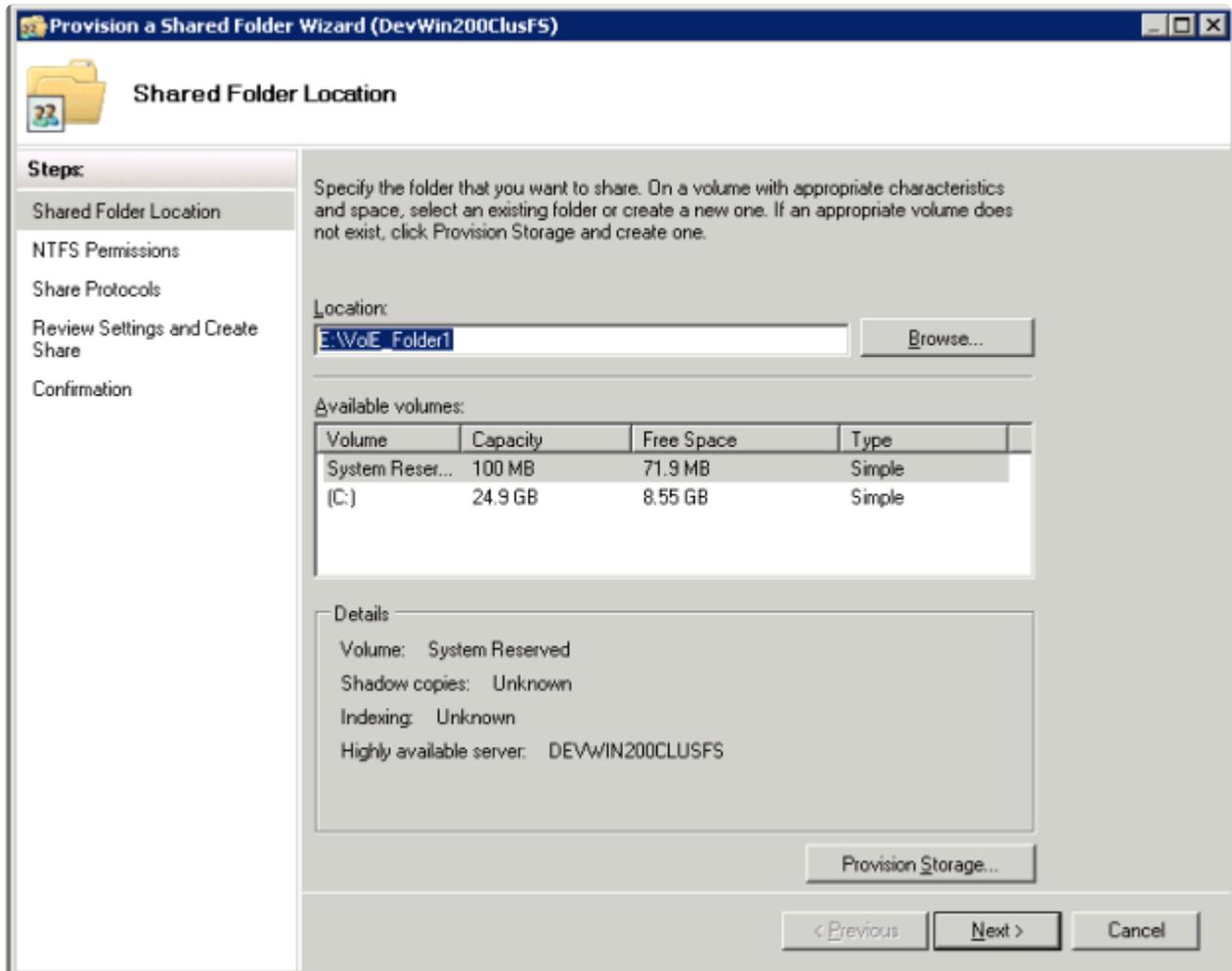
5. Using the **Failover Cluster Manager**, create a resource dependency from the File Server resource to the DataKeeper Volume resource. This dependency relationship is very important to coordinate in-service and out-of-service operations of the file share and volume resources when moving the File Share resource from one node to another node.
 - a. Right-click on the **File Server** resource name (center panel, selected above), then select **Properties**.
 - b. Add the **DataKeeper Volume** resource as a dependency for the **File Server** resource, and click **OK**.



6. The File Server resource is now ready for file shares to be added. File Shares can be added several ways.
 - a. Right-click on the **File Server resource** (highlighted below) and select “**Add a shared folder**”. Or, use the “Add a shared folder” action on the right panel shown below.



b. The **Shared Folder Location** screen shown below includes a browse button to locate the folder to share on the DataKeeper Volume. Then click **Next**.

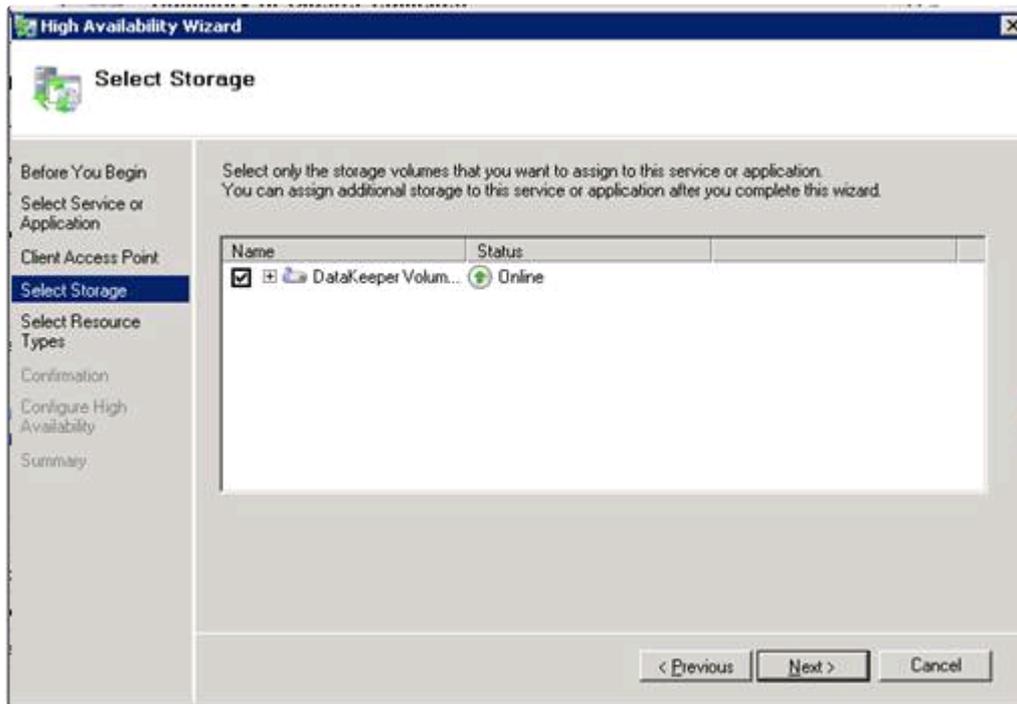


- c. The **NTFS Permissions** screen provides alternative **NTFS permission level**, and click **Next**.
 - d. The **Share Protocols** screen provides **protocol** selection, **share name**, confirm **Share Path**, and click **Next**.
 - e. The **SMB Settings** screen provides a **Description** for the Share, and click **Next**.
 - f. The **SMB Permissions** screen provides alternative SMB permissions, click **Next**.
 - g. The **DFS Namespace** screen provides a publish to DFS namespace option, click **Next**.
 - h. The **Review** screen provides a configuration summary, click **Next**.
 - i. The **Confirmation** screen displays success or failure to create the file share, click **Close**.
7. Add a file share using a DataKeeper replicated volume resource is now completed. Shares are displayed in the lower Shared Folders panel shown below.

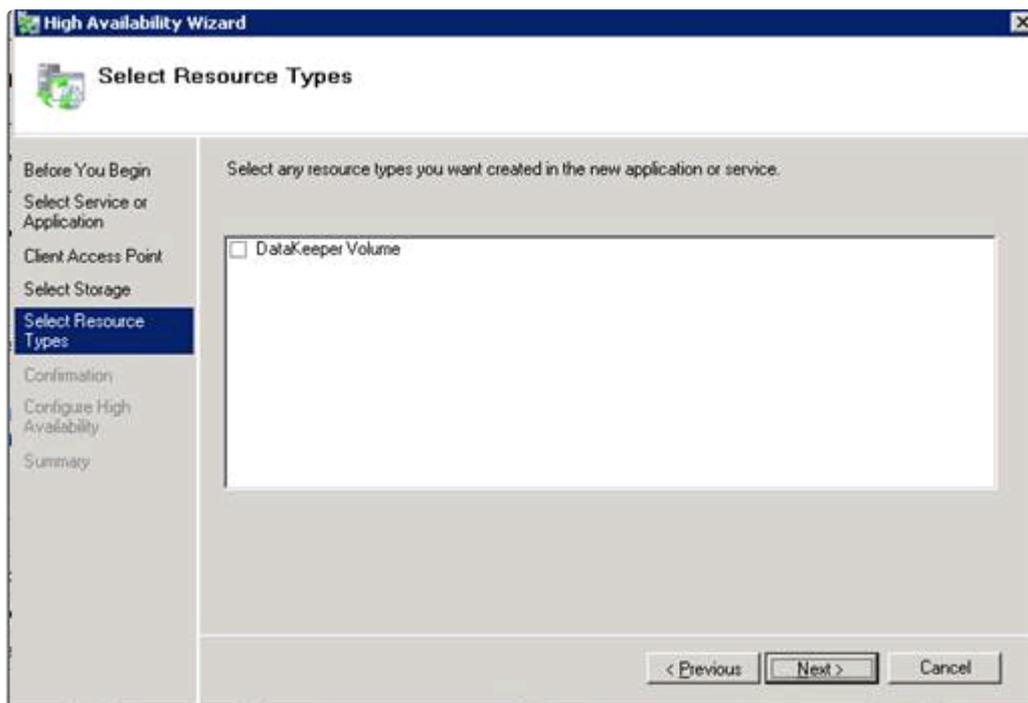
8.9.11.18. Creating Other Server Resource in WSFC

When creating an **Other Server** resource in WSFC, you will be prompted for a storage resource (DataKeeper resource) twice. You will check the first one, but do not need to check the second dialog.

Click the “checkbox” for the first dialog “Select Storage”.



But **DO NOT** check the box in the 2nd dialog “Select Resource Types”. This will attempt to create another resource, which is not required.



8.10. FAQs

Refer to this section for answers to the most frequently asked questions about SIOS DataKeeper and SIOS DataKeeper Cluster Edition.

[Add a New Disk / DK Volume to an Existing Clustered SQL Role](#)

[Awareness of Windows Filenames and Directory Names](#)

[AWS Issues and Workarounds](#)

[Change Mirror Endpoints](#)

[Change Mirror Type](#)

[Create a Mirror and Rename Job and Delete Job Actions Grayed Out](#)

[Data Transfer Network Protocols](#)

[Delete and Switchover Actions Grayed Out](#)

[Deleting a Mirror FAQ](#)

[Error Messages Log](#)

[Evict a Node from a Cluster](#)

[Inability to Create a Mirror](#)

[Network Disconnect](#)

[Reclaim Full Capacity of Target Drive](#)

[Remove DataKeeper Storage from a Windows Server Failover Cluster Role](#)

[Resize or Grow Mirrored Volumes](#)

[Server 2012: Server Manager “File and Storage Services” Disk Status](#)

[Split-Brain FAQs](#)

[Stop Replication Between Source and Target](#)

[Using Volume Shadow Copy](#)

[Volumes Unavailable for Mirroring](#)

8.10.1. Add a New Disk / DK Volume to an Existing Clustered SQL Role

When adding an additional disk to an existing cluster, the dependency relationship must be verified and configured manually based on the following requirements:

- The IP Address and the Disk Resource/DataKeeper Volume do not depend on anything
- The SQL Network Name depends on the IP Address
- The SQL Server depends on the Network Name and a Disk Resource/DataKeeper Volume
- The SQL Agent depends on SQL Server

8.10.2. Awareness of Windows Filenames and Directory Names

Question

Is SIOS DataKeeper aware of Windows filenames and directory names?

Answer

SIOS DataKeeper is implemented with a Windows kernel mode filter driver that sits above the physical disk driver but below the file system. As a result, the SIOS DataKeeper driver knows nothing about individual files or the file system itself. It is only aware of raw writes to the disk.

8.10.3. AWS Issues and Workarounds

Question

What is the best practice for shutting down clustered VMs in AWS?

Answer

If shutting down the primary source node, all cluster roles depending on a SIOS DataKeeper Volume Resource should be placed in the Offline state. Also make sure all mirrors are in the mirroring state prior to shutting down any VM. The node shutdown order does not matter as long as the previous steps have been taken.

8.10.4. Change Mirror Endpoints

Question

Can I change the mirror endpoints (IP address) of a system currently associated with an existing mirror?

Answer

Yes. The EMCMD called [CHANGEMIRRORENDPOINTS](#) allows you to change the endpoints of a mirrored volume that is configured on 3 nodes or fewer. (If your configuration consists of more than three nodes, the mirrors must be deleted and recreated.)

8.10.5. Change Mirror Type

Question

Can you change the mirror type of an existing mirror from Synchronous to Asynchronous or vice-versa?

Answer

Yes, you can change the mirror type using the EMCMD [CHANGEMIRRORTYPE](#) command.

8.10.6. Create a Mirror and Rename Job and Delete Job Actions Grayed Out

Question

Why are the Create a Mirror, Rename Job and Delete Job actions grayed out?

Answer

If a node that is part of the job is down, these actions will not be enabled.

8.10.7. Data Transfer Network Protocols

Question

What are the network protocols used for SIOS DataKeeper Data Transfer?

Answer

SIOS DataKeeper uses named pipe communication and TCP Sockets.

8.10.8. Delete and Switchover Actions Grayed Out

Question

Why are the Delete and Switchover actions grayed out on the DataKeeper User Interface?

Answer

If the volume is under clustering protection (Microsoft clustering or SIOS LifeKeeper clustering), these actions are disabled.

8.10.9. Deleting a Mirror

Question

What actually happens when you delete a mirror?

Answer

The data remains on both sides, but the target and source data are no longer synchronized. The target volume is unlocked and made fully accessible.

8.10.10. Error Messages Log

Question

Where does DataKeeper log error messages?

Answer

DataKeeper events are logged in the **Windows Application Event Log** and the **Windows System Event Log**. Here is a breakdown of the messages you can look for.

Application Event Log:

- Source = ExtMirrSvc – events related to the DataKeeper service.
- Source = DataKeeperVolume – events related to DataKeeper Volume Resources defined in Windows Failover Clustering (WSFC).
- Source = SIOS.SDRSnapIn – events related to the DataKeeper GUI connecting to the DataKeeper systems.

System Event Log:

- Source = ExtMirr – events directly related to mirror creation, mirror manipulation and replication.

 Note: The **System Event Log** should always be set to “**Overwrite events as needed**”. If the System Event Log fills up or becomes corrupted, it will prevent DataKeeper from properly recognizing mirror state changes.

8.10.11. Inability to Create a Mirror

Question

Why can't I create a mirror?

Answer

- The common cause of this problem is that the volume on either source or target is in use by another process. Stop the process that is accessing the volume and try again. The SIOS DataKeeper software requires exclusive access to the target volume during the creation of the mirror.
- The target volume must be as large, or larger, than the source volume. It is recommended that the user compare the target volume size with the source volume size using the Disk Management utility. If the sizes are not the same, recreate the target partition a little larger. See [Volume Considerations](#) for more information.
- An error experienced during [Create Mirror](#) could indicate that the target volume is corrupt. If this occurs, format the target volume and attempt to create the mirror again.

! **WARNING:** Drive letters on the target and source must match when using Windows Server Failover Clustering.

8.10.12. Network Disconnect

Scenario #1

In a 2-Node, non-clustering configuration (1×1) replicating a 100TB volume between Source server and Target server over a WAN connection, the network goes down for twenty minutes.

Question

In this scenario, what would happen to the **Mirror State** with DataKeeper Standard Edition?

Answer

After a couple of minutes, the Source server will detect that the network is down and the mirror will go from the **MIRRORING** state to the **PAUSED** state.

Question

Does DataKeeper continue to track changes on the Source server?

Answer

Yes. The Bitmap (# of Dirty Sectors) will continue to be updated on the Source server while the mirror is in the **PAUSED** state.

Question

Once the network is resumed, will a partial resync to the Target server occur?

Answer

Yes. The mirror will go to the **RESYNC** state and remain there until all dirty sectors are written to the Target server. It will be a partial resync.

Scenario #2

In a 2-Node, non-clustering configuration (1×1) replicating a 100TB volume between Source and Target over a WAN connection, the network goes down for twelve hours. The Source server is rebooted while the network is down.

Question

In this scenario, what would happen to the status of the Source server in DataKeeper Standard Edition?

Answer

The Bitmap on the Source server is persistent (on disk), so it will not be affected by a Source reboot. Only a partial resync is needed if the Source server is rebooted. The Target server will report that it is in the **MIRRORING** state until it is reconnected to the Source server. Then it will go to the **RESYNC** state while the resync is proceeding.

8.10.13. Reclaim Full Capacity of Target Drive

Question

How do I reclaim the full capacity of my target drive when I no longer need it for mirroring?

Answer

The file system on the target drive is overlaid by SIOS DataKeeper, thereby making it smaller than the actual partition size. Although Disk Management indicates the full partition size, SIOS DataKeeper and Windows Explorer indicate the smaller mirror size. To reclaim full capacity of the drive, reformat the partition or use a partition resizing utility such as GParted (<http://gparted.sourceforge.net/>).

8.10.14. Remove DataKeeper Storage from a Windows Server Failover Cluster Role

To remove an existing DataKeeper Resource/Mirror from Windows Server Failover Clustering:

- Without impacting the existing role in WSFC, i.e. File Shares, SAP, Oracle, SQL
- Without having to run various emcmd commands, e.g. deletelocalmirroronly, cleanupmirror

Note: In the DataKeeper UI, “Switchover Mirrors”, “Delete Job” and “Delete Mirror” are grayed out in the Action Panel.

Reason: When a DataKeeper mirror is or becomes a part of a cluster/WSFC all administration takes place at the WSFC level.



<https://fast.wistia.net/embed/iframe/of9povjurq>

Steps to Remove:

In Failover Cluster Manager:

1. From the **Roles** panel, select **Storage** and the related **DataKeeper Volume**
2. Right click and select **Remove from the role you've created**, then select **Yes**
3. From WFSC select **Storage\Disk**

The DataKeeper Volume is now listed as/Assigned To, Available Storage.

4. Select **Remove** then select **Yes**

The DataKeeper Storage is no longer a resource in the cluster/WSFC.

5. In the DataKeeper UI > Action Panel, select **Delete Job**. You will be prompted ...“Are you sure you want to delete the ‘Volume (drive)’ and its mirror? Select **Yes**

If you have multiple mirrors/targets, select **Delete Mirror**, and the jobs will be deleted also.

8.10.15. Resize or Grow Mirrored Volumes

Question

Can you resize or grow mirrored volumes?

Answer

Yes, beginning with Version 7.4, users can extend and shrink their DataKeeper volumes dynamically while retaining mirror settings. See [DataKeeper Volume Resize](#) for more information.

8.10.16. Server 2012: Server Manager “File and Storage Services” Disk Status

Question

Why are DataKeeper Volumes that are being used in a Microsoft Failover Cluster not shown by Server Manager as “Clustered”?

Answer

On Server 2012, the new Server Manager tool is capable of detecting if a complete “Disk” is being used by Failover Cluster, for example as a Microsoft Cluster Shared Disk. However, the tool cannot detect if one or more Volumes located on a “Disk” are being used as DataKeeper (replicated) Volumes in a Cluster.

8.10.17. Split-Brain FAQs

Scenario

I am using DataKeeper in a non-cluster environment. I am mirroring from Server1 at one site to Server2 at a second site. Communication is broken due to site-to-site VPN, and I need to fail over from Server1 to Server2. I cannot access Server1 from anywhere. Server1 is actually still on but not reachable internally or externally, and there may be some processes still running in the backend.

Question

How can I fail over from Server1 to Server2?

Answer

Using the [SWITCHOVERVOLUME](#) command or the **Switchover Mirror** option in the DataKeeper UI, switch the source of the mirror to Server2. There will be a delay while the Target tries to connect to the Source, but that should complete in 30-40 seconds or so.

Question

During the switchover period, both Server1 and Server2 are writing new data to the disk (Volume F on both Server1 and Server2). When the connection comes back online, will Server1 automatically become the Target?

Answer

No. This scenario will cause a [split-brain](#) condition. Perform one of the following to resolve this issue:

- Using the DataKeeper User Interface, perform the [Split-Brain Recovery Procedure](#).

or

- Run the EMCMD [PREPARETOBECOMETARGET](#) command on the system that is going to become the Target, and then run the [CONTINUEMIRROR](#) command on the system that is going to become the Source.

Question

Which of the two methods above do you recommend for resolving the split-brain issue?

Answer

Whichever you prefer – they both perform the same functions.

Question

Can the command for the Target server be run from the Source server?

Answer

Yes, the command for the Target server can be run from the Source server.

Question

How does DataKeeper sync the changed and unchanged blocks?

Answer

When resolving a split-brain condition, any changes on the system that is becoming the Target will be overwritten and lost. If there are changes on that system that you want to retain, manually copy those changes to the system that is going to become the Source.

Question

When running the [PREPARETOBECOMETARGET](#) command to resolve a split-brain condition, will a full resync or partial resync occur from the Source?

Answer

The **PREPARETOBECOMETARGET** command will delete the mirror(s) on that system but will leave the volume locked. The bitmap will remain intact so that a partial resync can be performed in the next step ([CONTINUEMIRROR](#)).

Question

How can I simulate a split-brain scenario?

Answer

To simulate a split-brain scenario, unplug the network between two systems so they cannot communicate. Run the [SWITCHOVERVOLUME](#) command (or select the **Switchover Mirror** option in the DataKeeper UI) on the Target so they both become Source, then reconnect the network. You are in a split-brain condition at that point.

Question

Should I wait for the **PREPARETOBECOMETARGET** command to complete before running **CONTINUEMIRROR** on the Source?

Answer

The **PREPARETOBECOMETARGET** command completes immediately.

8.10.18. Stop Replication Between Source and Target

Question

How do I stop the replication between the Source and Target volumes?

Answer

Replication occurs at the driver level and can only be stopped or interrupted by sending a command from the DataKeeper GUI or the DataKeeper command line (EMCMD) to the DataKeeper driver to do one of the following:

- [PAUSE the mirror](#) – Mirror endpoints still exist, but all replication is suspended. Writes are tracked on the source system so only a partial resync of the data is necessary to bring the target volume back into sync when the mirror is CONTINUED.
- [BREAK the mirror](#) – Mirror endpoints still exist, but all replication is suspended. Writes to the source system are not tracked. RESYNCING the mirror will initiate a full resync of the data which is required to bring the target volume back into sync with the source.
- [DELETE the mirror](#) – Mirror endpoints are deleted and replication stops.



Note: Stopping the DataKeeper service does not stop replication.

8.10.19. Using Volume Shadow Copy

Question

Can Volume Shadow Copy (VSS) be Used with DataKeeper Volumes?

Answer

VSS Shadow Copy can be enabled for DataKeeper volumes. However, the following guidelines apply:

- VSS snapshot images must not be stored on a DataKeeper volume. Storing VSS snapshots on a DataKeeper volume will prevent DataKeeper from being able to lock the volume and switch it over to another node.
- When a DataKeeper volume is switched or failed over, any previous snapshots that were taken of the DataKeeper volume are discarded and cannot be reused.
- VSS snapshot scheduling is not copied between the DataKeeper servers. If snapshots are scheduled to be taken twice a day on the primary server and a switchover occurs, this schedule will not be present on the backup server and will need to be redefined on the backup server.
- When switching back to a server where snapshots were previously enabled, VSS snapshots are automatically re-enabled; HOWEVER, any previous snapshots that were taken of the DataKeeper volume are discarded and cannot be reused.

8.10.20. Volumes Unavailable for Mirroring

Question

Why are some of my volumes not available for mirroring?

Answer

The SIOS DataKeeper service filters out the following types of disk partitions:

- Windows system volume
- Volume(s) that contain the Windows pagefile
- Non-NTFS formatted volumes (e.g. FAT, Raw FS)
- Non-fixed drive types (e.g. CD-ROMs, diskettes)
- Target volumes that are smaller than the source volume

8.11. DataKeeper Troubleshooting

The topics in this section contain important information about known issues and restrictions offering possible workarounds and/or solutions.

[Known Issues and Workarounds](#)

[Access to Designated Volume Denied](#)

[Antivirus Software Exclusion List](#)

[DataKeeper Cannot be used as a Quorum Device for a Cluster](#)

[DataKeeper Volume cannot come Online after Network failure with clustered IP Address on Replication network](#)

[DataKeeper Volume Not Available as Cluster Resource Type](#)

[Failed to Create Mirror](#)

[Hyper-V Host Cluster Error](#)

[Live Migration Failure](#)

[MaxResyncPasses Value](#)

[Mirroring with Dynamic Disks](#)

[New Resources Offline But Unlocked](#)

[Server Login Accounts and Passwords Must Be Same on Each Server in the Cluster](#)

[System Event Log – Create Mirror Failed in the GUI](#)

[Unable to Determine Previous Install Path](#)

[User Interface – Failed to Create Mirror](#)

[User Interface – Shows Only One Side of the Mirror](#)

[WSFC – MS DTC Resource Failure](#)

[WSFC 2008 R2 SP1 Procedure Change](#)

[Windows Server 2012 Specific Issues](#)

[Windows Server 2012 MMC Snap-in Crash](#)

[Windows Server 2012 — Simultaneous Move of Multiple Clustered File Server Roles Can Result in DataKeeper Switchover Failures](#)

[Windows Server 2012 iSCSI Target Role Does Not Support Dynamic Disks](#)

[Windows Server 2012 Default Information Missing During Mirror Creation](#)

[Windows Server 2012 NIC Teaming Issue](#)

[WSFC 2012 Cluster Creation Default Setting Issue](#)

[WSFC 2012 Failover Cluster Manager UI Defect](#)

[WSFC 2012 File Server Resource Manager Event Log Errors](#)

[WSFC 2012 File Shares Cannot be Created for File Server Role Using Server Manager or Failover Cluster Manager](#)

[WSFC 2012 New File Server Type Not Supported](#)

[WSFC 2012 Server Manager — Incorrect Volume Display](#)

[WSFC 2012 Server Manager — DataKeeper “Disk” Not Shown as Clustered](#)

[Windows 2012 File Share](#)

[Windows Server 2016 Specific Issues](#)

[Occasional Job Creation Failure](#)

[WSFC 2016 File Shares Cannot be Created for File Server Role Using Server Manager or Failover Cluster Manager](#)

[Restrictions](#)

[Bitlocker Does Not Support DataKeeper](#)

[CHANGEMIRRORENDPOINTS Restriction](#)

[CHKDSK](#)

[DataKeeper Volume Resize Restriction](#)

[Directory for Bitmap Must Be Created Prior to Relocation](#)

[Duplicate IP Addresses Disallowed Within a Job](#)

[Intensive I-O with Synchronous Replication](#)

[Resource Tag Name Restrictions](#)

8.11.1. DKCE Common Solutions

The following are the most commonly requested solutions.

- [Installation Solutions](#)
- [Clustering Solutions](#)
- [Storage Solutions](#)
- [Networking Solutions](#)

8.11.1.1. Most Common DKCE Installation Solutions

The following are the most commonly requested installation related solutions.

[How do I get and install my license\(s\)?](#)

[Where can I get the latest software?](#)

(Log into the [Customer Portal](#) to access)

[Why can't I create a new mirror?](#)

- [Firewall Issue](#)
- [Locked Target](#)
- [Mirror remnants left from a previous mirror on the target](#)
- [Mirror Sizes](#)
- [Pagefiles](#)
- [Volume in a RAW state](#)
- Volume is not on-line in Disk Management on Target

Not able to lock volume. Event ID 144 (Pagefile)

Issue:

DataKeeper was not able to lock a volume and received the following error:

```
Log Name: System
Source: ExtMirr
Date: 4/26/2013 10:10:18 AM
Event ID: 144
Task Category: Mirror Creation
Level: Warning
Keywords: Classic
User: N/A
Computer: 12345
Description:
The volume could not be locked as requested.
```

```
Volume Device:
Local Volume : V
```

Error Code : 0xC0000022

There was an error locking the volume. (The error code above is a driver status value).

RECOMMENDATION/SOLUTION:

Disk locks will fail if a pagefile exists on the target of the mirror. It will not allow the mirror to be continued from a paused/broken state if the target is accessible (unlocked). When this occurs a tool like “process explorer” will show one or more open handles to a pagefile on that volume.

Ensure there is no pagefile on the offending volume (in this case it was the target DK volume).

A system administrator had accidentally placed this pagefile on a mirrored volume after the mirror had been created.

DataKeeper does not support mirroring to or from volumes containing Windows pagefiles.

Volume goes into a RAW state when the *emcmd . unlockvolume* command is run

Issue:

- Able to create a mirror
- Once created and the *emcmd . unlockvolume* command is executed the Targeted volume enters into a RAW state per Disk Management

Solution:

Verify that the Bytes Per Physical Sector are identical on both the Source and Targeted volumes. Below is example of the output generated for Volume E, from the *fsutil fsinfo ntfsinfo {drive letter}* command:

```
C:\Windows\System32>fsutil fsinfo ntfsinfo e:
NTFS Volume Serial Number : 0x26ace2a1ace26aaf
NTFS Version : 3.1
LFS Version : 2.0
Number Sectors : 0x00000000009fe7ff
Total Clusters : 0x000000000013fcff
Free Clusters : 0x0000000000dc0b3
Total Reserved : 0x000000000000400
Bytes Per Sector : 512
Bytes Per Physical Sector : 512
Bytes Per Cluster : 4096
Bytes Per FileRecord Segment : 1024
Clusters Per FileRecord Segment : 0
```

Mft Valid Data Length : 0x0000000000040000
Mft Start Lcn : 0x0000000000040000
Mft2 Start Lcn : 0x0000000000000002
Mft Zone Start : 0x0000000000040040
Mft Zone End : 0x000000000004c840
Max Device Trim Extent Count : 4096
Max Device Trim Byte Count : 0xffffffff
Max Volume Trim Extent Count : 62
Max Volume Trim Byte Count : 0x40000000
Resource Manager Identifier : 5E5AB85D-6A6A-11E8-A950-00155D667911

How do I create a LifeKeeper SQL cluster with DataKeeper as storage?

LifeKeeper/SQL installation Cheat Sheet

After the SQL Server CD/DVD or ISO media has been installed:

Via the SQL Server Installation Center:

- Select New installation or add features to an existing installation
- Select all the defaults for the “Setup Support Files”
- For Setup Role select “SQL Server Feature Installation”
- On the Feature Selection screen, select the features of your choice
 - **Note:** Under “Shared feature Directory:” maintain the default installation path(s). During the LifeKeeper MS SQL Server installation, the database will be directed to the mirrored volumes
- Per the Instance Configuration select “Default instance”
- Verify Disk Space Requirement, then select Next

Server Configuration:

- In the dialogue box below, (bottom right) select “Use the same account for all SQL Server services”
- For the Account Name and Password, a domain administrator or an account with elevated domain permission should be entered
- Then select Next.



NOTE: These credentials are required to be the same on other servers running SQL/LifeKeeper.

Database Engine Configuration:

- Authentication Mode
 - Select Mixed Mode (SQL Server authentication and Windows authentication)
 - Specify the password for the SQL Server system administrator (sa) account

 **NOTE: These credentials are required to be the same on other servers running SQL/LifeKeeper.**

- Specify SQL Server administrators
 - Choose “Add Current User” which is a domain administrator or an account with elevated permission. SAME as from the Server Configuration portion earlier.
- Analysis Service Configuration
 - Choose “Add Current User” which is a domain administrator or an account with elevated permission. SAME as from the Server Configuration portion earlier.

Reporting Services Configuration:

- Install, but do not configure the report server

Error Reporting (Optional)

Ready to Install:

- Select Install

8.11.1.2. Most Common DKCE Clustering Solutions

The following are the most commonly requested clustering related solutions.

Perform a [Health Check](#)

[How do I add/register an existing DataKeeper Volume to a cluster?](#)

Why has my Role FAILED in WSFC (e.g. SQL, SAP, FileShare, Hyper-V, Generic App)?

- For licensing and rehosting information refer to [Licensing](#)

Example of a Basic WFSC Dependency Relationship of Hyper-V and DataKeeper

Hyper-V

Dependency Report for the following:

- 1×1
- Windows Server 2012
- DataKeeper x.x.x
- Hyper-V



Dependency Report

Cluster: SupportNodes
Role: Bentgrass2012
Started 11/13/2018 3:59:03 PM
Completed 11/13/2018 3:59:04 PM

'Bentgrass2012 DataKeeper Volume K' has no required dependencies.

'Virtual Machine Bentgrass2012' dependencies are 'Virtual Machine Configuration Bentgrass2012'.

'Virtual Machine Bentgrass2012' required dependencies are Virtual Machine Configuration.

'Virtual Machine Configuration Bentgrass2012' dependencies are 'Bentgrass2012 DataKeeper Volume K'.

'Virtual Machine Configuration Bentgrass2012' has no required dependencies.



represents 'AND' relationship: all child resources must be on-line



represents 'OR' relationship: at least one child resource must be on-line



```

graph LR
    VM[Virtual Machine Bentgrass2012] --> VMConfig[Virtual Machine Configuration Bentgrass2012]
    VMConfig --> DKVol[DataKeeper Volume Bentgrass2012 DataKeeper Volume K]
  
```

Bentgrass2012 DataKeeper Volume K has no required dependencies
 Virtual Machine Bentgrass2012 dependencies are Virtual Machine Configuration Bentgrass2012
 Virtual Machine Bentgrass2012 required dependencies are Virtual Machine Configuration
 Virtual Machine Configuration Bentgrass2012 dependencies are Bentgrass2012 DataKeeper Volume K
 Virtual Machine Configuration Bentgrass2012 has no required dependencies

SQL

Dependency Report for the following:

- 1x1
- Windows Sever 2012
- DataKeeper x.x.x
- SQL Server 2008 or higher

Microsoft

Dependency Report

Cluster:
Role: SQL Server (MSSQLSERVER)
Started 11/13/2018 10:20:31 AM
Completed 11/13/2018 10:20:33 AM

'DataKeeper Volume E' has no required dependencies.

'IP Address: 172.17.100.57' has no required dependencies.

'Name: SIOSSQL' dependencies are 'IP Address: 172.17.100.57'.

'SQL Network Name (SIOSSQL)' required dependencies are IP Address.

'SQL Server' dependencies are 'Name: SIOSSQL'.

'SQL Server' has no required dependencies.

'SQL Server Agent' dependencies are 'SQL Server'.

'SQL Server Agent' has no required dependencies.

 represents 'AND' relationship: all child resources must be on-line

 represents 'OR' relationship: at least one child resource must be on-line

```

    graph LR
      A["SQL Server Agent  
SQL Server Agent"] --> B["SQL Server  
SQL Server"]
      B --> C["Network Name  
Name: SIOSSQL"]
      C --> D["IP Address  
IP Address: 172.17.100.57"]
      E["DataKeeper Volume  
DataKeeper Volume E"]
  
```

DataKeeper Volume E has no required dependencies
 IP Address: 172.17.100.57 has no required dependencies
 Name: SIOSSQL dependencies are IP Address: 172.17.100.57
 SQL Network Name (SIOSSQL) required dependencies are IP Address
 SQL Server dependencies are Name: SIOSSQL
 SQL Server has no required dependencies
 SQL Server Agent dependencies are SQL Server
 SQL Server Agent has no required dependencies

File Share

Dependency Report for the following:

- 1x1
- Windows Server 2016
- DataKeeper x.x.x

 **Note:** An existing job in the DataKeeper GUI will most likely have a **RED X status**.

Solution:

- Remove all of the old mirror remnants from the Source and Target nodes
- Manually recreate the mirror via the `emcmd . createmirror` command

To remove the mirror configuration from both nodes:

- `cd %extmirrbase%/support` (This is a shortcut to the DataKeeper\Support directory)
- run “`cleanupmirror (drive letter)`”

 **Note:** Run this command on the Source first. This command performs the following:

- deletes the local mirror only (NO DATA)
- resets the switchover flag
- notifies the driver and service that no mirror is present

To verify that the mirror has been properly removed, execute the following:

- `cd extmirrbase` (This is a shortcut to the DataKeeper directory)
 - run “`emcmd . getmirrorvolinfo (drive letter)`”
- The output should reflect no mirror e.g. `0 servername 0`

Now you are in a position to manually recreate the mirror.

The syntax is as follows:

- `emcmd (Source IP) createmirror (drive letter) (Target IP) A or S (Async mirror/Sync Mirror)`

Upon completion, the DataKeeper UI will now reflect a Resyncing status. This can also be verified from a command line by executing:

- `emcmd . getmirrorvolinfo e`

The output will reflect “E: 1 servername (Target IP) 2, where 2 is a mirror definition, indicating a Resyncing status

Return to Windows Failover Clustering and online the Failed DataKeeper Resource.

8.11.1.3. Most Common Storage Solutions

The following are the most commonly requested storage related solutions.

Why don't I see my Target Drive when creating a mirror?

Target Volume Not Available During Mirror Creation

Issue:

A new volume on a Target node has just been formatted, assigned a letter and put online. On the Source node when creating the mirror, the newly assigned volume/drive letter is not posted in the drop down box.

Recommendation/Solution:

Go to Services and restart the "SIOS DataKeeper" Service

OR

From the command line type:

```
net stop "SIOS DataKeeper" Service, then  
net start "SIOS DataKeeper" Service
```

Recreate the mirror, starting on the Source node and now via your drop down box you should be able to select the newly created Target Volume.

Status = 33 When Creating a New Mirror

Issue:

When trying to create a new mirror via the DataKeeper GUI or from an *emcmd . createmirror* command you may receive a Status = 33 message.

Probable cause: a pagefile may be located on the Target volume. **Pagefiles are prohibited on DataKeeper volumes.**

Solution:

Relocate the pagefile

Ways to relocate the pagefile:

Disk Management applet

Because the pagefile is a hidden system file, you will need to modify the folder attributes so that you can see this file. Go to Control Panel\Appearance\Folder Options, the View Tab, select “Show hidden files, folders, and drives”. Now the Volume will show pagefile.sys.

If the file needs to be relocated, go to Control Panel\System and Security\System, Performance, Settings, Advanced, Virtual Memory/Change, deselect “Automatically manage paging file size for all drives”. Select the drive for the new pagefile location, Customize size, then press Set. **Note:** This may require a reboot.

In the DataKeeper Action Panel, why are Switchover, Delete Job and other functions not available?

- [Creating a DataKeeper Volume Resource in WSFC](#)

How to Remove DataKeeper Storage from a Windows Server Failover Cluster Role

Scenario:

Remove an existing DataKeeper Resource/Mirror from Windows Server Failover Clustering:

- Without impacting the existing role in WSFC, i.e. File Shares, SAP, Oracle, SQL
- Without having to run various emcmd commands (e.g. *deletelocalmirroronly*, *cleanupmirror*)



Note: In the DataKeeper UI, the Action Panel shows “Switchover Mirrors”, “Delete Job” and “Delete Mirror” are grayed out.

Reason: When a DataKeeper mirror is or becomes a part of a cluster/WSFC, all administration takes place at the WSFC level.

Steps to Remove:

In Failover Cluster Manager:

- From the Roles panel, select Storage and the related DataKeeper Volume
 - Right click and select “Remove from the role you’ve created” “ and say Yes
- From WFSC select Storage\Disk
 - The DataKeeper Volume is now listed as/Assigned To, Available Storage
 - Select Remove and and select Yes

The DataKeeper Storage is no longer a resource in the cluster/WSFC.

Now that the aforementioned tasks have been completed in the DataKeeper UI, in the Action Panel:

- Select “Delete Job”

- You will be prompted, “Are you sure you want to delete the ‘Volume (drive)’ and its mirror? Select Yes
- If you have multiple mirrors/Target, select “Delete Mirror”, thus its job will be deleted also

[How do I remove my mirror/volume from an existing cluster?](#)

How can I expand (resize) my disks?

- [DataKeeper Volume Resize](#)

Volume List in Disk Management Not Reporting the Correct Size after Extending

Issue:

I have resized but Disk Management is not reporting the correct size.

The following steps extend a mirrored volume:

- Pause and Unlocked the mirror
- Via Disk Manager, extend the volume for the Source and Target
- Continue and Lock All Mirrors

At that time in Disk Management, the OS was NOT reporting the Extended Size.

Solution:

Via *DISKPART*, the volume needs to be selected, then the volume needs to be extended.

```

C:\Windows\system32\diskpart.exe
Current Read-only State : No
Read-only : No
Boot Disk : No
Pagefile Disk : No
Hibernation File Disk : No
Crashdump Disk : No
Clustered Disk : No

  Volume ###  Ltr  Label      Fs          Type        Size        Status       Info
  -----
  Volume 3     D    System DB  NTFS        Partition   9 GB        Healthy

DISKPART> filesystems
There is no volume selected.
Please select a volume and try again.
DISKPART> select volume=D
Volume 3 is the selected volume.
DISKPART> filesystems
Current File System
Type           : NTFS
Allocation Unit Size : 4096
Flags : 00000000

File Systems Supported for Formatting
Type           : NTFS (Default)
Allocation Unit Sizes: 512, 1024, 2048, 4096 (Default), 8192, 16K, 32K, 64K
Type           : FAT32
Allocation Unit Sizes: 4096, 8192 (Default), 16K, 32K, 64K
Type           : REFS
Allocation Unit Sizes: 64K (Default)

DISKPART> extend
DiskPart successfully extended the volume.
DISKPART> select volume=e
Volume 4 is the selected volume.
DISKPART> extend
DiskPart successfully extended the volume.
DISKPART> select volume=f
Volume 5 is the selected volume.
DISKPART> extend
DiskPart successfully extended the volume.
DISKPART> select volume=i
Volume 8 is the selected volume.
DISKPART> extend
DiskPart successfully extended the volume.
DISKPART> _

```

Upon completion, Disk Management will reflect the correct values.

Also, if you extend the volume using *DISKPART*, you will need to extend the file system in *DISKPART* (Disk Management will extend the volume and the file system but *DISKPART* only extends the volume).

Here is the command in *DISKPART* to extend the file system after extending the volume in *DISKPART*:

```
select file system=D
```

```
extend filesystem
```

If needed run:

```
emcmd . updatevolumeinfo <volume letter>
```

This command will ensure that DataKeeper will see the updated size of the volume.

Troubleshooting Resizing Issues

I have properly resized my Source and/or Targets (properly performed the resizing e.g. AWS, Azure, VMware, Hyper-V and other host/bare metal platforms). However in Disk Management, those changes are not readily reflected as these are known issues per Microsoft.

To ensure that the Source and Target are the same size or the Target is larger, perform the following:

Use the `emcmd . getvolumeinfo` command:

```
C:\Program Files (x86)\SIOS\DataKeeper>emcmd Sourceservername getvolumeinfo e 1
```

```
----- LEVEL 1 INFO -----
Volume Root = E:
Last Modified = Sun Jan 10 23:21:40 2021
Mirror Role = SOURCE
Label = SQL Data
FileSystem = NTFS
Total Space = 4291817472
Num Targets = 1
Attributes : 0h
```

I rem out/filter the other Volume attributes therefore for the Source only reflects:

```
C:\Program Files (x86)\SIOS\DataKeeper>emcmd Sourceservername getvolumeinfo e 1 |findstr Total
Total Space = 4291817472
```

Filter for the Target:

```
C:\Program Files (x86)\SIOS\DataKeeper>emcmd Targetservername getvolumeinfo e 1 |findstr Total
Total Space = 4291817472
```

The aforementioned gives you a view of the Total Space/Total Capacity.

If the Target is Locked, Access is Denied or Not Available then your output will reflect:

```
Total Space = N/A
```

Note: This is still under investigation, we have experienced Total Space will sometimes yield a Total Space value when locked.

- As an alternative method, while at your elevated Administrator command prompt, consider executing the following:

emcmd . updatevolumeinfo (drive letter)

This command causes the SIOS DataKeeper service to query the driver for the correct mirror state. This command is useful if the DataKeeper GUI displays information that appears to be incorrect or not up-to-date. It is also useful with updating the Disk Management UI.

- A third method is to review the Total Capacity of the Source/Target in Disk Management:
 - Select the drive, choose Properties and view Capacity. Capacity equals Total Capacity as also reflected in the *emcmd . getvolumeinfo* output.

If any of the aforementioned steps are NOT yielding the proper sizes after resizing, please perform any of the following:

- In Disk Management, Offline the Disk in question (e.g. Disk 1, Disk 2), then Online. This action will update the partition tables to reflect the correct sizes. If performing this on the Source, you may want to inform users first, as they won't be able to access a(n) Offline Disk. There are no problems with these actions on a Targeted Volume.
- Rebooting the Target is also a welcomed measure for refreshing the disks and related size changes.
- Use *DISKPART* to ensure the resize changes get accurately propagated:

From an elevated Administrator command prompt:

type **DISKPART**

DISKPART> **list volume**

DISKPART> **select volume #** (where # is the number of the affected volume which can be found with list volume)

DISKPART> **extend filesystem**

Now the file system size should match the new partition size.

Type **Exit** to leave *DISKPART* and return to your command prompt

Upon completion, from the DataKeeper UI, select **Continue and Lock All Mirrors**

Raw Volume

Issue:

- Able to create a mirror
- Once created and the *emcmd . unlockvolume* command is executed, the Targeted volume enters into a RAW state per Disk Management

Solution:

- Verify that the Bytes Per Physical Sector are identical on both the Source and Targeted volumes.

Below is example of the output generated for Volume E, from the *fsutil fsinfo ntfsinfo {drive letter}* command:

```
C:\Windows\System32>fsutil fsinfo ntfsinfo e:
NTFS Volume Serial Number : 0x26ace2a1ace26aaf
NTFS Version : 3.1
LFS Version : 2.0
Number Sectors : 0x00000000009fe7ff
Total Clusters : 0x000000000013fcff
Free Clusters : 0x0000000000dc0b3
Total Reserved : 0x000000000000400
Bytes Per Sector : 512
Bytes Per Physical Sector : 512
Bytes Per Cluster : 4096
Bytes Per FileRecord Segment : 1024
Clusters Per FileRecord Segment : 0
Mft Valid Data Length : 0x000000000040000
Mft Start Lcn : 0x000000000040000
Mft2 Start Lcn : 0x0000000000000002
Mft Zone Start : 0x000000000040040
Mft Zone End : 0x00000000004c840
Max Device Trim Extent Count : 4096
Max Device Trim Byte Count : 0xffffffff
Max Volume Trim Extent Count : 62
Max Volume Trim Byte Count : 0x40000000
Resource Manager Identifier : 5E5AB85D-6A6A-11E8-A950-00155D667911
```

How can I change my partition type from MBR to GPT?

Note: MBR has a 2 TB limitation

How to transition existing MBR volumes to GPT

The steps to take in achieving this are as follows for a 1×1 configuration. The volumes in the example will be E and F:

- In Server A, create 2 new mirrors. One from volume E to one of the new volumes (e.g. volume X), and another from volume F to the other new volume (e.g. volume Y).
- See [Disk-to-Disk](#) replication

Once both mirrors have fully synced, proceed to delete the mirrors as volumes that are used for Disk-to-Disk replication can't also be configured to replicate to another system.

To delete the mirrors:

1. Select the job that contains the mirror you want to delete
2. Right-click on the mirror and choose "Delete Mirror" or select "Delete Mirror" from the Actions task

pane

3. Select Yes to delete the mirror
4. The mirror will be deleted and removed from the associated job

 **Note:** If the Delete Mirror option is grayed out (not available), this could mean the volume is under clustering protection (Microsoft clustering or SIOS Protection Suite clustering).

- Once the mirrors have been deleted, create another 2 new mirrors, this time from Server A to Server B
- Ensure that the new volumes on B share the same letters as those on A (e.g. volume X and Y), as well as other considerations from the documentation:

See [Creating a Mirror](#)

OR

Transition existing mirrors using MBR volumes to GPT volumes in a 1×1×1 configuration:

- In DataKeeper for Volume E “Pause and Unlock All Mirrors”
- On the Targets, Server B and Server C, in Disk Management, Delete Volume . . .
- On the Targets, Server B and Server C, in Disk Management, create the partitions as GPT

 **NOTE:** Before you Continue and Lock All Mirrors in DataKeeper, verify the size(s) of the Source and Target are of equal size or the **Target is larger than the Source**.

- Once the sizes has been verified, select “Continue and Lock All Mirrors”
- The mirror will enter into a Resyncing state in the DataKeeper UI

Once the mirrors have completed their FULL resync on Server B & Server C, in Failover Clustering perform a move of your Role/Resource.

Now Server B or Server C becomes a Source and you can use the aforementioned steps to change Volume E on Server A from MBR to GPT.

Does DataKeeper Support GPT (GUID Partition Table) Partitions?

Yes, DataKeeper supports GPT (GUID Partition Table) partitions.

Mirroring can be accomplished via the following partitioning schemes:

- MBR to GPT
- GPT to GPT

 **NOTE:** The aforementioned schemes are based on newly created partitions. Converting either MBR or GPT requires the partition to be deleted.

8.11.1.4. Most Common Networking Solutions

The following are the most commonly requested networking related solutions.

SIOS DataKeeper Service Will Not Start

DataKeeper Service Stopped Unexpectedly

Issues/Symptoms:

The DataKeeper Service periodically stops. The System Event Viewer will produce the following:

Log Name: System

Source: Microsoft-Windows-Resource-Exhaustion-Detector

Date:

Event ID: 2004

Task Category: Resource Exhaustion Diagnosis Events

Level: Warning

Keywords: Events related to exhaustion of system commit limit (virtual memory).

User: SYSTEM

Computer:

Description:

Windows successfully diagnosed a low virtual memory condition. The following programs consumed the most virtual memory: disp+work.exe (12276) consumed 4458348544 bytes, disp+work.exe (10580) consumed 3786977280 bytes, and disp+work.exe (6068) consumed 1657556992 bytes.

Solution:

ExtMirrSvc logs that it stopped because it couldn't spawn a GUI thread. This is probably due to all the memory being used up by disp+work.exe processes.

Errors from “extmirrsvc” service when establishing mirror

Issue:

When trying to configure SIOS DataKeeper Cluster Edition, it is not able to identify the server name or IP addresses even though the servers are reachable via PING, NetBIOS and Telnet.

Solution:

Ensure that the account used to start the SIOS DataKeeper Service is a member of the local Administrators Group on both nodes.

Also if you're using a Host file for name resolution, ensure the hostname and ipaddress for both nodes

are populated in the hostfile. Once added, restart the SIOS DataKeeper Service via the Services Applet.

Server Overview in DataKeeper Not Showing Servers

DataKeeper Server Overview Showing Remote System (not remote drives)

Issue:

DataKeeper Server Overview showing remote system, but not remote drives

Solution:

Ensure that if you're using a hostfile, the following must be present on both nodes:

- The Full Qualified Domain Name/FQDN is being used
- All host entries are identical on both nodes

Volume Missing in Server Overview when Attempting to Create a Mirror

Issue:

When attempting to create a mirror via the DataKeeper GUI you may notice the following:

- Target Volume is present in Server Overview but after attempting to create, the Volume disappears
- When attempting to manually create the mirror using *EMCmd <system> CREATEMIRROR <volume letter> <target system> <Type>*. You may receive an error message "Status = 317"

 **Note:** The Graphical View of the volumes in Disk Management are showing the Source and Target volumes are of equal size.

Solution:

It was determined that the Target volume disk was smaller than the Source.

Rules for mirror creation are as follows:

- Source & Target must be equal in size or Target must be larger than the Source

This can be verified by viewing the Total Capacity of the volume (select Properties) via Disk Management or by using the following emcmd command:

EMCmd <system> GETVOLUMEINFO <volume letter> <level>, This output, Total Space in particular, needs to meet the criteria for mirror creation. Once resolved by increasing/shrinking the volumes, you should be able to successfully create a mirror.

[How do I move my existing mirror to a different network without having to perform a FULL Resync?](#)

Cluster Performance is Slow After Installing DataKeeper

- [High-Speed Storage Best Practices](#)
- [Using AWS Instance Storage \(ephemeral storage/disk\) Properly](#)

8.11.2. Known Issues and Workarounds

Included below are known issues open against DataKeeper and DataKeeper Cluster Edition as well as possible workarounds and/or solutions.

[Access to Designated Volume Denied](#)

[Antivirus Software Exclusion List](#)

[DataKeeper Cannot be used as a Quorum Device for a Cluster](#)

[DataKeeper Volume cannot come Online after Network failure with clustered IP Address on Replication network](#)

[DataKeeper Volume Not Available as Cluster Resource Type](#)

[Failed to Create Mirror](#)

[Hyper-V Host Cluster Error](#)

[Live Migration Failure](#)

[MaxResyncPasses Value](#)

[Mirroring with Dynamic Disks](#)

[New Resources Offline But Unlocked](#)

[Server Login Accounts and Passwords Must Be Same on Each Server in the Cluster](#)

[System Event Log – Create Mirror Failed in the GUI](#)

[Unable to Determine Previous Install Path](#)

[User Interface – Failed to Create Mirror](#)

[User Interface – Shows Only One Side of the Mirror](#)

[WSFC – MS DTC Resource Failure](#)

[WSFC File Server Type Not Supported](#)

[WSFC 2008 R2 SP1 Procedure Change](#)

[Windows Server 2012 Specific Issues](#)

[Windows Server 2012 MMC Snap-in Crash](#)

[Windows Server 2012 — Simultaneous Move of Multiple Clustered File Server Roles Can Result in DataKeeper Switchover Failures](#)

[Windows Server 2012 iSCSI Target Role Does Not Support Dynamic Disks](#)

[Windows Server 2012 Default Information Missing During Mirror Creation](#)

[Windows Server 2012 NIC Teaming Issue](#)

[WSFC 2012 Cluster Creation Default Setting Issue](#)

[WSFC 2012 Failover Cluster Manager UI Defect](#)

[WSFC 2012 File Server Resource Manager Event Log Errors](#)

[WSFC 2012 File Shares Cannot be Created for File Server Role Using Server Manager or Failover Cluster Manager](#)

[WSFC 2012 Server Manager — Incorrect Volume Display](#)

[WSFC 2012 Server Manager — DataKeeper “Disk” Not Shown as Clustered](#)

[Windows 2012 File Share](#)

[Windows Server 2016 Specific Issues](#)

[Occasional Job Creation Failure](#)

[WSFC 2016 File Shares Cannot be Created for File Server Role Using Server Manager or Failover Cluster Manager](#)

8.11.2.1. Access to Designated Volume Denied

If access to the designated volume is denied, then check whether you are attempting to create the mirror while other applications are accessing the volume. During Mirror Creation, the volumes must be locked on the target system for exclusive access by the SIOS DataKeeper software.

In particular, the Distributed Tracking Client service, which is set to run by default in Windows, keeps two file handles open for each volume. If the volume houses a SIOS DataKeeper target, the SIOS DataKeeper driver cannot lock the volume. You must therefore stop the Distributed Tracking Client service and set its startup policy to Manual.

8.11.2.2. Antivirus Software Exclusion List for LifeKeeper and DataKeeper for Windows

Description

Antivirus software stops LifeKeeper from updating a LifeKeeper registry key.

Antivirus software also quarantines LifeKeeper and DataKeeper executables causing LifeKeeper and DataKeeper not to run properly.

Suggested Action

List of things to exclude in the antivirus software for LifeKeeper and DataKeeper:

- For SPS C:\LK* directory (or whatever folder LifeKeeper is installed in).
- For DataKeeper C:\Program Files (x86)\SIOS\DataKeeper\ directory (or whatever folder DataKeeper is installed in).
- The bitmap file location (by default on the c: drive but it may be relocated – C:\Program Files (x86)\SIOS\DataKeeper\Bitmaps).

These locations include all of the executables and sometimes the antivirus software can quarantine them, thus rendering LifeKeeper or DataKeeper inoperable.

Refer to [Registry Entries](#) for the list of registry keys that LifeKeeper and DataKeeper use.

AND

The UpperFilters registry key is located at:

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Class\{71A27CDD-812A-11D0-BEC7-08002BE2092F}
```

8.11.2.3. DataKeeper Cannot be used as a Quorum Device for a Cluster

Question

Can a DataKeeper drive be used for a quorum disk?

Answer

No, a DataKeeper drive cannot be used for a quorum disk.

The quorum type is set to **Node Majority** if the number of nodes is odd (**ex:** 3-node cluster).

The quorum type is set to **Node and File Share Witness Majority** if the final number of nodes is even (**ex:** 2-node cluster or 4-node cluster).

8.11.2.4. DataKeeper Volume cannot come Online after Network failure with clustered IP Address on Replication network

If you have multiple cluster networks, IP Addresses shouldn't be set up on the same network that DataKeeper Volume resources are using for replication. Network errors may cause the DataKeeper mirror to go into a Paused state. If the network error also causes the cluster IP Address resource to fail its health checks, any resource hierarchy that contains both a DataKeeper Volume resource and the cluster IP Address will not be brought Online on remote nodes due to the DataKeeper Volume mirror state being in a non-Mirroring state.

8.11.2.5. DataKeeper Volume Not Available as Cluster Resource Type

WSFC Server – The DataKeeper Volume is Not Available as a Cluster Resource Type After DataKeeper is Installed in a Microsoft WSFC Environment

Error/Message

The DataKeeper Volume is not available as a cluster resource type after DataKeeper is installed in a Microsoft WSFC environment.

The Event Log will include the following message: **“Failed to register the ‘DataKeeper Volume’ Resource DLL (DataKeeperVolume.dll). Error: 70”**

Description

Resource DLL registration requires that all cluster nodes are up and online. In the case where one node of an existing cluster is currently unavailable (offline, cluster service stopped, etc.), automatic DataKeeper Resource DLL registration may fail during installation/update.

Suggested Action

The problem is normally corrected automatically when the other cluster node goes online. As soon as the DataKeeper service is started there, Resource DLL registration will be attempted from that node and registration will occur cluster-wide. In the event that automatic Resource DLL registration does not occur, restart the DataKeeper service on any node after all cluster nodes are up and online. The registration process begins 60 seconds after the DataKeeper service starts.

8.11.2.6. Failed to Create Mirror

User Interface – Failed to Create Mirror – Application Event Log

Error/Message

Logged in the **Application Event Log**:

File: .\GuiThread.cpp Line: 3099 Attempt to connect to remote system REMOTESERVER failed with error 5. Please ensure that the local security policy for “**Network Access: Let Everyone permissions apply to anonymous users**” is enabled on all the servers running DataKeeper.

Check: Local security policy setting on the specified system.

Description

Failed to create the mirror. Mirror is created but not stored in the job.

Suggested Action

Make local security policy change, open command prompt and run “%EXTMIRRBASE %\emcmd.deletemirror <volume>”, then perform the mirror creation action again.

8.11.2.7. Hyper-V Host Cluster Error

Failover Cluster Error After Changing Virtual Machine Configuration While VM Is Clustered

Description

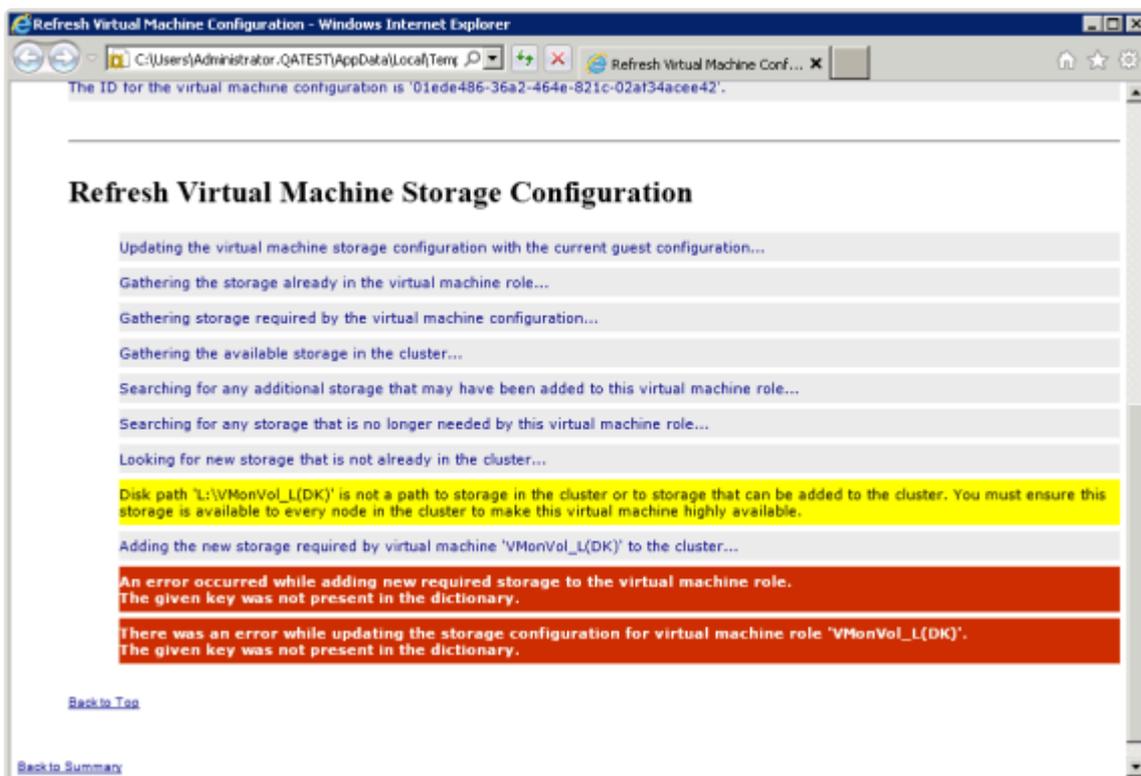
If Failover Cluster Manager is used to modify the VM configuration while the VM is clustered such as adding a Network Interface to the VM, “**Refresh Virtual Machine Storage Configuration**” errors may be generated and the VM will fail Quick Migration and/or Live Migration to another cluster node.

This problem occurs only when the following criteria are met:

1. The VM is in the cluster
2. Failover Cluster Manager is used to change the VM network configuration
3. Storage other than Cluster Shared Disk is used for VM storage, such as DataKeeper Volume replicated storage

All three criteria must be met for this error to occur. This error does not occur if Hyper-V Manager is used to change VM network configurations when the VM is out of the cluster.

Here is what to look for:



Suggested Action

Contact Microsoft for information on a solution.

To make Virtual Machine network adapter changes without installing the Microsoft Hotfix, perform the following:

1. Take the VM out of the cluster
2. Verify that Virtual Network Names for NIC connections are identical on all cluster nodes
3. Use Hyper-V Manager to make virtual machine network configuration changes
4. Return the VM to the cluster and bring the DataKeeper Volume resource into the VM resource hierarchy
5. Re-create the Virtual Machine Configuration resource to DataKeeper Volume resource dependency (shown in yellow below)



8.11.2.8. Live Migration Failure

Live Migration Fails if Virtual Network Names Differ

Description

When attempting to perform a live migration of a virtual machine(s) to another node in **Failover Cluster Manager**, if **Virtual Network Names** for NIC connections are not identical on all cluster nodes, the migration issues a “failed” status.

Suggested Action

Make sure that **Virtual Network Names** for NIC connections are identical on all cluster nodes.

8.11.2.9. MaxResyncPasses Value

If, during a volume resynchronization, the number of passes made through the intent log exceeds the **MaxResyncPasses** registry value (200 by default), SIOS DataKeeper logs a message to the **Event Log** indicating that the resync process is taking too many passes and requests that the administrator stop whatever process is writing to the drive being resynchronized. The mirror then goes to the **Paused** state. You can increase the **MaxResyncPasses** value from the registry to give the resync process more time.

8.11.2.10. Mirroring with Dynamic Disks

When changing from a **Basic Disk** to a **Dynamic Disk**, the underlying volume GUID may be changed by the OS upon reboot. This will cause a DataKeeper mirror to break.

Suggested Action

When mirroring with dynamic disks, your **dynamic** volumes should be created and a reboot should be performed PRIOR to creating your mirror. If the mirror has already been created, it must be deleted prior to creating your dynamic volumes.

8.11.2.11. New Resources Offline But Unlocked

WSFC Server – Newly Created Resources Appear Offline But Are Unlocked

Error/Message

Newly created resources appear offline but are unlocked.

Description

The new resource is always offline and unlocked before it is used.

Suggested Action

Switch the resource to online.

8.11.2.12. Server Login Accounts and Passwords Must Be Same on Each Server in the Cluster

The DataKeeper GUI cannot connect to the target server in a cluster if server **Login Accounts** and **Passwords** are different on each server.

Error Message

An Error Code 1326 will appear in the Application log (**Note:** The Error Code may also be a 2 with Event ID 0):

```
SteelEye.Dialogs.AddServerWindow: Failed to connect to server:
172.17.105.112 System.ApplicationException: Failed to open a connection
to 172.17.105.112 (error_code = 1326) at
SteelEye.DAO.Impl.DataReplication.ClientLibrarySDRService.ThrowIfNonZero(UInt32
errorCode, String message) at
SteelEye.DAO.Impl.DataReplication.ClientLibrarySDRService.GetServiceInfo(String
serverName) at
SteelEye.DAO.Impl.DataReplication.CachingSDRService.<>c__DisplayClass2.b__0()
at SteelEye.DAO.Impl.DataReplication.Cacher`1.fetch(String typekey,
String datakey, Fetcher fetcher) at
SteelEye.DAO.Impl.DataReplication.CachingSDRService.GetServiceInfo(String
serverName) at
SteelEye.DataKeeper.SDR.SDRDataKeeperService.ConnectToServer(String
serverName) at
SteelEye.Dialogs.AddServerWindow.<>c__DisplayClass4.b__0(Object s,
DoWorkEventArgs e) at
System.ComponentModel.BackgroundWorker.WorkerThreadStart(Object argument)
```

```
net helpmsg 1326 shows:
```

```
Logon failure: unknown user name or bad password
```

Description/Cause

The Service Account User Names and Passwords being used to start DataKeeper are the same on both servers and the firewalls are disabled on the servers; however, the Passwords used to log in to the servers themselves are different.

Suggested Action

The DataKeeper GUI uses the server Login ID and Password; therefore, the User Name and Password

used to log in to the servers themselves must be the same on each server and must have administrator privileges.

8.11.2.13. System Event Log – Create Mirror Failed in the GUI

Error/Message

Create Mirror Failed in the GUI.

Description

This can result if a vmms.exe program is holding on to volume and preventing SIOS DataKeeper from locking it.

8.11.2.14. Unable to Determine Previous Install Path

Installation – Fatal Error: Unable to Determine Previous Install Path

Error/Message

Fatal Error: Unable to determine previous install path. DataKeeper cannot be uninstalled or reinstalled.

Description

When performing a “**Repair**” or “**Uninstall**” of DataKeeper, the “**ExtMirrBase**” value is missing in the installation path of DataKeeper in the registry under **HKLM\System\CurrentControlSet\Control\Session Manager\Environment**.

Suggested Action

Perform one of the following:

- Under the **Environment** key, create “**ExtMirrBase**” as a REG_SZ and set the value to the DataKeeper installation path (i.e. **C:\Program Files(x86)\SIOS\DataKeeper**).
- To force InstallShield to perform a new install of DataKeeper, delete the following registry key:

```
HKLM\Software\Wow6432Node\Microsoft\Windows\CurrentVersion\
Uninstall\
{B00365F8-E4E0-11D5-8323-0050DA240D61}.
```

This should be the installation key created by InstallShield for the DataKeeper product.

8.11.2.15. User Interface – Failed to Create Mirror

User Interface – Failed to Create Mirror, Event ID 137

Error/Message

Failed to create the mirror.

Event Id: 137

System Event Log

Unable to initialize mirror on the target machine.

Volume Device:

Source Volume: E

Target Machine: 10.17.103.135

Target Volume: E

Failed operation: Target reports error

Error Code: 0xC0000055

Description

DataKeeper cannot lock the Target volume during mirror creation.

Suggested Action

1. Verify the Distributed Link Tracking Client service is not running on either system.
2. Stop any other processes that may prevent DataKeeper from locking the Target volume (e.g. anti-virus software).
3. Recreate the mirror.

8.11.2.16. User Interface – Shows Only One Side of the Mirror

If the SIOS DataKeeper UI shows a volume as a source and its corresponding target as available or a volume as a target with the corresponding source volume as available, you can use the command line utility to force an update to the SIOS DataKeeper GUI or delete the orphaned side of the mirror. From a command prompt, go to the SIOS DataKeeper directory on the server which is displaying unexpected mirror status and perform the following steps:

1. Make sure that the mirror is not in a **Paused** or **Broken** state on the source. If so, continue the mirror on the source. This should result in the mirror being re-established to the target.
2. Run EMCMD <system name> UpdateVolumeInfo <volume letter>

Where

<system name> is the name of the system;

<volume letter> is the letter of the volume.

3. If the problem is not resolved in Step 1, then stop and restart the SIOS DataKeeper service.

8.11.2.17. WSFC – MS DTC Resource Failure

Error/Message

The cluster resource host subsystem (RHS) stopped unexpectedly. An attempt will be made to restart it. This is usually due to a problem in a resource DLL. Please determine which resource DLL is causing the issue and report the problem to the resource vendor.

Description

In Windows Failover Clustering, an MS DTC Resource fails to come online if configured with a DataKeeper volume resource.

Log Name: System

Source: Microsoft-Windows-FailoverClustering

Date: <Date Time>

Event ID: 1146

Task Category: Resource Control Manager

Suggested Action

Install Service Pack 1 for Windows 2008 R2 or download and install the Microsoft Hotfix described in the following KB article: <http://support.microsoft.com/kb/978476>. This will allow the MS DTC resource to operate properly with a DataKeeper volume resource.

8.11.2.18. WSFC 2008 R2 SP1 Procedure Change

Description

When using WSFC 2008 R2 SP1, the procedure for Extending a Traditional 1×1 2-Node WSFC Cluster to a Shared-Replicated 3-Node Cluster has changed. The WSFC mmc GUI must not be used for adding a node that is hosting a DataKeeper shared volume.

Suggested Action

When using WSFC 2008 R2 SP1, additional nodes with shared DataKeeper volumes can be safely added to an existing cluster only with the WSFC Command line tool "cluster /add /node:

8.11.2.19. Windows Server 2012 Specific Issues

For issues related to **Windows Server 2012**, see the following topics:

[Windows Server 2012 MMC Snap-in Crash](#)

[Windows Server 2012 DataKeeper Switchover Failures](#)

[Windows Server 2012 iSCSI Target Role Does Not Support Dynamic Disks](#)

[Windows Server 2012 Default Information Missing During Mirror Creation](#)

[Windows Server 2012 NIC Teaming Issue](#)

[WSFC 2012 Cluster Creation Default Setting Issue](#)

[WSFC 2012 Failover Cluster Manager UI Defect](#)

[WSFC 2012 File Server Resource Manager Event Log Errors](#)

[WSFC 2012 File Shares Cannot be Created for File Server Resource](#)

[WSFC 2012 New File Server Type Not Supported](#)

[WSFC 2012 Server Manager — Incorrect Volume Display](#)

[WSFC 2012 Server Manager — DataKeeper “Disk” Not Shown as Clustered](#)

[WSFC 2012 File Share](#)

8.11.2.19.1. Windows Server 2012 MMC Snap-in Crash

Description

When using the DataKeeper user interface (MMC Snap-in) on Windows Server 2012, the mmc.exe process may crash unexpectedly due to an internal .Net or Windows Presentation Foundation (WPF) issue. The error may show up on the screen and/or the event viewer.

Suggested Action

This crash does not affect the server(s) to which the snap-in was connected or any DataKeeper mirrors established at the time of the crash. The MMC Snap-in may be safely relaunched. Simply close the UI and restart it.

The following are examples of **Application Event Log messages** that may be logged during this failure.

Log Name: Application
Source: Desktop Window Manager
Date: 11/28/2012 8:34:00 AM
Event ID: 9009
Task Category: None
Level: Information
Keywords: Classic
User: N/A
Computer: CAE-QA-V96.QAGROUP.COM
Description:
The Desktop Window Manager has exited with code (0xd00002fe)

Log Name: Application
Source: .NET Runtime
Date: 11/28/2012 8:34:00 AM
Event ID: 1026
Task Category: None
Level: Error
Keywords: Classic
User: N/A
Computer: CAE-QA-V96.QAGROUP.COM
Description:
Application: mmc.exe

Framework Version: v4.0.30319

Description: The process was terminated due to an unhandled exception.

Log Name: Application

Source: Application Error

Date: 11/28/2012 8:34:00 AM

Event ID: 1000

Task Category: (100)

Level: Error

Keywords: Classic

User: N/A

Computer: CAE-QA-V96.QAGROUP.COM

Description:

Faulting application name: mmc.exe, version: 6.2.9200.16384, time stamp:
0x50109efd

Faulting module name: KERNELBASE.dll, version: 6.2.9200.16384, time stamp:
0x5010ab2d

Exception code: 0xe0434352

Fault offset: 0x000000000000189cc

Faulting process id: 0xdc4

Faulting application start time: 0x01cdccd27c68a1c6

Faulting application path: C:\Windows\system32\mmc.exe

Faulting module path: C:\Windows\system32\KERNELBASE.dll

Report Id: 443c3ed3-3960-11e2-9400-0050569b131b

Faulting package full name:

Faulting package-relative application ID:

8.11.2.19.2. Windows Server 2012 -- Simultaneous Move of Multiple Clustered File Server Roles Can Result in DataKeeper Switchover Failures

Description

If more than one File Server role is created in Failover Clustering, each of which is using one or more DataKeeper Volume resources for storage, errors can occur if two or more roles are manually moved from one node to another simultaneously. In some cases, one or more DataKeeper Volume resources can fail to come online.

It is also possible that an error message is logged but the switchover works successfully; in that case, the message logged will be Event ID 196:

```
Attempt to connect to remote system failed with error 64. Please ensure that the local security policy for "Network Access: Let Everyone permissions apply to anonymous users" is enabled on all the servers running DataKeeper.
```

In this case, this event message can be ignored.

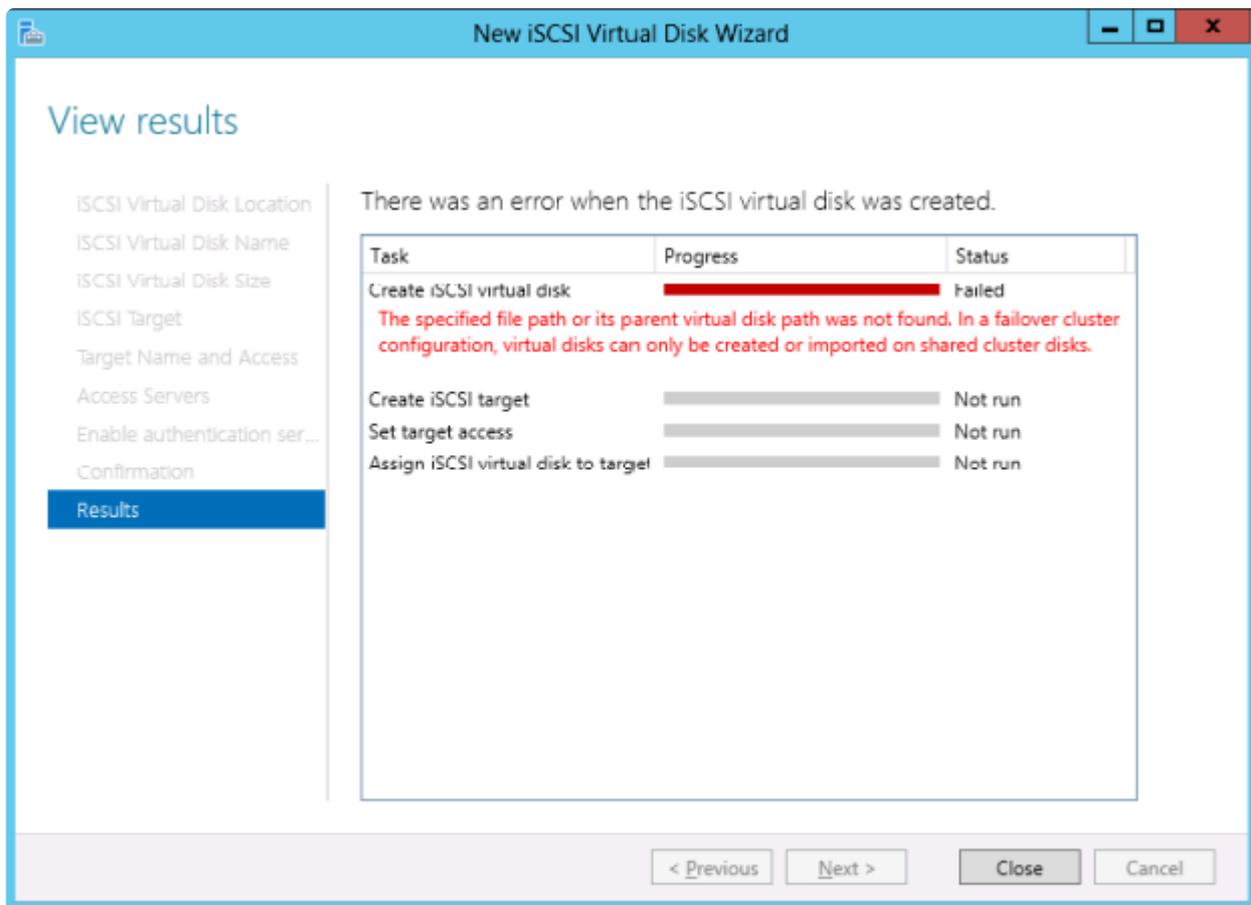
Suggested Action

If more than one File Server needs to be manually moved to another node, each one should be moved independently. Make sure that the File Server has completely come online before attempting to move any other File Servers.

8.11.2.19.3. Windows Server 2012 iSCSI Target Role Does Not Support Dynamic Disks

Description

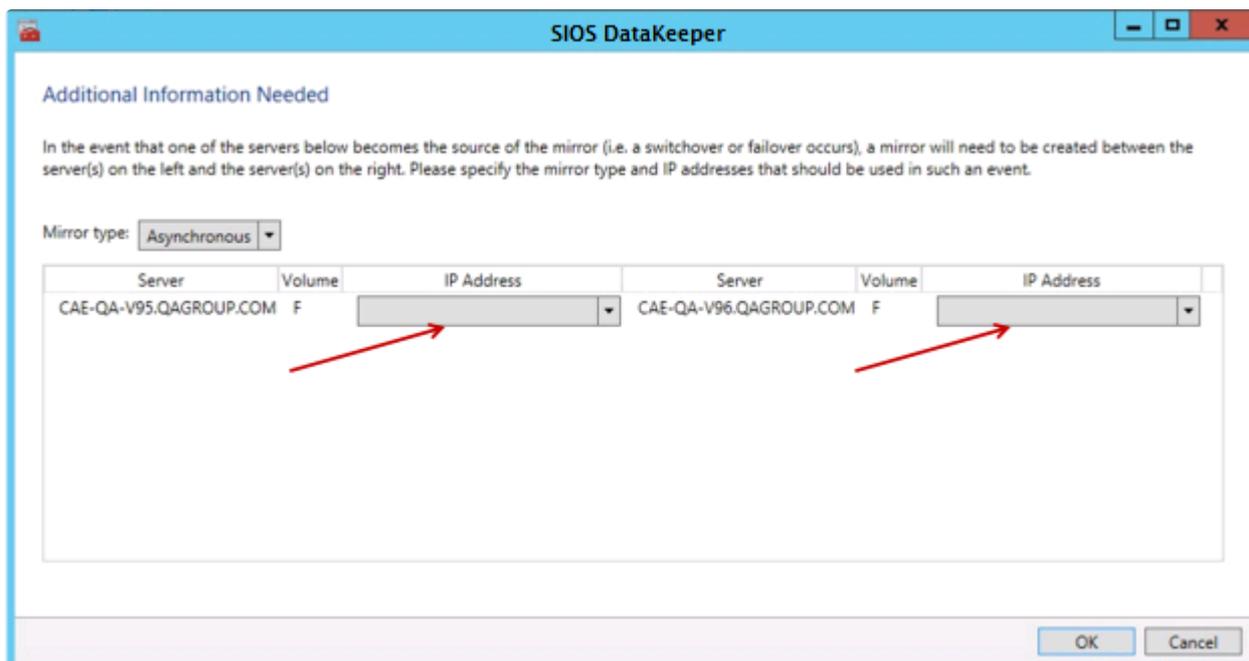
The iSCSI Target Role only supports DataKeeper Volumes that are mirrors of **Simple Volumes** placed on **Basic Disks**. If any of your mirrors are using volumes such as Striped or Spanned volumes on a Dynamic Disk on either the source or target system, then you cannot create an iSCSI Target role that uses those DataKeeper Volume resources for storage.



8.11.2.19.4. Windows Server 2012 Default Information Missing During Mirror Creation

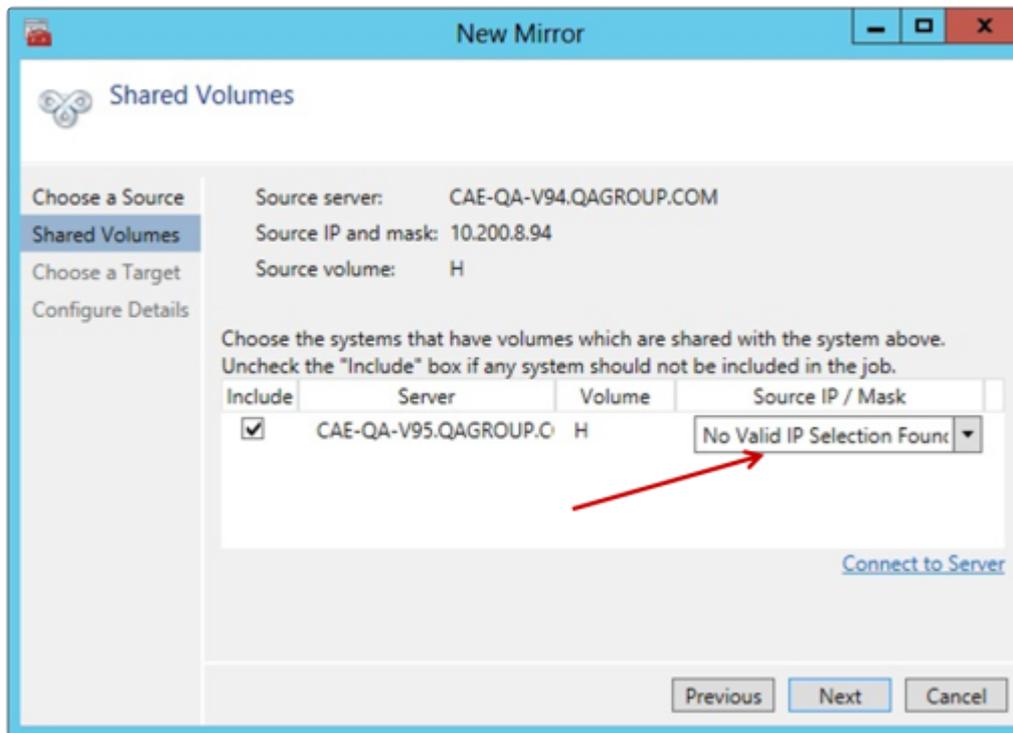
Creating Mirrors with Multiple Targets

The first issue is during mirror creation in a multi-target configuration. In the final step, the user is prompted for secondary relationship information. In previous OS versions, a default Source IP is provided on this **Additional Information Needed** dialog. In Windows Server 2012, however, this default IP is not provided, but the correct IP address must still be selected. If **OK** is clicked without selecting the IP address, the mirror will still create, but key relationship information will be missing.



Creating Mirrors with Shared Volumes

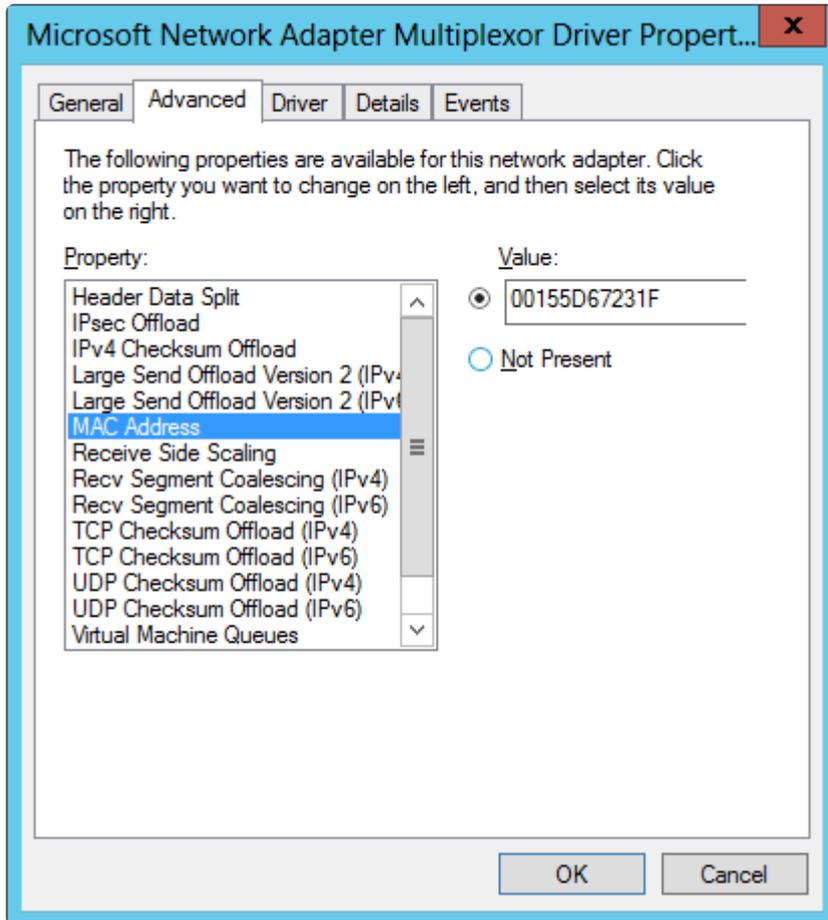
The other issue is with the **Shared Volumes** dialog box when creating mirrors with shared volumes. In previous OS versions, a default Source IP is provided on this screen. In Windows Server 2012, however, this dialog will display "**No Valid IP Selection Found.**" The correct Source IP will still need to be selected.



8.11.2.19.5. Windows Server 2012 NIC Teaming Issue

If you use the **NIC Teaming** feature of Windows Server 2012, Windows 2012 will report only one adapter MAC address for the license. If you have many underlying adapters, the MAC address will arbitrarily change and Windows may pick one of the adapters that may no longer be licensed.

To resolve this issue, configure the **MAC address** property of the virtual team adapter. This property can be changed using the **Advanced** tab of the **Adapter Properties** as shown in the diagram:



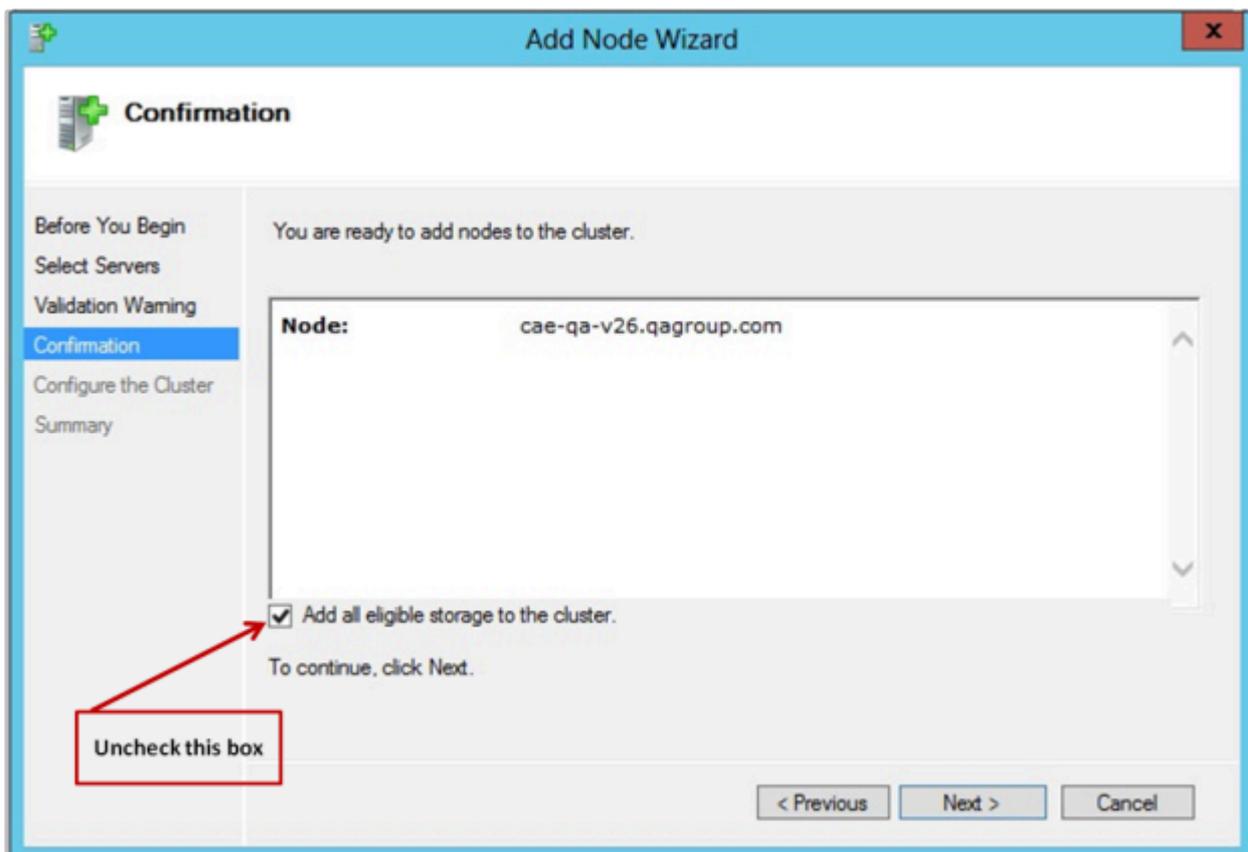
8.11.2.19.6. WSFC 2012 Cluster Creation Default Setting Issue

Description

During the cluster creation process in **Windows Server 2012**, Microsoft has added a new option to automatically consume all disks and manage them through Failover Clustering. As a result, any attempts to create a mirror in DataKeeper will fail and a message will be received in **Disk Manager** that the disk is being managed by **Failover Clustering**.

Suggested Action

To prevent this from happening, in the **Add Node Wizard**, uncheck the box marked “**Add all eligible storage to the cluster**” (shown below). Specific disks can then be added after the cluster is created.



To remedy if already being managed by **Failover Clustering**, remove the disks from **Available Storage**, then online the disks in **Disk Manager** and use **DataKeeper** to manage the volumes.

8.11.2.19.7. WSFC 2012 Failover Cluster Manager UI Defect (Delete Action Missing)

Description

On Windows Server 2012, the Microsoft Failover Cluster Manager UI tool has a defect. When a “right-click” is performed on a DataKeeper Volume resource from the Available Storage group, the drop-down action list does not appear. That action list would normally include the “**Delete**” command (among other actions) to delete the resource from the cluster.

Unfortunately, when the Admin is finished using a DataKeeper Volume storage resource, the resource cannot be removed from the cluster with the **Failover Cluster Manager UI** tool. This appears to affect only non-Microsoft storage resources. Microsoft is working on a correction for this.

Suggested Action

Microsoft has released a Server 2012 Hotfix for this defect. Microsoft Article [2804526](#) provides a high level overview of several WSFC Server 2012 issues including this problem. This article will refer you to several hotfixes for Server 2012. Installing Microsoft Hotfix 2795997 will correct this particular problem. Windows Update KB2803748 must also be installed (this normally occurs automatically). If KB2803748 is not installed, the cluster will become unstable

When requesting this hotfix, click on “**Show hotfixes for all platforms and languages**” and check the **x64** selection. Be sure to also update your 2012 Server with all Windows Updates after installing this hotfix.

The workaround for this issue without installing the Microsoft hotfix is to delete the “**DataKeeper Volume**” resource using **Windows PowerShell**. To remove a DataKeeper Volume resource from a cluster with PowerShell, perform the following command:

```
remove-clusterResource "<DataKeeper Resource Name>"
```

For example:

```
PS C:\> remove-clusterResource "New DataKeeper Volume"
Remove-ClusterResource
Are you sure you want to remove cluster resource 'New DataKeeper Volume'?
[Y] Yes [N] No [S] Suspend [?] Help (default is "Y"): Y
PS C:\>
```

In the above example, replace “**New DataKeeper Volume**” with the actual name of your DataKeeper Volume resource.

8.11.2.19.8. WSFC 2012 File Server Resource Manager Event Log Errors

Description

In Windows 2012, if a File Server Role is created which uses one or more DataKeeper Volume resources and the **File Server Resource Manager** feature is enabled on the system, then a series of “**SRMSVC**” errors (ID 8228) will be received on the offline node:

```
File Server Resource Manager was unable to access the following file or volume: 'E:'. This file or volume might be locked by another application right now, or you might need to give Local System access to it.
```

Note: If any DataKeeper Volume resource is offline, this message will be received every ten seconds.

Suggested Action

These messages can be ignored; however, to prevent these messages from being received, **File Server Resource Manager Service** may be disabled.

8.11.2.19.9. WSFC 2012 File Shares Cannot be Created for File Server Role Using Server Manager or Failover Cluster Manager

Description

Once a cluster File Server role is created, neither **Server Manager** nor **Failover Cluster Manager** can be used to initially create the share.

Suggested Action

Microsoft Article [2804526](#) provides a high level overview of several WSFC Server 2012 issues including this problem. This article will refer you to several hotfixes for Server 2012.

When using Failover Cluster Manager on Server 2012, the File Share Wizard would not start when right-clicking the “Add File Share” short-cut or when using the right panel “Add File Share” button if third party storage was used. Installing Microsoft Hotfix 2795993 will correct this problem.

Alternatively, installing the following Windows Update modules for Server 2012 will also correct this problem:

KB2815769 KB2803676 KB2785094 KB2779768 KB2771744 KB2761094

KB2812829 KB2800088 KB2784160 KB2779562 KB2771431 KB2758246

KB2812822 KB2795944 KB2783251 KB2778171 KB2770917 KB2756872

KB2811660 KB2790920 KB2782419 KB2777166 KB2769165 KB2751352

KB2803748 KB2788350 KB2780342 KB2771821 KB2764870

The **Server 2012 Windows Update List** shown above was cumulative as of 4/2/2013. Our lab tests showed that Hotfix 2795993 may not install on every Server 2012 system. In that case, we recommend installing at least the Windows Update modules listed above.

On Server 2012, the Server Manager tool could not be used to create shares on clustered volumes if third party storage was used. Installing Microsoft Hotfix 2796000 will correct this problem. Alternatively, installing the same set of Windows Update modules listed above will also correct this problem.

The workaround if not installing the above is to create the share using **Windows Explorer**. Once the share is created through Windows Explorer, adjusting permissions or other aspects of the file share can be performed normally through **Server Manager** or **Failover Cluster console**.

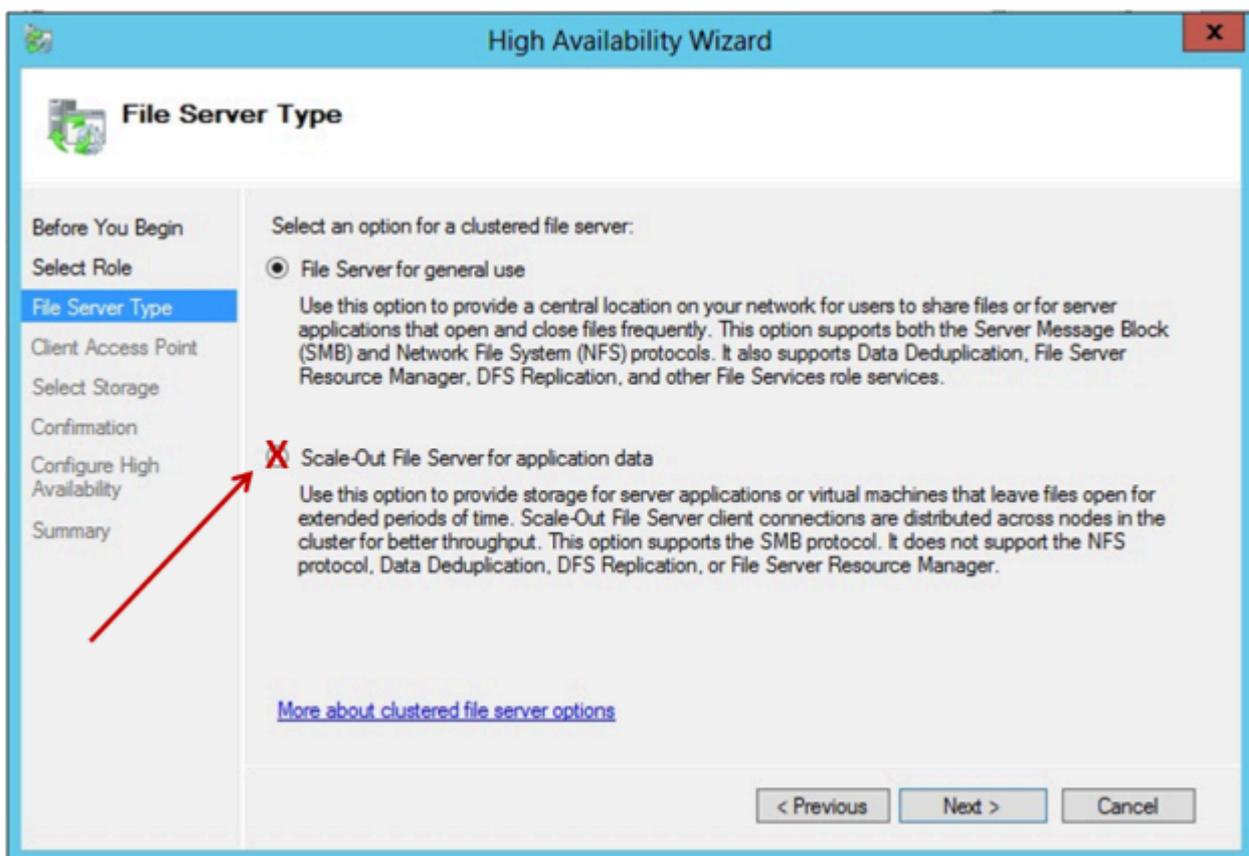
8.11.2.19.10. WSFC File Server Type Not Supported

Description

Most Windows versions offer two options for **File Server Resources**:

- File Server for General Use
- **Scale-Out File Server for Application Data (NEW)**

The option, “**Scale-Out File Server for Application Data**”, is not currently supported.



Suggested Action

When selecting a **File Server Type**, the first option, “**File Server for General Use**”, must be selected. This File Server type existed in failover clusters prior to Windows Server 2012. It can be used to increase the availability of files that are shared for use by users or by applications that open and close files frequently.

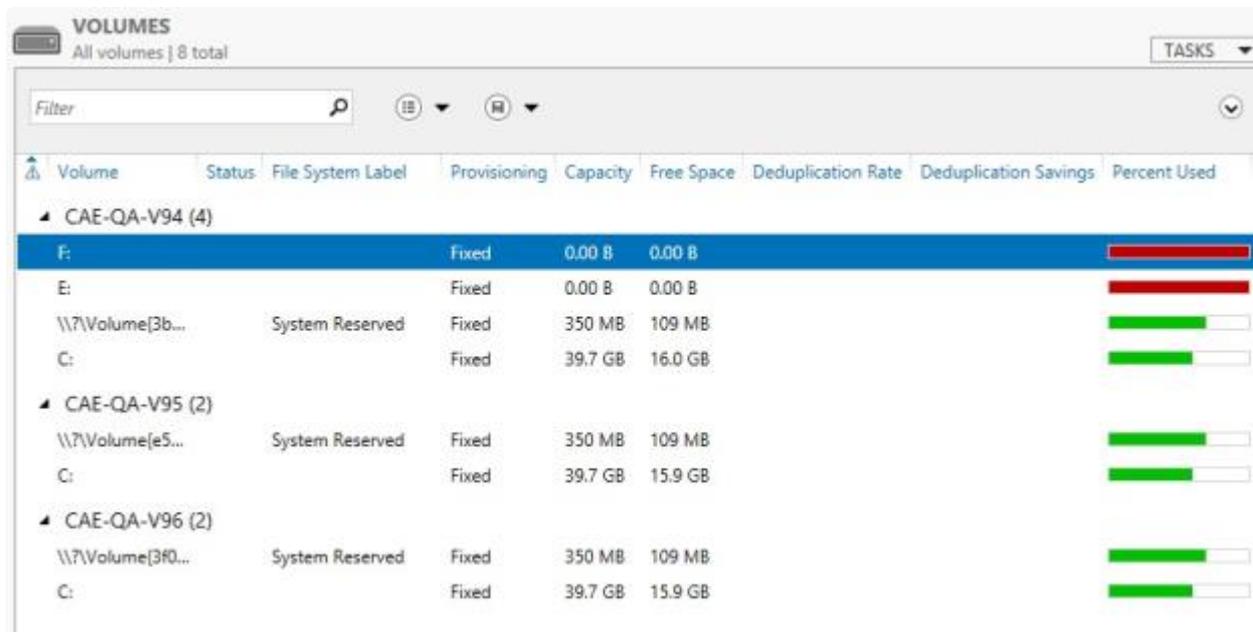
Note: Windows Server ReFS (Resilient File System) is also not currently supported.

8.11.2.19.11. WSFC 2012 Server Manager -- Incorrect Volume Display

Description

In Windows Server 2012, volume status can be viewed and volume manipulation can be performed within **Server Manager > File and Storage Services > Volumes**. However, when using DataKeeper volumes with cluster resources, this interface will not accurately reflect volume status.

In the following example, the DataKeeper Volumes E and F are split. One is Cluster Owner\Source on CAE-QA-V95 and the other is Cluster Owner\Source on CAE-QA-V96; however, the **Server Manager "Volumes"** display shows the volumes (E & F) on CAE-QA-V94 with red "percent used" progress bars and does not show any volumes on CAE-QA-V95 or CAE-QA-V96.



If both resources share the same Cluster Owner\Source as in the following example (CAE-QA-V96), the **Server Manager** shows the correct information.

VOLUMES
All volumes | 8 total

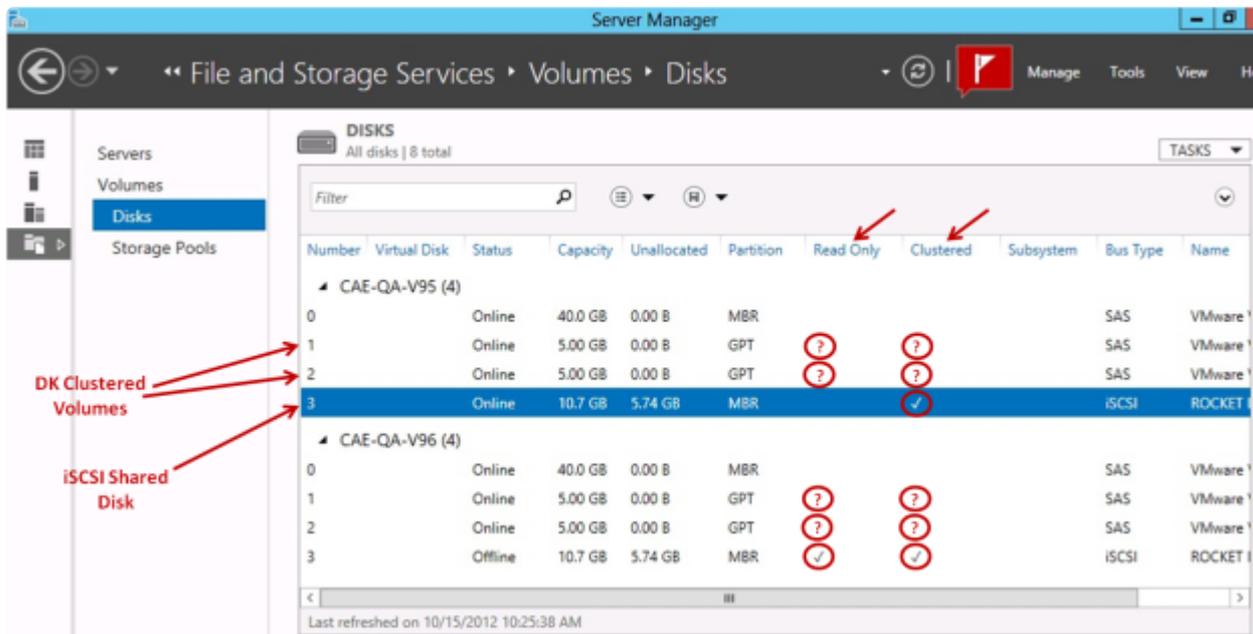
Filter (ID) (R)

Volume	Status	File System Label	Provisioning	Capacity	Free Space	Deduplication Rate	Deduplication Savings	Percent Used
<ul style="list-style-type: none"> CAE-QA-V94 (2) <ul style="list-style-type: none"> \\?\Volume{3b...} System Reserved Fixed 350 MB 109 MB C: Fixed 39.7 GB 16.0 GB CAE-QA-V95 (2) <ul style="list-style-type: none"> \\?\Volume{e5...} System Reserved Fixed 350 MB 109 MB C: Fixed 39.7 GB 15.9 GB CAE-QA-V96 (4) <ul style="list-style-type: none"> \\?\Volume{3f0...} System Reserved Fixed 350 MB 109 MB C: Fixed 39.7 GB 15.9 GB E: Volume1 Fixed 4.97 GB 3.95 GB F: Volume2 Fixed 4.97 GB 3.95 GB 								

8.11.2.19.12. WSFC 2012 Server Manager -- DataKeeper "Disk" Not Shown as Clustered

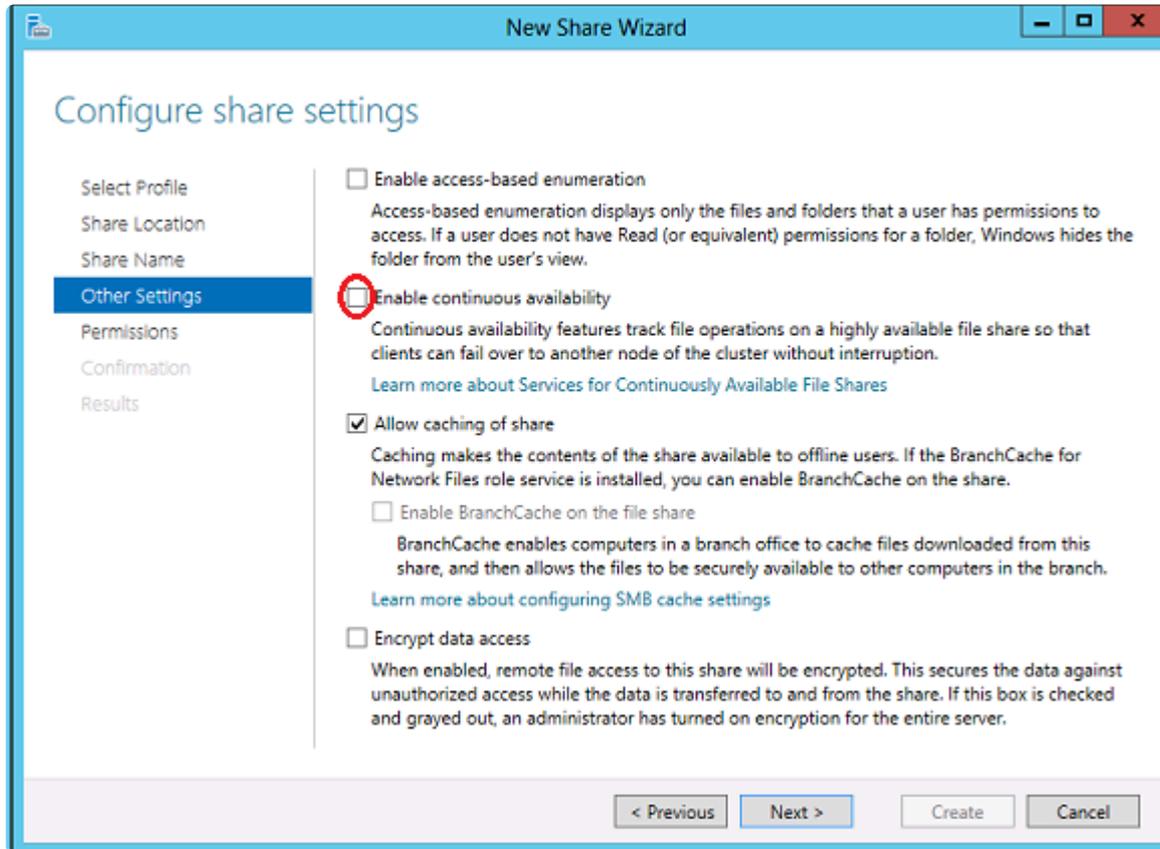
There are some inconsistencies in how cluster disks are shown in the "Disks" display under **Server Manager > File and Storage Services > Volumes > Disks**.

The following screen shot shows an iSCSI Shared Disk and two DataKeeper Volumes in a cluster. There is a check mark under the "Clustered" column heading for the iSCSI Disk, however, the DK Clustered Volumes do not have a check mark even though they are in a cluster. There will be nothing displayed in either the "Read Only" column or the "Clustered" column. This is due to the fact that DataKeeper operates with **Volumes**, not **Disks**.



8.11.2.19.13. Windows 2012 File Share

When creating a fileshare using “SMB – Basic” on Windows 2012, by default the “Enable Continuous availability” flag is checked which prohibits creating a fileshare resource. To solve this problem, uncheck the box as shown in the picture.



8.11.2.20. Windows Server 2016 Specific Issues

For issues related to **Windows Server 2016**, see the following topic:

- [Occasional Job Creation Failure](#)
- [WSFC 2016 File Shares Cannot be Created for File Server Role Using Server Manager or Failover Cluster Manager](#)

8.11.2.20.1. Occasional Job Creation Failure

Occasionally, new job creation on Windows 2016 systems can fail. If this occurs, retry the create.

8.11.2.20.2. WSFC 2016 File Shares Cannot be Created for File Server Role Using Server Manager or Failover Cluster Manager

Description

Once a cluster File Server role is created, neither **Server Manager** nor **Failover Cluster Manager** can be used to initially create the share.

Suggested Action

Microsoft Article [2804526](#) provides a high level overview of several WSFC Server 2016 issues including this problem. This article will refer you to several hotfixes for Server 2012.

When using Failover Cluster Manager on Server 2016, the File Share Wizard would not start when right-clicking the “Add File Share” short-cut or when using the right panel “Add File Share” button if third party storage was used. Installing Microsoft Hotfix 2795993 will correct this problem.

Alternatively, installing the following Windows Update modules for Server 2012 will also correct this problem:

KB2815769 KB2803676 KB2785094 KB2779768 KB2771744 KB2761094

KB2812829 KB2800088 KB2784160 KB2779562 KB2771431 KB2758246

KB2812822 KB2795944 KB2783251 KB2778171 KB2770917 KB2756872

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KB2803748 KB2788350 KB2780342 KB2771821 KB2764870

The **Server 2012 Windows Update List** shown above was cumulative as of 4/2/2013. Our lab tests showed that Hotfix 2795993 may not install on every Server 2012 system. In that case, we recommend installing at least the Windows Update modules listed above.

On Server 2012, the Server Manager tool could not be used to create shares on clustered volumes if third party storage was used. Installing Microsoft Hotfix 2796000 will correct this problem. Alternatively, installing the same set of Windows Update modules listed above will also correct this problem.

The workaround if not installing the above is to create the share using **Windows Explorer**. Once the share is created through Windows Explorer, adjusting permissions or other aspects of the file share can be performed normally through **Server Manager** or **Failover Cluster console**.

8.11.3. Message Catalogs

[DKCE with WSFC Message Catalog](#)

[DKCE Service ExtMirrSvc Message Catalog](#)

[DKCE Driver ExtMirr – System Event Log Messages](#)

[SIOS SDRSnapin \(DataKeeper GUI\) Message Catalog](#)

8.11.3.1. DKCE with WSFC Message Catalog

Use **Control F** to search for a specific error code.

Code	Severity	Message	Cause/Action
17	Info	DataKeeper Cluster Resource 'Online' operation for Volume 'Y:' was successful.	
18	Error	DataKeeper Cluster Resource failed to connect to DataKeeper service for Volume 'Y:'	2 – The System cannot find the file specified 231 – All pipe instances are busy
19	Error	DataKeeper Cluster Resource 'GetServiceInfo' failed for Volume '%3:'. Error: [%4]	
20	Error	DataKeeper Cluster Resource 'GetVolumeInfo' failed for Volume 'M:'. Error: [15]	15 – The System cannot find the drive specified
21	Error	DataKeeper Cluster Resource 'Unlock Volume' failed for Volume '%3:'. Error: [%4]	
22	Error	DataKeeper Cluster Resource 'Switchover' operation failed for Volume 'Y:'. Error: [64]	1 – Incorrect function 53 – The network path was not found 64 – The specified network name is no longer available
23	Error	DataKeeper Cluster Resource Volume 'F:' has no mirror.	
24	Error	DataKeeper Cluster Resource 'Lock Volume' failed for Volume 'I:'. Error: [33]	33 – The process cannot access the file because another process has locked a portion of the file.
25	Info	DataKeeper Cluster Resource 'Offline' for Volume 'Y:' was successful.	
26	Info	DataKeeper Cluster Resource 'LooksAlive' test for Volume '%3:' failed.	

27	Error	DataKeeper Cluster Resource create temp filename on Volume '%3:' failed. Error:[%4]	
28	Warning	DataKeeper Cluster Resource open temp file '%3' for Volume '%4:' failed.	
29	Warning	DataKeeper Cluster Resource flush temp file '%3' for Volume '%4:' failed.	
30	Warning	DataKeeper Cluster Resource write temp file '%3' for Volume '%4:' failed.	
31	Warning	DataKeeper Cluster Resource create online thread for Volume '%3:' failed. Error:[%4]	
32	Warning	DataKeeper Cluster Resource create offline thread for Volume '%3:' failed. Error:[%4]	
33	Warning	DataKeeper Cluster Resource failed to validate volume letter private property.	
34	Error	DataKeeper Volume Resource '1:' failed to find a valid DataKeeper Cluster Edition license.	
35	Error	DataKeeper Cluster Resource 'Get Configuration' for WSFC failed for Volume 'W:'. Error: [2]	2 – The System cannot find the file specified
36	Error	DataKeeper Cluster Resource 'Set Configuration' for WSFC failed for Volume '1:'. Error: [2]	2 – The System cannot find the file specified
37	Info	DataKeeper Cluster Resource 'TampaShare' for volume 'W:' is being deleted.	
38	Info	Clearing WSFC flag for DataKeeper Cluster Resource 'TampaShare' for volume 'W:' on node 'MACHINE'.	
39	Error	Mirror state for drive '%3:' is invalid for switchover. State is %4.	Info only – no action required
40	Error	Unable to read the 'VolumeLetter' property of a DataKeeper Volume resource. The 'VolumeLetter' property may not have been assigned to the resource. Check the properties of this resource and make sure a 'VolumeLetter' property is assigned. The Online operation has failed. Error: [13]	13 – The data is invalid
41	Error	The Online operation for DataKeeper Volume Resource 'H:' has timed out waiting for a DataKeeper service connection. Check the DataKeeper service and make sure it is running. The Online operation has failed. Error: [2]	2 – The System cannot find the file specified
42	Error	DataKeeper Volume Resource '%3:' Online operation was terminated by the Resource Manager. The Online operation has failed.	
43	Info	New node to DataKeeper Cluster Resource 'New DataKeeper Volume' for volume 'N:' is being added.	
44	Warning	Error %3 in getting job information for DataKeeper Cluster Resource '%4' for volume '%5:'.	
45	Error	No job defined in DataKeeper on system %3 for volume '%4:'. The resource %5 will not come online on that node until job is defined.	
46	Info	Attempted to bring volume L Online on this system, but the last source	

		for this mirror is MACHINE1. This system is not a valid node for Online – only the mirror target node or a share of the mirror source is valid.	
47	Error	Attempt to connect to service locally failed with error %3.	
48	Info	Volume N: is owned by node marl-pfc01n02 and is in state 129	
49	Info		
50	Info		
51	Error	Attempt to query dos device for volume %3 failed with error %4	
52	Error	Attempt to create dos device name for volume %3 failed with error %4	
53	Error	Attempt to delete dos device name for volume %3 failed with error %4	
54	Error		
55	Warning	During Offline, the resource DLL failed to start a separate thread to periodically update the resource state. If the Offline request takes a long time to complete, the resource might be marked FAILED by the cluster service.	
56	Error	During volume Offline, DataKeeper Cluster Resource failed to connect to DataKeeper service for Volume '%3:'. Error: [%4]	
57	Error	During volume Offline, DataKeeper Cluster Resource 'Lock Volume' failed for Volume '%3:'. Error: [%4]. The DataKeeper Offline procedure will continue to attempt to bring this resource offline. Resolve the lock failure by closing any applications that have an exclusive handle on the volume. If the volume still cannot be locked, reboot the system to force the termination of Offline retries.	
58	Error	During volume Offline, DataKeeper Cluster Resource 'GetVolumeInfo' failed for Volume '%3:'. Error: [%4]. The DataKeeper Offline procedure will continue to attempt to bring this resource offline, and will try again to get the volume information for this resource. If the information still cannot be retrieved, reboot the system to force the termination of Offline retries.	
59	Error	During volume Online, DataKeeper Cluster Resource 'GetVolumeInfo' failed at '%3' for Volume '%4:' Error: [%5]. The Volume '%3' will be marked as failed.	
60	Warning	During Online, the resource DLL failed to start a separate thread to periodically update the resource state. If the Online request takes a long time to complete, the resource might fail to be brought online.	
61	Error	The attempt to bring the DataKeeper Cluster Resource online failed for Volume '%3:'. Error: [%4]. The Volume '%3' will be marked as failed.	
62	Warning	During the Online operation for DataKeeper Volume Resource '%3:', the cluster node handle for the previous source system, '%4', could not be opened.	
63	Error	During volume Online, DataKeeper Cluster Resource 'GetConfiguration' failed for Volume '%3:'. Error: [%4]. The Volume '%3' will be marked as failed.	
64	Error	During volume Online, DataKeeper Cluster Resource 'SetConfiguration' failed for Volume '%3:'. Error: [%4]. The Volume '%3' will be marked as failed.	
80	Error	A failure occurred during the check of volume '%3'. Error: [%4]. The	

		volume '%3' may be marked as failed.	
96	Error	A failure occurred trying to open a handle to the local cluster. Error: [%3].	
97	Error	A failure occurred trying to open a handle to the cluster node '%3'. Error: [%4]	
98	Error	The Online request was denied because a node outside the cluster, '%4', is still reporting itself as Source for its corresponding volume '%5'.	
99	Error	The Private Property '%4' was found with value '%5'. This indicates that the target may have not been in the mirroring state with the source.	
100	Error	This volume is in the Source role, but node '%4' has brought the volume Online more recently. This appears to be an attempt to move a mirror that is currently in the Split Brain state. Reboot the local server or restart the Cluster service to resolve the Split Brain condition.	
101	Info	The DataKeeper Volume Join Cluster thread has completed split brain checking and is exiting with status %1.	
102	Error	The DataKeeper Volume LooksAlive health check for volume %1 failed with status %2.	
103	Error	The DataKeeper Volume IsAlive health check for volume %1 failed with status %2.	
104	Warning	The DataKeeper Volume %3 has an active snapshot. Bypassing the volume lock to prevent dropping the active snapshot.	

8.11.3.2. DKCE Service ExtMirrSvc Message Catalog

Use **Control F** to search for a specific error code.

Code	Severity	Message	Cause/Action
17	Info	The SIOS DataKeeper Service version %1 is starting.	
18	Warning	The SIOS DataKeeper Service has been stopped.	
19		The SIOS DataKeeper Service has been paused.	
20		The SIOS DataKeeper Service has been continued.	
21		The SIOS DataKeeper Service terminated with error code %1 "%2"	
22	Info	The SIOS DataKeeper Service has been installed successfully	
23		The SIOS DataKeeper Service has been successfully removed.	
24		Debug checkpoint "%1" was encountered.	
25		The registry value "%1" could not be found in the key "%2". This value is required for the service to start successfully. Please reconfigure the service, or add the value to the above source. The service will be stopped.	
26		While attempting to execute the function: "%1", error %2 was encountered on line %3 in file: "%4":	
27			
28			
29	Error	Error 1073 while trying to create the SIOS DataKeeper service	
30		Error %1 while trying to Open the Service Control Manager	
31		Error %1 while trying to install the SIOS DataKeeper service	
32		While attempting to create thread: "%1", error %2 was encountered on line %3 in file: "%4":	
33		The control connection to system "%1" could not be initialized. Pipe Name="%2". Command="%3". The error code was "%4".	
34		Cannot allocate enough memory. Line: %1 File: %2	
35		The GUI Thread pipe is waiting for a connection.	
36		Error getting Service Info.	
37		Command received from GUI: %1	
38		Exit command received from GUI.	
39		Service STOP command received from GUI.	
40	Info	Setting attributes for volume "X:". New Attributes bitmap: "128"	
41		Error "%1" while trying to set the volume attributes for volume "%2".	
48		Pausing a mirror for volume "%1" with target system "%2"	

49			
50		Restarting a mirror for volume "%1" with target system "%2"	
51			
52		Unknown command received from GUI: %1	
53		Error %1 receiving command from GUI.	
54		Error %1 sending response to GUI.	
55		Error %1 creating GUI pipe.	
56		Error %1 trying to connect to the GUI.	
57		Error %1 trying to enable the process's privilege.	
58		Error %1 trying to initialize the potential mirror structure.	
64		Error %1 while trying to open the registry key %2	
65		Error %1 while trying to read the registry value %2	
66		Error %1 while trying to set the registry value %2	
67		String "%1" already exists in Registry key value: %2.	
69		An auto-discover request was received by "%1".	
70	Info	The Auto Discovery thread is waiting for requests.	
71		The value read from the registry key is not of the expected type. Registry Value: %1	
72		Attempt to get the job associated with system '%3' and volume '%4' failed. Error: %5	
73		No job found associated with system '%3' and volume '%4'.	
80		Could not determine computername from FQDN '%3'	
81		The Compare Volume pipe is waiting for a connection	
82		Attempt to set the cluster resource property '%3' for volume '%4' to value '%5' failed. Error: '%6'	
83		Failed to open the key '%3' for the Cluster Resource associated with volume '%4'. Error: %5	
84		Failed to get the Cluster Resource Key associated with volume '%3'. Error: %4	
85		Failed to get the Cluster Resource associated with volume '%3'. Error: %4	
86		Failed to get the state of the Cluster Resource associated with volume '%3'. Error: %4	
87		Failed to get the local computer name. Error: %3	
88		Resource Mirror State Property for Volume [%3:], Target:%4, State:%5 could not be saved in the Cluster Database. Error: %6	
89		Could not obtain a handle to the cluster.	
97	Info	Event Log Monitor started monitoring the "System" log.	
98		Error code returned is [%1]	

99		Couldn't create an event for monitoring the event log by the service. The service can not continue. Error code returned is [%1].	
100		Couldn't set the change notification for events for monitoring the event log by the service. The service can not continue. Error code returned is [%1]	
101		The number of strings expected for the change status event were not received. The number received was [%1].	
102		The value for %1 could not be parsed from the event log because of error %2.	
112		DataKeeper License Manager failed to initialize: %1	
113	Info	Found DataKeeper cluster permanent license key.	
114	Error	Error in obtaining SteelEye DataKeeper license key.	The hostid of this system does not match the hostid specified in the license file.
115	Info	DataKeeper cluster evaluation license key found, expires at midnight in 21 days.	
116		EM master license key has expired.	
117	Error	No valid DataKeeper license key was found	
118	Warning	IMPORTANT NOTICE! SIOS DataKeeper on this system is using an evaluation license key which will expire at midnight on 06/07/09. To continue functioning beyond that time, a permanent license key must be obtained. Please contact the original supplier of your evaluation software, or visit http://www.steeleye.com for information about purchasing a permanent license key for SIOS DataKeeper.	
119	Error	ERROR! The evaluation license key for SteelEye DataKeeper on this system has expired. Please contact the original supplier of your evaluation software, or visit http://www.steeleye.com for information about purchasing a permanent license key for SIOS DataKeeper.	
120	Error	SIOS DataKeeper shutdown is now in progress.	
121		The SIOS DataKeeper Service has started. Found EM restricted permanent license key.	
122		Licensing initialization – server not ready.	
129			
130		Found SDR OEM Key	
131		SDR OEM Key is not valid	
132		SDR OEM Key is valid but has expired %1 seconds differential	
133		Localization File `'%1'` is invalid	
134		Failed to get the current machine locale when locale restricted licensing is in operation	
135		Found Locale restriction. Current Locale is `'%1'`	

136		This version of SDR is Licensed for the `%1` locale, but you are not using this locale.	
137		Failed to restore machine to `C` locale.	
144		The EventLog Monitoring thread received an unexpected return value in WaitForSingleObject – status %1.	
145		The EventLog Monitoring thread received an unexpected return value in ReadEventLog – status %1.	
146		Couldn't open event log for monitoring by the service. Error code returned is [%1].	
147		Couldn't set the change notification for events for monitoring the event log by the service. Error code returned is [%1].	
148		Unable to allocate memory for volume target information – service is terminating.	
149		The number of strings expected for the change role event were not correct. Expected 5 strings. The number received was [%1].	
150		Unable to allocate memory for volume rewind log information – service is terminating.	
151		Unable to create thread for volume rewind log – service is terminating.	
152	Info	Rewind thread has been started for volume L:.	
153		The rewind thread for volume %1: failed to initialize properly. Failure reason: %2	
154	Info	The rewind thread for volume L: is terminating.	
155		A rewind thread for was unable to open the ExtMirr Parameters registry key.	
156		Rewind thread for volume %1: was unable to open the ExtMirr volume Parameters registry key.	
157		Rewind thread for volume %1: was unable to read rewind log file.	
158		Rewind thread for volume %1: was unable to truncate rewind log file.	
159		Rewind thread for volume %1: was unable to create rewind log file.	
160		Rewind log file for volume %1: is an invalid size – truncating to size 0.	
161		Rewind log file for volume %1: is wrapping to start of file due to high filesystem usage on rewind log volume. Less than %2 MB free.	
162		Rewind log file for volume %1: is wrapping to start of file – size limit %2 MB reached.	
163		Rewind log file for volume %1: is wrapping to start of file – age limit %2 minutes reached.	
164		Rewind log file for volume %1: is corrupt – index number has overflowed. Zeroing out the log file.	
165		Rewind thread for volume %1: was unable to write to rewind log file.	
166		Rewind thread for volume %1: was unable to read dumpfile. Rewind log file will be truncated to size 0.	
167		Rewind thread for volume %1: was unable to determine if rewind is still	

		enabled for this volume. Assuming rewind is disabled.	
168		Rewind thread for volume %1: was unable to create rewind log file. The RewindLogLocation registry value is not set in either the global ExtMirr Parameters key, or in the volume's key.	
169		Rewind thread for volume %1: was unable to %2 compression of the rewind log file.	
170		Rewind thread for volume %1: the system appears to be recovering from a crash. Deleting all contents of the rewind log.	
171		Rewind thread for volume %1: The mirror role is not target, but service was unable to clear rewind log contents. Status %2.	
172		Rewind thread for volume %1: Mirror role is not Target – successfully cleared logfile contents.	
173		Unable to modify registry setting %2.	
174	Info	Initiated switchover of mirror on volume H:\.	
175		Bad Arguments: Switchover called with %3 as the server name.	
176		GetMirrorVolume for drive %4 failed with error number %3.	
177	Info	Calling Failover for volume Y:\.	
178		Failover of volume %3 on has failed with error %4.	
179	Info	Calling DeleteLocalMirrorOnly() for volume H:\.	
180		DeleteLocalMirrorOnly() for volume %3 failed with error %4.	
181	Info	Calling CreateMirror().	
182		CreateMirror() failed with error %3.	
183	Info	Invoking switchover of mirror on volume Y:\ on source system 10.37.4.21.	
184		Mirror role is %3. Cannot continue with switchover of mirror.	
185		Mirror role is %3. Cannot perform switchover of mirror.	
186		Cannot determine IP address for mirror target %3.	
187	Error	Switchover of mirror for drive E:\ cannot be performed. Mirror state is Resync.	
188		DataKeeper WSFC Resource '%3' was not found in the Cluster folder.	
189		DataKeeper was unable to access the local cluster. The handle is NULL.	
190	Error	Failed to register the 'DataKeeper Volume' Resource DLL (DataKeeperVolume.dll). Error: 70	Error 70
191		Failed to create process to register DataKeeper Resource Extension DLL (%1). Error: %2	
192		Failed to register the '%1' Resource Extension DLL (%2). Error: %3	
193		Failed to disable WOW64 Redirection.	
194		Failed to re-enable WOW64 redirection.	
195	Error	Attempt to connect to remote system 007IT-NAS-TW2 failed with error 5.	Error 5

195	Error	Attempt to connect to remote system 007IT-NAS-TW2 failed with error 53.	Error 53
196	Error	Attempt to connect to remote system 192.168.85.7 failed with error 53. Please ensure that the local security policy for "Network Access: Let Everyone permissions apply to anonymous users" is enabled on all the servers running DataKeeper.	Error 53
196	Error	Attempt to connect to remote system MACHINE.FQDN failed with error 64. Please ensure that the local security policy for "Network Access: Let Everyone permissions apply to anonymous users" is enabled on all the servers running DataKeeper.	Error 64
196	Error	Attempt to connect to remote system MACHINE.FQDN failed with error 64. Please ensure that the local security policy for "Network Access: Let Everyone permissions apply to anonymous users" is enabled on all the servers running DataKeeper.	Error 1326
196	Error	Attempt to connect to remote system MACHINE.FQDN failed with error 1131. Please ensure that the local security policy for "Network Access: Let Everyone permissions apply to anonymous users" is enabled on all the servers running DataKeeper.	Error 1131
208	Info	Creating a new job.	
209		Job (ID: %3) has invalid endpoints data.	
210		Failed to create a GUID string. Error code was %3.	
211	Info	Attempting to update job(ID: 86e75d13-c32b-441b-9663-1aa661a83310) info on local system.	
212		Failed to update job(ID: %3) on local system. Error code was %4.	
213		Reading info for job(ID: %3).	
214		Reading all jobs from the Registry.	
215		Attempting to get all jobs from the registry.	
216	Info	Updating job(ID: 8027a98a-fc8e-45f0-a9e9-cbccaef670f3) on all servers.	
217	Info	Attempting to delete job(ID: 910f97f2-12d0-4bfb-96bd-0f96d904d21f) on remote server VIRTSERVER3.TTT. LOCAL.	
218	Info	Attempting to update job(ID: 8027a98a-fc8e-45f0-a9e9-cbccaef670f3) on remote server MACHINE.FQDN	
219	Info	Update of job(ID: 86e75d13-c32b-441b-9663-1aa661a83310) info failed. Error code was 1326.	Error 234, 1326
220	Info	Deleting job with ID DF04CDE3-5AA5-49FA-9410-8B6E57D12E77.	
221	Info	Deleting registry key for job with ID 910f97f2-12d0-4bfb-96bd-0f96d904d21f.	
224	Info	Registered 'DataKeeper Volume' Cluster Resource Type.	
225	Info	Registered 'DataKeeper Volume' Resource Extension DLL.	
226		Could not save mirror settings in registry.	
227	Error	Switchover of volume Y:\ is aborting – unable to establish a connection to source system 10.37.4.21, although the source system appears to be online. Make sure that the SteelEye DataKeeper Service is running	

		on system 10.37.4.21.	
228		Switchover of volume %3 is continuing – source system name with IP address %4 was not available from job info.	
229		Creation of additional targets after primary switchover failed with status %3	
230	Info	Switchover of volume I:\ started on shared node.	
231	Info	Switchover of volume I:\ on shared node completed successfully.	
232	Error	Switchover of volume N:\ failed on shared node failed with error 1.	
233	Info	Shared node WINSUPB.QATEST.COM is the source of the existing mirror for volume I:\.	
234	Error	Shared node WINSUPB.QATEST.COM is the target of the existing mirror for volume N:\.	
235	Error	Mirror node RUFIOUS.QATEST.COM is the source of the existing mirror for volume N:\.	
236	Info	Mirror node RUFIOUS.QATEST.COM is the target of the existing mirror for volume I:\.	
237	Error	Switchover of mirror for volume E:\ on source system 172.17.102.129 failed with error 121.	Error [33], [121]
238	Info	Attempting to unlock volume I:\ before creating mirror.	
239		Attempting to unlock volume %3.	
240	Info	Attempting to create mirror (source ip::vol – target ip::vol) 172.17.102.128::I – 172.17.108.135::I	
241		Create mirror failed with error %3.	
242		IOCTL for configuration setting for volume %3 failed with error %4.	
243		Switchover for mirror %3 completed. %4 mirrors created.	
256		FLEXnet: The lc_flexinit_property_handle_create API has failed. Error: %3	
257		FLEXnet: The lc_flexinit_property_handle_set API has failed. Error: %3	
258		FLEXnet: The lc_flexinit API has failed. Error: %3	
259		FLEXnet: The lc_flexinit_cleanup API has failed. Error: %3	
260		FLEXnet: The lc_flexinit_property_handle_free has failed. Error: %3	
261		Attempt to enable shared configuration for volume %3 failed. Error: %4	
262		Attempt to disable shared configuration for volume %3 failed. Error: %4	
263		Directories could not be created for bitmap file: %3. Multi-target switchovers will require full resync.	
264		Bitmap file could not be copied from old mirror source on %4.	
265		Switchover for volume %3 was requested while volume was in the Source role. This is an invalid request and will be failed.	
266		A request to prepare volume %3 to relinquish the Source role was received while the volume was not in the Source role. This is an invalid request and will be failed.	

267	Info	Prepare volume I:\ to relinquish source role during switchover.	
268		Error number %3 getting mirror volume info for volume %4.	
269	Error	Volume E: Mirror role 0 not allowed to pass mirror settings.	
270		Mirror in wrong role. Cannot update mirror setting on system %3 and volume %4.	
271		Cannot connect to %3. Cannot send mirror property setting.	
272		Error %3 setting mirror property on system %4 volume %5.	
273	Error	Unsuccessful mirror settings broadcast to shared systems from WINSUPA.QATEST.COM.	
274	Error	Switchover of mirror for volume I:\ failed. Source system 10.1.29.21 did not have a mirror in the mirroring state to this target, failed with error 87.	Error 87
275		Job update did not contain the correct number of endpoints.	
276		During switchover, a shared source system did not respond to DataKeeper requests, but does not appear to be dead. Switchover will be aborted – that node may be the mirror source. Please make sure that the SIOS DataKeeper Service is running on all nodes.	
277		Multiple shared nodes found to be in the Source role for volume %3.	
278		The Job for volume %3 is non-standard and contains unexpected data. This could result in operational failures. Please ensure that the Job is configured correctly.	
279			
280			
281		GetVolumeInfo for source volume %3 failed on server %4. Error %5. The volume is not configured or missing. Switchover is continuing. If the missing volume is replaced, you must force a full resync to the new media.	
289		During switchover Old Source Volume %3 EmVolume.Open failed on server %4. A Full Resync is required.	
290		Switchover for volume %3 on source system %4 has encountered a network error, code %5, and is attempting recovery .	
291		A switchover request for volume %3 is being aborted. The volume is still Online on this cluster node.	
292		A duplicate switchover request was detected for volume %3. Returned saved status: %4.	
293		A duplicate switchover request was detected for volume %3, and the wait has failed. Wait error: %4.	
294		Failed to detach filter driver %3 from volume %4. Error: %5.	
295		Failed to load VirtDisk.dll.	
296		Failed to find the %3 function in VirtDisk.dll!	
297		Failed to create the Virtual Disk %3. Error: %4.	
298		Failed to open the Virtual Disk %3. Error: %4.	

299		Failed to attach the Virtual Disk %3. Error: %4.	
300		Failed to detach the Virtual Disk %3. Error: %4.	
301		Failed to retrieve the Physical Device Path for the Virtual Disk %3. Error: %4.	
302		Failed to open the device %3.	
303		Failed to initialize the device %3.	
304		There is no snapshot location configured for volume %3.	
305		The volume %3 could not be prepared for snapshotting.	
306		The snapshot %3 could not be deleted. Error: %4	
307		The Snapshot files for volumes %1 have been initialized. Preparing to contact the source system to begin snapshotting.	
308		The snapshots %3 do not have the same Source system. This is required for simultaneous snapshots.	
309		The volume %3 does not have a job associated with it. Jobs are required for snapshots.	
310		Failed to create the Virtual Disk %3. File already exists and is in use.	
311		The SIOS DataKeeper Service failed to quiesce a group of volumes: "%1".	
312		The SIOS DataKeeper Service %1	
313		The SIOS DataKeeper Service encountered a non-fatal issue when quiescing a group of volumes:	
314		On source, no job found for snapshot target volume %3 on Server %4, Error %5. Snapshot cancelled.	
315		On source, no matching mirror found for snapshot to target volume %3 on Server %4. Snapshot cancelled.	
316		Snapshot source volume 3 info was not found for snapshot to target volume %4 on target server %5, Error: 6. Snapshot cancelled.	
317		Snapshot source volume %3 not in source role for snapshot to target volume %4 on target server %5. Snapshot cancelled.	
318		Snapshot source volume %3 not in mirroring state for snapshot to target volume %4 on target server %5. Snapshot cancelled.	
319		Snapshot source volume %3 was locked for snapshot to target volume %4 on target server %5. Snapshot cancelled.	
320		Unable to stop driver snapshot operation for volume %3 – status %4.	
321		While dropping snapshots for volumes %1 one or more error or warning conditions were encountered.	
322		Snapshots for volumes %1 successfully dropped.	
323		Failed to initiate snapshot of volume %3 on target system %4, status %5.	
324		Failed to initiate snapshot of volume %3 on target system %4, status %5. Could not open handle to the volume.	
325		Failed to retrieve snapshot initialization status of volume %3 on target	

		system %4, status %5.	
326		Failed to retrieve snapshot initialization status of volume %3 on target system %4, status %5. Could not open handle to the volume.	
327		Snapshot initialization of volume %3 on target system %4 failed with status %5.	
328		Snapshot requested for volumes %1.	
329		Snapshot for volumes %1 created successfully.	
330		Failed to wait for snapshot drop operation to complete, status %1.	
331		One or more drop events was abandoned while waiting for snapshot drop operation to complete.	
332		Timed out while waiting for snapshot drop operation to complete.	
333		Failed to signal a drop-complete event, status %1.	
334		During switchover of volume %2 volume open failed with status %1. Switchover aborted.	
335		Attempt to switchover volume %2 is being aborted because there is a snapshot active on the volume. Query status was %1.	
336		Cluster registration of volume %1 failed with status %2. Refer to product documentation for steps to manually create a cluster resource.	
337		Failed to determine the status of volume %3 on system %4. Error: %5.	
338		DataKeeper WSFC resource file '%3' could not be copied to the Cluster at '%4', Error: '%5'.	
339		DataKeeper WSFC resource file '%3' was missing in the DataKeeper folder. Cluster registration cannot be performed.	
340		Shared Volume failover of volume %3 encountered an error using the Shared Owner file. %5 : status %4.	
341		Shared Volume switchover of volume %3 failed. No shared targets were reported by the current source system.	
342		ClearBlockTarget() on system %3 for volume %4 failed with error %5.	
343		SetConfiguration() on system %3 for volume %4 failed with error %5.	
344		ClearBlockTarget() volume open on system %3 for volume %4 failed with error %5.	
345		Successfully added DataKeeperVolume registry entries.	
346		Failed to add DataKeeperVolume registry entries. Failed with error %3.	
347		Unable to determine if the mirror break to %3 for volume %4 was user requested. Setting to user requested.	
348		Failed to find job for server %3 and volume %4. Error: %5.	
349		Successfully set the cluster resource property '%3' for volume '%4' to value '%5'.	
350		Failed to change mirror type. %4	
352	Info	IMPORTANT – VSS Quiesce failed. This may be due to the SIOS VSS Provider not being activated. To activate the SIOS VSS Provider, run the script "install-siosprovider.cmd" which is located in	

		“%ExtMirrBase%\VSSProvider”.	
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8.11.3.3. DKCE Driver ExtMirr – System Event Log Messages

Use **Control F** to search for a specific error code.

Code	Severity	Message
1	Info	The SteelEye DataKeeper driver version 7.0 has started successfully.
2	Error	The SIOS DataKeeper driver could not be started since the system is running an unsupported version of the operating system. Required OS Version: %t%2.%3 Build %4 Current OS Version: %t%5.%6 Build %7
16	Warning	The mirrored state of a Source volume has been changed.
16	Warning	The mirrored state of a Source volume has been changed.
16	Warning	The mirrored state of a Source volume has been changed.
16	Warning	The mirrored state of a Source volume has been changed.
16	Warning	The mirrored state of a Source volume has been changed.
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16	Warning	The mirrored state of a Source volume has been changed.
16	Warning	The mirrored state of a Source volume has been changed.
16	Warning	The mirrored state of a Source volume has been changed.
17	Error	An invalid attempt was made to change the state of a Source volume. The volume will remain in state %3.
18	Error	A partition that is currently involved in a mirror has been modified. As a result, the mirror will be broken. Volume Device: %t%1 Volume Letter: %t%2 Current State: %t%3 In the future, please break all mirrors on a physical disk before re-partitioning that disk in order to ensure the integrity of data on the mirrored volumes.
19	Warning	The driver has determined that the file system is invalid.
20	Warning	The mirrored state of a Target volume has been changed.
20	Warning	The mirrored state of a Target volume has been changed.
20	Warning	The mirrored state of a Target volume has been changed.
20	Warning	The mirrored state of a Target volume has been changed.
20	Warning	The mirrored state of a Target volume has been changed.
21	Warning	The mirror role of the volume has been changed.
22	Warning	Unable to connect to the target machine for this volume.
23	Warning	The mirror role of the volume has been changed.

23	Warning	The mirror role of the volume has been changed.
23	Warning	The mirror role of the volume has been changed.
23	Warning	The mirror role of the volume has been changed.
23	Warning	The mirror role of the volume has been changed.
33	Error	Unable to connect to the target machine for this volume.
34	Error	An error occurred while writing a connection header to the target. The will be broken. The error code above is a driver status value.
35	Warning	Writes to this volume will no longer be mirrored to the target. The mirror will be broken.
37	Error	A write to the local (source) disk has failed.
38	Error	A write to the local (source) disk has been cancelled. Cancelling of writes is not supported for mirrored drives.
39	Error	The DataKeeper driver failed to queue a volume write.
40	Error	Cannot create a mirror on the drive where persistent bitmap files are stored. Mirror creation has been terminated. To create a mirror on this volume, change the BitmapBaseDir value in the ExtMirr driver Parameters registry key to use a different drive, and reboot.
48	Warning	The mirror has been deleted.
49	Warning	The mirror has been deleted. However, since the delete was performed during a mirror resynchronization, or before a previously-interrupted resynchronizaion was ever completed, the contents of the volume may be corrupted.
50	Warning	The mirror has been commanded to failover.
55	Error	Error 5 creating GUI pipe

55	Error	Error 5 creating GUI pipe
58	Error	An error occurred while writing a keep-alive packet over the network.
59	Error	An error occurred while writing a keep-alive packet over the network. The mirror will be BROKEN.
64	Error	An error occurred while writing a keep-alive packet over the network. The mirror will be PAUSED.
65	Error	An error occurred while writing data to the target over the network. The mirror will be BROKEN.
66	Error	An error occurred while writing data to the target over the network. The mirror will be PAUSED.
67	Error	An error occurred while attempting to read the response from the target machine over the network. The mirror will be broken.
68	Error	The target machine has reported an error in writing the sent data to its disk. The mirror will be broken.
69	Warning	A network error occurred while transmitting data to the target machine. An attempt will be made to reconnect with the target system without losing any mirrored write. The mirror will not be broken at this time.
70	Error	There was an error after attempting to reconnect to the target system. The mirror will be broken.
71	Info	Successfully recovered from a network failure.
72	Error	Error creating a volume named pipe.
73	Error	Error connecting to the existing volume named pipe, although the Target Control Thread is alive. The EM service will attempt to restart the volume pipe.
96	Info	A mirror resynchronization has begun.
97	Info	The mirror resynchronization has completed successfully.

98	Warning	During Resynchronization, a large number of passes to update the mirror has been made due to incoming writes. In order to ensure that the resynchronization will complete soon, please stop all write access to the volume.
99	Info	The mirror resynchronization has failed.
100	Error	The mirror resynchronization has been aborted due to a mirror state change.
101	Error	The mirror resynchronization has been aborted due to an error reading a block from the source volume.
128	Warning	This volume was not shutdown cleanly. As a result, the mirror could not be continued. An automatic mirror resynchronization will be performed to ensure that the source and target are in sync.
129	Warning	The mirror on this volume could not be continued as the volume was not in None state at the time of a system shutdown. An automatic mirror resynchronization will be performed to ensure that the source and target are in sync.
130	Warning	A continue of the mirror on this volume could not be performed as the volume was not in None state. This could be due to writes received during boot before a connection could be made to the target machine. An automatic mirror resynchronization will be performed to ensure that the source and target are in sync.
131	Warning	SIOS DataKeeper was told to continue a mirror on this volume during a system boot, but the registry value ""AutoResyncOnBoot"" was set to 2. This indicates that the volume should always be resynchronized in the event of a system reboot. As a result, an automatic mirror resynchronization will be performed to ensure that the source and target are in sync.
132	Warning	SIOS DataKeeper was told to continue a mirror on this volume, but the registry value ""AutoResyncOnContinue"" was set to 2. This indicates that the volume should always be resynchronized when continued. As a result, an automatic mirror resynchronization will be performed to ensure that the source and target are in sync.
133	Info	The mirroring of this volume will be continued.
134	Info	The mirroring of this volume will be continued.
135	Info	A mirror will be created for this volume.
136	Warning	A continue of the mirror could not be performed because the target drive was out of sync with the source. An automatic mirror resynchronization will be performed to ensure that the source and target are in sync. Volume Device: %%1
137	Error	The target side of the mirror creation has failed.

144	Warning	The volume could not be locked as requested.
145	Error	The volume could not be opened to lock it.
146	Info	The volume has been locked as requested
147	Warning	The volume has been unlocked as requested
148	Warning	The volume has not been unlocked as requested
149	Info	Open handles have been detected on this volume while trying to lock it.
150	Error	An invalid attempt to establish a mirror occurred. Both systems were found to be Source. This may have been due to all of LifeKeeper's Comm Paths being disconnected, the reconnected later, or by bringing the mirror into service on each of the systems individually without being able to contact the other system.
151		The target volume could not be accessed/locked during mirror creation.

		This could be because other processes have open handles on this volume, or the filesystem is corrupted.
152	Info	During the process of locking the target volume the driver has responded to IOCTL_DISK_IS_WRITABLE with a status code STATUS_MEDIA_WRITE_PROTECTED.
153	Warning	The user has deleted the drive letter assignment from a volume that is part of a mirror. Unless the drive letter mapping is re-established, this mirror will not be in a usable state.
154		The DataKeeper driver could not open the registry key.
155	Error	The DataKeeper driver could not query the registry value.
156	Info	Unable to get filesystem info (FSCTL_GET_NTFS_VOLUME_DATA).
160	Info	BEFORE %t%1
161	Info	AFTER %t%1
162	Warning	Unable to allocate storage for RemoteTargetInfo structure.
163	Error	The source system for this mirror has been changed.
164	Error	Unable to allocate storage during mirror creation.
165	Info	Cannot unlock target volume during resync, or until a previously-interrupted resync has been completed.
166	Warning	The remote system reports that a different machine is now the source for its mirror. The local mirror will be paused. To re-establish the mirror with this system as source, delete the current active mirror to the remote system, and continue the mirror from this system.
167	Error	Unable to connect to the volume port
167	Error	Unable to connect to the volume port

167	Error	Unable to connect to the volume port
167	Error	Unable to connect to the volume port
168	Error	Unable to initialize mirror on the target machine.
168	Error	Unable to initialize mirror on the target machine.
168	Error	Unable to initialize mirror on the target machine.
168	Error	Unable to initialize mirror on the target machine.

168	Error	Unable to initialize mirror on the target machine.
169	Warning	Unable to create bitmap to track writes on the target volume. This volume will not be able to be unlocked in read-write mode until a successful bitmap creation occurs, following a full or partial resync with the source, or following a reboot.
169	Info	Rewind thread for volume L: was unable to disable compression of the rewind log file.
170	Info	Successfully created bitmap to track writes on the target volume. This volume may now be unlocked in read-write mode.
171	Warning	Rewind logging is enabled for this volume, but the driver cannot communicate with rewind log service. The driver will log rewind data to its dump file instead, until communication with the rewind log daemon is restored.
172	Error	Rewind logging is enabled for this volume, but the target driver cannot allocate memory to read current disk contents. This is a critical rewind failure – the rewind feature will be disabled for this volume, and must be manually re-enabled.
173	Error	Rewind logging is enabled for this volume, but the driver cannot read current disk contents. This is a critical rewind failure – the rewind feature will be disabled for this volume, and must be manually re-enabled.
174	Info	Communication to the rewind log service has been re-established.
175	Error	The RewindLogLocation value is not found in the ExtMirr\Parameters registry key, or the value found is not a valid path. Time-indexed replay will be disabled. The RewindLogLocation value should be a REG_SZ value that contains the full path to the directory where time-indexed replay logs should be created – normally the RewindLog directory in the DataKeeper install directory.
176	Error	Unable to allocate memory for bitmap – mirror creation has failed
177	Error	Unable to create persistent file for bitmap. The persistent bitmap for this mirror will be marked Invalid.
178	Warning	Unable to delete persistent bitmap file.
179	Error	Unable to create BitmapWrite thread. The persistent bitmap for this mirror will be marked Invalid.
180	Error	The BitmapBaseDir value is not found in the ExtMirr\Parameters registry key, or the value found is not a valid path. Persistent Bitmap file creation will be disabled. The BitmapBaseDir value should be a REG_SZ value that contains the full path to the directory where persistent bitmaps should be created – normally the Bitmaps directory in the DataKeeper install directory.
181	Error	Unable to set the BitmapFileEnabled flag.
182	Error	Unable to set the BitmapFileValid flag.
183	Error	Unable to read data from the persistent bitmap file.
184	Error	Unable to write data to the persistent bitmap file.
185	Error	Unable to allocate memory to report target dirty bitmap. Mirror will be paused on the source system.

186	Error	Unable to receive target's dirty bitmap list.
187	Error	Unable to allocate memory to read bitmap file. The persistent bitmap for this mirror has been marked invalid.
188	Error	Unable to determine sector size or filesystem cluster size for disk where bitmap files are stored. The persistent bitmap for this device cannot be created. Please verify that the BitmapBaseDir registry value in the ExtMirr driver Parameters key is set to the correct path. BitmapBaseDir is currently set to >.
189	Error	Failover was detected on this volume. The Persistent Bitmap file was not in a valid state when the system went down, so a full resync will be performed.
192	Error	ending disk write tracking during switchover of volume %2. Remaining mirror creation will require full resync.
193	Error	Rewind logging is enabled for this volume, but the driver cannot write to the dump file to store rewind events. This is a critical rewind failure – the rewind feature will be disabled for this volume, and must be manually re-enabled.
194	Info	Rewind logging has been enabled for this volume.
195	Info	Rewind logging has been disabled for this volume.
196	Warning	An attempt to merge the bitmap from a writable target was made, but the bitmap bitmap file for one or more targets was not valid. Bits cannot be saved – a full resync to all targets is required after switchover.
197	Warning	An attempt to merge the bitmap from a writable target was made, but the target was not successfully queried for its bitmap file report, possibly due to a network failure. A full resync to all targets will be required after switchover.
198	Warning	The drive letter (2:) was unassigned from the volume containing DataKeeper bitmap files.
199	Error	Mirror creation failed due to an error creating the persistent bitmap file.
200	Error	Target-side mirror creation failed due to the switchover flag being set for this volume (G:). Use the CLEARSWITCHOVER option in EmCmd to clear this flag.
201	Info	
202	Info	The DataKeeper driver has detected that networking is now available.
203	Error	Mirror switchover failed due to the error below.

234	Warning	Cannot enable snapshot for volume %2 – volume size is 0.
235	Warning	Cannot enable snapshot for volume %2 – bitmap allocation failed – out of memory.
236	Warning	Cannot enable snapshot for volume %2 – snapshot thread creation failed with status %3.
237	Warning	While disabling snapshot for volume %2, unable to lock volume (status %3).
238	Error	Volume %2: Mirror role is Source, but no targets found in the registry. Changing role to None and forcing full resync.
239	Info	Wrote the following string to SharedOwner file on volume %2:
240	Info	Read the following string from SharedOwner file on volume %2:
241	Warning	Data read from the shared owner file on volume %2 was unexpected – does not appear to be a string.
242	Warning	Data to be written to the shared owner file on volume %2 was unexpected – does not appear to be a string.
243	Error	Cannot claim ownership of shared volume %2 – Unable to start the Shared Owner watch thread, status %3.
244	Error	Cannot claim ownership of shared volume %2 – unable to create Shared Owner file, status %3.
245	Error	Cannot claim ownership of shared volume %2 – unable to get our ComputerName, status %3.
246	Error	Cannot claim ownership of shared volume %2 – unable to allocate buffer for shared file I/O, status %3.
247	Error	Failed to read or write Shared Owner file for shared volume %2. Status %3.
248	Error	During volume lock of shared volume %2, failed to initiate thread to modify Shared Owner file, status %3.
249	Error	Unable to unlock shared volume %2, failed to claim shared owner file, status %3.
250	Warning	Unable to allocate target sequence tracking array. This is not a major error but may result in a full resync in the event of a failover.
251	Info	Successfully allocated target sequence tracking array.
252	Warning	Unable to allocate target sequence tracking list entry. This is not a major error but may result in a full resync to some targets in the event of a failover.
253	Error	An invalid packet payload of type %2 was encountered.
254	Error	A received packet payload goes over the end of the total packet size.
255	Error	The data received in the packet payload was not in the expected form.
256	Warning	Received a duplicate packet payload of type %2.
257	Warning	Unable to allocate a flush header – this may indicate a memory shortage. It is not a critical DataKeeper error.
258	Warning	DataKeeper sequence number tracking encountered a condition that could lead to a full resync.
259	Warning	DataKeeper sequence number tracking encountered a condition that could lead to a full resync to the given target.
260	Warning	DataKeeper sequence number tracking encountered a condition that requires a full resync.
261	Warning	DataKeeper sequence number tracking encountered a condition that requires a full resync to the given target.
262	Error	An invalid response packet was received from the target system. A display of the relevant sequence numbers is given below.
263	Error	Unable to set the value for the mirror.

264	Error	The state of this mirror changed to a Non-Mirroring state, but the cluster was not notified within the specified timeout. All pending writes to this volume will be failed, and the volume will be locked.
265	Error	The state of this mirror changed to a Non-Mirroring state, but the attempt to notify the cluster failed. All pending writes to this volume will be failed, and the volume will be locked.
266	Warning	An invalid attempt to establish a mirror occurred. The volume on the remote system is now a Target of a different Source system.
267	Warning	Mirror create fails for shared volume %2 – ineligible to become a target.
268	Warning	Unable to allocate storage for SavedBitmapInfo structure during switchover.
269	Warning	Unable to allocate an MDL packet in the current chaining loop (#%2). This may indicate a memory shortage. It is not a critical DataKeeper error.
270	Error	Unable to initialize RemoteTargetInfo structure.
271	Error	Unexpected device removal during mirror initialization – aborting mirror creation.
272	Error	An invalid attempt to establish a mirror occurred. Both systems were found to be Source.
273	Error	Source and target volume sector sizes don't match.
274	Error	Unexpected device removal – driver was not previously notified to clean up.
275	Info	Initiate switchover to source for volume %2.
276	Error	Switchover to source for volume %2 failed – %3.
277	Error	An invalid attempt to establish a mirror occurred. Both systems were found to be Source.
278	Error	At the last reboot, there were writes on volume %2 which were not tracked in a persistent bitmap. A full resync of this volume is required.
279	Info	Incoming writes are being temporarily blocked in order to allow mirror resync to complete.
280	Info	Resync complete – unblocking writes.
281	Error	The resync unblock timer expired – unblocking writes and terminating resync.

8.11.3.4. SIOS SDRSnapin (DataKeeper GUI) Message Catalog

Use **Control F** to search for a specific error code.

Code	Severity	Message	Cause	
0	Error	SDRDataKeeperService: Mirror creation failed, rolling back the job endpoint.		
0	Warning	SDRDataKeeperService: Resolving split brain. WMSSVR:E is to become the source with WMSSVR1:E as its target		
0	Warning	DataReplication.Cacher: Item fetch failed, updating the cache time for key 'volumeinfo.MACHINE.FQDN.vol-J'		
0	Warning	DataReplication.Cacher: Item fetch failed, updating the cache time for key 'mirrorconfiguration.MACHINE.FQDN.vol-G.target-10.0.5.15.compression'		
0	Error	CompleteMirrorPairsWindow: Failed to create the relationship. This is an invalid configuration and is not supported.		This from rela the cre look rela be i mus num the Exa 1 re 3 sy rela syst rela
0	Error	SDR.StateUpdater: Failed to get volume information from server 'MACHINE.FQDN': System.ApplicationException: Failed to open a connection to MACHINE.FQDN (error_code = 2)	2	
0	Error	SDR.StateUpdater: Failed to get compression, bwlimit, and/or target infos information from server 'MACHINE': System.ApplicationException: Mirror operation failed (error_code = 2)	2	
0	Error	DataKeeperSnapIn: Failed to show modal dialogSystem.Reflection.TargetInvocationException: Exception has been thrown by the target of an invocation. —> System.ApplicationException: Volume operation failed (error_code = 2)	2	
0	Error	NewMirror.NewMirrorWizard: Failed to create the mirror or prompt to complete mirror pairsSystem.ApplicationException: Volume operation failed (error_code = 5)	5	
0	Error	SDR.StateUpdater: Failed to get volume information from server 'MACHINE': System.ApplicationException: getVolumeInfo(...) failed (error_code = 15)	15	
0	Error	ResolveSplitbrainsWindow: Failed to launch resolve splitbrains windowSystem.ApplicationException: Volume operation failed (error_code = 22)	22	

0	Warning	SDR.Mirror: The post-pause unlock request failed: System.ApplicationException: Volume operation failed (error_code = 22)	22	
0	Error	NewMirror.NewMirrorWizard: Failed to create the mirror and/or complete mirror pair informationSystem.ApplicationException: Mirror operation failed (error_code = 33)	33	Ver "Dis Tra serv star "Ma
0	Error	ClientLibrarySDRService: Connectivity test failed for server 'MACHINE.FQDN': SteelEye.DAO.DataReplication.Exception.ServiceNotFoundException: Failed to open a connection to MACHINE.FQDN (error_code = 53)	53	
0	Error	DataReplication.ClientLibrarySDRService: Failed to get the state/pre-lock the target volume (probably due to an inaccessible target system from here): SteelEye.DAO.DataReplication.Exception.ServiceNotFoundException: Failed to open a connection to 10.30.89.11 (error_code = 53)	53	Ver Mic che
0	Warning	SDR.SDRDataKeeperService: Reconnecting previously connected server, at startup, failed: SteelEye.DAO.DataReplication.Exception.ServiceNotFoundException: Failed to open a connection to 10.1.0.189 (error_code = 53)	53	
0	Error	StateUpdater: Failed to get compression, bwlimit, and/or target information for volume 'N' from server 'WINSUPB': SteelEye.DAO.DataReplication.Exception.ServiceNotFoundException: Failed to open a connection to WINSUPB (error_code = 53)	53	
0	Error	StateUpdater: Failed to get volume information from server 'MACHINE.FQDN': SteelEye.DAO.DataReplication.Exception.ServiceNotFoundException: Failed to open a connection to MACHINE.FQDN (error_code = 53)	53	Ver Mic che
0	Error	StateUpdater: Failed to get compression, bwlimit, and/or target infos information from server 'MACHINE.FQDN': SteelEye.DAO.DataReplication.Exception.ServiceNoLongerAvailableException: Failed to open a connection to MACHINE.FQDN (error_code = 64)	64	
0	Error	StateUpdater: Failed to get volume information from server 'MACHINE': SteelEye.DAO.DataReplication.Exception.ServiceNoLongerAvailableException: Failed to open a connection to MACHINE (error_code = 64)	64	
0	Error	StateUpdater: Failed to get volume information from server 'MACHINE.FQDN': System.ApplicationException: getVolumeInfo(...) failed (error_code = 232)	232	
0	Error	SDRDataKeeperService: Unexpected error in update loop (legacy job generation pass): System.ApplicationException: Volume operation failed (error_code = 234)	234	
0	Error	NewMirror.NewMirrorWizard: Failed to create the mirror and/or complete mirror pair informationSystem.ApplicationException: Mirror operation failed (error_code = 995)	995	995 to a issu (ma syst on p to m ping FQD syst syst con
0	Error	NewMirror.NewMirrorWizard: Failed to create the mirror or prompt to complete	995	

		mirror pairs.System.ApplicationException: Mirror operation failed (error_code = 995)		
0	Error	SDRDataKeeperService: Mirror creation failed: System.ApplicationException: Mirror operation failed (error_code = 995)	995	Che SR port ass driv Por
0	Error	NewMirror.NewMirrorWizard: Failed to create the mirror or prompt to complete mirror pairsSystem.ApplicationException: Mirror operation failed (error_code = 1225)	1225	Loc corr in S abo con (0x ID 1 Eve CLE FLA
0	Error	ResolveSplitbrainsWindow: Failed to launch resolve splitbrains windowSystem.ApplicationException: Mirror operation failed (error_code = 1235)	1235	
0	Error		1265	The a po com Plea you serv auth Net syst ;Do
0	Error	SteelEye.Dialogs.AddServerWindow: Failed to connect to server: MACHINE.FQDNSystem.ApplicationException: Failed to open a connection to MACHINE.FQDN (error_code = 1326)	1326	132 Sec Che in V Don dom res Che
0	Warning	SteelEye.Dialogs.NewMirror.NewMirrorSource: Failed to go to next wizard pageSystem.NullReferenceException: Object reference not set to an instance of an object.	FAILED TO GET NEXT WIZARD PANE	
0	Error	SDRDataKeeperService: Mirror creation failed, rolling back the job endpoint.	MIRROR CREATION FAILED, ROLLING BACK THE JOB ENDPOINT	
0	Warning	SteelEye.Views.JobView: Failed to update after selected target changedSystem.InvalidOperationException: The following operation is not valid because the class View has shut down: Clear.	OPERATION NOT VALID	

0	Error	JobListView: Failed to handle right button upSystem.InvalidOperationException: ShowContextMenu requires that an item be selected.	RIGHT BUTTON	
0	Warning	SDR.SDRDataKeeperService: Resolving split brain. MACHINE.FQDN:F is to become the source with MACHINE.FQDN:F as its target	SPLIT BRAIN	
0	Warning	DataReplication.ClientLibrarySDRService: Extended volume info not available for volume 'M' on server 'WINSUPA.QATEST.COM'	Extended Volume Info not available	
1053	Warning	SDR.StateUpdater: Server 'MACHINE.FQDN' (via MACHINE) looks dead! Setting it's flag and ignoring until we check again. Error: System.ApplicationException: Failed to open a connection to MACHINE (error_code = 2)	2	
1053	Warning	SDR.StateUpdater: Server 'DEV-LRX3-12.DEVELOPMENT.SCHQ.SECIOUS.COM' (via DEV-LRX3-12.DEVELOPMENT.SCHQ.SECIOUS.COM) looks dead! Setting it's flag and ignoring until we check again. Error: System.ApplicationException: Failed to open a connection to DEV-LRX3-12.DEVELOPMENT.SCHQ.SECIOUS.COM (error_code = 51)	51	
1053	Warning	SDR.StateUpdater: Server 'MACHINE.FQDN' (via MACHINE.FQDN) looks dead! Setting it's flag and ignoring until we check again. Error: SteelEye.DAO.DataReplication.Exception.ServiceNotFoundException: Failed to open a connection to MACHINE.FQDN (error_code = 53)	53	
1053	Warning	SDR.StateUpdater: Server 'MACHINE.FQDN' (via MACHINE.FQDN) looks dead! Setting it's flag and ignoring until we check again. Error: SteelEye.DAO.DataReplication.Exception.ServiceNoLongerAvailableException: Failed to open a connection to MACHINE.FQDN (error_code = 64)	64	
1053	Warning	SDR.StateUpdater: Server 'WMS1' (via 200.200.200.18) looks dead! Setting it's flag and ignoring until we check again. Error: System.ApplicationException: Failed to open a connection to 200.200.200.18 (error_code = 1229)	1229	
1053	Warning	StateUpdater: Server '007IT-NAS-TW2' (via 192.168.10.2) looks dead! Setting it's flag and ignoring until we check again. Error: System.ApplicationException: Failed to open a connection to 192.168.10.2 (error_code = 1231)	1231	
1053	Warning	SDR.StateUpdater: Server 'MACHINE.FQDN' (via MACHINE.FQDN) looks dead! Setting it's flag and ignoring until we check again. Error: System.ApplicationException: Failed to open a connection to MACHINE.FQDN (error_code = 1326)	1326	
1053	Warning	SDR.StateUpdater: Server 'MACHINE.FQDN' (via MACHINE.FQDN) looks dead! Setting it's flag and ignoring until we check again. Error: System.ApplicationException: Failed to open a connection to MACHINE (error_code = 1450)	1450	
2053	Warning	SDR.StateUpdater: Server 'MACHINE.FQDN' (via MACHINE.FQDN) has come back to life!	COME BACK TO LIFE!	

8.11.4. Restrictions

Included below are restrictions associated with DataKeeper and DataKeeper Cluster Edition as well as possible workarounds and/or solutions.

[Bitlocker Does Not Support DataKeeper](#)

[CHANGEMIRRORENDPOINTS Restriction](#)

[CHKDSK](#)

[DataKeeper Volume Resize Restriction](#)

[Directory for Bitmap Must Be Created Prior to Relocation](#)

[Duplicate IP Addresses Disallowed Within a Job](#)

[Intensive I-O with Synchronous Replication](#)

[Resource Tag Name Restrictions](#)

[SQL FCI on Workgroup Clusters](#)

8.11.4.1. Bitlocker Does Not Support DataKeeper

According to Microsoft, Bitlocker is not supported to work with Software RAID configurations. Since DataKeeper is essentially a software RAID 1, Microsoft does not support Bitlocker working with DataKeeper.

Note: EFS (Encrypting File System) and TDE (Transparent Disk Encryption) are compatible with DataKeeper and can be used to encrypt data. In addition, both will also encrypt the data sent over the network by DataKeeper.

The specific article and section can be found here:

https://technet.microsoft.com/en-us/library/ee449438#BKMK_R2disks

8.11.4.2. CHANGEMIRRORENDPOINTS

Description:

This command, which is used to move a DataKeeper protected volume to another network location, only supports changing the endpoints of a mirrored volume that is configured on 3 nodes or fewer.

Workaround:

For configurations greater than three nodes, the mirrors must be deleted and recreated with the final endpoint at the local site and use route adds to get the mirrors created and resynced before moving the server to the final location/address/DR site.

8.11.4.3. CHKDSK

Description

If you must run CHKDSK on a volume that is being replicated by SIOS DataKeeper, it is recommended that you **PAUSE** the mirror before initiating the CHKDSK. After running CHKDSK, **CONTINUE** the mirror. A [partial resync](#) occurs (updating those writes generated by the CHKDSK) and replication will continue.

Note: The bitmap file (for non-shared volumes) is located on the C drive which is defined by [BitmapBaseDir](#) as the default location. Running CHKDSK on the C drive of the **Source** system will cause an error due to the active bitmap file. Therefore, a switchover must be performed so that this Source becomes Target and the bitmap file becomes inactive. The CHKDSK can then be executed on this system as the new target (original source).

8.11.4.4. DataKeeper Volume Resize Restriction

The DataKeeper volume resize procedure should be performed on only one volume at a time.

8.11.4.5. Directory for Bitmap Must Be Created Prior to Relocation

Description

If you choose to relocate the bitmap file from the default location (**%EXTMIRRBASE%\Bitmaps**), you must first create the new directory before changing the location in the registry and rebooting the system.

8.11.4.6. Duplicate IP Addresses Disallowed Within a Job

A DataKeeper job contains the endpoint information for all mirrors that are part of the job. This information includes the host name, IP address, and drive letter of each mirror endpoint.

Within a job, an IP address cannot be duplicated on more than one node. For example, in a 4-node job, nodes "A" and "B" may be configured with a private network connection, and nodes "C" and "D" may be configured with a separate private network connection. However, the IP addresses on those private networks must be unique for each node. If nodes A and B use 192.168.0.1 and 192.168.0.2 for replication, then nodes C and D cannot also use 192.168.0.1 or 192.168.0.2 for replication.

8.11.4.7. Intensive I-O with Synchronous Replication

Description

Due to the nature of synchronous replication (blocking volume writes while waiting for a response from the target system), you may experience sluggish behavior with any applications that are writing to the mirrored volume. The frequency of these events could be high depending on the ratio of “Volume I/O traffic” to “system resource”. It is recommended that you use asynchronous replication when continuous and intensive I/O traffic is anticipated for the volume or when SIOS DataKeeper is used on a low bandwidth network.

8.11.4.8. Resource Tag Name Restrictions

Tag Name Length

All tags within DataKeeper may not exceed the 256 character limit.

Valid “Special” Characters

-	_	.	/
---	---	---	---

However, the first character in a tag should not contain “.” or “/”.

Invalid Characters

+	:	!	@	#	\$	*	=	“space”
---	---	---	---	---	----	---	---	---------

8.11.4.9. SQL FCI on Workgroup Clusters

According to Microsoft, SQL Server failover cluster instance (FCI) requires the cluster nodes to be domain joined. Due to this restriction SIOS DataKeeper Cluster Edition cannot be used to protect Microsoft SQL Server Failover Cluster Instances in a workgroup environment.

8.12. Solutions

How to properly use AWS instance storage (ephemeral storage/disk)

- If SIOS AMIs are not being deployed on an AWS server, these disk initialization steps must be considered. This was introduced with Windows 2016 and continues in later releases.
 - AWS ephemeral storage (Instance Store) must be initialized every time a node starts up from a “cold” shutdown (i.e. having been shut down in the AWS Console or from a CLI “shutdown /s” from Windows – not a reboot).
 - Windows 2012 R2 performs this step automatically (Ec2Config service). AWS includes scripts (EC2Launch) to perform this initialization but the script has to be manually scheduled by the user so that it runs at boot time.
 - The SIOS AMIs on AWS have this task set up automatically. If you launch your own Windows image in AWS and fail to set the script up to run at boot, and you are using ephemeral storage for bitmaps (as recommended in [Best Practices](#)), the bitmap file/volume will be missing and DataKeeper mirrors will not recreate.

SOLUTION

- Launch Disk Management and make sure the ephemeral storage is on-line, healthy, and is assigned the volume letter you selected for the ephemeral storage.
- Ensure that the drive/drive letter assigned to the ephemeral storage is listed in the registry located at `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters . . . BitmapBaseDir`

Note: Apply this workaround to all nodes in the cluster.

LONG TERM SOLUTION

Schedule the EC2Launch script to run at boot time on each system in the cluster to ensure that the ephemeral storage is always available.

How to change the hostname of an existing license

- From the [License Support menu](#) select **List License**
- Select the checkbox for the license you want to change (you can only do one license at a time)
- Click the **Action** dropdown and select **Repair**
- Enter the new hostname
- Select **Repair** then select **Complete**

How to deploy OpenJDK on LifeKeeper

Download OpenJDK, the Windows x64 Installer, from <https://openjdk.java.net/>

Deploy the software on the Target node first

In LifeKeeper, perform a switchover/In-Service

Repeat the steps above on other Target(s) after the switchovers are completed

Note: This is a Highly Available deployment as you are never installing the software on the Source/Active node.

From a Command Prompt

type **javac -version**

Your output should be as follows:

“C:\Windows\system32>javac -version javac 14.0.1”

If not, you may need to add the following to your Systems Variable PATH/environment:

- Control Panel\System and Security\System\System Properties\
- Select the **Advance Tab**
- Select **Startup and Recovery**
- Select **Environment Variables...**
- Select **Path** and then **Edit**

Add *C:\Program Files\Java\jdk-14.0.1\bin* to your string to reflect the following in the example below:

```
C:\Program Files (x86)\Common
Files\Oracle\Java\
javapath;SystemRoot%\system32;%SystemRoot;%SystemRoot%\System32\
Wbem;%SYSTEMROOT%\System32\WindowsPowerShell\v1.0\;C:\Program
Files\Microsoft SQL Server\Client SDK\ODBC\110\Tools\Binn\;C:\Program Files
(x86)\Microsoft SQL Server\120\Tools\Binn\;C:\Program Files\Microsoft SQL Server\120\
Tools\Binn\;C:\Program Files\Microsoft SQL Server\120\DTS\Binn\;C:\Program Files
(x86)\Microsoft SQL Server\120\Tools\Binn\ManagementStudio\;C:\Program
Files (x86)\Microsoft SQL Server\120\DTS\Binn\;C:\Program Files\Java\jdk-14.0.1\bin
```

Perform the aforementioned on all nodes in your cluster(s).

How to recreate a mirror for an existing clustered DataKeeper Resource

Problem:

A customer may have experienced some issues where a DataKeeper Resource is listed as Offline via Windows Server Failover Cluster.

Note: An existing job in the DataKeeper GUI will most likely have a **RED X status**

Solution:

Remove all of the old mirror remnants from the Source and Target nodes Manually recreate the mirror via the `emcmd . createmirror` command

To remove the mirror configuration from both nodes:

- `cd %extmirrbase%/support` (This is a shortcut to the DataKeeper\Support directory)
- run “`cleanupmirror (drive letter)`” **Note: Run this command on the Source first.** This command performs the following:
 - deletes the local mirror only (NO DATA)
 - resets the switchover flag
 - notifies the driver and service that no mirror is present

To verify that the mirror has been properly removed, execute the following:

- `cd extmirrbase` (This is a shortcut to the DataKeeper directory)
- run “`emcmd . getmirrorvolinfo (drive letter)`”
The output should reflect no mirror e.g. `0 servername 0`

Now you are in a position to manually recreate the mirror.

The syntax is as follows:

- `emcmd (Source IP) createmirror (drive letter) (Target IP) A or S (Async mirror/Sync Mirror)`
Upon completion, the DataKeeper UI will now reflect a Resyncing status. This can also can be verified from a command line by executing:
- `emcmd . getmirrorvolinfo e`
The output will reflect “E: 1 servername (Target IP) 2, where 2 is a mirror definition, indicating a Resyncing status

Return to Windows Failover Clustering and online the Failed DataKeeper Resource

How to determine what GPOs have been applied to a server**Problem:**

Group Policy Objects are sometimes deployed or redeployed after a server is rebooted impacting the way the LifeKeeper (GUI) or DataKeeper may or may not perform.

Solution:

There are two methods:

From Start\Run enter **rsop.msc**

- The console will provide a list of policies that have been applied to a server

Or from an elevated command prompt, enter **gpresult /Scope Computer /v**

- This output will display a list of policies that have been applied to a server

Note: To determine what GPOs are being enforced per a user, enter **gpresult /Scope user /v**

Deleting mirrorendpoints

Steps to delete mirrorendpoints:

- Go in the registry for the node
- Go to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\ExtMirr\Parameters\Jobs
- Find the job for that endpoint and remove the endpoint from that job

9. DKCE Support Matrix

Server Components

Supported Operating System	v8.6.1	v8.6.2	v8.6.3	v8.6.4	v8.7.0	v8.7.1	v8.7.2	v8.8.0
Microsoft Windows Server 2008 Enterprise and DataCenter Editions								
Microsoft Windows Server 2008 R2 Enterprise and DataCenter Editions	64-bit							
Microsoft Windows Server 2012 Standard and DataCenter Editions	64-bit							
Microsoft Windows Server 2012 R2 Standard and DataCenter Editions	64-bit							
Microsoft Windows Server 2016 Standard and DataCenter Editions	64-bit							
Microsoft Windows Server 2019 Standard and DataCenter Editions				64-bit	64-bit	64-bit	64-bit	64-bit

Note: The operating system versions listed above are supported for guests running on the following virtual platforms:

- Microsoft Azure
- Azure Stack on Windows 2019
- VMware vSphere 5.5, 6.0, 6.5, 6.7, 7.0
- Microsoft Hyper-V Server 2008 R2 or later
- Google Cloud
- Amazon EC2 (AWS)

User Interface Components

Supported Operating System	v8.6.1	v8.6.2	v8.6.3	v8.6.4	v8.7.0	v8.7.1	v8.7.2	v8.8.0
Microsoft Windows Server 2008	64-bit							
Microsoft Windows Server 2008 R2	64-bit							

Note: The operating system versions listed above are supported for guests running on the following virtual platforms:

- Microsoft Azure
- Azure Stack on Windows 2019
- VMware vSphere 5.5, 6.0, 6.5, 6.7, 7.0
- Microsoft Hyper-V Server 2008 R2 or later
- Google Cloud
- Amazon EC2 (AWS)

Supported Operating System	v8.6.1	v8.6.2	v8.6.3	v8.6.4	v8.7.0	v8.7.1	v8.7.2	v8.8.0
Microsoft Windows Server 2012	64-bit							
Microsoft Windows Server 2012 R2	64-bit							
Microsoft Windows Server 2016	64-bit							
Microsoft Windows Server 2019				64-bit	64-bit	64-bit	64-bit	64-bit
Windows XP								
Windows Vista								
Windows 7	64-bit							
Windows 8	64-bit							
Windows 8.1	64-bit							
Windows 10						64-bit	64-bit	64-bit

Note: The operating system versions listed above are supported for guests running on the following virtual platforms:

- Microsoft Azure
- Azure Stack on Windows 2019
- VMware vSphere 5.5, 6.0, 6.5, 6.7, 7.0
- Microsoft Hyper-V Server 2008 R2 or later
- Google Cloud
- Amazon EC2 (AWS)

Installing Localized Language Supplement

LifeKeeper for Windows Localized Language Supplements are available to support LifeKeeper running in a localized environment. The Localized Language Supplement contains translated LifeKeeper GUI text strings and context-sensitive help in the localized language. For LifeKeeper v7.2.1 and beyond, language supplements are available for Japanese language. The SIOS Protection Suite for Windows Core installation program installs the required version of JRE.

The Japanese Localized Language Supplement includes language content for the SIOS Protection Suite including LifeKeeper and DataKeeper products. The administrator can select which product to update. The DataKeeper mmc-based GUI requires the Windows language pack be installed unless the complete localized OS is already installed.

The LifeKeeper for Windows Localized Language Supplement, like the SIOS Protection Suite Core, is installed via InstallShield. The installation requires no selection for Typical/Compact/Custom options. To install the LifeKeeper for Windows Localized Language Supplement, run the setup program shipped with the Localized Language Supplement product.

To repair an existing installation of LifeKeeper for Windows Localized Language Supplement, run the setup program and choose **Repair** from the list of InstallShield options.

To remove LifeKeeper for Windows Localized Language Supplement, run **Add/Remove Programs** from the **Windows Control Panel**. The Localized Language Supplement must be removed before removing the LifeKeeper core product.