



Technical Report

Best Practices and Prescriptive Guidance for NetApp SMI-S Agent 5.0

Santhosh Harihara Rao, Chris Lionetti, NetApp
July 2013 | TR-4205

Abstract

In Virtual Machine Manager (VMM) 2012, you can discover, classify, and provision remote storage on supported storage arrays through the VMM console. VMM fully automates the assignment of storage to a Hyper-V™ host or Hyper-V host cluster and tracks the storage that is managed by VMM.

To enable the new storage features, VMM 2012 uses the new Microsoft® Storage Management Service to communicate with external arrays through a Storage Management Initiative Specification (SMI-S) Agent. The Storage Management Service is installed by default during the installation of VMM 2012. You must install a supported SMI-S Agent on an available server and then connect the agent to VMM 2012 management. NetApp® Data ONTAP® SMI-S Agent helps to manage NetApp storage systems by using SCVMM 2012 SP1.

TABLE OF CONTENTS

1	Overview	4
2	SMI-S Agent 5.0 Features	4
3	NetApp SMI-S Agent Architecture	4
4	Setup and Configuration	5
4.1	Environment Prerequisites	6
4.2	Setting up and Configuring SMI-S Agent	6
4.3	Populating the SMI-S Agent with NetApp Targets to Manage	6
4.4	Setting up and Configuring SCVMM 2012 SP1	7
4.5	Installation of NetApp PowerShell Toolkit	8
5	Discovering Storage System in SMI-S Agent and Adding SMI-S Agent in SCVMM	8
5.1	Discovery	8
6	Classification of Storage in SCVMM 2012 SP1	11
6.1	Storage Allocation	12
7	Provisioning	12
7.1	Provisioning a LUN for SAN Environments	12
7.2	Provisioning a CIFS Share for SMB 3.0 Environments (Windows Server 2012)	13
8	Indications	14
9	Use Cases	15
9.1	Rapid Provisioning of Virtual Machines in a SAN Environment	15
10	Upgrading the SMI-S Agent	17
11	Scalability and Performance	17
12	Troubleshooting	17
13	Glossary	17

LIST OF TABLES

Table 1)	Command parameters	7
Table 2)	Command parameters	9
Table 3)	Scalability measurements	17

LIST OF FIGURES

Figure 1) Logical diagram of Data ONTAP SMI-S Agent 5.0 interaction with NetApp storage systems.	5
Figure 2) Enter the IP address of the SMI-S server along with account details.....	10
Figure 3) Classification of storage.	11

1 Overview

The NetApp Data ONTAP SMI-S Agent allows administrators to manage and monitor NetApp FAS storage systems through open standard protocols and classes defined by two organizations:

- [Distributed Management Task Force \(DMTF\)](#)
- [Storage Networking Industry Association \(SNIA\)](#)

The Data ONTAP Storage Management Initiative Specification (SMI-S) Agent is a command-based interface that detects and manages platforms that run Data ONTAP. SMI-S Agent uses web-based enterprise management (WBEM) protocols, which allow you to manage, monitor, and report on storage elements.

Data ONTAP SMI-S Agent 5.0 can be installed on both Windows® and Linux® platforms.

This SMI-S integration is designed to allow end-to-end discovery of logical and physical objects and the associations between them, add capacity to hosts/clusters, and rapidly provision VMs using the SAN and SMB 3.0. The SMI-S Agent interface can also be used to allow simple tasks to be accomplished using System Center Virtual Machine Manager (SCVMM) to create and deploy new storage to individual hosts or clusters.

The SMI-S integration does not prevent the use of SnapDrive®, System Manager, or Data ONTAP PowerShell Toolkit scripts from also creating or provisioning LUNs, either new or from NetApp Snapshot™ copies. If other tools are used, the SMI-S Agent will over time catch up with the newly deployed assets.

Compliance to SMI-S standards is defined by the [Conformance Test Program](#) set by SNIA. Data ONTAP SMI-S Agent 5.0 is compliant with SMI-S 1.5 and 1.6 specifications.

2 SMI-S Agent 5.0 Features

- Complies with the SMI-S 1.5 and SMI-S 1.6 specifications set by SNIA.
- Manages and monitors NetApp storage systems.
 - Support for Data ONTAP 7.3.5 or later for 7-Mode systems.
 - Support for clustered Data ONTAP 8.2.
- Supports provisioning of SAN and NAS environments for NetApp storage systems using Microsoft SCVMM 2012 SP1.
- Supports lifecycle indications that monitor SMI-S operations.
- Supports ASUP™ reporting.

Refer to the installation and administration guide for the latest supported operating systems, Data ONTAP versions, platforms, and hardware requirements.

3 NetApp SMI-S Agent Architecture

Data ONTAP SMI-S Agent 5.0 includes three components that allow administrators to manage and monitor NetApp FAS storage systems:

- Common Information Model Object Manager (CIMOM)
- Provider objects
- Repository

CIMOM is the foundation for the Data ONTAP SMI-S Agent. CIMOM collects, validates, and authenticates each application request and then responds to the application. It becomes a conduit for each request by invoking the appropriate command to handle each request.

Applications that interact with the SMI-S Agent are SCVMM and the Windows Storage Management Service feature in Windows Server® 2012. These applications register with the SMI-S Agent to perform storage management tasks on NetApp FAS storage systems.

When an application issues a command or query to the SMI-S Agent, CIMOM loads a shared library object, invokes it to handle a request, and returns the resulting information to the application. CIMOM uses a flat-file database for its repository. It stores persistent data required at the CIM level. Data ONTAP SMI-S Agent uses CIM-XML encoding over HTTP and service location protocol (SLP).

Figure 1) Logical diagram of Data ONTAP SMI-S Agent 5.0 interaction with NetApp storage systems.

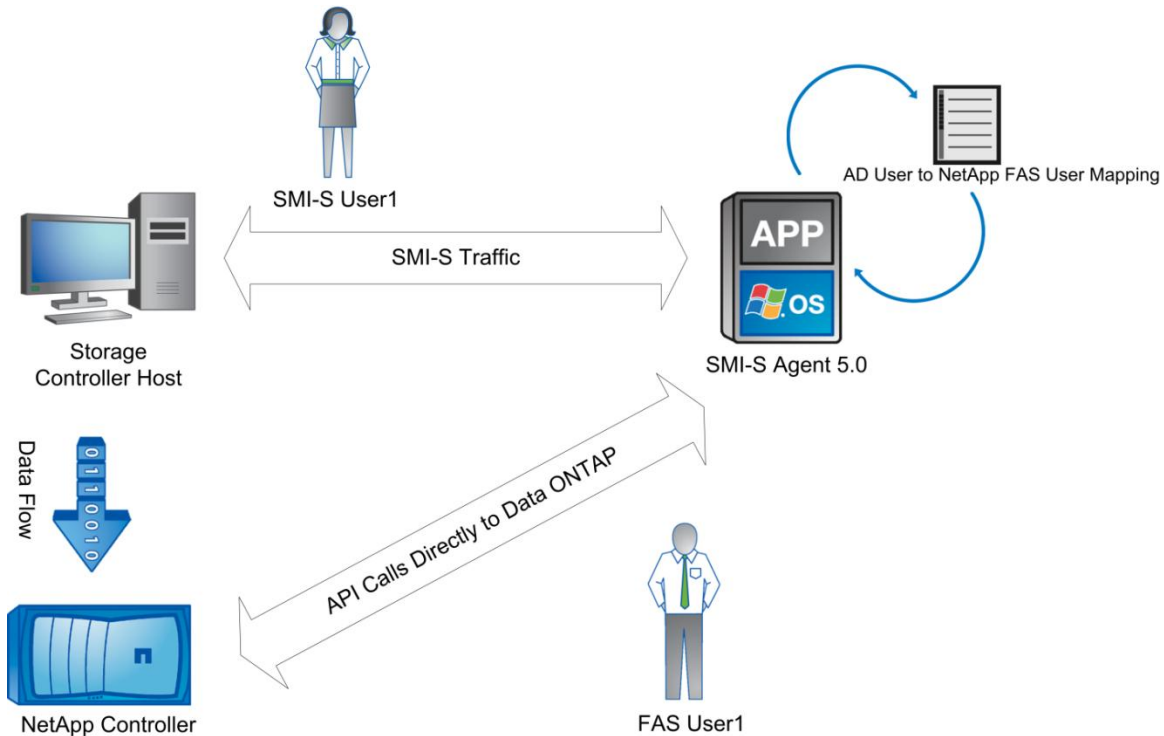


Figure 1 shows how Data ONTAP SMI-S Agent interacts with NetApp storage when Data ONTAP SMI-S Agent receives a query or command from a storage management application or storage consumer host. Note the following:

- SMI-S Agent stores the user name and credentials for the NetApp storage systems.
- SMI-S Agent keeps a record of the storage with which the SMI-S user (Windows account) is allowed to communicate.
- The data flow using NFS, CIFS, iSCSI, Fibre Channel (FC), or Fibre Channel over Ethernet (FCoE) has nothing to do with the SMI-S communication. Only management traffic, not data, is sent through the SMI-S communication path.

4 Setup and Configuration

A number of assumptions are made that your environment has been set up according to best practices described. Refer to the following best practice guides when setting up your environment:

- [TR-3702: NetApp Storage Best Practices for Microsoft Virtualization and NetApp SnapManager for Hyper-V](#)
- [TR-4172: Microsoft Hyper-V over SMB 3.0 with Clustered Data ONTAP: Best Practices](#)

4.1 Environment Prerequisites

The following are prerequisites for SMI-S installation:

- An active [NetApp Support](#) account
- AD/DNS infrastructure with administrator credentials
- NetApp storage systems running Data ONTAP 7.3.5 or higher for Data ONTAP 7-Mode systems
- NetApp storage systems running clustered Data ONTAP 8.2
- SCVMM 2012 SP1
- Appropriate licenses for the protocol (iSCSI, FCP, or CIFS) that will be used on the NetApp target
- FlexClone[®] license for creation of LUN clones
- Download and installation of [Data ONTAP PowerShell Toolkit](#) on the SCVMM server to build custom storage-related workflows

Windows Failover Clusters

It is expected that when the guidance in [TR-3702](#) is followed, your Windows failover cluster should be able to successfully pass the Microsoft Windows failover cluster validation process. Do not continue with this report unless your Windows failover cluster environment is healthy and operational. This should include support for quorum disks and for CSVs being enabled.

SMB 3.0 Environments

Follow the guidelines provided in [TR-4172: Microsoft Hyper-V over SMB 3.0 with Clustered Data ONTAP: Best Practices](#) before proceeding to manage Hyper-V over SMB 3.0 environments using SMI-S.

Note: IPv6 is not supported with Data ONTAP SMI-S Agent.

4.2 Setting up and Configuring SMI-S Agent

The NetApp SMI-S Agent 5.0 can be downloaded directly from the [NetApp Support](#) site.

1. Select Downloads > Software.
2. From the list, choose Data ONTAP SMI-S Agent.
3. Select your Windows OS and click Go.
4. After you have accepted the license terms, you will find the system requirements for the SMI-S Agent software as well as a link to the Data ONTAP SMI-S Agent Installation and Configuration Guide (ICG).

The SMI-S Agent can easily be run within a virtual machine because only IP connectivity to the SCVMM/SCOM server and NetApp storage controllers is needed.

5. After the SMI-S Agent has been installed and tested against a target device, you will want to save credentials on the SMI-S Agent server for possibly a set or farm on NetApp controllers.

Note: Installing SMI-S Agent on the server in which SCVMM is installed is not supported.

4.3 Populating the SMI-S Agent with NetApp Targets to Manage

The following command is used to open the communication path between the storage controller and the SMI-S Agent. This command can be run from the command window that can be found by clicking the Start menu, selecting the Data ONTAP SMI-S Agent folder, then selecting Data ONTAP SMI-S Agent.

In the command window, enter the following command to connect to a controller:

```
SMIS %user1% %password1% add %array% %user2% %password2%
```

Table 1 lists the parameters that need to be used to populate the preceding command.

Table 1) Command parameters.

Variable Name	Variable Usage
%user1% & %password1%	Local domain account name and password
%password1%	Password for %user1%
%array%	IP address or resolvable FQDN to a NetApp array
%user2% & %password2%	Account that is authorized on the NetApp array

To use an account other than the one used to install the agent, use the following command to add that user to the SMI-S Agent:

```
CimUser -a -u %user1% -w %password1%
```

Upon success, you will receive confirmation of the method used to connect such as a protocol or a port. The success message will appear similar to the following:

```
Returned Path ONTAP_FilerData.hostname"10.58.2.3",port=80
```

A failure message will appear as follows:

```
CIM_ERR_FAILED: Cant connect to host (err=10060). -With storage 10.58.2.3
```

After you have connected to the array, you can verify both HTTP and HTTPS by using the following command to retrieve data:

```
SMIS %user1% %password1% disks -t https
```

This should return the SMI-S data for those disks. If you want to test this using HTTP instead of HTTPS, simply replace http in the preceding command.

4.4 Setting up and Configuring SCVMM 2012 SP1

Set up and install SCOM and SCVMM as per Microsoft's published best practices. After the installation of SCOM and SCVMM is complete, this document will guide you to getting the SCVMM instance communicating with the SMI-S Agent.

Individual standalone Hyper-V servers as well as your Windows failover cluster Hyper-V servers can be added to the SCVMM 2012 SP1 environment.

To connect the SMI-S Agent to the SCVMM instance, complete the following steps.

1. Choose Fabric Resources, and then from the left pane open Storage item.
2. Under Storage, locate and right-click Providers, and select the Add a Storage Device option.
3. Alternately, you can click the Add Resources icon on the main taskbar at the top, then select Storage Device from the list of resources. In the Add Storage Device Wizard window, enter the IP address of the server running the SMI-S Agent as well as the port.
4. The SMI-S Agent port can be discovered by issuing the following command from the SMI-S Agent window:

```
SMIS Config Show
```

In the output of this command, look for the line that refers to the HTTPS port and its current value.

An example of the machine name and port that will be used in the Add Storage Device Wizard will appear as follows:

```
SMISAgent.sea-tm.netapp.com:5989
```

5. In the window for adding a RunAs account, either select an account that already has local administrative privileges on the SMI-S Agent server or create a new account and add those privileges.

As the SCVMM engine discovers the SMI-S Agent's list of controllers and the subsequent list of storage aggregates, you will be asked to define a set of service levels. If as an example you have two large aggregate pools of SATA drives, you might want to classify them as a bronze-level service pool. A set of 15,000 RPM high-speed SAS drives, however, might be classified as a gold-level service pool, and 10,000 RPM SAS drives might constitute a silver-level service pool.

4.5 Installation of NetApp PowerShell Toolkit

Installing the NetApp PowerShell Toolkit on the SMI-S Agent server for troubleshooting purposes and the SCVMM 2012 machine for commands or maintenance tasks that are not built into SCVMM is highly recommended.

1. Log in and download the toolkit from the [Data ONTAP PowerShell Toolkit Downloads](#).
2. Download this toolkit to the default location for Windows PowerShell modules, which is likely the following:

```
C:\windows\system32\windowspowershell\v1.0\modules
```

3. Under this directory, extract the ZIP file. This will create a directory named `Dataontap`.
4. To test the installation, from a Windows PowerShell prompt type:

```
Import-module Dataontap
```

5. If the module imports properly, you should be able to use the following command to open a communications channel to the controller:

```
Connect-NAController %ip% -credential %user1%
```

6. Type the password when prompted.

5 Discovering Storage System in SMI-S Agent and Adding SMI-S Agent in SCVMM

5.1 Discovery

To add new storage controllers and arrays to your storage farm requires two steps. The first step is to add credentials to the SMI-S Agent server to allow it to open a communication channel with the controller. The second step involves directing the SCVMM to rescan the SMI-S Agent to allow it to expose those new controllers.

Adding Controller Credentials to the SMI-S Agent

The following command is used to open the communication path between the storage controller and the SMI-S Agent. This command can be run from the command window that can be found by clicking the Start menu, selecting the Data ONTAP SMI-S Agent folder, and then selecting Data ONTAP SMI-S Agent.

In the command window, enter the following command to connect to a controller:

```
SMIS %user1% %password1% add %array% %user2% %password2%
```

Table 2 lists the parameters that need to be used to populate the preceding command.

Table 2) Command parameters.

Variable Name	Variable Usage
%user1% & %password1%	Local domain account name and password
%password1%	Password for %user1%
%array%	IP address or resolvable FQDN to a NetApp array
%user2% & %password2%	Account that is authorized on the NetApp array

Upon success, you will receive confirmation of the method used to connect such as a protocol or a port. The success message will appear similar to the following:

```
Returned Path ONTAP_FilerData.hostname"10.58.2.3",port=80
```

A failure message will look like this:

```
CIM_ERR_FAILED: Cant connect to host (err=10060). With storage 10.58.2.3
```

After you have connected to the array, you can verify both HTTP and HTTPS by using a command to retrieve data:

```
SMIS %user1% %password1% disks -t https
```

This should return the SMI-S data for those disks. If you want to test this using HTTP instead of HTTPS, simply replace http in the preceding command.

Best Practice

Due to the manner by which SCVMM and SMI-S identify storage resources, care should be taken to make sure that your storage aggregate names are fully descriptive as opposed to the default aggregate names. As an example, a default name for an aggregate on a storage controller might be "aggr1," whereas the recommended name for that aggregate would be "ControllerName_aggr1_15KSAS." This allows less chance for error when choosing aggregates and less chance for error when depositing those aggregates into resource pools. The reason for this is that some SCVMM screens require you to select a source aggregate without telling you from which controller it is being selected.

Adding Controller Credentials to the PowerShell Toolkit

A number of commands and methods exist to deploy virtual servers and VHDs within the PowerShell Toolkit. After the PowerShell Toolkit has been added to the SCOM/SCVMM server, you can connect to the controller by using the following command:

```
Connect-NAController %ipaddr% -credential %username%
```

After this command is entered, a challenge window will appear to authorize the toolkit with the appropriate password to the controller. You can also choose to allow the PowerShell Toolkit to store these authenticated sessions using the following command:

```
Add-NACredential %ipaddr% -credential %username%
```

After a controller credential has been stored, you can connect using the `Connect-NaController %ipaddr%` command without having to supply the `-credential` options and without requiring authentication. This can be very useful for scripting operations. It is also possible to connect to several controllers at once and use the `-controller %ipaddr%` suffix specify against which controller you want the current command to be run.

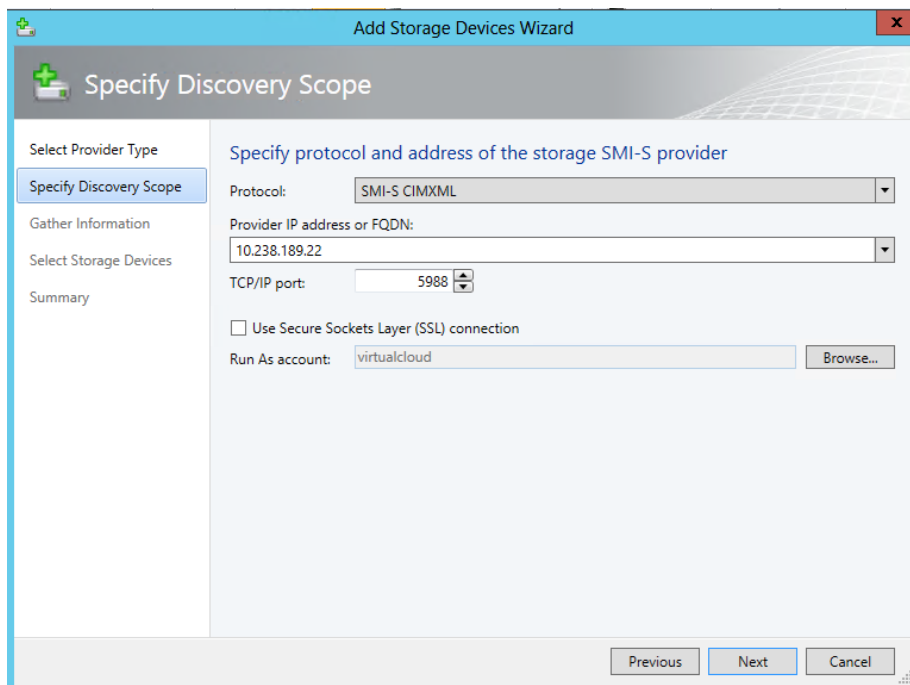
Exposing New SMI-S Agent Managed Controllers to SCVMM

To expose the new the new SMS-S Agent managed controllers to SCVMM, complete the following steps:

1. Install System Center Virtual Machine Manager 2012 as per Microsoft best practices and install the SMI-S Agent in the designated server.
2. Choose Fabric Resources and then from the left pane open the Storage item.
3. Under Storage options, right-click Providers and click “Add a storage device.”
4. Enter the IP address and the port details of the server running the SMI-S Agent.
5. In the window for adding a RunAs account, either select an account that already has local administrative privileges on the SMI-S Agent server or create a new account and add those privileges.

SCVMM discovers the SMI-S Agent’s list of controllers and the subsequent list of storage aggregates for which you will be asked to define a set of service levels.

Figure 2) Enter the IP address of the SMI-S server along with account details.



An example of the machine name and port that will be used in the Add Storage Device Wizard will appear as follows:

```
SMISAGENT.sea-tm.netapp.com:5989
```

6. Select the newly added storage controller of the storage array to add and select Next.

Best Practice

After adding storage systems to the Data ONTAP SMI-S Agent, verify that the agent can see the important logical and physical objects of the storage system.

Best Practice

If the NetApp FAS storage systems and SMI-S Agent are in different domains, authentication must be enabled before the SMI-S Agent can be used.

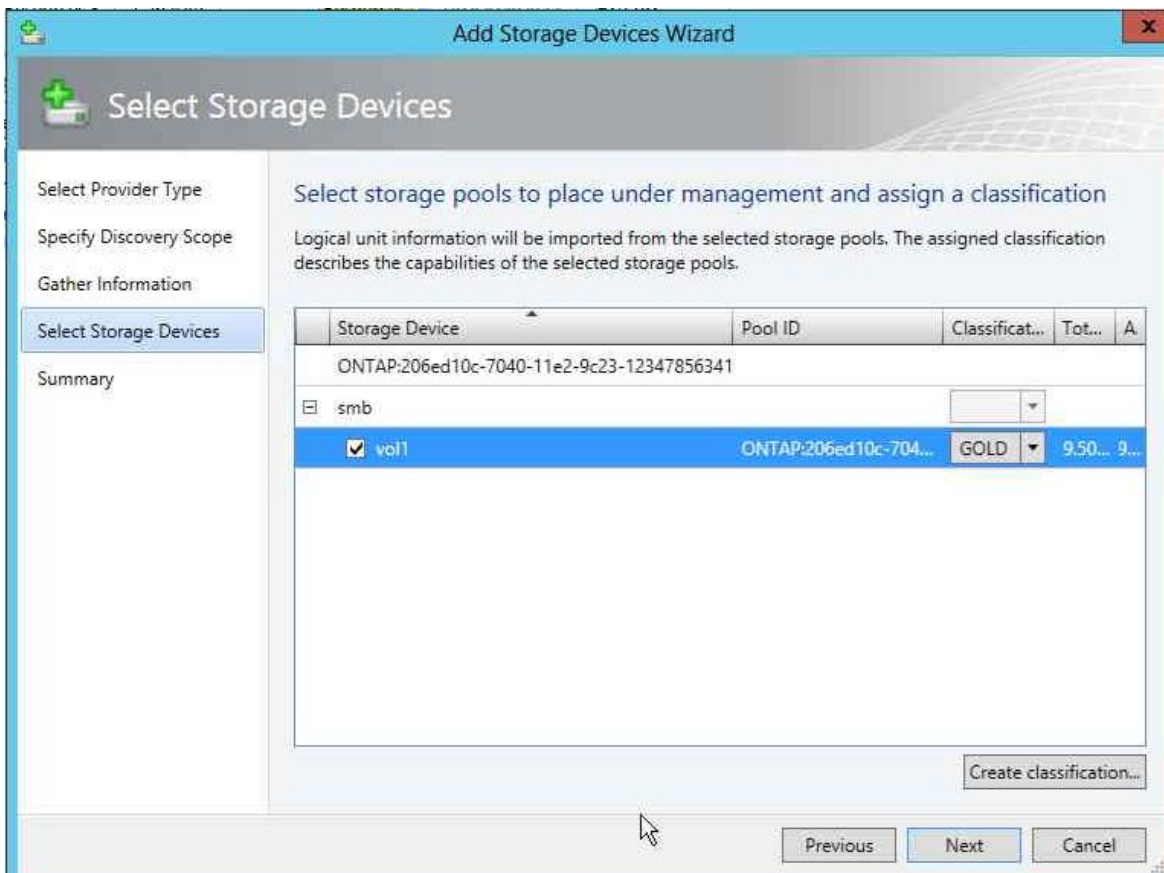
6 Classification of Storage in SCVMM 2012 SP1

Classification of storage pools can be done along a number of different valid methods. The most commonly used method is to deploy your classifications based on the drive type and RPM such as the following:

- Bronze: 7200 SATA
- Silver: 10K RPM SAS 2.5"
- Gold: 15K RPM SAS 3.5"
- Platinum: SSD

Although these classification pools are commonly adopted, other methods to differentiate aggregates also exist. These other methods might include the class of controller to which the storage is connected, because a midrange controller might not be capable of driving load as efficiently as a high-end controller would. Another possible classification type could be the size of the underlying aggregates; a 54-drive aggregate would have different performance and capacity considerations than a 10-drive set. Your classification pools could also be defined strictly along financial boundaries, either by the cost of the underlying storage or by storage asset owner.

Figure 3) Classification of storage.



Consider creating a special pool for monitoring the aggregates to which you don't plan to deploy. An example of this is to create a pool for aggr0, which is commonly reserved for administrative use.

6.1 Storage Allocation

After you have sets of hosts and storage pools defined, the next step is to allow access to specific pools by specific host groups. To allocate a pool to a host group, complete the following steps:

1. In the SCVMM console, in the left pane, navigate to Fabric > Servers > All hosts > (host group name).
2. Right-click the <host group> name and click Properties.
3. In the properties window, select Storage.
4. Click Allocate storage pools.
The storage aggregate pools are listed.
5. Click Allocate Logical Units.
6. Select the LUN from the "Available logical units" pool and click Add.

7 Provisioning

7.1 Provisioning a LUN for SAN Environments

To create a new LUN, complete the following steps:

1. Select Storage from the left pane.
2. Right-click Classification and Pools and select Create New Logical Unit.
3. Choose the source aggregate and provide a new name, description, and size for the LUN.
4. In the Classification and Pools window, these new LUNs will appear with the "Assigned" setting set to "False," which means that they are yet to be mapped to a physical server. SMI-S Agent allows creating a LUN in an existing volume by allowing the user to enter the full path of the LUN.

Best Practice

NetApp recommends creating thin-provisioned volumes for allocating the LUNs to the hosts.

Alternate Method to Create the LUN

If more granular control is needed in the LUN creation process, you can use the PowerShell Toolkit command to create a LUN with the same method as the GUI. To create a new LUN, you will need to know the array name, the volume in which you want it to reside, the name of the LUN, the size, and if you want the LUN to be thin or thick.

```
Connect-naController %IPAddr%  
New-naLUN /vol/%VolumeName%/%LunName %size%GB -type windows_2008 -unreserved
```

After the command has run, you can use the refresh option for SMI-S to allow SCOM/SCVMM 2012 to see and use the new LUN. Because this process might require a complex process of removing and reconnecting the SMI-S Agent, this method should only be used when absolutely needed such as when you need exact control over in which volume a LUN will be created.

Establishing an iSCSI Session

To establish an iSCSI session to a host, complete the following steps:

1. Open System Center 2012 - Virtual Machine Manager (SCVMM) SP1.
2. In the bottom left pane, select VMs and Services. The VMs and Services pane loads on the top left.

3. In the VMs and Services pane, expand All Hosts.
4. Right-click the selected server name.
5. Select Properties.
6. In the Properties window, select Storage.
7. Click the Add iSCSI Array option.
8. Enter the storage array details, target portal, and initiator IP.
9. Click Create.

Mapping Operation

To make that LUN available to a server running Hyper-V, complete the following steps:

1. Right-click either the server name or the server host group and select Properties.
2. In the Properties window, select Storage and choose Allocate LUN. This will allow you to select the LUN defined in the previous step and assign it to the host or host group.
3. Before clicking OK in this selection, be sure that you have issued the proper zoning command to the switches if using Fibre Channel or that you can establish a session if using iSCSI.
4. A LUN can be just as simply removed from a host by selecting that host and right-clicking and selecting Properties. In the Properties window, select Storage, select the storage volume you want to remove, and click Remove.

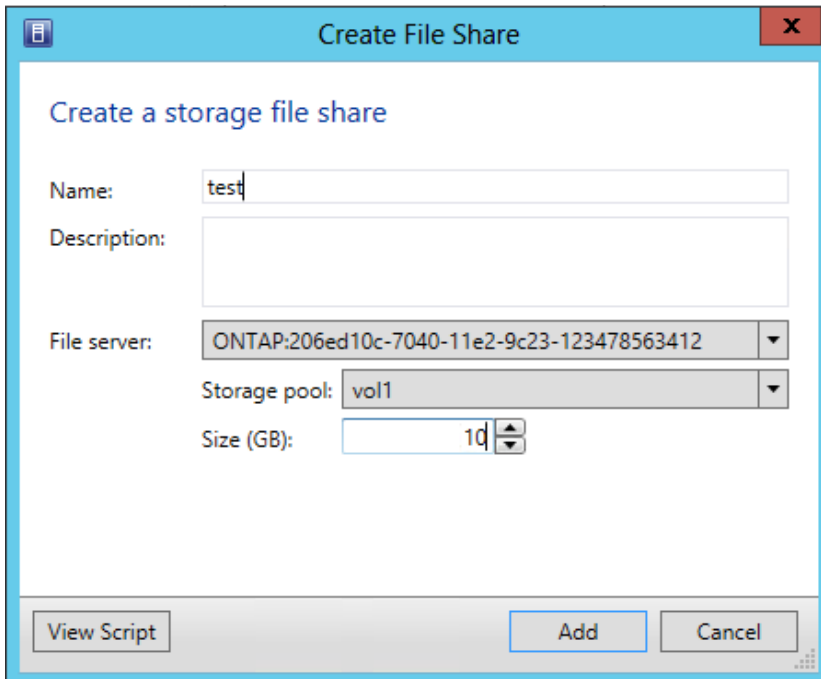
Best Practice

Enable Asymmetric Logical Unit Access (ALUA) on all FC igroups if using Data ONTAP DSM 3.4 or later.

7.2 Provisioning a CIFS Share for SMB 3.0 Environments (Windows Server 2012)

Clustered Data ONTAP 8.2 supports the Hyper-V over SMB 3.0 feature in Windows Server 2012. Users can now create virtual machines and host them on CIFS shares that are continuously available on NetApp storage systems. To complete creation of a file share using SCVMM 2012 SP1, complete the following steps. Note that a CIFS Vserver must be first created on the NetApp clustered Data ONTAP storage system. The CIFS Vserver is then listed as a file server and is available for file share creation.

1. In the SCVMM 2012 SP1 console, click Fabric > Storage > File server.
2. Right-click File server and click "Create new file share."
3. Enter a file share name and its size and click Add.



The file share is successfully created.

Note: All SMB 3.0 workflows are supported only on clustered Data ONTAP 8.2 and SCVMM 2012 SP1.

Note: SMI-S Agent does not expose root volumes, file shares in root volumes, or shares that are mounted to an entire volume.

Best Practice

To create a file share and use it in Windows, NetApp mandates creating the file share in an NTFS-only volume. This is to avoid problems with the credentials that access the file share. To create the volume with NTFS, type the following command:

```
vol create -vserver <vserver_name> -volume <volume_name> -aggregate  
<aggr_name> -size<volume_size> -security-style ntfs
```

8 Indications

An indication is a CIM event that is the occurrence of a phenomenon of interest. It can be classified as either lifecycle or alert.

Lifecycle indications are tracked in SCVMM 2012 SP1. SMI-S 5.0 Agent tracks certain lifecycle indications every five minutes. Lifecycle indications capture any out-of-band operations and report them to the clients. You can use these indications to monitor SMI-S Agent operations. In SCVMM 2012 SP1, lifecycle indications for creation, modification, and deletion of objects are tracked every five minutes. The following CIM classes are tracked:

- CIM_DiskDrive
- CIM_StoragePool
- CIM_StorageVolume
- CIM_SCSIProtocolController
- CIM_ProtocolControllerForUnit

- CIM_SCSIProtocolEndpoint
- CIM_FCPort
- CIM_ComputerSystem
- CIM_StorageHardwareID
- CIM_AuthorizedSubject

Alert indications are used to forward SNMP traps generated by Data ONTAP.

Note: Lifecycle indications are not supported for Linux operating systems.

Note: Alert indications are disabled for clustered Data ONTAP 8.2.

9 Use Cases

9.1 Rapid Provisioning of Virtual Machines in a SAN Environment

Rapid provisioning of VMs requires that you decide if you want to use the default Snapshot or clone method built into SCVMM or if you want to issue commands through Windows PowerShell for more granular control. In both methods, the SCVMM console can be used to expose those LUNs to the Hyper-V cluster or standalone Hyper-V server.

Snapshot and Clone Considerations for VMs (GUI Method)

Two methods to quickly provision a LUN with a VM for SCVMM 2012 are the use of Snapshot copies and the use of clones. Traditionally, the terms snapshot and clone are not similar to the Snapshot and FlexClone technology that NetApp uses.

Snapshot copies can be created on most storage controllers almost instantaneously; Snapshot copies use virtually no extra hard drive space beyond the deltas. Storage controllers that use copy-on-write (CoW) Snapshot copies limit the number of allowed active Snapshot copies because each Snapshot copy degrades performance. To alleviate this problem, classical/legacy storage controllers offer a clone type operation in which the Snapshot copy is relocated (copied) to a fresh set of physical blocks, possibly in a new RAID set. This allows the Snapshot copy to be released and performance to be returned to baseline expectation. The disadvantage of a clone operation on classic/legacy controllers is that each clone can consume the same amount of storage on the controller as the original data. When deploying VMs on classic/legacy controllers, care must be taken to balance your space consumption (clones) versus your performance expectations (Snapshot copies).

Because NetApp controllers use WAFL[®] and not CoW-type Snapshot copies, they do not suffer performance degradation, and therefore the limits on number of Snapshot copies per volume are relatively high (256). In addition, the clone operation on a NetApp controller duplicates the original data, drastically increasing your ability to scale. Performance generally increases drastically when Snapshot copy deployments of VMs are used instead of new copies because common blocks are cached. Alternately, clones can be utilized not to increase performance at the cost of disk space but to allow for administrative settings such as deduplication schedules, thin-provisioning fencing, or BC/DR operations to be configured uniquely.

Best Practice

License FlexClone software on NetApp storage systems when cloning LUNs by using the Data ONTAP SMI-S Agent.

Best Practice

Snapshot copies and sub-LUN clones can exist between LUNs, but not across NetApp volumes. Deduplication also exists within a single LUN. When creating a set of VMs that are highly clonable or deduplicatable, keeping VMs not within just a single pool but in a single aggregate and a single NetApp volume is recommended. In an environment with extended read cache due to the addition of FlexCache® modules, this could equate to a great boost in performance. For more specifics of the advantages of FlexCache, refer to [TR-3832: Flash Cache Best Practices Guide](#).

PowerShell Method of Creating a New VM Image

The GUI method is capable of creating a clone of an existing LUN with a VM, but when utilized to add a new VM to an existing LUN (such as when adding multiple VMs to a CSV), it falls back to a network copy operation. For more granularity, sub-LUN clones can be used to create a copy of a VHD or a new VM in an existing LUN or a new LUN.

The following is an example of the commands used to take a LUN that is considered a golden image (SysPreped VHD) and create four identical LUNs. This operation is similar to the results you would get from the GUI method of creating a Snapshot copy of a LUN.

```
Connect-nacontroller %ipaddr% -credential root
New-nasnapshot Vol1 goldsnap
New-nalunclone /vol/vol1/LUN1 /vol/vol1/GoldImageLun goldsnap
New-nalunclone /vol/vol1/LUN2 /vol/vol1/GoldImageLun goldsnap
New-nalunclone /vol/vol1/LUN3 /vol/vol1/GoldImageLun goldsnap
New-nalunclone /vol/vol1/LUN4 /vol/vol1/GoldImageLun goldsnap
```

This example assumes that vol1 is used as the working volume, and a golden image LUN is already created and populated. It will create the four LUNs from a Snapshot copy called `goldsnap` created in the second line.

Another example would be to use sub-LUN cloning to create four copies of the VHD on a volume to populate to a cluster as a CSV. You may mount the newly created LUN to the management server temporarily to be able to identify the disks, but then you might want to remove the LUN from that management server.

```
Connect-NAController %ipaddr% -credential root
New-nasnapshot Vol1 goldsnap
New-nalunclone /vol/vol1/CSV1 /vol/vol1/GoldImageLun goldsnap
Add-nalunmap MgmtSvrIGroupName /vol/vol1/CSV1
# Rescan the disks on the management server, and give it a drive letter x:
# Assume that the existing /vol/vol1/GoldImageLun is mounted on this server as Z:\
Copy-nahostfile z:\goldImage.vhd x:\VM1.vhd
Copy-nahostfile z:\goldImage.vhd x:\VM2.vhd
Copy-nahostfile z:\goldImage.vhd x:\VM3.vhd
Copy-nahostfile z:\goldImage.vhd x:\VM4.vhd
Remove-nalunmap MgmtSrvIGroupName /vol/vol1/CSV1
```

In this scenario, a new LUN has been created and had been prepopulated with four VHDs from a golden image on another LUN. This operation required minimum host traffic and took a fraction of the time that a copy operation would have taken.

A last example would be that you want to place a large, empty VHD on a LUN, which can then be deployed to a server. You can use the following procedure to perform this on the array without creating any load on the controller or any network on a SAN:

```
Connect-NAController %ipaddr% -credential root
New-nalun /vol/vol1/LUN5 1005G -type windows_2008 -unreserved
Add-nalunmap MgmtSvrIGroupName /vol/vol1/LUN5
# Rescan disks on the management server, online it, Initialize it, quick format it and give it a
drive letter p:
New-navirtualdisk P:\VM5.vhd -size 1000GB
```



```
Remove-nalunmap MgmtSvrIGroupName /vol/vol1/LUN5
```

Of these three examples, the first one is analogous to the actions taken in the GUI, while the last two examples have no GUI method to accomplish the same task. The benefit of learning the granular method of deploying storage can be seen in the space savings on the controllers as well as the instant nature of the activities that might normally take hours to complete.

Refresh the SMI-S Agent

After actions such as deploying or creating LUNs are taken through the GUI or the CLI, it is good practice to refresh the fabric to allow those changes to be seen in the GUI. This can be done by removing the SMI-S Agent and adding it again. The propagation of those changes might take a few minutes to be discovered and to update the SCVMM fabric overview. This process of removing the SMI-S Agent and reading that agent is the fastest and most reliable method to quickly refresh SCOM/SCVMM 2012 SP1.

10 Upgrading the SMI-S Agent

Because there no direct upgrade path to install SMI-S Agent 5.0 from a previous version, you must uninstall the older version of the SMI-S Agent and install the new version. After reinstallation of SMI-S Agent, the user should add the storage system again.

11 Scalability and Performance

Data ONTAP SMI-S Agent 5.0 has been validated for the scale in Table 3.

Table 3) Scalability measurements.

Parameter	Scale
Windows Server 2012 nodes in a cluster	16 nodes
Virtual machines	100 virtual machines in 45 minutes
Vservers/storage systems	30
LUNs	1,500 per volume

12 Troubleshooting

- **SCVMM 2012 SP1.** For general information about troubleshooting SCVMM 2012 P1 such as collecting traces and logging information, see [VMM 2012 General Troubleshooting Guide](http://go.microsoft.com/fwlink/?LinkID=211124) (<http://go.microsoft.com/fwlink/?LinkID=211124>) on the Microsoft Download Center.
- **SMI-S Agent troubleshooting.** To troubleshoot connectivity issues with the SMI-S server, the logs are located on the SMI-S server at C:\Program Files(x86)\Ontap\smis\pegasus\logs. Refer to the SMI-S installation and administrator guide for troubleshooting tips: <http://now.netapp.com/knowledge/docs/smi-s/5.0/pdfs/install.pdf>.
- **NetApp FAS controller.** To access the logs from the controller itself, connect to the controller's IP address using the following: [HTTPS://%IP%/na_admin/logs/](https://%IP%/na_admin/logs/). This address will allow full access when credentials are given to the system logs for the controller.

13 Glossary

Acronym/Abbreviation	Definition
CIM	Common Information Model. CIM includes a modeling language and methodology, a

Acronym/ Abbreviation	Definition
	schema, and some access protocols. It was developed at DMTF and adopted by SNIA as the foundation for the heterogeneous storage management of SMI-S.
CIMOM	Common Information Model Object Manager. A CIM server has at least a CIMOM (a CIM Object Manager), an object repository, and a store of provider DLLs.
SMI-S	Storage Management Initiative Specification.

Refer to the [Interoperability Matrix Tool \(IMT\)](#) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

NetApp provides no representations or warranties regarding the accuracy, reliability, or serviceability of any information or recommendations provided in this publication, or with respect to any results that may be obtained by the use of the information or observance of any recommendations provided herein. The information in this document is distributed AS IS, and the use of this information or the implementation of any recommendations or techniques herein is a customer's responsibility and depends on the customer's ability to evaluate and integrate them into the customer's operational environment. This document and the information contained herein may be used solely in connection with the NetApp products discussed in this document.

Go further, faster®