Direct Storage Access Using NetApp SnapDrive®

Installation & Administration Guide
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SnapDrive overview

SnapDrive for Windows enables you to automate storage provisioning tasks and to manage data in Microsoft Windows environments. You can run SnapDrive on Windows hosts in either a physical or virtual environment.

What SnapDrive does

SnapDrive software integrates with Windows Volume Manager so that storage systems can serve as virtual storage devices for application data in Windows Server 2003 and Windows Server 2008 environments.

SnapDrive manages LUNs on a storage system, making these LUNs available as local disks on Windows hosts. This allows Windows hosts to interact with the LUNs just as if they belonged to a directly attached redundant array of independent disks (RAID).

SnapDrive provides the following additional features:

• It enables online storage configuration, LUN expansion, and streamlined management.
• It enables connection of up to 168 LUNs.
• It integrates Data ONTAP Snapshot technology, which creates point-in-time images of data stored on LUNs.
• It enables support on Microsoft cluster configurations.
• It enables iSCSI session management.

What SnapDrive does not do

Some functionality is currently not supported in SnapDrive for Windows.

• A LUN managed by SnapDrive cannot be configured as a “dynamic” disk (a storage device that is divided into volumes rather than partitions); it can serve only as a “basic” disk (a storage device for host-side application data).
• A LUN cannot be configured as an extended partition. SnapDrive supports only a single, primary partition on a LUN.

Recommendations for using SnapDrive

Follow these recommendations whenever you use SnapDrive for Windows.

• Use SnapDrive to create and manage all the LUNs on your storage system.
• Place all LUNs connected to the same host on a dedicated volume accessible by just that host.
  If you require more volumes, contact support@artisaninfrastructure.com
  If you use Snapshot copies, you cannot use the entire space on a storage system volume to store your LUN.
  • If you use Snapshot copies, you cannot use the entire space on a storage system volume to store your LUN.

The storage system volume hosting the LUN should be the size of all the LUNs on the volume, with enough additional space for the Snapshot copies of the volume. The additional space should be based on the change rate of the LUNs in the volume and the retention policy for the Snapshot copies.
SnapDrive changes with MMC 3.0

SnapDrive's implementation of MMC 3.0 introduces some changes from previous versions of SnapDrive, including the introduction of a new Action pane and improved error messages.

Using MMC 3.0 Action pane

You can use the new MMC 3.0 Action pane in SnapDrive to perform all the available operations for a specific node or disk; however, the Action pane is not displayed by default on Windows Server 2003 hosts, so you must enable it manually.

Steps
1. If the Action pane is not displayed (to the right of the main MMC Details pane), click the Show/Hide Action Pane icon at the top of MMC. The Action pane is displayed.
2. In the left MMC pane, click the instance of SnapDrive or a LUN for which you want to perform an operation.
The available operations are displayed in the Action pane.

Error messages in MMC 3.0

SnapDrive uses new functionality in MMC 3.0 that enables SnapDrive to notify you when you type incorrect information in a text box or field.
Rather than displaying an error message in a pop-up window, an error message icon is displayed next to the field, along with an error description. Additional error details are viewed by using the mouse to hover over the error icon.
SnapDrive components

| SnapDrive “snap-in”                                                                 | This software module integrates with the Microsoft Management Console (MMC) 3.0 to provide a graphical interface for managing LUNs on the storage system. The module does the following:  
  • Resides in the Windows Server 2003 or 2008 computer management storage tree  
  • Provides a native MMC snap-in user interface for configuring and managing LUNs  
  • Supports remote administration so that you can manage SnapDrive on multiple hosts  
  • Provides SnapMirror integration  
  • Provides AutoSupport integration, including event notification |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SnapDrive command-line interface                                                   | The sdcli.exe utility enables you to manage LUNs from the command prompt of the Windows host. You can do the following tasks with the sdcli.exe utility:  
  • Enter individual commands  
  • Run management scripts |
| Underlying SnapDrive service                                                        | This software interacts with software on the storage system to facilitate LUN management for the following:  
  • A host  
  • Applications running on a host |

How LUNs work

The following section describes how LUNs work by interacting with Windows hosts and with storage systems.

How the storage system interacts with the LUN

To the storage system, a LUN is a logical representation of a physical unit of storage. The storage system handles each LUN as a single storage object. The size of this LUN is slightly larger than the raw disk size reported to the Windows host. SnapDrive must be used to expand the disk because SnapDrive expands both the LUN and the Windows partition.
How Windows hosts interact with a LUN

You manage LUNs on the storage system just as you manage other Windows disks that store application data. LUNs on the storage systems are automatically formatted by SnapDrive the same way that you format other Windows disks. Moreover, a Windows host interacts with all user data files on the LUN as if they were NTFS files distributed among the disks of a locally attached RAID array.

LUN capabilities and limitations

A LUN managed by SnapDrive can be used for data storage and can be a boot disk. A LUN cannot be a dynamic disk.

SnapDrive can also make a Snapshot copy of LUNs when they are used for data storage, and it can work with SnapMirror at the volume level and SnapVault at the qtree level for data protection.

How volume space is used

SnapDrive uses space on a storage system volume for LUNs and their data, and also for the data that changes between Snapshot copies, the LUN's active file system, and for metadata.

Volume-size rules

Storage system volumes that will hold LUNs must be large enough to hold all the LUNs in the volume, as well any Snapshot copies if Snapshot copies are created. The following factors govern the appropriate minimum size for a volume that holds a LUN:

- If the LUNs are space reserved, then the volume must be more than twice the combined size of all the LUNs on the volume if a Snapshot copy of the volume is created. This enables the volume to hold the LUNs and a special reserved space.

No matter how much the contents of the LUNs change between Snapshot copies, the entire contents of the disks are written to the volume.

- The volume must also provide enough additional space to hold the number of Snapshot copies you intend to keep online.

The amount of space consumed by a Snapshot copy depends on the amount of data that changes after the Snapshot copy is taken. The maximum number of Snapshot copies is 255 per storage system volume.
Preparing hosts for SnapDrive

Before installing SnapDrive for Windows, you must prepare each Windows host in your SnapDrive configuration.

Steps
1. Verify that the host meets the minimum requirements for use with SnapDrive.
2. Add a 2\textsuperscript{nd} vNIC to the host and configure with a static IP address from your defined storage network, connect the vNIC to your vFiler vLAN.
   \textbf{Note:} Please refer to your account information for storage network details.
3. Determine whether the Microsoft iSCSI Software Initiator program is installed.
   \textbf{Note:} If you are running Windows Server 2008, the iSCSI Software Initiator comes built in with the operating system, but needs to be enabled.
4. Download SnapDrive to the host.

\textbf{Snap Drive 6.3 for Windows 32bit}
http://support.artisan.tv/index.php?\_m=downloads&\_a=viewdownload&downloaditemid=4&nav=0

\textbf{Snap Drive 6.3 for Windows 64bit}
http://support.artisan.tv/index.php?\_m=downloads&\_a=viewdownload&downloaditemid=5

SnapDrive service account requirements

To perform functions related to SnapDrive for Windows on either the host or a storage system, SnapDrive needs to be able to use a service account that has specific types of access established. The SnapDrive service account must meet the following requirements.

- The service account must be created using US-ASCII characters only, even when you use non-ASCII operating systems.
- You must be able to log in to the host using the service account.

\textbf{Note:} If at any time you change the password for this account (for example, from the Windows login panel), remember that you must make the same change to the password the SnapDrive service uses to log in. You can configure the SnapDrive service using the Services and Applications option in MMC.

- The service account must have administrative rights on the host.

Installing or upgrading the SnapDrive components

Use this procedure to install or upgrade the SnapDrive for Windows components.

\textit{Before you begin}

- Stop the SnapDrive for Windows Service
- Make sure that you have prepared your host for SnapDrive and that all the minimum requirements are met.
- Perform this procedure from the system console, not from a Terminal Service client.
- If you are upgrading SnapDrive on a server cluster, install SnapDrive on all nodes, starting with the nodes that do not own the cluster resources and rotating which system is the owner until all nodes in the cluster have the same version of SnapDrive installed.
• If you are running NetApp Host Agent, stop the NetApp Host Agent service.
• If a version of SnapDrive is already installed on your system, stop the SnapDrive service, if you have not already done so, and close the Microsoft Management Console (MMC) window.

Steps

1. Browse to the location of the SnapDrive installation package and double-click the executable file.
2. Click Next on the Welcome to the SnapDrive Installation Wizard screen.
3. If this is a new SnapDrive installation, read and accept the license agreement, and then click Next.
4. If you are upgrading SnapDrive, the Program Maintenance panel appears. Select Modify/Upgrade, and then click Next.
5. The SnapDrive License panel is displayed. Select “Per Storage System”, and then click Next.
6. If this is a new installation, follow the procedure in this step. If you are upgrading, skip to the next step.
   a. In the Customer Information panel, type your user name and organization name, and then click Next.
   b. The Destination Folder panel prompts you for a directory in which to install SnapDrive on the host. By default, this is C:\Program Files\NetApp\SnapDrive\ for new installations. To accept the default, click Next and then proceed to the next step.
   To specify a different location, click the Change button. In the Change Current Destination Folder panel, either type the path to the target directory in the Folder Name text box, or navigate to the folder you prefer and select it. When the correct target location appears in the Folder Name text box, click OK to return to the Destination Folder panel, and then click Next.
   Note: If you are upgrading SnapDrive from a version earlier than 4.1, the default installation directory is C:\Program Files\SnapDrive\.
7. On the VirtualCenter or ESX Server Web Service Credentials screen, deselect “Enable VirtualCenter or ESX Server Settings”, and then click Next.
8. On the SnapDrive Management Service Credentials screen, if you are upgrading and the account name is already filled in, type the account password in both the Password and Confirm Password text boxes, and then click Next. Otherwise, you can type in the account you want to use, or complete the following steps to select a user account.
   a. Click Add.
   The Select User window is displayed.
   b. In the "From this location" field, verify that the location is set to the proper domain if your storage system is in a domain, or click the Locations button and select the local host if your storage system is in a workgroup.
   c. In the "Enter the object name to select" text box, type the user name with administrator privileges that you want to use, and then click the Check Names button to verify the user you entered. Click OK.
   Note: If you are installing SnapDrive for use with a storage system in a workgroup, enter the name of the user that you configured for pass-through authentication.
   d. Type the account password in both the Password and Confirm Password text boxes, and then click Next.
9. In the SnapDrive Web Service Configuration window, leave the default ports unless any of them are already being used exclusively by another service. Click Next.
10. In the Transport Protocol Default Setting window, select HTTP and enter your vFiler access details and click Next.
11. In the **Operations Manager Configuration** screen, deselect “Enable Protection Manager Integration” and Click **Next**.
12. On the **Ready to** panel, click **Install** or **Upgrade**.
13. When the **SnapDrive Installation Completed** screen appears, click **Finish**.

**Note:** If you are upgrading a server cluster and you try to use MMC after upgrading SnapDrive on the first node and before upgrading SnapDrive on the remaining nodes, you get an error message indicating that the SnapDrive service is unavailable owing to an invalid tag. This message is the result of the temporary presence of two versions of SnapDrive on the same cluster. No corrective action is needed; just upgrade SnapDrive on the other nodes.

**Result**
A shortcut to the standalone SnapDrive for Windows Management Console is added to the Start Menu, and you can also access the SnapDrive snap-in in MMC.

**After you finish**
- If you are running Windows Server 2008, you must configure the Windows Firewall to allow SnapDrive communications.
- If you are upgrading or installing SnapDrive to support a SnapManager installation, and you use verification servers, you must install SnapDrive on the verification servers as well as on the production systems, and both the verification server and the production servers must be using the same version of SnapDrive.
- If a verification server will be connecting to LUNs over an iSCSI session, make sure you also install the Microsoft iSCSI Software Initiator on the verification server and establish a session from the verification server to the iSCSI target on the storage system where the database to be verified resides. This connection enables the verification server to connect to the Snapshot copy LUN that contains the database, and you must create it explicitly before the verification server attempts to connect to the LUN.

**Enabling SnapDrive to communicate through the Windows Firewall**

If the Windows Firewall is enabled on your host, you need to configure it to allow SnapDrive for Windows communications. The Windows Firewall is enabled by default in Windows Server 2008.

**Steps**
2. Navigate to **Control Panel > Windows Firewall > Allow a program through Windows Firewall > Exceptions**.
3. Select the COM+ Network Access checkbox.
4. If you will be using HTTP or HTTPS, select the World Wide Web Services (HTTP) or Secure World Wide Web Services (HTTPS) checkboxes.
5. Click **Add program** and browse to `C:\Program Files\NetApp\SnapDrive\`, or to wherever you installed SnapDrive if you did not use the default location.
6. Select SWSvc.exe and click **Open**, then click **OK** in the **Add a Program** window and in the **Windows Firewall Settings** window.

**Note:** If Windows Firewall is enabled on your SnapDrive host and you want to use the -m option in the command-line interface to execute a command from a remote host, you must add sdcli to the allowed programs list for Windows Firewall. Follow the same procedure as for adding SWSvc.exe.
7. Reboot the system.
Managing SnapDrive

SnapDrive includes features that enable you to perform general SnapDrive management tasks.

Enabling SnapDrive notification settings

SnapDrive enables you to set up e-mail notification and to enable storage system AutoSupport in the event of a SnapDrive message or storage system error.

About this task

When you set up notification, you can specify the following information:

- Whether and where to send e-mail notification
- What types of messages to report

Steps

1. Select the appropriate SnapDrive instance, then from the menu choices on top of MMC, click Action > Notification Settings.
2. Select Use Storage System AutoSupport if you want to enable a subset of the Windows System Events for AutoSupport on the storage system.
3. In the Notification Settings panel, select Enable SnapDrive E-mail Notification.
4. Under E-mail Settings, type the outgoing SMTP server, and the From and the To e-mail addresses.
   Note: The e-mail address must be in a valid SMTP format, for example, administrator@mycompany.com.
5. Under Event Category, select one or more event categories about which you want to be notified.
6. Under Event Type, select one or more event types about which you want to be notified when the specified event types take place.
7. Click OK.

Adding and removing initiators with SnapDrive

You can use SnapDrive to add or remove initiators for LUNs created using SnapDrive.

Steps

1. Double-click SnapDrive in the left MMC pane, and then, if the Disks option is not already expanded, double-click Disks. The currently connected disks are displayed.
2. Select the disk for which you want to add or remove initiators.
3. From the menu choices on top of MMC, click Action > Add/Remove Initiator. The Initiators Management screen is displayed.
   Note: You do not have the option to add or remove initiators for LUNs created on a VMware Guest OS.
4. To add or remove initiators, follow the instructions in the Initiators Management screen.
   Note: If you remove an initiator that belongs to an igroup to which other initiators have been added, a dialog box informs you that all initiators will be removed. Click Yes to remove all initiators. If you try to remove an initiator that belongs to an igroup that contains initiators from another host, the operation will fail. SnapDrive does not support this configuration.
5. Click OK.
Managing iSCSI sessions

SnapDrive enables you to manage iSCSI sessions on the storage system.

Establishing an iSCSI session to a target

Before creating a LUN, you need to have an iSCSI session to the target on which you will manage the LUN.

Before you begin
Verify that the iSCSI service is started.

Steps

1. Perform the following actions to launch the Create iSCSI Session wizard:
   a. In the left MMC pane, select the instance of SnapDrive you want to manage.
   b. Select iSCSI Management.
   c. From the menu choices at the top of MMC, navigate to , Action > Establish Session.
2. In the ISCSI Session wizard, click Next.
   The Provide Storage System Identification panel is displayed.
3. In the Provide Storage System Identification panel, enter the storage system name or IP address of the storage system management port you want to establish the iSCSI session with, and then click Next.
   The Provide iSCSI HBA panel is displayed.
4. In the upper pane of the Provide iSCSI HBA panel, click the radio button next to an available iSCSI HBA to specify the initiator portal you want to use.
5. In the lower pane of the Provide iSCSI HBA panel, perform the following actions:
   a. Select the target portal to which SnapDrive will establish the iSCSI session by clicking the radio button next to the IP address of the target portal you want to use.
   Note: The IP address of the target portal MUST be in the same network as the iSCSI initiator. Please refer to your account information to obtain the correct storage network details.
   c. Click Next.
   The Completing the iSCSI Session Wizard panel is displayed.
6. In the Completing the iSCSI Session Wizard, perform the following actions:
   a. Review the information to make sure it is accurate.
   b. If the information is not accurate, use Back to go back to previous panels of the wizard to modify information.
   c. Click Finish.

Result
An iSCSI session to the target is established.

Creating LUNs

SnapDrive enables you to quickly create LUNs on a storage system for use in a Windows environment.

Rules for creating LUNs

To avoid problems creating LUNs when using SnapDrive, you must keep some rules in mind.

• Create LUN names using US-ASCII characters only, even when you are using non-ASCII operating systems.
• If you are adding the LUN to a Windows Server 2003 or 2008 cluster, make sure to create the LUN on the node that owns the cluster group in which you are creating a new physical disk resource.

**Note:** Shared disks on Windows Server 2003 cluster nodes that do not own the disks often display as unknown and unreadable, and as offline on Windows 2008, in MMC Disk Management utility; however, the disks will continue to function normally on all nodes in the cluster.

- To ensure that Snapshot copies can be made, follow these guidelines:
  - Do not attempt to create a LUN on a storage system volume that holds anything other than LUNs.
  - Conversely, do not put anything other than LUNs on a storage system volume that contains LUNs.
  - All LUNs in the same storage system volume should be created using SnapDrive or, if they were created outside of SnapDrive, prepared for management in SnapDrive.

### Creating a dedicated LUN

You can use SnapDrive to create dedicated iSCSI-accessed LUNs.

**About this task**

Keep the following considerations in mind when creating a LUN:

- Unless the LUN is shared within a Windows cluster, the LUN must not be connected to more than one host.
- LUNs should be created using SnapDrive.

**Steps**

1. Perform the following actions to launch the Create Disk wizard:
   a. Select the SnapDrive instance for which you want to create a disk.
   b. Select Disks.
   c. From the menu choices at the top of MMC, navigate to Action > Create Disk.

   The Create Disk Wizard is launched.

2. In the Create Disk Wizard, click Next.

   The Provide Storage System Name, LUN Path and Name panel is displayed.

3. In the Provide a Storage System Name, LUN Path and Name panel, perform the following actions:
   a. In the “Storage System Name” field, type the storage system name where the LUN will be created or select an existing storage system using the pull-down menu.
   b. In the “LUN Path” field, type the LUN path or select the path on the storage system you added in Step a.
   c. In the "LUN Name" field, enter a name for the LUN and click Next.

   The Select a LUN Type panel is displayed.

4. In the Select a LUN Type panel, select Dedicated, and then click Next.

5. In the Select LUN Properties panel, either select a drive letter from the list of available drive letters or type a volume mount point for the LUN you are creating. When you create a volume mount point, type the drive path that the mounted drive will use: for example, G:\mount_drive1\.

   **Note:** The root of the volume mount point must be owned by the node on which you are creating the new disk.

   Note: You can create cascading volume mount points (one mount point mounted on another mount point); however, in the case of a cascading mount point created on an MSCS shared disk, you might receive a system event warning indicating that disk dependencies might not be
correctly set. This is not the case, however, as SnapDrive will create the dependencies and the mounted disks will function as expected.

6. While still in the Select LUN Properties panel, complete the following actions:
   a. Click Limit or Do not limit for the option labeled “Do you want to limit the maximum disk size to accommodate at least one snapshot?”
      If you keep the default, Limit, which is the recommended option, the disk size limits displayed are accurate only when they first appear on the Select LUN Properties panel. When this option is selected, the following actions might interfere with the creation of at least one Snapshot copy:
         • Changing the option to Do not limit and using SnapDrive to create an additional LUN in the same storage system volume.
         • Creating a LUN in the same storage system volume without using SnapDrive.
         • Storing data objects other than LUNs on this storage system volume.
   b. Select a LUN size, which must fall within the minimum and maximum values displayed in the panel.
   c. Click Next.

The Select Initiators panel is displayed.

7. In the Initiator List pane, select an initiator for the LUN you are creating. If you select an iSCSI initiator, and an iSCSI connection to the storage system on which you are creating the LUN does not exist, SnapDrive launches the Create iSCSI Session wizard, and you are prompted to select a target portal and initiator. Also, if your target requires authentication of hosts that connect to it, you can type that information here. After you click OK, the iSCSI connection from the Windows host to the storage system is established, even if you do not complete the Create Disk wizard.

8. Click Next.

The Select Initiator Group Management panel is displayed.

10. In the Select Initiator Group Management panel, specify whether you will use automatic or manual igroup management. If you select automatic igroup management, SnapDrive uses existing igroups or, when necessary, creates new igroups for the initiator you specified in Step 8. If you select manual igroup management, you manually choose existing igroups or create new ones as needed.

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| Automatic igroup management  | Click Next. 
SnapDrive uses existing igroups, one igroup per initiator, or, when necessary, creates new igroups for the initiators you specified in Step 8. |
| Manual igroup management     | Click next, and then perform the following actions: 
   a. In the Select Initiator Groups panel, select from the list the igroups to which you want the new LUN to belong. 
   Note: A LUN can be mapped to an initiator only once. 
   OR 
   Click Manage Igroups and for each new igroup you want to create, |
You are done with igroup management.

9. In the Completing the Create Disk Wizard panel, perform the following actions:
   a. Verify all the settings.
      If you need to change any settings, click Back to go back to the previous Wizard panels.
   b. Click Finish.

   Disk creation might take several seconds to complete. SnapDrive displays disk creation status in the lower panel of the center MMC pane.

Creating a shared LUN

You can use SnapDrive to create iSCSI-accessed LUNs that are shared between clustered Windows servers.

**Before you begin**
- Verify that the iSCSI services have been started on the storage system.

**About this task**
Keep the following consideration in mind when creating a LUN:
- LUNs should be created using SnapDrive.
- SnapDrive filters volumes, qtrees, and LUNs depending on storage system access control settings that might exist in the AccessControl.xml file on your storage system. During LUN creation, SnapDrive displays the message "Checking access control" to indicate it is checking these access control settings.

**Steps**
1. Perform the following actions to launch the Create Disk wizard:
   a. Select the SnapDrive instance for which you want to create a disk.
   b. Select Disks.
   c. From the menu choices at the top of MMC, navigate to **Action > Create Disk**.

   The **Create Disk Wizard** is launched.

2. In the **Create Disk Wizard**, click **Next**.

   The Provide Storage System Name, LUN Path and Name panel is displayed.

3. In the **Provide a Storage System Name, LUN Path and Name** panel, perform the following actions:
   a. In the “Storage System Name” field, type the storage system name where the LUN will be created or select an existing storage system using the pull-down menu.
   b. In the “LUN Path” field, type the LUN path or select the path on the storage system you added in Step a.
   c. In the "LUN Name" field, enter a name for the LUN and click **Next**.

   The **Select a LUN Type** panel is displayed.
4. In the Select a LUN Type panel, select Shared, and then click Next.
5. In the “Information About the Microsoft Cluster Services System” panel, verify that you want the disk to be shared by the nodes listed, and then click Next.

The Specify Microsoft Cluster Services Group panel is displayed.
6. In the Specify Microsoft Cluster Services Group panel, perform ONE of the following actions and then click Next.
   - Select a cluster group from the Group Name drop-down list.
   - Select Create a new cluster group to create a new cluster group.

**Note:** When selecting a cluster group for your LUNs, choose the cluster group your application will use. If you are creating a volume mount point, the cluster group is already selected. This is because the cluster group owns your root volume physical disk cluster resources. It is recommended that you create new shared LUNs outside of the cluster group.
   - Select Add to cluster shared volumes.

7. In the Select LUN Properties panel, either select a drive letter from the list of available drive letters or enter a volume mount point for the LUN you are creating. When you create a volume mount point, enter the drive path that the mounted drive will use: for example, G:\mount_drive1\.

**Note:** The root of the volume mount point must be owned by the node on which you are creating the new disk.

**Note:** You can create cascading volume mount points (one mount point mounted on another mount point); however, in the case of a cascading mount point created on an MSCS shared disk, you might receive a system event warning indicating that disk dependencies might not be correctly set. This is not the case, however, as SnapDrive will create the dependencies and the mounted disks will function as expected.

8. While still in the Select LUN Properties panel, complete the following actions:
   a. Click Limit or Do not limit for the option labeled “Do you want to limit the maximum disk size to accommodate at least one snapshot?”

If you select Limit, the disk size limits displayed are accurate only when they first appear on the Select LUN Properties panel. When this option is selected, the following actions might interfere with the creation of at least one Snapshot copy:
   - The option is changed to Do not limit and SnapDrive is used to create an additional LUN in the same storage system volume.
   - A LUN is created in the same storage system volume without using SnapDrive
   - Data objects other than LUNs are stored on this storage system volume.
   b. Select a LUN size. The size must fall within the minimum and maximum values displayed in the panel.

9. In the Select Initiators panel, perform the following actions:
   a. Double-click the cluster group name to display the hosts that belong to the cluster.
   b. Click the name of a host to select it.

The available initiators for that host are displayed in the Initiator List in the lower half of the pane.

10. In the Initiator List pane, select an initiator for the LUN you are creating.

**Note:** If you select an iSCSI initiator, and an iSCSI connection to the storage system on which you are creating the LUN does not exist, SnapDrive launches the Create iSCSI Session wizard, and you are prompted to select a target portal and initiator. Also, if your target requires authentication of hosts that connect to it, you can type that information here. After you click OK, the iSCSI connection from the Windows host to the storage system is established, even if you do not complete the Create Disk wizard.
If you have MPIO installed and you are using FC, you have the option to select several FC initiators.

11. Repeat Step 10 and Step 11 for all hosts, and then click Next.

**Note:** The Next button remains unavailable until initiators for all hosts of a cluster have been selected. The Select Initiator Group management panel is displayed.

12. In the **Select Initiator Group management** panel, specify whether you will use automatic or manual igroup management. If you select automatic igroup management, SnapDrive uses existing igroups or, when necessary, creates new igroups for the initiators you specified in Step 10 through Step 12. If you select manual igroup management, you manually choose existing igroups or create new ones as needed.

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<td>Automatic igroup management</td>
<td>Click Next. You are done with igroup management.</td>
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<tr>
<th>If you specify...</th>
<th>Then...</th>
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</table>
| Manual igroup management | Click Next, and then perform the following actions:  
  a. In the Select igroups panel, select from the list the igroups to which you want the new LUN to belong. Repeat this action for each node in the cluster.  
  **Note:** A LUN can be mapped to an initiator only once.  
  OR  
  Click Manage igroups and for each new igroup you want to create, type a name in the igroup Name text box, select initiators, click Create, and then click Finish to return to the Select igroups panel.  
  b. Click Next.  
  **Note:** The Next button will remain unavailable until the collection of selected igroups contains all the initiators you selected in Step 11. |

The Completing the Create Disk Wizard panel is displayed.

15. In the Completing the Create Disk Wizard panel, perform the following actions:
   a. Verify all the settings.
   If you need to change any settings, click Back to go back to the previous wizard panels.
   b. Click Finish.

Disk creation might take several seconds to complete. SnapDrive displays disk creation status in the lower panel of the center MMC pane.
Deleting a LUN

You can delete a LUN using the SnapDrive for Windows MMC snap-in.

Before you begin

If you are deleting a disk that contains volume mount points, disconnect the mounted volumes on the disk first before deleting the disk. For example, disconnect G:\mount_disk1\, then disconnect G:\.

If you do not disconnect the mounted volume before you delete it, Windows keeps the volume mount point information in the Recycle Bin and both Windows and SnapDrive continue to see the mount point as valid. If your volume mount point contains data, remember that SnapDrive will not warn you that data is present when you delete the mount point.

About this task

Use the Delete Disk feature cautiously, because after you delete a LUN, you cannot use SnapDrive to undelete it.

Steps

1. Make sure that neither Windows Explorer nor any other Windows application is using or displaying any file on the LUN you intend to delete.
2. Under SnapDrive in the left MMC pane, expand the instance of SnapDrive you want to manage, then expand Disks and select the disk you want to manage.
3. From the menu choices at the top of MMC, navigate to Action > Delete Disk.
4. When prompted, click Yes to proceed with the operation.

Note: This procedure will not delete the folder that was created at the time the volume mount point was added. After you remove a mount point, an empty folder will remain with the same name as the mount point you removed.

The icons representing the deleted LUN disappear from MMC.

Guidelines for resizing disks

As your storage needs change, you might need to resize a disk to hold more data or shrink the disk to make space available on the storage system volume.

- The ability to shrink a disk is supported only on Windows Server 2008 and later.
- A good time to expand a disk is right after you have expanded your storage system volumes.
- A LUN cannot be expanded to more than ten times its original size.
- Remember that LUNs with MBR-style partitions have a size limit of 2 TB, and LUNs with GPT-style partitions have a storage system size limit of 16 TB.
- Understand the storage management implications of resizing the LUN volume size.
- If it is necessary to restore a LUN from a Snapshot copy made before the LUN was resized, SnapDrive for Windows automatically resizes the LUN to the size of the Snapshot copy and performs the restore. When the disk is restored, SnapDrive reconnects the disk. If you restore a LUN from a Snapshot copy taken before the LUN was resized, the LUN will return to its former size before it was reduced or enlarged. After the restore, data added to the LUN after it was resized must be restored from a Snapshot copy taken after it was resized.
- When creating a quorum disk, make sure it is the size recommended by Microsoft for your Windows cluster setup.
- While a LUN is being resized, it might not be available for use, so plan your disk resizing at a time when applications are less likely to be accessing the disk.
Resizing a disk

You can resize a disk using the SnapDrive for Windows MMC snap-in to either increase or decrease the amount of space it uses.

Before you begin
Take a Snapshot copy of your disk before you resize it. If necessary, you can use the Snapshot copy to restore the disk to its original size.

About this task
If the disk you want to resize is a quorum disk in a Microsoft cluster configuration, instead of performing the following steps, you need to follow the procedure to resize a quorum disk.

Steps
1. Under SnapDrive in the left MMC pane, expand the instance of SnapDrive you want to manage, then expand Disks and select the disk you want to manage.
2. From the menu choices at the top of MMC, navigate to Action > Resize Disk.
3. Next to "Maximum size" in the Resize Disk window, leave "Reserve space for at least one Snapshot copy" selected.

Note: When you select this option, the disk size limits displayed are accurate only when they first appear on the Select LUN Properties panel.
4. In the "New size" box, either type a value, or use the slider bar to increase or decrease the amount of space the disk uses.

Note: It might be possible to shrink a disk to a smaller size than the indicated minimum by performing the resize operation more than once.
5. Click OK.
6. Create a new Snapshot copy of the resized disk.

After you finish
If you change the size of your disk, you might need to close and reopen MMC before the resized disk size becomes visible in the Disk Management snap-in.
Managing space on storage system volumes

SnapDrive for Windows enables you to manage space on your storage system volumes.

What SnapDrive space reservation monitoring does

Space reservation monitoring in SnapDrive for Windows enables you to monitor fractional space reserved for LUNs on a storage system volume.

To monitor the fractional space reserved on your storage system from your Windows host, SnapDrive lets you perform the following tasks:

- Set fractional space reservation thresholds for volumes containing LUNs
- Set rate-of-change percentage between two Snapshot copies or between a Snapshot copy and the active file system of the storage system volume
- Monitor space that can be reclaimed by deleting a Snapshot copy
- Set monitor polling interval
- Enable and disable e-mail notification

Configuring space reservation monitoring

You can configure how SnapDrive for Windows monitors the fractional space reserved for LUNs on a storage system volume.

Steps
1. Under SnapDrive in the left MMC pane, expand the instance of SnapDrive you want to manage, then select Disks.
2. From the menu choices at the top of MMC, navigate to Action > Properties.
3. In the Disks Properties window, select the Space Reservation Monitor tab.
4. In the Space Reservation Monitor panel, perform the following actions:
   a. Click to deselect the Disable Space Reservation Monitoring checkbox.
   b. Type a value in the Monitor Time Interval field, in minutes.
      Values can be between 0 (disable) and 10,080 minutes (7 days).
   c. Under the Space Reservation Monitor Settings tree, select the storage system and volume name.
   d. Type a value for the Reserve Available percentage threshold.
   e. Type a value for the Rate of Change threshold and choose MB, GB, or TB for the Unit.
   f. Select the Alert checkbox if you want to be notified if this condition occurs.
5. Click OK or Apply to save your changes.
6. Click OK.

What Space Reclaimer does

You should remember these guidelines when using Space Reclaimer.

- For optimum storage performance, run Space Reclaimer as often as possible and until the entire NTFS file system has been scanned.
• Space reclamation is a time-consuming operation; therefore, it is best to run Space Reclaimer on your NTFS volume when there is a large amount of unused deleted space.
• The space reclamation process is CPU intensive, so run Space Reclaimer when storage system and Windows host usage is low; for instance, at night.
• Do not run disk defragmentation at the same time Space Reclaimer is running, as doing so can slow the disk reclamation process.
• In MSCS configurations, Space Reclaimer can be initiated from the owner node only.
• Although Space Reclaimer reclaims nearly all space from newly freed blocks, it does not reclaim 100 percent of the space.

Starting Space Reclaimer

You can start space reclamation using SnapDrive for Windows MMC snap-in.

Steps
1. Under SnapDrive in the left MMC pane, expand the instance of SnapDrive you want to manage, then expand Disks and select the disk you want to manage.
2. From the menu choices at the top of MMC, navigate to Action > Start Space Reclaimer.

<table>
<thead>
<tr>
<th>If SnapDrive detects that there is...</th>
<th>Then a window appears...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space to reclaim</td>
<td>Confirming that the LUN can be optimized for Snapshot copy creation. Continue to the next step.</td>
</tr>
<tr>
<td>No space to reclaim</td>
<td>Notifying you that you do not need to run Space Reclaimer on the selected disk. Click Cancel to exit the Confirm Space Reclamation on Disk window, or go to the next step to continue with space reclamation. <strong>Note:</strong> When you run Space Reclaimer on a disk that SnapDrive has determined has no space to reclaim, the space reclamation process can still take as long to complete as it would for a disk that does have reclaimable space. This is because SnapDrive performs NTFS block comparisons and analyzes disk infrastructure regardless of whether there is space to reclaim.</td>
</tr>
</tbody>
</table>

3. In the Confirm Space Reclamation on Disk window, limit the amount of time Space Reclaimer runs on a LUN by selecting the "Limit (in minutes) Space Reclamation operation" checkbox. In the space provided by the check box, type the number of minutes you want Space Reclaimer to run on the LUN. By default, Space Reclaimer runs until the LUN is optimized.
4. Click OK to continue.
The space reclamation process runs in the background. You can monitor the Space Reclaimer progress for the selected LUN by watching the status bar in the Details pane in MMC.

**Note:** SnapDrive might indicate that it is necessary to run Space Reclaimer again after it has successfully completed a space reclamation process. This can happen if data is deleted from a LUN while Space Reclaimer is running. It is strongly recommended that the space reclamation process is performed when there is little or no activity on both the storage system and the Windows host.

### Stopping Space Reclaimer manually

You can stop space reclamation using SnapDrive for Windows MMC snap-in.

**Steps**

1. Under SnapDrive in the left MMC pane, expand the instance of SnapDrive you want to manage, then expand **Disks** and select the disk you want to manage.
2. From the menu choices at the top of MMC, navigate to **Action > Stop Space Reclaimer**.

### Reasons for SnapDrive to automatically stop Space Reclaimer

SnapDrive for Windows automatically stops Space Reclaimer in several instances.

- During any LUN management operation on a LUN running Space Reclaimer, including LUN disconnect and LUN delete operations
- During any Snapshot copy management operation except Snapshot copy rename and delete
- On all LUNs of the same storage system volume during Snapshot copy creation
- If the SnapDrive service is stopped
- During LUN restore operations for any volume mount points directly or indirectly mounted (cascading) from the disk being restored
- During Windows host cluster failover

If a host cluster failover operation occurs on a Windows Server 2003 MSCS or Windows Server 2008 failover cluster while Space Reclaimer is running on a shared LUN, space reclamation will stop running on that LUN.

- During any MPIO path management operations, including adding or removing an initiator or active path selection
Managing Snapshot copies

You can use SnapDrive for Windows to create, schedule, restore, and delete Snapshot copies as well as some other Snapshot copy management tasks.

What a Snapshot copy is

A Snapshot copy is a read-only image of a traditional volume, a FlexVol volume, or an aggregate that captures the state of the file system at a point in time. Snapshot copies are your first line of defense to back up and restore data.

You can store up to 255 Snapshot copies at one time on each volume.

You can specify the percentage of disk space that Snapshot copies can occupy. The default setting is 20 percent of the total (both used and unused) space on the disk.

Reasons for creating Snapshot copies

You use SnapDrive to ensure that you create consistent Snapshot copies in the event you need to restore a LUN from that copy.

Snapshot operations on a single LUN actually make a Snapshot copy of all the LUNs on the volume. Because a storage system volume can contain LUNs from multiple hosts, the only consistent Snapshot copies are those of LUNs connected to the host that created the SnapDrive Snapshot copy. In other words, within a Snapshot copy, a LUN is not consistent if it is connected to any host other than the one that initiated the Snapshot copy. (This is why you are advised to dedicate your storage system volumes to individual hosts.) Therefore, it is important to back up a LUN using a SnapDrive Snapshot copy rather than using other means, such as creating Snapshot copies from the storage system console.

Note: If you use the SnapManager product to manage your database, instead of SnapDrive you must use SnapManager to create Snapshot copies. For more information about using SnapManager to create Snapshot copies, see the current SnapManager Installation and Administration Guide for your product.

Additionally, as part of the SnapDrive Snapshot copy process, the file system (NTFS) is flushed to disk and the disk image in the Snapshot copy is in a consistent state. This consistency cannot be ensured if the Snapshot copy was created outside the control of SnapDrive (that is, at the storage system console, or using the FilerView interface or rsh, or by backing up the LUN file in the active file system.)
Restrictions on Snapshot copy creation

You must keep in mind some restrictions for creating Snapshot copies.

- You can keep a maximum of 255 Snapshot copies. After the number of Snapshot copies has reached the limit, the Snapshot Create operation fails, and you must delete some of the old Snapshot copies before you can create any more.
- SnapDrive does not support Snapshot copies that are created from the storage system console, because such a practice can lead to inconsistencies within the NTFS file system. Therefore, use only SnapDrive to create Snapshot copies of LUNs.
- You cannot create a Snapshot copy of a LUN connected to a Snapshot copy.
- SnapDrive automatically turns off the Snapshot copy schedule on a storage system volume that stores LUNs, so that the storage system does not create automatic Snapshot copies.

Note: Any Snapshot copies inadvertently made at the storage system console or through FilerView are dimmed (unavailable) in the SnapDrive MMC plug-in and are not usable by SnapDrive.

Creating a Snapshot copy

You should always use SnapDrive to create Snapshot copies of LUNs to ensure that Snapshot copies are consistent.

Before you begin

The following requirements must be met in order to successfully create Snapshot copies using SnapDrive:

- You must create Snapshot copies through the SnapDrive MMC snap-in or through sdcli.exe, rather than the storage system console or the volume Snapshot copy schedule on the storage system. This is because SnapDrive must first flush NTFS so that the LUN is consistent at the moment the Snapshot copy is made. This ensures the usability of the LUN file in the Snapshot copy directory.
- Snapshot names must be created using US-ASCII characters only, even when using non-ASCII operating systems.

Note: The SnapDrive service can perform only one task at a time. If you schedule multiple tasks to start at exactly the same time, the first will proceed, and SnapDrive will queue the others until the first task either succeeds or times out.

Steps

1. Perform the following actions to get to the Create Snapshot menu item:
   a. In the left MMC pane, select the instance of SnapDrive you want to manage.
   b. Double-click Disks.
   c. Double-click the disk for which you want to create a Snapshot copy.
   d. Select Snapshots.
   e. From the menu choices at the top of MMC, navigate to Action > Create Snapshot.

The Create Snapshot text box is displayed.
2. In the **Create Snapshot** text box, perform the following actions:
   a. Type an easy-to-interpret name for the Snapshot copy.

   **Example**
   expenses_db_15Jan07_4pm

   **Note:** Snapshot copy names must be created using US-ASCII characters only, even when using non-ASCII operating systems.

   b. Click **OK**.

**Result**
Your Snapshot copy is created.

Details about the Snapshot copy appear at the bottom panel of the center MMC pane.

### Scheduling Snapshot copies

Create a Snapshot copy schedule to ensure that SnapDrive creates Snapshot copies at intervals appropriate to your environment.

**About this task**
All steps except Step 1 in the following procedure are performed using the Scheduled Task Wizard, a Windows task scheduling tool available on your Windows server.

**Steps**
1. Create a batch file (a file with a .bat extension) containing the following command on the Windows host on which you are scheduling Snapshot copies:

   `sdlcli snap create [-m MachineName] -s SnapshotName -D DriveLetterList [ . . ] [-x]`

   *MachineName* is the name of the Windows host on which the command will be executed. If no machine name is specified, the command is executed on the local machine.

   *SnapshotName* is the name of the Snapshot copy to be created.

   *DriveLetterList* is a list of space-separated drive letters.

   When `-x` flag is specified, Snapshot copies are created only for the drives specified by the `-D` flag. Otherwise, Snapshot copies are created for all the disks on the storage system volumes used by the listed drives.

   **Example**
   `sdlcli snap create -s Jun_13_07 -D j k l`

   The preceding example creates a Snapshot copy named Jun_13_07 for each volume containing one or more of the LUNs mapped to the specified drives (that is, J:, K:, and L:). The Snapshot copies created are consistent for all LUNs contained by those volumes.

2. Select **Start Menu > Settings > Control Panel > Scheduled Tasks**.
3. Double-click **Add Scheduled Task**.
   The **Scheduled Task Wizard** is launched.
4. In the **Scheduled Task Wizard**, click **Next**.
5. Click **Browse**, and locate the batch (.bat) file you created in Step 1.
6. Select the batch file and click **Open**.
7. In the next panel, select from the list of frequencies, then click **Next**.
8. In the next panel, type a start time and complete the detailed frequency parameters. The option details displayed on this panel vary depending on the Snapshot copy frequency you picked in the previous panel.
9. In the next panel, type the user name (the administrator account name and password, repeated for confirmation), then click **Next**.
10. Click **Finish**.

**Result**
Your schedule is created.
Connecting to a LUN in a Snapshot copy

Steps
1. Under SnapDrive in the left MMC pane, expand the instance of SnapDrive you want to manage, then expand Disks and select the disk you want to manage.
2. Expand the LUN whose Snapshot copy you want to connect, then click on Snapshot Copies to display the list of Snapshot copies. Select the Snapshot copy you want to connect.
3. From the menu choices at the top of MMC, navigate to Action > Connect Disk to launch the Connect Disk wizard.
4. In the Connect Disk Wizard, click Next.
5. In the Provide a Storage System Name, LUN Path and Name panel, the information for the LUN and Snapshot copy you selected is automatically filled in. Click Next.
6. In the Select a LUN Type panel, Dedicated is automatically selected because a Snapshot copy can be connected only as a dedicated LUN. Click Next.
7. In the Select LUN Properties panel, either select a drive letter from the list of available drive letters or type a volume mount point for the LUN you are connecting, then click Next. When you create a volume mount point, type the drive path that the mounted drive will use: for example, :\mount_drive1\.
8. In the Select Initiators panel, select the FC or iSCSI initiator for the LUN you are connecting and click Next.
9. In the Select Initiator Group management panel, specify whether you will use automatic or manual igroup management.

<table>
<thead>
<tr>
<th>If you specify...</th>
<th>Then...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Automatic igroup management</strong></td>
<td>Click Next. SnapDrive uses existing igroups, one igroup per initiator, or, when necessary, creates new igroups for the initiators you specified in the Select Initiators panel.</td>
</tr>
<tr>
<td><strong>Manual igroup management</strong></td>
<td>Click Next, and then perform the following actions: a. In the Select Initiator Groups panel, select from the list the igroups to which you want the new LUN to belong. <strong>Note:</strong> A LUN can be mapped to an initiator only once. OR Click <strong>Manage Igroups</strong> and for each new igroup you want to create, type a name in the Igroup Name text box, select initiators from the initiator list, click <strong>Create</strong>, and then click <strong>Finish</strong> to return to the Select Initiator Groups panel. b. Click Next.</td>
</tr>
</tbody>
</table>
10. In the **Completing the Connect Disk Wizard** panel, perform the following actions.
   a. Verify all the settings
   b. If you need to change any settings, click Back to go back to the previous Wizard panels.
   c. Click **Finish**.

**Result**
The newly connected LUN appears under Disks in the left MMC pane.

**How LUN restoration from Snapshot copies works**

When you restore a LUN from a Snapshot copy, the LUN reverts to the state it was in when the Snapshot copy was made: the restore operation overwrites all data written to the LUN since the Snapshot copy was made.

A LUN restore recalls a selected Snapshot copy. During a restore, the entire LUN drive is restored from the Snapshot copy. For a restore to succeed, no open connections can exist between the host machine (or any other application) and the files in the LUN.

**Note:** If it is necessary to restore a LUN from a Snapshot copy made before the LUN was resized, SnapDrive for Windows automatically resizes the LUN to the size of the Snapshot copy and performs the restore. Such a restore causes the loss of any data added to the LUN after it was resized, and it can damage virtual machines (such as Hyper-V VMs) or applications if they are running on the LUN during the restore.

**About the Data ONTAP LUN clone split (rapid LUN restore) feature**

SnapDrive uses the LUN clone split (rapid LUN restore) feature of Data ONTAP when restoring a LUN.

A LUN clone is a point-in-time, writable copy of a LUN in a Snapshot copy. After the clone is created, all read/write operations are made on the clone and read/write operations are no longer made on the original LUN.

A LUN clone shares space with the original LUN in the backing Snapshot copy. The clone does not require additional disk space until changes are made to it. When Data ONTAP splits the clone from the backing Snapshot copy, Data ONTAP copies the data from the Snapshot copy, and copies the blocks from the original LUN, to the clone. After the splitting operation, the clone becomes a regular LUN, and the original LUN is deleted by Data ONTAP.

**Note:** If you do not have enough disk space for both the clone and the original LUN, the split will not be initiated and no LUN restoration can occur.

**Benefit of using rapid LUN restore**

When rapid LUN restore, or LUN cloning, is used by SnapDrive, the clone is split from the backing Snapshot copy in the background, and the restored LUN is available to the Windows host for I/O operations within a few seconds.
Restoring a LUN from a Snapshot copy

SnapDrive restores a LUN using the rapid LUN restore feature.

**Before you begin**
- Shut down all resources directly or indirectly dependent on the LUN.
- Make sure that the LUN is not being used by the Windows file system or any other process, and that no user has the LUN open in Windows Explorer. Shut down any application that is using the LUN.

**Attention**: Make sure that the Windows Performance Monitor (perfmon) is not monitoring the LUN.

**Note**: Make sure that virtual machines, Microsoft Exchange, or any other applications are no longer running on a LUN before you restore that LUN from a Snapshot copy.

**Steps**
1. Perform the following actions:
   a. In the left MMC pane, select the instance of SnapDrive you want to manage.
   b. Double-click Disks to display all available disks.
   c. Select the LUN that you want to restore and double-click it to display all the Snapshot copies list.
   d. Select the Snapshot copy from which to restore the LUN.
2. In the menu choices at top of MMC, click **Action > Restore Disk**.

**Note**: You can only restore a Snapshot copy that is consistent with the active file system. Inconsistent Snapshot copies are not available for restoration and are grayed out.

The **Restore Snapshot Copy** panel is displayed.
3. In the **Restore Snapshot Copy** panel, click **Yes** to restore the LUN from the Snapshot copy you selected.

**Attention**: Do not attempt to manage any Windows cluster resources while the restore is in progress.

**Checking LUN restore status**

Check whether LUN restoration has completed by viewing the Restore Status field in the SnapDrive MMC.

**Steps**
1. Perform the following actions:
   a. In the left MMC pane, select the instance of SnapDrive you want to manage.
   b. Double-click Disks.
2. In the center MMC pane, locate the name of the disk you are restoring. The status is displayed in the lower panel of the center MMC pane.

**Note**: You can also check the status of a LUN restore using the disk list command of the sdcli.exe utility.

**Result**
If a restore is in progress, SnapDrive will display the percentage completed, otherwise; the status will display Normal.
Deleting a Snapshot copy

You should delete older SnapDrive Snapshot copies to keep the number of stored Snapshot copies less than the hard limit of 255 for Data ONTAP and to free space on the storage system volume. Be sure to delete old Snapshot copies before the hard limit is reached; otherwise, subsequent Snapshot copies could fail. Even before the Snapshot copy limit is reached, a Snapshot copy fails if insufficient reserved space for it remains on the disk.

Steps
1. Perform the following actions:
   a. In the left MMC pane, select the instance of SnapDrive you want to manage.
   b. Double-click Disks.
   c. Select the LUN whose Snapshot copy you want to delete.
2. In the right MMC pane, select the Snapshot copy you want to delete.
   
   **Note:** You can only delete a Snapshot copy that is consistent with the LUN. Inconsistent Snapshot copies are not available for deletion.
3. From the menu choices on top of MMC, click Action > Delete.
   The Delete Snapshot panel is displayed.
4. In the Delete Snapshot panel, click Yes to delete the Snapshot copy you selected.
   
   **Note:** If you get an error message stating that the Snapshot copy is busy or cannot be deleted, it is likely that the Snapshot copy is in use by a LUN that is backed by a Snapshot copy.

Executing sdcli commands

The sdcli commands consist of three input parameters, which must be specified in the correct order, followed by one or more command-line switches. You can specify the command-line switches in any order.

**Before you begin**
When you use the sdcli command-line utility on a Windows 2008 server, keep the following information in mind:

- You must be logged in as Administrator, or as a user with administrative rights.
- If you log in as a user other than the one used to install SnapDrive, you must update the SnapDrive service credentials with the new user information and restart the SnapDrive service.

**About this task**
Command-line switches are case-sensitive. For instance, the -d switch refers to a single drive letter, while the -D switch refers to one or more drive letters separated by spaces.

**Steps**
1. Using a host that has SnapDrive installed, select **Start > Run**.
2. Type `cmd` in the dialog box entry field, and then click **OK**.
3. After the Windows command prompt window opens, navigate to the directory on your host where SnapDrive is installed.
Example

C:

`cd \Program Files\NetApp\SnapDrive\`

4. Enter the individual command you want to run. Make sure to include all input parameters in the proper order and to specify both required and desired command-line switches in any order.

Example

`sdcli disk disconnect -d R`

Alternatively, enter the name and path of the automation script you want to run.

Example

`C:\SnapDrive Scripts\disconnect_R_from_host4.bat`