Dell Compellent SNMP Overview

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July 2014

A Dell Technical White Paper
Revisions

<table>
<thead>
<tr>
<th>Date</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>06/12/2013</td>
<td>Initial Draft</td>
</tr>
<tr>
<td>10/01/2013</td>
<td>Update: Trap chapter</td>
</tr>
<tr>
<td>10/12/2013</td>
<td>Reformat and update content</td>
</tr>
<tr>
<td>07/31/2014</td>
<td>Technical review</td>
</tr>
</tbody>
</table>

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# Table of contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revisions</td>
<td>2</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td>4</td>
</tr>
<tr>
<td>1. Introduction</td>
<td>5</td>
</tr>
<tr>
<td>2. SNMP overview</td>
<td>6</td>
</tr>
<tr>
<td>3. Getting the status of a Compellent array</td>
<td>7</td>
</tr>
<tr>
<td>3.1. MIB Browser installation and configuration</td>
<td>7</td>
</tr>
<tr>
<td>3.2. Configure SNMP on the Storage Center</td>
<td>13</td>
</tr>
<tr>
<td>3.3. Send a get request to the Storage Center</td>
<td>14</td>
</tr>
<tr>
<td>3.4. Interpreting the status of an SNMP</td>
<td>17</td>
</tr>
<tr>
<td>3.4.1. Disk status</td>
<td>17</td>
</tr>
<tr>
<td>3.4.2. Server status</td>
<td>20</td>
</tr>
<tr>
<td>3.4.3. Quick storage summary</td>
<td>24</td>
</tr>
<tr>
<td>3.5. Retrieving a trap from Storage Center</td>
<td>25</td>
</tr>
<tr>
<td>A. Sample XML file content</td>
<td>29</td>
</tr>
<tr>
<td>A.1. Customer support</td>
<td>29</td>
</tr>
</tbody>
</table>
Acknowledgments

A special thank you is extended to the Dell Solution Center team, especially Mr. Patrick Szczepaniak, for contributing to this document.
1 Introduction

This document presents useful information about the new MIB (Management Information Base) for Compellent arrays. Storage Center OS (SCOS), versions 6.3 and later, provide many valuable features for Compellent, like a rewritten MIB that is more comprehensive than the previous version. This document also presents an overview of SNMP (Simple Network Management Protocol) and a basic implementation of SNMP commands with the new Compellent MIB. The explanations in this document will provide a better understanding of the relationships between an SNMP tool (requester for example) and the status of a Compellent array.

Storage Center version 6.3 includes SNMP enhancements for general monitoring and problem notification. These SNMP enhancements improve the ability to monitor the health of Storage Centers and simplify the use of trap messages with third party, trouble ticket applications. The Storage Center generates an SNMP trap message whenever a condition occurs that requires some form of intervention by a user such as an operator, administrator, or maintenance person. SNMP enhancements include:

- Added support for the SNMPv2C protocol
- Additional object IDs to SNMP trap messages that are uniquely identifiable, without the need to parse text strings in the trap
- A field to SNMP trap messages that indicates the general class of the trap

This document was not written to provide a comprehensive nor complete representation of every SNMP method or function.
2 SNMP overview

At its beginning, SNMP was designed to manage IP (Internet Protocol) devices, such as network switches, routers, and modems. Since then, it has been extended to include many devices like servers, workstations, and storage arrays.

An SNMP implementation consists of:

- A managed device
- SNMP agent software that can convert the gathered information (for example, the status of an element) into an SNMP language
- An application that shows SNMP information (requests assistance from the SNMP agent or listens for a trap)

The MIB is a list of variables provided by a managed device. It is built with a hierarchical namespace containing several OIDs (Object IDentifiers).

There are three implementations of the protocol: SNMP v1, v2 and v3. Details are available in the following resources:
http://www.snmp.com/
http://en.wikipedia.org/wiki/Management_information_base

3 Getting the status of a Compellent array

This section provides instructions for obtaining the Compellent array status by using SNMP Get commands. The environment used for the example presented in the instructions was based on:

- A Compellent array with SCOS 6.3
- Mix pool of disks (15K and 7K)
- Windows 7 workstation
- Firefox browser
- Java software 1.6 (or another third party MIB browser tool)

3.1 MIB Browser installation and configuration

In the following demonstration, the free iReasoning tool MIB browser was used ([http://ireasoning.com/mibbrowser.shtml](http://ireasoning.com/mibbrowser.shtml)). This Java based tool works across all platforms. Other tools are also available for Windows, Linux and Unix.


   A folder titled, “mib” was created on the local hard drive of the Windows 7 workstation.

   ![Directory listing](https://example.com/directory-listing.png)

2. Extract all data from the archive to the same folder by using zip tool.

   The files are extracted to a folder titled, “ireasoning” inside the mib folder.

   ![Directory listing](https://example.com/directory-listing.png)
3. To view the content, navigate to the ireasoning\MIB browser folder and run a `dir` command.

```
PS Z:\mib> cd .\ireasoning\mibbrowser

PS Z:\mib\ireasoning\mibbrowser> dir

Directory: Z:\mib\ireasoning\mibbrowser

Mode     LastWriteTime          Length     Name
----------           --------    ------
d---- 30/07/2013  14:20          audio
  d---- 30/07/2013  14:20          bin
  d---- 30/07/2013  14:20          browser.app
  d---- 30/07/2013  14:20          config
  d---- 30/07/2013  14:20          docs
  d---- 30/07/2013  14:20          images
  d---- 30/07/2013  14:20          lib
  d---- 09/06/2013  23:31           log
  d---- 30/07/2013  14:20          mibs
  ----- 16/10/2009  13:59       142 browser.command
  ----- 06/05/2012  13:48           393 browser.sh
-a---- 07/01/2013  10:11       3327 license.txt
-a---- 23/03/2013  12:05       293 README.txt
  ----- 06/05/2012  13:48           142 snmpget.sh
  ----- 06/05/2012  13:48           146 snmpgetnext.sh
  ----- 06/05/2012  13:48           142 snmpset.sh
  ----- 06/05/2012  13:48           143 snmpwalk.sh
-a---- 07/01/2013  10:11     33622 THIRDPARTYLICENSEREADME.txt
  ----- 06/05/2012  13:48           145 trap.sh
  ----- 06/05/2012  13:48           158 trapd.sh
  ----- 06/05/2012  13:48           165 trapdconsole.sh
```

**Important:** Be sure that Java is installed.

4. Create a batch file named “browser.bat” with this content and change the location set for “HOME” to match your environment.

```
@echo off
set HOME="z:\mib\ireasoning\mibbrowser"
java -Xmx384m -Duser.country=US -Duser.language=en -jar %HOME%\lib\browser.jar
```
5. The MIB browser will run when the browser.bat file is launched.

Note: In order to load the Compellent MIB, it must be downloaded from the Compellent knowledge center at http://customer.compellent.com.
6. Save the Compellent MIB file in the MIB browser folder at the root of the mib folder.

```
PS Z:\mib> dir

Directory: Z:\mib

Mode    LastWriteTime        Length Name
----     -----------         ------ -----
d----      30/07/2013          11275 MIB2013.02.08.zip
-a---      30/07/2013          104774 compellent-mib.mib
-a---      30/07/2013          11275 MIB2013.02.08.zip
-a---      12/06/2013           9684650 mibbrowser.zip
```

7. Extract the Compellent-mib.mib file.

```
PS Z:\mib> dir

Directory: Z:\mib

Mode    LastWriteTime        Length Name
----     -----------         ------ -----
d----      30/07/2013          11275 MIB2013.02.08.zip
-a---      13/02/2013          104774 compellent-mib.mib
-a---      30/07/2013          11275 MIB2013.02.08.zip
-a---      12/06/2013           9684650 mibbrowser.zip
```
8. Click **File > Load MIBs** to load the Compellent MIB using the MIB browser tool.

![MIB Browser](image)

9. Select the `compellent-mib.mib` file and click **Open**.

![Open Dialog](image)

With the Compellent MIB file successfully loaded in the MIB browser, the expanded MIB Tree shows a private `mib` and `compellentEnterprise` folder.
Click **compellentEnterprise** to see the OID and the MIB reference.
3.2 Configure SNMP on the Storage Center

1. Configure the SNMP server on the Storage Center by using the web GUI (Storage Center Manager). Choose Storage Management > System > Access > Configure SNMP Server.

**Note:** This function requires a username and password to log in. The defaults are *Admin* and *mmm* respectively.

2. Initially, configure only the SNMP get/set parameters as shown below (the read and write community, not the SNMP trap).

**Notice:** A standard string (“public”) is used for the read only and read/write community strings. Keep in mind that the string sign ($) can not be used in the community string.

3. Click Start Agent.
The status of the agent changes from **Stopped** to **Running**.

### 3.3 Send a get request to the Storage Center

On the MIB browser, send get commands to the Storage Center.

1. On the top-left corner, write the IP address of the Storage Center and click **Advanced**.

2. Enter the read community, write community and SNMP version as shown below.
Keep in your mind that the Compellent MIB is compatible with SNMP version 2, not version 3.

3. Run your first query by clicking **Go** in the top-right of the corner.

   ![Advanced Properties of SNMP Agent](image)

   The first result is the product name:

   ![Result Table](image)

   The information includes:

   - The product name
   - The product description
   - The product vendor
   - The product version (SCOS version)

   For an entire scan of elements in the MIB, use a walk command as described below.

   1. Expand the **compellentEnterprise** tree (OID : .1.3.6.1.4.1.16139).
2. Choose the **Walk** operation in the top-right corner, and click **Go**.

Depending on the complexity of the Storage Center hardware configuration, it may take several minutes for the MIB browser to return all of the data.

The data can be exported in a raw format or in an XML file. An example of this output is in Appendix A, titled, "Sample XML file content". XML files can be viewed in the MIB browser by copying and pasting the content or using the right toolbar in the MIB Browser to load and open the file.
To view the information in an MIB browser tab, right-click `scServerTable` and choose Table View.

A table appears in a new tab as shown below.

![Table View](image)

In the remainder of this paper, output is viewed by double-clicking each OID.

### 3.4 Interpreting the status of an SNMP

#### 3.4.1 Disk status

For this example, a Storage Center with a failed drive that has the following properties is used.

- Position = 07-20
- Index = 144
- Folder = Pooldisk
- Classification = 7K
- Status = Down

Detailed Storage Center properties are displayed on the Compellent Storage Center Manager GUI as shown below.
Run an SNMP get command of the disk status on Storage Center with the MIB browser.

1. In the MIB browser interface, expand `compellentObjects` and `scDiskTable`.

2. Double-click `scDiskNamePosition` to scan the position of all the drives.

Storage Center has several drives and, typically, several enclosures. Each drive has a unique position in the SNMP table that is assigned a number starting with one.

Detailed information for each drive is displayed in the Result Table of the MIB browser; the Name/OID and Disk Number columns provide the information needed for this example.

<table>
<thead>
<tr>
<th>scDiskNamePosition, 94</th>
<th>07-04</th>
</tr>
</thead>
<tbody>
<tr>
<td>scDiskNamePosition, 95</td>
<td>07-05</td>
</tr>
<tr>
<td>scDiskNamePosition, 96</td>
<td>07-20</td>
</tr>
<tr>
<td>scDiskNamePosition, 97</td>
<td>07-18</td>
</tr>
<tr>
<td>scDiskNamePosition, 98</td>
<td>07-16</td>
</tr>
<tr>
<td>scDiskNamePosition, 99</td>
<td>07-23</td>
</tr>
</tbody>
</table>
Disk 07-20 (where 07 is the enclosure number and 20 is the disk number) has position 96 in the MIB listing.

3. Double-click `scDiskStatus` to view a status listing of all the disks in Storage Center.

4. Locate the row displaying the status for the disk in position 96.

| scDiskStatus.93 | 1 |
| scDiskStatus.94 | 1 |
| scDiskStatus.95 | 1 |
| scDiskStatus.96 | 2 |
| scDiskStatus.97 | 1 |
| scDiskStatus.98 | 1 |
| scDiskStatus.99 | 1 |

Compellent MIB status values are: 1 (up), 2 (down) and 3 (degraded).

Disk 96 (or 07–20) is down.

5. Double-click `scDiskHealthy` to view the health value of the Storage Center disks.

| scDiskHealthy.94 | true (1) |
| scDiskHealthy.95 | true (1) |
| scDiskHealthy.96 | false (2) |
| scDiskHealthy.97 | true (1) |
| scDiskHealthy.98 | true (1) |

The health value for disk 96 is `false(2)`.

6. Double-click the next OID, `scDiskStatusMsg`. 
The `scDiskStatusMsg` value is a string. The value for disk 96 indicates an error. Other disks show an information alert of a firmware upgrade.

7. The last OID (`scDiskApilIndex`) provides a device index that links the Compellent view back to the MIB view.

At the beginning of this example, drive 07-20 was selected in the Compellent Storage Center Manager GUI. It has a CML index of 144.

3.4.2 Server status

To view the OIDs for a server object, a Storage Center connected to several servers of different statuses is used. The three examples presented are:

- A basic server cluster object
- A server object with a disconnected status
• A server object with a partially disconnected status

3.4.2.1 Server cluster object
In the MIB tree, expand **scServerTable** and double-click **scServerName** to display a list of server objects.

![MIB tree diagram]

Notice, that the object **ESX_Prod** is represented in the same way as a server.

<table>
<thead>
<tr>
<th>scServerName.36</th>
<th>esx_prod02</th>
<th>OctetString</th>
</tr>
</thead>
<tbody>
<tr>
<td>scServerName.36</td>
<td>Storage Cmbr 601.60</td>
<td>OctetString</td>
</tr>
<tr>
<td>scServerName.37</td>
<td>CLUSTER SQL 2008</td>
<td>OctetString</td>
</tr>
<tr>
<td>scServerName.38</td>
<td>New Server Cluster 1</td>
<td>OctetString</td>
</tr>
<tr>
<td>scServerName.39</td>
<td>ESX_Prod</td>
<td>OctetString</td>
</tr>
<tr>
<td>scServerName.40</td>
<td>Au Server</td>
<td>OctetString</td>
</tr>
<tr>
<td>scServerName.41</td>
<td>VRF_HOST</td>
<td>OctetString</td>
</tr>
</tbody>
</table>

In the Compellent GUI, the object is displayed as shown below:

![Compellent GUI diagram]
### 3.4.2.2 Server object with a disconnected status

The server used in this example is labeled, “APPASSURE-REP” and has the following properties:

- Name: APPASSURE-REP
- Index: 45
- Type: Server
- Connectivity: Disconnected

This information is displayed in the Compellent Storage Center manager GUI as shown below.

1. Search the MIB reference for this object in the MIB tree and note the `scServerName` value.

<table>
<thead>
<tr>
<th><code>scServerName.21</code></th>
<th><code>scServerName.22</code></th>
<th><code>scServerName.23</code></th>
<th><code>scServerName.24</code></th>
<th><code>scServerName.25</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR-IDM-ADSRV</td>
<td>APPASSURE-REP</td>
<td>CSF-SRV006</td>
<td>SRV-PROXYCOM</td>
<td>appasure-53</td>
</tr>
</tbody>
</table>

2. Double-click the `scServerApiIndex` OID and locate object 22 in the MIB listing.

<table>
<thead>
<tr>
<th><code>scServerApiIndex.20</code></th>
<th><code>scServerApiIndex.21</code></th>
<th><code>scServerApiIndex.22</code></th>
<th><code>scServerApiIndex.23</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>43</td>
<td>45</td>
<td>47</td>
</tr>
</tbody>
</table>

3. Double-click the last OID (`ScServerStatus`) to view the server status.

<table>
<thead>
<tr>
<th><code>scServerStatus.21</code></th>
<th><code>scServerStatus.22</code></th>
<th><code>scServerStatus.23</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Compellent MIB status values are: 1 (up), 2 (down) and 3 (degraded). Server 22 is down.
3.4.2.3 A server object with a partially disconnected status

The server in this example is labeled, "hypsrv001". It has one FC HBA that is not communicating correctly on all the paths from the HBA to the CML controllers.

1. Retrieve the position of this object in the MIB listing using `scServerName` OID.

<table>
<thead>
<tr>
<th>scServerName.10</th>
<th>Centos001</th>
</tr>
</thead>
<tbody>
<tr>
<td>scServerName.11</td>
<td>VEEAMSRV001</td>
</tr>
<tr>
<td><strong>scServerName.12</strong></td>
<td>hypsrv001.par-idm.net</td>
</tr>
<tr>
<td>scServerName.13</td>
<td>SQLSRV001</td>
</tr>
</tbody>
</table>

2. Check the status of the server in position 12 using the `scServerStatus` OID.

<table>
<thead>
<tr>
<th>scServerStatus.12</th>
<th>3</th>
</tr>
</thead>
</table>

The value 3 shows that the server status is degraded.

3. Check the connectivity status using the `scServerCnctvy` OID.

<table>
<thead>
<tr>
<th>scServerCnctvy.11</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>scServerCnctvy.12</strong></td>
<td>3</td>
</tr>
<tr>
<td>scServerCnctvy.13</td>
<td>1</td>
</tr>
</tbody>
</table>

The `scServerCnctvy` status values are: 1 (up), 2 (down) and 3 (partial). Server 12 is partially connected.

4. The Compellent Storage Center Manager GUI confirms that the FC connectivity is not up on all paths.
3.4.3 Quick storage summary

This example demonstrates how to request the count of several objects in order to have a quick storage summary of a Compellent array. Right-click the `scObjCntTable` OID, and then choose Get Bulk (or press Ctrl + B).

The output shows:

- **Single controller**
  - `scObjCntrNbr.1` → 1
  - `scObjCntrDevSInUse.1` → 6

- **507 replays**
  - `scObjCntrReplays.1` → 507
  - `scObjCntrDisks.1` → 106

- **42 server objects**
  - `scObjCntrServers.1` → 42
  - `scObjCntrVolumes.1` → 76

⇒ 106 physical drives

⇒ 76 volumes
3.5 Retrieving a trap from Storage Center

Before configuring the MIB browser to accept a trap, choose the trap destination, and then enable the Storage Center to send a trap.

Follow the following instructions to set the trap destination.

1. Launch the **Configure SNMP Server** operation in the Storage Center Manager.
2. In the **Trap Destination** field, enter the target IP address; in this example the MIB browser workstation is used.

3. Click **Start Trap** and verify that the **Trap Status** changes from **Stopped** to **Running**.

4. Configure the MIB browser to accept traps by enabling the trap receiver. In the MIB browser, click **Tools > Trap Receiver** (or press Ctrl + I).

A new **Trap Receiver** tab appears in the right pane.
The MIB browser workstation is ready to receive the trap from the Storage Center. The MIB provides a way to force a trap to be sent. This eliminates the need to wait for an incident and a trap that would damage the Compellent array.

1. In the MIB tree, expand a table (scCtlrTable in this example).
2. Right-click scCtlrForceTrap and then click Table View to force a trap.

3. In the new tab that appears in the right-hand pane, select the first cell and click SNMP SET.

4. In the SNMP SET pop-up that displays, enter ForceTrap as the Value and click OK.
5. Click **OK** on the information pop-up.

6. View the trap received from the Storage Center on the **Trap Receiver** tab.

7. Click the trap to open a full description of the message.
A. Sample XML file content

The file linked below is a downloadable XML and provides an example of the output of the export walk command.

http://en.community.dell.com/techcenter/extras/m/white_papers/20439134/download.aspx

A.1. Customer support

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