Dell Compellent SNMP Overview

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Revisions

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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 explinations 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://tools.ietf.org/html/rfc1157
http://en.wikipedia.org/wiki/Simple_Network_Management_Protocol
http://en.wikipedia.org/wiki/Management_information_base
Douglas Mauro and Kevin Schmidt, *Essential SNMP*, Second Edition, O'Reilly Media, Inc., Sebastopol, CA, 2005.

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). This Java based tool works across all platforms. Other tools are also available for Windows, Linux and Unix.

1. Download the file mibbrowser.zip at http://www.ireasoning.com/downloadmibbrowserfree.php

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

```
PS Z:\mib> dir


    Directory: Z:\mib


Mode                LastWriteTime     Length Name
----                -------------     ------ ----
-a---        12/06/2013     14:14    9684650 mibbrowser.zip
```

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.

```
PS Z:\mib> dir


    Directory: Z:\mib


Mode                LastWriteTime     Length Name
----                -------------     ------ ----
d----        30/07/2013     14:20            ireasoning
-a---        12/06/2013     14:14    9684650 mibbrowser.zip
```

3. To view the content, navigate to the ireasoning\MIB browser folder and run a **dir** command.

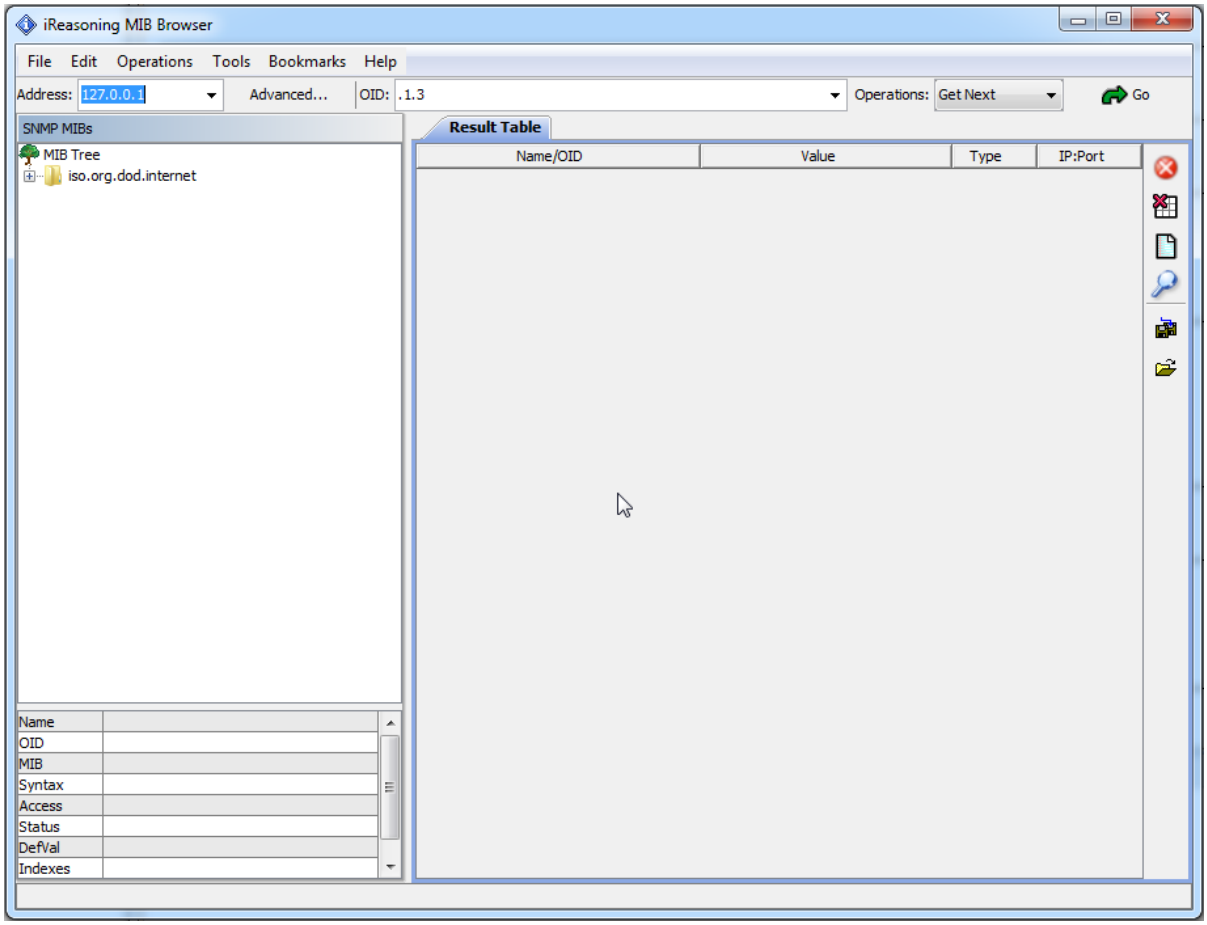
```
PS Z:\mib> cd .\ireasoning\mibbrowser

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.

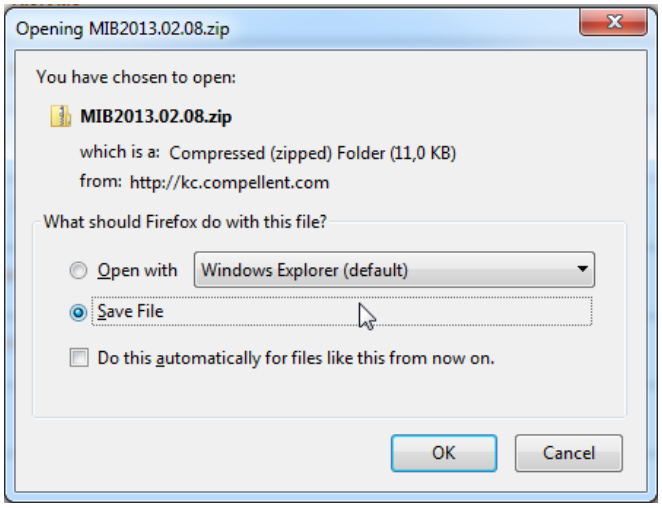
4. Create a batch file named “browser.bat” with this content and change the location set for “HOME” to match your environment.

```
@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.



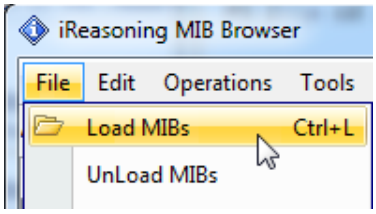
6. Save the Compellent MIB file in the MIB browser folder at the root of the mib folder.

```
PS Z:\mib> dir


    Directory: Z:\mib


Mode                LastWriteTime     Length Name
----                -------------     ------ ----
d----        30/07/2013     14:20            ireasoning
-a---        30/07/2013     14:57      11275 MIB2013.02.08.zip
-a---        12/06/2013     14:14    9684650 mibbrowser.zip
```

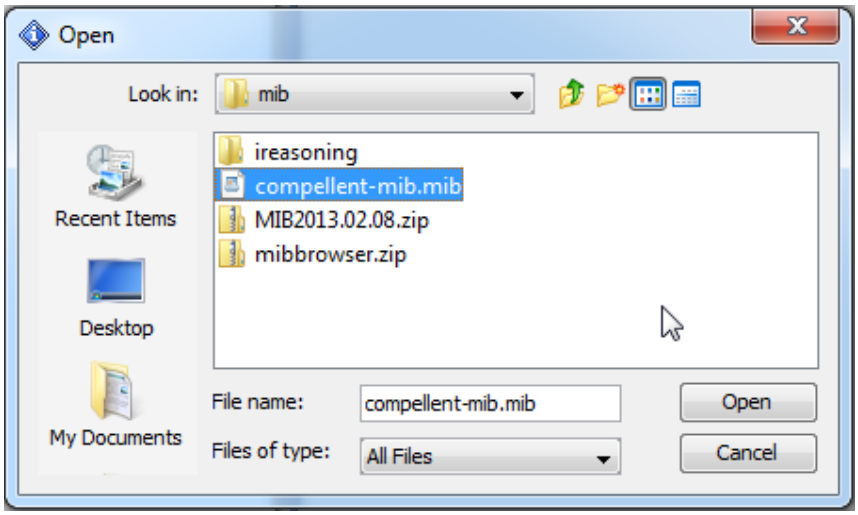
7. Extract the Compellent-mib.mib file.

```
PS Z:\mib> dir


    Directory: Z:\mib


Mode                LastWriteTime     Length Name
----                -------------     ------ ----
d----        30/07/2013     14:20            ireasoning
-a---        13/02/2013     13:44     104774 compellent-mib.mib
-a---        30/07/2013     14:57      11275 MIB2013.02.08.zip
-a---        12/06/2013     14:14    9684650 mibbrowser.zip
```

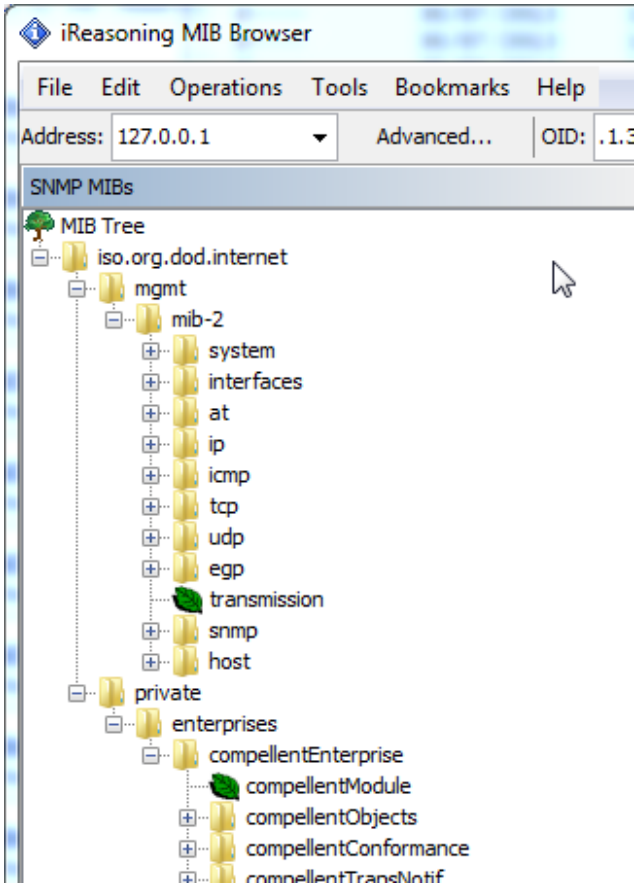
8. Click **File** > **Load MIBs** to load the Compellent MIB using the MIB browser tool.



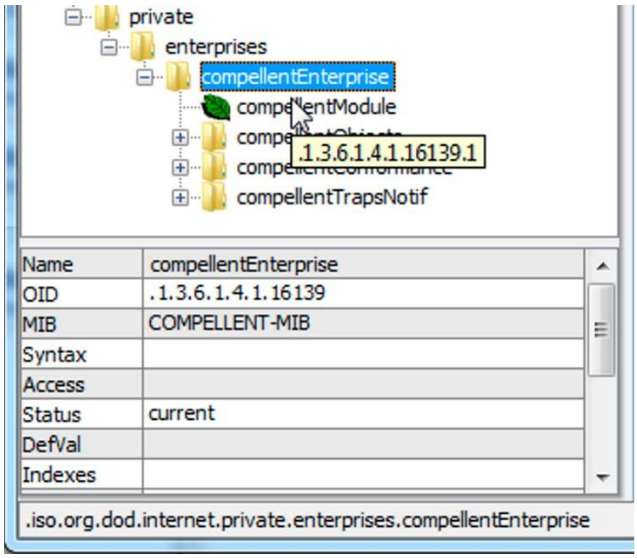
9. Select the compellent-mib.mib file and click **Open**.



With the Compellent MIB file successfully loaded in the MIB browser, the expanded MIB Tree shows a private mib and compellentEnterprise folder.



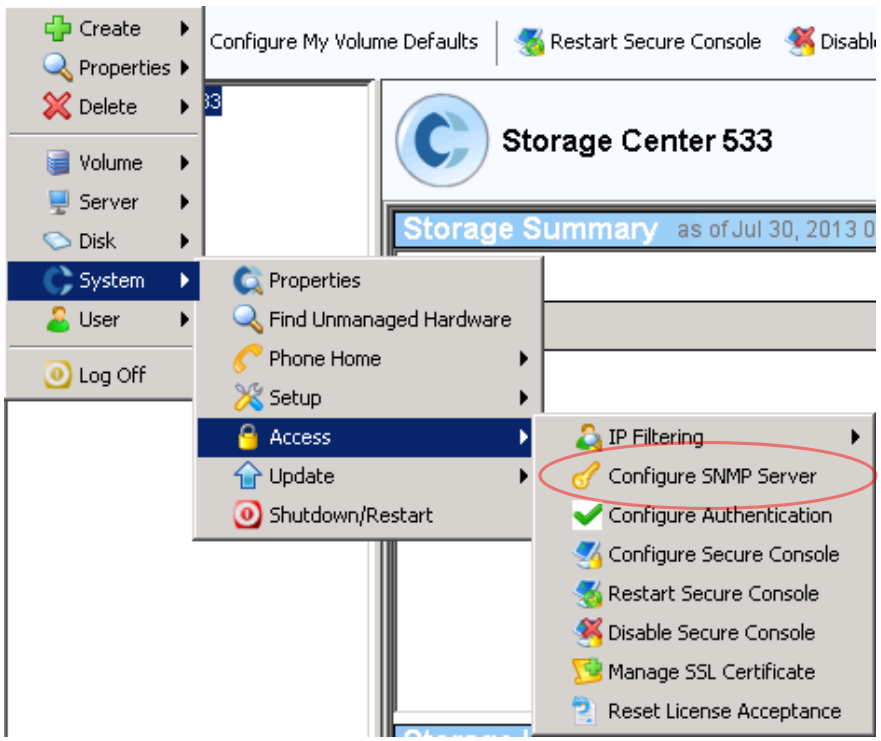
Click **compellentEnterprise** to see the OID and the MIB reference.



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.**

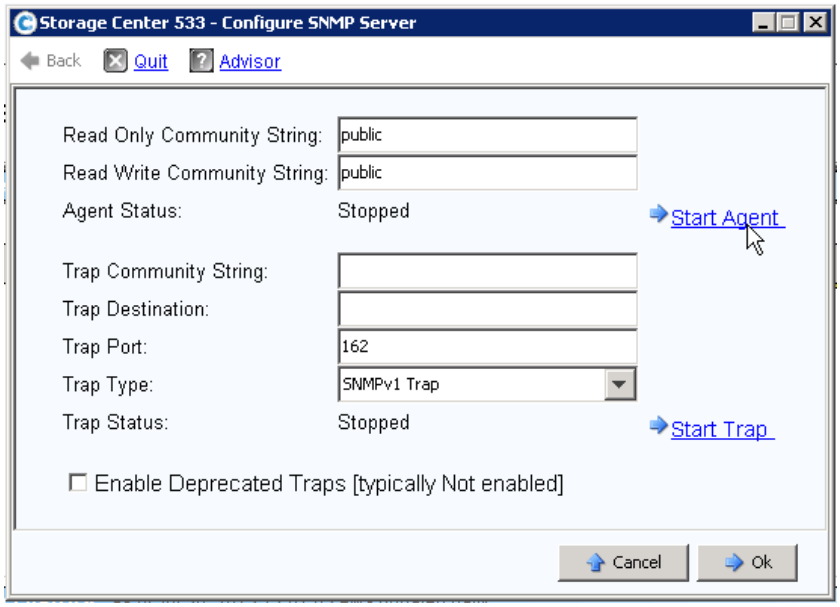
Note: This function requires a username and password to log in. The defaults are *Admin* and *mmm* respectively.



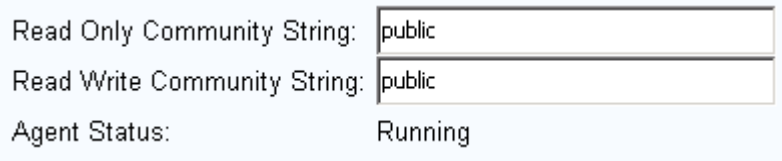
2. Initially, configure only the SNMP get/set parameters as shown below (the read and write community, not the SNMP trap).

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**.



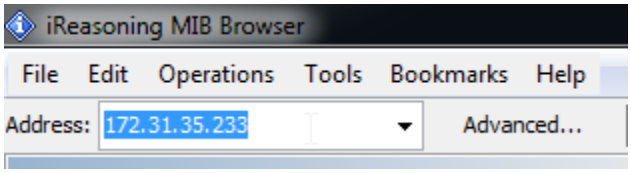
The status of the agent changes from **Stopped** to **Running**.



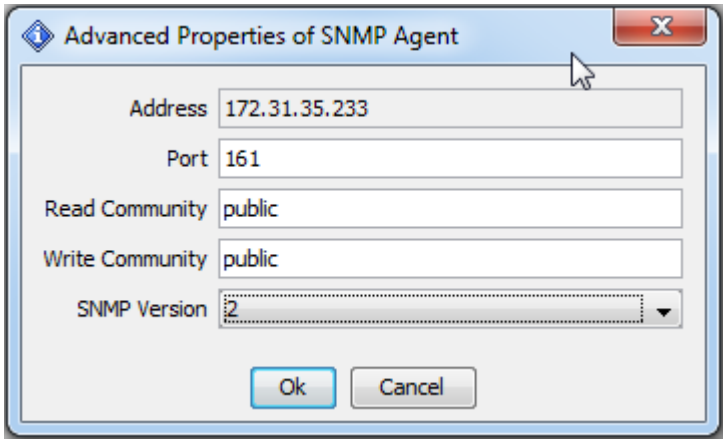
3.3 Send a get request to the Storage Center

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**.

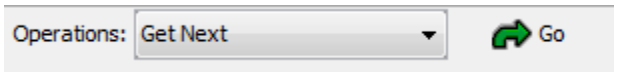


2. enter the read community, write community and SNMP version as shown below.

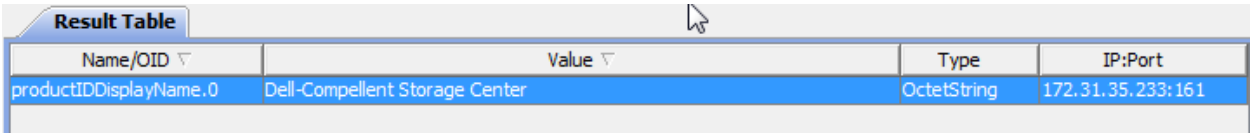


Keep in your mind that the Compellent MIB is compatible with SNMP version 2, not version 3.

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



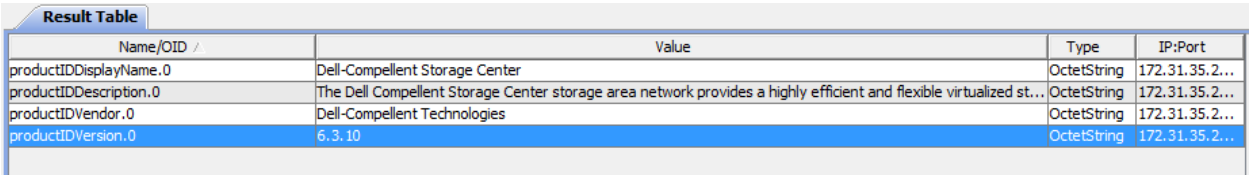
The first result is the product name :



Result Table

Name/OID	Value	Type	IP:Port
productIDDisplayName.0	Dell-Compellent Storage Center	OctetString	172.31.35.233:161

4. Display an overview by clicking **Go**.



Result Table

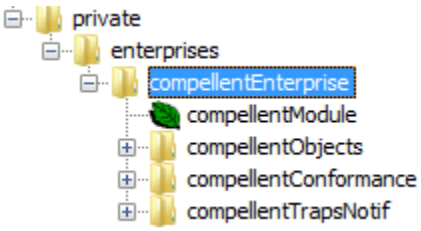
Name/OID	Value	Type	IP:Port
productIDDisplayName.0	Dell-Compellent Storage Center	OctetString	172.31.35.2...
productIDDescription.0	The Dell Compellent Storage Center storage area network provides a highly efficient and flexible virtualized st...	OctetString	172.31.35.2...
productIDVendor.0	Dell-Compellent Technologies	OctetString	172.31.35.2...
productIDVersion.0	6.3.10	OctetString	172.31.35.2...

The information includes:

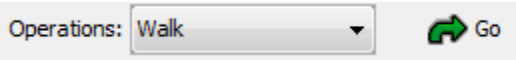
- The product name
- The product description
- The product vendor
- The product version (SCOS version)

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.

Result Table

Name/OID	Value	Type	IP:Port
productIDDisplayName.0	Dell-Compellent Storage Center	OctetString	172.31.35.2...
productIDDescription.0	The Dell Compellent Storage Center storage area network provides a highly efficient and flexible virtualized storage platform...	OctetString	172.31.35.2...
productIDVendor.0	Dell-Compellent Technologies	OctetString	172.31.35.2...
productIDVersion.0	6.3.10	OctetString	172.31.35.2...
productIDGlobalStatus.0	3	Integer	172.31.35.2...
productIDBuildNumber.0	6.3.10.106	OctetString	172.31.35.2...
productIDURL.0	https://172.31.35.233	OctetString	172.31.35.2...
scAlertDef.0	empty	OctetString	172.31.35.2...
scIndex.0	533	Gauge	172.31.35.2...
scTestString.0	SNMP server subsystem is accessible	OctetString	172.31.35.2...
scMiscAlertString.0	empty	OctetString	172.31.35.2...
scCtlrNbr.1	1	Gauge	172.31.35.2...
scCtlrStatus.1	1	Integer	172.31.35.2...
scCtlrName.1	SN 533	OctetString	172.31.35.2...
scCtlrIpAddr.1	172.31.35.233	OctetString	172.31.35.2...
scCtlrForceTrap.1	Empty	OctetString	172.31.35.2...
scDiskNbr.1	1	Gauge	172.31.35.2...
scDiskNbr.2	2	Gauge	172.31.35.2...
scDiskNbr.3	3	Gauge	172.31.35.2...
scDiskNbr.4	4	Gauge	172.31.35.2...
scDiskNbr.5	5	Gauge	172.31.35.2...
scDiskNbr.6	6	Gauge	172.31.35.2...
scDiskNbr.7	7	Gauge	172.31.35.2...
scDiskNbr.8	8	Gauge	172.31.35.2...
scDiskNbr.9	9	Gauge	172.31.35.2...
scDiskNbr.10	10	Gauge	172.31.35.2...
scDiskNbr.11	11	Gauge	172.31.35.2...
scDiskNbr.12	12	Gauge	172.31.35.2...
scDiskStatus.1	1	Integer	172.31.35.2...

The data can be exported in a raw format or in an XML file. An example of this ouputis 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.

← stop operation

← clear table

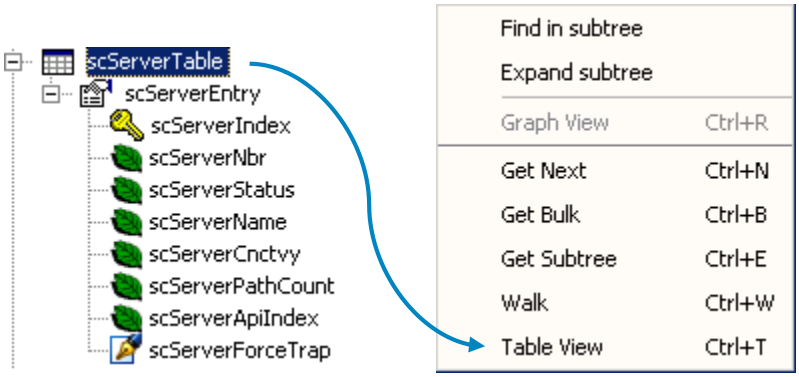
← raw data

← search tool

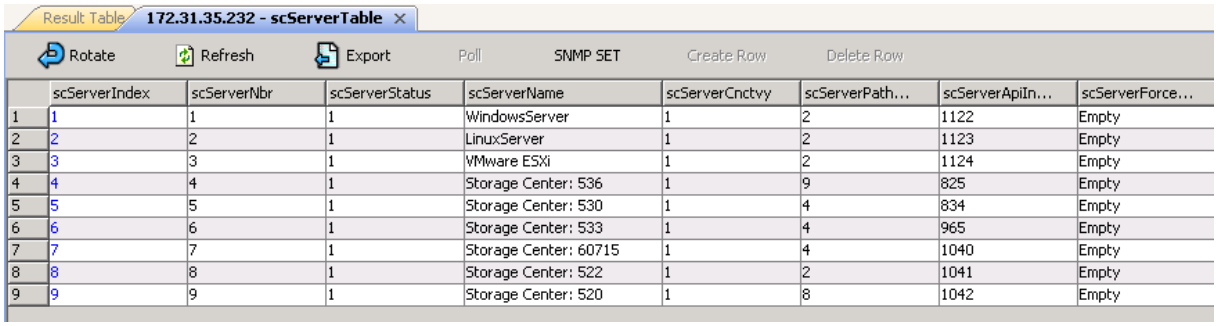
← save table (format: XML)

← load/open

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.



	scServerIndex	scServerNbr	scServerStatus	scServerName	scServerCnctvy	scServerPath...	scServerApiIn...	scServerForce...
1	1	1	1	WindowsServer	1	2	1122	Empty
2	2	2	1	LinuxServer	1	2	1123	Empty
3	3	3	1	VMware ESXi	1	2	1124	Empty
4	4	4	1	Storage Center: 536	1	9	825	Empty
5	5	5	1	Storage Center: 530	1	4	834	Empty
6	6	6	1	Storage Center: 533	1	4	965	Empty
7	7	7	1	Storage Center: 60715	1	4	1040	Empty
8	8	8	1	Storage Center: 522	1	2	1041	Empty
9	9	9	1	Storage Center: 520	1	8	1042	Empty

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

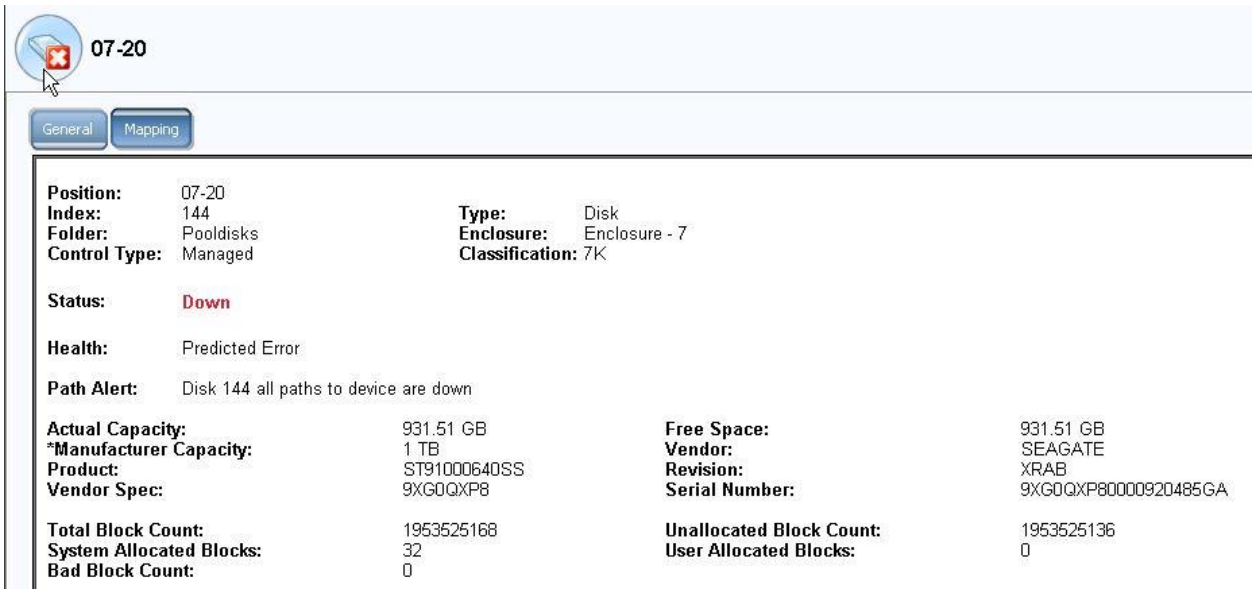
3.4 Interpreting the status of an SNMP

3.4.1 Disk status

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

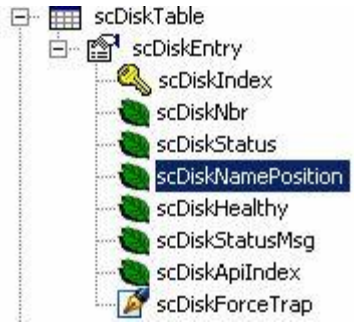
- Position = 07-20
- Index = 144
- Folder = Pooldisk
- Classification = 7K
- Status = Down

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.

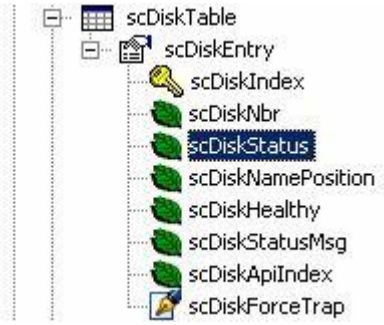
Storage Center has several drives and, typically, several enclosures. Each drive has a unique position in the SNMP table that is assigned a number starting with one.

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.

scDiskNamePosition.94	07-04
scDiskNamePosition.95	07-05
scDiskNamePosition.96	07-20
scDiskNamePosition.97	07-18
scDiskNamePosition.98	07-16
scDiskNamePosition.99	07-23

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.

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

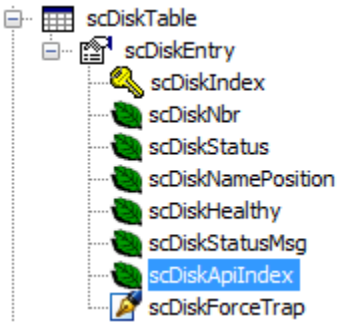
scDiskHealthy.94	true (1)
scDiskHealthy.95	true (1)
scDiskHealthy.96	false (2)
scDiskHealthy.97	true (1)
scDiskHealthy.98	true (1)

6. Double-click the next OID, **scDiskStatusMsg.**

scDiskStatusMsg.94	firmware alert status[Inform]
scDiskStatusMsg.95	firmware alert status[Inform]
scDiskStatusMsg.96	PredictedError uAllocs unbound
scDiskStatusMsg.97	firmware alert status[Inform]

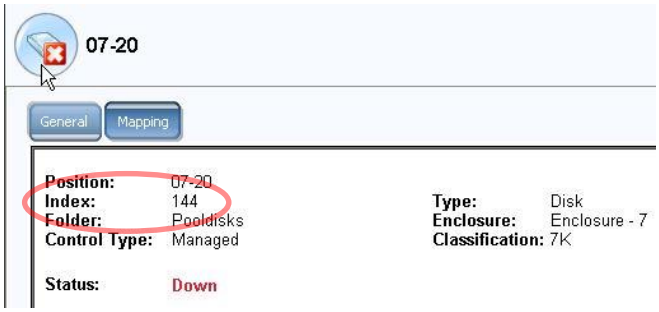
The scDiskStatusMsg value is a string. The value for disk 96 indicates an error. Other diskss show an information alert of a firmware upgrade.

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



scDiskApiIndex.94	142
scDiskApiIndex.95	143
scDiskApiIndex.96	144
scDiskApiIndex.97	145
scDiskApiIndex.98	146

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

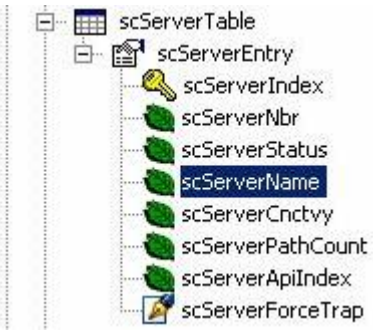
To view the OIBs for a server object, a Storage Center connected to several servers of different statuses is used. The three examples presented are:

- 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

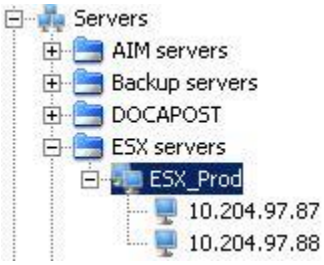
In the MIB tree, expand **scServerTable** and double-click **scServerName** to display a list of server objects.



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

scServerName.35	parasmesxi02	OctetString
scServerName.36	Storage Center: 60180	OctetString
scServerName.37	CLUSTER SQL 2008	OctetString
scServerName.38	New Server Cluster 1	OctetString
scServerName.39	ESX_Prod	OctetString
scServerName.40	AD Server	OctetString
scServerName.41	WIN7_HOST	OctetString

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



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.

scServerName.21	PAR-IDM-ADSRV
scServerName.22	APPASSURE-REP
scServerName.23	CSF-SRV006
scServerName.24	SRV-PROXYCOM
scServerName.25	appasure-53

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

scServerApiIndex.20	41
scServerApiIndex.21	43
scServerApiIndex.22	45
scServerApiIndex.23	47

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

scServerStatus.21	1
scServerStatus.22	2
scServerStatus.23	2

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.

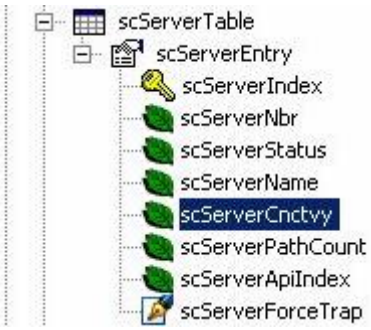
scServerName.10	Centos001
scServerName.11	VEEAMSRV001
scServerName.12	hypsrv001.par-idm.net
scServerName.13	SQLSRV001

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

scServerStatus.12	3
scServerStatus.13	1

The value 3 shows that the server status is degraded.

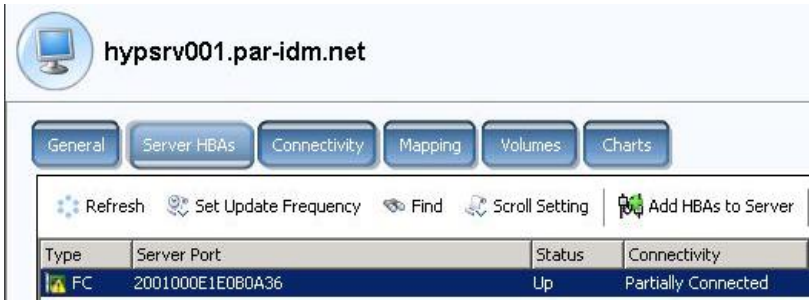
3. Check the connectivity status using the **scServerCnctvy** OID.



scServerCnctvy.11	2
scServerCnctvy.12	3
scServerCnctvy.13	1

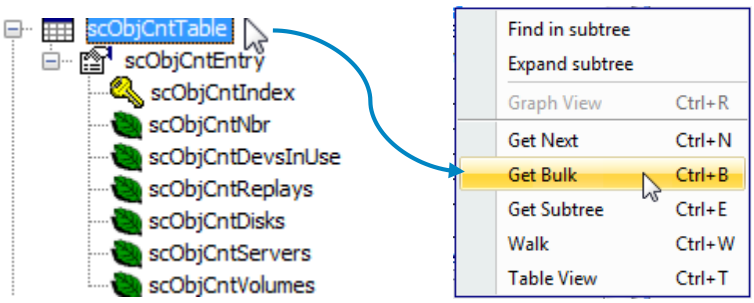
The scServerCnctvy status values are: 1 (up), 2 (down) and 3 (partial). Server 12 is partially connected.

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:

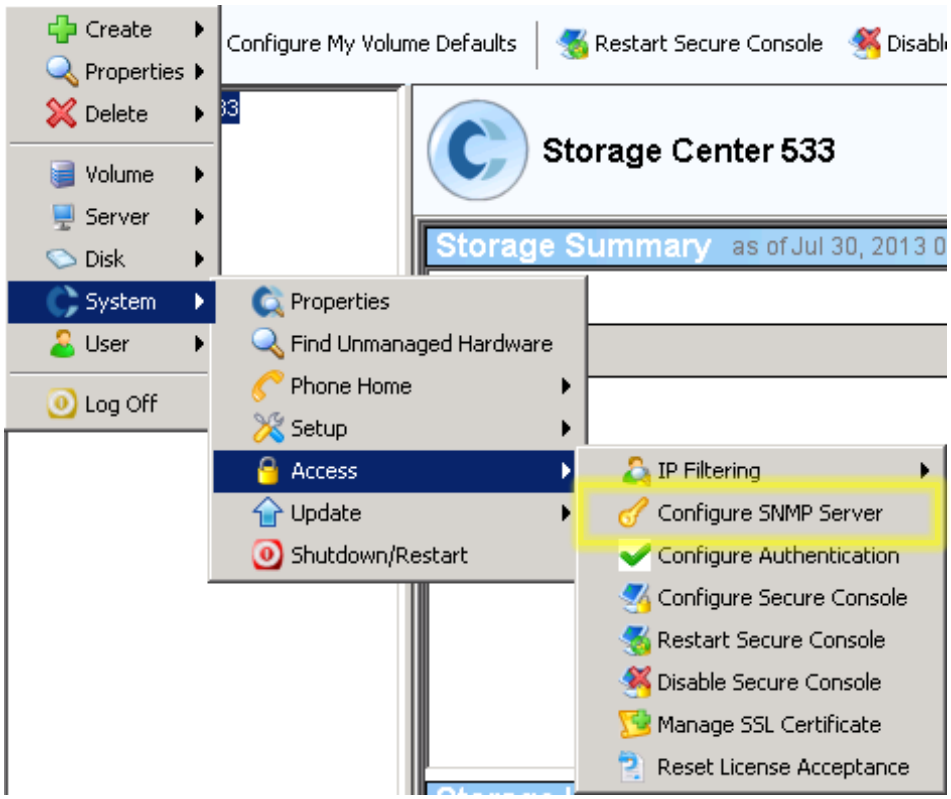
Single controller →	scObjCntNbr.1	1	
	scObjCntDevsInUse.1	6	
507 replays →	scObjCntReplays.1	507	
	scObjCntDisks.1	106	← 106 physical drives
42 server objects →	scObjCntServers.1	42	
	scObjCntVolumes.1	76	← 76 volumes

3.5 Retrieving a trap from Storage Center

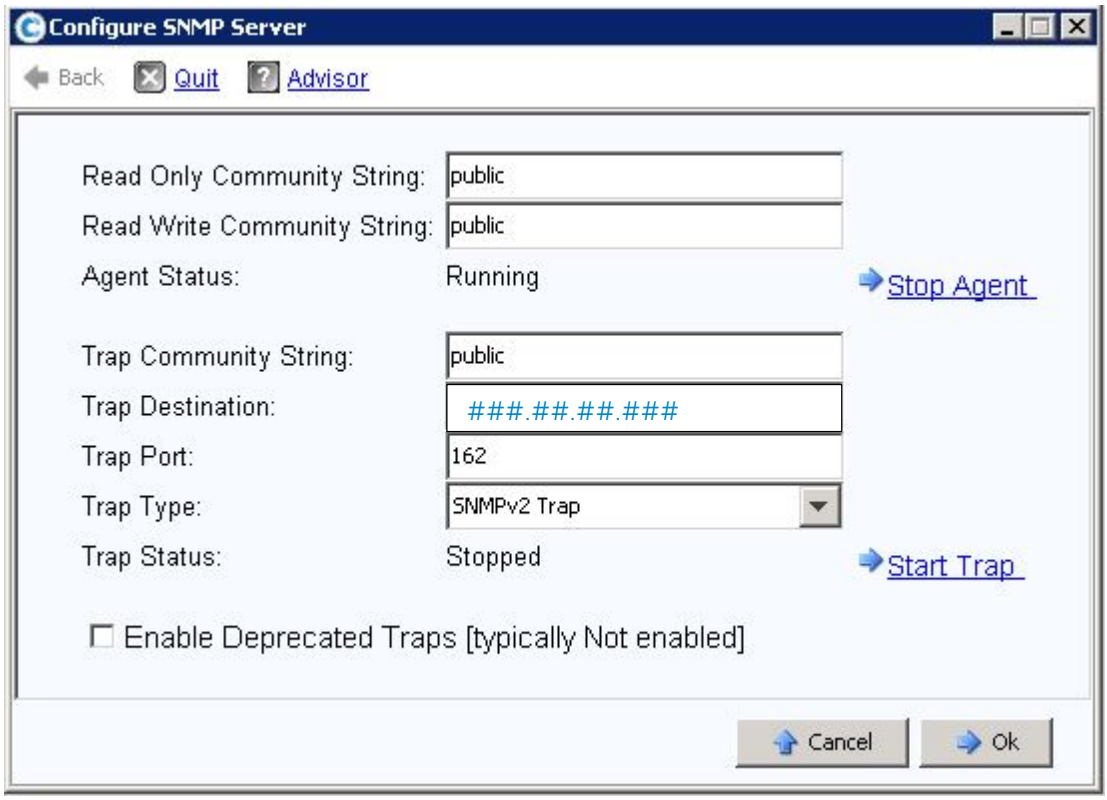
Before configuring the MIB browser to accept a trap, choose the trap destination, and then enable the Storage Center to send a trap.

Follow the following instructions to set the trap destination.

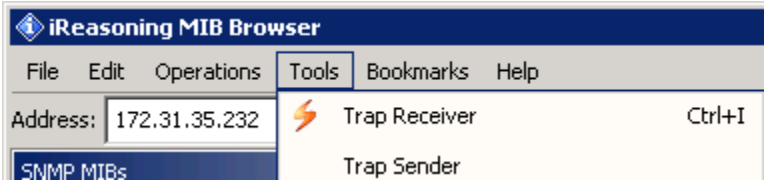
1. Launch the **Configure SNMP Server** operation in the Storage Center Manager.



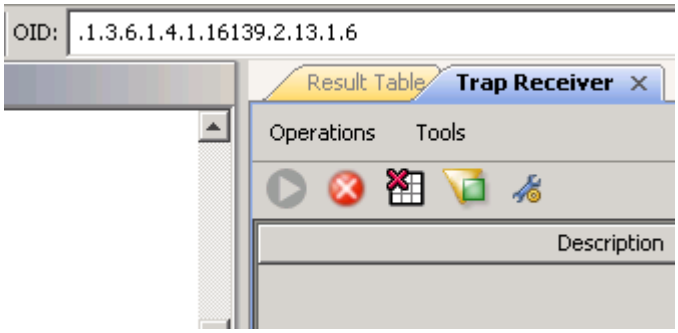
2. In the **Trap Destination** field, enter the target IP address; in this example the MIB browser workstation is used.
3. Click **Start Trap** and verify that the **Trap Status** changes from **Stopped** to **Running**.



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).

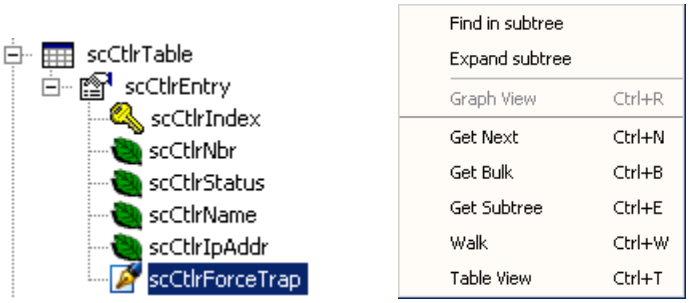


A new **Trap Receiver** tab appears in the right pane.

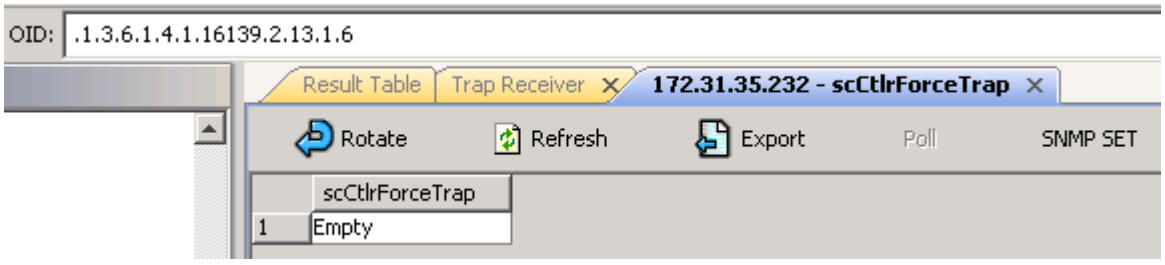


The MIB browser workstation is ready to receive the trap from the Storage Center. The MIB provides a way to force a trap to be sent. This eliminates the need to wait for an incident and a trap that would damage the Compellent array.

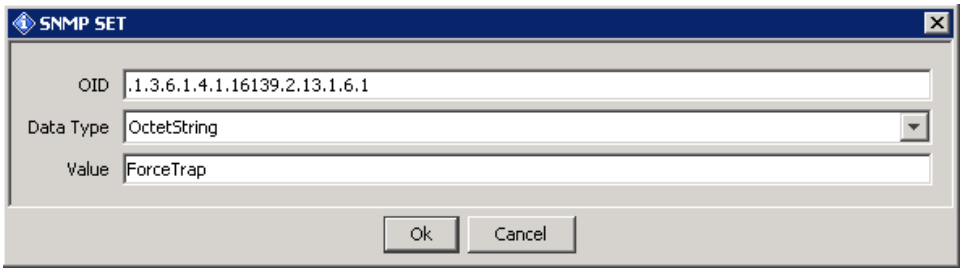
1. In the MIB tree, expand a table (**scCtlrTable** in this example).
2. Right-click **scCtlrForceTrap** and then click **Table View** to forace a trap.



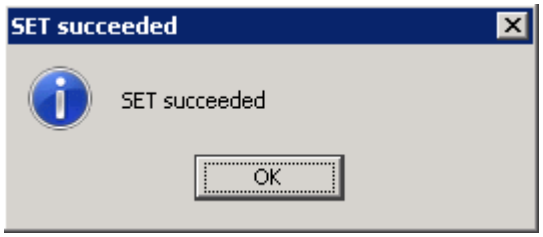
3. In the new tab that appears in the right-hand pane, select the first cell and click **SNMP SET**.



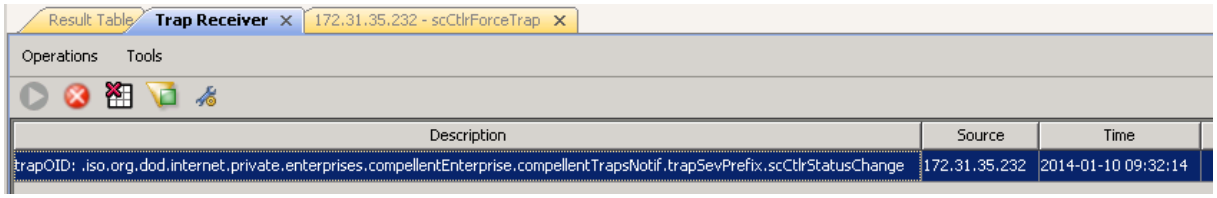
4. In the SNMP SET pop-up that displays, enter **ForceTrap** as the **Value** and click **OK**.



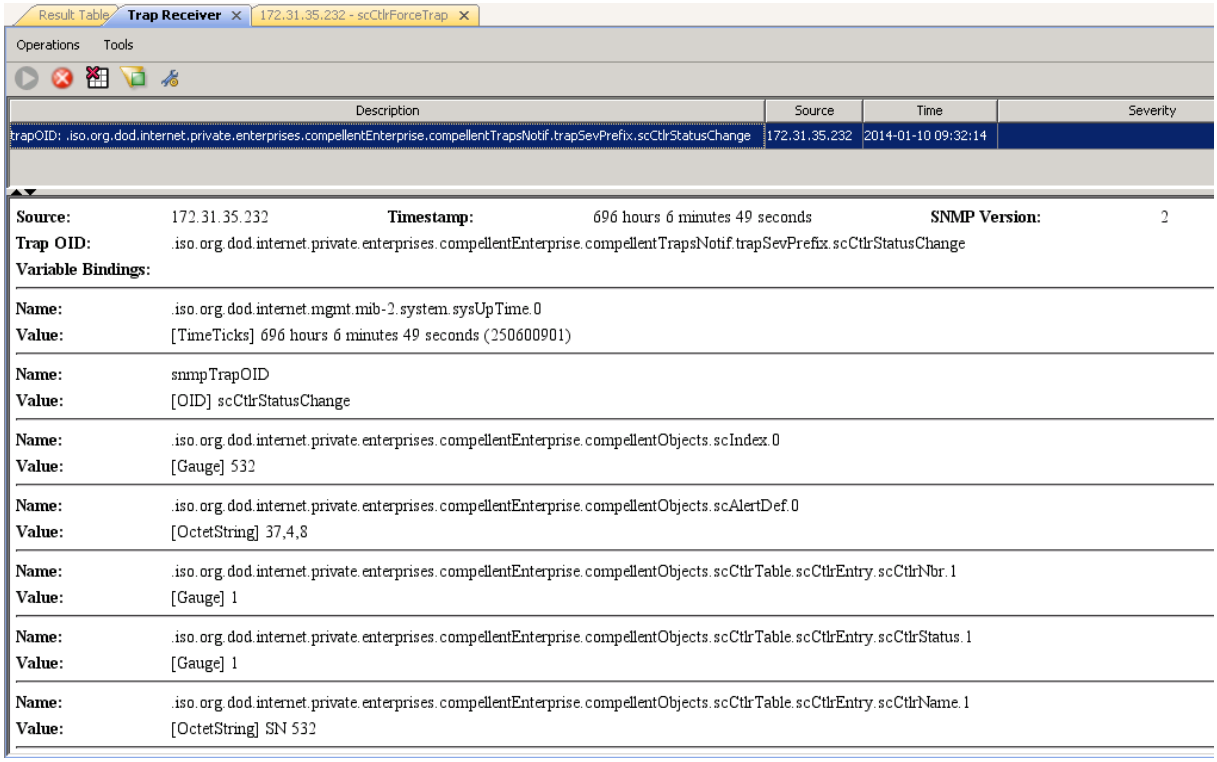
5. Click **OK** on the information pop-up.



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

Dell Compellent provides live support 1-866-EZSTORE (866.397.8673), 24 hours a day, 7 days a week, 365 days a year. For additional support, email Dell Compellent at support@compellent.com. Dell Compellent responds to emails during normal business hours.