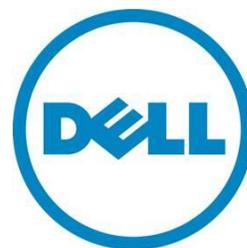

Monitoring Hardware Health for Dell Client Systems using Dell OMCI

A Dell Technical White Paper

Dell | Product Group

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Executive summary

The Dell OpenManage Client Instrumentation (OMCI) software enables Enterprise administrators to access detailed inventory, monitor status, and perform state changes like a remote shutdown on the client system. OMCI enables Dell client systems to be managed using the Common Information Model (CIM) standard, which is a system management protocol. CIM reduces your total cost of ownership, improves security, and provides a holistic approach to manage all devices including clients, servers, storage, network, and software devices.

You can also access OMCI through Web Services for Management Standards (WSMAN).

OMCI contains the underlying driver set that collects system information from a number of different sources on the client computer, including the BIOS, CMOS, System Management BIOS (SMBIOS), System Management Interface (SMI), operating system, APIs, DLLs, and registry settings. OMCI fetches this information through the CIM Object Manager (CIMOM) interface of the Windows Management Instrumentation (WMI) stack.

Although OMCI has numerous features, its primary purpose is to package and provide access to information requested by the CIM Object Manager (CIMOM), which in turn provides the information to the systems management application programs such as Microsoft System Center Configuration Manager, Operations Manager, and Dell OpenManage Essentials.

OMCI architecture

The OMCI data provider collects the system information data and stores the information in a proprietary XML format. The data manager is a service that loads these providers based on request. The OMCI CIM provider layer abstracts the interface to different CIMOM implementations. The input is a combination of XML and XSL data in proprietary form, while the output is a CIM object instance based on Management Profiles. The WSMAN that serves as the channel protocol requests the data from CIMOM and transmits it to the console.

The OMCI architecture has several layers that are integrated with the Microsoft WMI stack:

- WMI application layer – Consists of management applications, such as Dell Client Manager and other standards-based management tools, and WMI applications, such as Microsoft System Center Configuration Manager, LANDesk, and WMI Tools. The applications in this layer are consumers of the system's management data supplied by OMCI. These applications request client information and alerts through WSMAN/CIM Object Manager (CIMOM).
- OMCI CIM Provider – Lies beneath the CIMOM and contains two CIM providers, which is registered with the CIMOM:
 - The instance/method provider implements an interface that enables utility operations such as create, delete, modify, and query.
 - The indication provider implements an interface for WMI indications (or events).

When the CIMOM receives a request for information, it routes the request to the appropriate provider. Both Dell and Microsoft providers exist in this layer, and they provide information on system devices. The providers send management application requests from the CIMOM to the data router.

- OMCI Data Manager – A service that loads the data provider based on request from the upper layer.
- OMCI Event Manager – A service that monitors hardware and event provider indicators to the upper layer.
- Data Provider – Collects system information like hardware, drivers, and operating system data, and stores them in the proprietary XML format.

For example, a management console in the WMI application layer requests the available processor information on a client system. The WMI application layer makes the request over the network to the CIMOM on the client system. The CIMOM passes the request to the OMCI CIM provider and data manager. The data manager loads the corresponding data provider, which gets the information and stores it in a proprietary format. The information is then returned (through the same path in reverse) to the management console.

Monitoring hardware status through OMCI alerts

OMCI alerts

All alerts that are generated by OMCI are delivered in three ways: write to the OS Event log, write the log into DCIM_LogEntry class, and a CIM Indication is generated for the alert. All of the alerts written to the Windows Event Log have a *Source* value of *OpenManage Client Instrumentation*. The alerts supported by OMCI are:

Table 1. OMCI supported alerts

Windows Event Log ID	OMCI Event	Description	Severity Level
1054	TemperatureProbe	A temperature probe has exceeded a critical threshold.	CRITICAL
1103	FanProbe	A cooling device has exceeded a minor threshold.	MINOR
1153	VoltageProbe	A voltage probe has exceeded a minor threshold.	MINOR
1203	CurrentProbe	An electrical current probe has exceeded a minor threshold.	MINOR
1254	ChassisIntrusion	System Chassis Intrusion alert.	WARNING_DEGRADED
1403	EccMemory	A memory checksum failure has occurred.	MINOR
2030	NumberOfDisksIncreased	A hard drive has been added.	WARNING_DEGRADED
2031	NumberOfDisksDecreased	A hard drive has been removed.	WARNING_DEGRADED
2032	MemorySizeIncreased	The memory size has been increased.	WARNING_DEGRADED
2033	MemorySizeDecreased	The memory size has been decreased.	WARNING_DEGRADED
2034	DiskCapacity	One of the hard drives is running out of free space.	WARNING_DEGRADED
2035	NumberOfProcessorIncreased	A processor has been added.	WARNING_DEGRADED

Windows Event Log ID	OMCI Event	Description	Severity Level
2036	NumberOfProcessorDecreased	A processor has been removed.	WARNING_DEGRADED
2037	SMART	A hard drive condition has occurred that may eventually lead to a drive failure.	MAJOR
2038	DiskSizeIncreased	The size of at least one hard drive has increased.	WARNING_DEGRADED
2039	DiskSizeDecreased	The size of at least one hard drive has decreased.	WARNING_DEGRADED

Note: For alert 2034 the threshold is expressed as a percentage of the drive size. An event is generated when available free space on one of the monitored drivers falls below this percentage. The default threshold is set as 10 percent. Customer could change the *Disk Threshold* value inside the dccidy32.ini or ddcidy64.ini file under install path:

<OMCI installed location>\Dell\SysMgt\omsa\ini

Setting the polling interval through the .ini File

You can change the polling interval for events such as fan probe, temperature probe, voltage probe, current probe, disk increase/decrease, memory increase/decrease, processor increase/decrease and disk capacity, using the files dcsbdy32.ini or dcsbdy64.ini.

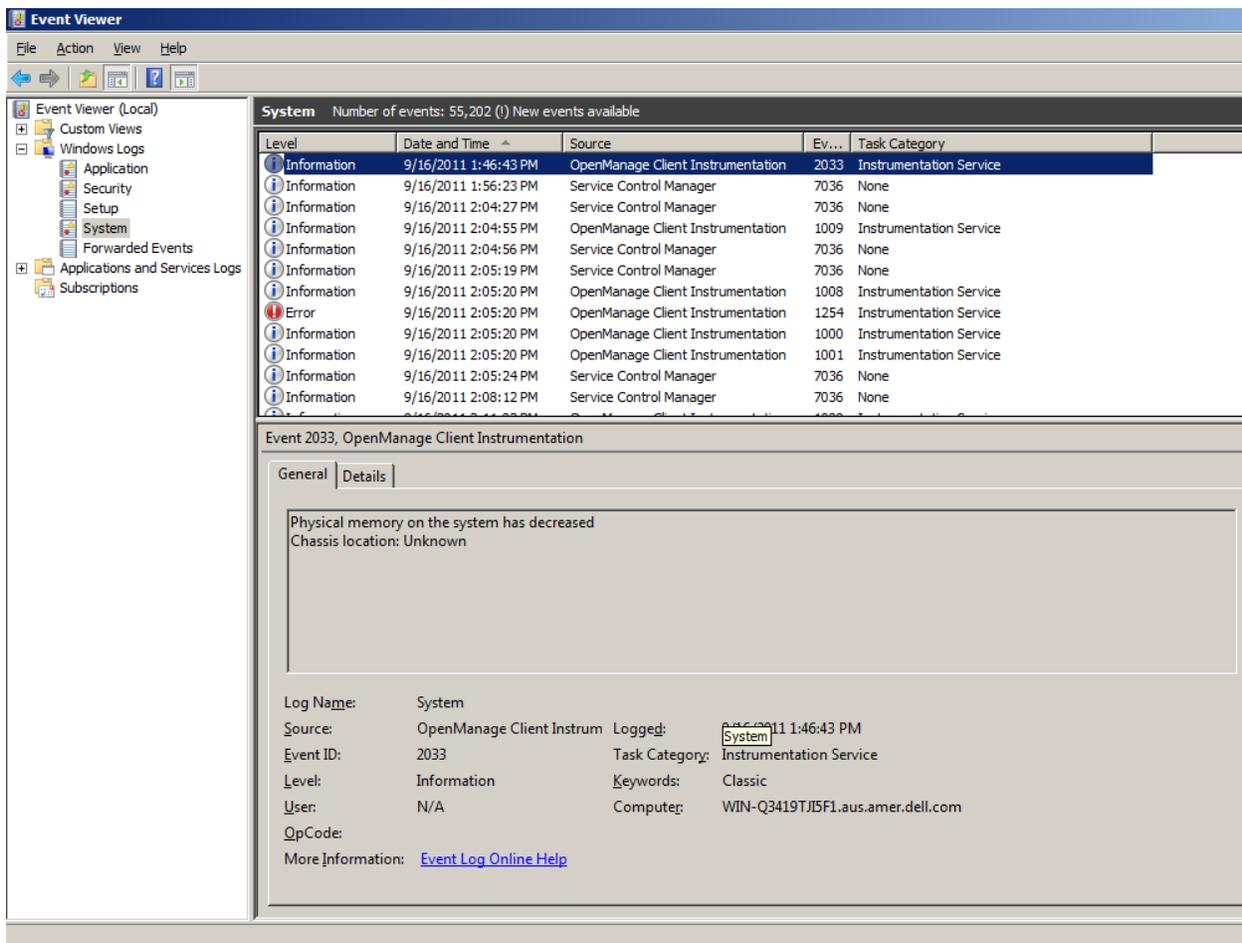
The dcsbdy32/64.ini file is present in the following location:

<OMCI installed location>\Dell\SysMgt\omsa\ini

NOTE: The numbers in the .ini file are the multiple numbers of 23 seconds. The default polling interval for disk capacity and SMART alert is 626 seconds (the real time = 626 X 23 seconds, which is close to three hours).

How OMCI alerts display in the Windows Event Viewer

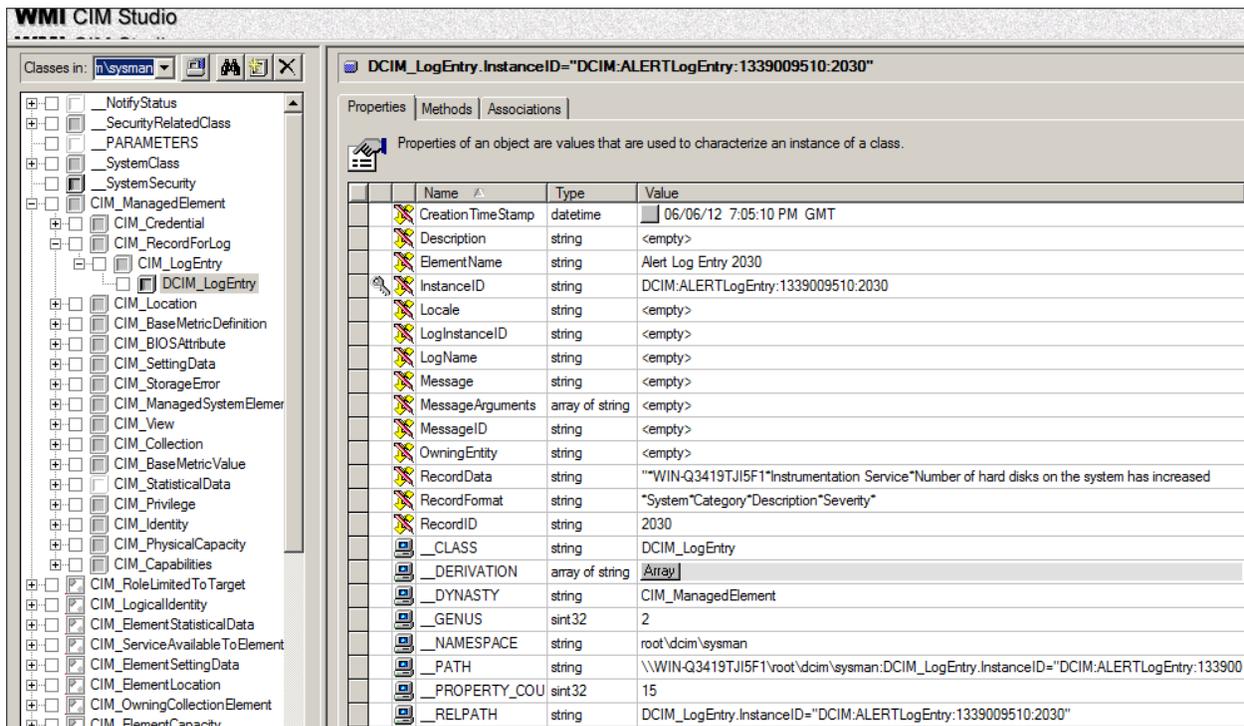
Figure 1. OMCI Alerts in the Windows Event Viewer.



How OMCI alerts present inside the WMI DCIM_LogEntry class?

The following screen shot shows an example of one instance OMCI retrieved from DCIM_LogEntry class from WMI CIM studio when one event is triggered. You could use other WMI tools or scripting to get this information from OMCI.

Figure 2. Example instance of a retrieved OMCI



How do OMCI alerts present from the CIM Indication Provider plugin?

OMCI includes CIM Indication Provider, which acts as plugin to CIMOM. Find more detailed information about the CIM indication Provider in the following DMTF white paper.

<http://dmf.org/sites/default/files/standards/documents/DSP0107.pdf>

You can implement CIM listener using scripting APIs, which WMI provides for monitoring all the indications to which OMCI polling and subscribed (Table in OMCI Alert) from DCIM_AlertIndication class. See the following link, which describes one of the major methods you can use to monitor the CIM Indication Provider:

[http://msdn.microsoft.com/en-us/library/windows/desktop/aa393865\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/desktop/aa393865(v=vs.85).aspx)

The following screenshot is the information with which you can get from monitoring the CIM indication from the OMCI DCIM_AlertIndication class when one event is triggered.

Figure 3. OMCI DCIM_AlertIndication class when one event is triggered

```

instance of DCIM_AlertIndication
{
    AlertingElementFormat = 2;
    AlertingManagedElement = "\\root/dcim/sysman:DCIM_Memory.SystemCreationClassName=\"DCIM_ComputerSystem\",
        CreationClassName=\"DCIM_Memory\", SystemName=\"64PG72S\",
        DeviceID=\"Root/MainSystemChassis/CompInVMemoryInObj\"";

    AlertType = 5;
    EventID = "\\2032";
    IndicationIdentifier = "\\DCIM:ID833";
    IndicationTime = "19700101000000.000000-000";
    Message = "\\Physical memory on system %1has increased.";
    MessageArguments = { "\\\", \"\", \"\", \"root/dcim/sysman:DCIM_ComputerSystem.CreationClassName=\"DCIM_ComputerSystem\",
        Name=\"64PG72S\""; };

    MessageID = "\\833";
    OwningEntity = "\\DMTF:Platform Message Registry 1.4.";
    ProbableCause = 1;
    ProviderName = "\\DCIM Indications Provider";
    SystemCreationClassName = "\\DCIM_ComputerSystem";
    SystemName = "\\64PG72S";
};
    
```

Using WMI Properties to monitor the Hardware Health Status from OMCI

Besides alerts, you can also monitor the following hardware health status, which is populated in the WMI properties:

Table 2. WMI Properties for hardware health

Description	WMI properties in OMCI root\dcim\sysman namespace
Fan Health	DCIM_Fan: PrimaryStatus
Fan Speed Sensor	DCIM_NumericSensor where ElementName is 'Fan%': CurrentState
Temperature Sensor Status	DCIM_NumericSensor where ElementName is 'Temperature%': CurrentState
Voltage Sensor Status	DCIM_NumericSensor where ElementName is 'Voltage%': CurrentState
Battery Health	DCIM_Battery: Status
Battery Charging Status	DCIM_Battery: BatteryStatus
Battery AC Line Charging Status	DCIM_Battery: ChargingStatus
Chassis Intrusion Status	DCIM_BIOSEnumeration where AttributeName is 'Chassis Intrusion Status': CurrentValue
Chassis Status	DCIM_ComputerSystem: HealthState
RAID Controller Status (8.1 above feature)	DCIM_ControllerView: PrimaryStatus
RAID Status (8.1 above feature)	DCIM_VitualDiskView: RAIDStatus
Drive AF Status: Determine if the drive is Advanced Format. (8.1 above feature)	DCIM_PhysicalDiskView: DriveAFSatus

Find the following value, valuemap, and descriptions of those WMI properties in the following tables:

Table 3. DCIM Fan: PrimaryStatus

<i>DCIM Fan: PrimaryStatus</i>		
PrimaryStatus provides a high level status value, intended to align with Red-Yellow-Green type representation of status.		
Value	ValueMap	Description
0	Unknown	Indicates the implementation is in general capable of returning this property, but is unable to do so at this time.
1	OK	Indicates the ManagedElement is functioning normally.
2	Degraded	Indicates the ManagedElement is functioning below normal.
3	Error	Indicates the ManagedElement is in an Error condition.

Table 4. DCIM_NumericSensor: CurrentState

<i>DCIM NumericSensor: CurrentState</i>	
The current state indicated by the Sensor. This is always one of the following "PossibleStates".	
PossibleStates Value	Description
Unknown	Indicates the implementation is in general capable of returning this property, but is unable to do so at this time.
Normal	Indicates the ManagedElement is functioning normally.
Fatal	If the CurrentReading is below the LowerThresholdFatal or above UpperThreshold Fatal, then the CurrentState is Fatal.
Lower Non-Critical	If CurrentReading is between LowerThresholdNonCritical and LowerThresholdCritical, then the CurrentState is Lower Non-Critical.
Upper Non-Critical	If CurrentReading is between UpperThresholdNonCritical and UpperThresholdCritical, then the CurrentState is Upper Non-Critical.
Lower Critical	If CurrentReading is between LowerThresholdCritical and LowerThresholdFatal, then the CurrentState is Lower Critical.
Upper Critical	If CurrentReading is between UpperThresholdCritical and UpperThresholdFatal, then the CurrentState is Upper Critical.

Table 5. DCIM Battery: Status

<i>DCIM Battery: Status</i>	
This is based on full charge capability/design capability	
Value	Description
Normal	Indicates the battery is good.
Caution 1	Indicates the battery charging capability is lower.
Caution 2	Indicates the battery charging capability is much lower.
Replacement Needed	Indicates the battery charging capability is very low and need to be replaced.
Unknown-battery not present	Indicates OMCI can't get the information from BIOS.

<i>DCIM Battery: BatteryStatus</i>		
Description of the charge status of the Battery.		
Value	ValueMap	Description
2	Unknown	Indicates OMCI cannot get the information from BIOS.
3	Fully Charged	Indicates the battery is fully charged.
4	Low	Indicates the battery is low.
5	Critical	Indicates the battery is very low and in critical state.
11	Partially Charged	Indicates the battery is in charging statue.

Table 6. DCIM Battery: ChargingStatus

<i>DCIM Battery: ChargingStatus</i>		
This property defines status information about the AC line in the notebook.		
Value	ValueMap	Description
2	Unknown	Indicates OMCI cannot get the information from BIOS.
3	Off – Line	Indicates system is not connected to AC line.
4	On – Line	Indicates system is connected to AC line.
5	On Backup Power	Indicates system is on backup power.

Table 7. DCIM BIOSEnumeration: Instance with AttributeName=“Chassis Intrusion Status” CurrentValue

<i>DCIM BIOSEnumeration: Instance with AttributeName=“Chassis Intrusion Status” CurrentValue</i>		
The CurrentValue is always one of the following “PossibleValues”		
Value	ValueMap	Description
1	Tripped	Read-only. The intrusion sensor detected that the chassis door was opened since the last time the sensor-detection logic was reset. This status is reset using the Trip Reset token.
2	Door open	Read-only. The chassis door is currently open.
3	Door closed	Read-only. The chassis door is currently closed.
4	Trip reset	Write-only. Resets the sensor-detection logic to detect the next closed-to-open transition on the chassis door. Set action is invoked by execute the method: DCIM_BIOSService->SetBIOSAttributes with AttributeName = “Chassis Intrusion Status” and AttributeValue=“4”.

Note: This class and property only have data with the system which has corresponding BIOS and hardware supported. (Currently only has value within few models of Dell Precision Workstation product line.)

Table 8. DCIM ComputerSystem: HealthState

<i>DCIM ComputerSystem: HealthState</i>		
Indicates the current state of the Chassis.		
Value	ValueMap	Description
0	Unknown	Indicates OMCI cannot get the information.
5	OK	The element is fully functional and is operating within normal operational parameters and without error.
10	Degraded/Warning	The element is in working order and all functionality is provided. However, the element is not working to the best of its abilities.
15	Minor failure	All functionality is available but some might be degraded.
20	Major failure	The element is failing.
25	Critical failure	The element is non-functional and recovery might not be possible.
30	Non-recoverable error	The element has completely failed, and recovery is not possible.

Table 9. DCIM ControllerView: PrimaryStatus

<i>DCIM ControllerView: PrimaryStatus</i>		
PrimaryStatus provides a high level status value, intended to align with Red-Yellow-Green type representation of status.		
Value	ValueMap	Description
0	Unknown	Indicates the implementation is in general capable of returning this property, but is unable to do so at this time.
1	OK	Indicates the ManagedElement is functioning normally.
2	Degraded	Indicates the ManagedElement is functioning below normal.
3	Error	Indicates the ManagedElement is in an Error condition.

Note: This class and property only has data from a system that has Intel RAID configured with release 8.1 and higher installed.

Table 10. DCIM VitualDiskView: RAIDStatus

<i>DCIM VitualDiskView: RAIDStatus</i>		
Value	ValueMap	Description
0	Unknown	Indicates the implementation is in general capable of returning this property, but is unable to do so at this time.
1	Ready	Indicates the RAID set is operational.
6	Failed	Indicates the RAID set has failed.
7	Degraded	Indicates the RAID set is no longer functioning in a fault tolerant mode.
8	Rebuilding	Indicates the RAID set is rebuilding. This implies a degraded operation. Once the rebuild completes successfully, the status will change to Ready (1). If the rebuilding process fails, the status will be updated appropriately.

Note: This class and property only has data from a system that has Intel RAID configured with release 8.1 and higher installed.

Table 11. DCIM PhysicalDiskView: DriveAFStatus

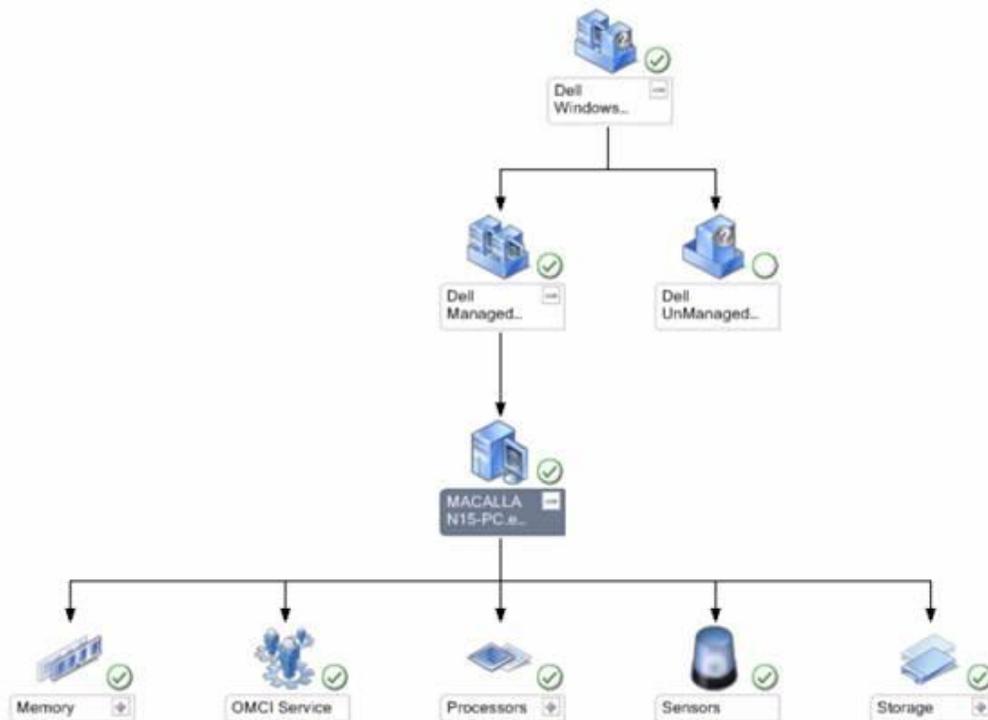
<i>DCIM PhysicalDiskView: DriveAFStatus</i>		
This field indicates if the physical disk is advanced format.		
Value	ValueMap	Description
0	Non AF Drive	Indicates the hard disk drive is not in Advanced Format.
1	AF Drive	Indicates the hard disk drive is in Advanced Format.
2	Unknown	Indicates can't get this information from the driver.

Note: Methodology is to communicate with disk driver to get IDENTIFY data so it works only with the IDE disk with an Intel SATA controller. In addition, this property is only available using release 8.1 and higher.

Using Dell Client Management Pack for Microsoft System Center Operations Manager to monitor the hardware healthy status for Dell Client systems

The Dell Client Management Pack (MP) for Microsoft System Center Operations Manager and System Center Essentials integrates monitoring of Dell Business Client Computers into Operations Manager. The Management Packs provide a list of Dell-specific views that you use to observe and drill down the system status in a network. You can download the latest MP 4.1 from [here](#). MP 4.1 works on all the Dell Business Client Systems with OMCI 8.0.1 installed. See the following sample screenshot, which shows the Microsoft System Center Operations Manager with MP 4.1 installed. It also shows the client has OMCI 8.0.1 installed.

Figure 4. Microsoft System Center Operations and OMCI



Using the OMCI_SMS_DEF.mof file OMCI provided within Microsoft System Center Configuration Manager to check corresponding static hardware status from the report

You can turn on the classes and properties (change the corresponding filed to “TRUE”) that you are interested in and compile the OMCI_SMS_DEF.mof within the Microsoft System Center Configuration Manager. Then run the report to determine the current hardware status for classes and properties that you want.

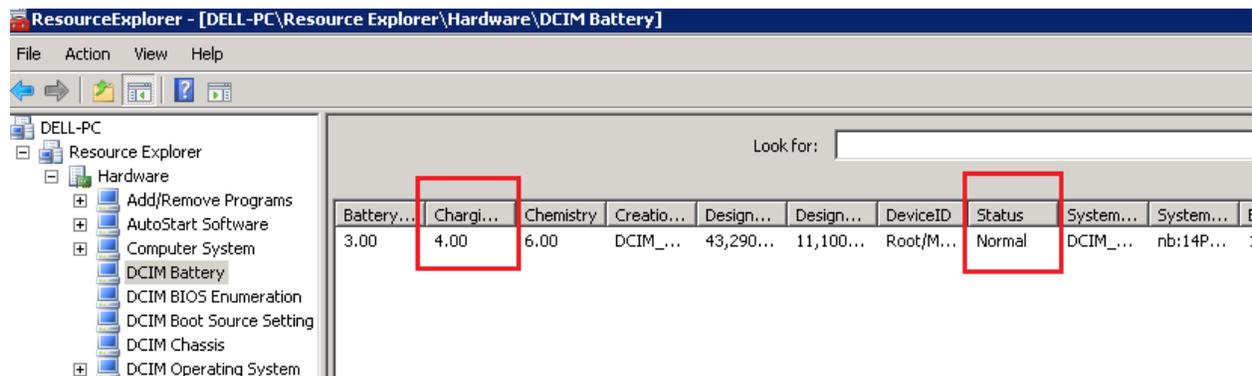
Find the detailed information of how to integrate OMCI into the Microsoft System Center Configuration Manager and the Sample MOF file from the following links:

[OMCI/SCCM white paper](#)

[Dell OMCI 8.x \(including 8.1\) MOF Extensions for ConfigMgr](#)

Figure 5 shows the sample screenshot captured from the Microsoft System Center Configuration Manager report for getting the number 3 battery related status:

Figure 5. Battery related status



The screenshot shows the Resource Explorer window for 'DELL-PC\Hardware\DCIM Battery'. The table below displays the properties of the battery, with the 'Chargi...' and 'Status' columns highlighted by red boxes.

Battery...	Chargi...	Chemistry	Creatio...	Design...	Design...	DeviceID	Status	System...	System...
3.00	4.00	6.00	DCIM_...	43,290...	11,100...	Root/M...	Normal	DCIM_...	nb:14P...

Appendix: Dell Business Client Platform Support Matrix

Table 12. Dell Business Client Platform Support Matrix

OMCI Event				
	<i>Latitude</i>	<i>Optiplex</i>	<i>Precision WorkStation Desktop</i>	<i>Precision WorkStation Notebook</i>
TemperatureProbe			•	
FanProbe			•	
VoltageProbe			•	
CurrentProbe			•	
ChassisIntrusion		•	•	
EccMemory	•	•	•	•
NumberOfDisksIncreased	•	•	•	•
NumberOfDisksDecreased	•	•	•	•
MemorySizeIncreased	•	•	•	•
MemorySizeDecreased	•	•	•	•
NumberOfProcessorIncreased	•	•	•	•
NumberOfProcessorDecreased	•	•	•	•
DiskCapacity	•	•	•	•
SMART	•	•	•	•
DiskSizeIncreased	•	•	•	•
DiskSizeDecreased	•	•	•	•
OMCI WMI Properties				
Fan Health			•	
Fan Speed Sensor			•	
Temperature Sensor Status			•	
Voltage Sensor Status			•	
Battery Health	•			•
Battery Charging Status	•			•
Battery AC Line Charging Status	•			•
Chassis Intrusion Status		•	•	
Chassis Status		•	•	
RAID Controller Status		•	•	
RAID Status		•	•	
Drive AF Status	•	•	•	•

Note: Some of the features are also depend on BIOS and hardware driver support.