Monitoring IBM DS RAID Storage

eG Innovations Product Documentation

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Total Performance Visibility

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Chapter 1: Introduction

IBM has brought together into one family, known as the DS family, a broad range of disk systems to help small to large size enterprises select the correct solutions for their needs. The DS family combines the high-performance IBM System Storage DS6000 and DS8000 series of enterprise servers that inherit from the Enterprise Storage Server® (ESS), with the DS4000 series of mid-range systems, and other line-of-entry systems (DS3000).

The DS4000 series of storage servers use Redundant Array of Independent Disks (RAID) technology. RAID technology is used to protect the user data from disk drive failures. DS4000 storage servers contain Fibre Channel interfaces to connect both the host systems and disk drive enclosures. The storage servers in the DS4000 series provide high system availability through the use of hot-swappable and redundant components.

This is why the DS4000 series of storage servers is used commonly in high-end customer environments such as server consolidation on storage area networks (SANs). Since the continuous availability of the storage is critical to such environments, even the slightest dips in the performance of the storage servers can adversely impact the smooth functioning of such environments. Continuous monitoring of the storage servers is hence essential so that, issues can be promptly identified and resolved. This can be achieved using eG Enterprise.

Chapter 2: How to Monitor IBM DS RAID Storage Using eG Enterprise?

eG Enterprise monitors the IBM DS RAID Storage using an eG external agent on any remote host in the environment. The eG agent invokes the **SMCli** utility provided by IBM to monitor the storage servers.

2.1 Pre-requisites for Monitoring the IBM DS RAID Storage

To enable the eG agent to use **SMCli** utility, make sure that the eG agent is installed on the host on which the **SMCli** utility is installed. Then, configure all the tests with the full path to the **SMCli** utility.

Once the requirements discussed in the above-mentioned sections are fulfilled, proceed to monitor the IBM DS RAID Storage using eG Enterprise. There are two broad steps in monitoring the IBM DS RAID Storage:

- Managing the IBM DS Raid Storage
- Configuring the tests

2.2 Managing the IBM DS Raid Storage

The eG Enterprise cannot automatically discover the IBM DS Raid Storage device. This implies that you need to manually add the component for monitoring. Remember that the eG Enterprise automatically manages the components that are added manually. To add an IBM DS Raid Storage, do the following:

1. Log into the eG administrative interface.
2. Follow the Components -> Add/Modify menu sequence in the **Infrastructure** tile of the **Admin** menu.
3. In the **COMPONENT** page that appears next, select *IBM DS Raid Storage* as the **Component type**. Then, click the **Add New Component** button. This will invoke Figure 2.1.

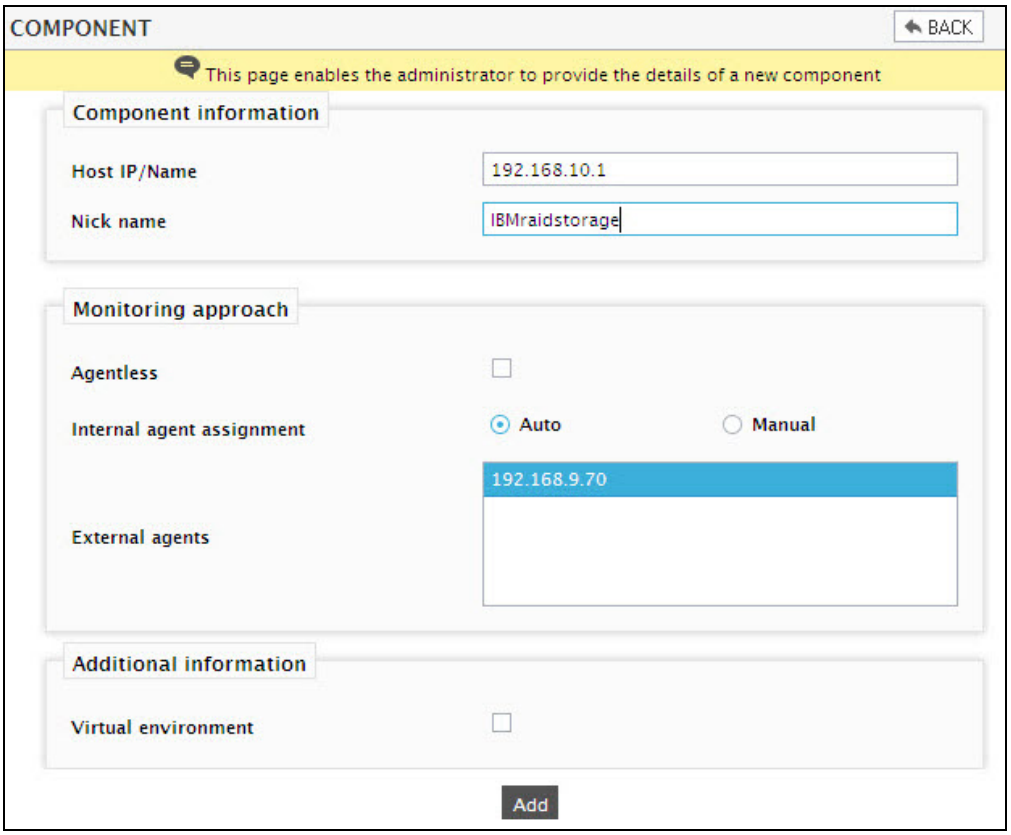


Figure 2.1: Adding an IBM DS Raid Storage device

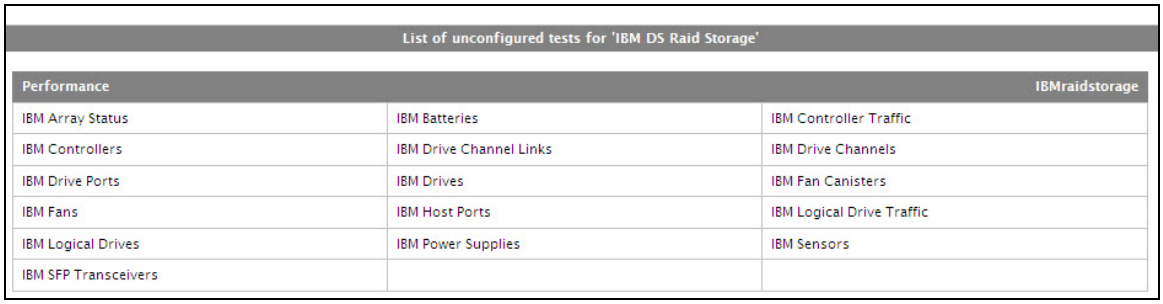
4. Specify the **Host IP** and the **Nick name** of the IBM DS Raid Storage device in Figure 2.1. Also set the **Agentless** flag to **Yes**, select **Other** as the **OS** and **SNMP** as the **Mode**. Then click the **Add** button to register the changes.

   Note:

   Though the **Mode** is set to **SNMP** while adding a new component, the eG agent will be able to collect metrics from the target environment through the **SMCLIlocation** path that will be specified by you during parameter configuration for the tests pertaining to the IBM DS Storage device.

2.3 Configuring the tests

1. When you attempt to sign out, a list of unconfigured tests will appear as shown in Figure 2.2.



List of unconfigured tests for 'IBM DS Raid Storage'

Performance		IBMraidstorage
IBM Array Status	IBM Batteries	IBM Controller Traffic
IBM Controllers	IBM Drive Channel Links	IBM Drive Channels
IBM Drive Ports	IBM Drives	IBM Fan Canisters
IBM Fans	IBM Host Ports	IBM Logical Drive Traffic
IBM Logical Drives	IBM Power Supplies	IBM Sensors
IBM SFP Transceivers		

Figure 2.2: List of Unconfigured tests to be configured for the IBM DS Raid Storage device

2. Click on any test in the list of unconfigured tests. For instance, click on the **IBM Array Status** test to configure it. In the page that appears, specify the parameters as shown in 2.3.

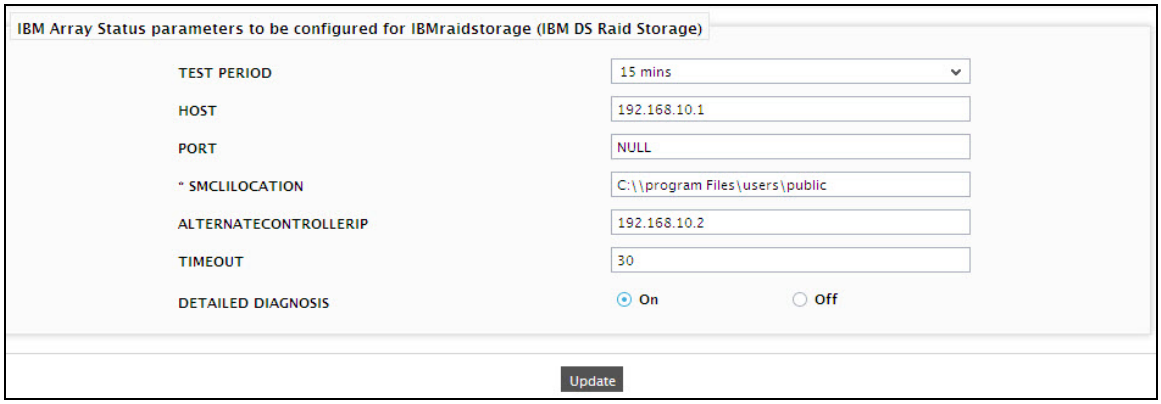


Figure 2.3: Configuring the IBM Array Status test

3. To know how to configure parameters, refer to **Monitoring the IBM DS RAID Storage** chapter.
4. Finally, signout of the eG administrative interface.

Chapter 3: Monitoring the IBM DS RAID Storage

eG Enterprise provides an 'agentless' *IBM DS Raid Storage* monitoring model is available, that invokes the **Smcli** utility to extract and report useful performance information pertaining to the storage device and its components.

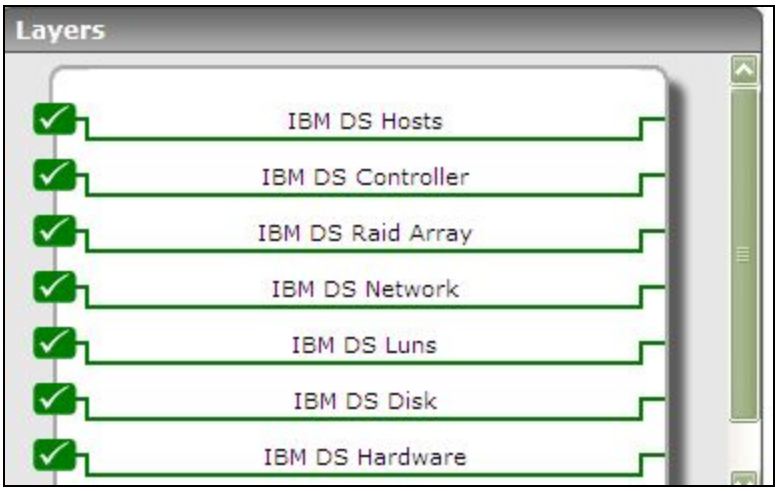


Figure 3.1: The layer model of the IBM DS Raid Storage

Using the metrics reported by this model, administrators can find quick and accurate answers for the following performance queries:

- Are all storage arrays on the RAID storage device adequately sized? Is any array running out of space?
- Do any error-prone drive channels exist on the device? If so, which one is it, and what type of errors are experienced by it?
- Has any drive channel failed?
- Are there I/O-intensive logical drives?
- Is any logical drive guilty of ineffective cache usage? If so, which one is it?
- Has any logical drive failed?
- Is I/O and transaction load balanced across all controllers on the device? Is any controller I/O-intensive?
- Are all controllers available?
- Has any battery failed or is about to reach its end of life?

- Are any fan canisters, SFP transceivers, temperature sensors, power supply units, and fans experiencing failures?
- Is any drive port or host port down?

3.1 The IBM DS Hardware Layer

Receive instant intimations of current and potential hardware failures with the help of the tests mapped to this layer.

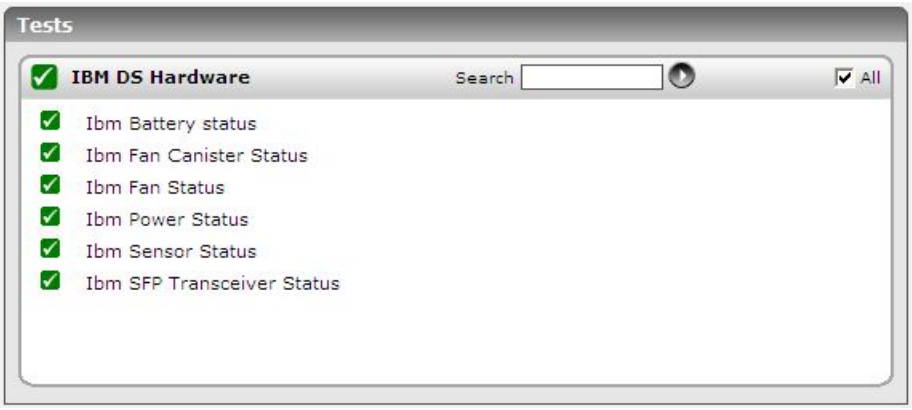


Figure 3.2: The tests mapped to the IBM DS Hardware layer

3.1.1 Ibm Battery status Test

This test reports the current status of each battery in the enclosure, and alerts you if any battery is about to reach its end of life.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each battery in the enclosure

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics

Parameter	Description
	from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Battery status	Indicates the current status of this battery.	Status	The values that this measure can report and the numeric values that correspond to them are listed below: **Measure Value** / **Numeric Value** Optimal: 1 Online: 2 Degraded: 3 Failed: 4

Measurement	Description	Measurement Unit	Interpretation
			<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Offline</td><td>5</td></tr><tr><td>Unknown</td><td>6</td></tr></table> **Note:** This measure reports the **Measure Value**s listed in the table above to indicate the current state of a battery. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.
Battery age	Indicates the remaining battery life in days.	Days	A high value is desired for this measure. A low value indicates that the battery is about to reach its end of life, and should hence be replaced soon.

3.1.2 Ibm Fan Canister Status Test

This test reports the current status of each fan canister in the enclosure.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each fan canister in the enclosure

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.

Parameter	Description
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Canister status	Indicates the current status of this fan canister.		The values that this measure can report and the numeric values that correspond to them are listed below: Measure Value / Numeric Value Optimal: 1 Online: 2 Degraded: 3

Measurement	Description	Measurement Unit	Interpretation
			<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Failed</td><td>4</td></tr><tr><td>Offline</td><td>5</td></tr><tr><td>Unknown</td><td>6</td></tr></table> **Note:** This measure reports the **Measure Value**s listed in the table above to indicate the current state of a fan canister. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.

3.1.3 Ibm Fan Status Test

This test reports the current status of each fan in the enclosure.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each fan in the enclosure

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box.

Parameter	Description
	Note: If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Fan status	Indicates the current status of this fan.		The values that this measure can report and the numeric values that correspond to them are listed below: **Measure Value** / **Numeric Value** Optimal: 1 Online: 2 Degraded: 3 Failed: 4 Offline: 5 Unknown: 6 **Note:**

Measurement	Description	Measurement Unit	Interpretation
			This measure reports the **Measure Value**s listed in the table above to indicate the current state of a fan. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.

3.1.4 Ibm Power Status Test

This test reports the current status of each power supply unit in the enclosure.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each power supply unit in the enclosure

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes,

Parameter	Description
	a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Power supply status	Indicates the power status of this power supply unit.		The values that this measure can report and the numeric values that correspond to them are listed below: **Measure Value** / **Numeric Value** Optimal: 1 Online: 2 Degraded: 3 Failed: 4 Offline: 5 Unknown: 6 **Note:** This measure reports the **Measure Value**s listed in the table above to indicate the current state of a power supply unit. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.

3.1.5 Ibm Sensor Status Test

This test reports the current status of each temperature sensor in the enclosure.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each temperature sensor in the enclosure

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Temp sensor status</td><td>Indicates the current status of this temperature sensor.</td><td></td><td>The values that this measure can report and the numeric values that correspond to them are listed below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Optimal</td><td>1</td></tr><tr><td>Online</td><td>2</td></tr><tr><td>Degraded</td><td>3</td></tr><tr><td>Failed</td><td>4</td></tr><tr><td>Offline</td><td>5</td></tr><tr><td>Unknown</td><td>6</td></tr></table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of a temperature sensor. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td></tr>
</table>

3.1.6 Ibm SFP Transceiver Status Test

This test reports the current status of each SFP Transceiver on a storage sub-system.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each SFP transceiver in the storage sub-system

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
SFP Transceiver status	Indicates the status of this SFP Transceiver.		The values that this measure can report and the numeric values that correspond to them are listed below:

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>Optimal</td><td>1</td></tr>
<tr><td>Online</td><td>2</td></tr>
<tr><td>Degraded</td><td>3</td></tr>
<tr><td>Failed</td><td>4</td></tr>
<tr><td>Offline</td><td>5</td></tr>
<tr><td>Unknown</td><td>6</td></tr>
</table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of an SFP Transceiver. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.
</td></tr>
</table>

3.2 IBM DS Disk Layer

Using the tests mapped to this layer, you can periodically monitor the status of drive channels, drive channel links, and drives.

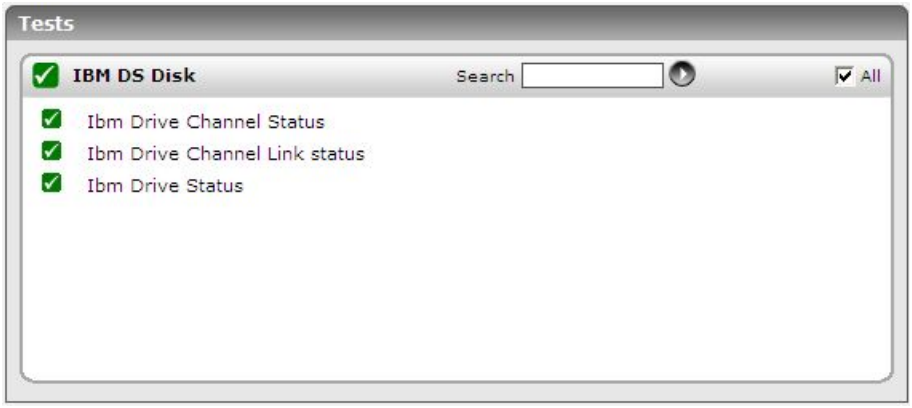


Figure 3.3: The tests mapped to the IBM DS Disk layer

3.2.1 Ibm Drive Channel Status Test

This test auto-discovers the drive channels on a storage controller, and reports the number and type of errors experienced by each channel.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each drive channel on the storage controller to be monitored

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.

Parameter	Description
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Controller detected errors	Indicates the number of controller detected errors in this drive channel controller link during the last measurement period.	Number	Ideally, the value of all these measures should be 0.
Drive detected errors	Indicates the number of drive detected errors in this drive channel controller link during the last measurement period.	Number	
Timeout errors	Indicates the number of timeout errors detected in this drive channel controller link during the last measurement period.	Number	
Link down errors	Indicates the number of link down errors detected in this drive channel controller link during the last measurement period.	Number	

3.2.2 Ibm Drive Channel Link status Test

This test reveals the current status of each drive channel on the storage controller, and also alerts administrators to connection failures between any of the drive channels and the controllers A and B.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each drive channel on the storage controller to be monitored

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Channel status</td><td>Indicates the current status of this drive channel.</td><td></td><td>The values that this measure can report and the numeric values that correspond to them are listed below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Optimal</td><td>1</td></tr><tr><td>Online</td><td>2</td></tr><tr><td>Degraded</td><td>3</td></tr><tr><td>Failed</td><td>4</td></tr><tr><td>Offline</td><td>5</td></tr><tr><td>Unknown</td><td>6</td></tr></table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of this drive channel. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td></tr>
<tr><td>Controller A link status</td><td>Indicates the current status of the connection between this drive channel and the controller A link.</td><td></td><td>The states that this measure can report and the numeric values that correspond to them are listed below:</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>Up</td><td>0</td></tr>
<tr><td>Failed</td><td>1</td></tr>
<tr><td>Down</td><td>2</td></tr>
<tr><td>Unknown</td><td>3</td></tr>
</table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of the connection between this drive channel and the controller A link. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.
</td></tr>
<tr><td>Controller B link status</td><td>Indicates the current status of the connection between this drive channel and the controller B link.</td><td></td><td>The states that this measure can report and the numeric values that correspond to them are listed below:
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>Up</td><td>0</td></tr>
<tr><td>Failed</td><td>1</td></tr>
<tr><td>Down</td><td>2</td></tr>
<tr><td>Unknown</td><td>3</td></tr>
</table>
Note:</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			This measure reports the **Measure Value**s listed in the table above to indicate the current state of the connection between this drive channel and the controller A link. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.

3.2.3 Ibm Drive Status Test

This test reports the current status of each drive.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each drive on the storage controller to be monitored

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.

Parameter	Description
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Drive status	Indicates the current status of this drive.		The values that this measure can report and the numeric values that correspond to them are listed below: **Measure Value** / **Numeric Value** Optimal – 1 Online – 2 Degraded – 3 Failed – 4 Offline – 5 Unknown – 6 **Note:** This measure reports the **Measure Value**s listed in the table above to indicate the current state of a drive. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.
Drive assigned	Indicates the current		The values that this measure can report and the

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td>assignment status of this drive.</td><td></td><td>numeric values that correspond to them are listed below:

<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Hot</td><td>0</td></tr><tr><td>Assigned</td><td>1</td></tr><tr><td>Unknown</td><td>2</td></tr></table>
Note:

This measure reports the Measure Values listed in the table above to indicate the current assignment state of a drive. However, in the graph of this measure, the assignment state is indicated using only the Numeric Values listed in the above table.</td></tr>
</table>

3.3 IBM DS Luns Layer

Use the test mapped to this layer to clsely track the traffic to and from each LUN, so as to accurately isolate overloaded LUNs.

Figure 3.4: The test mapped to the IBM DS Luns layer

3.3.1 IBM Logical Drive Traffic Test

This test reports the level of I/O and transaction traffic on each LUN so that, you can accurately isolate LUNs that are over-loaded.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each LUN

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Current IO operations	Indicates the number of I/O operations on this LUN during the last measurement period.	Number	
Percent read operations	Indicates the percentage of read operations on this LUN.	Percent	
Percent write operations	Indicates the percentage of write operations on this LUN.	Percent	
Cache hit percent	Indicates the percentage of requests served from the cache by this LUN.	Percent	A high value is ideally desired for this measure. A low value could imply that most of the data requested is not in the cache, which in turn could result in a high degree of direct disk accesses.
Transaction rate	Indicates the rate of transactions to this LUN.	KB/Sec	
I/O operations rate	Indicates the rate of I/O operations to this LUN.	IO/Sec	

3.4 IBM DS Network Layer

The current status of the drive ports and host ports on the controller can be determined using the tests associated with this layer.

Figure 3.5: The tests mapped to the IBM DS Network layer

3.4.1 Ibm Drive Port Status Test

This test reports the current status of each drive port in the enclosure.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each drive port in the enclosure

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP

Parameter	Description
	address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Link status	Indicates the current status of each drive port in the enclosure.		The values that this measure can report and the numeric values that correspond to them are listed below: Measure Value / Numeric Value Optimal: 1 Online: 2 Degraded: 3 Failed: 4 Offline: 5 Unknown: 6 **Note:** This measure reports the Measure Values listed in the table above to indicate the current state of a drive port. However, in the graph of this measure, the state is

Measurement	Description	Measurement Unit	Interpretation
			indicated using only the Numeric Values listed in the above table.

3.4.2 Ibm Host Port Status Test

This test reports the current status of each host port in the controller.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each host port in the controller

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.

Parameter	Description
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Link status	Indicates the current status of this host port.		The values that this measure can report and the numeric values that correspond to them are listed below: Measure Value / Numeric Value Optimal: 1 Online: 2 Degraded: 3 Failed: 4 Offline: 5 Unknown: 6 **Note:** This measure reports the **Measure Value**s listed in the table above to indicate the current state of a host port. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.

3.5 IBM DS Raid Array Layer

Quickly detect array failures and excessive space usage by an array with the help of the tests mapped to this layer.

Figure 3.6: The test mapped to the IBM DS Raid Array layer

3.5.1 Ibm Array Status Test

This test reports the current state of the target storage subsystem, and proactively alerts administrators to failures and space inadequacies experienced by the subsystem.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results the storage array being monitored

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller	By default, the Alternate Controller IP text box is set to *none*. This implies that by

Parameter	Description
IP	default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Storage array status</td><td>Indicates the current status of the storage array.</td><td></td><td>The values that this measure can report and the numeric values that correspond to them are listed below:
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>Optimal</td><td>1</td></tr>
<tr><td>Online</td><td>2</td></tr>
<tr><td>Degraded</td><td>3</td></tr>
<tr><td>Failed</td><td>4</td></tr>
<tr><td>Offline</td><td>5</td></tr>
<tr><td>Unknown</td><td>6</td></tr>
</table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of this array. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			The detailed diagnosis of this measure will report the logical drives in the array, and the capacity of each drive (in GB).
Total capacity	Indicates the total array capacity.	GB	
Used capacity	Indicates the total array capacity.	GB	
Percent free	Indicates the percentage of capacity that is unused.	Percent	Ideally, the value of this measure should be high. A very low value or a value that decreases consistently could be a cause for concern, as it could indicate a steady erosion of space in the array. The lack of storage space is a serious issue that could render the array unavailable for storing any more critical data. You may want to clear space in the array or increase the array capacity.

3.6 IBM DS Controller Layer

Use the tests mapped to this layer to monitor the status of the controllers and the traffic to and from each controller so that, a potential overload can be isolated and averted, and controllers in a degraded/failed state can be identified .

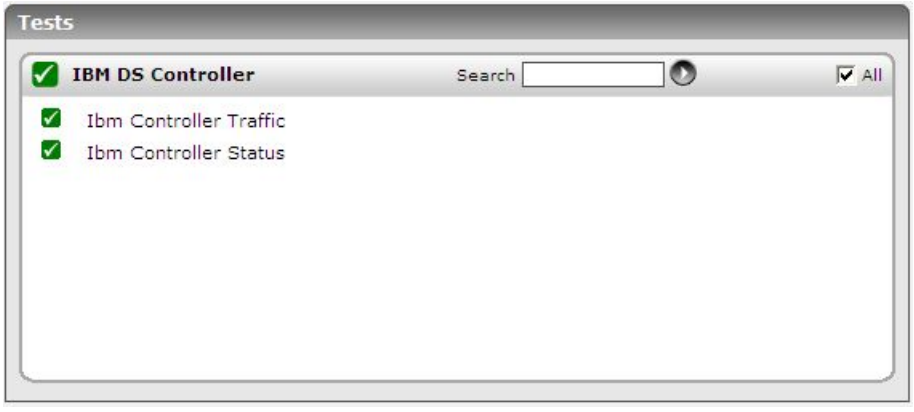


Figure 3.7: The tests mapped to the IBM DS Controller layer

3.6.1 Ibm Controller Traffic Test

This test monitors the I/O and transaction traffic on each controller on a storage device, and reports irregularities in load balancing across controllers.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each controller on the storage device being monitored

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Current IO Operations	Indicates the number of IO operations that occurred on this controller during the last measurement period.	Number	Comparing the value of this measure across controllers can reveal whether any controller is overloaded. If so, this revelation could turn the spotlight on imbalances in load distribution across the controllers.
Percent read operations	Indicates the percent of read operations that occurred on this controller.	Percent	
Percent write operations	Indicates the percentage of write operations that occurred on this controller.	Percent	
Cache hit percent	Indicates the percentage of requests to this controller that were served from the cache.	Percent	A high value is ideally desired for this measure. A low value could imply that most of the data requested is not in the cache, which in turn could result in a high degree of direct disk accesses.
Transaction rate	Indicates the rate of transactions to this controller.	KB/Sec	
IO operations rate	Indicates the rate of I/O operations to this controller.	IO/Sec	

3.6.2 Ibm Controller Status Test

This test reports the current status of each controller on the storage sub-system.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each controller on the storage device being monitored

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Controller status	Indicates the current status of this controller.	Status	The values that this measure can report and the numeric values that correspond to them are listed below:

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>Optimal</td><td>1</td></tr>
<tr><td>Online</td><td>2</td></tr>
<tr><td>Degraded</td><td>3</td></tr>
<tr><td>Failed</td><td>4</td></tr>
<tr><td>Offline</td><td>5</td></tr>
<tr><td>Unknown</td><td>6</td></tr>
</table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of a controller. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.
</td></tr>
</table>

3.7 IBM DS Hosts Layer

Determine the current status of the logical drives and the read/write caches with the help of the tests mapped to this layer.

Figure 3.8: The test mapped to the IBM DS Hosts layer

3.7.1 Ibm Logical Drive Status Test

This test reports the current status of each logical drive (i.e., LUN), and that of the read and write caches on each drive.

Target of the test : An IBM DS Raid Storage device

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each logical drive on the storage controller to be monitored

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed .
Host	The IP address of the storage device
Port	The port number at which the specified Host listens. By default, this is *NULL*.
SMCliLocation	The test uses the command-line utility, **SMcli.exe**, to collect the required statistics from the IBM DS Raid Storage device. To enable the test to run the **SMcli.exe**, provide the full path to the exe in the SMCliLocation text box. **Note:** If the **SMcli.exe** resides in say, *C:\Program Files\IBM_DS\client*, your SMCliLocation should be : *C:\Progra~1\IBM_DS\client*. On the other hand, if the **SMcli.exe** resides in say, *C:\Program Files (x86)\IBM_DS\client*, your SMCliLocation should be: *C:\Progra~2\IBM_DS\client*.

Parameter	Description
Alternate Controller IP	By default, the Alternate Controller IP text box is set to *none*. This implies that by default, the storage device being monitored supports a single controller only, and the IP address of this controller is the same as the IP address of the target Host. Sometimes, a storage device could be configured with two/more controllers, so as to provide fail-over services - in other words, if the primary controller is down, then one of the alternate controllers will take over from the primary to provide the critical storage services. In this case, you can provide a comma-separated list of alternate controller IPs in the Alternate Controller IP text box.
Timeout	Indicate the duration (in seconds) for which this test should wait for a response from the storage device. By default, this is set to 30 seconds.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Logical drive status	Indicates the current status of this logical drive.		The values that this measure can report and the numeric values that correspond to them are listed below: **Measure Value** / **Numeric Value** Optimal – 1 Online – 2 Degraded – 3 Failed – 4 Offline – 5 Unknown – 6 **Note:** This measure reports the **Measure Value**s listed in the table above to indicate the current state of this logical drive. However, in the graph of this measure, the state is indicated using only the **Numeric Value**s listed in the above table.

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>The detailed diagnosis of this measure reports the LUN number, host group name, and current owner of the logical drive.</td></tr>
<tr><td>Read cache status</td><td>Indicates the current status of the read cache of this logical drive.</td><td></td><td>The values that this measure can report and the numeric values that correspond to them are listed below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Enabled</td><td>1</td></tr><tr><td>Disabled</td><td>0</td></tr><tr><td>Unknown</td><td>2</td></tr></table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of the read cache. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td></tr>
<tr><td>Write cache status</td><td>Indicates the current status of the write cache of this logical drive.</td><td></td><td>The values that this measure can report and the numeric values that correspond to them are listed below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Enabled</td><td>1</td></tr><tr><td>Disabled</td><td>0</td></tr><tr><td>Unknown</td><td>2</td></tr></table>
Note:
This measure reports the Measure Values listed in the table above to indicate the current state of the write cache. However, in the graph of this measure, the state is indicated using</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			only the **Numeric Value**s listed in the above table.

About eG Innovations

eG Innovations provides intelligent performance management solutions that automate and dramatically accelerate the discovery, diagnosis, and resolution of IT performance issues in on-premises, cloud and hybrid environments. Where traditional monitoring tools often fail to provide insight into the performance drivers of business services and user experience, eG Innovations provides total performance visibility across every layer and every tier of the IT infrastructure that supports the business service chain. From desktops to applications, from servers to network and storage, from virtualization to cloud, eG Innovations helps companies proactively discover, instantly diagnose, and rapidly resolve even the most challenging performance and user experience issues.

eG Innovations is dedicated to helping businesses across the globe transform IT service delivery into a competitive advantage and a center for productivity, growth and profit. Many of the world's largest businesses use eG Enterprise to enhance IT service performance, increase operational efficiency, ensure IT effectiveness and deliver on the ROI promise of transformational IT investments across physical, virtual and cloud environments.

To learn more visit www.eginnovations.com.

Contact Us

For support queries, email support@eginnovations.com.

To contact eG Innovations sales team, email sales@eginnovations.com.