Monitoring the IBM DS RAID Storage

eG Enterprise v6

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Monitoring the IBM DS RAID Storage

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.

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.

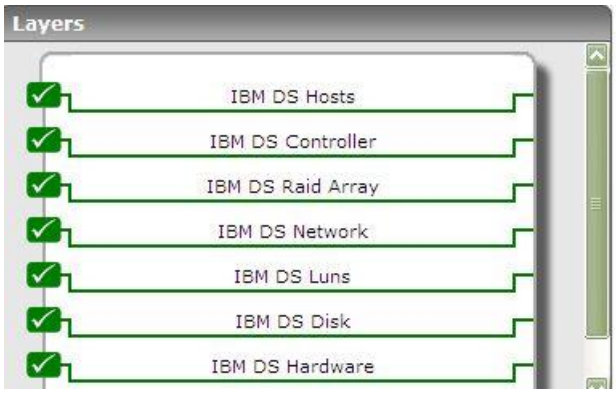

Figure 1: The layer model of the IBM DS Raid Storage

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?

1.1 Pre-requisites for Monitoring the IBM DS RAID Storage

The eG agent invokes the **SMCli** utility provided by IBM to monitor the storage servers. To enable the eG agent to use this 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.

The section that follow will discuss each of the layers in Figure 1 in detail.

1.2 The IBM DS Hardware Layer

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

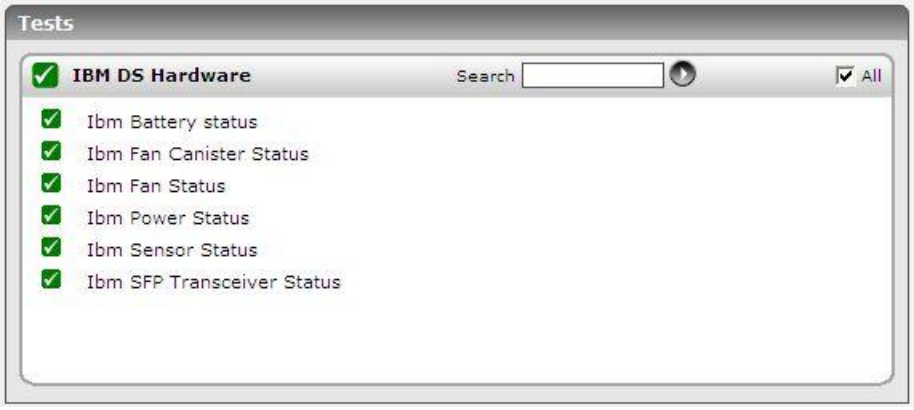

Figure 2: The tests mapped to the IBM DS Hardware layer

1.2.1 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.

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each battery in the enclosure</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr><td>test</td><td>Battery status:
Indicates the current status of this battery.</td><td>Status</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 battery. 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></td><td>Battery age:
Indicates the remaining battery life in days..</td><td>Days</td><td>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.</td></tr>
</table>

1.2.2 Ibm Fan Canister Status Test

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

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each fan canister in the enclosure</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr>
<td>test</td>
<td>Canister status:
Indicates the current status of this fan canister.</td>
<td>Status</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 fan canister. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td>
</tr>
</table>

1.2.3 Ibm Fan Status Test

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

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each fan in the enclosure</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr>
<td>test</td>
<td>Fan status:
Indicates the current status of this fan.</td>
<td>Status</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 fan. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td>
</tr>
</table>

1.2.4 Ibm Power Status Test

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

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each power supply unit in the enclosure</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr>
<td>test</td>
<td>Power supply status:
Indicates the power status of this power supply unit.</td>
<td>Status</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 power supply unit. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td>
</tr>
</table>

1.2.5 Ibm Sensor Status Test

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

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each temperature sensor in the enclosure</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr>
<td>test</td>
<td>Temp sensor status:
Indicates the current status of this temperature sensor.</td>
<td>Status</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>

1.2.6 Ibm SFP Transceiver Status Test

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

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each SFP transceiver in the storage sub-system</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr>
<td>test</td>
<td>SFP Transceiver status:
Indicates the status of this SFP Transceiver.</td>
<td>Status</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 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>

1.3 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: The tests mapped to the IBM DS Disk layer

1.3.1 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.

Purpose	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		
Configurable parameters for the test	1. **Test period** – How often should the test be executed 2. **Host** – The IP address of the storage device 3. **port** - The port at which the **HOST** listens; by default, this is NULL. 4. **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*. 5. **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. 6. **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.		
Outputs of the test	One set of results for each drive channel on the storage controller to be monitored		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

test	**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	

1.3.2 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.

Purpose	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		
Configurable parameters for the test	1. **Test period** – How often should the test be executed 2. **Host** – The IP address of the storage device 3. **port** - The port at which the **HOST** listens; by default, this is NULL. 4. **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*. 5. **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. 6. **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.		
Outputs of the test	One set of results for each drive channel on the storage controller to be monitored		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Channel status:
Indicates the current status of this drive channel.</td>
<td>Status</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>
</td>
</tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>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></td><td>Controller A link status:
Indicates the current status of the connection between this drive channel and the controller A link.</td><td>Status</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:
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></td><td>Controller B link status:
Indicates the current status of the connection between this drive channel and the controller B link.</td><td>Status</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:
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>
</table>

1.3.3 Ibm Drive Status Test

This test reports the current status of each drive.

Purpose	Reports the current status of each drive		
Target of the test	An IBM DS Raid Storage device		
Agent deploying the test	A remote agent		
Configurable parameters for the test	1. **Test period** – How often should the test be executed 2. **Host** – The IP address of the storage device 3. **port** - The port at which the **HOST** listens; by default, this is NULL. 4. **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*. 5. **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. 6. **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.		
Outputs of the test	One set of results for each drive on the storage controller to be monitored		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Drive status:
Indicates the current status of this drive.</td>
<td>Status</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 drive. 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></td>
<td>Drive assigned:
Indicates the current assignment status of this drive.</td>
<td>Status</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>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>

1.4 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 4: The test mapped to the IBM DS Luns layer

1.4.1 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.

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each LUN</td></tr>
<tr><td rowspan="3">Measurements made by the test</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
<tr><td>Current IO operations:
Indicates the number of I/O operations on this LUN during the last measurement period.</td><td>Number</td><td></td></tr>
<tr><td>Percent read operations:
Indicates the percentage of read operations on this LUN.</td><td>Percent</td><td></td></tr>
</table>

	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	

1.5 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 5: The tests mapped to the IBM DS Network layer

1.5.1 Ibm Drive Port Status Test

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

Purpose	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		
Configurable parameters for the test	1. **Test period** – How often should the test be executed 2. **Host** – The IP address of the storage device 3. **port** - The port at which the **HOST** listens; by default, this is NULL. 4. **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*. 5. **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. 6. **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.		
Outputs of the test	One set of results for each drive port in the enclosure		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Link status:
Indicates the current status of each drive port in the enclosure.</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 drive port. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td>
</tr>
</table>

1.5.2 Ibm Host Port Status Test

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

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each host port in the controller</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr>
<td>test</td>
<td>Link status:
Indicates the current status of this host port.</td>
<td>Status</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 host port. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.</td>
</tr>
</table>

1.6 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 6: The test mapped to the IBM DS Raid Array layer

1.6.1 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.

Purpose	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		
Configurable parameters for the test	1. **Test period** – How often should the test be executed 2. **Host** – The IP address of the storage device 3. **port** - The port at which the **HOST** listens; by default, this is NULL. 4. **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*. 5. **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. 6. **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.		
Outputs of the test	One set of results the storage array being monitored		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Storage array status:
Indicates the current status of the storage array.</td>
<td>Status</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.

The detailed diagnosis of this measure will report the logical drives in the array, and the capacity of each drive (in GB).</td>
</tr>
<tr>
<td></td>
<td>Total capacity:
Indicates the total array capacity.</td>
<td>GB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Used capacity:
Indicates the total array capacity.</td>
<td>GB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percent free:
Indicates the percentage of capacity that is unused.</td>
<td>Percent</td>
<td>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.</td>
</tr>
</table>

1.7 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 verted, and controllers in a degraded/failed state can be identified

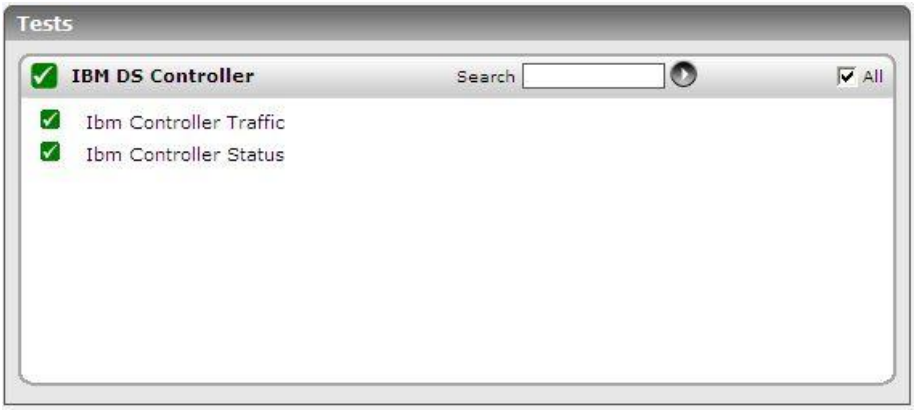

Figure 7: The tests mapped to the IBM DS Controller layer

1.7.1 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.

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.
5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each controller on the storage device being monitored</td></tr>
<tr><td rowspan="3">Measurements made by the test</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
<tr><td>Current IO Operations:
Indicates the number of IO operations that occurred on this controller during the last measurement period.</td><td>Number</td><td>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.</td></tr>
<tr><td>Percent read operations:
Indicates the percent of read operations that occurred on this controller.</td><td>Percent</td><td></td></tr>
</table>

	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	

1.7.2 Ibm Controller Status Test

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

Purpose	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

<table>
<tr><td>Configurable parameters for the test</td><td colspan="3">1. Test period – How often should the test be executed
2. Host – The IP address of the storage device
3. port - The port at which the HOST listens; by default, this is NULL.
4. 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.

5. 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.
6. 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.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each controller on the storage device being monitored</td></tr>
<tr><td>Measurements made by the</td><td>Measurement</td><td>Measurement Unit</td><td>Interpretation</td></tr>
</table>

<table>
<tr>
<td>test</td>
<td>Controller status:
Indicates the current status of this controller.</td>
<td>Status</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 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>

1.8 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 8: The test mapped to the IBM DS Hosts layer

1.8.1 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.

Purpose	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		
Configurable parameters for the test	1. **Test period** – How often should the test be executed 2. **Host** – The IP address of the storage device 3. **port** - The port at which the **HOST** listens; by default, this is NULL. 4. **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*. 5. **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. 6. **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.		
Outputs of the test	One set of results for each logical drive on the storage controller to be monitored		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Logical drive status:
Indicates the current status of this logical drive.</td>
<td>Status</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 logical drive. However, in the graph of this measure, the state is indicated using only the Numeric Values listed in the above table.
The detailed diagnosis of this measure reports the Lun No, host group name, and current owner of the logical drive.</td>
</tr>
<tr>
<td></td>
<td>Read cache status:
Indicates the current status of the read cache of this logical drive.</td>
<td>Status</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>
</table>

<table>
<tr>
<td></td>
<td>Write cache status:
Indicates the current status of the write cache of this logical drive.</td>
<td>Status</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 only the Numeric Values listed in the above table.</td>
</tr>
</table>

Chapter 2

Conclusion

This document has described in detail the monitoring paradigm used and the measurement capabilities of the eG Enterprise suite of products with respect to **IBM DS RAID Storage**. For details of how to administer and use the eG Enterprise suite of products, refer to the user manuals.

We will be adding new measurement capabilities into the future versions of the eG Enterprise suite. If you can identify new capabilities that you would like us to incorporate in the eG Enterprise suite of products, please contact support@eginnovations.com. We look forward to your support and cooperation. Any feedback regarding this manual or any other aspects of the eG Enterprise suite can be forwarded to feedback@eginnovations.com.