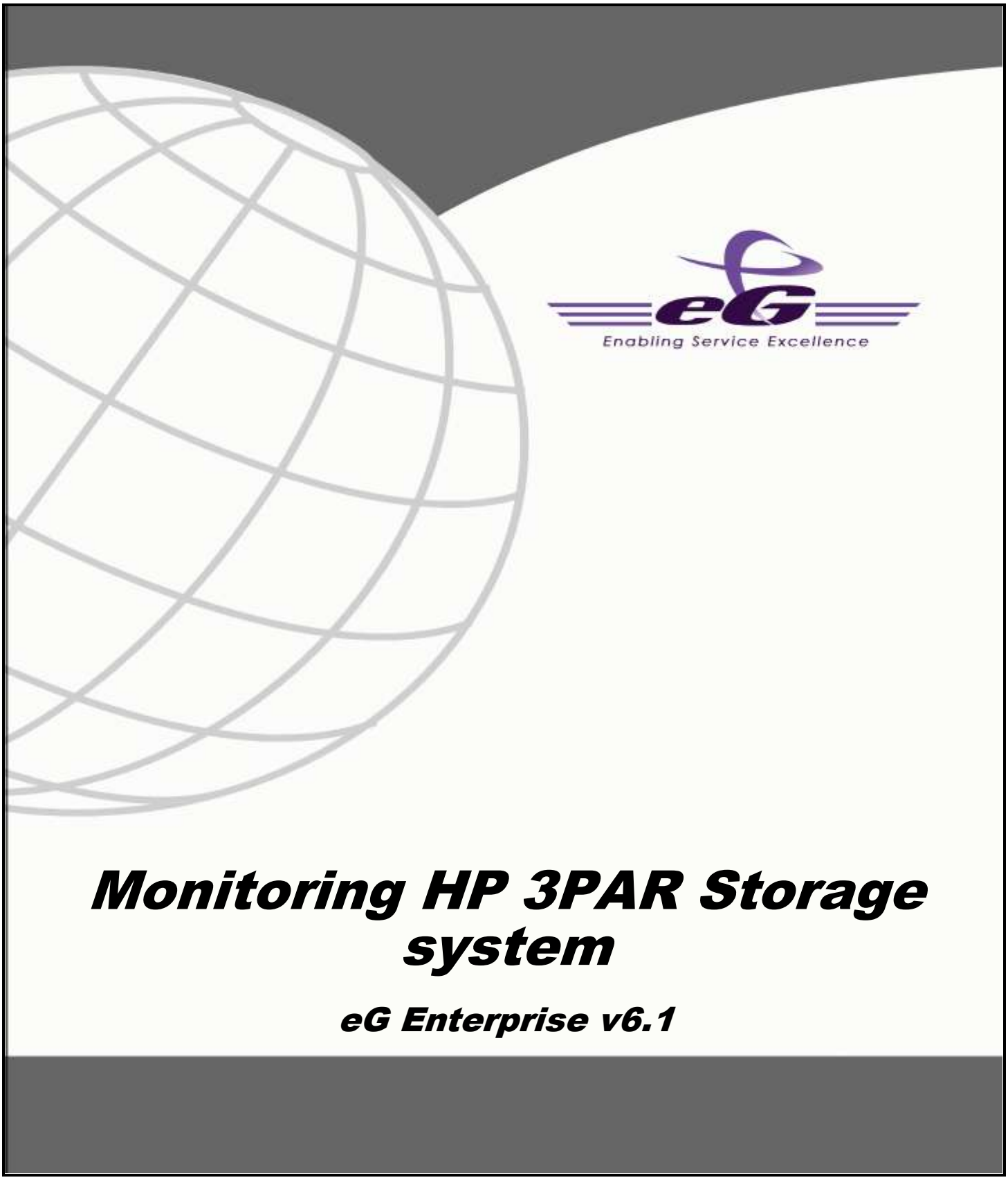

Monitoring HP 3PAR Storage system

eG Enterprise v6.1

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Monitoring HP 3PAR Storage system

HP 3PAR Utility Storage is the only virtualized storage platform that delivers 100% simple, efficient, and agile virtual and cloud data centers with respect to today's growing demands. Designed from the ground up to exceed the economic and operational requirements of today's most demanding IT environments, HP 3PAR Utility Storage also delivers the performance, scalability, and availability required of Tier 1 Storage along with unique technology benefits that are not available with traditional platforms.

The HP 3PAR Storage System family is the hardware foundation of HP 3PAR Utility Storage. Unlike modular and monolithic (or cache-centric) storage arrays, HP 3PAR Storage Systems use a cluster-based approach and feature fourth-generation HP 3PAR Thin Built In ASICs in each clustered Controller Node. The modularity of the system delivers a single HP Converged Storage platform that scales continuously from the small to the very large and offers complete fault tolerance of both hardware and software as part of an HP Converged Infrastructure. Any failure detected in the hardware or software of such storage platforms may result in the loss of huge amount of data. Anything that renders the data inaccessible or delays access to data, such as a disk failure or an I/O overload, can be disastrous to these mission-critical IT environments. This is why, it is important that the HP 3PAR Storage system is continuously monitored for performance flaws – both small or big!

eG Enterprise offers a specialized monitoring model that monitors the storage system inside-out and sheds light on current or probable performance dips that the storage system suffers.

Figure 1.1: The layer model of the HP 3PAR Storage system

Every layer of Figure 1.1 is mapped to a wide variety of tests that monitor critical performance parameters such as processing ability, load, and operational state, of the core components of the storage system's architecture. To pull out such useful performance data from the storage system, the eG agent needs to be deployed on a remote Windows host in the environment and configured to poll the SMI-S Provider of the HP 3PAR Storage system at set intervals. Section 1.1 discusses in detail on how to configure the eG agent to connect to the SMI-S Provider of the storage system.

1.1 How does eG Enterprise Monitor the HP 3PAR Storage system?

As said earlier, the eG agent will poll the **SMI-S Provider of the HP 3PAR Storage system** at set intervals and collect the required performance metrics. To know where to install this eG agent and how to configure the agent to interact with the SMI-S Provider, follow the guidelines discussed below:

1. By default, the SMI-S Provider/CIM Server is embedded within the HP 3PAR Storage system. The eG agent can therefore, be deployed on any remote windows host in the environment. Ensure that the Windows host is able to connect to the SMI-S Provider and pull out metrics related to the storage system.
2. By default, the SMI-S Provider is disabled in the HP 3PAR Storage system. To enable the SMI-S provider, the administrator should login to putty and connect to the target HP 3PAR Storage system via SSH. **Remember that the administrator should possess super user privileges to connect to the target storage system**.
3. Once connected to the target HP 3PAR Storage system, issuing the *startcim* command in the CLI of the target storage system will enable and start the SMI-S Provider.

The SMI-S Provider will start in 90 seconds after the *startcim* command is issued.

4. To disable the SMI-S Provider, issue the *stopcim* command. If you wish to be prompted to confirm your intention to disable the SMI-S Provider, then you may issue the *stopcim –f* command.
5. If you are in doubt about the current status of the SMI-S Provider, then you can verify the current status of the SMI-S Provider in the CLI by issuing the *showcim* command. An example SMI-S Provider status information is as follows:

```
-Service- -State- --SLP-- SLPPort -HTTP-- HTTPPort -HTTPS- HTTPSPort PGVer CIMVer
Enabled Active Enabled 427 Enabled 5988 Enabled 5989 2.9.1 3.1.2
```

   Using this command you can view the overall status of the SMI-S Provider; the status and ports used for the HTTP, HTTPS, and SLP; the version of the internal Pegasus CIM Object Manager; and the version of the CIM Server/SMI-S Provider.
6. Manage the target storage system using the eG administrative interface.

1.2 The HP 3PAR Hardware Layer

The tests mapped to this layer report on the overall health of the hardware supporting the HP 3PAR Storage system.

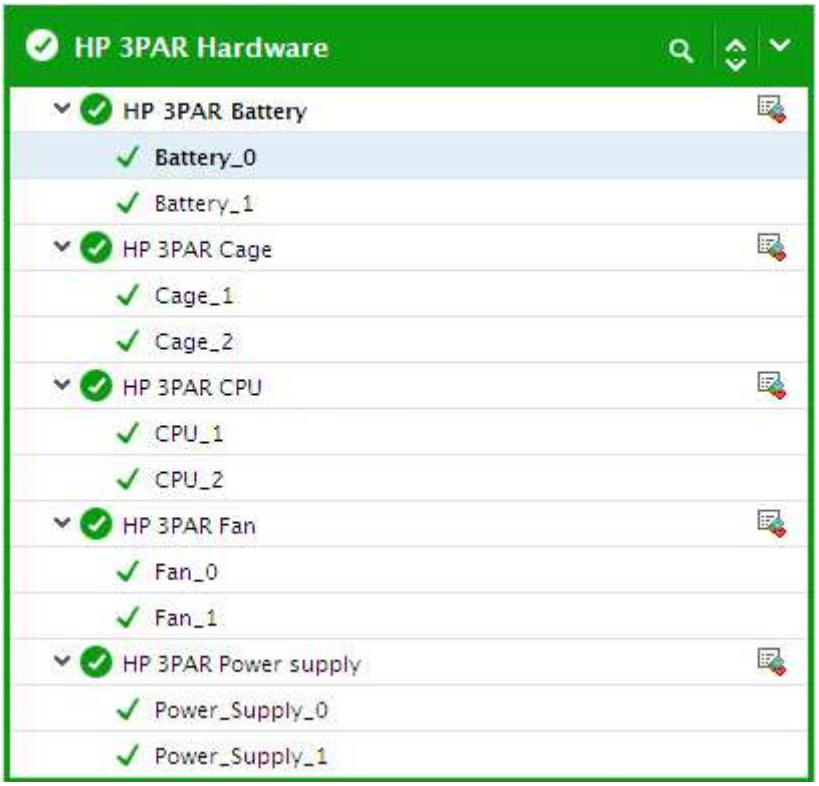

Figure 1.2: The tests mapped to the HP 3PAR Hardware layer

1.2.1 HP 3PAR Battery Test

A defective battery or a battery that is left with no charge can render the storage device unusable, denying users access to critical data! To prevent such eventualities, the health of the batteries used by the storage system should be periodically checked, and problem conditions promptly brought to the attention of administrators. This can be achieved using the **HP 3PAR Battery** test. This test reports the operational state and overall health of each of the batteries used by the storage system, proactively alerts administrators to potential abnormalities related to battery performance, and enables administrators to initiate pre-emptive action to avoid total battery failure.

Purpose	Reports the operational state and overall health of the batteries, proactively alerts administrators to potential abnormalities related to battery performance, and enables administrators to initiate pre-emptive action to avoid total battery failure
Target of the test	A HP 3PAR Storage system
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL –** Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**. 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.		
Outputs of the test	One set of results for each battery on the storage system		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Health state:
Indicates how healthy the battery currently is.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>OK</td></tr>
<tr><td>1</td><td>Unknown</td></tr>
<tr><td>2</td><td>Degraded/Warning</td></tr>
<tr><td>3</td><td>Minor failure</td></tr>
<tr><td>4</td><td>Major failure</td></tr>
<tr><td>5</td><td>Critical failure</td></tr>
<tr><td>6</td><td>Non-recoverable error</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the state of a battery. The graph of this measure however, represents the state of the batteries using the numeric equivalents only.</td>
</tr>
</table>

	Operational status: Indicates the current operational state of this battery.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormant
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 Note	By default, this measure reports the **Measure Values** discussed above to indicate the operational state of a battery. In the graph of this measure however, operational states are represented using the numeric equivalents only.

	Detailed operational state: Describes the current operational state of this battery.		**This measure will be reported only if the API provides a detailed operational state.** Typically, the detailed state will describe why the battery is in a particular operational state. For instance, if the *Operational status* measure reports the value *Stopping* for a battery, then this measure will explain why the battery is being stopped. The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	Online
1	Success
2	Power Saving Mode
3	Write Protected
4	Write Disabled
5	Not Ready
6	Removed
7	Rebooting
8	Offline
9	Failure

By default, this measure reports the **Measure Values** discussed above to indicate the detailed operational state of a battery. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.

	Battery state: Indicates the current battery state.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
1	Other
2	Unknown
3	Fully Charged
4	Partially Charged
5	Charging
6	Charging and High
7	Charging and Low
8	Charging and Critical
9	Overcharged
10	Low
11	Critical
12	Undefined
13	Learning

By default, this measure reports the **Measure Values** discussed above to indicate the battery state. In the graph of this measure however, battery states are represented using the numeric equivalents only.

1.2.2 HP 3PAR Cage Test

Drive Chassis, also referred to as Drive Cages are intelligent, switched, hyper-dense drive enclosures that serve as the capacity building block within the HP 3PAR Storage system. A single HP 3PAR Storage system can accommodate up to 48 Drive Chassis and scale from 16 to 1,920 drives online and non-disruptively. Each Drive Chassis consumes four EIA rack units in a 19-inch rack. Each Drive Chassis can be loaded with ten drive magazines holding four one-inch high drives. Because each Drive Chassis can hold up to 40 drives, a single Drive Chassis can pack up to 80 TB of data in just seven inches of rack space when using 2-TB Nearline (enterprise SATA) disk drives.

Each Drive Chassis may contain one or more physical drive types:

- Solid State Drives (SSDs) to meet even the most stringent performance demands
- Fiber Channel disk drives to meet high performance or capacity demands
- Nearline (enterprise SATA) disk drives to meet capacity demands at the lowest cost

If one or more drive chassis fails, the capacity of the storage system may be reduced drastically thus lowering the overall efficiency of the storage system. In order to maintain the efficiency of the storage system, it is important for the administrators to constantly monitor the health and operational state of each drive chassis in the HP 3PAR Storage system The **HP 3PAR Cage** test helps administrators in this regard.

This test auto discovers the drive chassis i.e., drive cages of the HP 3PAR storage system and for each drive cage, this test reports the health and operational state. In addition, this test helps administrators to identify the type of each drive cage and its enclosure ID.

Purpose	Auto discovers the drive chassis i.e., drive cages of the HP 3PAR storage system and for each drive cage, this test reports the health and operational state. In addition, this test helps administrators to identify the type of each drive cage and its enclosure ID.
Target of the test	A HP 3PAR Storage system
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL –** Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**. 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.		
Outputs of the test	One set of results for each cage on the storage system		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Health state:
Indicates the current health of this cage.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>OK</td></tr>
<tr><td>1</td><td>Unknown</td></tr>
<tr><td>2</td><td>Degraded/Warning</td></tr>
<tr><td>3</td><td>Minor failure</td></tr>
<tr><td>4</td><td>Major failure</td></tr>
<tr><td>5</td><td>Critical failure</td></tr>
<tr><td>6</td><td>Non-recoverable error</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the health of each cage. The graph of this measure however, represents the state of the batteries using the numeric equivalents only.</td>
</tr>
</table>

	Operational status: Indicates the current operational state of this cage.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormant
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 Note	By default, this measure reports the **Measure Values** discussed above to indicate the operational state of each cage. In the graph of this measure however, operational states are represented using the numeric equivalents only.

	Detailed operational state: Describes the current operational state of this cage.		**This measure will be reported only if the API provides a detailed operational state.** Typically, the detailed state will describe why the cage is in a particular operational state. For instance, if the *Operational status* measure reports the value *Stopping* for a cage, then this measure will explain why the cage is being stopped. The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	Online
1	Success
2	Power Saving Mode
3	Write Protected
4	Write Disabled
5	Not Ready
6	Removed
7	Rebooting
8	Offline
9	Failure

By default, this measure reports the **Measure Values** discussed above to indicate the detailed operational state of a cage. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.

<table>
<tr>
<td></td>
<td>Cage type:
Indicates the type of this cage.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>Unknown</td></tr>
<tr><td>2</td><td>DC1</td></tr>
<tr><td>3</td><td>DC2</td></tr>
<tr><td>4</td><td>DC3</td></tr>
<tr><td>5</td><td>DC4</td></tr>
<tr><td>6</td><td>DCS1</td></tr>
<tr><td>7</td><td>DCS2</td></tr>
<tr><td>8</td><td>DCN1</td></tr>
</table>


By default, this measure reports the Measure Values discussed above indicate the type of a cage. In the graph of this measure however, the cage types are represented using the numeric equivalents only.</td>
</tr>
<tr>
<td></td>
<td>Enclosure ID:
Indicates the enclosure ID of this cage.</td>
<td>Number</td>
<td></td>
</tr>
</table>

1.2.3 HP 3PAR CPU Test

This test auto discovers the CPUs of the HP 3PAR storage system and reports the current operational state of each CPU.

Purpose	Auto discovers the CPUs of the HP 3PAR storage system and reports the current operational state of each CPU
Target of the test	A HP 3PAR Storage system
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL** – Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False.** 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.		
Outputs of the test	One set of results for each CPU on the storage system		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Operational status:
Indicates the current operational state of this CPU.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>OK</td></tr>
<tr><td>1</td><td>In Service</td></tr>
<tr><td>2</td><td>Power Mode</td></tr>
<tr><td>3</td><td>Completed</td></tr>
<tr><td>4</td><td>Starting</td></tr>
<tr><td>5</td><td>Dormat</td></tr>
<tr><td>6</td><td>Other</td></tr>
<tr><td>7</td><td>Unknown</td></tr>
<tr><td>8</td><td>Stopping</td></tr>
<tr><td>9</td><td>Stressed</td></tr>
<tr><td>10</td><td>Stopped</td></tr>
<tr><td>11</td><td>Supporting Entity in Error</td></tr>
<tr><td>12</td><td>Degraded or Predicted Failure</td></tr>
<tr><td>13</td><td>Predictive Failure</td></tr>
<tr><td>14</td><td>Lost Communication</td></tr>
<tr><td>15</td><td>No Contact</td></tr>
<tr><td>16</td><td>Aborted</td></tr>
<tr><td>17</td><td>Error</td></tr>
<tr><td>18</td><td>Non-Recoverable Error</td></tr>
</table>

Note
By default, this measure reports the Measure Values discussed above to indicate the operational state of a CPU. In the graph of this measure however, operational states are represented using the numeric equivalents only.</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>Detailed operational status:
Describes the current operational state of this CPU.</td>
<td></td>
<td>This measure will be reported only if the API provides a detailed operational state.
Typically, the detailed state will describe why the CPU is in a particular operational state. For instance, if the operationalStatus measure reports the value Stopping for a CPU, then this measure will explain why the CPU is being stopped.

The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>Online</td></tr>
<tr><td>1</td><td>Success</td></tr>
<tr><td>2</td><td>Power Saving Mode</td></tr>
<tr><td>3</td><td>Write Protected</td></tr>
<tr><td>4</td><td>Write Disabled</td></tr>
<tr><td>5</td><td>Not Ready</td></tr>
<tr><td>6</td><td>Removed</td></tr>
<tr><td>7</td><td>Rebooting</td></tr>
<tr><td>8</td><td>Offline</td></tr>
<tr><td>9</td><td>Failure</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the detailed operational state of a CPU. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.</td>
</tr>
</table>

1.2.4 HP 3PAR Fans Test

If the fan suddenly stops running, then the temperature of the storage system hardware will soar, causing serious damage to the core components of the device. This is why, its good practice to keep track of the fan status using the

HP 3PAR Fans test. For each fan available on the storage system, this test reports how healthy the fan is and what is its current operational state.

Purpose	For each fan available on the storage system, this test reports how healthy the fan is and what is its current operational state.		
Target of the test	A HP 3PAR Storage system		
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL –** Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**. 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.		
Outputs of the test	One set of results for each fan on the storage system		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Health state:
Indicates how healthy this fan currently is.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>OK</td></tr>
<tr><td>1</td><td>Unknown</td></tr>
<tr><td>2</td><td>Degraded/Warning</td></tr>
<tr><td>3</td><td>Minor failure</td></tr>
<tr><td>4</td><td>Major failure</td></tr>
<tr><td>5</td><td>Critical failure</td></tr>
<tr><td>6</td><td>Non-recoverable error</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the state of a fan. The graph of this measure however, represents the state of the fans using the numeric equivalents only.</td>
</tr>
</table>

	Operational status: Indicates the current operational state of this fan.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormat
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 Note	By default, this measure reports the **Measure Values** discussed above to indicate the operational state of a fan. In the graph of this measure however, operational states are represented using the numeric equivalents only.

<table>
<tr>
<td></td>
<td>Detailed operational state:
Describes the current operational state of this fan.</td>
<td></td>
<td>This measure will be reported only if the API provides a detailed operational state.
Typically, the detailed state will describe why the fan is in a particular operational state. For instance, if the Operational status measure reports the value Stopping for a fan, then this measure will explain why the fan is being stopped.
The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>Online</td></tr>
<tr><td>1</td><td>Success</td></tr>
<tr><td>2</td><td>Power Saving Mode</td></tr>
<tr><td>3</td><td>Write Protected</td></tr>
<tr><td>4</td><td>Write Disabled</td></tr>
<tr><td>5</td><td>Not Ready</td></tr>
<tr><td>6</td><td>Removed</td></tr>
<tr><td>7</td><td>Rebooting</td></tr>
<tr><td>8</td><td>Offline</td></tr>
<tr><td>9</td><td>Failure</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the detailed operational state of a fan. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.</td>
</tr>
</table>

1.2.5 HP 3PAR Power supplies Test

The sudden failure of the power supply units of a storage device can cause the device to crash, leading to critical loss of data. To avoid this, you need to keep an eye on the state of each power supply unit of the storage system. This

can be achieved using the **HP 3PAR Power supplies** test. This test auto-discovers the power supply units of the storage system and reports the overall health and operational state of each unit.

Purpose	Auto-discovers the power supply units of the storage system and reports the overall health and operational state of each unit		
Target of the test	A HP 3PAR Storage system		
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL –** Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**. 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.		
Outputs of the test	One set of results for each power supply unit on the storage system		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Health state:
Indicates how healthy this power supply unit currently is.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>OK</td></tr>
<tr><td>1</td><td>Unknown</td></tr>
<tr><td>2</td><td>Degraded/Warning</td></tr>
<tr><td>3</td><td>Minor failure</td></tr>
<tr><td>4</td><td>Major failure</td></tr>
<tr><td>5</td><td>Critical failure</td></tr>
<tr><td>6</td><td>Non-recoverable error</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the state of a power supply unit. The graph of this measure however, represents the state of the power supplies using the numeric equivalents only.</td>
</tr>
</table>

	Operational status: Indicates the current operational state of this power supply unit.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormat
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 Note	By default, this measure reports the **Measure Values** discussed above to indicate the operational state of a power supply unit. In the graph of this measure however, operational states are represented using the numeric equivalents only.

	Detailed operational state: Describes the current operational state of this power supply unit.		**This measure will be reported only if the API provides a detailed operational state.** Typically, the detailed state will describe why the power supply unit is in a particular operational state. For instance, if the *Operational status* measure reports the value *Stopping* for a power supply unit, then this measure will explain why the power supply is being stopped. The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	Online
1	Success
2	Power Saving Mode
3	Write Protected
4	Write Disabled
5	Not Ready
6	Removed
7	Rebooting
8	Offline
9	Failure

By default, this measure reports the **Measure Values** discussed above to indicate the detailed operational state of a PSU. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.

1.3 The HP 3PAR Disk Layer

The **IBM DS8000 Disks** layer tracks the status and the health of each disk available in the IBM DS8000 Storage system and reports the capacity of each disk.

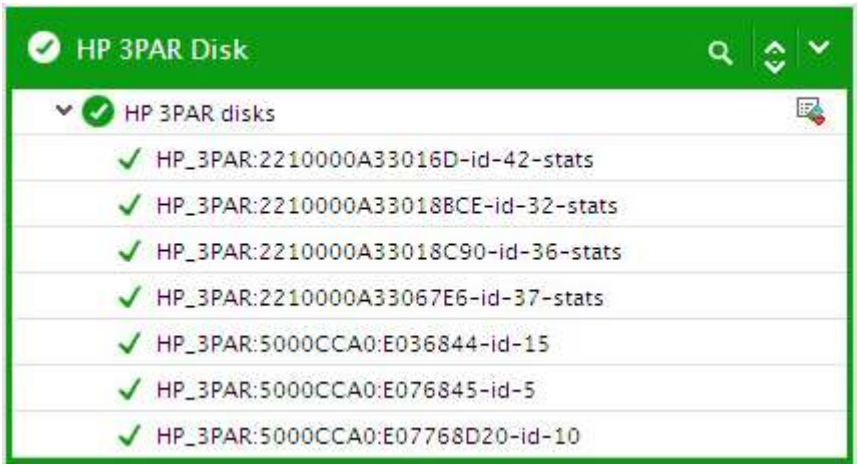

Figure 1.3: The tests mapped to the HP 3PAR Disk layer

1.3.1 HP 3PAR Disks Test

A disk that is currently offline or a disk that has failed will not be able to cater to the user requests thus causing prolonged delays in data access for users. Administrators hence have to continuously track the status and health of the disk so that abnormal health and status of the disk can be detected proactively and pre-emptively treated. The **HP 3PAR Disks** test helps administrators with this. This test monitors the health and status of each disk available on the HP 3PAR Storage system as well as the capacity of each disk, using which any abnormalities can be detected before users start complaining of slowdowns.

Purpose	Monitors the health and status of each disk available on an HP 3PAR Storage system as well as the capacity of each disk.
Target of the test	A HP 3PAR Storage system
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 system
3. PORT - The port number at which the Storage system listens. The default is NULL.
4. USER and PASSWORD – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the Monitor role.
5. CONFIRM PASSWORD – Confirm the PASSWORD by retyping it here.
6. SSL – Set this flag to True, if the storage system being monitored is SSL-enabled. By default this flag is set to False.
7. ISEMBEDDED – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to True, by default.
8. CIM SERVER PORT - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the CIM SERVER PORT text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.
9. DETAILED DIAGNOSIS - To make diagnosis more efficient and accurate, the eG Enterprise suite embeds an optional detailed diagnostic capability. With this capability, the eG agents can be configured to run detailed, more elaborate tests as and when specific problems are detected. To enable the detailed diagnosis capability of this test for a particular server, choose the On option. To disable the capability, click on the Off option.
The option to selectively enable/disable the detailed diagnosis capability will be available only if the following conditions are fulfilled:
➢ The eG manager license should allow the detailed diagnosis capability
➢ Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each disk 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>Operational status:
Indicates the current operating status of this disk.</td>
<td></td>
<td>The values that this measure can report and the states they indicate are tabulated below:
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>OK</td><td>0</td></tr>
<tr><td>In Service</td><td>1</td></tr>
<tr><td>Power Mode</td><td>2</td></tr>
<tr><td>Completed</td><td>3</td></tr>
<tr><td>Starting</td><td>4</td></tr>
<tr><td>Dormant</td><td>5</td></tr>
<tr><td>Other</td><td>6</td></tr>
<tr><td>Unknown</td><td>7</td></tr>
<tr><td>Stopping</td><td>8</td></tr>
<tr><td>Stressed</td><td>9</td></tr>
<tr><td>Stopped</td><td>10</td></tr>
<tr><td>Supporting Entity In Error</td><td>11</td></tr>
<tr><td>Degraded or Predicted Failure</td><td>12</td></tr>
<tr><td>Predictive Failure</td><td>13</td></tr>
<tr><td>Lost Communication</td><td>14</td></tr>
<tr><td>No Contact</td><td>15</td></tr>
<tr><td>Aborted</td><td>16</td></tr>
<tr><td>Error</td><td>17</td></tr>
<tr><td>Non-Recoverable Error</td><td>18</td></tr>
</table>
Note:
By default, this measure reports the above-mentioned States while indicating the current operating state of this disk. However, the graph of this measure will be represented using the corresponding numeric equivalents of the States as mentioned in the table above.</td>
</tr>
</table>

	Detailed operational status: Describes the current operational state of this disk.		**This measure will be reported only if the API provides a detailed operational state.** Typically, the detailed state will describe why the disk is in a particular operational state. For instance, if the *Operational status* measure reports the value *Stopping* for a disk, then this measure will explain why that disk is being stopped. The values that this measure can report and their corresponding numeric values are discussed in the table below: **Measure Value** / **Numeric Value** Online: 0 Success: 1 Power Saving Mode: 2 Write Protected: 3 Write Disabled: 4 Not Ready: 5 Removed: 6 Rebooting: 7 Offline: 8 Failure: 9 **Note:** By default, this measure reports the above-mentioned **Measure Values** only. However, in the graph of this measure, the detailed operational status of this disk. However, the graph of this measure will be represented using the corresponding numeric equivalents only.

<table>
<tr>
<td></td>
<td>Health state:
Indicates the current health of this disk.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are tabulated below:
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>OK</td><td>0</td></tr>
<tr><td>Unknown</td><td>1</td></tr>
<tr><td>Degraded/Warning</td><td>2</td></tr>
<tr><td>Minor failure</td><td>3</td></tr>
<tr><td>Major failure</td><td>4</td></tr>
<tr><td>Critical failure</td><td>5</td></tr>
<tr><td>Non-recoverable error</td><td>6</td></tr>
</table>
Note:
By default, this measure reports the above-mentioned Measure Values only. However, in the graph of this measure, the current health of this disk will be represented using the corresponding numeric equivalents only.</td>
</tr>
<tr>
<td></td>
<td>Data transmitted:
Indicates the rate at which data was transmitted by this disk.</td>
<td>MB/Sec</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IOPS:
Indicates the rate at which I/O operations were performed on this disk.</td>
<td>IOPS</td>
<td>Compare the value of this measure across disks to know which disk handled the maximum number of I/O requests and which handled the least. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across disks.
You may then want to take a look at the Reads and Writes measure to understand what to fine-tune – the load-balancing algorithm for read requests or that of the write requests.</td>
</tr>
<tr>
<td></td>
<td>Reads:
Indicates the rate at which read operations were performed on this disk.</td>
<td>Reads/Sec</td>
<td>Compare the value of this measure across disks to know which disk handled the maximum number of read requests and which handled the least. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across disks.</td>
</tr>
</table>

	Writes: Indicates the rate at which write operations were performed on this disk.	Writes/Sec	Compare the value of this measure across disks to know which disk handled the maximum number of write requests and which handled the least. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across disks.
	Data reads: Indicates the rate at which data is read from this disk.	MB/Sec	Compare the value of these measures across disks to identify the slowest disk in terms of servicing read and write requests (respectively).
	Data writes: Indicates the rate at which data is written to this disk.	MB/Sec	
	Disk busy: Indicates the percentage of time this disk was busy processing requests.	Percent	Compare the value of this measure across disks to know which disk was the busiest and which disk was not. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across disks.
	Average read size: Indicates the amount of data read from this disk per I/O operation	MB/Op	Compare the value of these measures across disks to identify the slowest disk in terms of servicing read and write requests (respectively).
	Average write size: Indicates the amount of data written to this disk per I/O operation.	MB/Op	
	Read hits: Indicates the percentage of read requests that were serviced by the cache of this disk.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct disk accesses, which are expensive operations, are high.
	Write hits: Indicates the percentage of write requests that were serviced by the cache of this disk.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct disk accesses, which are expensive operations, are high.
	Average response time: Indicates the time taken by this disk to respond to I/O requests.	Microsecs	Ideally, this value should be low. If not, it implies that the disk is slow.
	Queue length: Indicates the number of requests that are in queue for this disk.	Number	A consistent increase in this value indicates a potential processing bottleneck with the disk.

1.4 The HP 3PAR System Layer

The **IBM DS8000 LUNs** layer tracks the status and the health of each LUN available in the IBM DS8000 Storage system and reports the level of traffic on each LUN as well as the processing capability of each LUN.

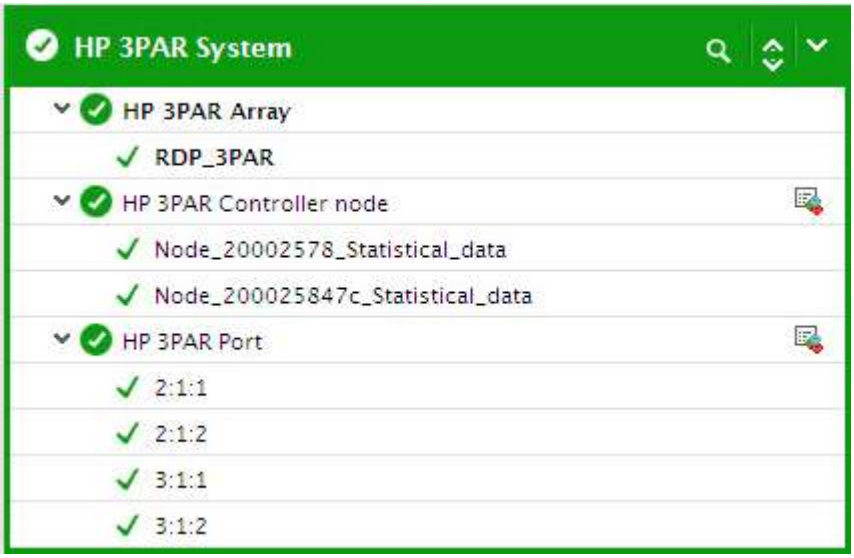

Figure 1.4: The tests mapped to the HP 3PAR System layer

1.4.1 HP 3PAR Arrays Test

This test monitors the current state, overall health, and the load-balancing capability of each storage array in the HP 3PAR storage system. With the help of this test, administrators can be proactively alerted to potential array failures / slowdowns / overload conditions. This way, irregularities in the distribution of I/O load across arrays comes to light, prompting administrators to fine-tune the load-balancing algorithm.

Purpose	Monitors the current state, overall health, and the load-balancing capability of each storage array in the HP 3PAR storage system
Target of the test	A HP 3PAR Storage system
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL –** Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**. 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.
Outputs of the test	One set of results for each storage array on the storage system being monitored

	Operational status: Indicates the current operational state of this storage array.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormant
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 By default, this measure reports the **Measure Values** discussed above to indicate the operational state of a storage array. In the graph of this measure however, operational states are represented using the numeric equivalents only.

<table>
<tr>
<td></td>
<td>Detailed operational status:
Describes the current operational state of this storage array.</td>
<td></td>
<td>This measure will be reported only if the API provides a detailed operational state.
Typically, the detailed state will describe why the storage array is in a particular operational state. For instance, if the Operational status measure reports the value Stopping for a storage array, then this measure will explain why that storage array is being stopped.
The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>Online</td></tr>
<tr><td>1</td><td>Success</td></tr>
<tr><td>2</td><td>Power Saving Mode</td></tr>
<tr><td>3</td><td>Write Protected</td></tr>
<tr><td>4</td><td>Write Disabled</td></tr>
<tr><td>5</td><td>Not Ready</td></tr>
<tr><td>6</td><td>Removed</td></tr>
<tr><td>7</td><td>Rebooting</td></tr>
<tr><td>8</td><td>Offline</td></tr>
<tr><td>9</td><td>Failure</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the detailed operational state of an array. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.</td>
</tr>
<tr>
<td></td>
<td>Data transmitted:
Indicates the rate at which data was transmitted by this storage array.</td>
<td>MB/Sec</td>
<td></td>
</tr>
</table>

	IOPS: Indicates the rate at which I/O operations were performed on this storage array.	IOPS	Compare the value of this measure across storage arrays to know which storage array handled the maximum number of I/O requests and which handled the least. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across storage arrays. You may then want to take a look at the *Reads* and *Writes* measures to understand what to fine-tune – the load-balancing algorithm for read requests or that of the write requests.
	Reads: Indicates the rate at which read operations were performed on this storage array.	Reads/Sec	Compare the value of this measure across storage arrays to know which storage array handled the maximum number of read requests and which handled the least.
	Writes: Indicates the rate at which write operations were performed on this storage array.	Writes/Sec	Compare the value of this measure across storage arrays to know which storage array handled the maximum number of write requests and which handled the least.
	Data reads: Indicates the rate at which data is read from this storage array.	MB/Sec	Compare the value of these measures across storage arrays to identify the slowest storage array in terms of servicing read and write requests (respectively).
	Data writes: Indicates the rate at which data is written to this storage array.	MB/Sec	
	Read hits: Indicates the percentage of read requests that were serviced by the cache of this storage array.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct storage array accesses, which are expensive operations, are high.
	Write hits: Indicates the percentage of write requests that were serviced by the cache of this storage array.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct storage array accesses, which are resource-intensive operations, are high.

	Average read size: Indicates the amount of data read from this storage array per I/O operation.	MB/Op	Compare the value of these measures across storage arrays to identify the slowest storage array in terms of servicing read and write requests (respectively).
	Average write size: Indicates the amount of data written to this storage array per I/O operation.	MB/Op	

1.4.2 HP 3PAR Controllers Test

The controller of the HP 3PAR storage system enables the administrator in serving the purpose of the following:

- binding LUNs
- execute CLI commands
- perform read/write operations from external server to SAN

Excessive usage of or heavy I/O load on a single controller can cause deterioration in the overall performance of the Storage system, as it is indicative of severe deficiencies in the load-balancing algorithm that drives the controllers. Using the **HP 3PAR Controllers** test, administrators can easily monitor the current state, usage, and load on each of the controller on the Storage system, quickly detect an overload condition, precisely point to the controller that is overloaded, and promptly initiate measures to resolve the issue, so as to ensure the optimal performance of the Storage system.

Purpose	Using the **HP 3PAR Controllers** test, administrators can easily monitor the current state, usage, and load on each of the controller on the Storage system, quickly detect an overload condition, precisely point to the controller that is overloaded, and promptly initiate measures to resolve the issue, so as to ensure the optimal performance of the Storage system
Target of the test	A HP 3PAR Storage system
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL –** Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**. 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.		
Outputs of the test	One set of results for each controller on the HP 3PAR Storage system		
Measurements made by the test	**Measurement**	**Measurement Unit**	**Interpretation**

	Operational status: Indicates the current operational state of this controller.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormant
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 By default, this measure reports the **Measure Values** discussed above to indicate the operational state of a controller. In the graph of this measure however, operational states are represented using the numeric equivalents only.

	Detailed operational status: Describes the current operational state of this controller.		**This measure will be reported only if the API provides a detailed operational state.** Typically, the detailed state will describe why the controller is in a particular operational state. For instance, if the *Operational status* measure reports the value *Stopping* for a controller, then this measure will explain why that controller is being stopped. The values that this measure can report and their corresponding numeric values are discussed in the table below: **Numeric Value** / **Measure Value** 0 – Online 1 – Success 2 – Power Saving Mode 3 – Write Protected 4 – Write Disabled 5 – Not Ready 6 – Removed 7 – Rebooting 8 – Offline 9 – Failure Note: By default, this measure reports the **Measure Values** discussed above to indicate the detailed operational state of a controller. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.

	Data transmitted: Indicates the rate at which data was transmitted by this controller.	MB/Sec	
	IOPS: Indicates the rate at which I/O operations were performed on this controller.	IOPS	Compare the value of this measure across controllers to know which controller handled the maximum number of I/O requests and which handled the least. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across controllers. You may then want to take a look at the *Reads* and *Writes* measures to understand what to fine-tune – the load-balancing algorithm for read requests or that of the write requests.
	Reads: Indicates the rate at which read operations were performed on this controller.	Reads/Sec	Compare the value of this measure across controllers to know which controller handled the maximum number of read requests and which handled the least.
	Writes: Indicates the rate at which write operations were performed on this controller.	Writes/Sec	Compare the value of this measure across controllers to know which controller handled the maximum number of write requests and which handled the least.
	Data reads: Indicates the rate at which data is read from this controller.	MB/Sec	Compare the value of these measures across controllers to identify the slowest controller in terms of servicing read and write requests (respectively).
	Data written: Indicates the rate at which data is written to this controller.	MB/Sec	
	Average read size: Indicates the amount of data read from this controller per I/O operation	MB/Op	Compare the value of these measures across controllers to identify the slowest controller in terms of servicing read and write requests (respectively).

	Average write size: Indicates the amount of data written to this controller per I/O operation.	MB/Op	
	Read hits: Indicates the percentage of read requests that were serviced by the cache of this controller.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct controller accesses, which are expensive operations, are high.
	Write hits: Indicates the percentage of write requests that were serviced by the cache of this controller.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct controller accesses, which are expensive operations, are high.

1.4.3 HP 3PAR Ports Test

Storage ports help the controllers receive and process I/O requests. By periodically checking port status and measuring the I/O load on the ports, you can identify overloaded ports and thus proactively detect potential/existing load-balancing irregularities and/or processing bottlenecks with the ports. The **HP 3PAR Ports** test facilitates this port check. For every port configured for the controllers supported by the Storage system, this test reports the port state, the I/O load on the ports, and the processing ability of the ports. In the process, the test not only points administrators to overloaded ports, but also puts a finger on ports that are slow when processing I/O requests.

Purpose	For every port configured for the controllers supported by the Storage system, this test reports the port state, the I/O load on the ports, and the processing ability of the ports. In the process, the test not only points administrators to overloaded ports, but also puts a finger on ports that are slow when processing I/O requests
Target of the test	A HP 3PAR Storage system
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 system 3. **PORT** - The port number at which the Storage system listens. The default is *NULL*. 4. **USER** and **PASSWORD** – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the **Monitor** role. 5. **CONFIRM PASSWORD** – Confirm the **PASSWORD** by retyping it here. 6. **SSL –** Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**. 7. **ISEMBEDDED** – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default. 8. **CIM SERVER PORT** - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the **CIM SERVER PORT** text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.		
Outputs of the test	One set of results for each storage port on the HP 3PAR Storage system		
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

<table>
<tr>
<td>test</td>
<td>Health state:
Indicates how healthy this port currently is.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>OK</td></tr>
<tr><td>1</td><td>Unknown</td></tr>
<tr><td>2</td><td>Degraded/Warning</td></tr>
<tr><td>3</td><td>Minor failure</td></tr>
<tr><td>4</td><td>Major failure</td></tr>
<tr><td>5</td><td>Critical failure</td></tr>
<tr><td>6</td><td>Non-recoverable error</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the state of a port. In the graph of this measure however, states are represented using the numeric equivalents only.</td>
</tr>
</table>

	Operational status: Indicates the current operational state of this port.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormant
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 Note	By default, this measure reports the **Measure Values** discussed above to indicate the operational state of a port. In the graph of this measure however, operational states are represented using the numeric equivalents only.

<table>
<tr>
<td></td>
<td>Detailed operational status:
Describes the current operational state of this port.</td>
<td></td>
<td>This measure will be reported only if the API provides a detailed operational state.
Typically, the detailed state will describe why the port is in a particular operational state. For instance, if the Operational status measure reports the value Stopping for a port, then this measure will explain why that port is being stopped.
The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>Online</td></tr>
<tr><td>1</td><td>Success</td></tr>
<tr><td>2</td><td>Power Saving Mode</td></tr>
<tr><td>3</td><td>Write Protected</td></tr>
<tr><td>4</td><td>Write Disabled</td></tr>
<tr><td>5</td><td>Not Ready</td></tr>
<tr><td>6</td><td>Removed</td></tr>
<tr><td>7</td><td>Rebooting</td></tr>
<tr><td>8</td><td>Offline</td></tr>
<tr><td>9</td><td>Failure</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the detailed operational state of a port. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.</td>
</tr>
<tr>
<td></td>
<td>Data transmitted:
Indicates the rate at which data was transmitted by this port.</td>
<td>MB/Sec</td>
<td></td>
</tr>
</table>

	IOPS: Indicates the rate at which I/O operations were performed on this port.	IOPS	Compare the value of this measure across ports to know which port handled the maximum number of I/O requests and which handled the least. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across ports.

1.5 The HP 3PAR Service Layer

The **IBM DS8000 System** layer tracks the status and the health of each FC port and reports the level of traffic flowing through each port.

Figure 1.5: The tests mapped to the HP 3PAR Service layer

1.5.1 HP 3PAR LUNs Test

A logical unit number (LUN) is a unique identifier used to designate individual or collections of hard disk devices for address by a protocol associated with a SCSI, iSCSI, Fiber Channel (FC) or similar interface. LUNs are central to the management of storage arrays shared over a storage area network (SAN). LUN errors, poor LUN cache usage, and abnormal I/O activity on the LUNs, if not promptly detected and resolved, can hence significantly degrade the performance of the storage array. This is why, it is important that LUN performance is continuously monitored. This can be achieved using the **HP 3PAR LUNs** test. This test auto-discovers the LUNs in the Storage system and reports the current state of each LUN, captures LUN errors, and measures the level of I/O activity on every LUN, so that administrators are notified of LUN-related problems well before they impact Storage system performance.

Purpose	Auto-discovers the LUNs in the Storage system and reports the current state of each LUN, captures LUN errors, and measures the level of I/O activity on every LUN, so that administrators are notified of LUN-related problems well before they impact Storage system performance
Target of the test	A HP 3PAR Storage system
Agent deploying the	A remote agent

<table>
<tr><td>test</td><td colspan="3"></td></tr>
<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 system
3. PORT - The port number at which the Storage system listens. The default is NULL.
4. USER and PASSWORD – Specify the credentials of a user who has the right to execute API commands on the storage device and pull out metrics. To monitor the HP 3PAR Storage system, you will have to provide the credential of a user who has been assigned the Monitor role.
5. CONFIRM PASSWORD – Confirm the PASSWORD by retyping it here.
6. SSL – Set this flag to True, if the storage system being monitored is SSL-enabled. By default this flag is set to False.
7. ISEMBEDDED – By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to True, by default.
8. CIM SERVER PORT - The SMI–S provider of the HP 3PAR Storage system provides access for monitoring and management via the HTTP and HTTPS protocols for CIM API request/response semantics. To enable the eG agent to access the SMI-S Provider, invoke the CIM API commands, and collect the required metrics, you need to specify the service port of the SMI- S provider in the CIM SERVER PORT text box that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.
9. DETAILED DIAGNOSIS - To make diagnosis more efficient and accurate, the eG Enterprise suite embeds an optional detailed diagnostic capability. With this capability, the eG agents can be configured to run detailed, more elaborate tests as and when specific problems are detected. To enable the detailed diagnosis capability of this test for a particular server, choose the On option. To disable the capability, click on the Off option.
The option to selectively enable/disable the detailed diagnosis capability will be available only if the following conditions are fulfilled:
➢ The eG manager license should allow the detailed diagnosis capability
➢ Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.</td></tr>
<tr><td>Outputs of the test</td><td colspan="3">One set of results for each LUN on the HP 3PAR Storage system 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>Health state:
Indicates how healthy this LUN currently is.</td>
<td></td>
<td>The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>OK</td></tr>
<tr><td>1</td><td>Unknown</td></tr>
<tr><td>2</td><td>Degraded/Warning</td></tr>
<tr><td>3</td><td>Minor failure</td></tr>
<tr><td>4</td><td>Major failure</td></tr>
<tr><td>5</td><td>Critical failure</td></tr>
<tr><td>6</td><td>Non-recoverable error</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the state of a LUN In the graph of this measure however, states are represented using the numeric equivalents only.

The detailed diagnosis of this measure if enabled, lists the capacity of the LUN.</td>
</tr>
</table>

	Operational status: Indicates the current operational state of this LUN.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

Numeric Value	Measure Value
0	OK
1	In Service
2	Power Mode
3	Completed
4	Starting
5	Dormant
6	Other
7	Unknown
8	Stopping
9	Stressed
10	Stopped
11	Supporting Entity in Error
12	Degraded or Predicted Failure
13	Predictive Failure
14	Lost Communication
15	No Contact
16	Aborted
17	Error
18	Non-Recoverable Error

			 By default, this measure reports the **Measure Values** discussed above to indicate the operational state of a LUN. In the graph of this measure however, operational states are represented using the numeric equivalents only.

<table>
<tr>
<td></td>
<td>Detailed operational state:
Describes the current operational state of this LUN.</td>
<td></td>
<td>Typically, the detailed state will describe why the LUN is in a particular operational state. For instance, if the Operational status measure reports the value Stopping for a LUN, then this measure will explain why that LUN is being stopped.

The values that this measure can report and their corresponding numeric values are discussed in the table below:
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>0</td><td>Online</td></tr>
<tr><td>1</td><td>Success</td></tr>
<tr><td>2</td><td>Power Saving Mode</td></tr>
<tr><td>3</td><td>Write Protected</td></tr>
<tr><td>4</td><td>Write Disabled</td></tr>
<tr><td>5</td><td>Not Ready</td></tr>
<tr><td>6</td><td>Removed</td></tr>
<tr><td>7</td><td>Rebooting</td></tr>
<tr><td>8</td><td>Offline</td></tr>
<tr><td>9</td><td>Failure</td></tr>
</table>


By default, this measure reports the Measure Values discussed above to indicate the detailed operational state of a LUN. In the graph of this measure however, detailed operational states are represented using the numeric equivalents only.</td>
</tr>
<tr>
<td></td>
<td>Data transmitted:
Indicates the rate at which data was transmitted by this LUN.</td>
<td>MB/Sec</td>
<td></td>
</tr>
</table>

	IOPS: Indicates the rate at which I/O operations were performed on this LUN.	IOPS	Compare the value of this measure across LUNs to know which LUN handled the maximum number of I/O requests and which handled the least. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across LUNs. You may then want to take a look at the *Reads* and *Writes* measures to understand what to fine-tune – the load-balancing algorithm for read requests or that of the write requests.
	Reads: Indicates the rate at which read operations were performed on this LUN.	Reads/Sec	Compare the value of this measure across LUNs to know which LUN handled the maximum number of read requests and which handled the least.
	Writes: Indicates the rate at which write operations were performed on this LUN.	Writes/Sec	Compare the value of this measure across LUNs to know which LUN handled the maximum number of write requests and which handled the least.
	Data reads: Indicates the rate at which data is read from this LUN.	MB/Sec	Compare the value of these measures across LUNs to identify the slowest LUN in terms of servicing read and write requests (respectively).
	Data writes: Indicates the rate at which data is written to this LUN.	MB/Sec	
	LUNs busy: Indicates the percentage of time this LUN was busy processing requests.	Percent	Compare the value of this measure across LUNs to know which LUN was the busiest and which LUN was not. If the gap between the two is very high, then it indicates serious irregularities in load-balancing across LUNs.
	Average read size: Indicates the amount of data read from this LUN per I/O operation.	MB/Op	Compare the value of these measures across LUNs to identify the slowest LUN in terms of servicing read and write requests (respectively).
	Average write size: Indicates the amount of data written to this LUN per I/O operation.	MB/Op	

	Read hits: Indicates the percentage of read requests that were serviced by the cache of this LUN.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct LUN accesses, which are expensive operations, are high.
	Write hits: Indicates the percentage of write requests that were serviced by the cache of this LUN.	Percent	A high value is desired for this measure. A very low value is a cause for concern, as it indicates that cache usage is very poor; this in turn implies that direct LUN accesses, which are expensive operations, are high.
	Average response time: Indicates the time taken by this LUN to respond to I/O requests.	Microsecs	Ideally, this value should be low. If not, it implies that the LUN is slow.
	Queue depth: Indicates the number of requests that are in queue for this LUN.	Number	A consistent increase in this value indicates a potential processing bottleneck with the LUN.

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 the **HP 3PAR Storage system**. 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.