Monitoring HP 3PAR Storage System

eG Innovations Product Documentation

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Total Performance Visibility

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Chapter 1: Introduction

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! This is where eG Enterprise helps storage administrators.

Chapter 2: How to Monitor the HP 3PAR Storage System Using eG Enterprise?

eG Enterprise monitors the HP 3PAR Storage system using a single external eG agent on any remote host in the environment. 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 in the below section.

2.1 Pre-requisites for monitoring the HP 3PAR Storage System

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.

   Note:

   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. To know the procedure refer to Section **Chapter 3**.

2.2 Managing the HP 3PAR Storage System

The eG Enterprise cannot automatically discover the HP 3PAR Storage system. This implies that you need to manually add the component for monitoring. Remember that the eG Enterprise automatically manages the components that are added manually. To add a HP 3PAR Storage system, do the following:

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

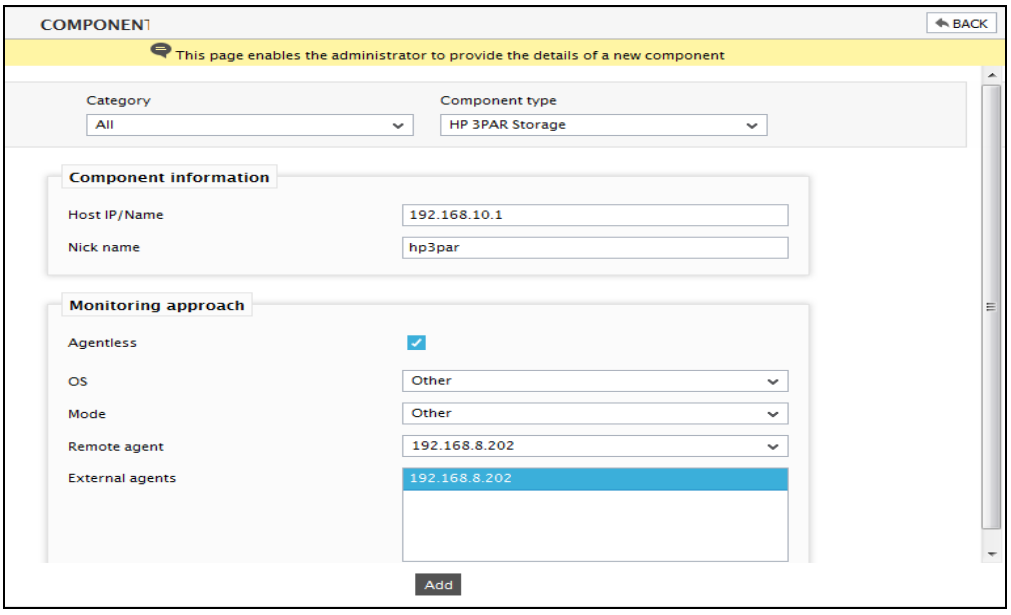

Figure 2.1: Adding a HP 3PAR Storage system server

4. Specify the **Host IP** and the **Nick name** of the HP 3PAR Storage system. By default, the HP 3PAR Storage system is monitored in an agentless manner. Therefore, make sure that the

"Agentless" flag is selected. Also select **Other** as the **OS** and **Other** as the **Mode**. Then, choose a remote agent from the **Remote agent** drop down.

5. Then, click the **Add** button to register the changes.
6. When you attempt to sign out, a list of unconfigured tests appears as shown in Figure 2.2

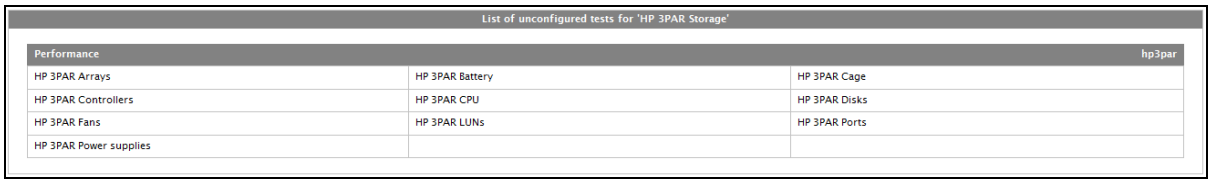

Figure 2.2: List of Unconfigured tests to be configured for the HP 3PAR Storage system

7. Click on the test names to configure. To know how to configure the tests, refer to **Monitoring HP 3PAR Storage System**.
8. Once all tests are configured, signout of the eG administrative interface.

Chapter 3: Monitoring HP 3PAR Storage System

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.

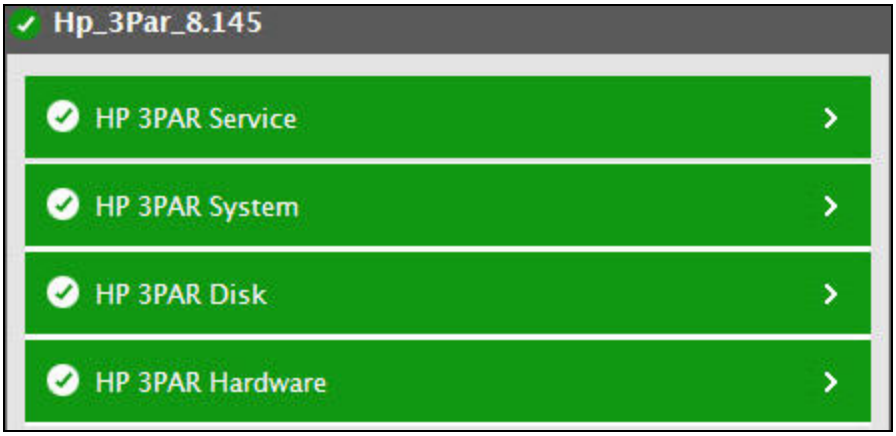

Figure 3.1: The layer model of the HP 3PAR Storage system

Every layer of the layer model 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 **2.1** discusses in detail on how to configure the eG agent to connect to the SMI-S Provider of the storage system.

3.1 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.

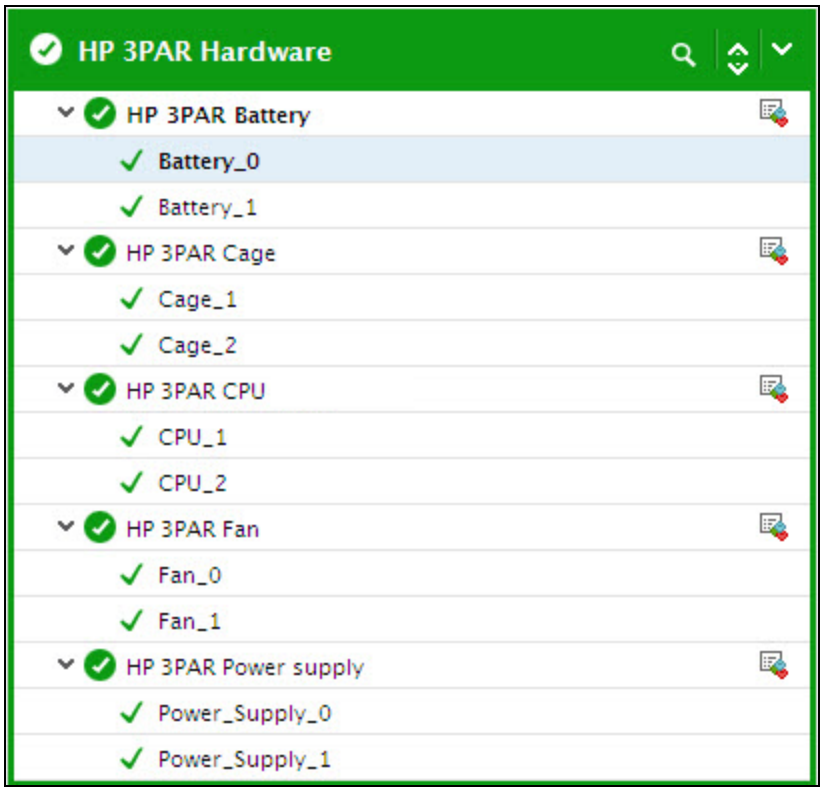

Figure 3.2: The tests mapped to the HP 3PAR Hardware layer

3.1.1 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each battery on the storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Health state	Indicates how healthy the battery currently is.		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: Unknown

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></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>
Note:
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>
<tr><td>Operational status</td><td>Indicates the current operational state of this battery.</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>Dormant</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</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td></td><td>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 battery. In the graph of this measure however, operational states are represented using the numeric equivalents only.
</td></tr>
<tr><td>Detailed operational state</td><td>Describes the current operational state of this battery.</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 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:</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>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>
Note:
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.
</td></tr>
<tr><td>Battery state</td><td>Indicates the current battery state.</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>1</td><td>Other</td></tr>
<tr><td>2</td><td>Unknown</td></tr>
<tr><td>3</td><td>Fully Charged</td></tr>
<tr><td>4</td><td>Partially Charged</td></tr>
<tr><td>5</td><td>Charging</td></tr>
<tr><td>6</td><td>Charging and</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td></td><td>High</td></tr>
<tr><td>7</td><td>Charging and Low</td></tr>
<tr><td>8</td><td>Charging and Critical</td></tr>
<tr><td>9</td><td>Overcharged</td></tr>
<tr><td>10</td><td>Low</td></tr>
<tr><td>11</td><td>Critical</td></tr>
<tr><td>12</td><td>Undefined</td></tr>
<tr><td>13</td><td>Learning</td></tr>
</table>
Note:
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.
</td></tr>
</table>

3.1.2 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each cage on the storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Health state</td><td>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>
Note:
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>
<tr><td>Operational status</td><td>Indicates the current operational state 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>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></table></td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>5</td><td>Dormant</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 each cage. In the graph of this measure however, operational states are represented using the numeric equivalents only.
</td></tr>
<tr><td>Detailed operational state</td><td>Describes the current operational state of this cage.</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 cage is in a particular operational state. For instance, if the Operational status measure reports the value</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>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:

<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>

Note:

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.</td></tr>
<tr><td>Cage type</td><td>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:</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			<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> **Note:** By default, this measure reports the **Measure Value**s 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.
Enclosure ID	Indicates the enclosure ID of this cage.	Number	

3.1.3 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each CPU on the storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.

Parameter	Description
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Operational status	Indicates the current operational state of this CPU.		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

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></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>
<tr><td>Detailed operational status</td><td>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</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>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>

Note:

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>

3.1.4 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each fan on the storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Health state	Indicates how healthy this fan currently is.		The values that this measure can report and their corresponding numeric values are discussed in the table below:

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>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>
Note:
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>
<tr><td>Operational status</td><td>Indicates the current operational state of this fan.</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>
</table>
</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></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 fan. In the graph of this measure however, operational states are represented using the numeric equivalents only.
</td></tr>
<tr><td>Detailed operational state</td><td>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:</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>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>
Note:
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>

3.1.5 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each power supply unit on the storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Health state	Indicates how healthy this power supply unit currently is.		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: Unknown

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></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>
Note:
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>
<tr><td>Operational status</td><td>Indicates the current operational state of this power supply unit.</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>
</table>
</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></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 power supply unit. In the graph of this measure however, operational states are represented using the numeric equivalents only.
</td></tr>
<tr><td>Detailed operational state</td><td>Describes the current operational state of this power supply unit.</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 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:</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			<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> **Note:** By default, this measure reports the **Measure Value**s 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.

3.2 The HP 3PAR Disk Layer

The **HP 3PAR 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.

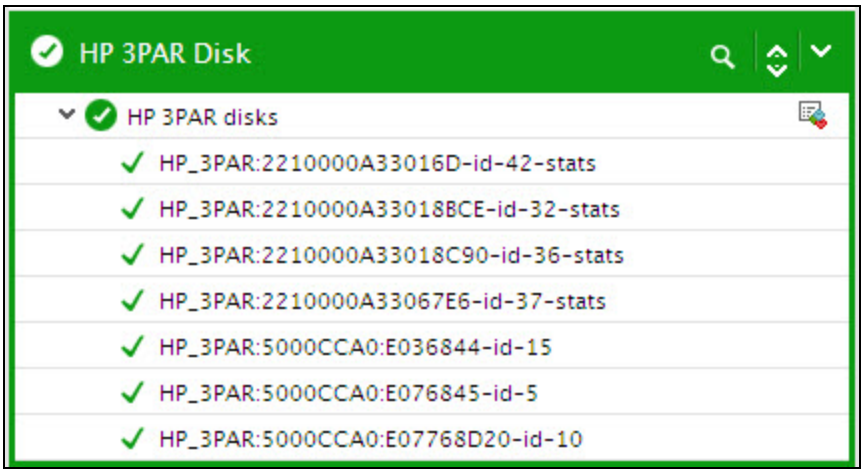

Figure 3.3: The tests mapped to the HP 3PAR Disk layer

3.2.1 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each disk being monitored.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.

Parameter	Description
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.
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.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Operational status	Indicates the current operating status of this disk.		The values that this measure can report and the states they indicate are tabulated below: Measure Value: OK — Numeric Value: 0

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>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 Fail-ure</td><td>12</td></tr>
<tr><td>Predictive Fail-ure</td><td>13</td></tr>
<tr><td>Lost Com-munication</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-Recov-erable 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>
<tr><td>Detailed operational</td><td>Describes the current</td><td></td><td>This measure will be reported only if the</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>status</td><td>operational state of this disk.</td><td></td><td>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:

<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Online</td><td>0</td></tr><tr><td>Success</td><td>1</td></tr><tr><td>Power Saving Mode</td><td>2</td></tr><tr><td>Write Protected</td><td>3</td></tr><tr><td>Write Disabled</td><td>4</td></tr><tr><td>Not Ready</td><td>5</td></tr><tr><td>Removed</td><td>6</td></tr><tr><td>Rebooting</td><td>7</td></tr><tr><td>Offline</td><td>8</td></tr><tr><td>Failure</td><td>9</td></tr></table>
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.</td></tr>
<tr><td>Health state</td><td>Indicates the current health of this disk.</td><td></td><td>The values that this measure can report and their corresponding numeric values</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>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>Data transmitted</td><td>Indicates the rate at which data was transmitted by this disk.</td><td>MB/Sec</td><td></td></tr>
<tr><td>IOPS</td><td>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>Reads</td><td>Indicates the rate at</td><td>Reads/Sec</td><td>Compare the value of this measure</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
	which read operations were performed on this disk.		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.
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.

Measurement	Description	Measurement Unit	Interpretation
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.

3.3 The HP 3PAR System Layer

The **HP 3PAR System** layer tracks the status and the health of each array available in the Storage system and reports the state of on each controller as well as the data transmitting capability of each port.

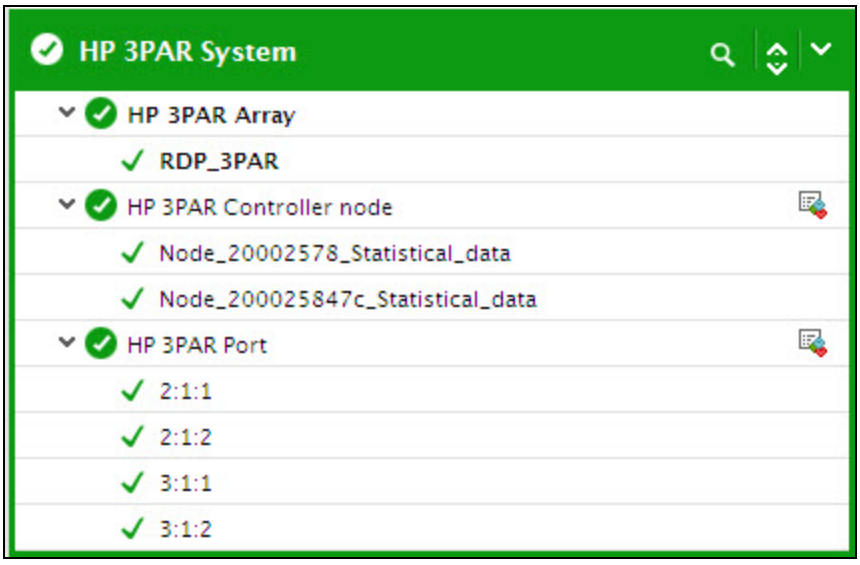

Figure 3.4: The tests mapped to the HP 3PAR System layer

3.3.1 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each storage array on the storage system being monitored.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Operational status</td><td>Indicates the current operational state of this storage array.</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>Dormant</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</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>indicate the operational state of a storage array. In the graph of this measure however, operational states are represented using the numeric equivalents only.</td></tr>
<tr><td>Detailed operational status</td><td>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>

Note:

By default, this measure reports the</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			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.
Data transmitted	Indicates the rate at which data was transmitted by this storage array.	MB/Sec	
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

Measurement	Description	Measurement Unit	Interpretation
			(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	

3.3.2 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each controller on the HP 3PAR Storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Operational status</td><td>Indicates the current operational state of this controller.</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>Dormant</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</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>indicate the operational state of a controller. In the graph of this measure however, operational states are represented using the numeric equivalents only.</td></tr>
<tr><td>Detailed operational status</td><td>Describes the current operational state of this controller.</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 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:

<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>

Note:

By default, this measure reports the Measure Values discussed above to</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			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	MB/Sec	

Measurement	Description	Measurement Unit	Interpretation
	this controller.		
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.

3.3.3 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each storage port on the HP 3PAR Storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Health state	Indicates how healthy this port currently is.		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: Unknown

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></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>
Note:
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>
<tr><td>Operational status</td><td>Indicates the current operational state of this port.</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>Dormant</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</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td></td><td>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 port. In the graph of this measure however, operational states are represented using the numeric equivalents only.</td></tr>
<tr><td>Detailed operational status</td><td>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:</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>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>
Note:
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>Data transmitted</td><td>Indicates the rate at which data was transmitted by this port.</td><td>MB/Sec</td><td></td></tr>
<tr><td>IOPS</td><td>Indicates the rate at which I/O operations were performed on this port.</td><td>IOPS</td><td>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.</td></tr>
</table>

3.4 The HP 3PAR Service Layer

The **HP 3PAR Service** layer tracks the status and the health of each FC port and reports the level of traffic flowing through each port.

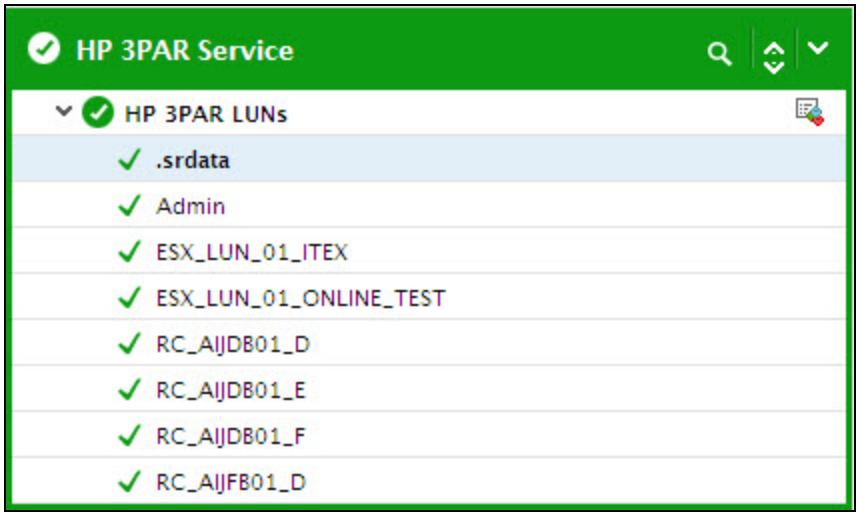

Figure 3.5: The tests mapped to the HP 3PAR Service layer

3.4.1 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.

Target of the test : A HP 3PAR Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each LUN on the HP 3PAR Storage system being monitored.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the Storage system.
Port	The port number at which the Storage system listens. The default is *NULL*.
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.
Confirm Password	Confirm the password by retyping it here.
SSL	Set this flag to **True**, if the storage system being monitored is SSL-enabled. By default this flag is set to **False**.
IsEmbedded	By default, the target HP 3PAR Storage system is embedded within the storage platform. Therefore, this flag is set to **True**, by default.
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 on 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 port 5988. If the service port on the SMI-S Provider listens only to HTTPS requests, then specify the port as 5989.
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.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Health state</td><td>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>
Note:
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>
<tr><td>Operational status</td><td>Indicates the current operational state of this LUN.</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></table></td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Numeric Value</th><th>Measure Value</th></tr>
<tr><td>3</td><td>Completed</td></tr>
<tr><td>4</td><td>Starting</td></tr>
<tr><td>5</td><td>Dormant</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 LUN. In the graph of this measure however, operational states are represented using the numeric equivalents only.
</td></tr>
<tr><td>Detailed operational state</td><td>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</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>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>
Note:

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>Data transmitted</td><td>Indicates the rate at which data was transmitted by this LUN.</td><td>MB/Sec</td><td></td></tr>
<tr><td>IOPS</td><td>Indicates the rate at which I/O operations were performed on this LUN.</td><td>IOPS</td><td>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,</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
			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	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

Measurement	Description	Measurement Unit	Interpretation
	cache of this LUN.		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.

About eG Innovations

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

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

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