Monitoring HP P2000 SAN Storage system

eG Enterprise v6

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Monitoring HP P2000 SAN Storage system

The HP P2000 SAN storage system is a high-performance storage solution that provides direct attached, external shared storage services. It allows storage capacity to be expanded as needed, up to 57.6 TB SAS, 288 TB SAS Midline (MDL) or 192 TB SATA MDL, using the maximum additional drive enclosures with Large Form Factor (LFF) drives. The array can be configured with a single controller or with dual controllers for higher availability and performance.

Owing to its flexible, yet fail-proof architecture, HP P2000 storage systems are very popular in medium and large-sized enterprises, where uninterrupted access to data is key. Anything that renders the data inaccessible or delays access to data, such as a sensor failure or a disk failure or an I/O overload, can be disastrous to these mission-critical IT environments. This is why, it is imperative that the HP P2000 storage system is continuously monitored for performance flaws – both small or big!

eG Enterprise offers a specialized *HP P2000 SAN* monitoring model that monitors the storage system inside-out and sheds light on current or probable performance dips that the storage system suffers.
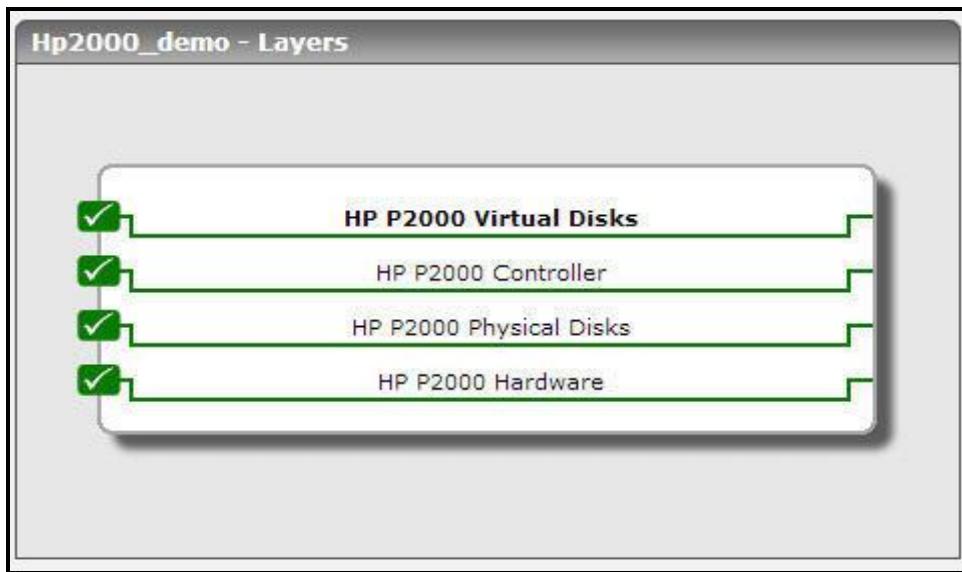
Figure 1.1: The layer model of the HP P2000 SAN storage system

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 connect to the management controller of the storage system

(via HTTP/HTTPS), where the XML API resides. The eG agent then runs XML API commands to collect the desired metrics. To be able to use the XML API, the pre-requisites detailed in Section 1.1 will have to be fulfilled.

1.1 Pre-requisites for monitoring the HP P2000 SAN storage system

1. In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user with the *monitor* role to the target storage system. To create such a user, do the following:

2. Login to the console of the target HP P2000 SAN storage system.

3. In the command prompt that appears, specify the command for creating the user. The syntax of the command is as follows:

```
create user
[authentication-type MD5]
[base 10]
[interfaces wbi]
[level monitor]
[type standard]
[units auto]
<username>
```

For example, to create a user named "admin", the command would be:

```
create user authentication-type MD5 base 10 interfaces wbi level monitor type
standard units auto admin
```

4. After providing the user creation command, you will be required to provide a password for the specified user "admin".

```
Enter new password: ************
Re-enter new password: ************
```

Once the user is created, the HP P2000 SAN Storage system is ready for monitoring by the eG Enterprise suite.

The metrics so collected would enable administrators to find accurate answers for the following performance queries:

> ➢ What is the operational state of the vdisk? How healthy is the vdisk at present?

> ➢ Is any vdisk slow in processing I/O requests?

> ➢ What is the level of I/O traffic on each volume?

> ➢ Is any volume not using its cache optimally?

> ➢ How healthy is each volume?

> ➢ Is any controller hogging CPU?

> ➢ How well are the controllers using their read/write caches? Is any controller cache under-utilized?

> ➢ What is the current status and health of the expander port of each controller?

> ➢ How healthy is the controller network?

> ➢ What is the current operational state and health of each host port?

> ➢ What is the current status and health of each controller?

> ➢ What is the level of traffic on each host port?

> ➢ What is the current status of each disk?

> ➢ What is the status of the LEDs available in each disk?

> ➢ How healthy is the disk?

> ➢ What is the current status of the expander and its SES elements?

> ➢ How many trap messages were sent from the HP P2000 SAN storage system?

The **Operating System**, **Network**, **TCP**, **Application Processes and Windows Service** layers of a *HP P2000 SAN* storage system model are similar to that of a *Windows Generic* server model. Since these tests have been dealt with in the *Monitoring Unix and Windows Servers* document, the below mentioned sections focus only on the layers pertaining to the HP P2000 SAN storsge system alone.

1.2 The HP P2000 Virtual Disks Layer

The **HP P2000 Virtual Disks** layer tracks the status and the health of each vdisk and the volumes of the vdisks available in the HP P2000 SAN storage system and reports the level of traffic on each vdisk as well as the volumes.

Figure 1.2: The tests mapped to the HP P2000 Virtual Disks layer

1.2.1   HP P2000 VDisk Status Test

A Vdisk is a group of disk drives configured with a RAID level. The HP P2000 G3 system can have a maximum of 16 Vdisks per controller in a dual controller system for a total of 32 virtual disks. In a single controller system, the maximum is 32 virtual disks.

If a user to the storage system is unable to access data in the storage system, it could be because a faulty, degraded, critical, or simply, an offline Vdisk is holding the disk drive that contains the data being accessed. To be able to proactively detect such abnormalities and promptly initiate corrective action, administrators need to periodically check the health of each Vdisk in the HP P2000 storage system. This is where the **HP P2000 VDisk Status** test helps. This test reports the current operational status and the overall health of each Vdisk in the target storage system, so that administrators are instantly intimated of the abnormal state of a Vdisk and are enabled to rapidly initiate remedial action, so that critical data always remains accessible to users.

Purpose	Reports the current operational status and the overall health of each Vdisk in the target storage system, so that administrators are instantly intimated of the abnormal state of a Vdisk and are enabled to rapidly initiate remedial action, so that critical data always remains accessible to users
Target of the test	A HP P2000 SAN 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 host for which the test is to be configured.
	3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.*
	4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1.
	5. **CONFIRM PASSWORD** – Confirm the password by retyping it here.
	6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*.
	7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.
	8. **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:
	o The eG manager license should allow the detailed diagnosis capability
	o Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
Outputs of the test	One set of results for each Vdisk being monitored
Measurements made by the	**Measurement** **Measurement Unit** **Interpretation**

Measurements made by the	Measurement	Measurement Unit	Interpretation

test	**Status:** Indicates the current status of this Vdisk.		The values that this measure can report and their corresponding numeric values are tabulated below:
			<table><tr><td>**Measure Value**</td><td>**Numeric Value**</td></tr><tr><td>Offline</td><td>0</td></tr><tr><td>Critical</td><td>1</td></tr><tr><td>Fault tolerant with down disks</td><td>2</td></tr><tr><td>Quarantined critical</td><td>3</td></tr><tr><td>Quarantined offline</td><td>4</td></tr><tr><td>Quarantined with down disks</td><td>5</td></tr><tr><td>The vdisk is stopped</td><td>6</td></tr><tr><td>Unknown</td><td>7</td></tr><tr><td>Fault tolerant and online</td><td>8</td></tr><tr><td>The vdisk is online</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 Vdisk status will be represented using the corresponding numeric equivalents only.

	Health: Indicates the overall health of this vdisk.		The values that this measure can report and the states they indicate are tabulated below: | State	Numeric Value | |---|---| | Fault | 0 | | Degraded | 1 | | OK | 2 | | Unknown | 3 | **Note:** By default, this measure reports the above-mentioned **State**s while indicating the health of this vdisk. However, the graph of this measure will be represented using the corresponding numeric equivalents of the **State**s as mentioned in the table above. The detailed diagnosis of this measure if enabled, lists the name of the vdisk and the primary reason why the health state of that vdisk is what it is.

1.2.2   HP P2000 VDisks Test

A vdisk with a processing bottleneck will not be able to process user requests for data quickly, thereby causing prolonged delays in data access for users. Similarly, a vdisk that is overloaded will not be able to perform at peak capacity, thus affecting the user experience with the storage system. Administrators hence have to continuously track the load on and the processing speed of each of the vdisks, so that potential overload conditions and probable processing delays can be detected proactively and pre-emptively treated. The **HP P2000 VDisks** test helps administrators with this. This test monitors the level of traffic on each vdisk on a HP P2000 SAN storage system, and helps isolate irregularities in load balancing across the vdisks. Alongside, the test also helps identify which vdisk is experiencing processing bottlenecks (if any), so that the bottleneck is cleared before users complain of slowdowns.

Purpose	Monitors the level of traffic on each vdisk on a HP P2000 SAN storage system, and helps isolate irregularities in load balancing across the vdisks. Alongside, the test also helps identify which vdisk is experiencing processing bottlenecks (if any), so that the bottleneck is cleared before users complain of slowdowns.
Target of the test	A HP P2000 SAN 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 host for which the test is to be configured. 3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 5. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.
Outputs of the test	One set of results for each vdisk being monitored

Measurements made by the test	Measurement	Measurement Unit	Interpretation
	Data transmitted: Indicates the rate at which data is transmitted through this vdisk during the last measurement period.	MB/Sec	This is a good indicator of the load on the vdisk. You can compare the value of this measure across vDisks to figure out whether the load has been distributed uniformly across all vdisks or a few vdisks are overloaded. In case of the latter, you may have to fine-tune the load-balancing algorithm used.
	IOPS: Indicates the rate at which the I/O operations were performed by this vdisk during the last measurement period.	IOPS	This measure serves as a good indicator of the I/O processing ability of the vDisk. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.
	Reads: Indicates the rate at which the read operations were performed on this vdisk during the last measurement period.	Reads/Sec	Ideally, the value of these measures should be high. A steady dip in these values could indicate a potential processing bottleneck that will have to be cleared immediately to ensure the normal transaction of business.

	Writes: Indicates the rate at which the write operations were performed on this vdisk during the last measurement period.	Writes/Sec	
	Data reads: Indicates the rate at which the data was read from this vdisk during the last measurement period.	MB/Sec	Comparing the value of these measures across the vdisks will clearly indicate which vdisk is the slowest in terms of reading and writing. This way, you can quickly identify the vdisk that is experiencing a processing bottleneck.
	Data writes: Indicates the rate at which the data was written from this vdisk during the last measurement period.	MB/Sec	

1.2.3 HP P2000 Volumes Test

A volume is a logical subdivision of a vdisk, and can be mapped to controller host ports for access by hosts. A mapped volume provides the storage for a file system partition you create with your operating system or third-party tools. The storage system presents only volumes, not vdisks, to hosts. This is why, if a single volume in the HP P2000 storage system is unable to process I/O requests from hosts quickly, it can rupture the user experience with the entire storage system. Therefore, to improve fault tolerance and I/O performance of a volume, you can set cache options for individual volumes. A well-tuned cache can go a long way in reducing direct volume accesses and related I/O processing overheads. In the absence of such a cache, processing slowdowns become inevitable! In times of heavy load, weak load-balancing algorithms can aggravate the slowdown, thereby adversely impacting the user experience with the storage system. To avoid this, administrators need to continuously monitor the I/O load, the processing ability, and the cache usage of every volume in the storage system, proactively detect an I/O processing latency, rapidly determine the exact cause of the poor I/O performance – is it an improperly configured cache? Or an ineffective load-balancing engine? Or both? - and promptly initiate measures to rectify the root-cause, so that normalcy of operations can be restored. This is where the **HP P2000 Volumes** test helps. This test auto-discovers the volumes in the storage system and reports how well each volume handles the I/O requests it receives. In addition, the test also focuses on the cache usage of every volume from time to time, and reveals whether/not any cache has been grossly under-utilized. This way, the test turns the spotlight on volumes that are experiencing a slowdown and also reveals what is causing the slowdown – load-balancing irregularities across volumes or badly configured caches?

Purpose	Auto-discovers the volumes in the storage system and reports how well each volume handles the I/O requests it receives. In addition, the test also focuses on the cache usage of every volume from time to time, and reveals whether/not any cache has been grossly under-utilized. This way, the test turns the spotlight on volumes that are experiencing a slowdown and also reveals what is causing the slowdown – load-balancing irregularities across volumes or badly configured caches?
Target of the test	A HP P2000 SAN storage system
Agent deploying the	A remote agent

test	
Configurable parameters for the test	5. **TEST PERIOD** - How often should the test be executed 6. **HOST -** The host for which the test is to be configured. 7. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 8. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 9. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 10. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 11. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.
Outputs of the test	One set of results for each volume being monitored

Measurements made by the test	Measurement	Measurement Unit	Interpretation
	Data transmitted: Indicates the rate at which data is transmitted through this volume of this vdisk during the last measurement period.	MB/Sec	This is a good indicator of the load on the volume. You can compare the value of this measure across volumes to figure out whether the load has been distributed uniformly across all volumes or a few volumes are overloaded. In case of the latter, you may have to fine-tune the load-balancing algorithm used.
	IOPS: Indicates the rate at which the I/O operations were performed by this volume during the last measurement period.	IOPS	This measure serves as a good indicator of the I/O processing ability of the volume. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.
	Reads: Indicates the rate at which the read operations were performed on this volume during the last measurement period.	Reads/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential reading bottleneck. Under such circumstances, you may want to check the value of the *Read cache hits* and *Read cache misses* measure to figure out whether under-utilization of the cache is the cause for the reading delay.

| Read cache hits: Indicates the rate at which the blocks were read from the cache instead of this volume. | Hits/Sec | Ideally, the value of the *Read cache hits* measure should be high, and the value of the *Read cache misses* measure should be low. A consistent drop in cache hits and a steady increase in cache misses during the same time frame is indicative of ineffective read cache usage, which can lead to a slowness in read request servicing. To improve read cache usage, you may want to consider turning on read-ahead caching. You can optimize a volume for sequential reads or streaming data by changing its read-ahead cache settings. Read ahead is triggered by two back-to-back accesses to consecutive LBA ranges, whether forward (increasing LBAs) or reverse (decreasing LBAs).

You can change the amount of data read in advance after two back-to-back reads are made. Increasing the read-ahead cache size can greatly improve performance for multiple sequential read streams; however, increasing read-ahead size will likely decrease random read performance.

• The **Default** option works well for most applications: it sets one chunk for the first access in a sequential read and one stripe for all subsequent accesses. The size of the chunk is based on the chunk size used when you created the vdisk (the default is 64 KB). Non-RAID and RAID-1 vdisks are considered to have a stripe size of 64 KB.

• **Specific size** options let you select an amount of data for all accesses.

• The **Maximum** option lets the controller dynamically calculate the maximum read-ahead cache size for the volume. For example, if a single volume exists, this setting enables the controller to use nearly half the memory for read-ahead cache. Only use **Maximum** when disk latencies must be absorbed by cache. For example, for read-intensive applications, you will want data that is most often read to be in cache so that the response to the read request is very fast; otherwise, the controller has to locate which disks the data is on, move it up to cache, and then send it to the host. |

			• Do not use **Maximum** if more than two volumes are owned by the controller on which the read-ahead setting is being made. If there are more than two volumes, there is contention on the cache as to which volume's read data should be held
	Read cache misses: Indicates the rate at which the read requests to this volume were not serviced by the read cache.	Misses/Sec	and which has the priority; each volume constantly overwrites the other volume's data in cache, which could result in taking a lot of the controller's processing power. • The **Disabled** option turns off read-ahead cache. This is useful if the host is triggering read ahead for what are random accesses. This can happen if the host breaks up the random I/O into two smaller reads, triggering read-ahead.
	Writes: Indicates the rate at which the write operations were performed on this volume during the last measurement period.	Writes/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential writing bottleneck. Under such circumstances, you may want to check the value of the *Write cache hits* and *Write cache misses* measures to figure out whether under-utilization of the cache is the cause for the writing delay.
	Write cache hits: Indicates the rate at which the write requests to this volume were fulfilled by the write cache.	Hits/Sec	Ideally, the value of the Write cache hits measure should be high, and the value of the Write cache misses measure should be low. A consistent drop in cache hits and a steady increase in cache misses during the same time frame is indicative of ineffective read
	Write cache misses: Indicates the rate at which the write requests to this volume were not serviced by the write cache.	Misses/Sec	cache usage, which can lead to a slowness in write request servicing. To improve write cache usage, you may want to consider changing that volume's write-back cache setting. Write-back is a cache-writing strategy in which the controller receives the data to be written to disks, stores it in the memory buffer, and immediately sends the host operating system a signal that the write operation is complete, without waiting until the data is actually written to the disk. Write-back cache mirrors all of the data from one controller module cache to the other. Write-back cache improves the performance of write operations and the throughput of the controller.

	Data reads: Indicates the rate at which the data was read from this volume during the last measurement period.	MB/Sec	Comparing the value of these measures across the volumes will clearly indicate which volume is the busiest in terms of the rate at which data is read and written - it could also shed light on irregularities in load balancing across the volumes.
	Data writes: Indicates the rate at which the data was written to this volume during the last measurement period.	MB/Sec	
	Small destages: Indicates the number of times the flush from the cache to this volume is not a full stripe.	Number	
	Full stripe write destages: Indicates the number of times the flush from the cache to this volume is a full stripe.	Number	
	Write cache: Indicates the percentage of space in the write cache of this volume that is currently used.	Percent	A value close to 100% is a cause for concern, as it indicates that the cache is running out of space and may not be able to service subsequent write requests. In such a situation, you are advised to resize the write cache in order to accommodate more entries, so that the cache continues to handle requests and reduce processing overheads.

1.2.4   HP P2000 Volume Status Test

A volume is a logical subdivision of a vdisk, and can be mapped to controller host ports for access by hosts. A mapped volume provides the storage for a file system partition you create with your operating system or third-party tools. The storage system presents only volumes, not vdisks, to hosts. A faulty or degraded volume therefore can deny hosts access to critical data stored in the storage system. If this is to be avoided, administrators will have to track changes in the state of the volumes and promptly capture the abnormal state of a volume. To achieve this, administrators can use the **HP P2000 Volume Status** test. For each volume configured in the HP P2000 storage system, this test reports the current status of the volume, and thus enables administrators to identify those volumes that are in an abnormal state.

Purpose	For each volume configured in the HP P2000 storage system, this test reports the current status of the volume, and thus enables administrators to identify those volumes that are in an abnormal state
Target of the test	A HP P2000 SAN storage system
Agent	A remote agent

deploying the test	
Configurable parameters for the test	1. **TEST PERIOD** - How often should the test be executed 2. **HOST -** The host for which the test is to be configured. 3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 5. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds. 8. **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.
Outputs of the test	One set of results for each volume of the storage system being monitored
Measurements made by the	**Measurement** **Measurement Unit** **Interpretation**

| test | **Health:**

Indicates the overall health of this volume. | | The values that this measure can report and their corresponding numeric values are tabulated below:

<table><tr><td>**Measure Value**</td><td>**Numeric Value**</td></tr><tr><td>Fault</td><td>0</td></tr><tr><td>Degraded</td><td>1</td></tr><tr><td>OK</td><td>2</td></tr><tr><td>Unknown</td><td>3</td></tr></table>
Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the overall health of a volume. However, in the graph of this measure, volume health will be represented using the corresponding numeric equivalents only.

The detailed diagnosis of this measure if enabled, lists the name of the volume and the reason why a volume is in the state that it is in. |

1.3 The HP P2000 Controller Layer

The tests associated with this layer (see Figure 3) monitor the status of the controllers, the level of traffic on each controller, the network flowing through each management port, the traffic on each host port and on each expander port etc.

Figure 1.3: The tests mapped to the HP P2000 Controller layer

1.3.1   HP P2000 Controller Test

The storage controller is essentially a server that's responsible for performing a wide range of functions for the storage system. Each controller has an I/O path to communicate to the storage network or the directly-attached servers, an I/O path that communicates to the attached storage devices or shelves of devices, and a processor that handles the movement of data as well as other data-related functions, such as RAID and volume management. In the modern data center, the performance of the storage system can be directly impacted (and in many cases determined) by the speed and capabilities of the storage controller. If the controller or its processor is unable to meet the I/O processing demands of the infrastructure they support, then slowdowns will become a norm, and user complaints will become routine. Under such circumstances, IT administrators will seriously consider switching to alternative storage solutions with more robust controllers and high processing power. To avoid this eventuality, administrators need to keep checking on overall controller performance and processor usage from time to time, so that they can spot a potential I/O overload condition or a processing delay or a CPU contention before user experience is affected, and fine-tune cache usage, processor capacity, and/or the load-balancing algorithm of the controller to ensure peak performance of the storage system at all times. The **HP P2000 Controller** test helps administrators in this regard.

This test auto-discovers the controllers of the HP P2000 SAN storage system, monitors the I/O processing ability of each controller, and reveals the following:

> ➢ Is any controller hogging its CPU? If so, which one is it?

> ➢ Which controller is slow in processing I/O requests? What type of requests are being serviced slowly by that controller – read requests or write requests?

> ➢ How is the cache usage of the slow controller? Is the cache being utilized optimally, or are too many read-write requests serviced by direct disk accesses?

The answers to these questions indicate how healthy each controller is and provide pointers to right-size the processor and controller cache (if needed).

Purpose	Auto-discovers the controllers of the HP P2000 SAN storage system, monitors the I/O processing ability of each controller, and reveals the following: ➢ Is any controller hogging its CPU? If so, which one is it? ➢ Which controller is slow in processing I/O requests? What type of requests are being serviced slowly by that controller – read requests or write requests? ➢ How is the cache usage of the slow controller? Is the cache being utilized optimally, or are too many read-write requests serviced by direct disk accesses?
Target of the test	A HP P2000 SAN 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 host for which the test is to be configured. 3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 5. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.
Outputs of the test	One set of results for every controller of the HP P2000 storage system being monitored

Measurements made by the test	Measurement	Measurement Unit	Interpretation
	CPU busy: Indicates the percentage of time the processor on this controller was busy processing requests.	Percent	A value close to 100 is a cause of concern. Comparing the value of this measure across controllers will enable you to accurately identify the controller whose CPU resources are consumed excessively. If the value of this measure remains high for that controller, it is an indication that the processor is getting choked and may require more processing power. This would also indicate an I/O overload. In this case, you may want to tweak the load-balancing algorithm of the storage system to reduce the load on a single controller and to optimize CPU usage.
	Data transmitted: Indicates the rate at which data was transmitted by this controller during the last measurement period.	MB/sec	This is a good indicator of the load on the controller. You can compare the value of this measure across controllers to figure out whether the load has been distributed uniformly across all controllers or a few controllers are overloaded. In case of the latter, you may have to fine-tune the load-balancing algorithm used.

	IOPS: Indicates the rate at which the I/O operations were performed by this controller during the last measurement period.	IOPS	This measure serves as a good indicator of the I/O processing ability of the controller. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.
	Reads: Indicates the rate at which the read operations were performed on this controller during the last measurement period.	Reads/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential reading bottleneck. Under such circumstances, you may want to check the value of the *Read cache hits* and *Read cache misses* measure to figure out whether under-utilization of the cache is the cause for the reading delay.
	Read cache hits: Indicates the rate at which the blocks were read from the cache instead of the volumes held by this controller.	Hits/Sec	Ideally, the value of the *Read cache hits* measure should be high, and the value of the *Read cache misses* measure should be low. A consistent drop in cache hits and a steady increase in cache misses during the same time frame is indicative of ineffective read

Read cache misses: Indicates the rate at which the read requests to the volume of this controller were not serviced by the read cache.	Misses/Sec	cache usage, which can lead to a slowness in read request servicing. To improve read cache usage, you may want to consider turning on read-ahead caching. You can optimize a volume for sequential reads or streaming data by changing its read-ahead cache settings. Read ahead is triggered by two back-to-back accesses to consecutive LBA ranges, whether forward (increasing LBAs) or reverse (decreasing LBAs). You can change the amount of data read in advance after two back-to-back reads are made. Increasing the read-ahead cache size can greatly improve performance for multiple sequential read streams; however, increasing read-ahead size will likely decrease random read performance. • The **Default** option works well for most applications: it sets one chunk for the first access in a sequential read and one stripe for all subsequent accesses. The size of the chunk is based on the chunk size used when you created the vdisk (the default is 64 KB). Non-RAID and RAID-1 vdisks are considered to have a stripe size of 64 KB. • **Specific size** options let you select an amount of data for all accesses. • The **Maximum** option lets the controller dynamically calculate the maximum read-ahead cache size for the volume. For example, if a single volume exists, this setting enables the controller to use nearly half the memory for read-ahead cache. Only use **Maximum** when disk latencies must be absorbed by cache. For example, for read-intensive applications, you will want data that is most often read to be in cache so that the response to the read request is very fast; otherwise, the controller has to locate which disks the data is on, move it up to cache, and then send it to the host.

	Writes: Indicates the rate at which the write operations were performed on this controller during the last measurement period.	Writes/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential writing bottleneck. Under such circumstances, you may want to check the value of the *Write cache hits* and *Write cache misses* measures to figure out whether under-utilization of the cache is the cause for the writing delay.
	Write cache hits: Indicates the rate at which the write requests to the volume of this controller were fulfilled by the write cache.	Hits/Sec	Ideally, the value of the *Write cache hits* measure should be high, and the value of the *Write cache misses* measure should be low. A consistent drop in cache hits and a steady increase in cache misses during the same time frame is indicative of ineffective read cache usage, which can lead to a slowness in write request servicing. To improve write cache usage, you may want to consider changing that volume's write-back cache setting. Write-back is a cache-writing strategy in which the controller receives the data to be written to disks, stores it in the memory buffer, and immediately sends the host operating system a signal that the write operation is complete, without waiting until the data is actually written to the disk. Write-back cache mirrors all of the data from one controller module cache to the other. Write-back cache improves the performance of write operations and the throughput of the controller.
	Write cache misses: Indicates the rate at which the write requests to the volume of this controller were not serviced by the write cache.	Misses/Sec	
	Data reads: Indicates the rate at which the data was read from this controller during the last measurement period.	MB/Sec	Comparing the value of these measures across the controllers will clearly indicate which controller is the busiest in terms of the rate at which data is read and written - it could also shed light on irregularities in load balancing across the controllers.
	Data writes: Indicates the rate at which the data was written from this controller during the last measurement period.	MB/Sec	

1.3.2 HP P2000 Controller Expander Ports Test

An Expander Port refers to the connection slot(s) used to connect the storage system or unit to multiple storage systems or units. Since the expander ports play a crucial role in expanding the storage capacity of a storage solution, error-prone ports, disconnected ports, or faulty/degraded ports, can deny remote hosts access to the additional

storage capacity that has been made available via these ports. To prevent this, administrators will have to rapidly detect port-related abnormalities and swiftly initiate measures to correct them, so that the expanded ports, and through them the attached storage systems, are always accessible. To capture these abnormalities and instantly bring them to the attention of administrators, use the **HP P2000 Controller Expander Ports** test. For every expanded port in the storage system, this test reports the current status and overall health of the port, and thus leads administrators to defective ports.

Purpose	For every expanded port in the storage system, this test reports the current status and overall health of the port, and thus leads administrators to defective ports
Target of the test	A HP P2000 SAN Storage system
Agent deploying the test	A remote agent
Configurable parameters for the test	8. **TEST PERIOD** - How often should the test be executed 9. **HOST -** The host for which the test is to be configured. 10. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 11. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 12. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 13. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 14. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds. 15. **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: o The eG manager license should allow the detailed diagnosis capability o Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
Outputs of the test	One set of results for every expander port of the HP P2000 SAN storage system being monitored
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

test	Status: Indicates the current status of this expander port.	Percent	The values that this measure can report and their corresponding numeric values are tabulated below:

State	Numeric Value
Error	0
Disconnected	1
Warning	2
Unknown	3
Up	4
Not Present	5

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the operational status of an expander port. However, in the graph of this measure, the same will be represented using the corresponding numeric equivalents only.

	Health: Indicates the overall health of this expander port.		The values that this measure can report and their corresponding numeric values are tabulated below:

Measure Value	Numeric Value
Fault	0
Degraded	1
Unknown	2
OK	3
Not applicable	4

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the overall health of this expander port. However, in the graph of this measure, the same will be represented using the corresponding numeric equivalents only.

1.3.3   HP P2000 Controller Networks Test

This test reports the current status of the network of each controller of the storage system.

Purpose	Reports the current status of the network of each controller of the storage system
Target of the test	A HP P2000 SAN 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 host for which the test is to be configured. 3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 5. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds. 8. **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: o The eG manager license should allow the detailed diagnosis capability o Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
Outputs of the test	One set of results for each controller in the storage system being monitored
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

test	Health: Indicates the overall health of the network of this controller of the HP P2000 SAN storage system.		The values that this measure can report and their corresponding numeric values are tabulated below:
			<table><tr><td>**Measure Value**</td><td>**Numeric Value**</td></tr><tr><td>Degraded</td><td>0</td></tr><tr><td>OK</td><td>1</td></tr></table>
			Note: By default, this measure reports the above-mentioned **Measure Value**s while indicating the network status. However, in the graph of this measure, the same will be represented using the corresponding numeric equivalents only. The detailed diagnosis of this measure if enabled, lists the time, the name of the management port on the controller, and the reason for the health of the network.

1.3.4 HP P2000 Controller Ports Test

A **Host Port** is a port on a controller module that interfaces with a host computer, either directly or through a network switch. If users repeatedly complain that they are unable to access the storage system from remote hosts, it would be good practice to check the availability, and the overall operational and health status of the host ports on the controller, as disconnected, error-prone, and even faulty host ports can render the storage system inaccessible to users. This is when the **HP P2000 Controller Ports** test becomes useful. This test reports the current status and health of each host port of every controller available in the HP P2000 SAN storage system, thus leading administrators to the defective ports.

Purpose	Reports the current status and health of each host port of the controllers available in the HP P2000 SAN storage system.
Target of the test	A HP P2000 SAN 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 host for which the test is to be configured.
	3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.*
	4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1.
	5. **CONFIRM PASSWORD** – Confirm the password by retyping it here.
	6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*.
	7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.
	8. **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:
	o The eG manager license should allow the detailed diagnosis capability
	o Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
Outputs of the test	One set of results for each host port of the controller being monitored
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

test	**Status:**		The values that this measure can report and their corresponding numeric values are indicated below:
	Indicates the current operational state of this host port of this controller.		

Measure Value	Numeric Value
Error	0
Disconnected	1
Warning	2
Unknown	3
Up	4
Not Present	5

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the operational state of a host port of this controller. However, in the graph of this measure the same will be represented using the corresponding numeric equivalents only.

	Health: Indicates the overall health of this host port of this controller.		The values that this measure can report and their corresponding numeric values are indicated below:

Measure Value	Numeric Value
Fault	0
Degraded	1
OK	2
Not applicable	3

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the overall health of a host port. However, in the graph of this measure, the health of a host port will be represented using the corresponding numeric equivalents only.

The detailed diagnosis of this measure if enabled, lists the time, the name of the host port and the reason for the health of the host port.

1.3.5   HP P2000 Controller Status Test

The storage controller is essentially a server that's responsible for performing a wide range of functions for the storage system. Each controller has an I/O path to communicate to the storage network or the directly-attached servers, an I/O path that communicates to the attached storage devices or shelves of devices, and a processor that handles the movement of data as well as other data-related functions, such as RAID and volume management. In the modern data center, the performance of the storage system can be directly impacted (and in many cases determined) by the overall health of the storage controller. In single-controller configurations, if the storage controller crashes, then the storage system as a whole will become inaccessible to users. This is why, it is good practice to go for dual-controller configurations. A dual-controller configuration improves application availability because in the unlikely event of a controller failure, the affected controller fails over to the surviving controller with little interruption to the flow of data. However, since fail over occurs automatically upon the failure of a controller, administrators may not even know why the primary controller failed or whether the secondary has taken over or not! This is when the HP P2000 Controllers test comes in handy! This test not only monitors the status of each controller in the HP P2000 storage system, but also promptly reports controller failures and the reason for the failure. In the process, the test also indicates whether the primary controller has failed over to the secondary or not.

Purpose	Monitors the status of each controller in the HP P2000 storage system, promptly reports controller failures and the reason for the failure, and also indicates whether the primary controller has failed over to the secondary or not
Target of the test	A HP P2000 SAN storage system
Agent deploying the	A remote agent

test	
Configurable parameters for the test	1. **TEST PERIOD** - How often should the test be executed 2. **HOST -** The host for which the test is to be configured. 3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 5. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds. 8. **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: o The eG manager license should allow the detailed diagnosis capability o Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
Outputs of the test	One set of results for each controller of the HP P2000 SAN storage system being monitored
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

test	**Status:** Indicates the current operational status of this controller.		The values that this measure can report and their corresponding numeric values are tabulated below:
			<table><tr><td>**Measure Value**</td><td>**Numeric Value**</td></tr><tr><td>Down</td><td>0</td></tr><tr><td>Unknown</td><td>1</td></tr><tr><td>Operational</td><td>2</td></tr><tr><td>Not installed</td><td>3</td></tr></table> **Note:** By default, this measure reports the above-mentioned **Measure Value**s while indicating the operational status of a controller. However, in the graph of this measure, controller status will be represented using the corresponding numeric equivalents only.
	Failed over: Indicates whether this controller has failed over to the partner controller i.e., the secondary controller (in a redundant setup).		The values that this measure can report and their corresponding numeric values are tabulated below: <table><tr><td>**Measure Value**</td><td>**Numeric Value**</td></tr><tr><td>Yes</td><td>0</td></tr><tr><td>No</td><td>1</td></tr></table> **Note:** By default, this measure reports the above-mentioned **Measure Value**s while indicating the failed over status of this controller. However, the graph of this measure will be represented using the corresponding numeric equivalents of the **Measure Value**s as mentioned in the table above. The detailed diagnosis capability of this measure if enabled, lists the time, the name of the controller and the reason for the fail over of the controller.

	Health: Indicates the overall health of this controller.		The values that this measure can report and their corresponding numeric values are tabulated below: | Measure Value	Numeric Value
Fault	0
OK	1
Unknown	2 | **Note:** By default, this measure reports the above-mentioned **Measure Value**s while indicating the overall health of this controller. However, in the graph of this measure, controller health will be represented using the corresponding numeric equivalents only. The detailed diagnosis capability of this measure if enabled, lists the time, the name of the controller and the reason for the overall health of the controller.

1.3.6   HP P2000 Host Ports Test

A **Host Port** is a port on a controller module that interfaces with a host computer, either directly or through a network switch. Since host ports facilitate host-controller interactions, any slowdown in I/O processing that a user may complain of can be attributed to an overloaded port or poor I/O performance of a port. To be able to proactively detect such problems with a port and take adequate measures to curb them, administrators need to keep an eye on the level of I/O activity on each host port, measure the I/O processing ability of the ports, and identify the 'weak links' of the storage environment – i.e., isolate those host ports that are either overloaded or are slow in processing requests. Such host ports can be identified using the **HP P2000 Host Ports** test. For every host port on a controller, this test reports the rate at which the port services read and write requests and reveals the count of requests that are pending processing by the port. This way, the test clearly points administrators to a probable overload or a processing delay with the host ports.

Purpose	Reports the rate at which the port services read and write requests and reveals the count of requests that are pending processing by the port
Target of the test	A HP P2000 SAN 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 host for which the test is to be configured.
	3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.*
	4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1.
	5. **CONFIRM PASSWORD** – Confirm the password by retyping it here.
	6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*.
	7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.
Outputs of the test	One set of results for each host port on each controller of the HP P2000 SAN storage system being monitored

Measurements made by the test	Measurement	Measurement Unit	Interpretation
	Data transmitted: Indicates the rate at which data is transmitted through this host port during the last measurement period.	MB/Sec	This is a good indicator of the load on the port. You can compare the value of this measure across host ports to figure out whether the load has been distributed uniformly across all ports or a few ports are overloaded. In case of the latter, you may have to fine-tune the load-balancing algorithm used.
	IOPS: Indicates the rate at which the I/O operations were performed through this host port during the last measurement period.	IOPS	This measure serves as a good indicator of the I/O processing ability of the host port. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.
	Reads: Indicates the rate at which the read operations were performed through this host port during the last measurement period.	Reads/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential reading bottleneck. By comparing the value of this measure across host ports, you can quickly identify that host port which is the slowest in processing read requests.

	Writes: Indicates the rate at which the write operations were performed through this host port during the last measurement period.	Writes/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential writing bottleneck. By comparing the value of this measure across host ports, you can quickly identify that host port which is the slowest in processing write requests.
	Data reads: Indicates the rate at which the data was read through this host port during the last measurement period.	MB/Sec	Comparing the value of these measures across the host ports will clearly indicate which host port is the busiest in terms of data transmission - it could also shed light on irregularities in load balancing across the host ports.
	Data writes: Indicates the rate at which the data was written through this host port during the last measurement period.	MB/Sec	
	Queue depth: Indicates the number of pending I/O operations that are currently being serviced through this host port.	Number	A consistent rise in the value of this measure indicates a processing bottleneck at the port that is causing I/O requests to queue up.

1.4 The HP P2000 Physical Disks Layer

The **HP P2000 Physical Disks** layer monitors each disk of the HP P2000 SAN storage system and reports the status, health and the LED status of each disk. Also this layer emphasizes on the level of traffic on each disk and helps you identify the disks that are frequently used and are over-working.

Figure 1.4: The tests mapped to the HP P2000 Physical Disks layer

1.4.1   HP P2000 Disk Status Test

If one/more disks in a storage system experience errors or are faulty or have failed, then users will be unable to access the data stored in the disks. Administrators should then be able to rapidly identify which disks are in an abnormal state and determine the reason for the abnormality, so that the problems can be solved quickly. For this purpose, administrators can use the **HP P2000 Disk Status** test. This test reports the current status and health of each disk of the HP P2000 SAN storage system. In addition, this test also reports the LED status of each disk.

Purpose	Reports the current status and health of each disk of the HP P2000 SAN storage system. In addition, this test also reports the LED status of each disk.
Target of the test	A HP P2000 SAN storarage 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 host for which the test is to be configured. 3. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 4. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 5. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 6. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 7. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.**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: o The eG manager license should allow the detailed diagnosis capability o Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
Outputs of the test	One set of results for each physical disk of the HP P2000 SAN storage system being monitored

Measurements made by the	Measurement	Measurement Unit	Interpretation

test	**Status:** Indicates the current state of this disk.		The values that this measure can report and the their corresponding numeric values are tabulated below:

Measure Value	Numeric Value	Description
Error	0	The disk is present but is not detected by the expander.
Warning	1	The disk is present but the system is having communication problems with the disk LED processor. For disk and midplane types where this processor also controls power to the disk, power-on failure will result in the **Error** status.
Spun Down	2	The disk is present and has been spun down by the drive spin down feature.
Up	3	The disk is present and is properly communicating with the expander.
Not Present	4	The disk slot indicates that no disk is present.
Unknown	5	Initial status when the disk is first detected or powered on.

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the status of this disk. However, in the graph of this measure disk status will be represented using the numeric equivalents only.

<table>
<tr><td rowspan="2"></td><td>

LED Status:

Indicates the current state of the LED of this disk.

</td><td></td><td>

The values that this measure can report and the their corresponding numeric values are tabulated below:

Measure Value	Numeric Value	Description
Fault	0	The disk has a fault.
Predictive Failure	1	The disk has a predictive failure.
Rebuild	2	The disk's vdisk is being reconstructed.
Online	3	The disk is operating normally.
Identify the disk	4	The locator LED is illuminated to identify the disk.

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the state of the LED of this disk. However, in the graph of this measure LED status will be represented using the corresponding numeric equivalents only.

</td></tr>
</table>

Health:		The values that this measure can report and the their corresponding numeric values are tabulated below:
Indicates the overall health of this disk.		

Measure Value	Numeric Value
Fault	0
Degraded	1
Unknown	2
OK	3
Not applicable	4

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the health of this disk. However, in the graph of this measure, disk health will be represented using the corresponding numeric equivalents only.

The detailed diagnosis of this measure if enabled, lists the name of the disk and the reason for the health of the disk.

1.4.2   HP P2000 Disks Test

Processing bottlenecks in disks can significantly delay reading from and/or writing to the disks, affecting user experience with the storage system as a whole. If this is to be prevented, administrators need to keep a close watch on the I/O activity on each disk of the storage system, detect a slowdown well before users notice it, and take pre-emptive action. The **HP P2000 Disks** test can help administrators achieve this. This test monitors the level of I/O activity on each physical disk mounted on a HP P2000 SAN storage system, helps isolate overload conditions or processing latencies in te disks.

Purpose	Monitors the level of I/O activity on each physical disk mounted on a HP P2000 SAN storage system, helps isolate overload conditions or processing latencies in te disks
Target of the test	A HP P2000 SAN storage system
Agent deploying the test	A remote agent

Configurable parameters for the test	1. **TEST PERIOD** - How often should the test be executed 12. **HOST -** The host for which the test is to be configured. 13. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 14. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 15. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 16. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 17. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds.
Outputs of the test	One set of results for each physical disk of the HP P2000 SAN storage system being monitored

Measurements made by the test	Measurement	Measurement Unit	Interpretation
	Data transmitted: Indicates the rate at which data is transmitted through this disk during the last measurement period.	MB/Sec	This is a good indicator of the load on the disk. You can compare the value of this measure across disks to figure out whether the load has been distributed uniformly across all disks or a few disks are overloaded. In case of the latter, you may have to fine-tune the load-balancing algorithm used.
	IOPS: Indicates the rate at which the I/O operations were performed through this disk during the last measurement period.	IOPS	This measure serves as a good indicator of the I/O processing ability of the disk. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.
	Reads: Indicates the rate at which the read operations were performed on this disk during the last measurement period.	Reads/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential reading bottleneck. By comparing the value of this measure across disks, you can quickly identify that disk which is the slowest in processing read requests.

	Writes: Indicates the rate at which the write operations were performed on this disk during the last measurement period.	Writes/Sec	Ideally, the value of this measure should be high. A steady dip in this measure value could indicate a potential writing bottleneck. By comparing the value of this measure across disks, you can quickly identify that disk which is the slowest in processing write requests.
	Data reads: Indicates the rate at which the data was read from this disk during the last measurement period.	MB/Sec	Comparing the value of these measures across the disks will clearly indicate which disk is the busiest in terms of data transmission - it could also shed light on irregularities in load balancing across the disks.
	Data writes: Indicates the rate at which the data was written from this disk during the last measurement period.	MB/Sec	
	Queue depth: Indicates the number of pending I/O operations that are currently being serviced on this disk.	Number	A consistent rise in the value of this measure indicates a processing bottleneck at the disk that is causing I/O requests to queue up.

1.5 The HP P2000 Hardware Layer

The **HP P2000 Hardware** layer reports the current status of the expander and the SES elements available in the expander. In addition, the status of the sensors are also monitored in this layer.

Figure 1.5: The tests mapped to the HP P2000 Hardware layer

1.5.1   HP P2000 Expander Status Test

This test reports the current status of the expander present in the HP P2000 SAN storage system and the status of

the SES elements available in the expander.

Purpose	Reports the current status of the expander present in the HP P2000 SAN storage system and the status of the SES elements available in the expander
Target of the test	A HP P2000 SAN storage system
Agent deploying the test	A remote agent
Configurable parameters for the test	1. **TEST PERIOD** - How often should the test be executed 18. **HOST -** The host for which the test is to be configured. 19. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 20. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 21. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 22. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 23. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds. 24. **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: o The eG manager license should allow the detailed diagnosis capability o Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
Outputs of the test	One set of results for every expander being monitored
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

test	**Status:** Indicates the current status of this expander.	Reads/Sec	The values that this measure can report and the their corresponding numeric values are tabulated below: | **Measure Value**	**Numeric Value**
Enabled - Degraded	0
Disabled	1
Enabled - Healthy	2
Unavailable	3 | **Note:** By default, this measure reports the above-mentioned **Measure Value**s while indicating the current status of this expander. However, in the graph of this measure, status will be represented using the corresponding numeric equivalents only.
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Elem status: Indicates the current status of the SES elements available in this expander.	MB/Sec	Most SCSI enclosure products support a protocol called **SCSI Enclosure Services** (SES). The initiator can communicate with the enclosure using a specialised set of SCSI commands to access power, cooling, and other non-data characteristics. The SCSI initiator communicates with an SES device using two SCSI commands: *Send Diagnostic* and *Receive Diagnostic Results*.

Some universal SCSI commands such as *Inquiry* are also used with standalone enclosure services to perform basic functions such as initial discovery of the devices. These commands can be addressed to a specific SES element in the enclosure. There are many different element codes defined to cover a wide range of devices. The most common SES elements are power supply, cooling fan, temperature sensor, and UPS.

The values that this measure can report and the their corresponding numeric values are tabulated below:

Measure Value	Numeric Value
Disabled	0
Error	1
Non-critical	2
Unknown	3
OK	4
Not Used	5

Note:

By default, this measure reports the above-mentioned **Measure Value**s while indicating the current status of the SES elements. However, in the graph of this measure, the same will be represented using the corresponding numeric equivalents only.

The detailed diagnosis of this measure if enabled, lists the PHY type of the SES element and the primary reason for the health of the SES element.

1.5.2   HP P2000 Sensors Test

Power, cooling fan, temperature, and voltage sensors are located at key points in each enclosure of the storage system. Failure of any of these sensors can bring the entire storage system to a halt. Administrators need to be able to promptly detect sensor failures and take correction action before any permanent damage is done. The **HP P2000 Sensors** tst can help administrators in this direction. This test monitors the status of each sensor, and promptly captures and reports real/potential sensor failures.

Purpose	Monitors the status of each sensor, and promptly captures and reports real/potential sensor failures
Target of the test	A HP P2000 SAN storage system
Agent deploying the test	A remote agent
Configurable parameters for the test	2. **TEST PERIOD** - How often should the test be executed 1. **HOST -** The host for which the test is to be configured. 2. **PORT** – The port number at which the specified **HOST** listens. By default, this is *NULL.* 3. **USER** and **PASSWORD** – In order to monitor a HP P2000 SAN storage system, the eG agent has to be configured with the credentials of a user who has been assigned the *Monitor* role. Specify the login credentials of such a user in the **USER** and **PASSWORD** text boxes. To know how to create such a user, refer to Section 1.1. 4. **CONFIRM PASSWORD** – Confirm the password by retyping it here. 5. **SERVICE PORT** - The Management Controller of the HP P2000 storage system provides access for monitoring and management via the HTTP and HTTPS protocols for XML API request/response semantics. To enable the eG agent to access the management controller, invoke the XML API commands, and collect the required metrics, you need to specify the service port on the controller that listens for HTTP/HTTPS requests for XML API semantics. By default, this is port *80*. 6. **TIMEOUT** - Specify the time duration for which this test should wait for a response from the storage system in the **TIMEOUT** text box. By default, this is 60 seconds
Outputs of the test	One set of results for each sensor being monitored
Measurements made by the	**Measurement**	**Measurement Unit**	**Interpretation**

test	**Status:** Indicates the current status of this sensor.		The values that this measure can report and the their corresponding numeric values are tabulated below: | State	Numeric Value
Unsupported	0
Not Installed	1
Unknown	2
Unrecoverable	3
Unavailable	4
Error	5
Warning	6
OK	7 | **Note:** By default, this measure reports the above-mentioned **Measure Value**s while indicating the current status of this sensor. However, in the graph of this measure, sensor status will be represented using the corresponding numeric equivalents only.

1.5.3   HP P2000 Traps Test

This test intercepts the SNMP traps sent out by the HP P2000 storage system and reports the number and details of the SNMP trap messages so sent.

Purpose	Intercepts the SNMP traps sent out by the HP P2000 storage system and reports the number and details of the SNMP trap messages so sent
Target of the test	A HP P2000 SAN 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 host for which the test is to be configured. 3. **SOURCEADDRESS** – Specify a comma-separated list of IP addresses or address patterns of the hosts from which traps are considered in this test. For example, *10.0.0.1,192.168.10.**. A leading '*' signifies any number of leading characters, while a trailing '*' signifies any number of trailing characters. 4. **OIDVALUE** Provide a comma-separated list of OID and value pairs returned by the traps. The values are to be expressed in the form, *DisplayName:OID-OIDValue*. For example, assume that the following OIDs are to be considered by this test: *.1.3.6.1.4.1.9156.1.1.2* and *.1.3.6.1.4.1.9156.1.1.3*. The values of these OIDs are as given hereunder:

<div align="center">

OID	Value
.1.3.6.1.4.1.9156.1.1.2	Host_system
.1.3.6.1.4.1.9156.1.1.3	NETWORK

</div>

In this case the **OIDVALUE** parameter can be configured as *Trap1:.1.3.6.1.4.1.9156.1.1.2-Host_system,Trap2:.1.3.6.1.4.1.9156.1.1.3-Network,* where *Trap1* and *Trap2* are the display names that appear as descriptors of this test in the monitor interface.

An * can be used in the OID/value patterns to denote any number of leading or trailing characters (as the case may be). For example, to monitor all the OIDs that return values which begin with the letter 'F', set this parameter to *Failed:*-F*.*

Typically, if a valid value is specified for an OID in the *OID-value* pair configured, then the test considers the configured OID for monitoring only when the actual value of the OID matches with its configured value. For instance, in the example above, if the value of OID *.1.3.6.1.4.1.9156.1.1.2* is found to be *HOST* and not *Host_system*, then the test ignores OID *.1.3.6.1.4.1.9156.1.1.2* while monitoring. In some cases however, an OID might not be associated with a separate value – instead, the OID itself might represent a value. While configuring such OIDs for monitoring, your **OIDVALUE** specification should be: *DisplayName:OID-any*. For instance, to ensure that the test monitors the OID *.1.3.6.1.4.1.9156.1.1.5*, which in itself, say represents a failure condition, then your specification would be:

Trap5: .1.3.6.1.4.1.9156.1.1.5-any.

5. **SHOWOID** – Specifying **true** against **SHOWOID** will ensure that the detailed diagnosis of this test shows the OID strings along with their corresponding values. If you enter **false**, then the values alone will appear in the detailed diagnosis page, and not the OIDs.

6. **TRAPOIDS** – By default, this parameter is set to *all*, indicating that the eG agent considers all the traps received from the specified **SOURCEADDRESS**es. To make sure that the agent considers only specific traps received from the **SOURCEADDRESS**, then provide a comma-separated list of OIDs in the **TRAPOIDS** text box. A series of OID patterns can also be specified here, so that the test considers only those OIDs that match the specified pattern(s). For instance, **94.2*,*.1.3.6.1.4.25**, where *** indicates leading and/or trailing spaces.

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7. **DD FREQUENCY** - Refers to the frequency with which detailed diagnosis measures are to be generated for this test. The default is *1:1*. This indicates that, by default, detailed measures will be generated every time this test runs, and also every time the test detects a problem. You can modify this frequency, if you so desire. Also, if you intend to disable the detailed diagnosis capability for this test, you can do so by specifying *none* against **DD FREQUENCY**.

8. **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 enabled/disable the detailed diagnosis capability will be available only if the following conditions are fulfilled:

o   The eG manager license should allow the detailed diagnosis capability

o   Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.
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Outputs of the test	One set of results for each of the traps configured for the storage system being monitored

Measurements made by the test	Measurement	Measurement Unit	Interpretation
	Number of events: Indicates the number of trap messages of this type that is currently being sent from this storage system.	Number	The detailed diagnosis of this measure if enabled, lists the name of the event that triggered the message.

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 P2000 SAN 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.