Monitoring IBM DS8000 Storage System

eG Innovations Product Documentation

www.eginnovations.com

Total Performance Visibility

Table of Contents

CHAPTER 1: INTRODUCTION 1

CHAPTER 2: HOW TO MONITOR IBM DS8000 STORAGE SYSTEM USING EG ENTERPRISE? 2

CHAPTER 3: MONITORING IBM DS8000 STORAGE SYSTEM 5

3.1 The IBM DS8000 Disks Layer 5

3.1.1 IBM DS8000 Disks Test 6

3.2 The IBM DS8000 LUNs Layer 10

3.2.1 IBM DS8000 LUNs Test 10

3.3 The IBM DS8000 System Layer 16

3.3.1 IBM DS8000 FC Ports Test 17

3.4 The IBM DS8000 Arrays Layer 26

3.4.1 IBM DS8000 Rank Pool Status Test 26

3.4.2 IBM DS8000 Array Pools Test 31

3.4.3 IBM DS8000 Rank Pool Performance Test 36

ABOUT EG INNOVATIONS 39

Table of Figures

Figure 3.1: Figure 1.1: The layer model of the IBM DS8000 Storage system 5
Figure 3.2: The tests mapped to the IBM DS8000 Disks layer 5
Figure 3.3: The tests mapped to the IBM DS8000 LUNs layer 10
Figure 3.4: The tests mapped to the IBM DS8000 System layer 17
Figure 3.5: The tests mapped to the IBM DS8000 Arrays layer 26

Chapter 1: Introduction

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

The IBM DS8000 is a new high-performance, high-capacity series of disk storage systems which offers a unique combination of flexibility, scalability, resiliency, performance, and security that can help address the many challenges stemming from a sprawling and heterogeneous infrastructure.

The flexible architecture of the IBM DS8000 Storage system makes it popular in large-sized enterprises, where uninterrupted access to data is key. 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 imperative that the IBM DS8000 Storage system is continuously monitored for performance flaws – both small or big! Administrators can achieve this task using eG Enterprise.

Chapter 2: How to Monitor IBM DS8000 Storage System using eG Enterprise?

As said earlier, the eG agent will poll the **SMI-S Provider** of the IBM DS8000 Storage system at set intervals and collect the required performance metrics. To know where to install this eG agent and how to configure the agent to interact with the **SMI-S Provider**, follow the guidelines discussed below:

1. Know how the SMI-S Provider has been implemented in the IBM DS8000 Storage system to be monitored.

   SMI-S Providers can be implemented either as **proxies to the storage devices** or as **embedded software within the actual storage platform**. Prior to the Release 2.4 of the IBM DS8000 storage system, the SMI-S Provider was implemented as a proxy to the storage device and starting from Release 2.4 of the storage system, the SMI-S Provider is embedded within the actual storage platform.

   Before deploying the eG agent, know how the SMI-S Provider of the target storage system has been implemented – as a proxy? or as an embedded software?. To identify this, you may need to know the exact Release of the target IBM DS8000 Storage system that needs to be monitored.

2. Choose the host for eG agent deployment based on how the SMI-S Provider has been implemented in the storage system

   If the SMI-S Provider has been implemented as a proxy i.e, if the IBM DS8000 Storage system to be monitored is prior to Release 2.4, then the eG agent should be deployed on the same host as the SMI-S Provider. On the other hand, if the provider has been embedded in the storage platform or if the target storage system is of Release 2.4 and above, the eG agent can be deployed on any remote Windows host in the environment. However, in the case of the latter, make sure that the Windows host is able to connect to the SMI-S provider and pull out metrics related to the storage system.

3. Ensure that the SMI-S Provider is enabled and started on the IBM DS 8000 Storage system.

   If the IBM DS8000 Storage system to be monitored is of Release 4 and above, the SMI-S Provider is enabled and configured automatically.

If the IBM DS8000 Storage system to be monitored is prior to Release 4.1, then you have to configure and enable the CIM agent through the Hardware Management Console (HMC). Follow the steps mentioned below to configure the CIM agent using the HMC:

a. Download the *dscimcli* utility from the DS CIM agent web site and install on a separate server.

b. Follow the steps mentioned below to enable the CIM agent:

- From the HMC Welcome page, click HMC Management. The HMC Management window is displayed.
- Click *Start/Stop CIM Agent*. The HMC CIM Agent window is displayed with the current state of the CIM agent
- Select *Start CIM Agent* and click **Apply**. The CIM agent is started and the state is updated.

c. Then, configure the CIM agent for HMC by creating user names and passwords that are used to authenticate CIM client requests. For IBM DS8000 Storage system release 4.0 and earlier, the CIM agent administrator and the storage device administrators maintain separate usernames and passwords to authenticate CIM client requests. For release 4.1 and higher, since the CIM agent is embedded with the IBM DS8000 Storage system, the CIM administrator need not create separate usernames and passwords. The Storage system usernames and passwords are used by the CIM clients to attach to the CIM agent and thus help in authenticating the CIM requests. The user so created should possess **admin** role.

d. Finally, verify whether the CIM agent is able to connect to the Storage system by using the following command in the HMC console:

```
dscimcli -s https://hmc_ip:6989 -u DS8000user
-p DS8000password lsdev -1
```

where

- hmc ip is the IP address of the HMC
- DS8000user is the user name that is used to log into the DS8000 Storage Manager
- DS8000password is the password that is used to log into the DS8000 Storage Manager.

e. If the status returned in the output is failed, then it indicates that the CIM agent is unable to communicate with the target IBM DS8000 Storage system.

4. Manage the target storage system using the eG administrative interface. The steps for

achieving this have been discussed in the .

You need to provide a **HOST** when managing the storage system using the eG admin interface. This **HOST** specification varies according to the SMI-S Provider implementation. If the **SMI-S Provider** is an embedded software, then specify the IP address of the storage system as the **HOST**. If the provider is a proxy, then enter the IP address of the host on which the SMI-S Provider software has been installed as the **HOST**.

Chapter 3: Monitoring IBM DS8000 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.

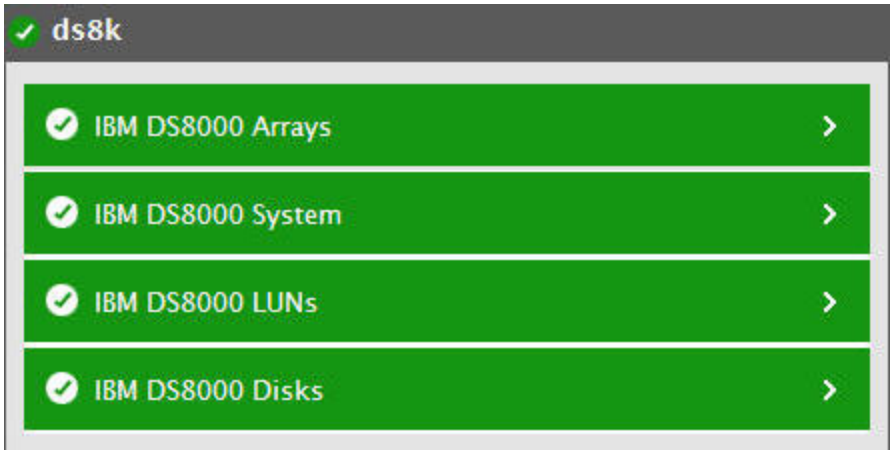

Figure 3.1: Figure 1.1: The layer model of the IBM DS8000 Storage system

Every layer of Figure 1.1 is mapped to a wide variety of tests that monitor critical performance parameters such as processing ability, load, and operational state, of the core components of the storage system's architecture. To pull out such useful performance data from the storage system, the eG agent needs to be deployed on a remote Windows host in the environment and configured to poll the SMI-S Provider of the IBM DS8000 Storage system at set intervals. The SMI-S Provider may be either implemented as a proxy or embedded in the storage platform depending on the version of the storage system that is to be monitored. Section 1.1 discusses in detail on how to configure the eG agent to connect to the SMI-S Provider of the storage system.

3.1 The IBM DS8000 Disks Layer

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

Figure 3.2: The tests mapped to the IBM DS8000 Disks layer

3.1.1 IBM DS8000 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 **IBM DS8000 Disks** test helps administrators with this. This test monitors the health and status of each disk available on the IBM DS8000 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 : An IBM DS8000 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 host for which the test is to be configured.
Port	The port number at which the specified host listens. By default, this is *NULL*.
User and Password	In order to monitor an IBM DS8000 Storage system, the eG agent has to be configured with the credentials of a read only user. Specify the login credentials of such a user in the User and Password text boxes.
Confirm Password	Confirm the password by retyping it here.
SSL	If the IBM DS8000 Stotage system to be monitored is SSL-enabled, then set this flag to **Yes**.
CIM Server Port	The SMI –S provider of the IBM DS8000 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 that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is port 6988. If the service port on the SMI-S provider listens only to HTTPS requests, then specify the port as *6989*.
IsEmbedded	If this flag is set to **True**, it indicates that the SMI-S provider is embedded on the

Parameter	Description
	storage system. On the other hand, if this flag is set to **False**, it indicates that the SMI-S provider has been implemented as a proxy.
Serial Number	If the SMI-S provider has been implemented as a proxy, then such a provider can be configured to manage multiple storage devices. This is why, if the IsEmbedded flag is set to **False**, you will have to explicitly specify which storage system you want the eG agent to monitor. Since each storage system is uniquely identified by a serialnumber, specify the same here. The format of this number and where you can find it will differ from one storage system to another. You are hence advised to contact the storage administrator to know what to enter against serialnumber. If the IsEmbedded flag is set to **True**, then you may specify this value as default.
NameSpace	Specify the namespace that uniquely identifies the profiles specific to the provider in use.

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	Numeric Value
OK	0
In Service	1
Power Mode	2
Completed	3
Starting	4
Dormant	5
Other	6
Unknown	7
Stopping	8
Stressed	9
Stopped	10

<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>Supporting Entity In Error</td><td>11</td></tr>
<tr><td>Degraded or Predicted Failure</td><td>12</td></tr>
<tr><td>Predictive Failure</td><td>13</td></tr>
<tr><td>Lost Communication</td><td>14</td></tr>
<tr><td>No Contact</td><td>15</td></tr>
<tr><td>Aborted</td><td>16</td></tr>
<tr><td>Error</td><td>17</td></tr>
<tr><td>Non-Recoverable Error</td><td>18</td></tr>
</table>
Note:
By default, this measure reports the above-mentioned States while indicating the current operating state of this disk. However, the graph of this measure will be represented using the corresponding numeric equivalents of the States as mentioned in the table above.
</td></tr>
<tr><td>Detailed operational status</td><td>Describes the current operational state of this disk.</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 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:</td></tr>
</table>

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

Measurement	Description	Measurement Unit	Interpretation
			<table><tr><th>Measure Value</th><th>Numeric Value</th></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 Value**s only. However, in the graph of this measure, the current health of this disk will be represented using the corresponding numeric equivalents only.
Capacity	Indicates the total capacity of this disk.	GB	

3.2 The IBM DS8000 LUNs Layer

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

Figure 3.3: The tests mapped to the IBM DS8000 LUNs layer

3.2.1 IBM DS8000 LUNs Test

A logical volume composed of fixed block extents is called a LUN. A fixed block LUN is composed of one or more 1 GB (230) extents from one FB extent pool. A LUN cannot span multiple extent pools, but a LUN can have extents from different ranks within the same extent pool. LUN failures, poor LUN health, and abnormal I/O activity on the LUNs, if not promptly detected and resolved, can hence significantly degrade the performance of the storage system. This is why, it is important to continuously monitor the LUN performance. This can be achieved using the **IBM DS8000 LUNs** test. This test auto-discovers the LUNs in the storage system, reports the health and operating state

of each LUN 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 : An IBM DS8000 Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each LUN in the IBM DS8000 Storage system that is being monitored.

Configurable parameters for the test

Parameter	Description
Test period	How often should the test be executed.
Host	The host for which the test is to be configured.
Port	The port number at which the specified host listens. By default, this is *NULL*.
User and Password	In order to monitor an IBM DS8000 Storage system, the eG agent has to be configured with the credentials of a read only user. Specify the login credentials of such a user in the User and Password text boxes.
Confirm Password	Confirm the password by retyping it here.
SSL	If the IBM DS8000 Stotage system to be monitored is SSL-enabled, then set this flag to **Yes**.
CIM Server Port	The SMI –S provider of the IBM DS8000 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 that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is port 6988. If the service port on the SMI-S provider listens only to HTTPS requests, then specify the port as *6989*.
IsEmbedded	If this flag is set to **True**, it indicates that the SMI-S provider is embedded on the storage system. On the other hand, if this flag is set to **False**, it indicates that the SMI-S provider has been implemented as a proxy.
Serial Number	If the SMI-S provider has been implemented as a proxy, then such a provider can be configured to manage multiple storage devices. This is why, if the IsEmbedded flag is set to **False**, you will have to explicitly specify which storage system you want the eG agent to monitor. Since each storage system is uniquely identified by a serialnumber, specify the same here. The format of this number and where you can find it will differ from one storage system to another. You are hence advised to contact the storage

Parameter	Description
	administrator to know what to enter against serialnumber. If the IsEmbedded flag is set to **True**, then you may specify this value as default.
NameSpace	Specify the namespace that uniquely identifies the profiles specific to the provider in use.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Health state	Indicates the current health of this LUN.		The values that this measure can report and their corresponding numeric values are tabulated below: **Measure Value** / **Numeric Value** OK – 0 Unknown – 1 Degraded/Warning – 2 Minor failure – 3 Major failure – 4 Critical failure – 5 Non-recoverable error – 6 **Note:** By default, this measure reports the above-mentioned **Measure Value**s only. However, in the graph of this measure, the health status of this rank. However, the graph of this measure will be represented using the corresponding numeric equivalents only.
Operational status	Indicates the current operational state of this LUN.		The values that this measure can report and the states they indicate are tabulated below:

Measurement	Description	Measurement Unit	Interpretation

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

Note:

By default, this measure reports the above-mentioned **State**s while indicating the current operating state of this rank. However, the graph of this measure will be represented using the corresponding numeric equivalents of the States as mentioned in the table above.

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

The values that this measure can report and their corresponding numeric values are discussed in the table below:

<table><tr><th>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 LUN will be represented using the corresponding numeric equivalents only.</td></tr>
<tr><td>Data transmitted</td><td>Indicates the rate at</td><td>MB/sec</td><td>This is a good indicator of the load on the</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
	which data is transmitted through this LUN during the last measurement period.		LUN. You can compare the value of this measure across LUNs to figure out whether the load has been distributed uniformly across all LUNs or a few LUNs are overloaded. In case of the latter, you may have to fine-tune the load-balancing algorithm used.
IOPS	Indicates the rate at which I/O operations were performed by this LUN during the last measurement period.	IOPS	This measure serves as a good indicator of the I/O processing ability of the LUN. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.
Reads	Indicates the rate at which read operations were performed on this LUN 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 needs to be cleared immediately to ensure the normal transaction of business.
Writes	Indicates the rate at which write operations were performed on this LUN during the last measurement period.	Writes/sec	
Data reads	Indicates the rate at which data was read from this LUN during the last measurement period.	MB/sec	Comparing the value of these measures across the LUNs will clearly indicate which LUN is the slowest in terms of reading and writing. This way, you can quickly identify the LUN that is experiencing a processing bottleneck.
Data written	Indicates the rate at which data was written from this LUN during the last measurement period.	MB/sec	
	LUNs busy: Indicates the percentage of time this LUN was busy processing requests.	Percent	A high value for this measure indicates higher I/O activity on the LUNs. Comparing the value of this measure across the LUNs will help you identify the LUN that is the most busiest.
Average read size	Indicates the amount of	MB/Op	Compare the value of these measures

Measurement	Description	Measurement Unit	Interpretation
	data read from this LUN per I/O operation during the last measurement period.		across LUNs to identify the slowest LUN in terms of servicing read and write requests (respectively).
Average write size	Indicates the average amount of data written to this LUN per I/O operation during the last measurement period.	MB/Op	
Read hit	Indicates the percentage of data that is read from the cache of this LUN in response to a request during the last measurement period.	Percent	Ideally, the value of this measure should be high. A consistent drop in the value of this measure indicates ineffective read cache usage which further leads to slowness in read request servicing.
Write hit	Indicates the percentage of data that was written directly on the cache of this LUN during the last measurement period.	Percent	Ideally the value of this measure should be high. A consistent drop in the value of this measure indicates ineffective write cache usage which eventually leads to slowness in write request servicing.
Average response time	Indicates the average time taken by this LUN to respond to a request during the last measurement period.	Microsec	A sudden/gradual increase in the value of this measure is a casue of concern.
Queue depth	Indicates the number of pending I/O operations that are currently being serviced through this LUN during the last measurement period.	Number	A consistent rise in the value of this measure indicates a processing bottleneck at the LUN that is causing I/O requests to queue up.

3.3 The IBM DS8000 System Layer

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

Figure 3.4: The tests mapped to the IBM DS8000 System layer

3.3.1 IBM DS8000 FC Ports Test

Fibre Channel is a technology standard that allows data to be transferred from one node to another at high speeds and great distances (up to 10 km and beyond). The DS8000 uses Fibre Channel protocol to transmit SCSI traffic inside Fibre Channel frames. It also uses Fibre Channel to transmit FICON traffic, which uses Fibre Channel frames to carry zSeries I/O. Each DS8000 Fibre Channel card offers four 2 Gbps Fibre Channel ports. The cable connector required to attach to this card is an LC type. Each port independently auto-negotiates to either 2 Gbps or 1 Gbps link speed. Each of the 4 ports on one DS8000 adapter can also independently be either Fibre Channel protocol (FCP) or FICON, though the ports are initially defined as switched point to point FCP. Selected ports will be configured to FICON automatically based on the definition of a FICON host. Each port can be either FICON or Fibre Channel protocol (FCP). The personality of the port is changeable via the DS Storage Manager GUI. A port cannot be both FICON and FCP simultaneously, but it can be changed as required. These ports are the primary handlers of I/O requests from the Storage system. I/O load on the ports directly translate into load on the volumes. Therefore it is important for the administrators to continuously monitor the data and commands handled by each port, so that overloaded ports can be identified and load balancing be performed accordingly. Often, port related errors may deny hosts access to the data stored in the Storage system. Therefore, administrators are required to constantly monitor the ports so that port related errors are detected quickly and resolved to ensure normal functioning of the Storage system. This can be achieved by the **IBM DS8000 FC Ports** test. For each FC port on the IBM DS8000 Storage system, this test reports the rate at which data and commands are handled and the number and nature of errors/failures encountered by each FC port. This way, administrators can be proactively alerted to potential port overloads and error conditions, and thus enabled to rapidly initiate remedial measures to avoid an impending storage system slowdown.

Target of the test : An IBM DS8000 Storage system

Agent deploying the test : A remote agent

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

Configurable parameters for the test

Parameter	Description
Test period	How often should the test be executed.
Host	The host for which the test is to be configured.
Port	The port number at which the specified host listens. By default, this is *NULL*.
User and Password	In order to monitor an IBM DS8000 Storage system, the eG agent has to be configured with the credentials of a read only user. Specify the login credentials of such a user in the User and Password text boxes.
Confirm Password	Confirm the password by retyping it here.
SSL	If the IBM DS8000 Stotage system to be monitored is SSL-enabled, then set this flag to **Yes**.
CIM Server Port	The SMI –S provider of the IBM DS8000 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 that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is port 6988. If the service port on the SMI-S provider listens only to HTTPS requests, then specify the port as *6989*.
IsEmbedded	If this flag is set to **True**, it indicates that the SMI-S provider is embedded on the storage system. On the other hand, if this flag is set to **False**, it indicates that the SMI-S provider has been implemented as a proxy.
Serial Number	If the SMI-S provider has been implemented as a proxy, then such a provider can be configured to manage multiple storage devices. This is why, if the IsEmbedded flag is set to **False**, you will have to explicitly specify which storage system you want the eG agent to monitor. Since each storage system is uniquely identified by a serialnumber, specify the same here. The format of this number and where you can find it will differ from one storage system to another. You are hence advised to contact the storage administrator to know what to enter against serialnumber. If the IsEmbedded flag is set to **True**, then you may specify this value as default.
NameSpace	Specify the namespace that uniquely identifies the profiles specific to the provider in use.

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 port.</td><td></td><td>The values that this measure can report and their corresponding numeric values are tabulated below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>OK</td><td>0</td></tr><tr><td>Unknown</td><td>1</td></tr><tr><td>Degraded/Warning</td><td>2</td></tr><tr><td>Minor failure</td><td>3</td></tr><tr><td>Major failure</td><td>4</td></tr><tr><td>Critical failure</td><td>5</td></tr><tr><td>Non-recoverable error</td><td>6</td></tr></table>
Note:
By default, this measure reports the above-mentioned Measure Values only. However, in the graph of this measure, the health status of this port. However, the graph of this measure will be represented using the corresponding numeric equivalents only.</td></tr>
<tr><td>Operational status</td><td>Indicates the current operating status of this port.</td><td></td><td>The values that this measure can report and the states they indicate are tabulated below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>OK</td><td>0</td></tr><tr><td>In Service</td><td>1</td></tr><tr><td>Power Mode</td><td>2</td></tr><tr><td>Completed</td><td>3</td></tr><tr><td>Starting</td><td>4</td></tr></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>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>Dormant</td><td>5</td></tr>
<tr><td>Other</td><td>6</td></tr>
<tr><td>Unknown</td><td>7</td></tr>
<tr><td>Stopping</td><td>8</td></tr>
<tr><td>Stressed</td><td>9</td></tr>
<tr><td>Stopped</td><td>10</td></tr>
<tr><td>Supporting Entity In Error</td><td>11</td></tr>
<tr><td>Degraded or Predicted Failure</td><td>12</td></tr>
<tr><td>Predictive Failure</td><td>13</td></tr>
<tr><td>Lost Communication</td><td>14</td></tr>
<tr><td>No Contact</td><td>15</td></tr>
<tr><td>Aborted</td><td>16</td></tr>
<tr><td>Error</td><td>17</td></tr>
<tr><td>Non-Recoverable Error</td><td>18</td></tr>
</table>
Note:
By default, this measure reports the above-mentioned States while indicating the current operating state of this port. 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 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 array pool is in a particular operational state. For instance, if 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>Operational status measure reports the value Stopping for an array pool, then this measure will explain why that array pool 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 port. However, the graph of this measure will be represented using the corresponding numeric equivalents only.</td></tr>
<tr><td>IOPS</td><td>Indicates the rate at which the I/O operations were performed through this port during the last measurement period.</td><td>IOPS</td><td>This measure serves as a good indicator of the I/O processing ability of the port. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.</td></tr>
<tr><td>SCSI reads</td><td>Indicates the rate at</td><td>Reads/Sec</td><td>Ideally, the value of this measure should</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
	which the SCSI commands were read through this port during the last measurement period.		be high. A steady dip in this measure value could indicate a potential reading bottleneck. By comparing the value of this measure across ports, you can quickly identify that port which is the slowest in processing read requests.
SCSI writes	Indicates the rate at which the SCSI commands were written through this 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 ports, you can quickly identify that port which is the slowest in processing write requests.
PPRC received	Indicates the rate at which the Peer to Peer remote copy operations were received by this port during the last measurement period.	Received/Sec	Peer to Peer Remote Copy or PPRC is a protocol to replicate a storage volume to another control unit in a remote site. Synchronous PPRC causes each write to the primary volume to be performed to the secondary as well, and the I/O is only considered complete when update to both primary and secondary have completed.
PPRC sent	Indicates the rate at which the Peer to Peer remote copy operations were sent through this port during the last measurement period.	Sent/sec	
SCSI data reads	Indicates the rate at which this port read the SCSI data during the last measurement period.	MB/Sec	Comparing the value of these measures across the ports will clearly indicate which port is the busiest in terms of data transmission - it could also shed light on irregularities in load balancing across the ports.
SCSI data written	Indicates the rate at which SCSI data was written through this port during the last measurement period.	MB/Sec	

Measurement	Description	Measurement Unit	Interpretation
PPRC data received	Indicates the rate at which data was received by this port for performing peer to peer remote copy operation (PPRC) during the last measurement period.	MB/Sec	
PPRC data sent	Indicates the rate at which data was sent through this port to perform peer to peer remote copy operation (PPRC) during the last measurement period.	MB/Sec	
FC link failure error count	Indicates the number of link failures experienced by this FC port.	Number	Ideally, the value of this measure should be zero. A non-zero value indicates that Fibre Channel connectivity with the port was “broken” that many times. This is likely an indicator for a faulty connector or cable. These are also caused when the device connected to the port is restarted, replaced or being serviced when the Fibre Channel cable connected to the port is temporarily disconnected.
	FC loss sync error count: Indicates the number of times this FC port failed to synchronize.	Number	Ideally, the value of this measure should be zero. A non-zero value for this measure indicates that port went into the “loss of synchronization” state, where it encountered continuous Disparity errors. This is likely an indicator for a faulty connector or cable. These are also caused when the device connected to the port is restarted, replaced or being serviced when the Fibre Channel cable connected to the port is temporarily disconnected. If the port is in the “loss of

Measurement	Description	Measurement Unit	Interpretation
			synchronization" state for longer than a specific period, the port will get into the link failure state which could degrade the performance of the Fibre Channel link.
FC loss signal error count	Indicates the number of times the signal was lost on this FC port.	Number	Ideally, the value of this measure should be zero. A non-zero value for this measure indicates that the port detected a loss of the electrical or optical signal used to transfer data on the port. This is likely an indicator for a faulty connector or cable. These are also caused when the device connected to the port is restarted, replaced or being serviced when the Fibre Channel cable connected to the port is temporarily disconnected. If the port is in the "loss of signal" state for longer than a specific period, the port will get into the link failure state which could degrade the performance of the Fibre Channel link.
FC primitive sequence error count	Indicates the number of Primitive Sequence protocol errors that occurred on this FC port.	Number	Ideally, the value of this measure should be zero.
FC invalid transmission word count	Indicates the number of invalid words that were transmitted through this FC port.	Number	Transmission Words are either data Transmission Words or control Transmission Words. The first two bits of a Transmission Word are the synchronization header, and are set to either 01h or 10h. The remaining 64 bits of the Transmission Word are the output of a scrambler applied to the Transmission Word body. The Transmission Word body is eight bytes that represent a pair of words and/or Special Functions.

Measurement	Description	Measurement Unit	Interpretation
			An invalid Transmission Word shall be recognized by the receiver when one of the following conditions is detected: • A code violation, as specified by the 8B/10B transmission code (see 5.2), is detected within a Transmission Word. This is referred to as a code violation condition; • A K30.7 special character is detected in any character position of a Transmission Word. This indicates an error condition has been detected at a lower implementation level within the receiver; • Any valid special character is detected in the second, third, or fourth character position of a Transmission Word. This is referred to as an invalid special code alignment condition; or • A defined Ordered Set is received with improper beginning running disparity. Ideally, the value of this measure should be zero.
FC CRC error count	Indicates the number of invalid CRCs that occurred on this FC port.	Number	This refers to the number of Fibre Channel frames handled by the port that contains checksum errors. Ideally, the value of this measure should be zero. These are usually recoverable errors and will not degrade system performance

Measurement	Description	Measurement Unit	Interpretation
			unless their occurrence is sustained when the data cannot be relayed after retransmissions.
FC illegal frame count	Indicates the number of illegal frames that were sent through this FC port.	Number	Ideally, the value of this measure should be zero.
FC out of order ACK count	Indicates the number of ACK frames that were identified as out of order while being transmitted through this port.	Number	Ideally, the value of this measure should be zero. Whenever a frame is missed during transmission, an out of order ACK error is reported. These errors are not during I/O operations, as I/O operations do not use ACK.

3.4 The IBM DS8000 Arrays Layer

The tests associated with this layer monitor the status of the ranks, health of the ranks, the level of I/O processing on each rank, the status and health of each array, the I/O processing on each array etc.

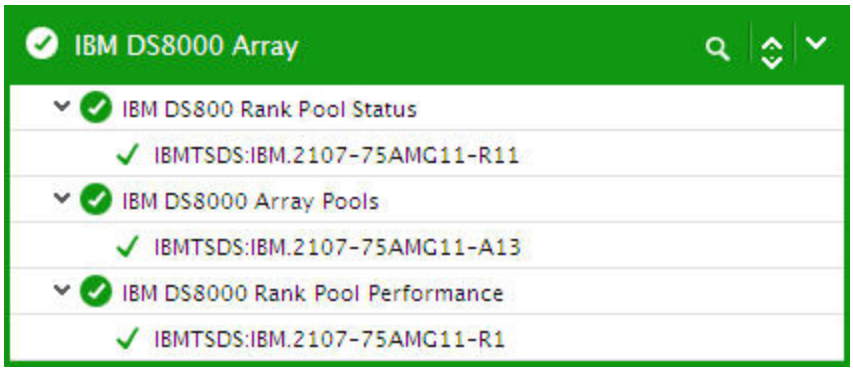

Figure 3.5: The tests mapped to the IBM DS8000 Arrays layer

3.4.1 IBM DS8000 Rank Pool Status Test

A rank is defined by the user of the IBM DS8000 Storage system. The user selects an array and defines the storage format for the rank, which is either Count Key Data (CKD) or Fixed Block (FB) data. The available space on each rank is divided into extents. The extents are the building blocks of the logical volumes. One rank will be assigned to one extent pool by the user. If there occurs a space crunch in the extents, then it may directly impact the performance of the ranks. Therefore, it is

imminent to keep a constant vigil on the overall performance of the ranks. The **IBM DS8000 Rank Pool Status** test helps you achieve this. This test auto discovers the ranks of the IBM DS8000 Storage system, monitors the health and status of the ranks and helps you identify how well the space is utilized by each rank. This way, potential space crunch (if any) in the ranks can be proactively identified and remedial actions can be taken before end users start complaining!

Target of the test : An IBM DS8000 Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each rank that is being monitored.

Configurable parameters for the test

Parameter	Description
Test period	How often should the test be executed.
Host	The host for which the test is to be configured.
Port	The port number at which the specified host listens. By default, this is *NULL*.
User and Password	In order to monitor an IBM DS8000 Storage system, the eG agent has to be configured with the credentials of a read only user. Specify the login credentials of such a user in the User and Password text boxes.
Confirm Password	Confirm the password by retyping it here.
SSL	If the IBM DS8000 Stotage system to be monitored is SSL-enabled, then set this flag to **Yes**.
CIM Server Port	The SMI –S provider of the IBM DS8000 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 that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is port 6988. If the service port on the SMI-S provider listens only to HTTPS requests, then specify the port as *6989*.
IsEmbedded	If this flag is set to **True**, it indicates that the SMI-S provider is embedded on the storage system. On the other hand, if this flag is set to **False**, it indicates that the SMI-S provider has been implemented as a proxy.
Serial Number	If the SMI-S provider has been implemented as a proxy, then such a provider can be configured to manage multiple storage devices. This is why, if the IsEmbedded flag is set to **False**, you will have to explicitly specify which storage system you want the eG agent to monitor. Since each storage system is uniquely identified by a serialnumber,

Parameter	Description
	specify the same here. The format of this number and where you can find it will differ from one storage system to another. You are hence advised to contact the storage administrator to know what to enter against serialnumber. If the IsEmbedded flag is set to **True**, then you may specify this value as default.
NameSpace	Specify the namespace that uniquely identifies the profiles specific to the provider in use.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Health state	Indicates the current health of this rank.	Percent	The values that this measure can report and their corresponding numeric values are tabulated below: **Measure Value** / **Numeric Value** OK: 0 Unknown: 1 Degraded/Warning: 2 Minor failure: 3 Major failure: 4 Critical failure: 5 Non-recoverable error: 6 Note: By default, this measure reports the above-mentioned Measure Values only. However, in the graph of this measure, the health status of this rank. However, the graph of this measure will be represented using the corresponding numeric equivalents only.
Operational status	Indicates the current operating status of this rank.	MB/sec	The values that this measure can report and the states they indicate are tabulated below:

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Measure Value</th><th>Numeric Value</th></tr>
<tr><td>OK</td><td>0</td></tr>
<tr><td>In Service</td><td>1</td></tr>
<tr><td>Power Mode</td><td>2</td></tr>
<tr><td>Completed</td><td>3</td></tr>
<tr><td>Starting</td><td>4</td></tr>
<tr><td>Dormant</td><td>5</td></tr>
<tr><td>Other</td><td>6</td></tr>
<tr><td>Unknown</td><td>7</td></tr>
<tr><td>Stopping</td><td>8</td></tr>
<tr><td>Stressed</td><td>9</td></tr>
<tr><td>Stopped</td><td>10</td></tr>
<tr><td>Supporting Entity In Error</td><td>11</td></tr>
<tr><td>Degraded or Predicted Failure</td><td>12</td></tr>
<tr><td>Predictive Failure</td><td>13</td></tr>
<tr><td>Lost Communication</td><td>14</td></tr>
<tr><td>No Contact</td><td>15</td></tr>
<tr><td>Aborted</td><td>16</td></tr>
<tr><td>Error</td><td>17</td></tr>
<tr><td>Non-Recoverable Error</td><td>18</td></tr>
</table>
Note:
By default, this measure reports the above-mentioned States while indicating the current operating state of this rank. However, the graph of this measure will be represented using the corresponding numeric equivalents of the States as mentioned in the table above.
</td></tr>
</table>

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Detailed operational status</td><td>Describes the current operational state of this rank.</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 rank is in a particular operational state. For instance, if the Operational status measure reports the value Stopping for a rank, then this measure will explain why that rank 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 rank will be represented using the corresponding numeric equivalents only.</td></tr>
<tr><td>Total space</td><td>Indicates the total space allocated to this rank.</td><td>GB</td><td></td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
Free space	Indicates the amount of space that is currently available for use in this rank.	GB	Ideally, the value of this measure should be high. If the value of this measure is close to the value of Total space measure, then it indicates that the rank is running out of space. Administrators can either free up the space in the rank or allocate additional space to the rank so as to ensure better performance of the rank.
Used space	Indicates the amount of space that is already used in this rank.	GB	
Used	Indicates the percentage of space that is used in this rank.	Percent	
Free	Indicates the percentage of space that is available for use in this rank.	Percent	A value close to 0 indicates that the rank is running out of space.
RAID level	Indicates the RAID that is used by this rank.	Number	

3.4.2 IBM DS8000 Array Pools Test

This test auto discovers the arrays of the IBM DS8000 Storage system, and reports the health and status of each array. In addition, this test helps administrators identify how well the space allocated to each array is utilized. This way, administrators may be proactively alerted to failures and space inadequecies experienced by the Storage system.

Target of the test : An IBM DS8000 Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each array of the IBM DS8000 Storage system being monitored.

Configurable parameters for the test

Parameter	Description
Test period	How often should the test be executed.
Host	The host for which the test is to be configured.
Port	The port number at which the specified host listens. By default, this is *NULL*.
User and Password	In order to monitor an IBM DS8000 Storage system, the eG agent has to be configured with the credentials of a read only user. Specify the login credentials of such a user in the User and Password text boxes.
Confirm Password	Confirm the password by retyping it here.
SSL	If the IBM DS8000 Stotage system to be monitored is SSL-enabled, then set this flag to **Yes**.
CIM Server Port	The SMI –S provider of the IBM DS8000 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 that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is port 6988. If the service port on the SMI-S provider listens only to HTTPS requests, then specify the port as *6989*.
IsEmbedded	If this flag is set to **True**, it indicates that the SMI-S provider is embedded on the storage system. On the other hand, if this flag is set to **False**, it indicates that the SMI-S provider has been implemented as a proxy.
Serial Number	If the SMI-S provider has been implemented as a proxy, then such a provider can be configured to manage multiple storage devices. This is why, if the IsEmbedded flag is set to **False**, you will have to explicitly specify which storage system you want the eG agent to monitor. Since each storage system is uniquely identified by a serialnumber, specify the same here. The format of this number and where you can find it will differ from one storage system to another. You are hence advised to contact the storage administrator to know what to enter against serialnumber. If the IsEmbedded flag is set to **True**, then you may specify this value as default.
NameSpace	Specify the namespace that uniquely identifies the profiles specific to the provider in use.

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 array.</td><td></td><td>The values that this measure can report and their corresponding numeric values are tabulated below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>OK</td><td>0</td></tr><tr><td>Unknown</td><td>1</td></tr><tr><td>Degraded/Warning</td><td>2</td></tr><tr><td>Minor failure</td><td>3</td></tr><tr><td>Major failure</td><td>4</td></tr><tr><td>Critical failure</td><td>5</td></tr><tr><td>Non-recoverable error</td><td>6</td></tr></table>
Note:
By default, this measure reports the above-mentioned Measure Values only. However, in the graph of this measure, the health status of this array. However, the graph of this measure will be represented using the corresponding numeric equivalents only.</td></tr>
<tr><td>Operational status</td><td>Indicates the current operating status of this array.</td><td></td><td>The values that this measure can report and the states they indicate are tabulated below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>OK</td><td>0</td></tr><tr><td>In Service</td><td>1</td></tr><tr><td>Power Mode</td><td>2</td></tr><tr><td>Completed</td><td>3</td></tr></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>Measure Value</th><th>Numeric Value</th></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 array . 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 status</td><td>Describes the current operational state of this 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 array is in a particular operational state. For instance, if 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>Operational status measure reports the value Stopping for an array, then this measure will explain why that 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>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 array will be represented using the corresponding numeric equivalents only.</td></tr>
<tr><td>Total space</td><td>Indicates the total space allocated to this array.</td><td>GB</td><td></td></tr>
<tr><td>Used space</td><td>Indicates the amount of space that is currently utilized in this array.</td><td>GB</td><td>A value close to the Total space measure indicates that the array is currently running out of space.</td></tr>
<tr><td>Used Percent</td><td>Indicates the percentage of space that is currently</td><td>Percent</td><td>A low value is desired for this measure. A value close to 100 indicates that the</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
	utilized in this array.		array is running out of space.
Free space	Indicates the amount of space that is available for use in this array.	GB	A high value is desired for this measure.
Free Percent	Indicates the percentage of space that is available for use in this array.	Percent	If the value of this measure is rapidly decreasing, then it indicates that the array is running out of space.
RAID level	Indicates the RAID level of this array.	Number	

3.4.3 IBM DS8000 Rank Pool Performance Test

For each rank configured on the IBM DS8000 Storage system, this test helps administrators identify how well I/O processing takes place in each rank and thus enables administrators figure out the rank that is the slowest in I/O processing.

Target of the test : An IBM DS8000 Storage system

Agent deploying the test : A remote agent

Outputs of the test : One set of results for each rank of the target IBM DS8000 Storage system being monitored.

Configurable parameters for the test

Parameter	Description
Test period	How often should the test be executed.
Host	The host for which the test is to be configured.
Port	The port number at which the specified host listens. By default, this is *NULL*.
User and Password	In order to monitor an IBM DS8000 Storage system, the eG agent has to be configured with the credentials of a read only user. Specify the login credentials of such a user in the User and Password text boxes.
Confirm Password	Confirm the password by retyping it here.
SSL	If the IBM DS8000 Stotage system to be monitored is SSL-enabled, then set this flag to **Yes**.

Parameter	Description
CIM Server Port	The SMI –S provider of the IBM DS8000 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 that listens for HTTP/HTTPS requests for CIM API semantics. By default, this is port 6988. If the service port on the SMI-S provider listens only to HTTPS requests, then specify the port as *6989*.
IsEmbedded	If this flag is set to **True**, it indicates that the SMI-S provider is embedded on the storage system. On the other hand, if this flag is set to **False**, it indicates that the SMI-S provider has been implemented as a proxy.
Serial Number	If the SMI-S provider has been implemented as a proxy, then such a provider can be configured to manage multiple storage devices. This is why, if the IsEmbedded flag is set to **False**, you will have to explicitly specify which storage system you want the eG agent to monitor. Since each storage system is uniquely identified by a serialnumber, specify the same here. The format of this number and where you can find it will differ from one storage system to another. You are hence advised to contact the storage administrator to know what to enter against serialnumber. If the IsEmbedded flag is set to **True**, then you may specify this value as default.
NameSpace	Specify the namespace that uniquely identifies the profiles specific to the provider in use.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
IOPS	Indicates the rate at which I/O operations were performed on this rank during the last measurement period.	IOPS	This measure serves as a good indicator of the I/O processing ability of the rank. A consistent drop in this value is hence a cause for concern, as it indicates a processing slowdown.
Reads	Indicates the rate at which read operations were performed on this rank during the last measurement period.	Reads/sec	Compare the value of this measure across ranks to know which rank handled the maximum number of read requests and which handled the least.
Writes	Indicates the rate at which write operations were	Writes/sec	Compare the value of this measure across ranks to know which rank

Measurement	Description	Measurement Unit	Interpretation
	performed on this rank during the last measurement period.		handled the maximum number of write requests and which handled the least.
Data reads	Indicates the rate at which data is read from this rank during the last measurement period.	MB/Sec	Compare the value of these measures across LUNs to identify the rank that is the slowest in terms of servicing read and write requests (respectively).
	Data writes: Indicates the rate at which data is written to this rank during the last measurement period.	MB/Sec	
Average read size	Indicates the average amount of data read from this rank per I/O operation during the last measurement period.	MB/Op	Compare the value of these measures across LUNs to identify the rank that is the slowest in terms of servicing read and write requests (respectively).
Average write size	Indicates the average amount of data written to this rank per I/O operation during the last measurement period.	MB/Op	
Average read response time	Indicates the average time taken by this rank to respond to read requests during the last measurement period.	Microsec	Ideally, the value of these measures should be low. An increasing trend for the value of this measure implies that the rank is slow.
Average write response time	Indicates the average time taken by this rank to respond to write requests during the last measurement period.	Microsec	

About eG Innovations

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

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

To learn more visit www.eginnovations.com.

Contact Us

For support queries, email support@eginnovations.com.

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