Monitoring SolidFire Storage System

eG Innovations Product Documentation

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Total Performance Visibility

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Chapter 1: Introduction

SolidFire's storage system combines all-SSD performance with highly efficient data distribution and management. Embedded granular thin provisioning, multi-layer data compression and global data deduplication techniques that solve traditional storage deficiencies making flash at scale an economic reality while delivering superior performance.

SolidFire's scale-out architecture ensures network, cache, and compute resources grow in tandem with capacity as the cluster is expanded. Compared with a more conventional scale-up model, the SolidFire scale-out architecture delivers linear performance gains as customers increase capacity by adding nodes to the cluster.

Since the continuous availability of the storage is critical to the target environments, even the slightest dips in the performance of the storage servers can adversely impact the smooth functioning of those environments. Continuous monitoring of the storage servers is hence essential so that, issues can be promptly identified and resolved. This can be achieved by monitoring the SolidFire Storage system.

Chapter 2: How does eG Enterprise Monitor SolidFire Storage System?

eG Enterprise monitors the SolidFire Storage system in an *agentless* manner only. To monitor the SolidFire storage system, a user with monitor role is required i.e., the account with which the user is created should be a *Cluster Admin Account*. To know how to create a Cluster Admin Account, refer to Section **2.1.1**.

2.1 Managing the SolidFire Storage System

The eG Enterprise cannot automatically discover the SolidFire Storage system so that you need to manually add the component for monitoring. Remember that the eG Enterprise automatically manages the components that are added manually. To manage a SolidFire Storage System component, do the following:

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

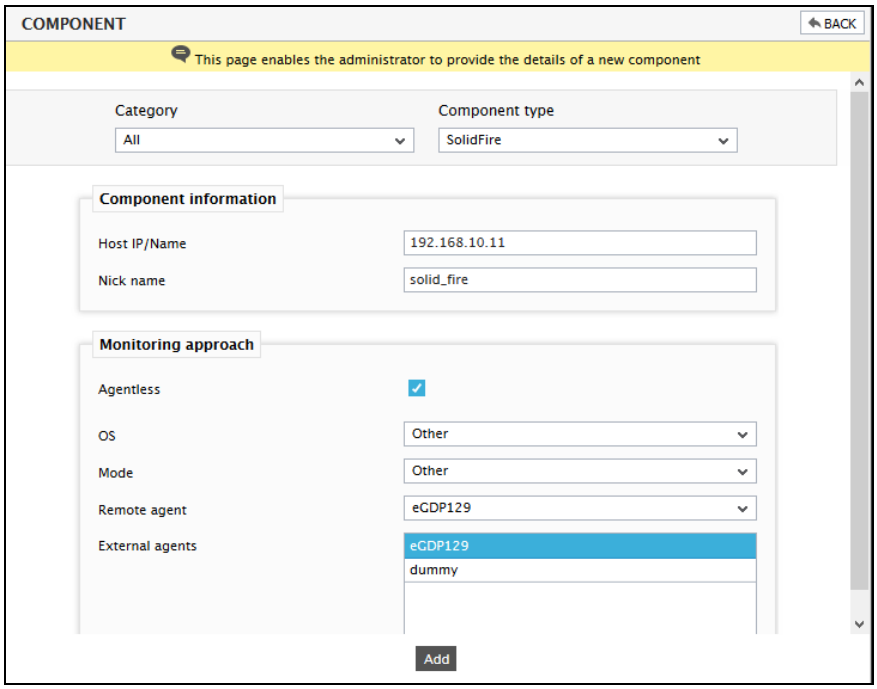

Figure 2.1: Adding the SolidFire Storage System

4. Specify the **Host IP/Name** and **Nick name** for the SolidFire Storage System. The SolidFire storage system can only be monitored in an agentless manner. Therefore, the **Agentless** check box will be checked by default. Next, select **Other** as the **OS** and **Other** as the **Mode**.
5. Then, click **Add** button to register the changes.
6. The SolidFire storage system so added will be managed automatically by eG Enterprise. Now, try to sign out of the user interface. Doing so, will bring up the following page as shown in Figure 2.2, which prompts you to configure a list of unconfigured tests for the target SolidFire storage system.

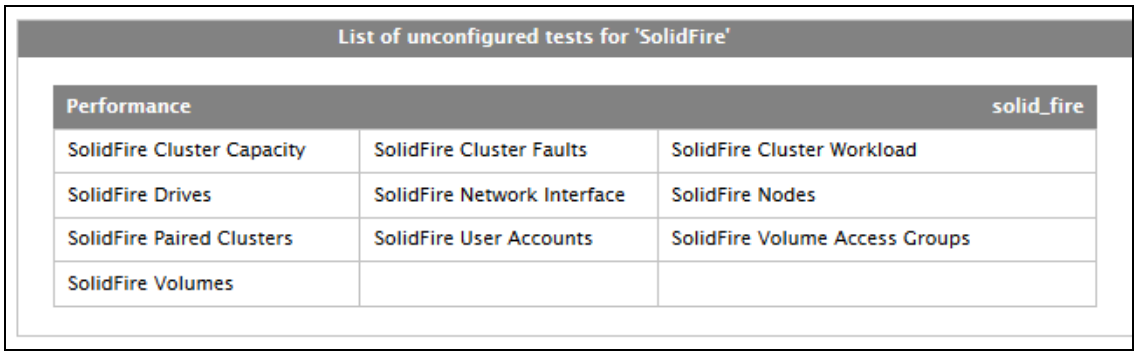

Figure 2.2: The list of unconfigured tests for the target storage system

7. Click on any test in the list of unconfigured tests. For instance, click on the **SolidFire Cluster Capacity** test to configure it. Figure 2.3 then appears.

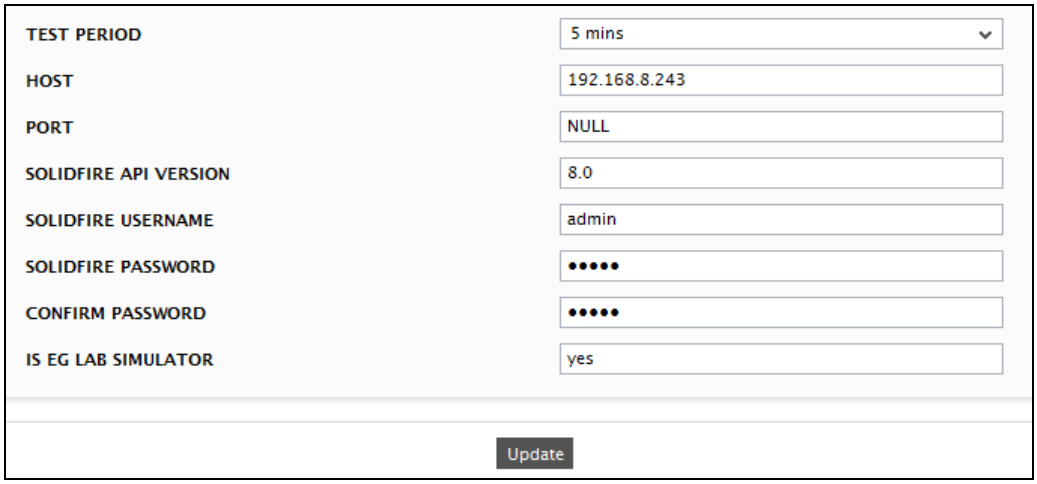

Figure 2.3: Configuring the VNXe Battery test

8. To know how to configure the test, refer to **Monitoring SolidFire Storage System**.
9. Finally, signout of administrative interface.

2.1.1 Creating a Cluster Admin Account

You can create new cluster administrator accounts to manage the storage cluster. You can configure the account permissions to allow or restrict access to specific areas of the storage system. The system grants read-only permissions for any permissions you do not assign to the cluster administrator.

Prerequisite

LDAP must be configured on the cluster before you can create a cluster administrator account in the LDAP directory.

To create a Cluster Admin Account, do the following:

1. Navigate to the menu sequence: *Users -> Cluster Admins*.
2. Click the **Create Cluster Admin** button.
3. To create a cluster-wide (non-LDAP) cluster administrator account:

- Select the **Cluster** option in the **Select User Type** area.
- Enter a username in the **Username** field.
- Enter a password for the account in the **Password** field.
- Confirm the password in the **Confirm Password** field.
- Choose permissions to apply to the account in the **Select User Permissions** area.
- Select the check box to agree to the SolidFire End User License Agreement.
- Click **Create Cluster Admin**.

4. To create a cluster administrator account in the LDAP directory:

- Select the **LDAP** option in the **Select User Type** area.
- Enter a full distinguished name for the user in the **Distinguished Name** text box, following the example.
- Choose permissions to apply to the account in the **Select User Permissions** area.
- Select the check box to agree to the SolidFire End User License Agreement.
- Click **Create Cluster Admin**.

Chapter 3: Monitoring SolidFire Storage System

eG Enterprise offers a dedicated monitoring model for the SolidFire Storage system (see Figure 3.1).

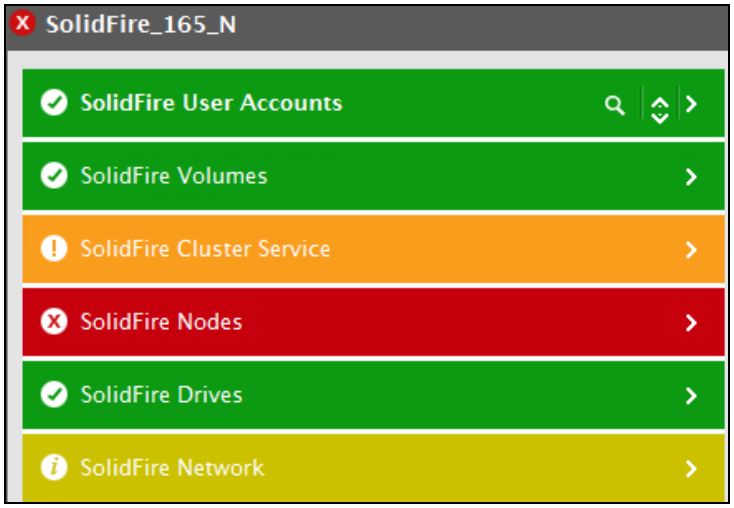

Figure 3.1: The layer model of a SolidFire Storage System

Using the metrics reported by eG Enterprise, administrators can find quick answers to the following questions:

- What is the space utilization of the volume drives in the cluster?
- What is the space utilization of the block drives in the cluster?
- How well the provisioned space is utilized in the block drives in the cluster?
- How many errors were reported for each type of fault?
- How many active iSCSI sessions were communicating with the cluster?
- How many I/O operations were performed on the cluster since midnight Coordinated Universal Time (UTC)?
- How well data was read from and written to the cluster?
- What is the current status of each drive?
- How well data was read from and written to the drive from the time the drive as provisioned (lifetime)?
- What is the space utilization of each drive? Is any drive running out of space?

- How well I/O operations were performed on each drive?
- What is the remaining lifetime of each drive?
- What is the current status of each network interface?
- What is the percentage of CPU utilized on each node?
- How well data is received and sent from the cluster interface of each node?
- How well data is received and sent from the storage interface of each node?
- How well data is received and sent from the management network interface of each node?
- What is the current connection status of the SolidFire cluster that is paired with the target SolidFire storage system?
- What is the time taken to transfer the data between the pared cluster and the target SolidFire storage system?
- What is the current status of each user account?
- How many volumes were owned by each user account?
- What is the overall efficiency of the volume associated with each user account?
- How many volumes were owned by each volume access group?
- How many initiators are available in each volume access group?
- What is the overall efficiency of each volume access group?
- What is the compression factor and thin provisioning factor of each volume access group?

The sections to come will elaborate on the tests executed on the target SolidFire storage system.

3.1 The SolidFire Network Layer

Using the test mapped to this layer, administrators can determine the current status of each network interface on each node of the target storage device.

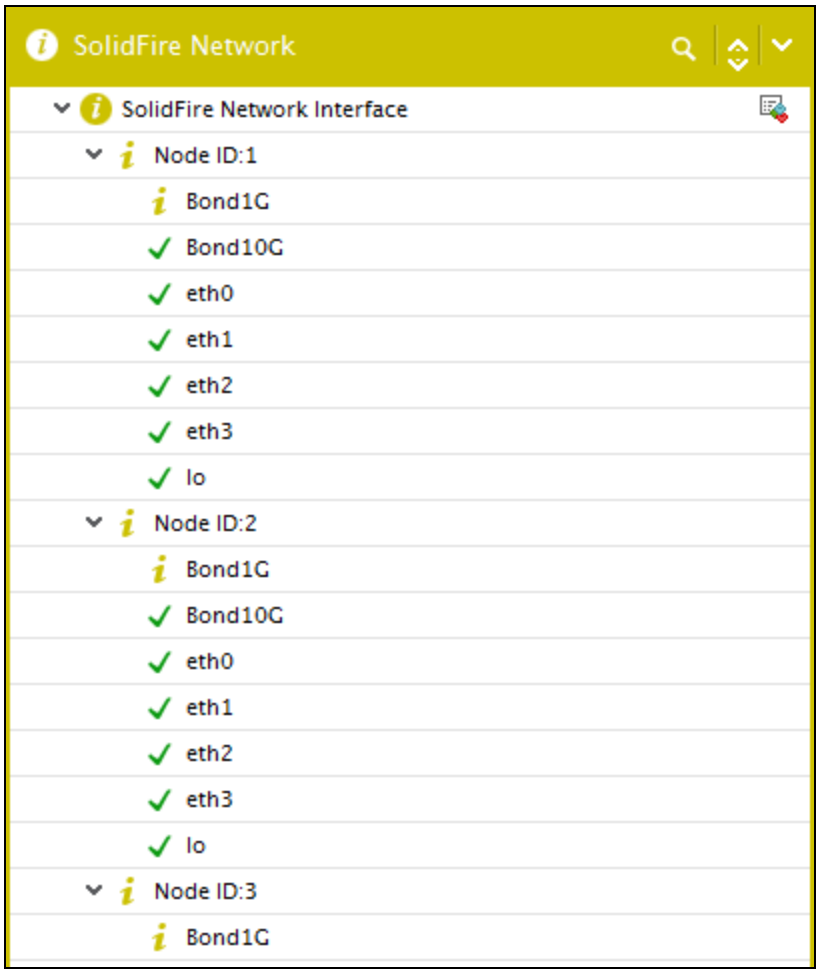

Figure 3.2: The tests mapped to the SolidFire Network layer

The section that follows will discuss the test in detail.

3.1.1 SolidFire Network Interface Test

This test reports the current status of each network interface on each node of the target storage device. Using this test, administrators can figure out the network interfaces that are down for a longer duration, analyze the reason on why the network interface is down and take remedial measures before end users start complaining of slowness.

Target of the test : A SolidFire Storage

Agent deploying the test : An internal agent

Outputs of the test : One set of results for each *Node: Network Interface* on the target storage device.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Status	Indicates the current status of this network interface.		The values reported by this measure and its numeric equivalents are mentioned in the table below: **Measure Value** / **Numeric Value** Up and Running – 1 Up – 2 Down – 3 Unknown – 4 **Note:** By default, this measure reports the **Measure Value**s listed in the table above to indicate the current health of this network interface. The graph of this measure however, represents the status of the network interface using the numeric equivalents only i.e, 1 to 4.

3.2 The SolidFire Drives Layer

The testmapped to this layer helps administrators to determine the status, space utilization and processing ability of each of the drives available in the target storage system.

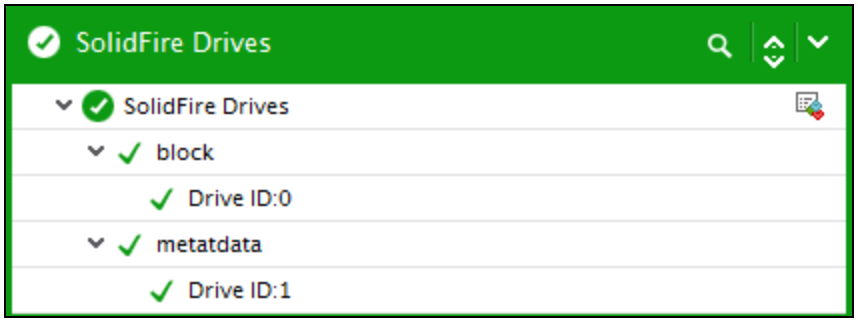

Figure 3.3: The tests mapped to the SolidFire Drives layer

3.2.1 SolidFire Drives Test

When a node is added to the SolidFire cluster, or new drives are installed to an existing node, the drives are available to be added to the SolidFire cluster. If a single drive in the SolidFire cluster is over-utilized or is unable to process I/O requests quickly, it can damage the user experience with the entire storage system. It is hence the responsibility of the storage administrator to keep an eye out for space contentions and processing bottlenecks with each of the drives, detect such anomalies even before they occur, and resolve them before users complain. The **SolidFire Drives** test helps the storage administrator discharge his duties efficiently.

This test auto-discovers the drives of the SolidFire storage system and reports the status, space utilization and processing ability of each of the drives. This enables administrators to proactively detect a potential slowdown in processing or a probable drive contention, identify which drive is contributing to these abnormal phenomena, and intervene to ensure that the problem is resolved before it spirals out of control.

Target of the test : A SolidFire Storage System

Agent deploying the test : An internal agent

Outputs of the test : One set of results for each *Drive Type:Drive* on the target SolidFire storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

<table>
<tr><th>Measurement</th><th>Description</th><th>Measurement Unit</th><th>Interpretation</th></tr>
<tr><td>Status</td><td>Indicates the current state of this drive.</td><td></td><td>The values that this measure can report and their corresponding numeric values have been discussed below:
<table><tr><th>Measure Value</th><th>Numeric Value</th></tr><tr><td>Active</td><td>0</td></tr><tr><td>Available</td><td>1</td></tr><tr><td>Erasing</td><td>2</td></tr><tr><td>Failed</td><td>3</td></tr><tr><td>Removing</td><td>4</td></tr></table>Note:
By default, this measure reports the States listed in the table above to indicate the current state of this drive. The graph of this measure however, represents the same using the numeric equivalents only.</td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
Active sessions	Indicates the number of active iSCSI sessions on this drive.	Number	This measure will be available only for metadata drive type.
Failed die count	Indicates the number of failed hardware elements in this drive.	Number	
Life remaining	Indicates the percentage of lifetime available in this drive.	Percent	Indicator
Power on hours	Indicates the number of hours since this drive was powered on.	Hours	
Reallocated sectors	Indicates the number of bad sectors that were replaced in this drive.	Number	
Reserve capacity	Indicates the percent of data available as reserve on this drive.	Percent	
Average life time read bandwidth	Indicates the average amount of data read for the lifetime from this drive per second during the last measurement period.	MB/Sec	A consistent decrease in the value of these measures for a drive indicates an I/O processing bottleneck.
Average life time write bandwidth	Indicates the average amount of data written for the lifetime to this drive per second during the last measurement period.	MB/Sec	
Average read bandwidth	Indicates the average rate at which data was read from this drive during the last measurement period.	MB/Sec	A consistent decrease in the value of these measures for a drive indicates an I/O processing bottleneck.
Average write bandwidth	Indicates the average rate at which data was written to this drive during the last measurement period.	MB/Sec	

Measurement	Description	Measurement Unit	Interpretation
Average bandwidth	Indicates the average rate at which data was read from and written to this drive during the last measurement period.	MB/Sec	
Average read IOPS	Indicates the average rate at which read operations were performed on this drive during the last measurement period.	IOPS	A consistent decrease in the value of these measures for a drive indicates an I/O processing bottleneck.
Average write IOPS	Indicates the average rate at which write operations were performed on this drive during the last measurement period.	IOPS	
Total IOPS	Indicates the average rate at which read and write operations were performed on this drive during the last measurement period.	IOPS	
Total space	Indicates the total capacity of this drive.	GB	
Used space	Indicates the amount of space utilized in this drive.	GB	A low value is desired for this measure.
Used space Percent	Indicates the percentage of space utilized in this drive.	Percent	A value close to 100 is an indication that the drive is about to run out of space. You may want to consider more drives, in this case, to make more space.
Free space	Indicates the amount of space available for use in this drive.	GB	A high value is desired for this measure.
Free space Percent	Indicates the percentage of space available for use in this drive.	Percent	A value close to 0 is an indication that the drive is about to run out of space. You may want to consider more drives, in this case, to make more space.

Measurement	Description	Measurement Unit	Interpretation
Used memory	Indicates the amount of memory current used by the node hosting this drive.	GB	

3.3 The SolidFire Nodes Layer

The tests mapped to this layer helps administrators to figure out the CPU utilization of each node, the throughput of each node, detect irregularities in the distribution of load across the nodes and analyze the memory utilization of each node.

Figure 3.4: The tests mapped to the SolidFire Nodes layer

3.3.1 SolidFire Nodes Test

A SolidFire storage node is a collection of drives that communicate with each other through the CIPI Bond10G network interface. Drives in the node contain block and metadata space for data storage and data management.

This test auto discovers the nodes of the target storage system and helps administrators to figure out the CPU utilization of each node, data transmission from and through the network interface and storage interface of the nodes, the throughput of the node, detect irregularities in the distribution of load across the nodes, analyze the memory utilization of each node and thus enables administrators to initiate pre-emptive measures when the load on the node increases abnormally.

Target of the test : A SolidFire Storage System

Agent deploying the test : An internal agent

Outputs of the test : One set of results for each node on the target storage device.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
CPU usage	Indicates the percentage of CPU utilized on this node.	Percent	
Network interface utilization for cluster	Indicates the utilization percentage of the network interface used for cluster communication on this node.	Percent	
Network interface utilization for storage	Indicates the utilization percentage of the storage network interface on this node.	Percent	
Total memory usage	Indicates the total amount off memory used by this node.	GB	
Data input	Indicates the amount of data received by the cluster interface of this node.	MB	
Data output	Indicates the amount of data sent from the cluster	MB	

Measurement	Description	Measurement Unit	Interpretation
	interface of this node.		
Data input rate	Indicates the rate at which data was received by the cluster interface of this node.	MB/sec	
Data output rate	Indicates the rate at which data was sent from the cluster interface of this node.	MB/sec	
Total throughput	Indicates the rate at which data was received by and sent from the cluster interface of this node.	MB/Sec	
Data input	Indicates the amount of data received by the storage interface of this node.	MB	
Data output	Indicates the amount of data sent from the storage interface of this node.	MB	
Data input rate	Indicates the rate at which data was received by the storage interface of this node.	MB/sec	
Data output rate	Indicates the rate at which data was sent from the storage interface of this node.	MB/sec	
Total throughput	Indicates the rate at which data was received by and sent from the storage interface of this node.	MB/sec	
Data input	Indicates the amount of data received by the management network interface of this node.	MB	

Measurement	Description	Measurement Unit	Interpretation
Data output	Indicates the amount of data sent by the management network interface of this node.	MB	
Data input rate	Indicates the rate at which data was received by the management network interface of this node.	MB/sec	
Data output rate	Indicates the rate at which data was sent by the management network interface of this node.	MB/sec	
Total throughput	Indicates the rate at which data was received by and sent by the management network interface of this node.	MB/sec	

3.4 The SolidFire Cluster Service Layer

The tests mapped to this layer helps administrators to determine the following:

- The space utilization in the block drives of the target SolidFire cluster;
- The number of faults detected for each fault type;
- the cluster utilization;
- the I/O operations and bandwidth of the cluster etc;

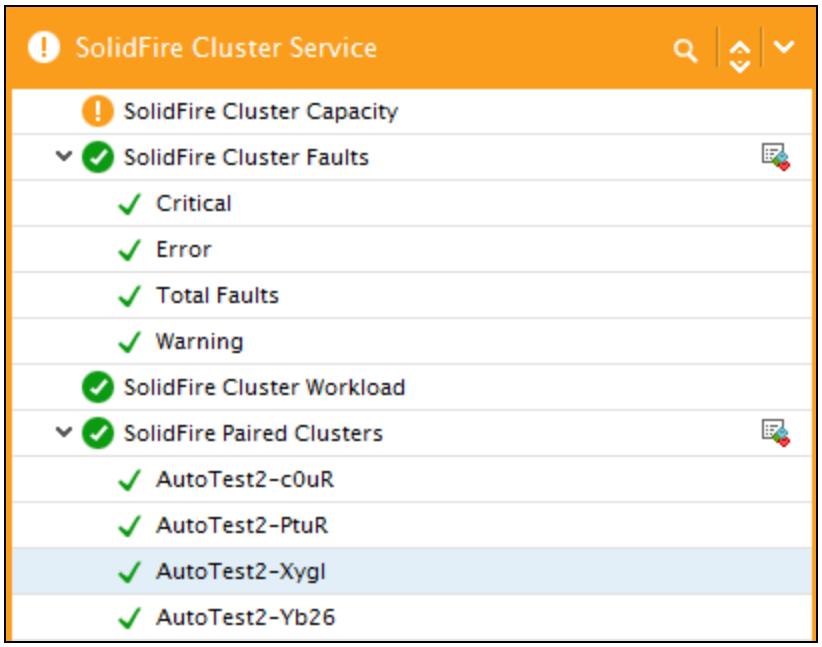

Figure 3.5: The tests mapped to the SolidFire Cluster Service layer

3.4.1 SolidFire Cluster Capacity Test

A SolidFire cluster is the hub of the SolidFire Storage System and is made up of a collection of SolidFire nodes. These nodes are connected over a 10Gb Ethernet network to create a storage cluster ranging from 4 to 100 nodes. The clusters can be expanded by simply adding new nodes as business and application demands dictate. There are two fundamental types of the nodes:

- **Storage node** is a collection of volume drives that communicate with each other through the CIPI Bond10G network interface. Volume drives in the nodes contain data blocks and metadata space for data storage and data management. You can create a cluster with new storage nodes, or add storage nodes to an existing cluster to increase storage capacity and performance.
- **Fibre Channel node** provides connectivity to a Fibre Channel switch, which you can connect to Fibre Channel clients. Fibre Channel nodes act as a protocol converter between the Fibre Channel and iSCSI protocols; this enables you to add Fibre Channel connectivity to any new or existing SolidFire cluster.

The SolidFire storage system scales up to 100 nodes, provides capacity from 35TB to 3.4PB, and can deliver between 200,000 and 7.5M guaranteed IOPS to more than 100,000 volumes / applications within a single system - increasing overall business productivity through consolidation, automation and granular scalability. These clusters instantly and automatically grow the capacity and performance of the entire system.

If the volume drives and the block drives in the nodes of the cluster lack space, then the data cannot be stored in the target storage system which may lead to critical data loss. To avoid this and to ensure peak performance of the cluster, it is mandatory to monitor the space utilization of the drives periodically. The **SolidFire Cluster Capacity** test helps administrators in this regard!

This test reports the space available in the volume drives and space that is utilized in the volume drives. This test also reports the utilization of provisioned space. By closely monitoring the space utilization of the volume drives and the block volume drives, administrators may be alerted to potential space crunch.

Target of the test : A SolidFire Storage System

Agent deploying the test : An internal agent

Outputs of the test : One set of results for the target SolidFire storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Total block space	Indicates the total amount of space in the block drives of the SolidFire cluster.	GB	
Used block space	Indicates the total amount	GB	

Measurement	Description	Measurement Unit	Interpretation
	of space that was already utilized in the block drives of the SolidFire cluster.		
Free block space	Indicates the total amount of space that is available for use in the block drives of the SolidFire cluster.	GB	
Block space usage	Indicates the percentage of space that was already utilized in the block drives of the SolidFire cluster.	Percent	
Block space free	Indicates the percentage of space that is available for use in the block drives of the SolidFire cluster.	Percent	
Total metadata space	Indicates the total amount of space that was allocated in the volume drives to store metadata.	GB	
Used metadata space	Indicates the amount of space that was already utilized to store metadata in the volume drives.	GB	
Free metadata space	Indicates the amount of space that is currently available for storing metadata in the volume drives.	GB	
Metadata space usage	Indicates the percentage of space that was already utilized to store metadata in the volume drives.	Percent	
Metadata space free	Indicates the percentage of space that is currently available in the volume drives to store metadata.	Percent	

Measurement	Description	Measurement Unit	Interpretation
Total provisioned space	Indicates the maximum amount of space that can be provisioned on the volumes of the SolidFire cluster.	GB	
Used provisioned space	Indicates the total amount of provisioned space in the volume drives that was already utilized.	GB	
Free provisioned space	Indicates the amount of provisioned space that is currently available for use in the volume drives of the SoliFire cluster.	GB	
Provisioned space usage	Indicates the percentage of provisioned space that was already utilized in the volume drives of the SolidFire cluster.	Percent	
Provisioned space free	Indicates the percentage of provisioned space that is still available for use in the volume drives of the SolidFire cluster.	Percent	
Used metadata space in snapshots	Indicates the amount of space in the volume drives that is used to store unique metadata in the snapshot.	GB	
Maximum provisionable space	Indicates the maximum amount of space that can be provisioned on the volume drives of the SoliFire cluster.	GB	

3.4.2 SolidFire Cluster Faults Test

For each type of fault detected on the target storage device, this test reports the total number of faults. Using this test, administrators can detect the type of fault that is most frequently occurring.

Target of the test : A SolidFire Storage

Agent deploying the test : An internal agent

Outputs of the test : One set of results for each type of fault detected on the target storage device.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.
Detailed diagnosis	To make diagnosis more efficient and accurate, the eG Enterprise suite embeds an optional detailed diagnostic capability. With this capability, the eG agents can be configured to run detailed, more elaborate tests as and when specific problems are detected. To enable the detailed diagnosis capability of this test for a particular server, choose the **On** option. To disable the capability, click on the **Off** option. The option to selectively enable/disable the detailed diagnosis capability will be available only if the following conditions are fulfilled: • The eG manager license should allow the detailed diagnosis capability • Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Error count	Indicates the number of errors reported for this type of fault.	Number	Ideally, the value of this measure should be zero. Compare the value of this measure across the types of faults to figure out the type of fault that is occurring more frequently. The detailed diagnosis of this measure lists the fault code, the unique ID, description of the fault, the Drive ID, Node ID, Service ID and the type of fault.

3.4.3 SolidFire Cluster Workload Test

This test reports the processing ability of each of the target SolidFire cluster and the active iSCSI sessions and peak iSCSI sessions since midnight. This enables administrators to proactively detect a potential slowdown in processing or a probable slowdown of the cluster, identify whiy the cluster is behaving abnormally, and intervene to ensure that the problem is resolved before it spirals out of control.

Target of the test : A SolidFire Storage

Agent deploying the test : An internal agent

Outputs of the test : One set of results for the target SolidFire storage system being monitored.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.

Parameter	Description
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Active sessions	Indicates the total number of iSCSI sessions that were actively communicating with the cluster.	Number	
Peak active sessions	Indicates the peak number of iSCSI sessions since midnight Coordinated Universal Time (UTC).	Number	
Average IOPS	Indicates the average I/O operations per second in this node since midnight Coordinated Universal Time (UTC).	IOPS	
Peak IOPS	Indicates the highest value of I/O Operations per second since midnight Coordinated Universal Time (UTC).	IOPS	
Thin provisioning	Indicates the thin provisioning factor of the cluster.	Number	
De-Duplication	Indicates the de-duplication factor of the cluster.	Number	
Compression	Indicates the compression factor of the cluster.	Number	
Overall efficiency	Indicates the overall	Number	

Measurement	Description	Measurement Unit	Interpretation
	efficiency factor of the cluster.		
Cluster utilization	Indicates the amount of cluster capacity being utilized.	Percent	
Read bandwidth	Indicates the rate at which data was read by the clients during the last measurement period.	MB/sec	
Write bandwidth	Indicates the rate at which data was written to the target SolidFire Cluster during the last measurement period.	MB/sec	
Total bandwidth	Indicates the total amount of data that was read from and written to the target SolidFire Cluster per second during the last measurement period.	MB/sec	
Read IOPS	Indicates the total number of read operations performed on the target SolidFire Cluster per second.	IOPS	
Write IOPS	Indicates the total number of write operations performed on the target SolidFire Cluster per second during the last measurement period.	IOPS	
Total IOPS	Indicates the total number of read and write operations performed on the target SolidFire Cluster per second during the last measurement period.	IOPS	

3.4.4 SolidFire Paired Clusters Test

You can use real-time replication (remote replication) functionality to connect (pair) two clusters and enable continuous data protection (CDP). When you pair two clusters, active volumes on one cluster can be continuously replicated to a second cluster to provide data recovery ability. Once the connection between two clusters has been established, you can identify volumes as being the source or target of the replication. Cluster pairing requires full connectivity between nodes on the management network. Replication requires connectivity between the individual nodes on the storage cluster network. Whenever connection between the paired clusters is down or if the connection is not configured properly, the replication of data may fail. This may cause severe data loss if failure is detected in the source SolidFire Cluster due to reasons such as damage, faults etc. To avoid such data loss, it is essential to keep track on the connectivity between the paired SolidFire Clusters. The **SolidFire Paired Clusters** test helps administrators in this regard!

This test auto-discovers the SolidFire Clusters that are paired with the target SolidFire Cluster, and for each paired SolidFire Cluster, this test reports the current connection status and the time taken for the target SolidFire Cluster to synchronize the data. Using this test, administrators can figure out the paired SolidFire Cluster that is slow to synchronize the data.

Target of the test : A SolidFire Storage

Agent deploying the test : An internal agent

Outputs of the test : One set of results for each SolidFire Cluster that is paired to the target storage device.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.

Parameter	Description
Confirm Password	Confirm the SolidFire Password by retyping it here.
Detailed diagnosis	To make diagnosis more efficient and accurate, the eG Enterprise suite embeds an optional detailed diagnostic capability. With this capability, the eG agents can be configured to run detailed, more elaborate tests as and when specific problems are detected. To enable the detailed diagnosis capability of this test for a particular server, choose the **On** option. To disable the capability, click on the **Off** option. The option to selectively enable/disable the detailed diagnosis capability will be available only if the following conditions are fulfilled: • The eG manager license should allow the detailed diagnosis capability • Both the normal and abnormal frequencies configured for the detailed diagnosis measures should not be 0.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Status	Indicates the current connection state of this SolidFire cluster that is paired with the target SolidFire Cluster.		The values reported by this measure and its numeric equivalents are mentioned in the table below: **Measure Value** / **Numeric Value** Connected: 1 Misconfigured: 2 Disconnected: 3 **Note:** By default, this measure reports the **Measure Value**s listed in the table above to indicate the current state of this SolidFire Cluster. The graph of this measure is however, represented using the numeric equivalents only i.e., 1 to 3.
Latency	Indicates the time taken by the target SolidFire Cluster to transfer the	Milliseconds	This measure appears only if the *Status* measure displays the *Connected* state.

Measurement	Description	Measurement Unit	Interpretation
	data to the SolidFire Cluster that is paired.		A high value for this measure indicates that the data synchronization is slower. Comparing the value of this measure against all the paired clusters would reveal the paired cluster that is slow in data synchronization.

3.5 The SolidFire Volumes Layer

Using the tests mapped to this layer, administrators can determine the count of volumes and initiators in each volume access group, determine the processing ability of each volume access group, the volume that is busy processing I/O requests etc.

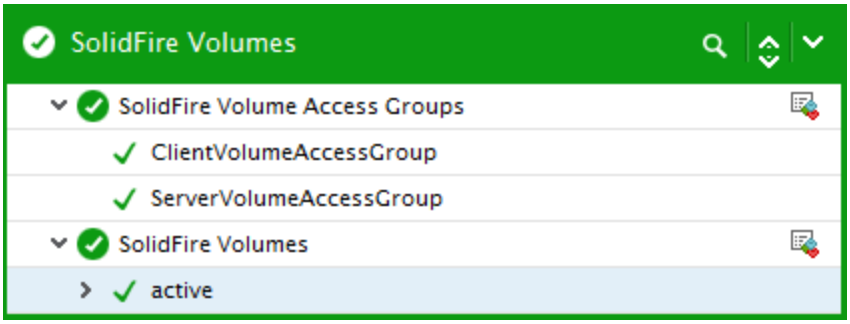

Figure 3.6: The tests mapped to the SolidFire Volumes layer

The sections that follow discusses the tests in detail.

3.5.1 SolidFire Volumes Test

This test auto discovers the volumes of the target storage system and helps administrators to figure out the volume that is busy processing I/O requests, detect irregularities in the distribution of I/O load across the volumes, analyze the space utilization of each volume and thus enables administrators to initiate pre-emptive measures when I/O processing capability decreases gradually.

Target of the test : A SolidFire Storage System

Agent deploying the test : An internal agent

Outputs of the test : One set of results for the target SolidFire storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Access	Indicates the current accessibility state of this volume.		
Is volume paired ?	Indicates whether/not this volume is paired.		
Total size	Indicates the total size of this volume.	GB	
Client queue depth	Indicates the number of read and write requests that were in queue for this volume from the clients.	Number	A low value is desired for this measure. A consistent increase in this value indicates a potential processing bottleneck with the volume.
Volume size	Indicates the current provisioned size of this volume.	GB	
Latency	Indicates the average time taken to complete the read and write operations on this	Microseconds	

Measurement	Description	Measurement Unit	Interpretation
	volume.		
Read latency	Indicates the average time taken to complete the read operations on this volume.	Microseconds	
Write latency	Indicates the average time taken to complete write operations on this volume.	Microseconds	
Average read bandwidth	Indicates the rate at which data was read from this volume by the clients during the last measurement period.	MB/Sec	
Average write bandwidth	Indicates the rate at which data was written to this volume by the clients during the last measurement period.	MB/Sec	
Bandwidth	Indicates the rate at which data was read from and written to this volume during the last measurement period.	MB/Sec	
Average read IOPS	Indicates the average number of read operations performed on this volume per second during the last measurement period.	Reads/Sec	
Average write IOPS	Indicates the average number of write operations performed on this volume per second during the last measurement period.	Writes/Sec	

Measurement	Description	Measurement Unit	Interpretation
Total IOPS	Indicates the total number of read and write operations performed on this volume per second during the last measurement period.	IOPS	
Compression	Indicates the compression factor of this volume.	Number	This measure is calculated using the following formulae: (uniqueblocks*4096)/uniqueBlocksUsed Space where, uniqueblocks is the number of unique blocks in the volume and uniqueBlocksUsedSpace is the amount of space used by the unique blocks in the volume
De-Duplication	Indicates the de-duplication factor of this volume.	Number	This measure is the ratio of the number of nonZeroBlocks to the number of uniqueBlocks.
Thin provisioning	Indicates the thin provisioning factor of this volume.	Number	
Overall efficiency	Indicates the overall efficiency of this volume.	Number	

3.5.2 SolidFire Volume Access Groups Test

This test auto-discovers the volume access groups of the SolidFire storage system and reports the count of the volumes, initiators in each of the volume access groups and the processing ability of each of the volume access groups.

Target of the test : A SolidFire Storage System

Agent deploying the test : An internal agent

Outputs of the test : One set of results for the target SolidFire storage system.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Number of volumes deleted from this volume access group	Indicates the total number of volumes deleted from this volume access group.	Number	
Number of volumes owned by this volume access group	Indicates the number of volumes owned by this volume access group.	Number	
Number of initiators belonging to this volume access group	Indicates the number of initiators belonging to this volume access group.	Number	
Number of missing volumes to calculate efficiency data	Indicates the number of volumes that were missed from this volume access group while calculating the overall efficiency.	Number	
Compression	Indicates the compression factor of this volume access group.	Number	
De-Duplication	Indicates the de-	Number	

Measurement	Description	Measurement Unit	Interpretation
	deplication factor of this volume access group.		
Thin provisioning	Indicates the thin provisioning factor of this volume access group.	Number	
Overall efficiency	Indicates the overall efficiency of this volume access group.	Number	

3.6 The SolidFire User Accounts Layer

The testmapped to this layer helps administrators determine the current status of each user account on the target storage device, determine the overall efficiency of the volumes associated with each user account and thus figure out the user account that is locked/removed from the storage device.

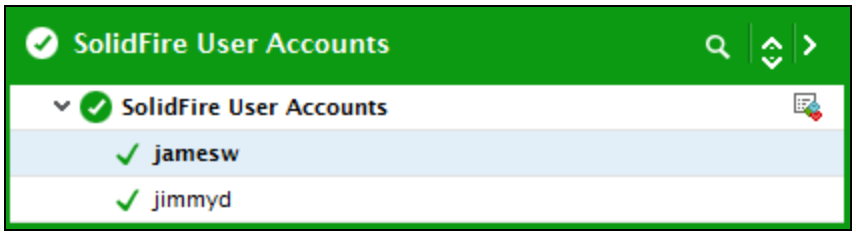

Figure 3.7: The tests mapped to the SolidFire User Accounts layer

The section that follow will discuss the test mapped to this layer in detail.

3.6.1 SolidFire User Accounts Test

The SolidFire storage system can cost-effectively deliver the required resources to drive large scale VDI environments which provide secure access to applications and data to huge number of users. With granular quality-of-service controls and a scale-out architecture, the target storage system manages the mixed and unpredictable workload profiles created by the users. The storage system allows creating the number of storage volumes to provision to the users who are accessing the applications via the authorized user accounts. For active user accounts, the storage volumes store the user data in its optimal form using the storage efficiency techniques such as thin provisioning, always-on deduplication and compression. This ensures that the users can read/write data quickly. This also ensures optimal utilization of storage space on the storage system and seamless user experience. For any reason, if the volumes become inaccessible or the data is not stored using the

storage efficiency techniques, efficiency of the volumes may degrade. Subsequently, the users may not be able to access the storage volumes. and this would hence, impact the performance of the storage system as well as the user experience. To avoid such adversities, administrators should closely monitor efficiency of the volumes associated with each user. This is where the **SolidFire User Accounts** test helps administrators!

This test reports the current status of each user account on the target storage device and also helps administrators figure out the overall efficiency of the volumes associated with each user account.

Target of the test : A SolidFire Storage

Agent deploying the test : An internal agent

Outputs of the test : One set of results for each user account associated with the target storage device.

Configurable parameters for the test

Parameter	Description
Test Period	How often should the test be executed.
Host	The IP address of the host for which this test is to be configured.
Port	The port at which the server listens.
SolidFire API Version	Specify the API version of the SolidFire storage system to be monitored.
SolidFire Username and SolidFire Password	Provide the credentials of a user who has been assigned with a **Monitor** role to access the SolidFire storage system in the SolidFire Username and SolidFire Password text boxes.
Confirm Password	Confirm the SolidFire Password by retyping it here.

Measurements made by the test

Measurement	Description	Measurement Unit	Interpretation
Current status of the account	Indicates the current status of this user account.		The values that this measure can report and their corresponding numeric values have been discussed 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>Active</td><td>0</td></tr>
<tr><td>Locked</td><td>1</td></tr>
<tr><td>Removed</td><td>2</td></tr>
</table>
Note:
By default, this measure reports the States listed in the table above to indicate the current status of this user account. The graph of this measure however, represents the same using the numeric equivalents only.
</td></tr>
<tr><td>Number of volumes owned by this account</td><td>Indicates the number of volumes in the storage device that are currently owned by this user account.</td><td>Number</td><td></td></tr>
<tr><td>Number of missing volumes to calculate efficiency data</td><td>Indicates the number of volumes that were missing while calculating the efficiency data for this user account.</td><td>Number</td><td></td></tr>
<tr><td>Compression</td><td>Indicates the amount of space that is currently saved by compressing the data of the volume associated with this user account.</td><td>Number</td><td></td></tr>
<tr><td>De-Duplication</td><td>Indicates the amount of space that is currently saved by not duplicating the data to the volumes associated with this user account.</td><td>Number</td><td></td></tr>
</table>

Measurement	Description	Measurement Unit	Interpretation
Thin provisioning	Indicates the ratio of space utilized in the volume associated with this user account to the amount of space allocated for storing the data.	Number	
Overall efficiency	Indicates the overall efficiency of the volume associated with this user account.	Number	This measure is the sum total of the *Compression, Deduplication* and the *Thin provisioning* measures.

About eG Innovations

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

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

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