# Monitor StorageGRID system

StorageGRID software

NetApp
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# Table of Contents


Monitor StorageGRID system . . . 1
Monitor a StorageGRID system . . . 1
View and manage the dashboard . . . 1
View the dashboard . . . 2
Manage dashboards . . . 3
Configure dashboards . . . 3
View the Nodes page . . . 4
View the Nodes page . . . 4
View the Overview tab . . . 6
View the Hardware tab . . . 8
View the Network tab . . . 24
View the Storage tab . . . 25
View the Objects tab . . . 27
View the ILM tab . . . 29
Use the Tasks tab . . . 30
View the Load balancer tab . . . 30
View the Platform services tab . . . 32
View the Manage drives tab . . . 33
View the SANtricity System Manager tab (E-Series only) . . . 34
Information to monitor regularly . . . 36
What and when to monitor . . . 36
Monitor system health . . . 36
Monitor storage capacity . . . 41
Monitor information lifecycle management . . . 49
Monitor networking and system resources . . . 50
Monitor tenant activity . . . 53
Monitor S3 client operations . . . 57
Monitor load balancing operations . . . 59
Monitor grid federation connections . . . 60
Manage alerts . . . 65
Manage alerts . . . 65
View alert rules . . . 66
Create custom alert rules . . . 67
Edit alert rules . . . 70
Disable alert rules . . . 73
Remove custom alert rules . . . 74
Manage alert notifications . . . 74
Alerts reference . . . 82
Commonly used Prometheus metrics . . . 94
Log files reference . . . 100
Log files reference . . . 100
StorageGRID software logs . . . 103
Deployment and maintenance logs . . . 109

About the bycast.log . . . 110
Configure audit message and log destinations . . . 118
Considerations for using an external syslog server . . . 118
Configure audit messages and external syslog server . . . 123
Use SNMP monitoring . . . 132
Use SNMP monitoring . . . 132
Configure the SNMP agent . . . 133
Update the SNMP agent . . . 140
Access MIB files . . . 141
Collect additional StorageGRID data . . . 143
Use charts and graphs . . . 143
Use text reports . . . 155
Monitor PUT and GET performance . . . 159
Monitor object verification operations . . . 160
Monitor events . . . 162
Review audit messages . . . 166
Collect log files and system data . . . 167
Manually trigger an AutoSupport package . . . 169
View the Grid Topology tree . . . 169
Review support metrics . . . 170
Run diagnostics . . . 172
Create custom monitoring applications . . . 177

# Monitor StorageGRID system

## Monitor a StorageGRID system

Monitor your StorageGRID system regularly to ensure it is performing as expected.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.

> To change units for the storage values displayed in the Grid Manager, select the user drop-down in the upper right of the Grid Manager, then select **User preferences**.

**About this task**

These instructions describe how to:

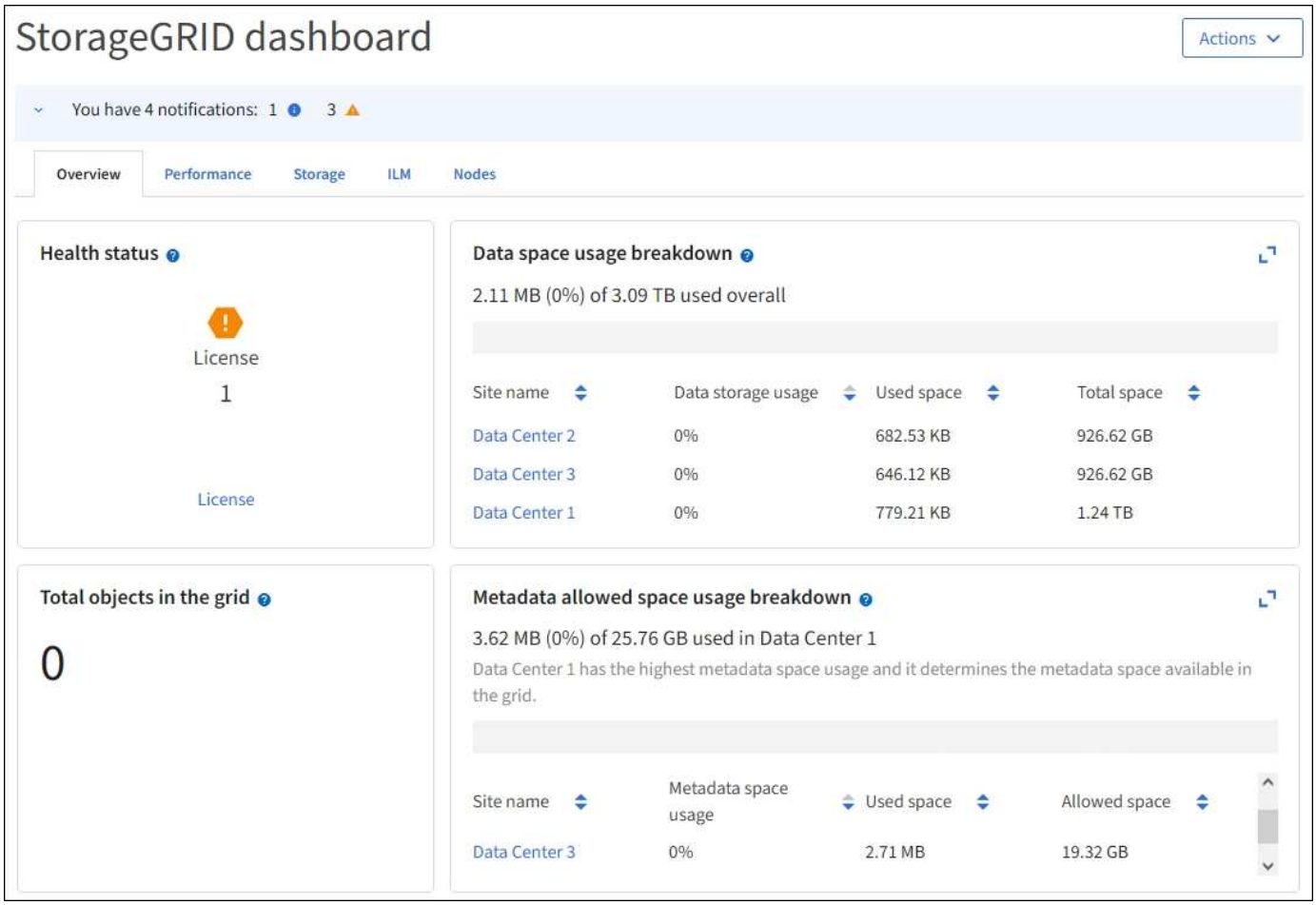
- View and manage the dashboard
- View the Nodes page
- Monitor these aspects of the system regularly:
  - System health
  - Storage capacity
  - Information lifecycle management
  - Networking and system resources
  - Tenant activity
  - Load balancing operations
  - Grid federation connections
- Manage alerts
- View log files
- Configure audit messages and log destinations
- Use an external syslog server to collect audit information
- Use SNMP for monitoring
- Obtain additional StorageGRID data, including metrics and diagnostics

## View and manage the dashboard

You can use the dashboard to monitor system activities at a glance. You can create custom dashboards to monitor your implementation of StorageGRID.

> To change units for the storage values displayed in the Grid Manager, select the user drop-down in the upper right of the Grid Manager, then select **User preferences**.

Your dashboard might be different based on system configuration.




## View the dashboard

The dashboard consists of tabs that contain specific information about the StorageGRID system. Each tab contains categories of information displayed on cards.

You can use the system-provided dashboard as is. Additionally, you can create custom dashboards that contain only the tabs and cards that are relevant to monitoring your implementation of StorageGRID.

The system-provided dashboard tabs contain cards with the following types of information:

| Tab on system-provided dashboard | Contains |
|---|---|
| Overview | General information about the grid, such as active alerts, space usage, and total objects in the grid. |
| Performance | Space usage, storage used over time, S3 operations, request duration, error rate. |
| Storage | Tenant quota usage and logical space usage. Forecasts of space usage for user data and metadata. |
| ILM | Information lifecycle management queue and evaluation rate. |

| Tab on system-provided dashboard | Contains |
| --- | --- |
| Nodes | CPU, data, and memory usage by node. S3 operations by node. Node to site distribution. |

Some of the cards can be maximized for easier viewing. Select the maximize icon in the upper right corner of the card. To close a maximized card, select the minimize icon or select **Close**.

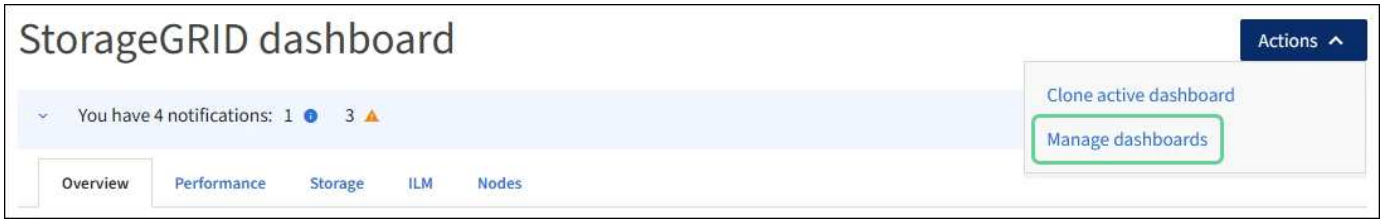
## Manage dashboards

If you have Root access (see Admin group permissions), you can perform the following management tasks for dashboards:

- Create a custom dashboard from scratch. You can use custom dashboards to control which StorageGRID information is displayed and how that information is organized.
- Clone a dashboard to create custom dashboards.
- Set an active dashboard for a user. The active dashboard can be the system-provided dashboard or a custom dashboard.
- Set a default dashboard, which is what all users see unless they activate their own dashboard.
- Edit a dashboard name.
- Edit a dashboard to add or remove tabs and cards. You can have a minimum of 1 and a maximum of 20 tabs.
- Remove a dashboard.

If you have any other permission besides Root access, you can only set an active dashboard.

To manage dashboards, select **Actions** > **Manage dashboards**.




## Configure dashboards

To create a new dashboard by cloning the active dashboard, select **Actions** > **Clone active dashboard**.

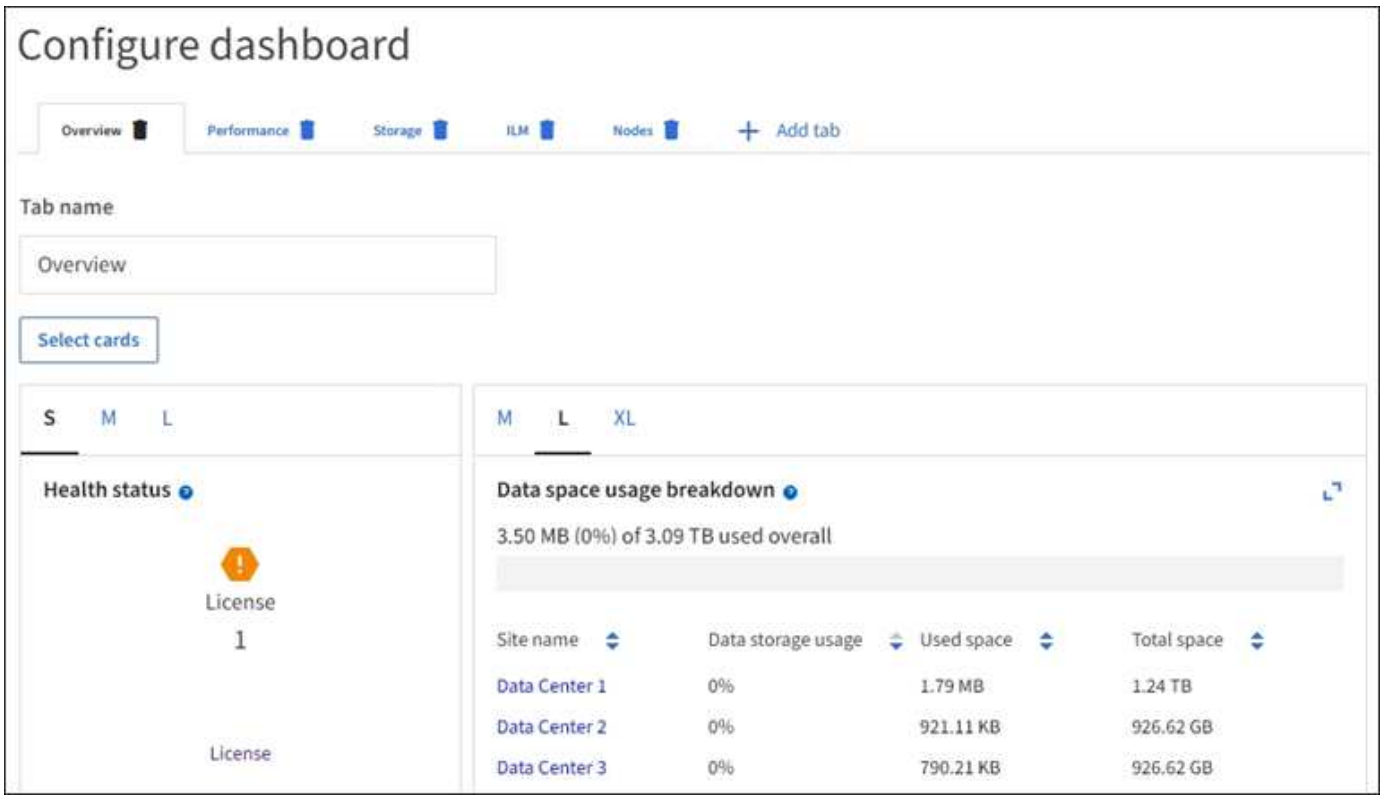
To edit or clone an existing dashboard, select **Actions** > **Manage dashboards**.

The system-provided dashboard can't be edited or removed.

When configuring a dashboard, you can:

- Add or remove tabs
- Rename tabs and give new tabs unique names

- Add, remove, or rearrange (drag) cards for each tab
- Select the size for individual cards by selecting **S**, **M**, **L** or **XL** at the top of the card




# View the Nodes page

## View the Nodes page

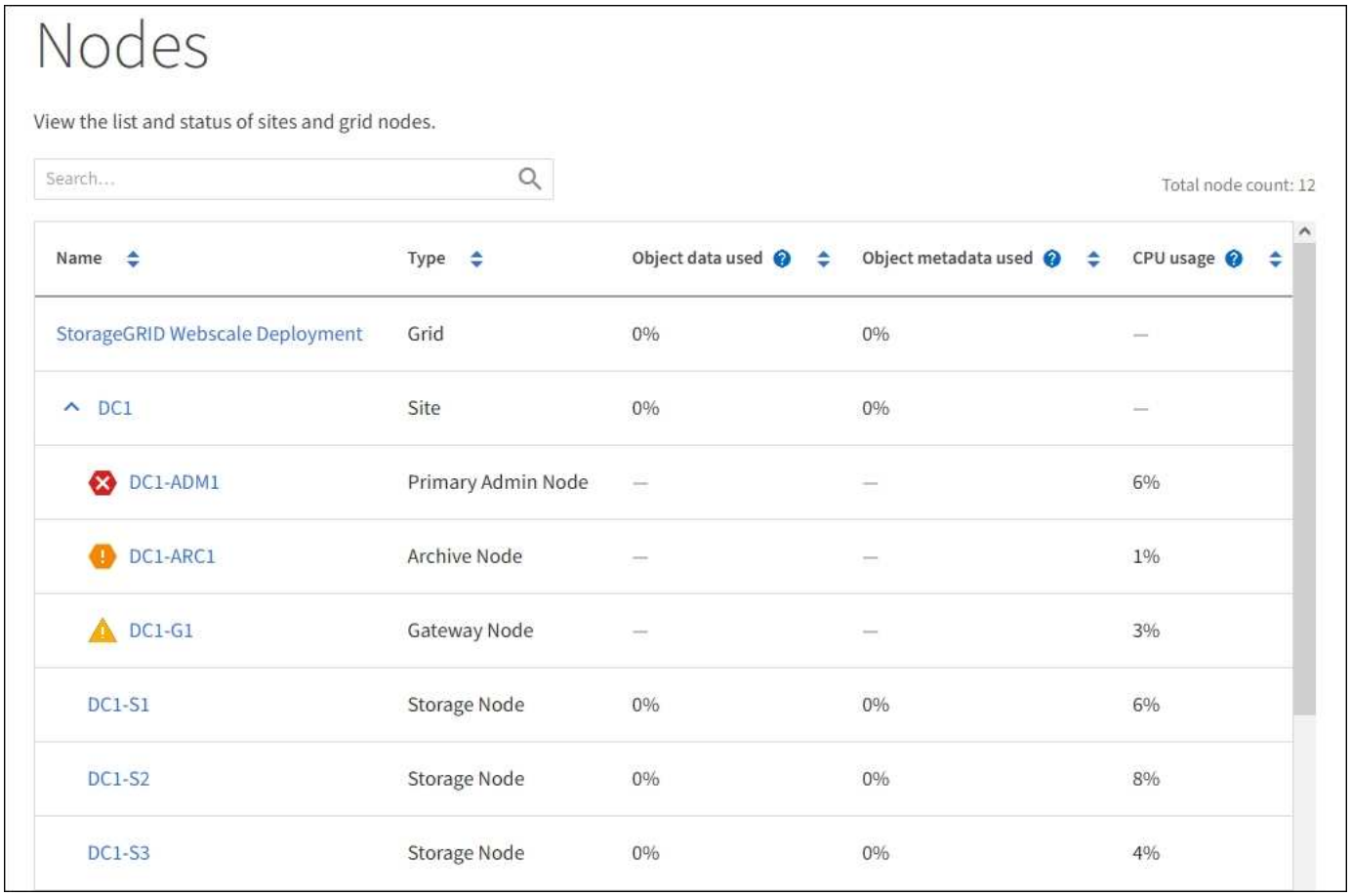
When you need more detailed information about your StorageGRID system than the dashboard provides, you can use the Nodes page to view metrics for the entire grid, each site in the grid, and each node at a site.

The Nodes table lists summary information for the entire grid, each site, and each node. If a node is disconnected or has an active alert, an icon appears next to the node name. If the node is connected and has no active alerts, no icon is shown.

When a node is not connected to the grid, such as during upgrade or a disconnected state, certain metrics might be unavailable or excluded from site and grid totals. After a node reconnects to the grid, wait several minutes for the values to stabilize.

To change units for the storage values displayed in the Grid Manager, select the user drop-down in the upper right of the Grid Manager, then select **User preferences**.

The screenshots shown are examples. Your results might vary depending on your StorageGRID version.




### Connection state icons

If a node is disconnected from the grid, either of the following icons appears next to the node name.

| Icon | Description | Action required |
|---|---|---|
| | **Not connected - Unknown**<br><br>For an unknown reason, a node is disconnected or services on the node are unexpectedly down. For example, a service on the node might be stopped, or the node might have lost its network connection because of a power failure or unexpected outage.<br><br>The **Unable to communicate with node** alert might also be triggered. Other alerts might also be active. | Requires immediate attention. Select each alert and follow the recommended actions.<br><br>For example, you might need to restart a service that has stopped or restart the host for the node.<br><br>**Note**: A node might appear as Unknown during managed shutdown operations. You can ignore the Unknown state in these cases. |

| Icon | Description | Action required |
| --- | --- | --- |
| | **Not connected - Administratively down**<br><br>For an expected reason, node is not connected to grid.<br><br>For example, the node, or services on the node, has been gracefully shut down, the node is rebooting, or the software is being upgraded. One or more alerts might also be active.<br><br>Based on the underlying issue, these nodes often go back online with no intervention. | Determine if any alerts are affecting this node.<br><br>If one or more alerts are active, Select each alert and follow the recommended actions. |

If a node is disconnected from the grid, it might have an underlying alert, but only the "Not connected" icon appears. To see the active alerts for a node, select the node.

#### Alert icons

If there is an active alert for a node, one of the following icons appears next to the node name:

**Critical**: An abnormal condition exists that has stopped the normal operations of a StorageGRID node or service. You must address the underlying issue immediately. Service disruption and loss of data might result if the issue is not resolved.

**Major**: An abnormal condition exists that is either affecting current operations or approaching the threshold for a critical alert. You should investigate major alerts and address any underlying issues to ensure that the abnormal condition does not stop the normal operation of a StorageGRID node or service.

**Minor**: The system is operating normally, but an abnormal condition exists that could affect the system's ability to operate if it continues. You should monitor and resolve minor alerts that don't clear on their own to ensure they don't result in a more serious problem.

#### View details for a system, site, or node

To filter the information shown in the Nodes table, enter a search string in the **Search** field. You can search by system name, display name, or type (for example, enter **gat** to quickly locate all Gateway Nodes).

To view the information for the grid, site, or node:

- Select the grid name to see an aggregate summary of the statistics for your entire StorageGRID system.
- Select a specific data center site to see an aggregate summary of the statistics for all nodes at that site.
- Select a specific node to view detailed information for that node.

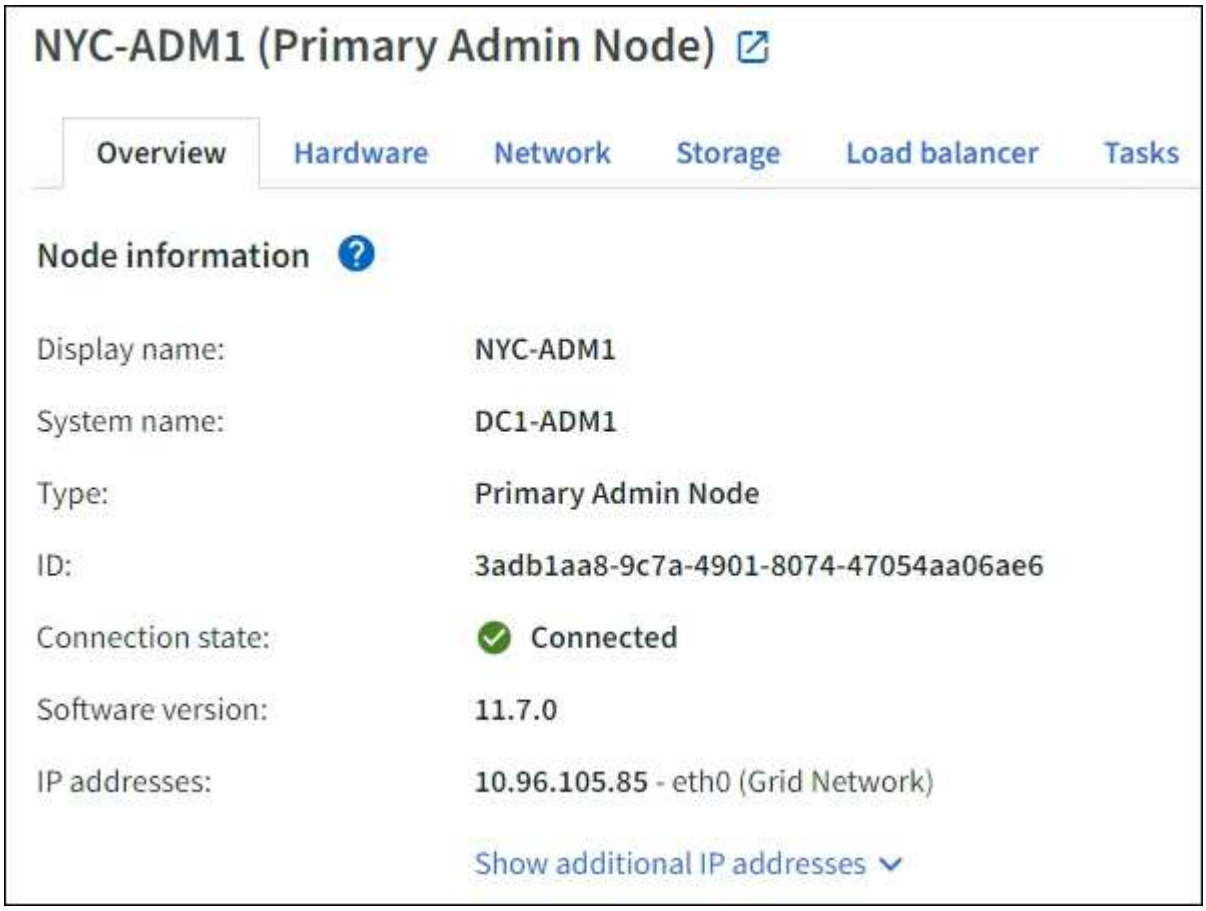
## View the Overview tab

The Overview tab provides basic information about each node. It also shows any alerts currently affecting the node.

The Overview tab is shown for all nodes.

### Node Information

The Node Information section of the Overview tab lists basic information about the node.




The overview information for a node includes the following:

- **Display name** (shown only if the node has been renamed): The current display name for the node. Use the Rename grid, sites, and nodes procedure to update this value.
- **System name**: The name you entered for the node during installation. System names are used for internal StorageGRID operations and can't be changed.
- **Type**: The type of node — Admin Node, primary Admin Node, Storage Node, or Gateway Node.
- **ID**: The unique identifier for the node, which is also referred to as the UUID.
- **Connection state**: One of three states. The icon for the most severe state is shown.
  - **Unknown**: For an unknown reason, the node is not connected to the grid, or one or more services are unexpectedly down. For example, the network connection between nodes has been lost, the power is down, or a service is down. The **Unable to communicate with node** alert might also be triggered. Other alerts might be active as well. This situation requires immediate attention.

    A node might appear as Unknown during managed shutdown operations. You can ignore the Unknown state in these cases.

**Administratively down**: The node is not connected to the grid for an expected reason. For example, the node, or services on the node, has been gracefully shut down, the node is rebooting, or the software is being upgraded. One or more alerts might also be active.

- **Connected**: The node is connected to the grid.

- **Storage used**: For Storage Nodes only.
  - **Object data**: The percentage of the total usable space for object data that has been used on the Storage Node.
  - **Object metadata**: The percentage of the total allowed space for object metadata that has been used on the Storage Node.
- **Software version**: The version of StorageGRID that is installed on the node.
- **HA groups**: For Admin Node and Gateway Nodes only. Shown if a network interface on the node is included in a high availability group and whether that interface is the Primary interface.
- **IP addresses**: The node's IP addresses. Click **Show additional IP addresses** to view the node's IPv4 and IPv6 addresses and interface mappings.

#### Alerts

The Alerts section of the Overview tab lists any alerts currently affecting this node that have not been silenced. Select the alert name to view additional details and recommended actions.

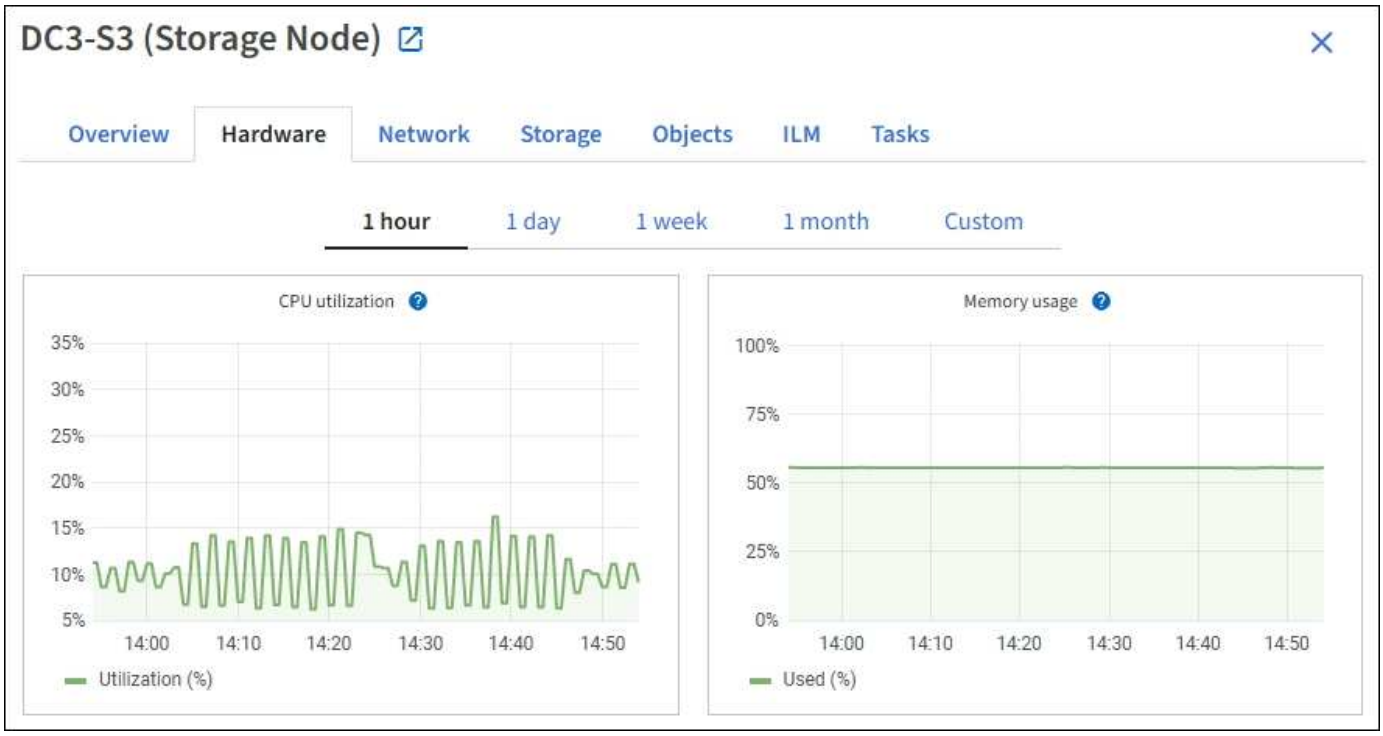

Alerts are also included for node connection states.

## View the Hardware tab

The Hardware tab displays CPU utilization and memory usage for each node, and additional hardware information about appliances.

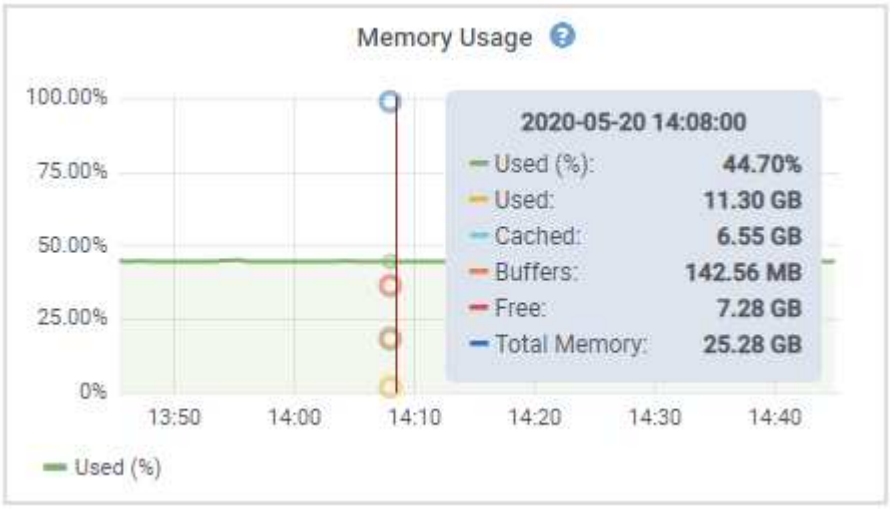
> The Grid Manager is updated with each release and might not match the example screenshots on this page.

The Hardware tab is shown for all nodes.




To display a different time interval, select one of the controls above the chart or graph. You can display the information available for intervals of 1 hour, 1 day, 1 week, or 1 month. You can also set a custom interval, which allows you to specify date and time ranges.

To see details for CPU utilization and memory usage, position your cursor over each graph.




If the node is an appliance node, this tab also includes a section with more information about the appliance hardware.

### View information about appliance Storage Nodes

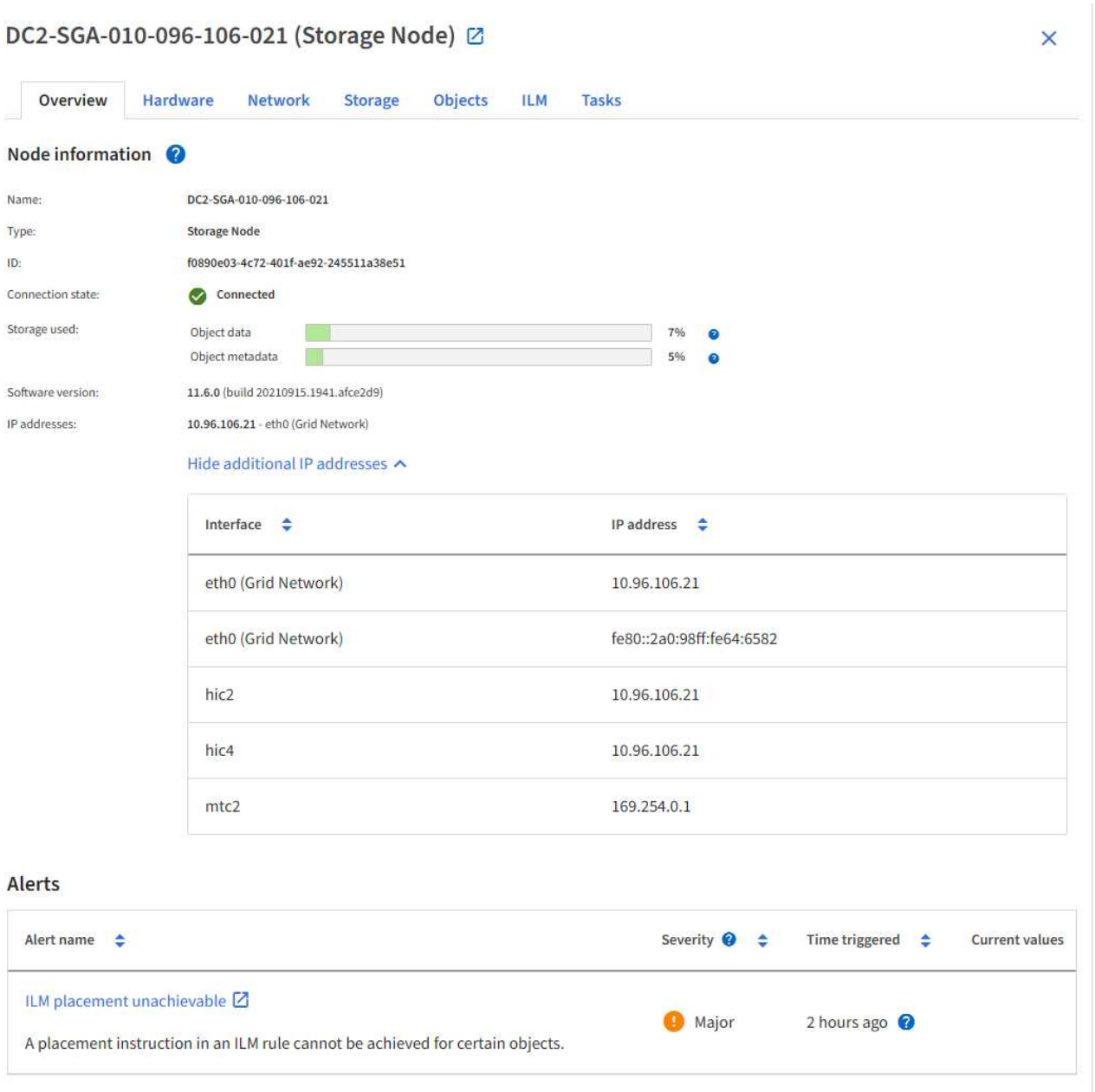
The Nodes page lists information about service health and all computational, disk device, and network resources for each appliance Storage Node. You can also see memory, storage hardware, controller firmware version, network resources, network interfaces, network addresses, and receive and transmit data.

**Steps**

1. From the Nodes page, select an appliance Storage Node.
2. Select **Overview**.

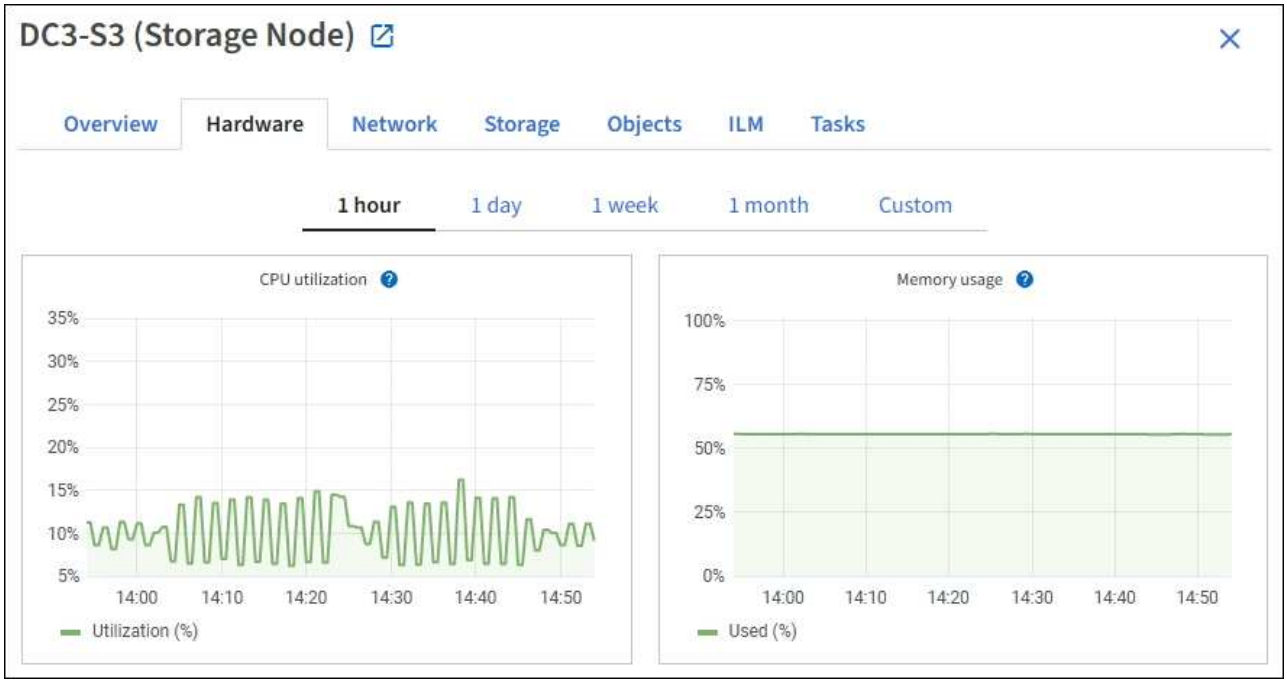
   The Node information section of the Overview tab displays summary information for the node, such as the node's name, type, ID, and connection state. The list of IP addresses includes the name of the interface for each address, as follows:

   - **eth**: The Grid Network, Admin Network, or Client Network.
   - **hic**: One of the physical 10, 25, or 100 GbE ports on the appliance. These ports can be bonded together and connected to the StorageGRID Grid Network (eth0) and Client Network (eth2).
   - **mtc**: One of the physical 1 GbE ports on the appliance. One or more mtc interfaces are bonded to form the StorageGRID Admin Network interface (eth1). You can leave other mtc interfaces available for temporary local connectivity for a technician in the data center.




   The Alerts section of the Overview tab displays any active alerts for the node.

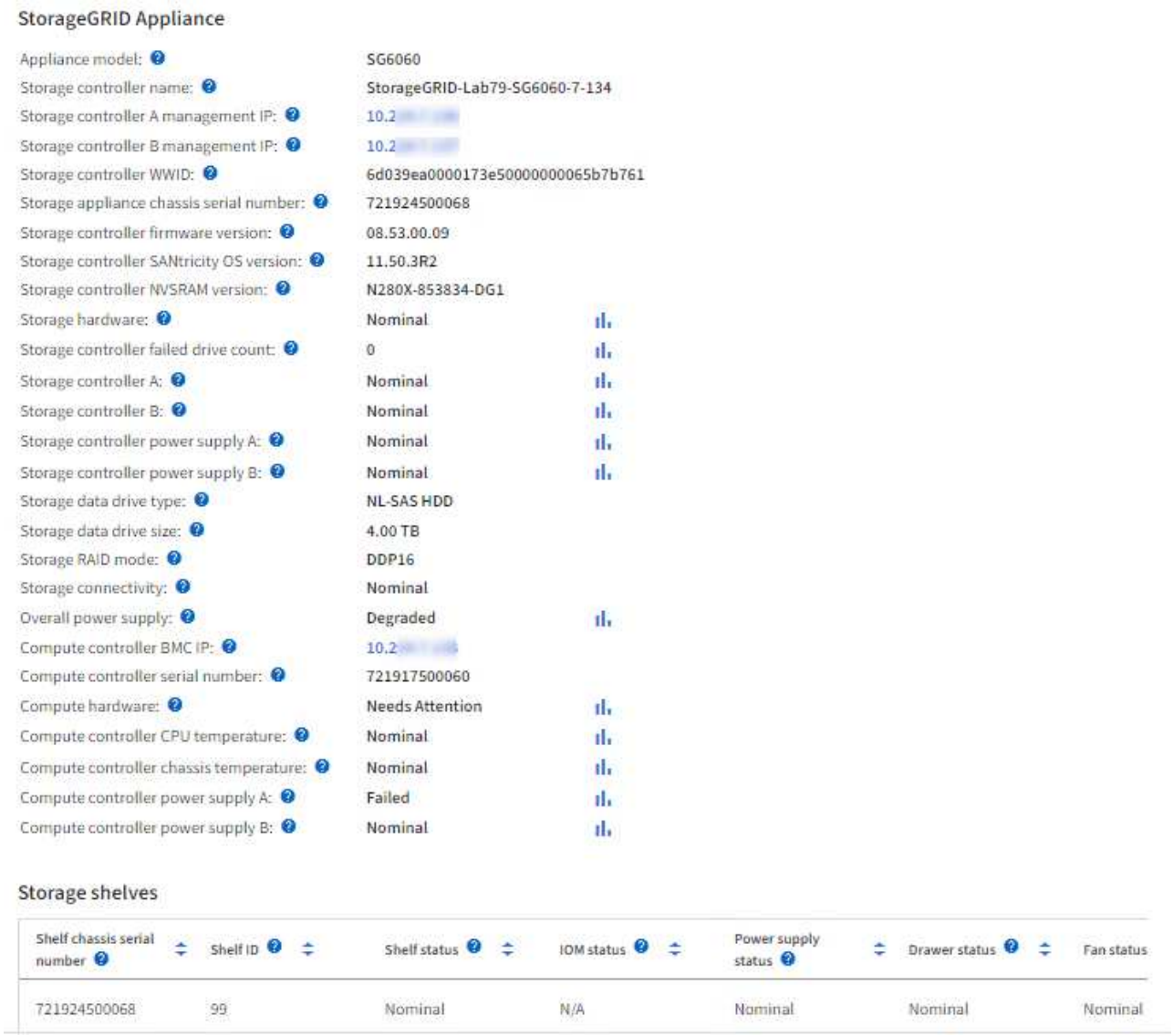
3. Select **Hardware** to see more information about the appliance.
   a. View the CPU Utilization and Memory graphs to determine the percentages of CPU and memory usage over time. To display a different time interval, select one of the controls above the chart or graph. You can display the information available for intervals of 1 hour, 1 day, 1 week, or 1 month. You can also set a custom interval, which allows you to specify date and time ranges.




   b. Scroll down to view the table of components for the appliance. This table contains information such as the model name of the appliance; controller names, serial numbers, and IP addresses; and the status of each component.

> Some fields, such as Compute controller BMC IP and Compute hardware, appear only for appliances with that feature.

   Components for the storage shelves, and expansion shelves if they are part of the installation, appear in a separate table below the appliance table.




| Field in the Appliance table | Description |
|---|---|
| Appliance model | The model number for this StorageGRID appliance shown in SANtricity OS. |
| Storage controller name | The name for this StorageGRID appliance shown in SANtricity OS. |
| Storage controller A management IP | IP address for management port 1 on storage controller A. You use this IP to access SANtricity OS to troubleshoot storage issues. |
| Storage controller B management IP | IP address for management port 1 on storage controller B. You use this IP to access SANtricity OS to troubleshoot storage issues.<br><br>Some appliance models don’t have a storage controller B. |
| Storage controller WWID | The worldwide identifier of the storage controller shown in SANtricity OS. |

| Field in the Appliance table | Description |
| --- | --- |
| Storage appliance chassis serial number | The chassis serial number of the appliance. |
| Storage controller firmware version | The version of the firmware on the storage controller for this appliance. |
| Storage controller SANtricity OS version | The SANtricity OS version of storage controller A. |
| Storage controller NVSRAM version | NVSRAM version of the storage controller as reported by SANtricity System Manager.<br><br>For the SG6060 and SG6160, if there is an NVSRAM version mismatch between the two controllers, the version of controller A displays. If controller A is not installed or operational, the version of controller B displays. |
| Storage hardware | The overall status of the storage controller hardware. If SANtricity System Manager reports a status of Needs Attention for the storage hardware, the StorageGRID system also reports this value.<br><br>If the status is "needs attention," first check the storage controller using SANtricity OS. Then, ensure that no other alerts exist that apply to the compute controller. |
| Storage controller failed drive count | The number of drives that aren’t optimal. |
| Storage controller A | The status of storage controller A. |
| Storage controller B | The status of storage controller B. Some appliance models don’t have a storage controller B. |
| Storage controller power supply A | The status of power supply A for the storage controller. |
| Storage controller power supply B | The status of power supply B for the storage controller. |
| Storage data drive type | The type of drives in the appliance, such as HDD (hard drive) or SSD (solid state drive). |

| Field in the Appliance table | Description |
| --- | --- |
| Storage data drive size | The effective size of one data drive.<br><br>For the SG6160, the size of the cache drive also displays.<br><br>**Note**: For nodes with expansion shelves, use the Data drive size for each shelf instead. Effective drive size might differ by shelf. |
| Storage RAID mode | The RAID mode configured for the appliance. |
| Storage connectivity | The storage connectivity state. |
| Overall power supply | The status of all power supplies for the appliance. |
| Compute controller BMC IP | The IP address of the baseboard management controller (BMC) port in the compute controller. You use this IP to connect to the BMC interface to monitor and diagnose the appliance hardware.<br><br>This field is not displayed for appliance models that don't contain a BMC. |
| Compute controller serial number | The serial number of the compute controller. |
| Compute hardware | The status of the compute controller hardware. This field is not displayed for appliance models that don't have separate compute hardware and storage hardware. |
| Compute controller CPU temperature | The temperature status of the compute controller's CPU. |
| Compute controller chassis temperature | The temperature status of the compute controller. |

| Column in the Storage shelves table | Description |
| --- | --- |
| Shelf chassis serial number | The serial number for the storage shelf chassis. |
| Shelf ID | The numeric identifier for the storage shelf.<br><br>• 99: Storage controller shelf<br>• 0: First expansion shelf<br>• 1: Second expansion shelf<br><br>**Note:** Expansion shelves apply only to the SG6060 and SG6160. |

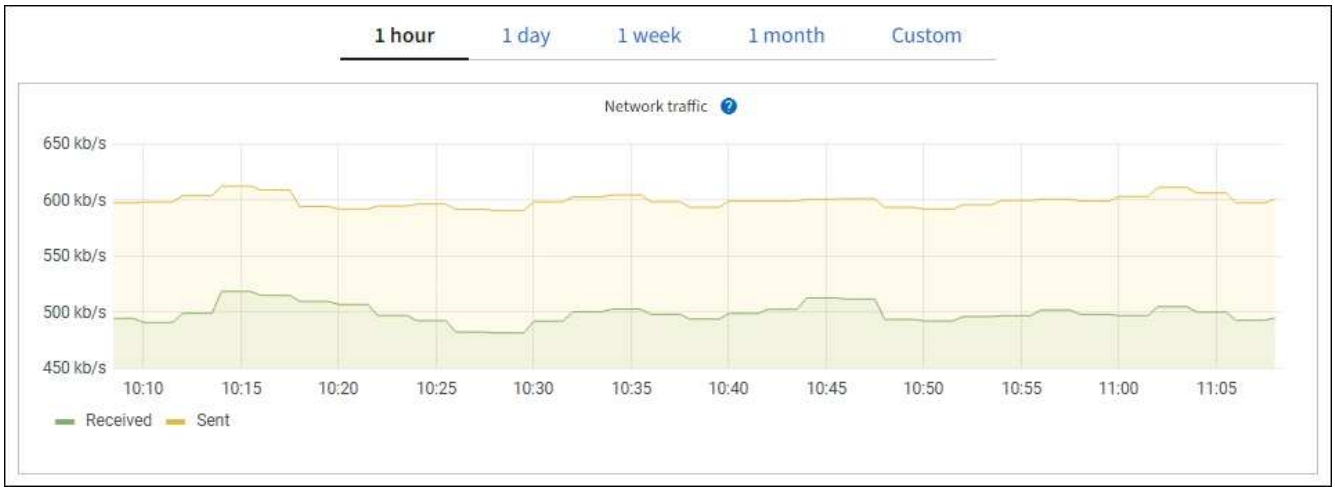
| Column in the Storage shelves table | Description |
| --- | --- |
| Shelf status | The overall status of the storage shelf. |
| IOM status | The status of the input/output modules (IOMs) in any expansion shelves. N/A if this is not an expansion shelf. |
| Power supply status | The overall status of the power supplies for the storage shelf. |
| Drawer status | The status of the drawers in the storage shelf. N/A if the shelf does not contain drawers. |
| Fan status | The overall status of the cooling fans in the storage shelf. |
| Drive slots | The total number of drive slots in the storage shelf. |
| Data drives | The number of drives in the storage shelf that are used for data storage. |
| Data drive size | The effective size of one data drive in the storage shelf. |
| Cache drives | The number of drives in the storage shelf that are used as cache. |
| Cache drive size | The size of the smallest cache drive in the storage shelf. Normally, cache drives are all the same size. |
| Configuration status | The configuration status of the storage shelf. |

c. Confirm that all statuses are "Nominal."

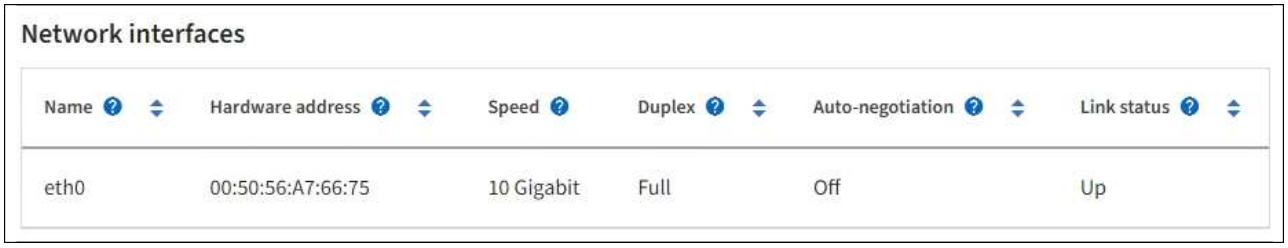
   If a status is not "Nominal," review any current alerts. You can also use SANtricity System Manager to learn more about some of these hardware values. See the instructions for installing and maintaining your appliance.

4. Select **Network** to view information for each network.

   The Network Traffic graph provides a summary of overall network traffic.




a. Review the Network Interfaces section.



**Network interfaces**

| Name | Hardware address | Speed | Duplex | Auto-negotiation | Link status |
|---|---|---|---|---|---|
| eth0 | 00:50:56:A7:66:75 | 10 Gigabit | Full | Off | Up |

Use the following table with the values in the **Speed** column in the Network Interfaces table to determine whether the 10/25-GbE network ports on the appliance were configured to use active/backup mode or LACP mode.

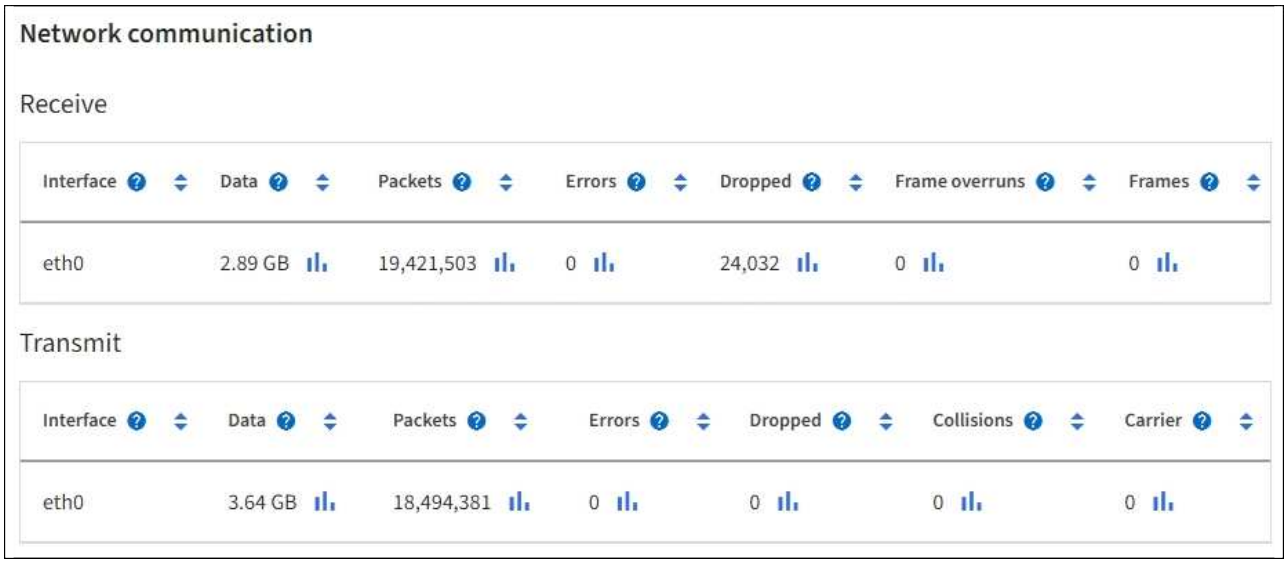
The values shown in the table assume all four links are used.

| Link mode | Bond mode | Individual HIC link speed (hic1, hic2, hic3, hic4) | Expected Grid/Client Network speed (eth0,eth2) |
|---|---|---|---|
| Aggregate | LACP | 25 | 100 |
| Fixed | LACP | 25 | 50 |
| Fixed | Active/Backup | 25 | 25 |
| Aggregate | LACP | 10 | 40 |
| Fixed | LACP | 10 | 20 |
| Fixed | Active/Backup | 10 | 10 |

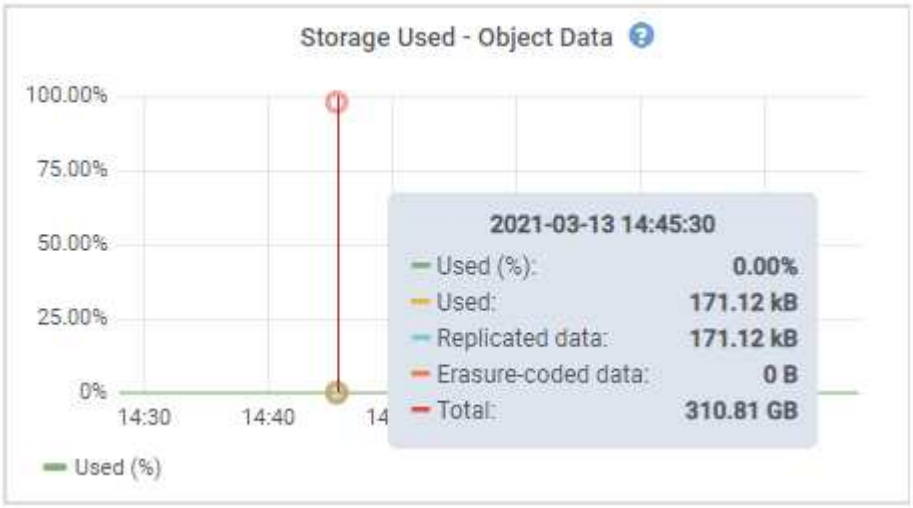
See Configure network links for more information about configuring the 10/25-GbE ports.

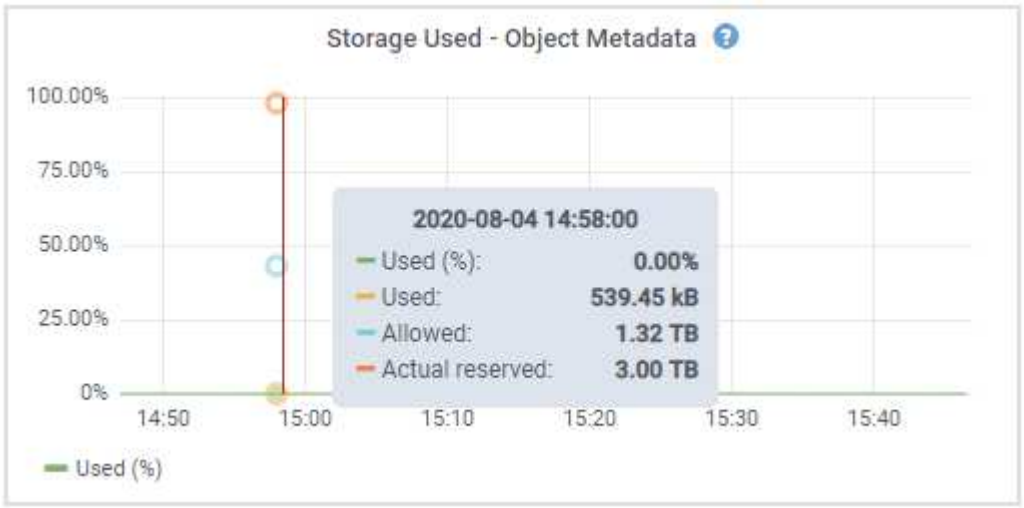
b. Review the Network Communication section.

The Receive and Transmit tables show how many bytes and packets have been received and sent across each network as well as other receive and transmit metrics.




5. Select **Storage** to view graphs that show the percentages of storage used over time for object data and object metadata, as well as information about disk devices, volumes, and object stores.

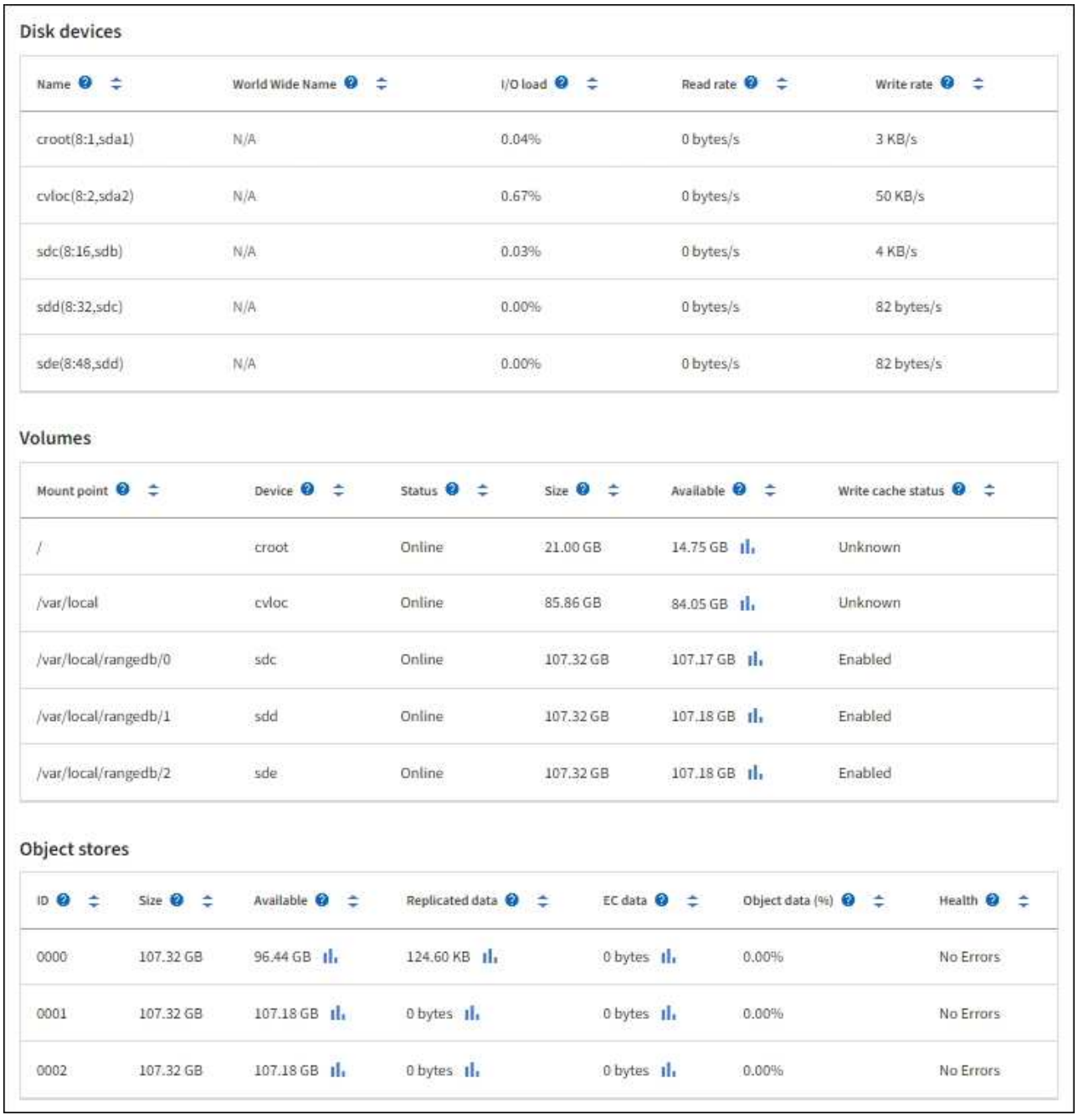


a. Scroll down to view the amounts of available storage for each volume and object store.

   The Worldwide Name for each disk matches the volume world-wide identifier (WWID) that appears when you view standard volume properties in SANtricity OS (the management software connected to the appliance's storage controller).

   To help you interpret disk read and write statistics related to volume mount points, the first portion of the name shown in the **Name** column of the Disk Devices table (that is, *sdc*, *sdd*, *sde*, and so on) matches the value shown in the **Device** column of the Volumes table.



**Disk devices**

| Name | World Wide Name | I/O load | Read rate | Write rate |
|---|---|---|---|---|
| croot(8:1,sda1) | N/A | 0.04% | 0 bytes/s | 3 KB/s |
| cvloc(8:2,sda2) | N/A | 0.67% | 0 bytes/s | 50 KB/s |
| sdc(8:16,sdb) | N/A | 0.03% | 0 bytes/s | 4 KB/s |
| sdd(8:32,sdc) | N/A | 0.00% | 0 bytes/s | 82 bytes/s |
| sde(8:48,sdd) | N/A | 0.00% | 0 bytes/s | 82 bytes/s |

**Volumes**

| Mount point | Device | Status | Size | Available | Write cache status |
|---|---|---|---|---|---|
| / | croot | Online | 21.00 GB | 14.75 GB | Unknown |
| /var/local | cvloc | Online | 85.86 GB | 84.05 GB | Unknown |
| /var/local/rangedb/0 | sdc | Online | 107.32 GB | 107.17 GB | Enabled |
| /var/local/rangedb/1 | sdd | Online | 107.32 GB | 107.18 GB | Enabled |
| /var/local/rangedb/2 | sde | Online | 107.32 GB | 107.18 GB | Enabled |

**Object stores**

| ID | Size | Available | Replicated data | EC data | Object data (%) | Health |
|---|---|---|---|---|---|---|
| 0000 | 107.32 GB | 96.44 GB | 124.60 KB | 0 bytes | 0.00% | No Errors |
| 0001 | 107.32 GB | 107.18 GB | 0 bytes | 0 bytes | 0.00% | No Errors |
| 0002 | 107.32 GB | 107.18 GB | 0 bytes | 0 bytes | 0.00% | No Errors |

### View information about appliance Admin Nodes and Gateway Nodes

The Nodes page lists information about service health and all computational, disk device, and network resources for each services appliance that is used as an Admin Node or a Gateway Node. You can also see memory, storage hardware, network resources, network interfaces, network addresses, and receive and

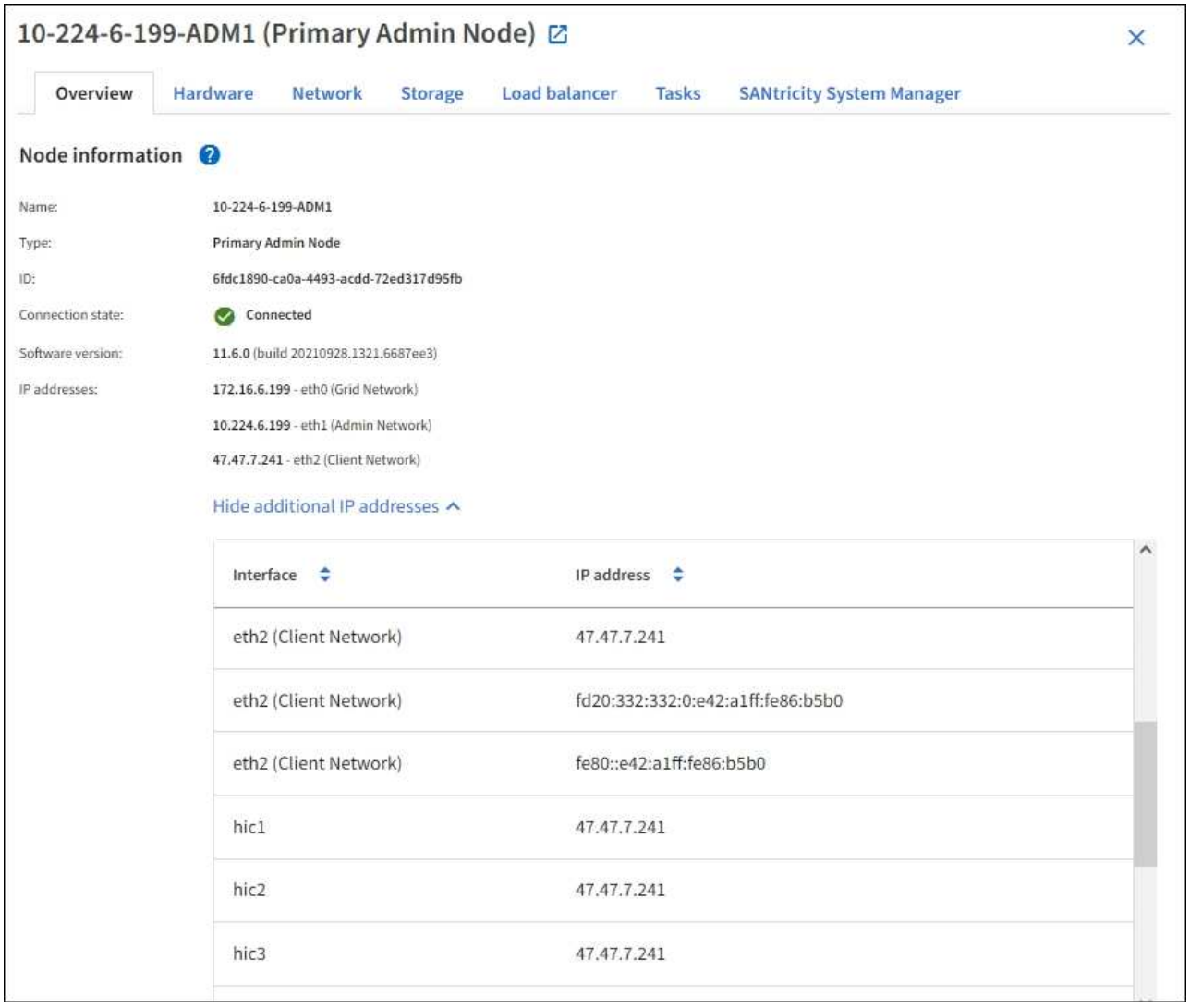
transmit data.

**Steps**

1. From the Nodes page, select an appliance Admin Node or an appliance Gateway Node.
2. Select **Overview**.

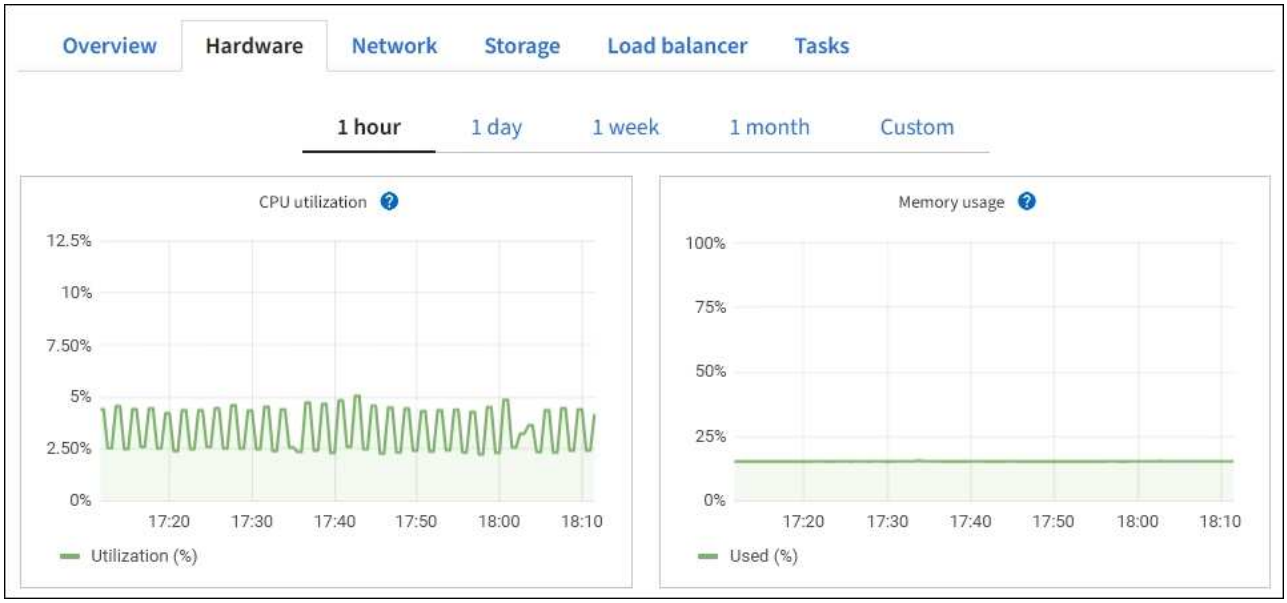
   The Node information section of the Overview tab displays summary information for the node, such as the node's name, type, ID, and connection state. The list of IP addresses includes the name of the interface for each address, as follows:

   - **adllb** and **adlli**: Shown if active/backup bonding is used for the Admin Network interface
   - **eth**: The Grid Network, Admin Network, or Client Network.
   - **hic**: One of the physical 10, 25, or 100 GbE ports on the appliance. These ports can be bonded together and connected to the StorageGRID Grid Network (eth0) and Client Network (eth2).
   - **mtc**: One of the physical 1-GbE ports on the appliance. One or more mtc interfaces are bonded to form the Admin Network interface (eth1). You can leave other mtc interfaces available for temporary local connectivity for a technician in the data center.

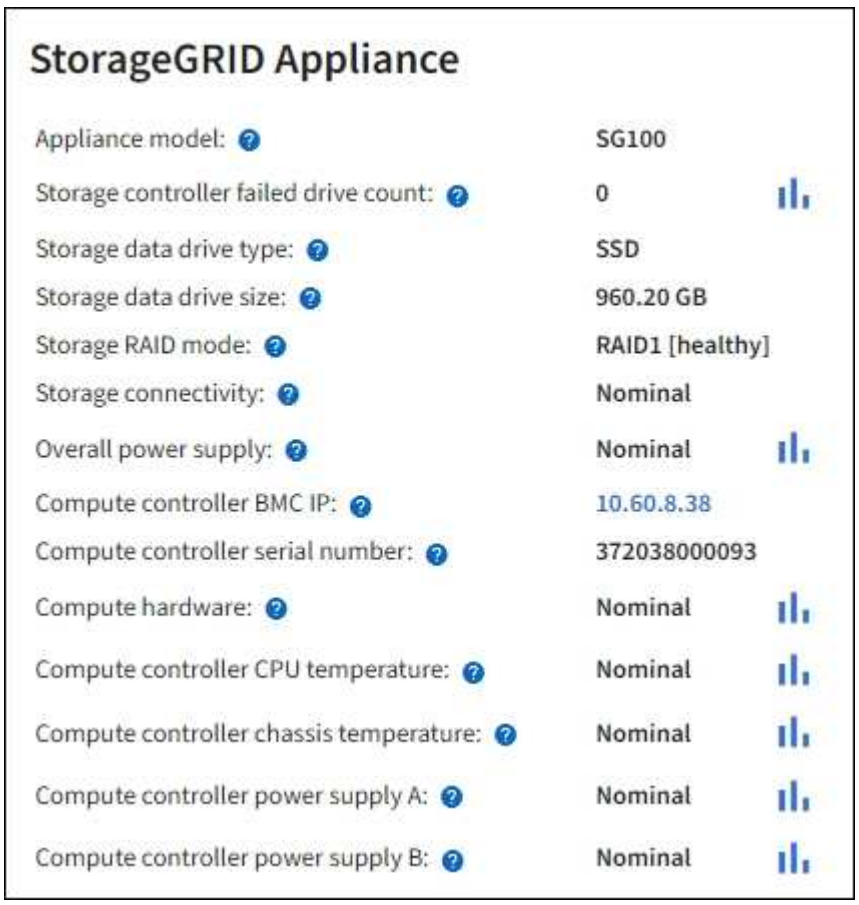



   The Alerts section of the Overview tab displays any active alerts for the node.

3. Select **Hardware** to see more information about the appliance.
   a. View the CPU Utilization and Memory graphs to determine the percentages of CPU and memory usage over time. To display a different time interval, select one of the controls above the chart or graph. You can display the information available for intervals of 1 hour, 1 day, 1 week, or 1 month. You can also set a custom interval, which allows you to specify date and time ranges.




   b. Scroll down to view the table of components for the appliance. This table contains information such as the model name, serial number, controller firmware version, and the status of each component.



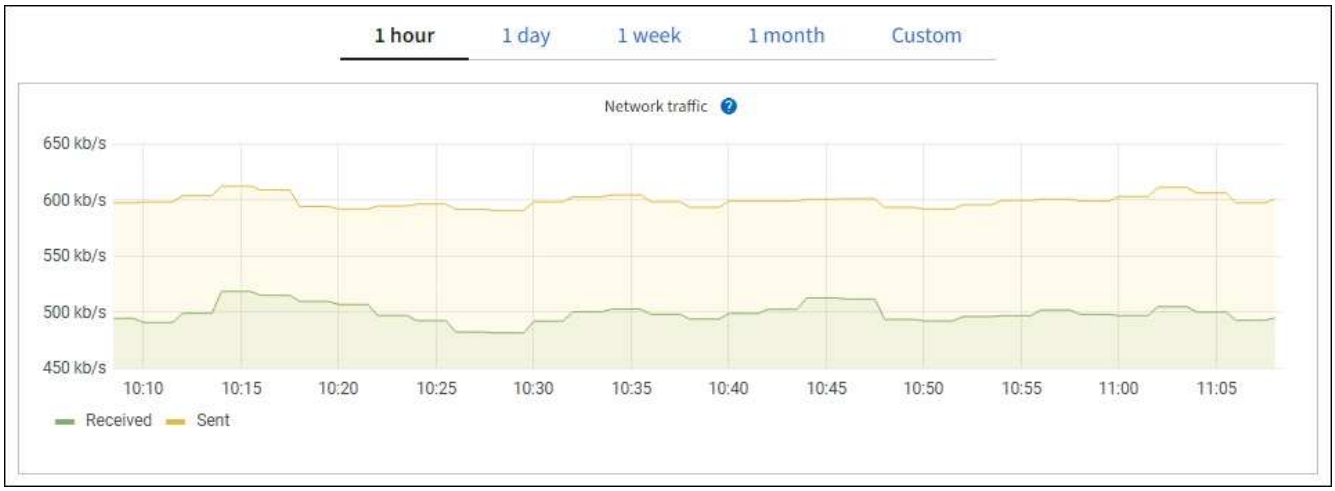
| Field in the Appliance table | Description |
| --- | --- |
| Appliance model | The model number for this StorageGRID appliance. |
| Storage controller failed drive count | The number of drives that aren't optimal. |
| Storage data drive type | The type of drives in the appliance, such as HDD (hard drive) or SSD (solid state drive). |
| Storage data drive size | The effective size of one data drive. |
| Storage RAID mode | The RAID mode for the appliance. |
| Overall power supply | The status of all power supplies in the appliance. |
| Compute controller BMC IP | The IP address of the baseboard management controller (BMC) port in the compute controller. You can use this IP to connect to the BMC interface to monitor and diagnose the appliance hardware.<br><br>This field is not displayed for appliance models that don't contain a BMC. |
| Compute controller serial number | The serial number of the compute controller. |
| Compute hardware | The status of the compute controller hardware. |
| Compute controller CPU temperature | The temperature status of the compute controller's CPU. |
| Compute controller chassis temperature | The temperature status of the compute controller. |

c. Confirm that all statuses are "Nominal."

   If a status is not "Nominal," review any current alerts.

4. Select **Network** to view information for each network.

   The Network Traffic graph provides a summary of overall network traffic.




a. Review the Network Interfaces section.

**Network interfaces**

| Name | Hardware address | Speed | Duplex | Auto-negotiation | Link status |
|---|---|---|---|---|---|
| eth0 | 0C:42:A1:86:B5:B0 | 100 Gigabit | Full | Off | Up |
| eth1 | B4:A9:FC:71:68:36 | Gigabit | Full | Off | Up |
| eth2 | 0C:42:A1:86:B5:B0 | 100 Gigabit | Full | Off | Up |
| hic1 | 0C:42:A1:86:B5:B0 | 25 Gigabit | Full | On | Up |
| hic2 | 0C:42:A1:86:B5:B0 | 25 Gigabit | Full | On | Up |
| hic3 | 0C:42:A1:86:B5:B0 | 25 Gigabit | Full | On | Up |
| hic4 | 0C:42:A1:86:B5:B0 | 25 Gigabit | Full | On | Up |
| mtc1 | B4:A9:FC:71:68:36 | Gigabit | Full | On | Up |
| mtc2 | B4:A9:FC:71:68:35 | Gigabit | Full | On | Up |

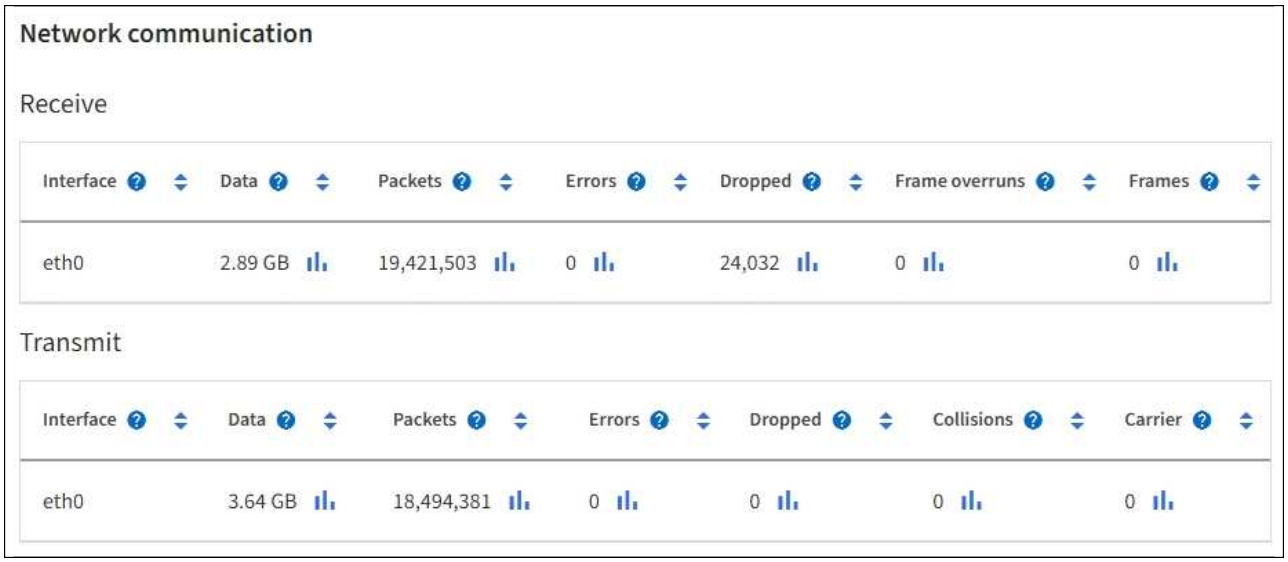
Use the following table with the values in the **Speed** column in the Network Interfaces table to determine whether the four 40/100-GbE network ports on the appliance were configured to use active/backup mode or LACP mode.

The values shown in the table assume all four links are used.

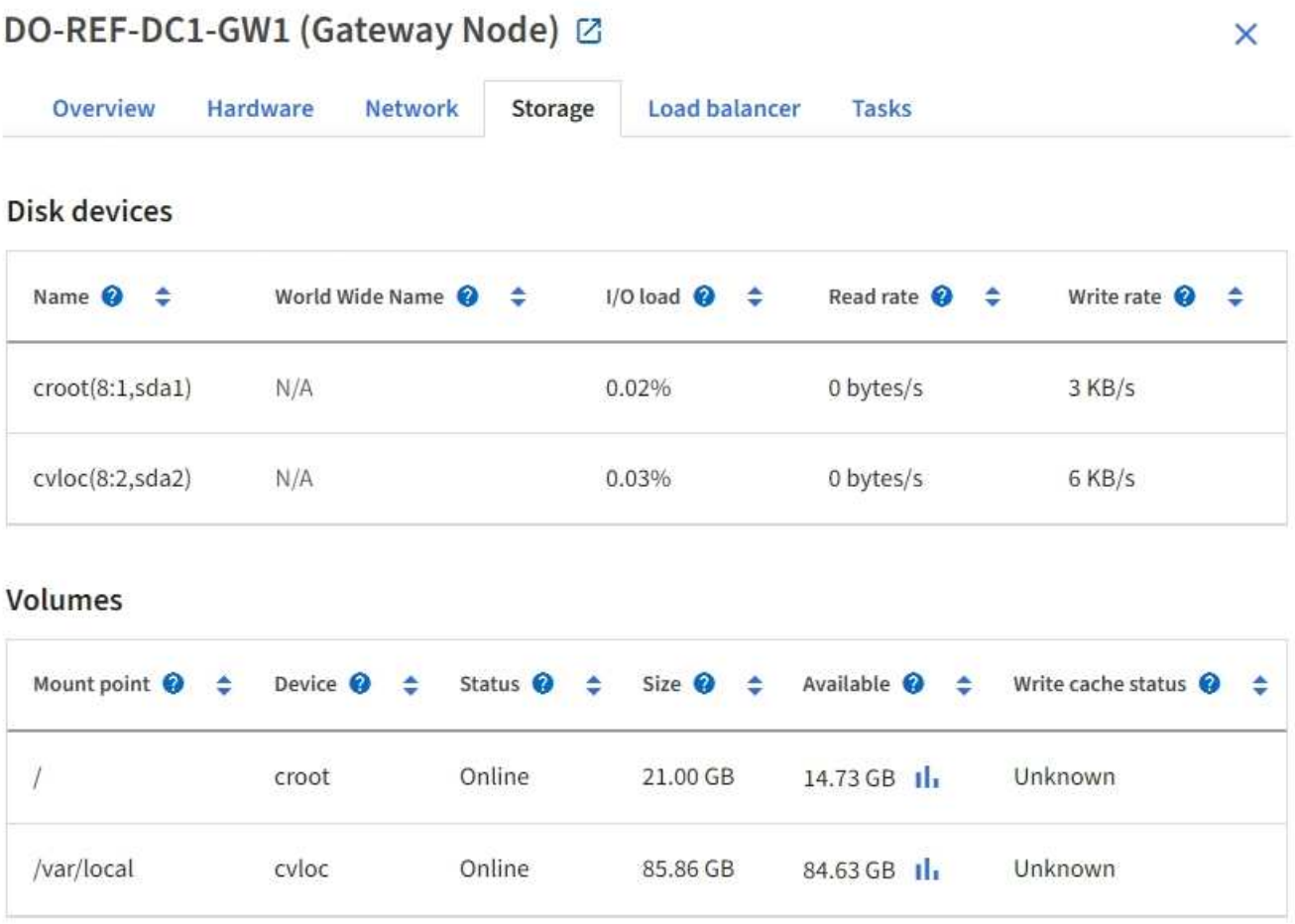
| Link mode | Bond mode | Individual HIC link speed (hic1, hic2, hic3, hic4) | Expected Grid/Client Network speed (eth0, eth2) |
|---|---|---|---|
| Aggregate | LACP | 100 | 400 |
| Fixed | LACP | 100 | 200 |
| Fixed | Active/Backup | 100 | 100 |
| Aggregate | LACP | 40 | 160 |
| Fixed | LACP | 40 | 80 |
| Fixed | Active/Backup | 40 | 40 |

b. Review the Network Communication section.

The Receive and Transmit tables show how many bytes and packets have been received and sent across each network as well as other receive and transmission metrics.




5. Select **Storage** to view information about the disk devices and volumes on the services appliance.



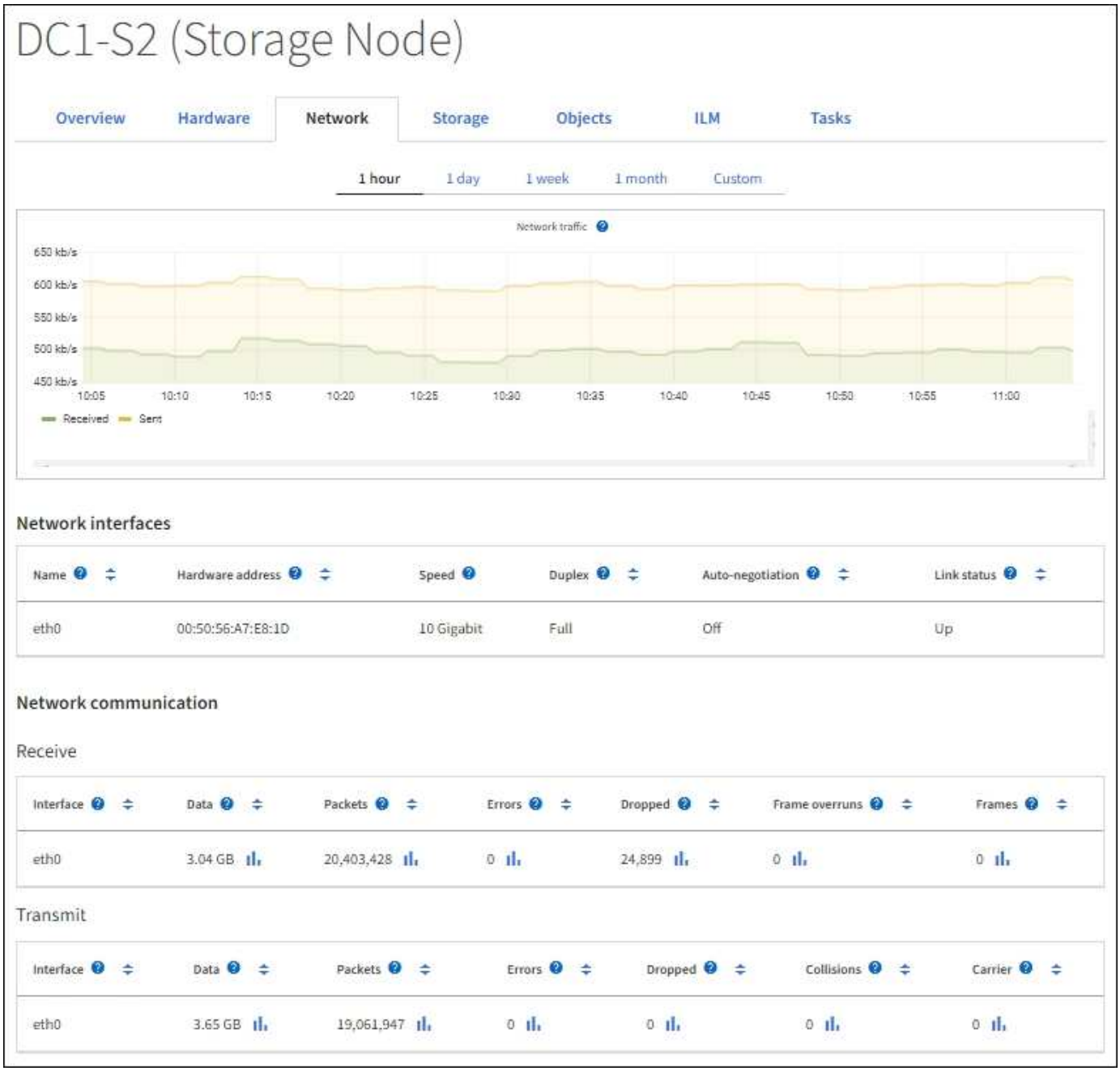

## View the Network tab

The Network tab displays a graph showing the network traffic received and sent across all of the network interfaces on the node, site, or grid.

The Network tab is shown for all nodes, each site, and the entire grid.

To display a different time interval, select one of the controls above the chart or graph. You can display the information available for intervals of 1 hour, 1 day, 1 week, or 1 month. You can also set a custom interval, which allows you to specify date and time ranges.

For nodes, the Network interfaces table provides information about each node's physical network ports. The Network communications table provides details about each node's receive and transmit operations and any driver reported fault counters.




**Related information**

Monitor network connections and performance

## View the Storage tab

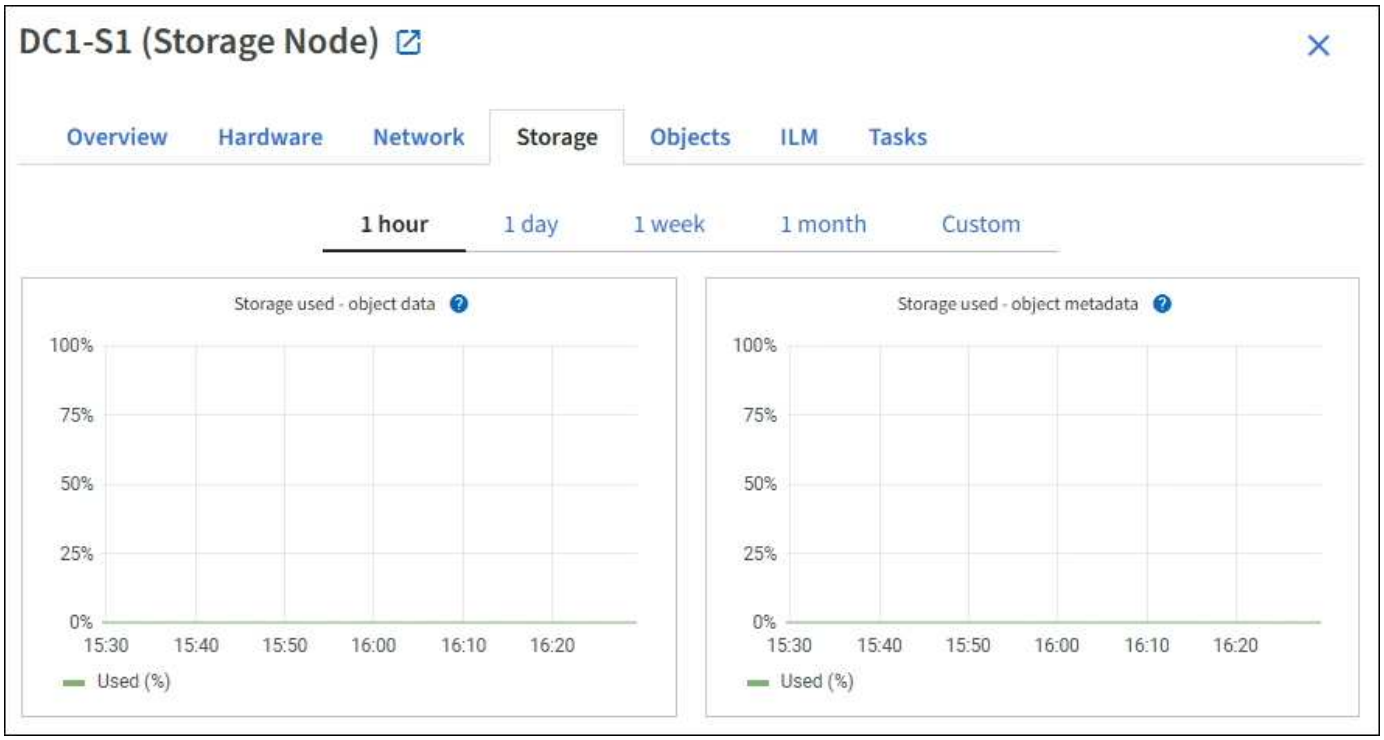
The Storage tab summarizes storage availability and other storage metrics.

The Storage tab is shown for all nodes, each site, and the entire grid.

### Storage used graphs

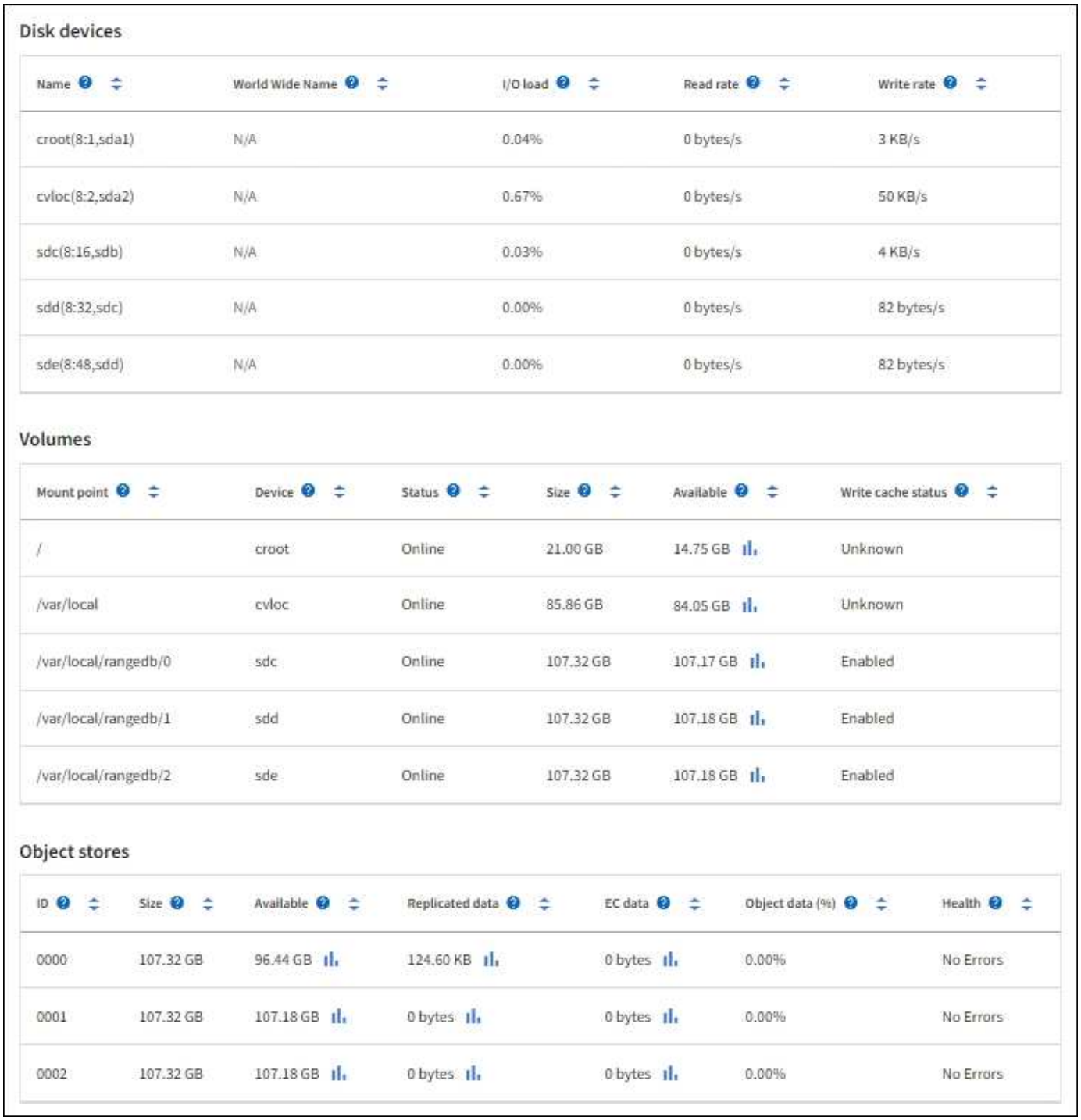
For Storage Nodes, each site, and the entire grid, the Storage tab includes graphs showing how much storage has been used by object data and object metadata over time.

When a node is not connected to the grid, such as during upgrade or a disconnected state, certain metrics might be unavailable or excluded from site and grid totals. After a node reconnects to the grid, wait several minutes for the values to stabilize.




### Disk devices, Volumes, and Object stores tables

For all nodes, the Storage tab contains details for the disk devices and volumes on the node. For Storage Nodes, the Object Stores table provides information about each storage volume.



Disk devices

| Name | World Wide Name | I/O load | Read rate | Write rate |
|---|---|---|---|---|
| croot(8:1,sda1) | N/A | 0.04% | 0 bytes/s | 3 KB/s |
| cvloc(8:2,sda2) | N/A | 0.67% | 0 bytes/s | 50 KB/s |
| sdc(8:16,sdb) | N/A | 0.03% | 0 bytes/s | 4 KB/s |
| sdd(8:32,sdc) | N/A | 0.00% | 0 bytes/s | 82 bytes/s |
| sde(8:48,sdd) | N/A | 0.00% | 0 bytes/s | 82 bytes/s |

Volumes

| Mount point | Device | Status | Size | Available | Write cache status |
|---|---|---|---|---|---|
| / | croot | Online | 21.00 GB | 14.75 GB | Unknown |
| /var/local | cvloc | Online | 85.86 GB | 84.05 GB | Unknown |
| /var/local/rangedb/0 | sdc | Online | 107.32 GB | 107.17 GB | Enabled |
| /var/local/rangedb/1 | sdd | Online | 107.32 GB | 107.18 GB | Enabled |
| /var/local/rangedb/2 | sde | Online | 107.32 GB | 107.18 GB | Enabled |

Object stores

| ID | Size | Available | Replicated data | EC data | Object data (%) | Health |
|---|---|---|---|---|---|---|
| 0000 | 107.32 GB | 96.44 GB | 124.60 KB | 0 bytes | 0.00% | No Errors |
| 0001 | 107.32 GB | 107.18 GB | 0 bytes | 0 bytes | 0.00% | No Errors |
| 0002 | 107.32 GB | 107.18 GB | 0 bytes | 0 bytes | 0.00% | No Errors |

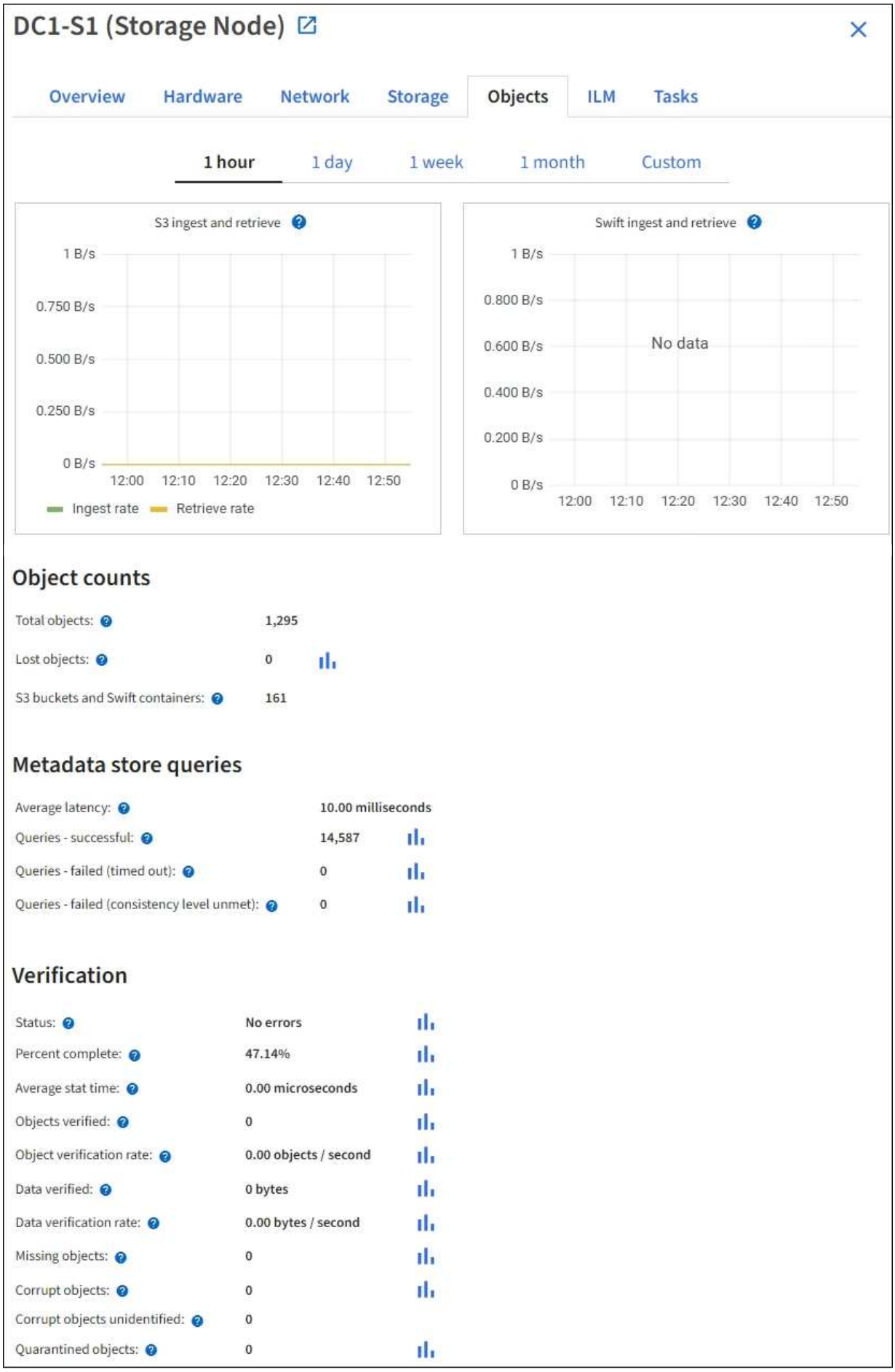
**Related information**

Monitor storage capacity

## View the Objects tab

The Objects tab provides information about S3 ingest and retrieve rates.

The Objects tab is shown for each Storage Node, each site, and the entire grid. For Storage Nodes, the Objects tab also provides object counts and information about metadata queries and background verification.

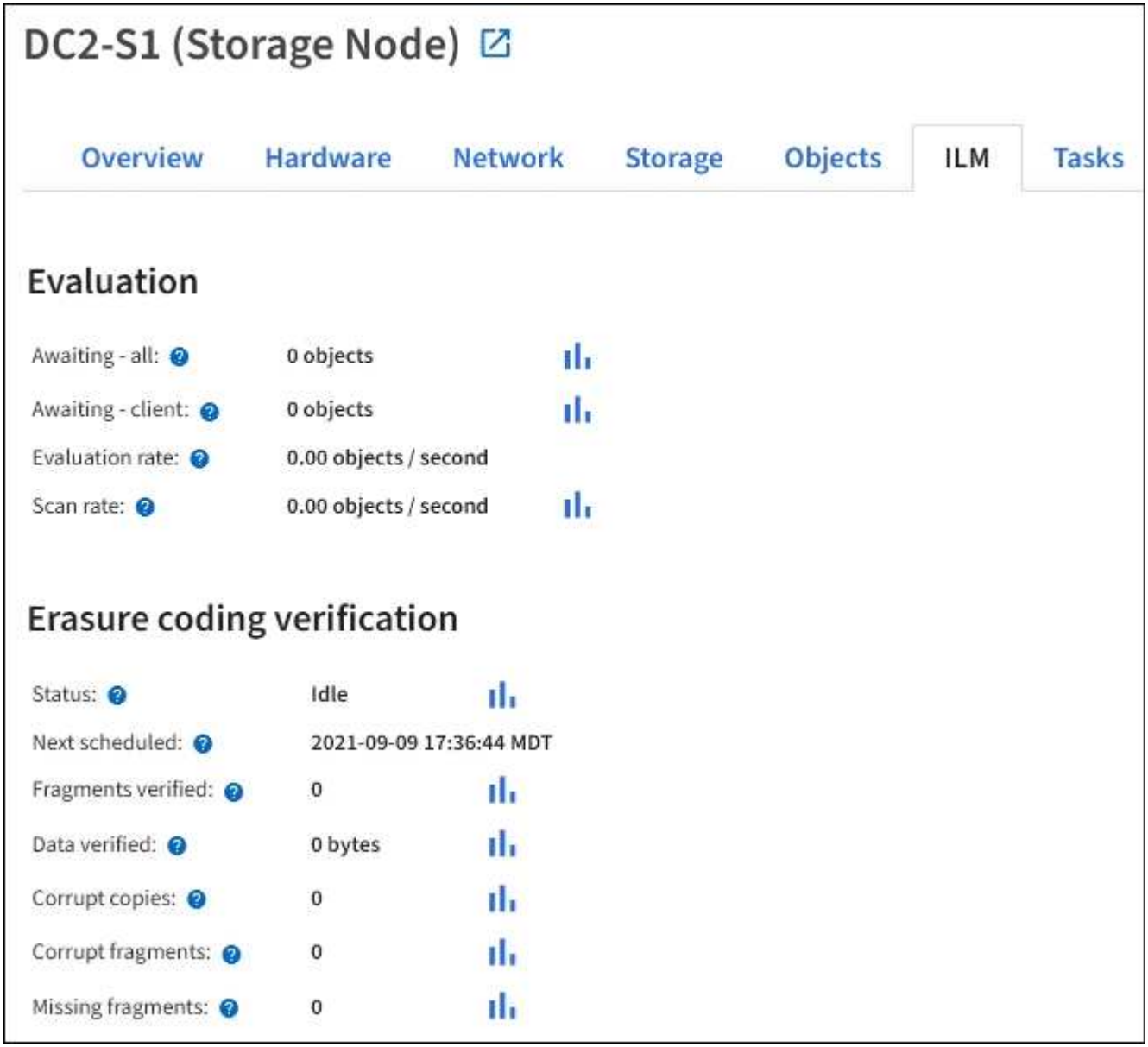

DC1-S1 (Storage Node)
Overview
Hardware
Network
Storage
Objects
ILM
Tasks
1 hour
1 day
1 week
1 month
Custom
S3 ingest and retrieve
1 B/s
0.750 B/s
0.500 B/s
0.250 B/s
0 B/s
12:00
12:10
12:20
12:30
12:40
12:50
Ingest rate
Retrieve rate
Swift ingest and retrieve
1 B/s
0.800 B/s
0.600 B/s
0.400 B/s
0.200 B/s
0 B/s
No data
12:00
12:10
12:20
12:30
12:40
12:50
Object counts
Total objects: 1,295
Lost objects: 0
S3 buckets and Swift containers: 161
Metadata store queries
Average latency: 10.00 milliseconds
Queries - successful: 14,587
Queries - failed (timed out): 0
Queries - failed (consistency level unmet): 0
Verification
Status: No errors
Percent complete: 47.14%
Average stat time: 0.00 microseconds
Objects verified: 0
Object verification rate: 0.00 objects / second
Data verified: 0 bytes
Data verification rate: 0.00 bytes / second
Missing objects: 0
Corrupt objects: 0
Corrupt objects unidentified: 0
Quarantined objects: 0

## View the ILM tab

The ILM tab provides information about information lifecycle management (ILM) operations.

The ILM tab is shown for each Storage Node, each site, and the entire grid. For each site and the grid, the ILM tab shows a graph of the ILM queue over time. For the grid, this tab also provides the estimated time to complete a full ILM scan of all objects.

For Storage Nodes, the ILM tab provides details about ILM evaluation and background verification for erasure-coded objects.




**Related information**

- Monitor information lifecycle management
- Administer StorageGRID

## Use the Tasks tab

The Tasks tab is shown for all nodes. You can use this tab to rename or reboot a node or to put an appliance node into maintenance mode.

For the complete requirements and instructions for each option on this tab, see the following:

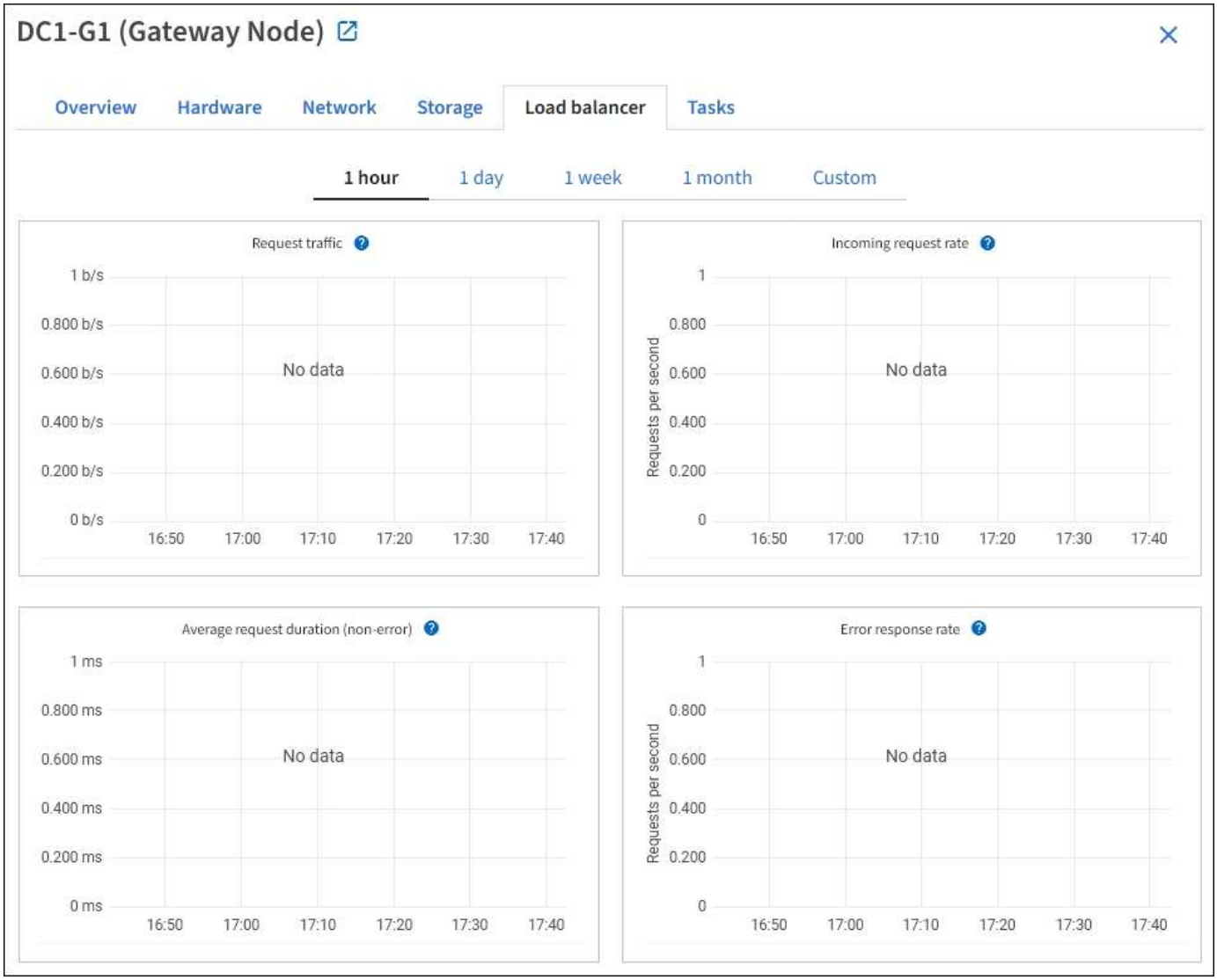
- Rename grid, sites, and nodes
- Reboot grid node
- Place appliance into maintenance mode

## View the Load balancer tab

The Load Balancer tab includes performance and diagnostic graphs related to the operation of the Load Balancer service.

The Load Balancer tab is shown for Admin Nodes and Gateway Nodes, each site, and the entire grid. For each site, the Load Balancer tab provides an aggregate summary of the statistics for all nodes at that site. For the entire grid, the Load Balancer tab provides an aggregate summary of the statistics for all sites.

If there is no I/O being run through the Load Balancer service, or there is no load balancer configured, the graphs display "No data."




### Request traffic

This graph provides a 3-minute moving average of the throughput of data transmitted between load balancer endpoints and the clients making the requests, in bits per second.

This value is updated at the completion of each request. As a result, this value might differ from the real-time throughput at low request rates or for very long-lived requests. You can look at the Network tab to get a more realistic view of the current network behavior.

### Incoming request rate

This graph provides a 3-minute moving average of the number of new requests per second, broken down by request type (GET, PUT, HEAD, and DELETE). This value is updated when the headers of a new request have been validated.

### Average request duration (non-error)

This graph provides a 3-minute moving average of request durations, broken down by request type (GET, PUT, HEAD, and DELETE). Each request duration starts when a request header is parsed by the Load Balancer service and ends when the complete response body is returned to the client.

#### Error response rate

This graph provides a 3-minute moving average of the number of error responses returned to clients per second, broken down by the error response code.

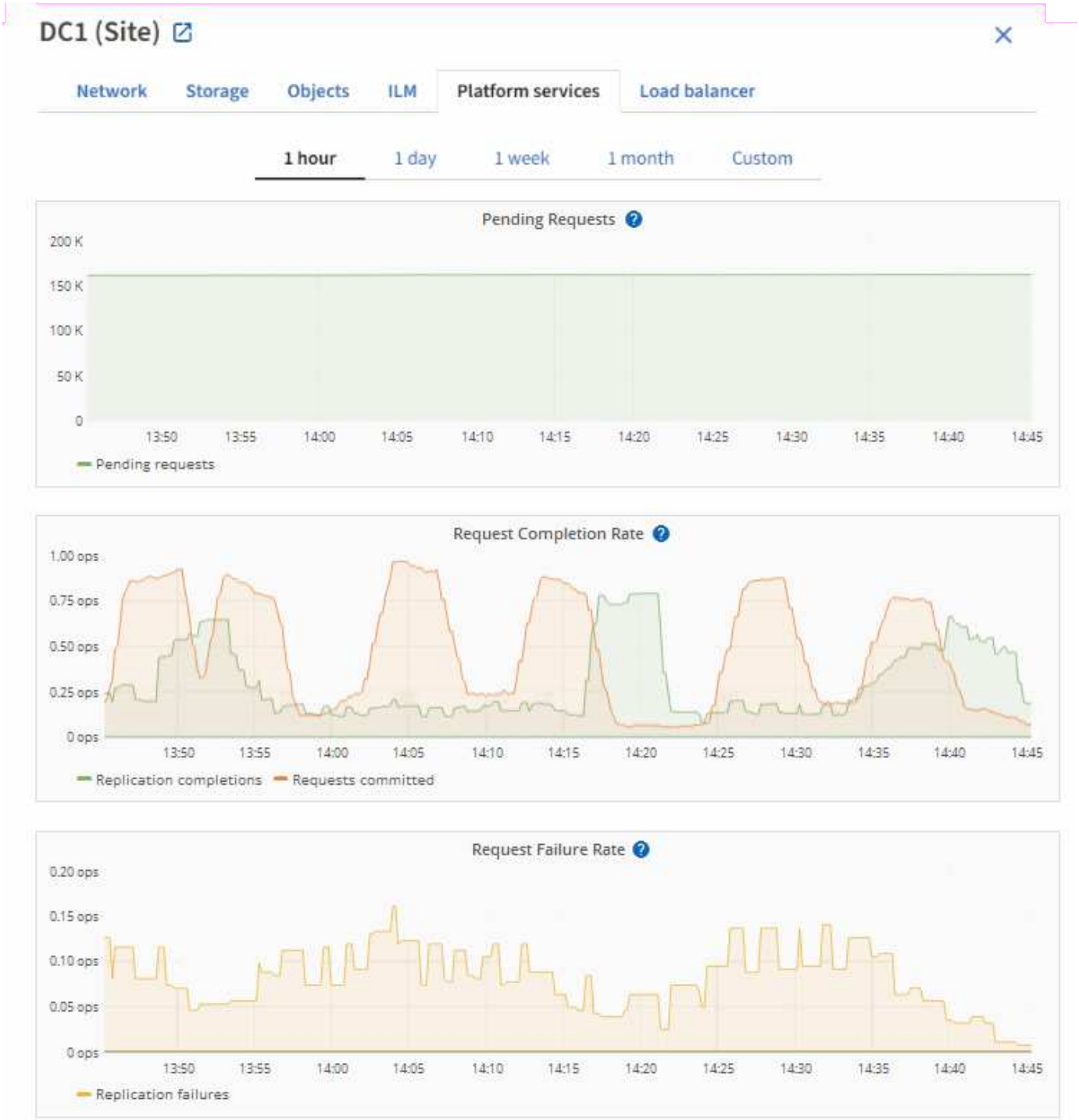
#### Related information

- Monitor load balancing operations
- Administer StorageGRID

## View the Platform services tab

The Platform services tab provides information about any S3 platform service operations at a site.

The Platform services tab is shown for each site. This tab provides information about S3 platform services, such as CloudMirror replication and the search integration service. Graphs on this tab display metrics such as the number of pending requests, request completion rate, and request failure rate.




For more information about S3 platform services, including troubleshooting details, see the instructions for administering StorageGRID.

## View the Manage drives tab

The Manage drives tab enables you to access details and perform troubleshooting and maintenance tasks on drives in the appliances that support this feature.

Using the Manage drives tab, you can do the following:

- View a layout of the data storage drives in the appliance

- View a table that lists each drive location, type, status, firmware version, and serial number
- Perform troubleshooting and maintenance functions on each drive

To access the Manage drives tab, you must have the Storage appliance administrator or Root access permission.

For information about using the Manage drives tab, see Use the Manage drives tab.

## View the SANtricity System Manager tab (E-Series only)

The SANtricity System Manager tab enables you to access SANtricity System Manager without having to configure or connect the management port of the storage appliance. You can use this tab to review hardware diagnostic and environmental information as well as issues related to the drives.

> Accessing SANtricity System Manager from the Grid Manager is generally meant only to monitor appliance hardware and configure E-Series AutoSupport. Many features and operations within SANtricity System Manager such as upgrading firmware don't apply to monitoring your StorageGRID appliance. To avoid issues, always follow the hardware maintenance instructions for your appliance. To upgrade SANtricity firmware, see the Maintenance configuration procedures for your storage appliance.

> The SANtricity System Manager tab is shown only for storage appliance nodes using E-Series hardware.

Using SANtricity System Manager, you can do the following:

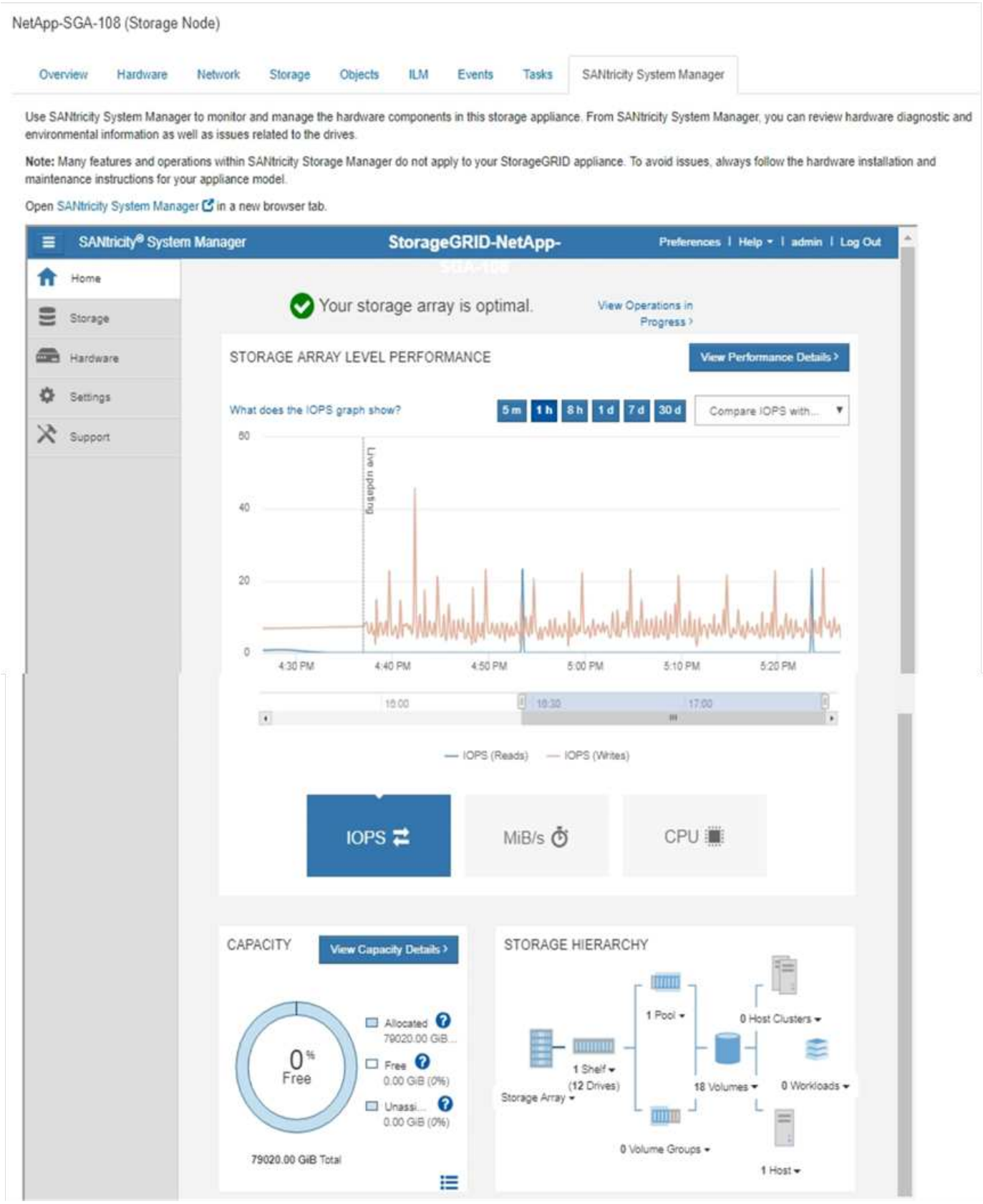
- View performance data such as storage array level performance, I/O latency, storage controller CPU utilization, and throughput.
- Check hardware component status.
- Perform support functions including viewing diagnostic data, and configuring E-Series AutoSupport.

> To use SANtricity System Manager to configure a proxy for E-Series AutoSupport, see Send E-Series AutoSupport packages through StorageGRID.

To access SANtricity System Manager through Grid Manager, you must have the Storage appliance administrator or Root access permission.

> You must have SANtricity firmware 8.70 or higher to access SANtricity System Manager using the Grid Manager.

The tab displays the home page of SANtricity System Manager.




You can use the SANtricity System Manager link to open the SANtricity System Manager in a new browser window for easier viewing.

To see details for storage array level performance and capacity usage, position your cursor over each graph.

For more details on viewing the information accessible from the SANtricity System Manager tab, see NetApp E-Series and SANtricity documentation.

# Information to monitor regularly

## What and when to monitor

Even though the StorageGRID system can continue to operate when errors occur or parts of the grid are unavailable, you should monitor and address potential issues before they affect the grid's efficiency or availability.

### Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.

### About monitoring tasks

A busy system generates large amounts of information. The following list provides guidance about the most important information to monitor on an ongoing basis.

| What to monitor | Frequency |
| --- | --- |
| System health status | Daily |
| Rate at which Storage Node object and metadata capacity is being consumed | Weekly |
| Information lifecycle management operations | Weekly |
| Networking and system resources | Weekly |
| Tenant activity | Weekly |
| S3 client operations | Weekly |
| Load balancing operations | After the initial configuration and after any configuration changes |
| Grid federation connections | Weekly |

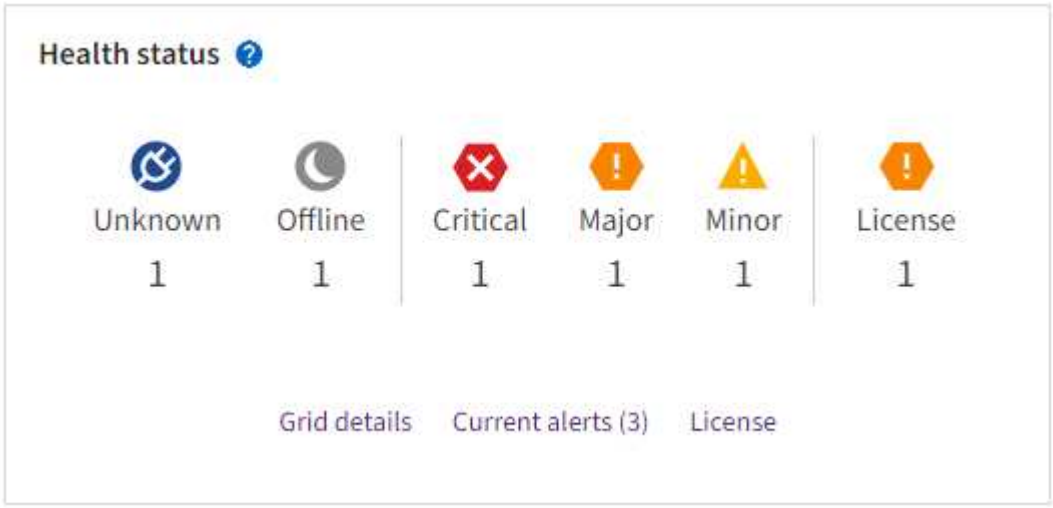
## Monitor system health

Monitor the overall health of your StorageGRID system on a daily basis.

### About this task

The StorageGRID system can continue to operate when parts of the grid are unavailable. Potential issues indicated by alerts aren't necessarily issues with system operations. Investigate issues summarized on the Health status card of the Grid Manager Dashboard.

To be notified of alerts as soon as they are triggered, you can set up email notifications for alerts or configure SNMP traps.




When issues exist, links appear that allow you to view additional details:

| Link | Appears when… |
| --- | --- |
| Grid details | Any nodes are disconnected (connection state Unknown or Administratively Down). |
| Current alerts (Critical, Major, Minor) | Alerts are currently active. |
| Recently resolved alerts | Alerts triggered in the past week are now resolved. |
| License | There is an issue with the software license for this StorageGRID system. You can update license information as needed. |

### Monitor node connection states

If one or more nodes are disconnected from the grid, critical StorageGRID operations might be affected. Monitor node connection states and address any issues promptly.

| Icon | Description | Action required |
| --- | --- | --- |
| | **Not connected - Unknown**<br><br>For an unknown reason, a node is disconnected or services on the node are unexpectedly down. For example, a service on the node might be stopped, or the node might have lost its network connection because of a power failure or unexpected outage.<br><br>The **Unable to communicate with node** alert might also be triggered. Other alerts might also be active. | Requires immediate attention. Select each alert and follow the recommended actions.<br><br>For example, you might need to restart a service that has stopped or restart the host for the node.<br><br>**Note**: A node might appear as Unknown during managed shutdown operations. You can ignore the Unknown state in these cases. |
| | **Not connected - Administratively down**<br><br>For an expected reason, node is not connected to grid.<br><br>For example, the node, or services on the node, has been gracefully shut down, the node is rebooting, or the software is being upgraded. One or more alerts might also be active.<br><br>Based on the underlying issue, these nodes often go back online with no intervention. | Determine if any alerts are affecting this node.<br><br>If one or more alerts are active, select each alert and follow the recommended actions. |
| | **Connected**<br><br>The node is connected to the grid. | No action required. |

**View current and resolved alerts**

**Current alerts**: When an alert is triggered, an alert icon is displayed on the dashboard. An alert icon is also displayed for the node on the Nodes page. If alert email notifications are configured, an email notification will also be sent, unless the alert has been silenced.

**Resolved alerts**: You can search and view a history of alerts that have been resolved.

Optionally, you have watched the video: Video: Alerts overview


The following table describes the information shown in the Grid Manager for current and resolved alerts.

| Column header | Description |
|---|---|
| Name or title | The name of the alert and its description. |
| Severity | The severity of the alert. For current alerts, if multiple alerts are grouped the title row shows how many instances of that alert are occurring at each severity.<br><br>**Critical**: An abnormal condition exists that has stopped the normal operations of a StorageGRID node or service. You must address the underlying issue immediately. Service disruption and loss of data might result if the issue is not resolved.<br><br>**Major**: An abnormal condition exists that is either affecting current operations or approaching the threshold for a critical alert. You should investigate major alerts and address any underlying issues to ensure that the abnormal condition does not stop the normal operation of a StorageGRID node or service.<br><br>**Minor**: The system is operating normally, but an abnormal condition exists that could affect the system's ability to operate if it continues. You should monitor and resolve minor alerts that don't clear on their own to ensure they don't result in a more serious problem. |
| Time triggered | **Current alerts**: The date and time the alert was triggered in your local time and in UTC. If multiple alerts are grouped, the title row shows times for the most recent instance of the alert (*newest*) and the oldest instance of the alert (*oldest*).<br><br>**Resolved alerts**: How long ago the alert was triggered. |
| Site/Node | The name of the site and node where the alert is occurring or has occurred. |
| Status | Whether the alert is active, silenced, or resolved. If multiple alerts are grouped and **All alerts** is selected in the drop-down, the title row shows how many instances of that alert are active and how many instances have been silenced. |
| Time resolved (resolved alerts only) | How long ago the alert was resolved. |

| Column header | Description |
| --- | --- |
| Current values or *data values* | The value of the metric that caused the alert to be triggered. For some alerts, additional values are shown to help you understand and investigate the alert. For example, the values shown for a **Low object data storage** alert include the percentage of disk space used, the total amount of disk space, and the amount of disk space used.<br><br>**Note:** If multiple current alerts are grouped, current values aren't shown in the title row. |
| Triggered values (resolved alerts only) | The value of the metric that caused the alert to be triggered. For some alerts, additional values are shown to help you understand and investigate the alert. For example, the values shown for a **Low object data storage** alert include the percentage of disk space used, the total amount of disk space, and the amount of disk space used. |

**Steps**

1. Select the **Current alerts** or **Resolved alerts** link to view a list of alerts in those categories. You can also view the details for an alert by selecting **Nodes** > ***node*** > **Overview** and then selecting the alert from the Alerts table.

   By default, current alerts are shown as follows:

   - The most recently triggered alerts are shown first.
   - Multiple alerts of the same type are shown as a group.
   - Alerts that have been silenced aren't shown.
   - For a specific alert on a specific node, if the thresholds are reached for more than one severity, only the most severe alert is shown. That is, if alert thresholds are reached for the minor, major, and critical severities, only the critical alert is shown.

     The Current alerts page is refreshed every two minutes.

2. To expand groups of alerts, select the down caret ⌄. To collapse individual alerts in a group, select the up caret ^, or select the group's name.
3. To display individual alerts instead of groups of alerts, clear the **Group alerts** checkbox.
4. To sort current alerts or alert groups, select the up/down arrows ⇅ in each column header.
   - When **Group alerts** is selected, both the alert groups and the individual alerts within each group are sorted. For example, you might want to sort the alerts in a group by **Time triggered** to find the most recent instance of a specific alert.
   - When **Group alerts** is cleared, the entire list of alerts is sorted. For example, you might want to sort all alerts by **Node/Site** to see all alerts affecting a specific node.
5. To filter current alerts by status (**All alerts**, **Active**, or **Silenced**, use the drop-down menu at the top of the table.

   See Silence alert notifications.

6. To sort resolved alerts:
   - Select a time period from the **When triggered** drop-down menu.

- Select one or more severities from the **Severity** drop-down menu.
- Select one or more default or custom alert rules from the **Alert rule** drop-down menu to filter on resolved alerts related to a specific alert rule.
- Select one or more nodes from the **Node** drop-down menu to filter on resolved alerts related to a specific node.

7. To view details for a specific alert, select the alert. A dialog box provides details and recommended actions for the alert you selected.
8. (Optional) For a specific alert, select silence this alert to silence the alert rule that caused this alert to be triggered.

   You must have the Manage alerts or Root access permission to silence an alert rule.

   > Be careful when deciding to silence an alert rule. If an alert rule is silenced, you might not detect an underlying problem until it prevents a critical operation from completing.

9. To view the current conditions for the alert rule:
   a. From the alert details, select **View conditions**.

      A pop-up appears, listing the Prometheus expression for each defined severity.

   b. To close the pop-up, click anywhere outside of the pop-up.
10. Optionally, select **Edit rule** to edit the alert rule that caused this alert to be triggered.

    You must have the Manage alerts or Root access permission to edit an alert rule.

    > Be careful when deciding to edit an alert rule. If you change trigger values, you might not detect an underlying problem until it prevents a critical operation from completing.

11. To close the alert details, select **Close**.

## Monitor storage capacity

Monitor the total usable space available to ensure that the StorageGRID system does not run out of storage space for objects or for object metadata.

StorageGRID stores object data and object metadata separately, and reserves a specific amount of space for a distributed Cassandra database that contains object metadata. Monitor the total amount of space consumed for objects and for object metadata, as well as trends in the amount of space consumed for each. This will enable you to plan ahead for the addition of nodes and avoid any service outages.

You can view storage capacity information for the entire grid, for each site, and for each Storage Node in your StorageGRID system.

### Monitor storage capacity for the entire grid

Monitor the overall storage capacity for your grid to ensure that adequate free space remains for object data and object metadata. Understanding how storage capacity changes over time can help you plan to add Storage Nodes or storage volumes before the grid's usable storage capacity is consumed.

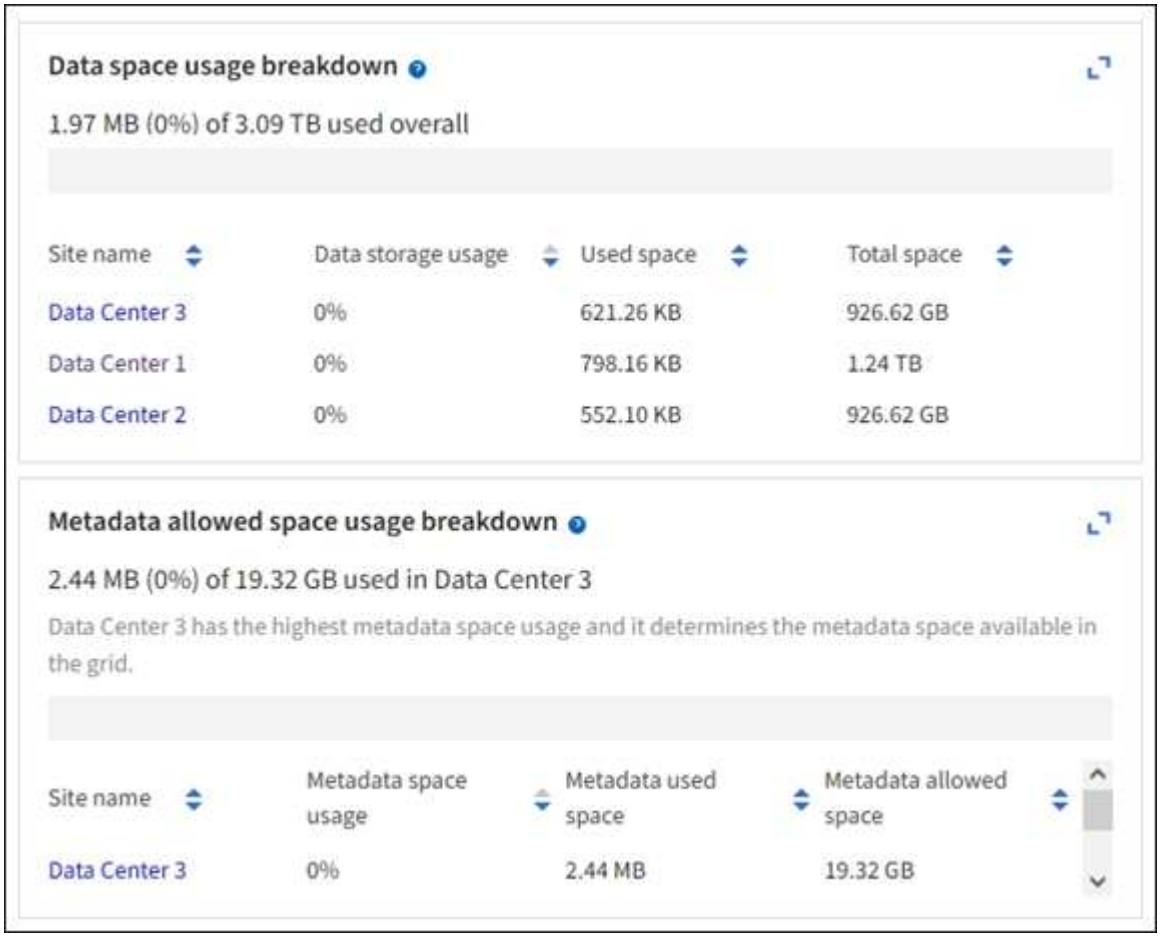
The Grid Manager dashboard lets you quickly assess how much storage is available for the entire grid and for

each data center. The Nodes page provides more detailed values for object data and object metadata.

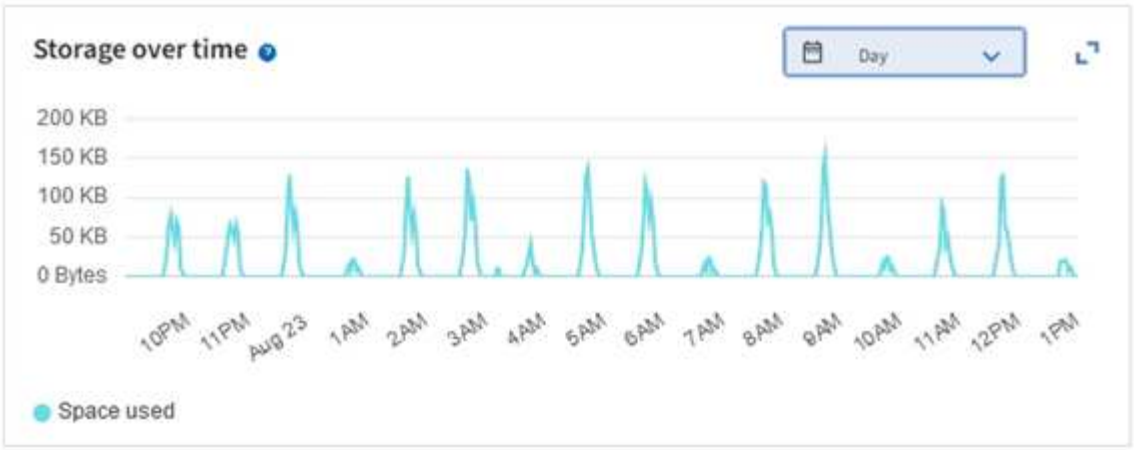
**Steps**

1. Assess how much storage is available for the entire grid and for each data center.
   a. Select **Dashboard > Overview**.
   b. Note the values on the Data space usage breakdown and the Metadata allowed space usage breakdown cards. Each card lists a percentage of storage usage, the capacity of used space, and the total space available or allowed by site.

      The summary does not include archival media.




   c. Note the chart on the Storage over time card. Use the time period drop-down to help you determine how quickly storage is consumed.




2. Use the Nodes page for additional details on how much storage has been used and how much storage remains available on the grid for object data and object metadata.
   a. Select **NODES**.
   b. Select ***grid*** > **Storage**.


   c. Position your cursor over the **Storage used - object data** and the **Storage used - object metadata** charts to see how much object storage and object metadata storage is available for the entire grid, and how much has been used over time.

> The total values for a site or the grid don't include nodes that have not reported metrics for at least five minutes, such as offline nodes.

3. Plan to perform an expansion to add Storage Nodes or storage volumes before the grid's usable storage capacity is consumed.

   When planning the timing of an expansion, consider how long it will take to procure and install additional storage.

If your ILM policy uses erasure coding, you might prefer to expand when existing Storage Nodes are approximately 70% full to reduce the number of nodes that must be added.

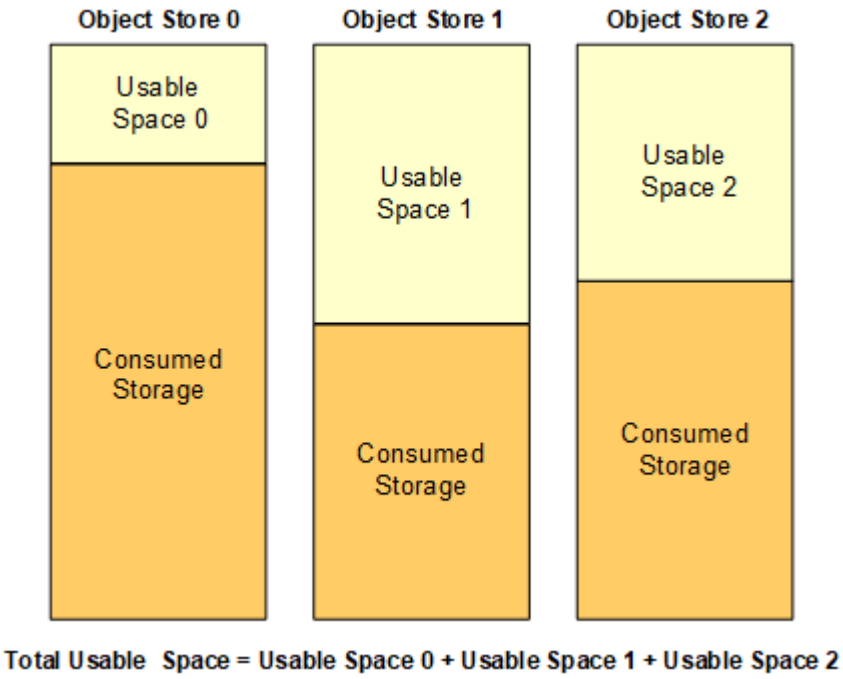
For more information about planning a storage expansion, see the instructions for expanding StorageGRID.

### Monitor storage capacity for each Storage Node

Monitor the total usable space for each Storage Node to ensure that the node has enough space for new object data.

#### About this task

Usable space is the amount of storage space available to store objects. The total usable space for a Storage Node is calculated by adding together the available space on all object stores within the node.




#### Steps

1. Select **NODES** > ***Storage Node*** > **Storage**.

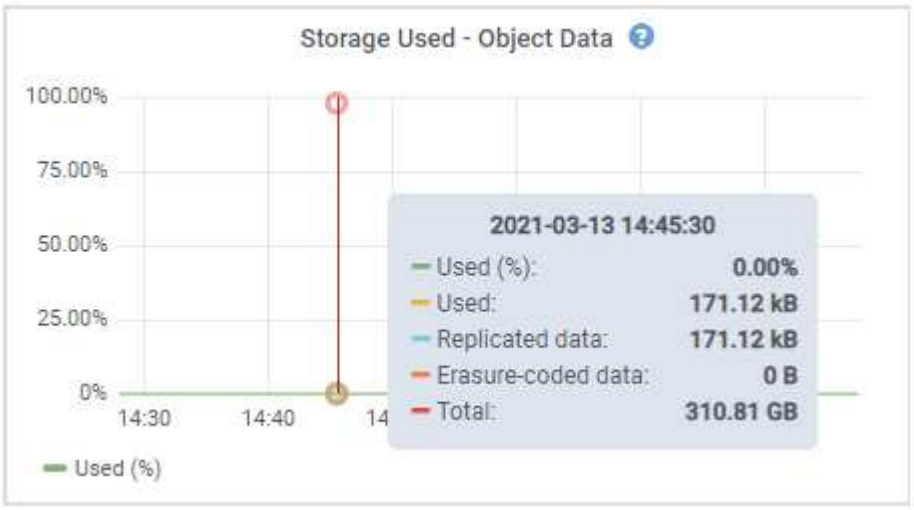
   The graphs and tables for the node appear.

2. Position your cursor over the Storage used - object data graph.

   The following values are shown:

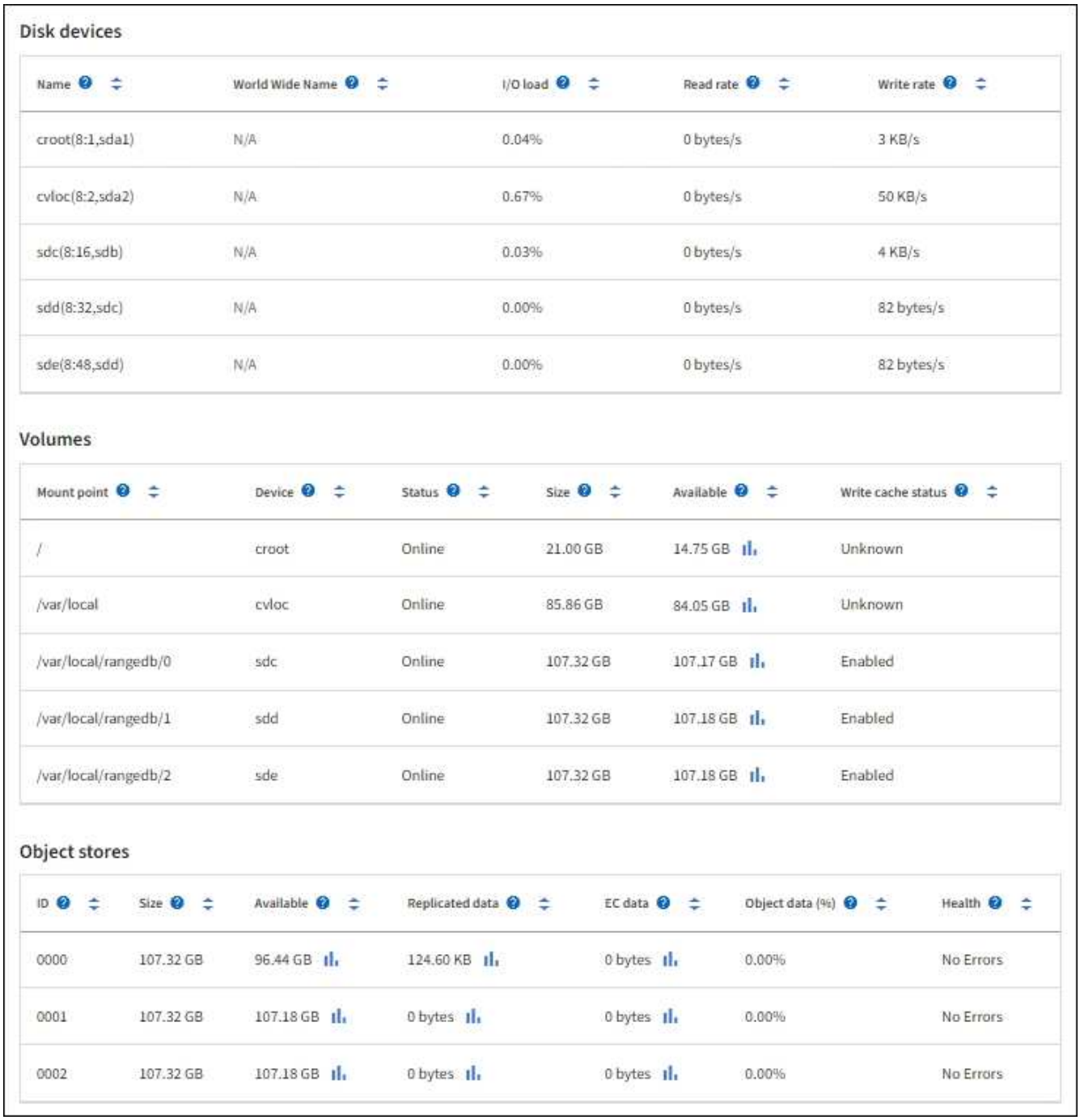
   - **Used (%)**: The percentage of the Total usable space that has been used for object data.
   - **Used**: The amount of the Total usable space that has been used for object data.
   - **Replicated data**: An estimate of the amount of replicated object data on this node, site, or grid.
   - **Erasure-coded data**: An estimate of the amount of erasure-coded object data on this node, site, or grid.
   - **Total**: The total amount of usable space on this node, site, or grid. The Used value is the

`storagegrid_storage_utilization_data_bytes` metric.




3. Review the Available values in the Volumes and Object stores tables, below the graphs.

> To view graphs of these values, click the chart icons in the Available columns.



Disk devices

| Name | World Wide Name | I/O load | Read rate | Write rate |
|---|---|---|---|---|
| croot(8:1,sda1) | N/A | 0.04% | 0 bytes/s | 3 KB/s |
| cvloc(8:2,sda2) | N/A | 0.67% | 0 bytes/s | 50 KB/s |
| sdc(8:16,sdb) | N/A | 0.03% | 0 bytes/s | 4 KB/s |
| sdd(8:32,sdc) | N/A | 0.00% | 0 bytes/s | 82 bytes/s |
| sde(8:48,sdd) | N/A | 0.00% | 0 bytes/s | 82 bytes/s |

Volumes

| Mount point | Device | Status | Size | Available | Write cache status |
|---|---|---|---|---|---|
| / | croot | Online | 21.00 GB | 14.75 GB | Unknown |
| /var/local | cvloc | Online | 85.86 GB | 84.05 GB | Unknown |
| /var/local/rangedb/0 | sdc | Online | 107.32 GB | 107.17 GB | Enabled |
| /var/local/rangedb/1 | sdd | Online | 107.32 GB | 107.18 GB | Enabled |
| /var/local/rangedb/2 | sde | Online | 107.32 GB | 107.18 GB | Enabled |

Object stores

| ID | Size | Available | Replicated data | EC data | Object data (%) | Health |
|---|---|---|---|---|---|---|
| 0000 | 107.32 GB | 96.44 GB | 124.60 KB | 0 bytes | 0.00% | No Errors |
| 0001 | 107.32 GB | 107.18 GB | 0 bytes | 0 bytes | 0.00% | No Errors |
| 0002 | 107.32 GB | 107.18 GB | 0 bytes | 0 bytes | 0.00% | No Errors |

4. Monitor the values over time to estimate the rate at which usable storage space is being consumed.
5. To maintain normal system operations, add Storage Nodes, add storage volumes, or archive object data before usable space is consumed.

   When planning the timing of an expansion, consider how long it will take to procure and install additional storage.

   > If your ILM policy uses erasure coding, you might prefer to expand when existing Storage Nodes are approximately 70% full to reduce the number of nodes that must be added.

   For more information about planning a storage expansion, see the instructions for expanding StorageGRID.

The Low object data storage alert is triggered when insufficient space remains for storing object data on a Storage Node.

### Monitor object metadata capacity for each Storage Node

Monitor the metadata usage for each Storage Node to ensure that adequate space remains available for essential database operations. You must add new Storage Nodes at each site before object metadata exceeds 100% of the allowed metadata space.

#### About this task

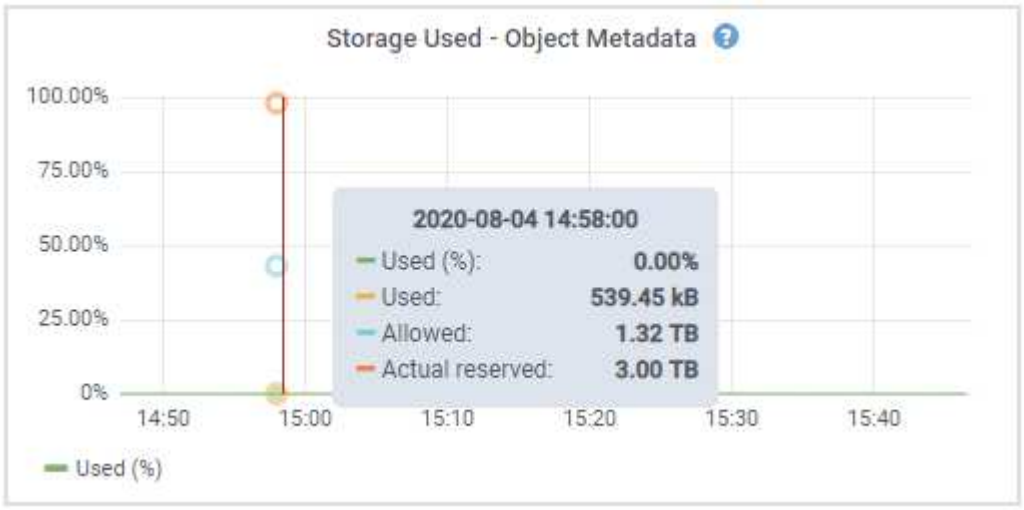
StorageGRID maintains three copies of object metadata at each site to provide redundancy and to protect object metadata from loss. The three copies are evenly distributed across all Storage Nodes at each site using the space reserved for metadata on storage volume 0 of each Storage Node.

In some cases, the grid's object metadata capacity might be consumed faster than its object storage capacity. For example, if you typically ingest large numbers of small objects, you might need to add Storage Nodes to increase metadata capacity even though sufficient object storage capacity remains.

Some of the factors that can increase metadata usage include the size and quantity of user metadata and tags, the total number of parts in a multipart upload, and the frequency of changes to ILM storage locations.

#### Steps

1. Select **NODES** > ***Storage Node*** > **Storage**.
2. Position your cursor over the Storage used - object metadata graph to see the values for a specific time.




**Used (%)**

The percentage of the allowed metadata space that has been used on this Storage Node.

Prometheus metrics: `storagegrid_storage_utilization_metadata_bytes` and `storagegrid_storage_utilization_metadata_allowed_bytes`

**Used**

The bytes of the allowed metadata space that have been used on this Storage Node.

Prometheus metric: `storagegrid_storage_utilization_metadata_bytes`

**Allowed**

The space allowed for object metadata on this Storage Node. To learn how this value is determine for each Storage Node, see the full description of Allowed metadata space.

Prometheus metric: `storagegrid_storage_utilization_metadata_allowed_bytes`

**Actual reserved**

The actual space reserved for metadata on this Storage Node. Includes the allowed space and the required space for essential metadata operations. To learn how this value is calculated for each Storage Node, see the full description of Actual reserved space for metadata.

*Prometheus metric will be added in a future release.*

> The total values for a site or the grid don't include nodes that have not reported metrics for at least five minutes, such as offline nodes.

3. If the **Used (%)** value is 70% or higher, expand your StorageGRID system by adding Storage Nodes to each site.

> The **Low metadata storage** alert is triggered when the **Used (%)** value reaches certain thresholds. Undesirable results can occur if object metadata uses more than 100% of the allowed space.

When you add the new nodes, the system automatically rebalances object metadata across all Storage Nodes within the site. See the instructions for expanding a StorageGRID system.

### Monitor space usage forecasts

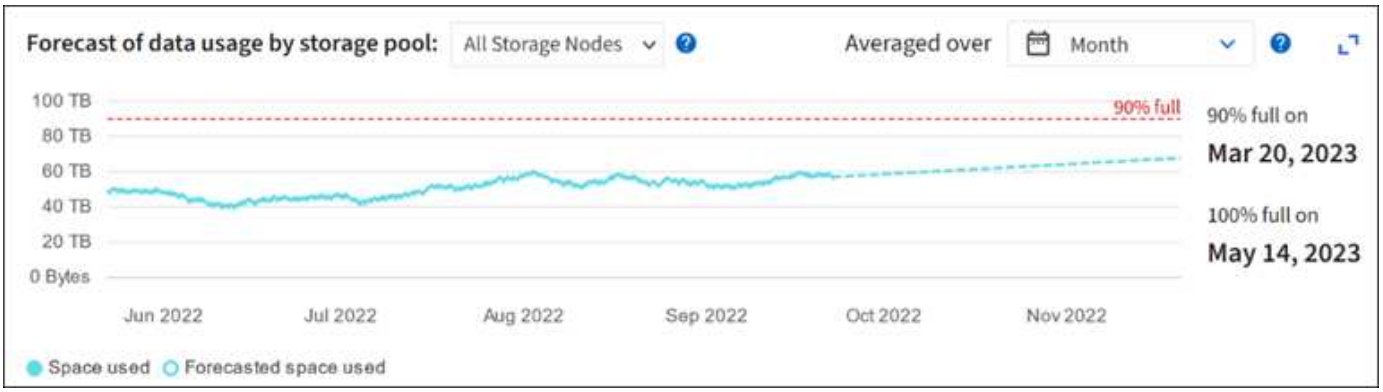
Monitor space usage forecasts for user data and metadata to estimate when you will need to expand a grid.

If you notice that the rate of consumption changes over time, select a shorter range from the **Averaged over** pull-down to reflect only the most recent ingest patterns. If you notice seasonal patterns, select a longer range.

If you have a new StorageGRID installation, allow data and metadata to accumulate before evaluating the space usage forecasts.

**Steps**

1. On the dashboard, select **Storage**.
2. View the dashboard cards, Forecast of data usage by storage pool and Forecast of metadata usage by site.
3. Use these values to estimate when you will need to add new Storage Nodes for data and metadata storage.




## Monitor information lifecycle management

The information lifecycle management (ILM) system provides data management for all objects stored on the grid. You must monitor ILM operations to understand if the grid can handle the current load, or if more resources are needed.

### About this task

The StorageGRID system manages objects by applying the active ILM policies. The ILM policies and associated ILM rules determine how many copies are made, the type of copies that are created, where copies are placed, and the length of time each copy is retained.

Object ingest and other object-related activities can exceed the rate at which StorageGRID can evaluate ILM, causing the system to queue objects whose ILM placement instructions can't be fulfilled in near real time. You should monitor whether StorageGRID is keeping up with client actions.

### Use Grid Manager dashboard tab

#### Steps

Use the ILM tab on the Grid Manager dashboard to monitor ILM operations:

1. Sign in to the Grid Manager.
2. From the dashboard, select the ILM tab and note the values on the ILM queue (Objects) card and ILM evaluation rate card.

   Temporary spikes in the ILM queue (Objects) card on the dashboard are to be expected. But if the queue continues to increase and never declines, the grid needs more resources to operate efficiently: either more Storage Nodes, or, if the ILM policy places objects in remote locations, more network bandwidth.

### Use the NODES page

#### Steps

Additionally, investigate ILM queues using the **NODES** page:

> The charts on the **NODES** page will be replaced with the corresponding dashboard cards in a future StorageGRID release.

1. Select **NODES**.
2. Select ***grid name*** > **ILM**.

3. Position your cursor over the ILM queue graph to see the value of following attributes at a given point in time:
   - **Objects queued (from client operations)**: The total number of objects awaiting ILM evaluation because of client operations (for example, ingest).
   - **Objects queued (from all operations)**: The total number of objects awaiting ILM evaluation.
   - **Scan rate (objects/sec)**: The rate at which objects in the grid are scanned and queued for ILM.
   - **Evaluation rate (objects/sec)**: The current rate at which objects are being evaluated against the ILM policy in the grid.
4. In the ILM Queue section, look at the following attributes.

   The ILM queue section is included for the grid only. This information is not shown on the ILM tab for a site or Storage Node.

   - **Scan period - estimated**: The estimated time to complete a full ILM scan of all objects.

     A full scan does not guarantee that ILM has been applied to all objects.

   - **Repairs attempted**: The total number of object repair operations for replicated data that have been attempted. This count increments each time a Storage Node tries to repair a high-risk object. High-risk ILM repairs are prioritized if the grid becomes busy.

     The same object repair might increment again if replication failed after the repair.

   These attributes can be useful when you are monitoring the progress of Storage Node volume recovery. If the number of Repairs attempted has stopped increasing and a full scan has been completed, the repair has probably completed.

## Monitor networking and system resources

The integrity and bandwidth of the network between nodes and sites, and the resource usage by individual grid nodes, are critical to efficient operations.

### Monitor network connections and performance

Network connectivity and bandwidth are especially important if your information lifecycle management (ILM) policy copies replicated objects between sites or stores erasure-coded objects using a scheme that provides site-loss protection. If the network between sites is not available, network latency is too high, or network bandwidth is insufficient, some ILM rules might not be able to place objects where expected. This can lead to ingest failures (when the Strict ingest option is selected for ILM rules), or to poor ingest performance and ILM backlogs.

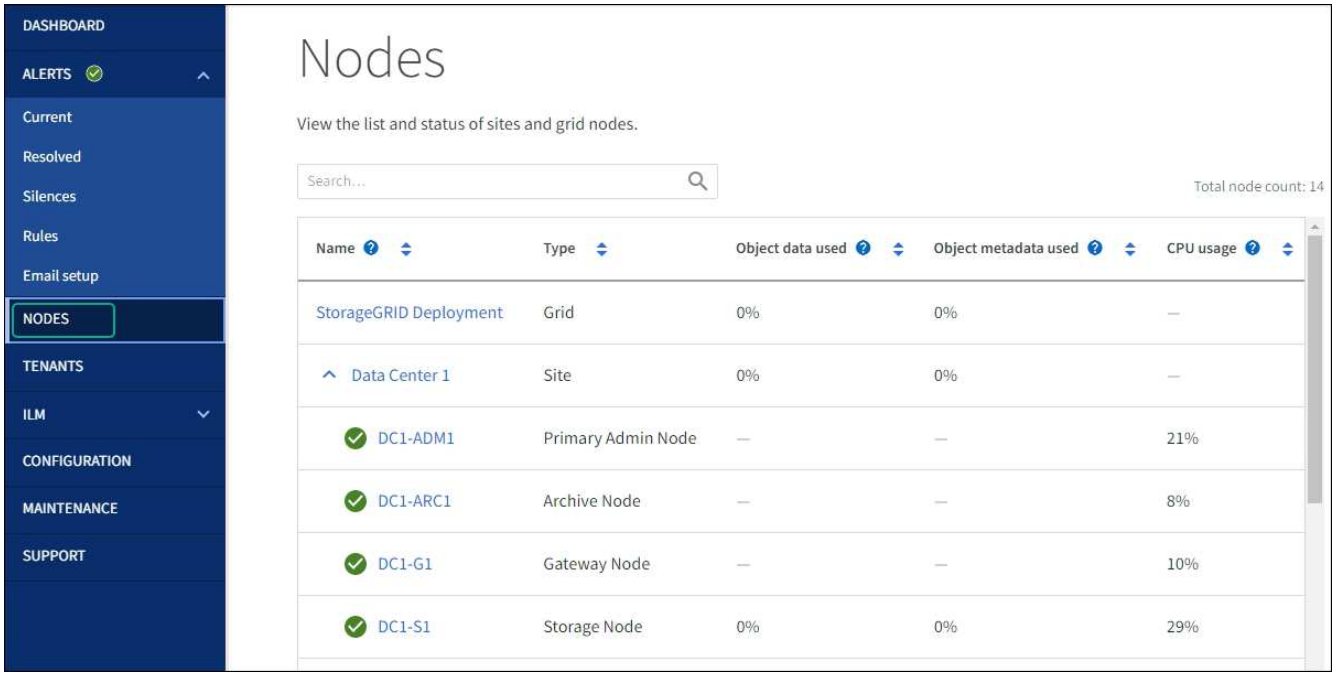
Use the Grid Manager to monitor connectivity and network performance, so you can address any issues promptly.

Additionally, consider creating network traffic classification policies so that you can monitor traffic related to specific tenants, buckets, subnets, or load balancer endpoints. You can set traffic limiting policies as needed.

**Steps**

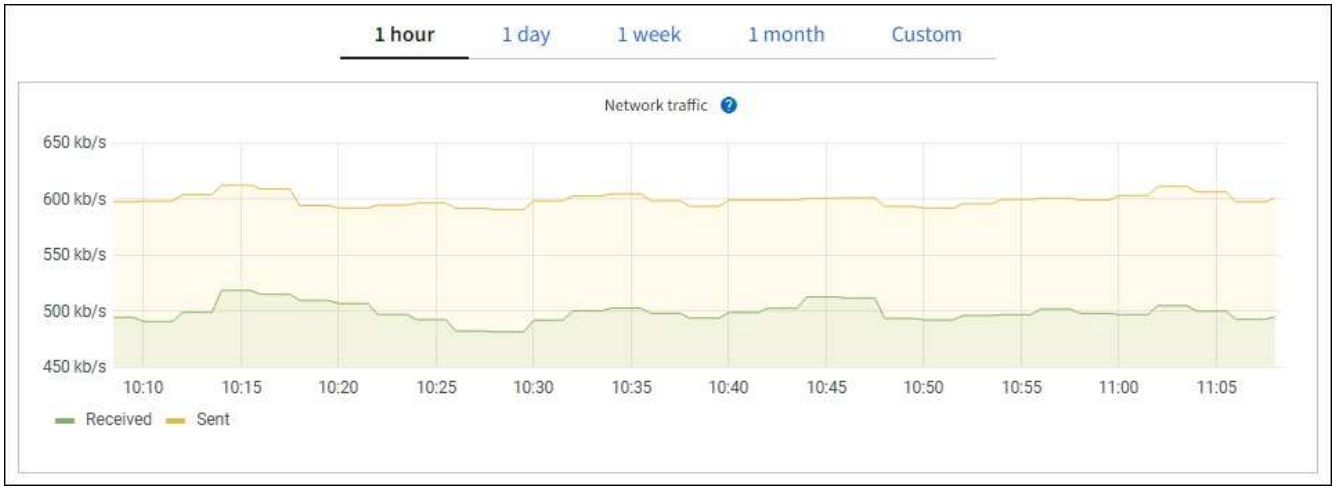
1. Select **NODES**.

The Nodes page appears. Each node in the grid is listed in table format.

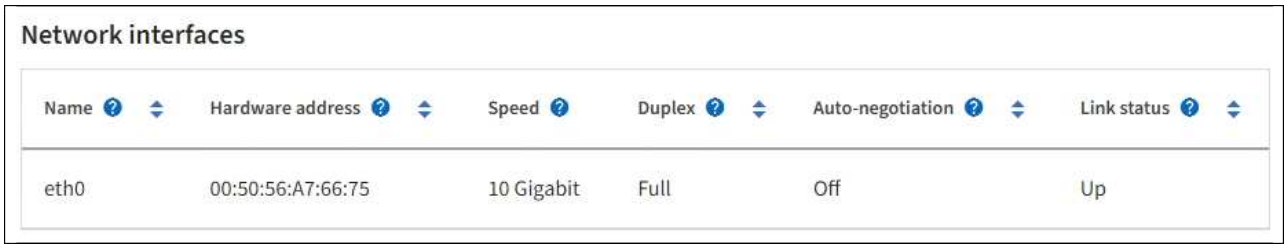



2. Select the grid name, a specific data center site, or a grid node, and then select the **Network** tab.

   The Network Traffic graph provides a summary of overall network traffic for the grid as a whole, the data center site, or for the node.



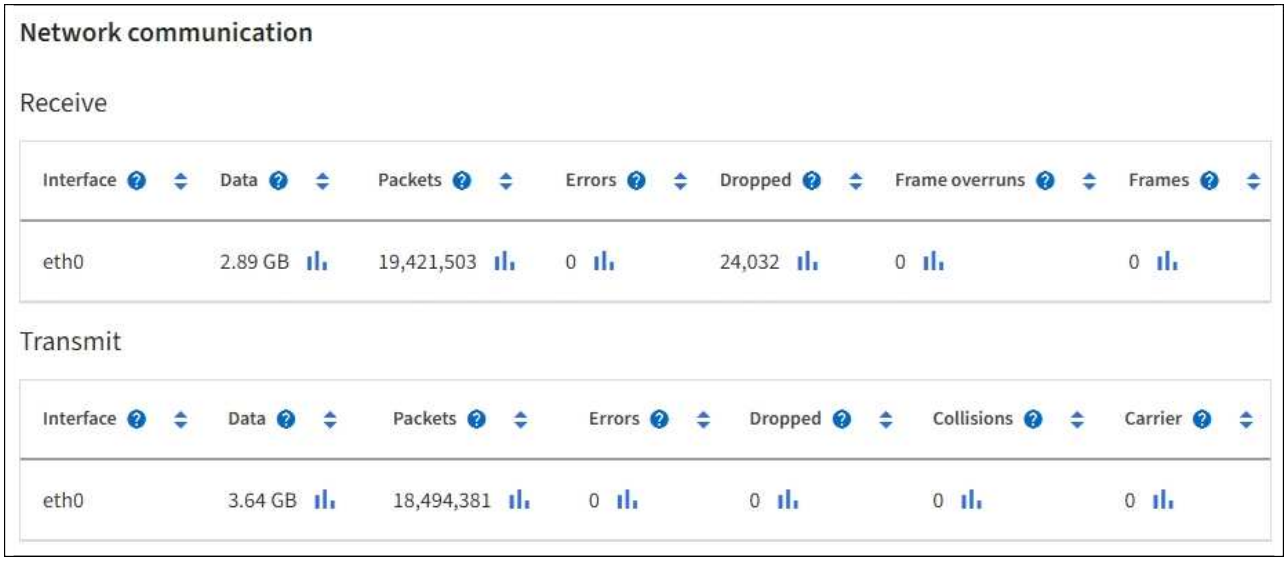

   a. If you selected a grid node, scroll down to review the **Network Interfaces** section of the page.




   b. For grid nodes, scroll down to review the **Network Communication** section of the page.

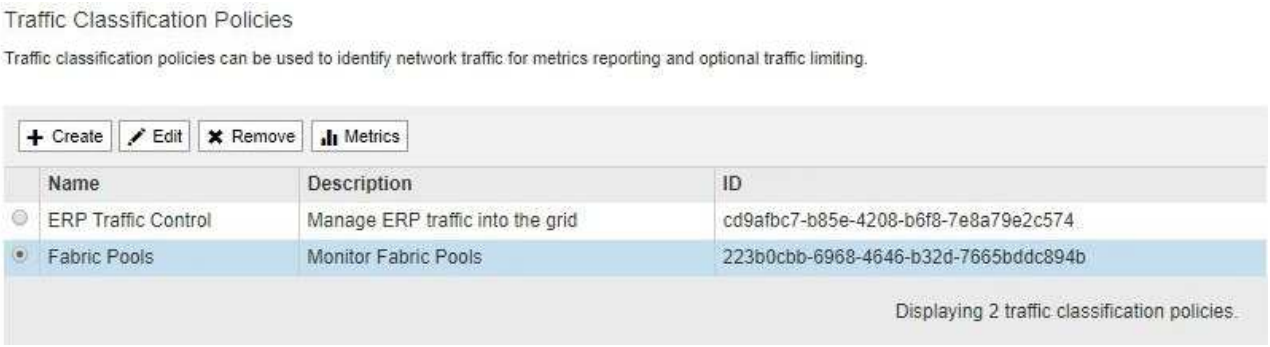
      The Receive and Transmit tables show how many bytes and packets have been received and sent

across each network as well as other receive and transmission metrics.




3. Use the metrics associated with your traffic classification policies to monitor network traffic.
   a. Select **CONFIGURATION** > **Network** > **Traffic classification**.

      The Traffic Classification Policies page appears, and the existing policies are listed in the table.




   b. To view graphs that show the networking metrics associated with a policy, select the radio button to the left of the policy, and then click **Metrics**.
   c. Review the graphs to understand the network traffic associated with the policy.

      If a traffic classification policy is designed to limit network traffic, analyze how often traffic is limited and decide if the policy continues to meet your needs. From time to time, adjust each traffic classification policy as needed.

**Related information**

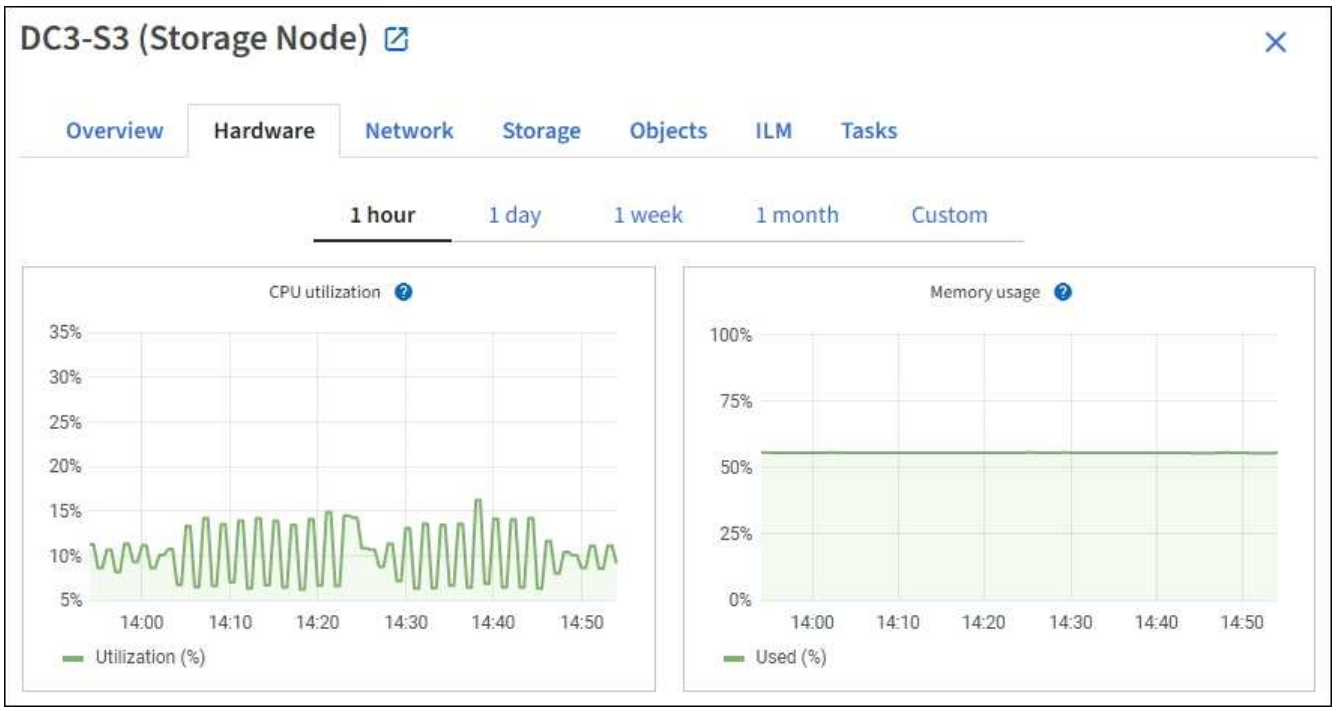
- View the Network tab
- Monitor node connection states

## Monitor node-level resources

Monitor individual grid nodes to check their resource usage levels. If nodes are consistently overloaded, more nodes might be required for efficient operations.

**Steps**

1. From the **NODES** page, select the node.
2. Select the **Hardware** tab to display graphs of CPU Utilization and Memory Usage.




3. To display a different time interval, select one of the controls above the chart or graph. You can display the information available for intervals of 1 hour, 1 day, 1 week, or 1 month. You can also set a custom interval, which allows you to specify date and time ranges.
4. If the node is hosted on a storage appliance or a services appliance, scroll down to view the tables of components. The status of all components should be "Nominal." Investigate components that have any other status.

**Related information**

- View information about appliance Storage Nodes
- View information about appliance Admin Nodes and Gateway Nodes

## Monitor tenant activity

All S3 client activity is associated with StorageGRID tenant accounts. You can use the Grid Manager to monitor the storage usage or network traffic for all tenants or a specific tenant. You can use the audit log or Grafana dashboards to gather more detailed information about how tenants are using StorageGRID.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have the Root access or Tenant accounts permission.

**View all tenants**

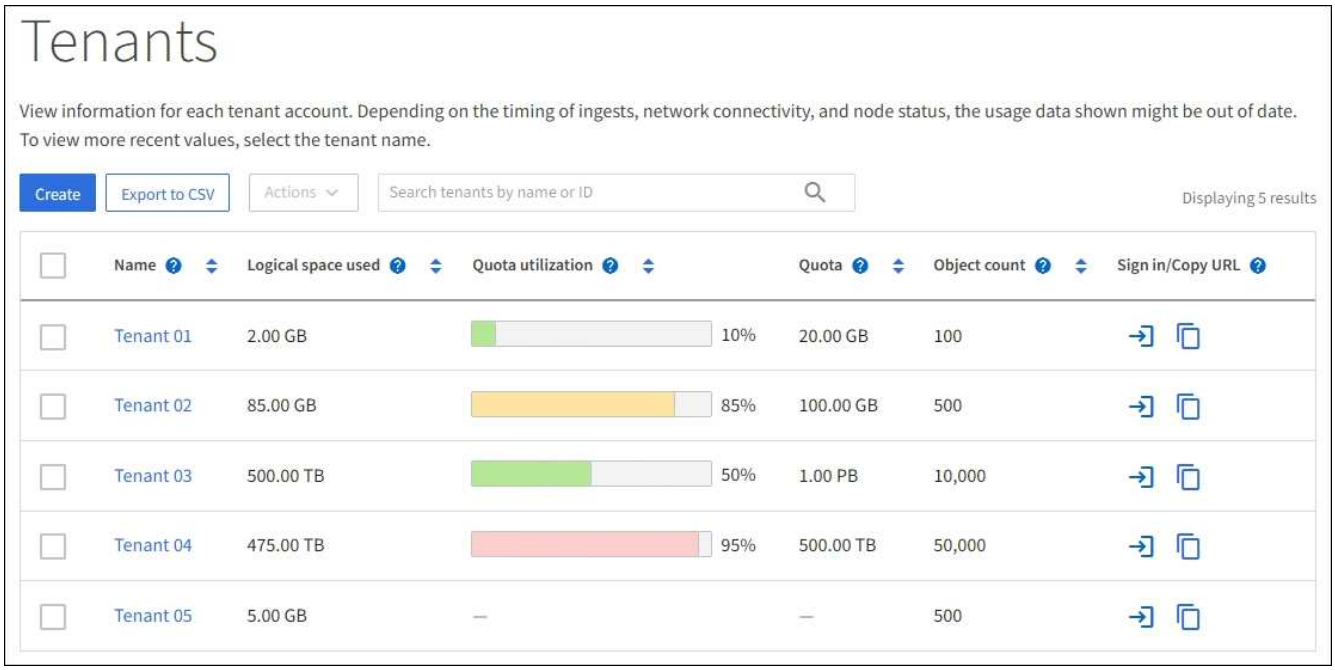
The Tenants page shows basic information for all current tenant accounts.

**Steps**

1. Select **TENANTS**.
2. Review the information shown on the Tenant pages.

   The Logical space used, Quota usage, Quota, and Object count are listed for each tenant. If a quota is not set for a tenant, the Quota usage and Quota fields contain a dash (—).

   > The space used values are estimates. These estimates are affected by the timing of ingests, network connectivity, and node status.




3. Optionally, sign in to a tenant account by selecting the sign-in link in the **Sign in/Copy URL** column.
4. Optionally, copy the URL for a tenant's sign-in page by selecting the copy URL link in the **Sign in/Copy URL** column.
5. Optionally, select **Export to CSV** to view and export a `.csv` file containing the usage values for all tenants.

   You are prompted to open or save the `.csv` file.

   The contents of the `.csv` file look like the following example:

| Tenant ID | Display Name | Space Used (Bytes) | Quota utilization (%) | Quota (Bytes) | Object Count | Protocol |
|---|---|---|---|---|---|---|
| 12659822378459233654 | Tenant 01 | 2000000000 | 10 | 20000000000 | 100 | S3 |
| 99658234112547853685 | Tenant 02 | 85000000000 | 85 | 110000000 | 500 | S3 |
| 03521145586975586321 | Tenant 03 | 60500000000 | 50 | 150000 | 10000 | S3 |
| 44251365987569885632 | Tenant 04 | 4750000000 | 95 | 140000000 | 50000 | S3 |
| 36521587546689565123 | Tenant 05 | 5000000000 | Infinity | | 500 | S3 |

   You can open the `.csv` file in a spreadsheet application or use it in automation.

6. If no objects are listed, optionally, select **Actions** > **Delete** to remove one or more tenants. See Delete tenant account.

   You can't remove a tenant account if the account includes any buckets or containers.

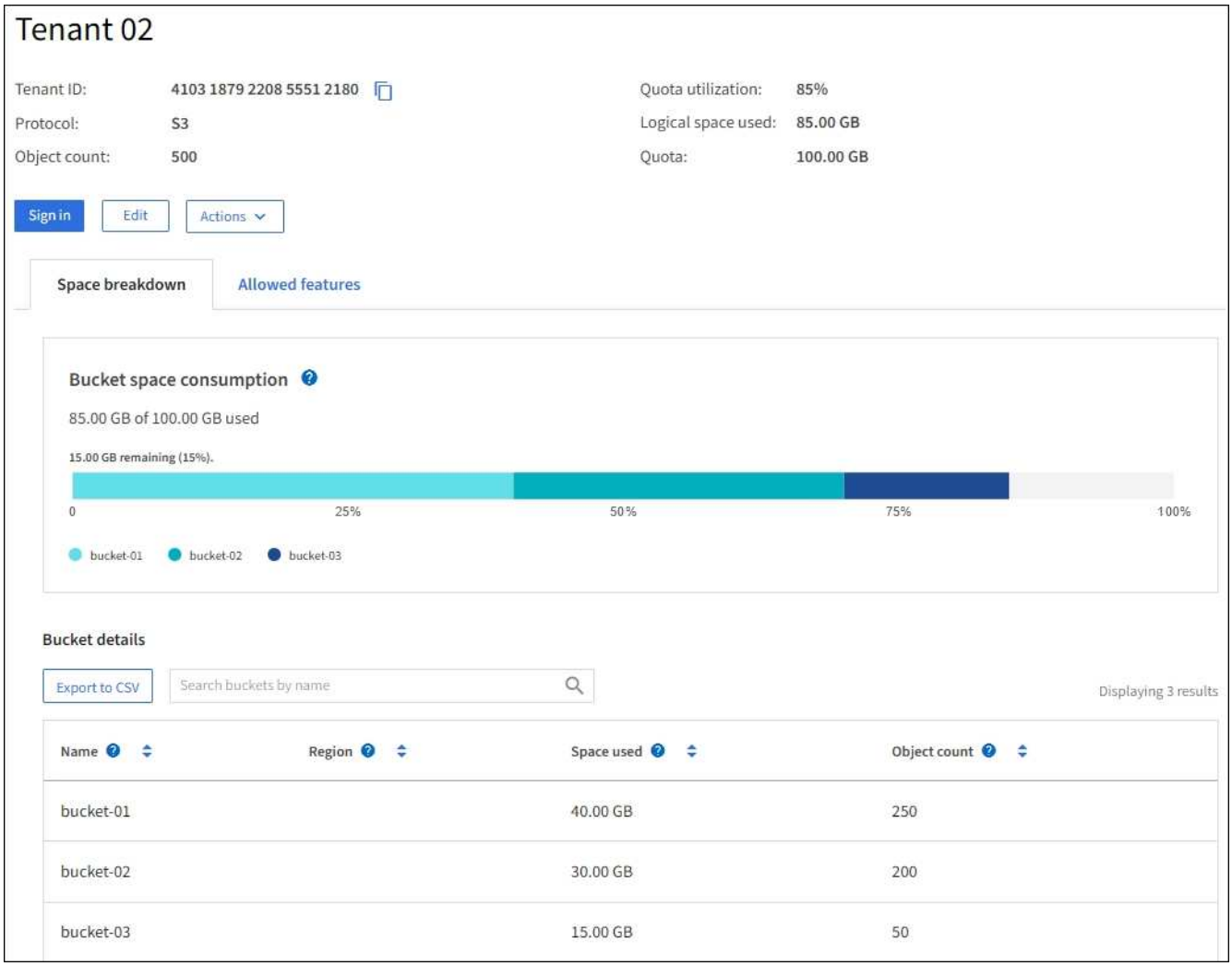
### View a specific tenant

You can view details for a specific tenant.

**Steps**

1. Select the tenant name from the Tenants page.

   The tenant details page appears.




2. Review the tenant overview at the top of the page.

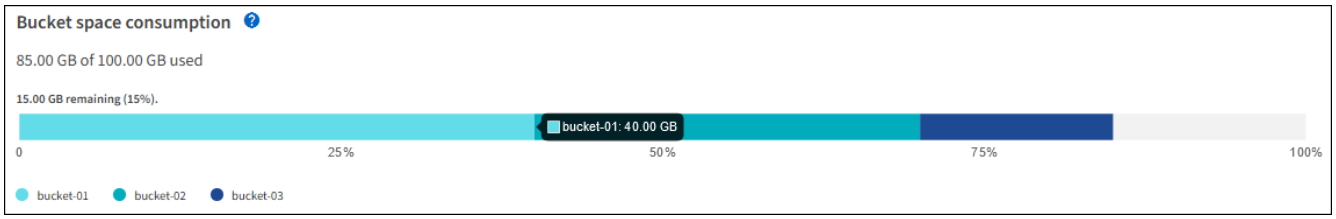
   This section of the details page provides summary information for the tenant, including the tenant's object count, quota usage, logical space used, and quota setting.

3. From the **Space breakdown** tab, review the **Space consumption** chart.

   This chart shows the total space consumption for all of the tenant's S3 buckets.

   If a quota was set for this tenant, the amount of quota used and remaining is displayed in text (for example, `85.00 GB of 100 GB used`). If no quota was set, the tenant has an unlimited quota, and the text includes only an amount of space used (for example, `85.00 GB used`). The bar chart shows the percentage of quota in each bucket or container. If the tenant has exceeded the storage quota by more than 1% and by at least 1 GB, the chart shows the total quota and the excess amount.

You can place your cursor over the bar chart to see the storage used by each bucket or container. You can place your cursor over the free space segment to see the amount of storage quota remaining.




Quota usage is based on internal estimates and might be exceeded in some cases. For example, StorageGRID checks the quota when a tenant starts uploading objects and rejects new ingests if the tenant has exceeded the quota. However, StorageGRID does not take into account the size of the current upload when determining if the quota has been exceeded. If objects are deleted, a tenant might be temporarily prevented from uploading new objects until the quota usage is recalculated. Quota usage calculations can take 10 minutes or longer.

A tenant's quota usage indicates the total amount of object data the tenant has uploaded to StorageGRID (logical size). The quota usage does not represent the space used to store copies of those objects and their metadata (physical size).

You can enable the **Tenant quota usage high** alert rule to determine if tenants are consuming their quotas. If enabled, this alert is triggered when a tenant has used 90% of its quota. For instructions, see Edit alert rules.

4. From the **Space breakdown** tab, review the **Bucket details**.

   This table lists the S3 buckets for the tenant. Space used is the total amount of object data in the bucket or container. This value does not represent the storage space required for ILM copies and object metadata.

5. Optionally, select **Export to CSV** to view and export a .csv file containing the usage values for each bucket or container.

   The contents of an individual S3 tenant's `.csv` file look like the following example:

| Tenant ID | Bucket Name | Space Used (Bytes) | Number of Objects |
|---|---|---|---|
| 64796966429038923647 | bucket-01 | 88717711 | 14 |
| 64796966429038923647 | bucket-02 | 21747507 | 11 |
| 64796966429038923647 | bucket-03 | 15294070 | 3 |

   You can open the `.csv` file in a spreadsheet application or use it in automation.

6. Optionally, select the **Allowed features** tab to see a list of the permissions and features that are enabled for the tenant. See Edit tenant account if you need to change any of these settings.
7. If the tenant has the **Use grid federation connection** permission, optionally select the **Grid federation** tab to learn more about the connection.

   See What is grid federation? and Manage the permitted tenants for grid federation.

### View network traffic

If traffic classification policies are in place for a tenant, review the network traffic for that tenant.

**Steps**

1. Select **CONFIGURATION** > **Network** > **Traffic classification**.

   The Traffic Classification Policies page appears, and the existing policies are listed in the table.

2. Review the list of policies to identify the ones that apply to a specific tenant.
3. To view metrics associated with a policy, select the radio button to the left of the policy, and select **Metrics**.
4. Analyze the graphs to determine how often the policy is limiting traffic and whether you need to adjust the policy.

See Manage traffic classification policies for more information.

### Use the audit log

Optionally, you can use the audit log for more granular monitoring of a tenant's activities.

For instance, you can monitor the following types of information:

- Specific client operations, such as PUT, GET, or DELETE
- Object sizes
- The ILM rule applied to objects
- The source IP of client requests

Audit logs are written to text files that you can analyze using your choice of log analysis tool. This allows you to better understand client activities, or to implement sophisticated chargeback and billing models.

See Review audit logs for more information.

### Use Prometheus metrics

Optionally, use Prometheus metrics to report on tenant activity.

- In the Grid Manager, select **SUPPORT** > **Tools** > **Metrics**. You can use existing dashboards, such as S3 Overview, to review client activities.

  > The tools available on the Metrics page are primarily intended for use by technical support. Some features and menu items within these tools are intentionally non-functional.

- From the top of the Grid Manager, select the help icon and select **API documentation**. You can use the metrics in the Metrics section of the Grid Management API to create custom alert rules and dashboards for tenant activity.

See Review support metrics for more information.

## Monitor S3 client operations

You can monitor object ingest and retrieval rates as well as metrics for object counts, queries, and verification. You can view the number of successful and failed attempts by

client applications to read, write, and modify objects in the StorageGRID system.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.

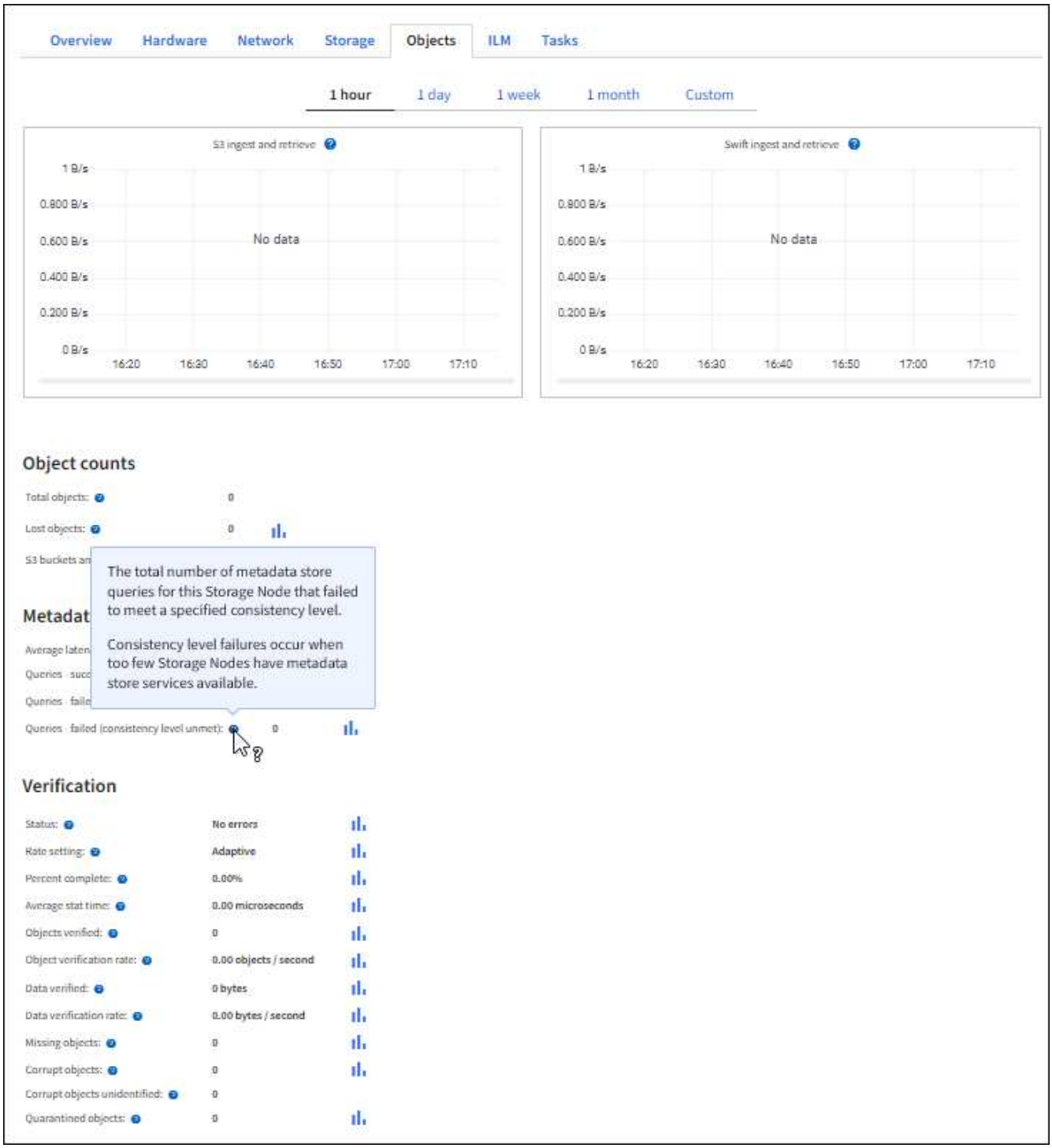
**Steps**

1. From the dashboard, select the **Performance** tab.
2. Refer to the S3 charts, which summarize the number of client operations performed by Storage Nodes and the number of API requests received by Storage Nodes during the selected time frame.
3. Select **NODES** to access the Nodes page.
4. From the Nodes home page (grid level), select the **Objects** tab.

   The chart shows S3 ingest and retrieve rates for your entire StorageGRID system in bytes per second and the amount of data ingested or retrieved. You can select a time interval or apply a custom interval.

5. To see information for a particular Storage Node, select the node from the list on the left, and select the **Objects** tab.

   The chart shows the ingest and retrieve rates for the node. The tab also includes metrics for object counts, metadata queries, and verification operations.




## Monitor load balancing operations

If you are using a load balancer to manage client connections to StorageGRID, you should monitor load balancing operations after you configure the system initially and after you make any configuration changes or perform an expansion.

### About this task

You can use the Load Balancer service on Admin Nodes or Gateway Nodes or an external third-party load balancer to distribute client requests across multiple Storage Nodes.

After configuring load balancing, you should confirm that object ingest and retrieval operations are being evenly distributed across Storage Nodes. Evenly distributed requests ensure that StorageGRID remains responsive to client requests under load and can help maintain client performance.

If you configured a high availability (HA) group of Gateway Nodes or Admin Nodes in active-backup mode, only one node in the group actively distributes client requests.

For more information, see Configure S3 client connections.

**Steps**

1. If S3 clients connect using the Load Balancer service, check that Admin Nodes or Gateway Nodes are actively distributing traffic as you expect:
   a. Select **NODES**.
   b. Select a Gateway Node or Admin Node.
   c. On the **Overview** tab, check if a node interface is in an HA group and if the node interface has the role of Primary.

      Nodes with the role of Primary and nodes that aren't in an HA group should be actively distributing requests to clients.

   d. For each node that should be actively distributing client requests, select the Load Balancer tab.
   e. Review the chart of Load Balancer Request Traffic for the last week to ensure that the node has been actively distributing requests.

      Nodes in an active-backup HA group might take the Backup role from time to time. During that time the nodes don't distribute client requests.

   f. Review the chart of Load Balancer Incoming Request Rate for the last week to review the object throughput of the node.
   g. Repeat these steps for each Admin Node or Gateway Node in the StorageGRID system.
   h. Optionally, use traffic classification policies to view a more detailed analysis of traffic being served by the Load Balancer service.
2. Verify that these requests are being evenly distributed to Storage Nodes.
   a. Select ***Storage Node*** > **LDR** > **HTTP**.
   b. Review the number of **Currently Established incoming Sessions**.
   c. Repeat for each Storage Node in the grid.

      The number of sessions should be roughly equal across all Storage Nodes.

## Monitor grid federation connections

You can monitor basic information about all grid federation connections, detailed information about a specific connection, or Prometheus metrics about cross-grid replication operations. You can monitor a connection from either grid.

**Before you begin**

- You are signed in to the Grid Manager on either grid using a supported web browser.
- You have the Root access permission for the grid you are signed in to.

### View all connections

The Grid federation page shows basic information about all grid federation connections and about all tenant accounts that are permitted to use grid federation connections.

#### Steps

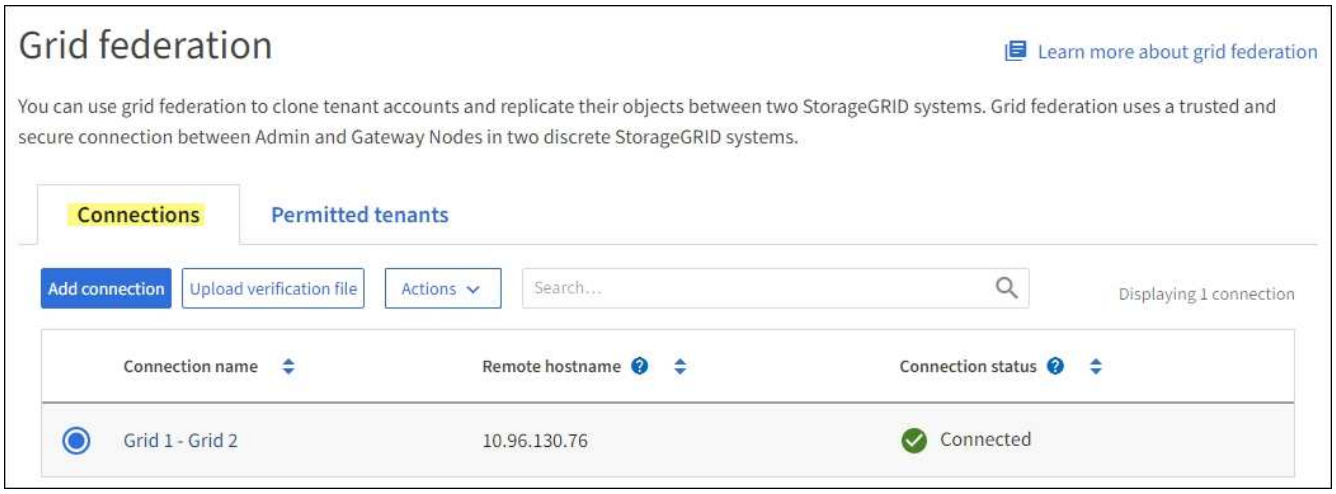
1. Select **CONFIGURATION** > **System** > **Grid federation**.

   The Grid federation page appears.

2. To see basic information for all connections on this grid, select the **Connections** tab.

   From this tab, you can:

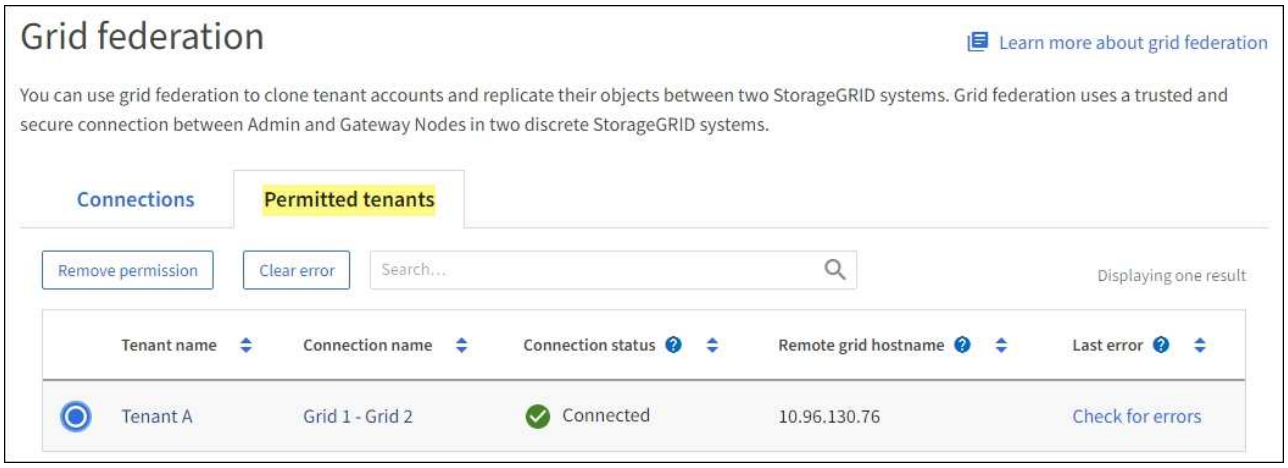
   - Create a new connection.
   - Select an existing connection to edit or test.




3. To see basic information for all tenant accounts on this grid that have the **Use grid federation connection** permission, select the **Permitted tenants** tab.

   From this tab, you can:

   - View the details page for each permitted tenant.
   - View the details page for each connection. See View a specific connection.
   - Select a permitted tenant and remove the permission.
   - Check for cross-grid replication errors and clear the last error, if any. See Troubleshoot grid federation errors.




### View a specific connection

You can view details for a specific grid federation connection.

**Steps**

1. Select either tab from the Grid federation page and then select the connection name from the table.

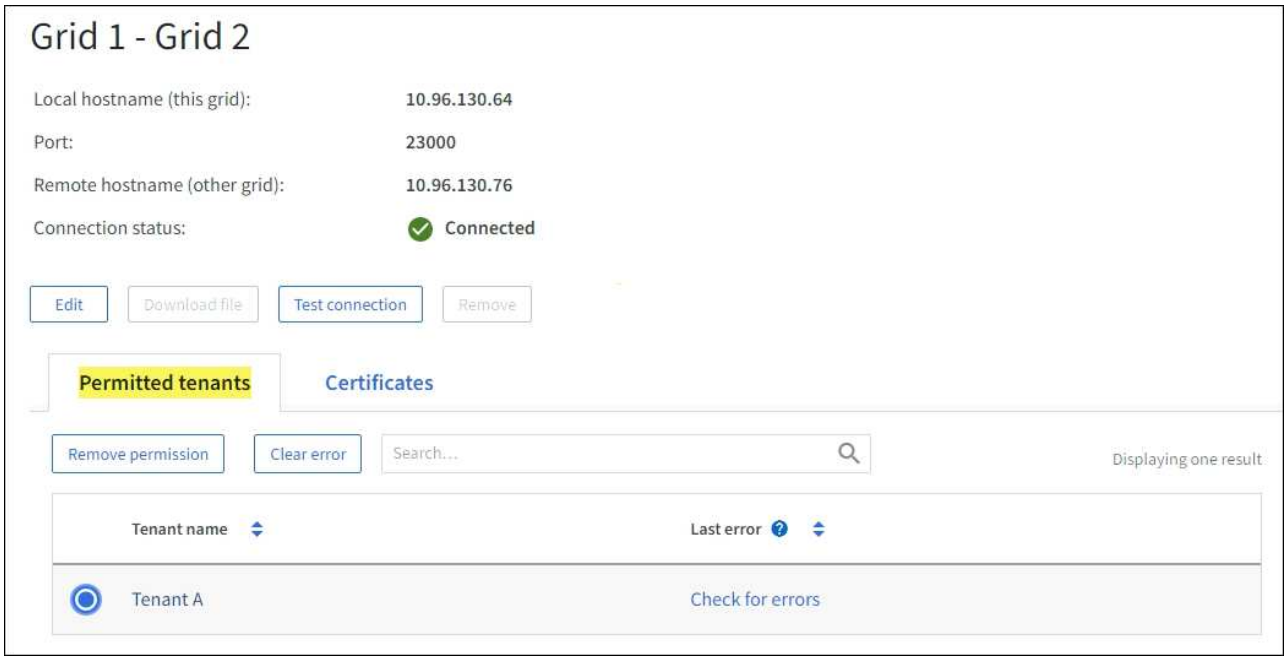
   From the details page for the connection, you can:

   - See basic status information about the connection, including the local and remote hostnames, port, and connection status.
   - Select a connection to edit, test, or remove.

2. When viewing a specific connection, select the **Permitted tenants** tab to view details about the permitted tenants for the connection.

   From this tab, you can:

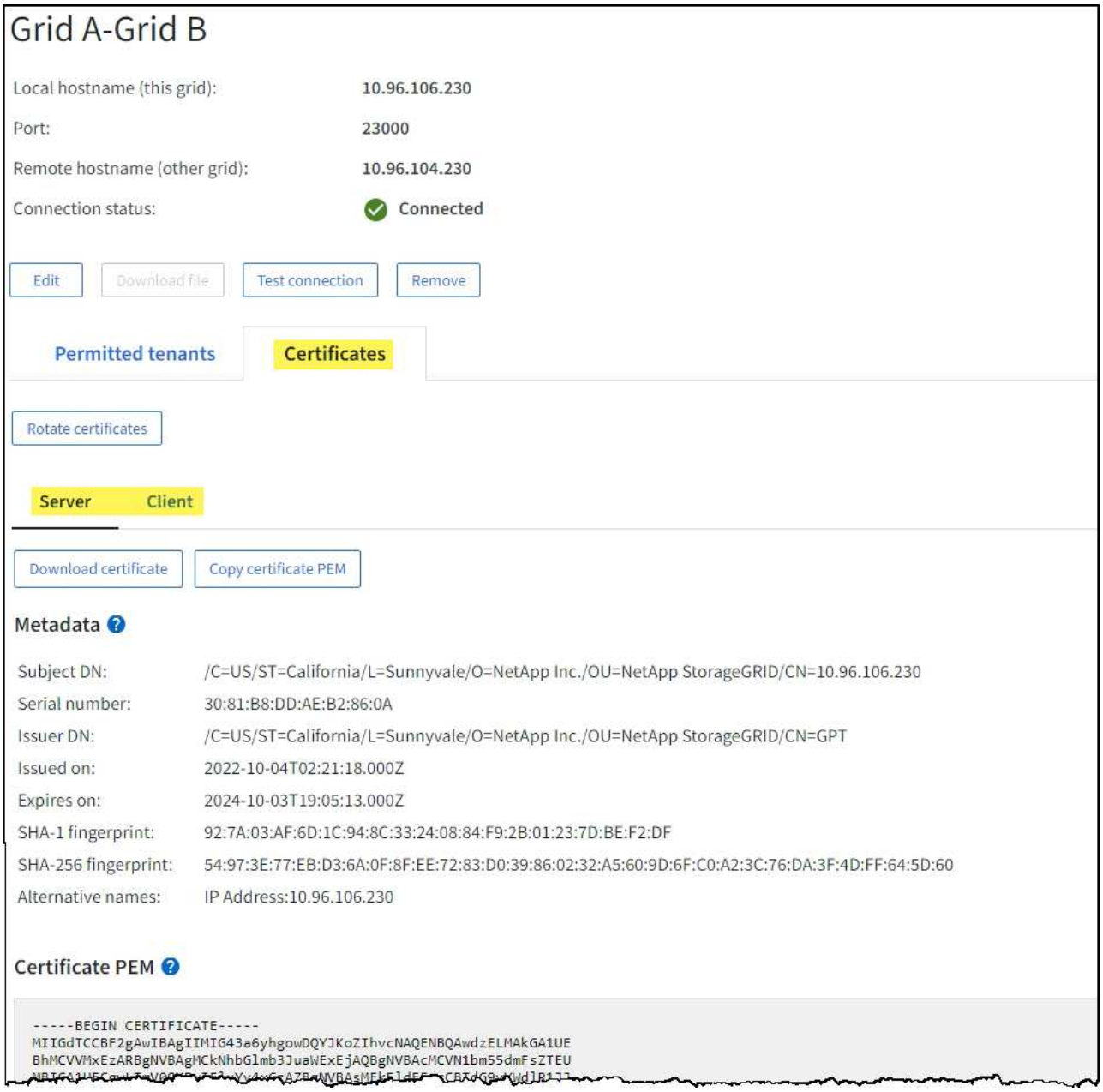
   - View the details page for each permitted tenant.
   - Remove a tenant's permission to use the connection.
   - Check for cross-grid replication errors and clear the last error. See Troubleshoot grid federation errors.




3. When viewing a specific connection, select the **Certificates** tab to view the system-generated server and client certificates for this connection.

   From this tab, you can:

   - Rotate connection certificates.
   - Select **Server** or **Client** to view or download the associated certificate or copy the certificate PEM.




### Review cross-grid replication metrics

You can use the Cross-Grid Replication dashboard in Grafana to view Prometheus metrics about cross-grid replication operations on your grid.

#### Steps

1. From the Grid Manager, select **SUPPORT** > **Tools** > **Metrics**.

   > The tools available on the Metrics page are intended for use by technical support. Some features and menu items within these tools are intentionally non-functional and are subject to change. See the list of commonly used Prometheus metrics.

2. In the Grafana section of the page, select **Cross Grid Replication**.

   For detailed instructions, see Review support metrics.

3. To retry replication of objects that failed to replicate, see Identify and retry failed replication operations.

# Manage alerts

## Manage alerts

The alert system provides an easy-to-use interface for detecting, evaluating, and resolving the issues that can occur during StorageGRID operation.

Alerts are triggered at specific severity levels when alert rule conditions evaluate as true. When an alert is triggered, the following actions occur:

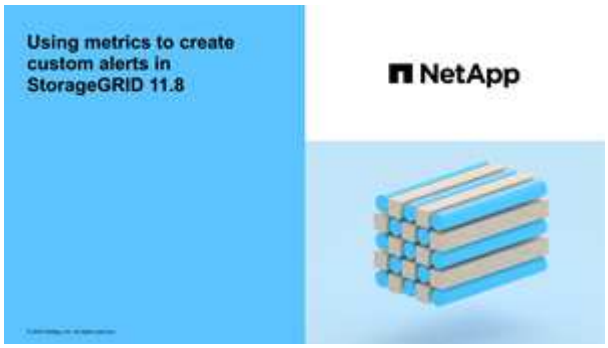
- An alert severity icon is shown on the dashboard in the Grid Manager, and the count of Current Alerts is incremented.
- The alert is shown on the **NODES** summary page and on the **NODES** > ***node*** > **Overview** tab.
- An email notification is sent, assuming you have configured an SMTP server and provided email addresses for the recipients.
- An Simple Network Management Protocol (SNMP) notification is sent, assuming you have configured the StorageGRID SNMP agent.

You can create custom alerts, edit or disable alerts, and manage alert notifications.

To learn more:

- Review the video: Video: Alerts overview


- Review the video: Video: Custom alerts




- See the Alerts reference.

# View alert rules

Alert rules define the conditions that trigger specific alerts. StorageGRID includes a set of default alert rules, which you can use as is or modify, or you can create custom alert rules.

You can view the list of all default and custom alert rules to learn which conditions will trigger each alert and to see whether any alerts are disabled.

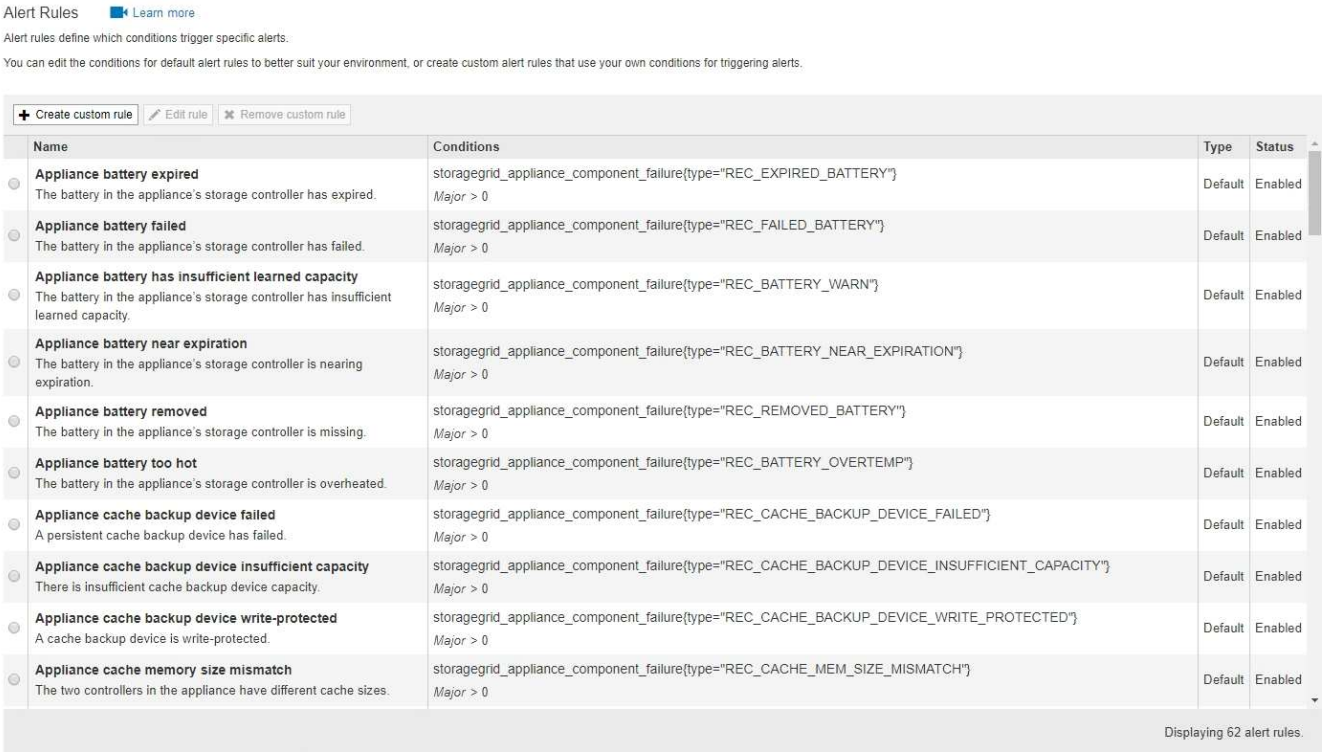
**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have the Manage alerts or Root access permission.
- Optionally, you have watched the video: Video: Alerts overview


**Steps**

1. Select **ALERTS** > **Rules**.

   The Alert Rules page appears.



2. Review the information in the alert rules table:

| Column header | Description |
| --- | --- |
| Name | The unique name and description of the alert rule. Custom alert rules are listed first, followed by default alert rules. The alert rule name is the subject for email notifications. |
| Conditions | The Prometheus expressions that determine when this alert is triggered. An alert can be triggered at one or more of the following severity levels, but a condition for each severity is not required.<br>• **Critical** : An abnormal condition exists that has stopped the normal operations of a StorageGRID node or service. You must address the underlying issue immediately. Service disruption and loss of data might result if the issue is not resolved.<br>• **Major** : An abnormal condition exists that is either affecting current operations or approaching the threshold for a critical alert. You should investigate major alerts and address any underlying issues to ensure that the abnormal condition does not stop the normal operation of a StorageGRID node or service.<br>• **Minor** : The system is operating normally, but an abnormal condition exists that could affect the system's ability to operate if it continues. You should monitor and resolve minor alerts that don't clear on their own to ensure they don't result in a more serious problem. |
| Type | The type of alert rule:<br>• **Default**: An alert rule provided with the system. You can disable a default alert rule or edit the conditions and duration for a default alert rule. You can't remove a default alert rule.<br>• **Default***: A default alert rule that includes an edited condition or duration. As required, you can easily revert a modified condition back to the original default.<br>• **Custom**: An alert rule that you created. You can disable, edit, and remove custom alert rules. |
| Status | Whether this alert rule is currently enabled or disabled. The conditions for disabled alert rules aren't evaluated, so no alerts are triggered. |

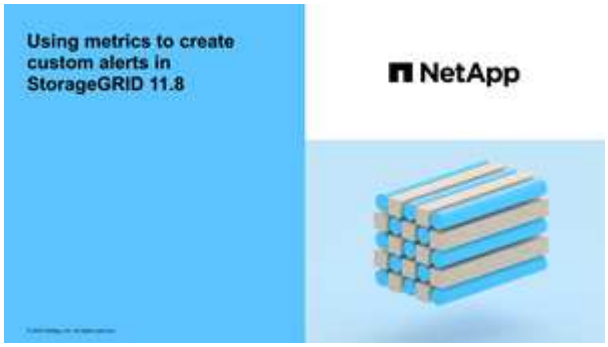
## Create custom alert rules

You can create custom alert rules to define your own conditions for triggering alerts.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have the Manage alerts or Root access permission.

- You are familiar with the commonly used Prometheus metrics.
- You understand the syntax of Prometheus queries.
- Optionally, you have watched the video: Video: Custom alerts.




**About this task**

StorageGRID does not validate custom alerts. If you decide to create custom alert rules, follow these general guidelines:

- Look at the conditions for the default alert rules, and use them as examples for your custom alert rules.
- If you define more than one condition for an alert rule, use the same expression for all conditions. Then, change the threshold value for each condition.
- Carefully check each condition for typos and logic errors.
- Use only the metrics listed in the Grid Management API.
- When testing an expression using the Grid Management API, be aware that a "successful" response might be an empty response body (no alert triggered). To see if the alert is actually triggered, you can temporarily set a threshold to a value you expect to be true currently.

  For example, to test the expression `node_memory_MemTotal_bytes < 24000000000`, first execute `node_memory_MemTotal_bytes >= 0` and ensure you get the expected results (all nodes return a value). Then, change the operator and the threshold back to the intended values and execute again. No results indicate there are no current alerts for this expression.

- Don’t assume a custom alert is working unless you have validated that the alert is triggered when expected.

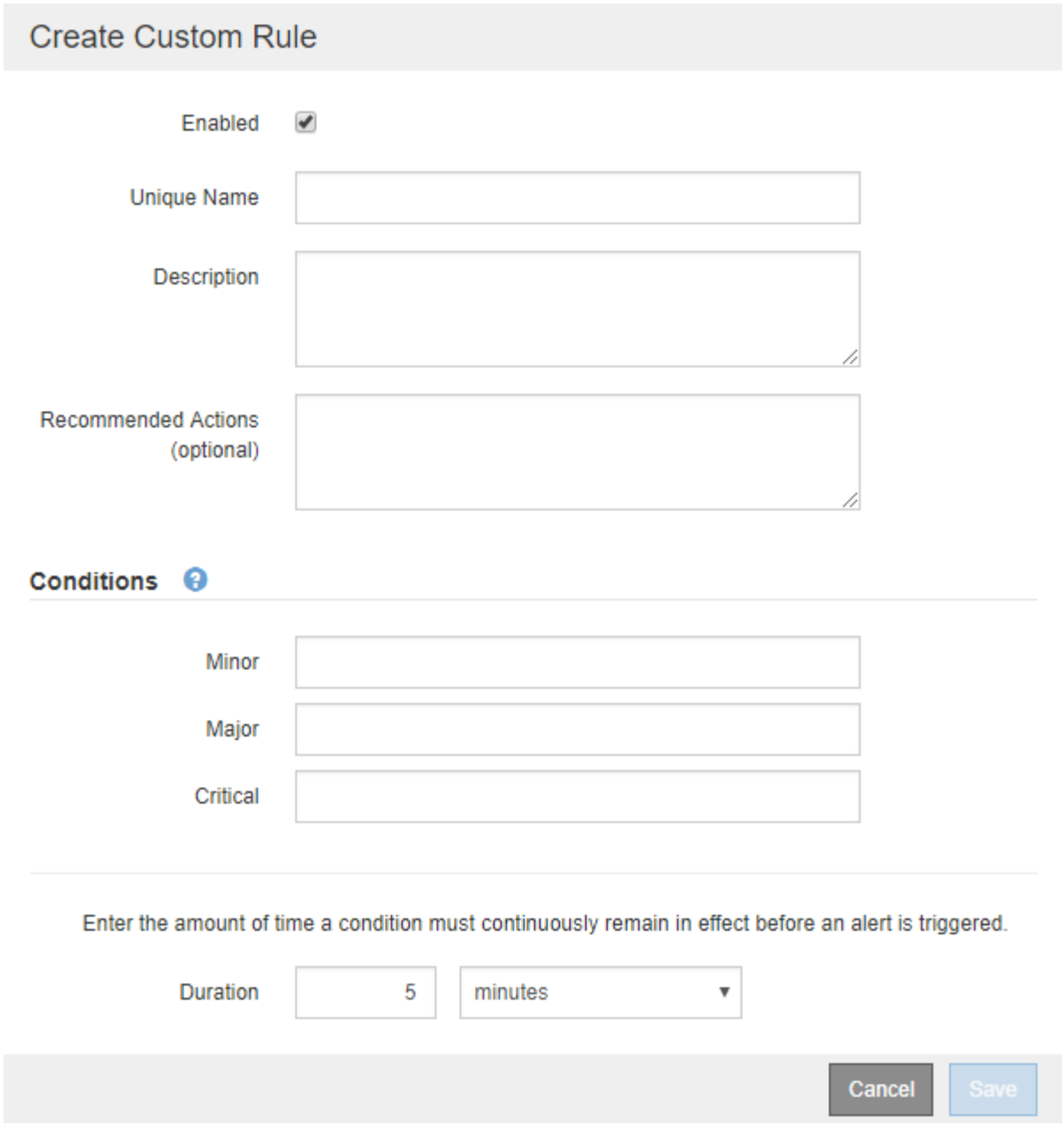
**Steps**

1. Select **ALERTS** > **Rules**.

   The Alert Rules page appears.

2. Select **Create custom rule**.

   The Create Custom Rule dialog box appears.




3. Select or clear the **Enabled** checkbox to determine if this alert rule is currently enabled.

   If an alert rule is disabled, its expressions aren't evaluated and no alerts are triggered.

4. Enter the following information:

| Field | Description |
| --- | --- |
| Unique Name | A unique name for this rule. The alert rule name is shown on the Alerts page and is also the subject for email notifications. Names for alert rules can be between 1 and 64 characters. |
| Description | A description of the problem that is occurring. The description is the alert message shown on the Alerts page and in email notifications. Descriptions for alert rules can be between 1 and 128 characters. |

| Field | Description |
| --- | --- |
| Recommended Actions | Optionally, the recommended actions to take when this alert is triggered. Enter recommended actions as plain text (no formatting codes). Recommended actions for alert rules can be between 0 and 1,024 characters. |

5. In the Conditions section, enter a Prometheus expression for one or more of the alert severity levels.

   A basic expression is usually of the form:

   ```
   [metric] [operator] [value]
   ```

   Expressions can be any length, but appear on a single line in the user interface. At least one expression is required.

   This expression causes an alert to be triggered if the amount of installed RAM for a node is less than 24,000,000,000 bytes (24 GB).

   ```
   node_memory_MemTotal_bytes < 24000000000
   ```

   To see available metrics and to test Prometheus expressions, select the help icon and follow the link to the Metrics section of the Grid Management API.

6. In the **Duration** field, enter the amount of time a condition must continuously remain in effect before the alert is triggered, and select a unit of time.

   To trigger an alert immediately when a condition becomes true, enter **0**. Increase this value to prevent temporary conditions from triggering alerts.

   The default is 5 minutes.

7. Select **Save**.

   The dialog box closes, and the new custom alert rule appears in the Alert Rules table.

## Edit alert rules

You can edit an alert rule to change the trigger conditions, For a custom alert rule, you can also update the rule name, description, and recommended actions.

### Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have the Manage alerts or Root access permission.

### About this task

When you edit a default alert rule, you can change the conditions for minor, major, and critical alerts; and the duration. When you edit a custom alert rule, you can also edit the rule's name, description, and recommended actions.

Be careful when deciding to edit an alert rule. If you change trigger values, you might not detect an underlying problem until it prevents a critical operation from completing.

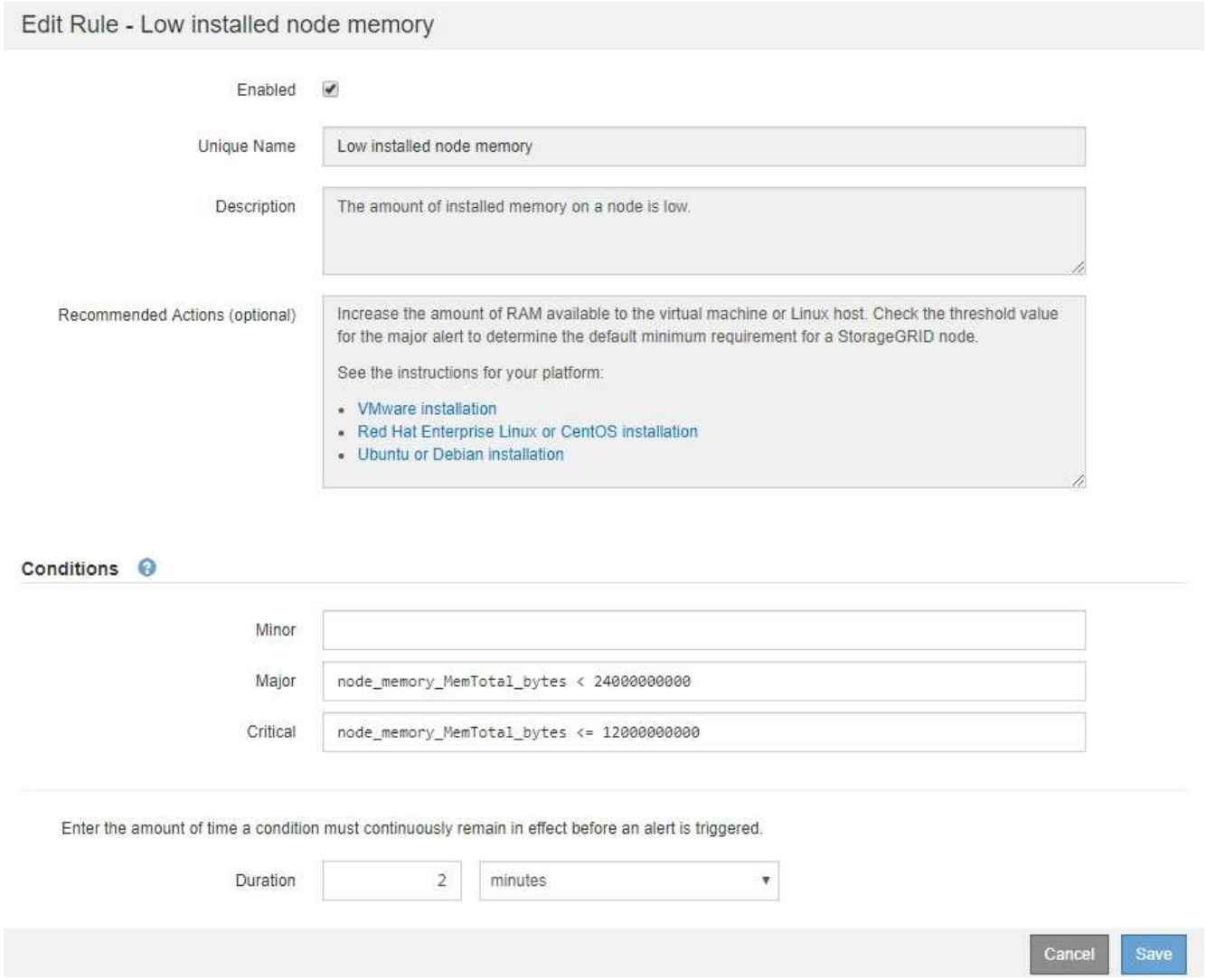
**Steps**

1. Select **ALERTS** > **Rules**.

   The Alert Rules page appears.

2. Select the radio button for the alert rule you want to edit.
3. Select **Edit rule**.

   The Edit Rule dialog box appears. This example shows a default alert rule—the Unique Name, Description, and Recommended Actions fields are disabled and can't be edited.




4. Select or clear the **Enabled** checkbox to determine if this alert rule is currently enabled.

   If an alert rule is disabled, its expressions aren't evaluated and no alerts are triggered.

   If you disable the alert rule for a current alert, you must wait a few minutes for the alert to no longer appear as an active alert.

In general, disabling a default alert rule is not recommended. If an alert rule is disabled, you might not detect an underlying problem until it prevents a critical operation from completing.

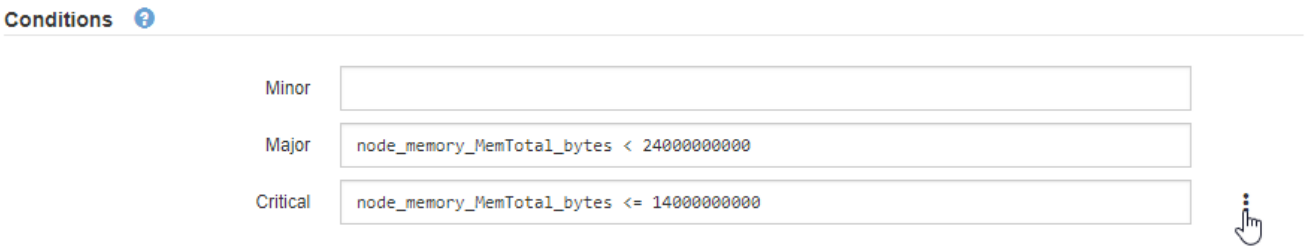
5. For custom alert rules, update the following information as required.

You can't edit this information for default alert rules.

| Field | Description |
|---|---|
| Unique Name | A unique name for this rule. The alert rule name is shown on the Alerts page and is also the subject for email notifications. Names for alert rules can be between 1 and 64 characters. |
| Description | A description of the problem that is occurring. The description is the alert message shown on the Alerts page and in email notifications. Descriptions for alert rules can be between 1 and 128 characters. |
| Recommended Actions | Optionally, the recommended actions to take when this alert is triggered. Enter recommended actions as plain text (no formatting codes). Recommended actions for alert rules can be between 0 and 1,024 characters. |

6. In the Conditions section, enter or update the Prometheus expression for one or more of the alert severity levels.

If you want to restore a condition for an edited default alert rule back to its original value, select the three dots to the right of the modified condition.




If you update the conditions for a current alert, your changes might not be implemented until the previous condition is resolved. The next time one of the conditions for the rule is met, the alert will reflect the updated values.

A basic expression is usually of the form:

```
[metric] [operator] [value]
```

Expressions can be any length, but appear on a single line in the user interface. At least one expression is required.

This expression causes an alert to be triggered if the amount of installed RAM for a node is less than 24,000,000,000 bytes (24 GB).

```
node_memory_MemTotal_bytes < 24000000000
```

7. In the **Duration** field, enter the amount of time a condition must continuously remain in effect before the alert is triggered, and select the unit of time.

   To trigger an alert immediately when a condition becomes true, enter **0**. Increase this value to prevent temporary conditions from triggering alerts.

   The default is 5 minutes.

8. Select **Save**.

   If you edited a default alert rule, **Default*** appears in the Type column. If you disabled a default or custom alert rule, **Disabled** appears in the **Status** column.

## Disable alert rules

You can change the enabled/disabled state for a default or custom alert rule.

### Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have the Manage alerts or Root access permission.

### About this task

When an alert rule is disabled, its expressions aren't evaluated and no alerts are triggered.

> In general, disabling a default alert rule is not recommended. If an alert rule is disabled, you might not detect an underlying problem until it prevents a critical operation from completing.

### Steps

1. Select **ALERTS** > **Rules**.

   The Alert Rules page appears.

2. Select the radio button for the alert rule you want to disable or enable.
3. Select **Edit rule**.

   The Edit Rule dialog box appears.

4. Select or clear the **Enabled** checkbox to determine if this alert rule is currently enabled.

   If an alert rule is disabled, its expressions aren't evaluated and no alerts are triggered.

   > If you disable the alert rule for a current alert, you must wait a few minutes for the alert to no longer display as an active alert.

5. Select **Save**.

   **Disabled** appears in the **Status** column.

## Remove custom alert rules

You can remove a custom alert rule if you no longer want to use it.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have the Manage alerts or Root access permission.

**Steps**

1. Select **ALERTS** > **Rules**.

   The Alert Rules page appears.

2. Select the radio button for the custom alert rule you want to remove.

   You can't remove a default alert rule.

3. Select **Remove custom rule**.

   A confirmation dialog box appears.

4. Select **OK** to remove the alert rule.

   Any active instances of the alert will be resolved within 10 minutes.

## Manage alert notifications

### Set up SNMP notifications for alerts

If you want StorageGRID to send SNMP notifications when alerts occur, you must enable the StorageGRID SNMP agent and configure one or more trap destinations.

You can use the **CONFIGURATION** > **Monitoring** > **SNMP agent** option in the Grid Manager or the SNMP endpoints for the Grid Management API to enable and configure the StorageGRID SNMP agent. The SNMP agent supports all three versions of the SNMP protocol.

To learn how to configure the SNMP agent, see Use SNMP monitoring.

After you configure the StorageGRID SNMP agent, two types of event-driven notifications can be sent:

- Traps are notifications sent by the SNMP agent that don't require acknowledgment by the management system. Traps serve to notify the management system that something has happened within StorageGRID, such as an alert being triggered. Traps are supported in all three versions of SNMP.
- Informs are similar to traps, but they require acknowledgment by the management system. If the SNMP agent does not receive an acknowledgment within a certain amount of time, it resends the inform until an acknowledgment is received or the maximum retry value has been reached. Informs are supported in SNMPv2c and SNMPv3.

Trap and inform notifications are sent when a default or custom alert is triggered at any severity level. To suppress SNMP notifications for an alert, you must configure a silence for the alert. See Silence alert notifications.

If your StorageGRID deployment includes multiple Admin Nodes, the primary Admin Node is the preferred

sender for alert notifications, AutoSupport packages, and SNMP traps and informs. If the primary Admin Node becomes unavailable, notifications are temporarily sent by other Admin Nodes. See What is an Admin Node?.

### Set up email notifications for alerts

If you want email notifications to be sent when alerts occur, you must provide information about your SMTP server. You must also enter email addresses for the recipients of alert notifications.

#### Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have the Manage alerts or Root access permission.

#### About this task

The email setup used for alert notifications is not used for AutoSupport packages. However, you can use the same email server for all notifications.

If your StorageGRID deployment includes multiple Admin Nodes, the primary Admin Node is the preferred sender for alert notifications, AutoSupport packages, and SNMP traps and informs. If the primary Admin Node becomes unavailable, notifications are temporarily sent by other Admin Nodes. See What is an Admin Node?.

#### Steps

1. Select **ALERTS** > **Email setup**.

   The Email Setup page appears.

2. Select the **Enable Email Notifications** checkbox to indicate that you want notification emails to be sent when alerts reach configured thresholds.

   The Email (SMTP) Server, Transport Layer Security (TLS), Email Addresses, and Filters sections appear.

3. In the Email (SMTP) Server section, enter the information StorageGRID needs to access your SMTP server.

   If your SMTP server requires authentication, you must provide both a username and a password.

| Field | Enter |
| --- | --- |
| Mail Server | The fully qualified domain name (FQDN) or IP address of the SMTP server. |
| Port | The port used to access the SMTP server. Must be between 1 and 65535. |
| Username (optional) | If your SMTP server requires authentication, enter the username to authenticate with. |
| Password (optional) | If your SMTP server requires authentication, enter the password to authenticate with. |

4. In the Email Addresses section, enter email addresses for the sender and for each recipient.

a. For the **Sender Email Address**, specify a valid email address to use as the From address for alert notifications.

   For example: `storagegrid-alerts@example.com`

b. In the Recipients section, enter an email address for each email list or person who should receive an email when an alert occurs.

   Select the plus icon ➕ to add recipients.

5. If Transport Layer Security (TLS) is required for communications with the SMTP server, select **Require TLS** in the Transport Layer Security (TLS) section.

   a. In the **CA Certificate** field, provide the CA certificate that will be used to verify the identify of the SMTP server.

      You can copy and paste the contents into this field, or select **Browse** and select the file.

      You must provide a single file that contains the certificates from each intermediate issuing certificate authority (CA). The file should contain each of the PEM-encoded CA certificate files, concatenated in certificate chain order.

   b. Select the **Send Client Certificate** checkbox if your SMTP email server requires email senders to provide client certificates for authentication.

   c. In the **Client Certificate** field, provide the PEM-encoded client certificate to send to the SMTP server.

      You can copy and paste the contents into this field, or select **Browse** and select the file.

   d. In the **Private Key** field, enter the private key for the client certificate in unencrypted PEM encoding.

      You can copy and paste the contents into this field, or select **Browse** and select the file.

      ⓘ If you need to edit the email setup, select the pencil icon ✎ to update this field.

6. In the Filters section, select which alert severity levels should result in email notifications, unless the rule for a specific alert has been silenced.

| Severity | Description |
|---|---|
| Minor, major, critical | An email notification is sent when the minor, major, or critical condition for an alert rule is met. |
| Major, critical | An email notification is sent when the major or critical condition for an alert rule is met. Notifications aren’t sent for minor alerts. |
| Critical only | An email notification is sent only when the critical condition for an alert rule is met. Notifications aren’t sent for minor or major alerts. |

7. When you are ready to test your email settings, perform these steps:

   a. Select **Send Test Email**.

      A confirmation message appears, indicating that a test email was sent.

b. Check the inboxes of all email recipients and confirm that a test email was received.

> If the email is not received within a few minutes or if the **Email notification failure** alert is triggered, check your settings and try again.

c. Sign in to any other Admin Nodes and send a test email to verify connectivity from all sites.

> When you test alert notifications, you must sign in to every Admin Node to verify connectivity. This is in contrast to testing AutoSupport packages, where all Admin Nodes send the test email.

8. Select **Save**.

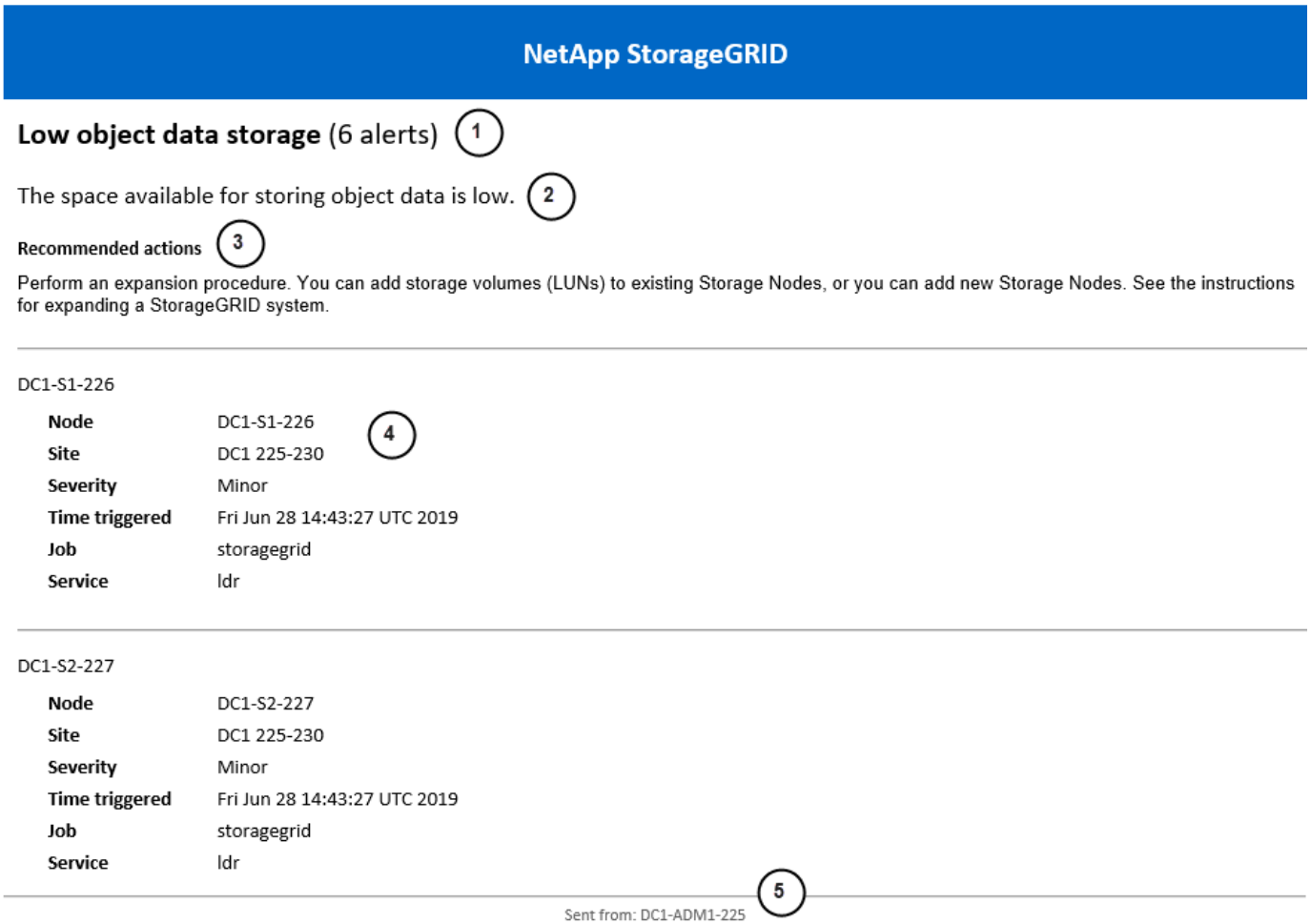
   Sending a test email does not save your settings. You must select **Save**.

   The email settings are saved.

#### Information included in alert email notifications

After you configure the SMTP email server, email notifications are sent to the designated recipients when an alert is triggered, unless the alert rule is suppressed by a silence. See Silence alert notifications.

Email notifications include the following information:



| Callout | Description |
| --- | --- |
| 1 | The name of the alert, followed by the number of active instances of this alert. |
| 2 | The description of the alert. |
| 3 | Any recommended actions for the alert. |
| 4 | Details about each active instance of the alert, including the node and site affected, the alert severity, the UTC time when the alert rule was triggered, and the name of the affected job and service. |
| 5 | The hostname of the Admin Node that sent the notification. |

#### How alerts are grouped

To prevent an excessive number of email notifications from being sent when alerts are triggered, StorageGRID attempts to group multiple alerts in the same notification.

Refer to the following table for examples of how StorageGRID groups multiple alerts in email notifications.

| Behavior | Example |
| --- | --- |
| Each alert notification applies only to alerts that have the same name. If two alerts with different names are triggered at the same time, two email notifications are sent. | • Alert A is triggered on two nodes at the same time. Only one notification is sent.<br>• Alert A is triggered on node 1, and Alert B is triggered on node 2 at the same time. Two notifications are sent—one for each alert. |
| For a specific alert on a specific node, if the thresholds are reached for more than one severity, a notification is sent only for the most severe alert. | • Alert A is triggered and the minor, major, and critical alert thresholds are reached. One notification is sent for the critical alert. |
| The first time an alert is triggered, StorageGRID waits 2 minutes before sending a notification. If other alerts with the same name are triggered during that time, StorageGRID groups all of the alerts in the initial notification. | 1. Alert A is triggered on node 1 at 08:00. No notification is sent.<br>2. Alert A is triggered on node 2 at 08:01. No notification is sent.<br>3. At 08:02, a notification is sent to report both instances of the alert. |
| If an another alert with the same name is triggered, StorageGRID waits 10 minutes before sending a new notification. The new notification reports all active alerts (current alerts that have not been silenced), even if they were reported previously. | 1. Alert A is triggered on node 1 at 08:00. A notification is sent at 08:02.<br>2. Alert A is triggered on node 2 at 08:05. A second notification is sent at 08:15 (10 minutes later). Both nodes are reported. |

| Behavior | Example |
| --- | --- |
| If there are multiple current alerts with the same name and one of those alerts is resolved, a new notification is not sent if the alert reoccurs on the node for which the alert was resolved. | 1. Alert A is triggered for node 1. A notification is sent.<br>2. Alert A is triggered for node 2. A second notification is sent.<br>3. Alert A is resolved for node 2, but it remains active for node 1.<br>4. Alert A is triggered again for node 2. No new notification is sent because the alert is still active for node 1. |
| StorageGRID continues to send email notifications once every 7 days until all instances of the alert are resolved or the alert rule is silenced. | 1. Alert A is triggered for node 1 on March 8. A notification is sent.<br>2. Alert A is not resolved or silenced. Additional notifications are sent on March 15, March 22, March 29, and so on. |

#### Troubleshoot alert email notifications

If the **Email notification failure** alert is triggered or you are unable to receive the test alert email notification, follow these steps to resolve the issue.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have the Manage alerts or Root access permission.

**Steps**

1. Verify your settings.
   a. Select **ALERTS** > **Email setup**.
   b. Verify that the Email (SMTP) Server settings are correct.
   c. Verify that you have specified valid email addresses for the recipients.
2. Check your spam filter, and make sure that the email was not sent to a junk folder.
3. Ask your email administrator to confirm that emails from the sender address aren't being blocked.
4. Collect a log file for the Admin Node, and then contact technical support.

   Technical support can use the information in the logs to help determine what went wrong. For example, the prometheus.log file might show an error when connecting to the server you specified.

   See Collect log files and system data.

#### Silence alert notifications

Optionally, you can configure silences to temporarily suppress alert notifications.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.

- You have the Manage alerts or Root access permission.

**About this task**

You can silence alert rules on the entire grid, a single site, or a single node and for one or more severities. Each silence suppresses all notifications for a single alert rule or for all alert rules.

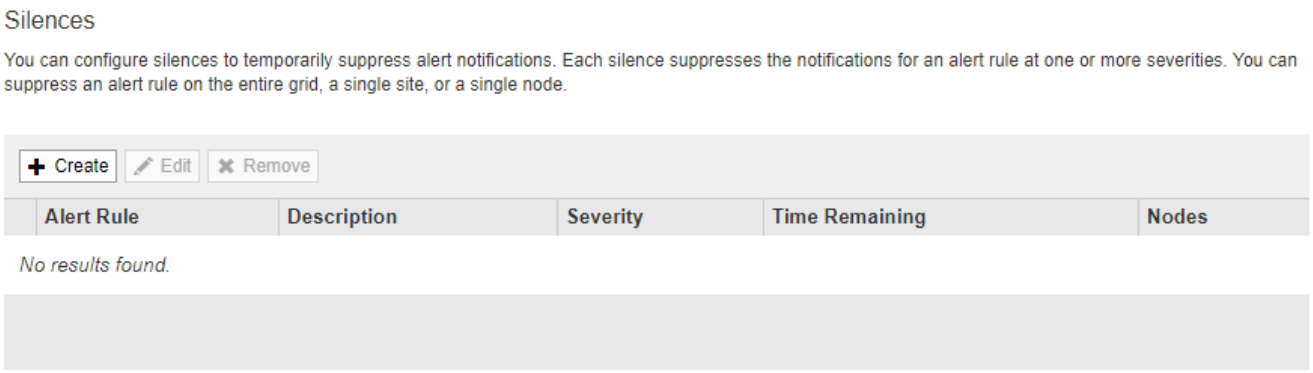
If you have enabled the SNMP agent, silences also suppress SNMP traps and informs.

> Be careful when deciding to silence an alert rule. If you silence an alert, you might not detect an underlying problem until it prevents a critical operation from completing.

**Steps**

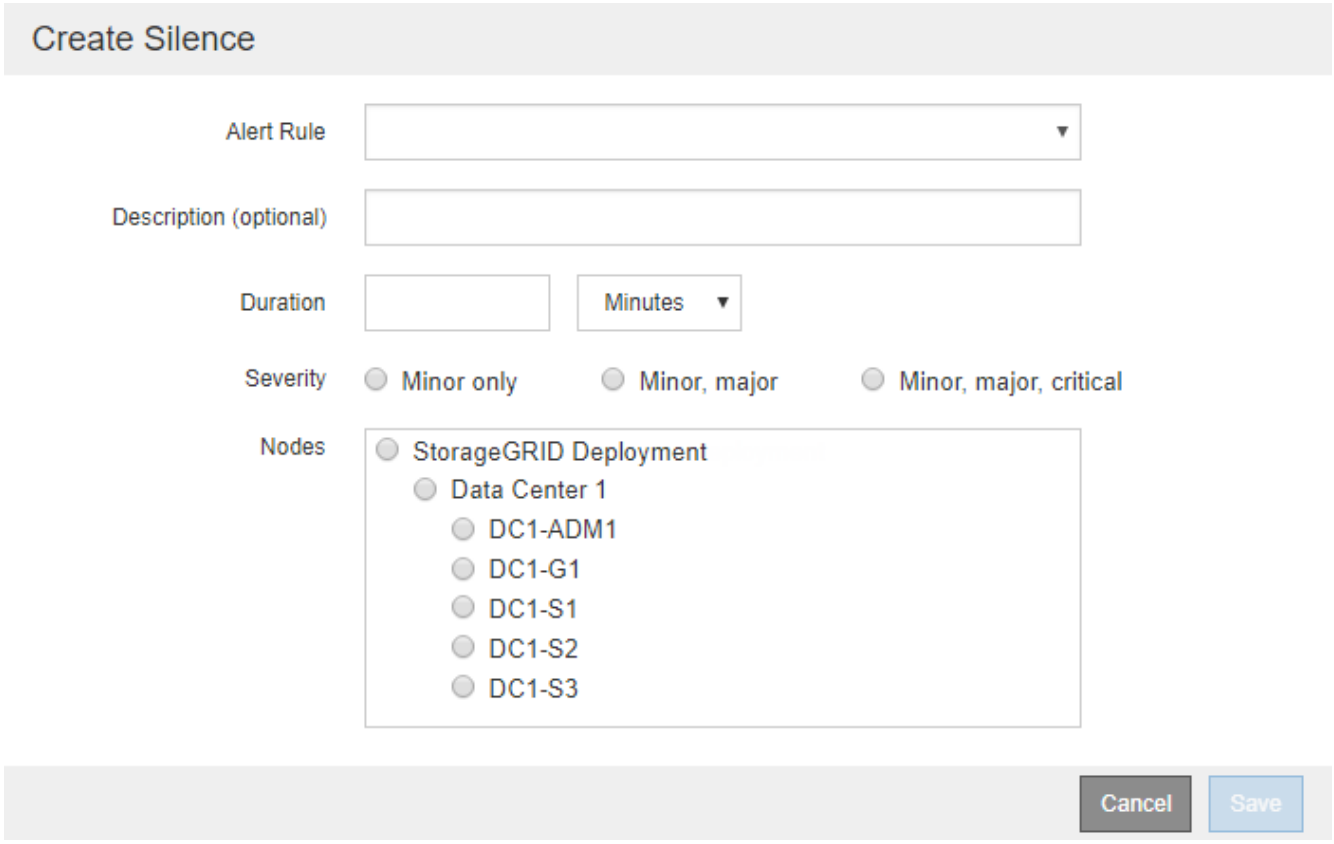
1. Select **ALERTS** > **Silences**.

   The Silences page appears.




2. Select **Create**.

   The Create Silence dialog box appears.




3. Select or enter the following information:

| Field | Description |
|---|---|
| Alert Rule | The name of the alert rule you want to silence. You can select any default or custom alert rule, even if the alert rule is disabled.<br><br>**Note:** Select **All rules** if you want to silence all alert rules using the criteria specified in this dialog box. |
| Description | Optionally, a description of the silence. For example, describe the purpose of this silence. |
| Duration | How long you want this silence to remain in effect, in minutes, hours, or days. A silence can be in effect from 5 minutes to 1,825 days (5 years).<br><br>**Note:** You should not silence an alert rule for an extended amount of time. If an alert rule is silenced, you might not detect an underlying problem until it prevents a critical operation from completing. However, you might need to use an extended silence if an alert is triggered by a specific, intentional configuration, such as might be the case for the **Services appliance link down** alerts and the **Storage appliance link down** alerts. |
| Severity | Which alert severity or severities should be silenced. If the alert is triggered at one of the selected severities, no notifications are sent. |

| Field | Description |
| --- | --- |
| Nodes | Which node or nodes you want this silence to apply to. You can suppress an alert rule or all rules on the entire grid, a single site, or a single node. If you select the entire grid, the silence applies to all sites and all nodes. If you select a site, the silence applies only to the nodes at that site.<br><br>**Note:** You can't select more than one node or more than one site for each silence. You must create additional silences if you want to suppress the same alert rule on more than one node or more than one site at one time. |

4. Select **Save**.
5. If you want to modify or end a silence before it expires, you can edit or remove it.

| Option | Description |
| --- | --- |
| Edit a silence | a. Select **ALERTS** > **Silences**.<br>b. From the table, select the radio button for the silence you want to edit.<br>c. Select **Edit**.<br>d. Change the description, the amount of time remaining, the selected severities, or the affected node.<br>e. Select **Save**. |
| Remove a silence | a. Select **ALERTS** > **Silences**.<br>b. From the table, select the radio button for the silence you want to remove.<br>c. Select **Remove**.<br>d. Select **OK** to confirm you want to remove this silence.<br><br>**Note**: Notifications will now be sent when this alert is triggered (unless suppressed by another silence). If this alert is currently triggered, it might take few minutes for email or SNMP notifications to be sent and for the Alerts page to update. |

**Related information**

Configure the SNMP agent

## Alerts reference

This reference lists the default alerts that appear in the Grid Manager. Recommended actions are in the alert message you receive.

As required, you can create custom alert rules to fit your system management approach.

Some of the default alerts use Prometheus metrics.

### Appliance alerts

| Alert name | Description |
|---|---|
| Appliance battery expired | The battery in the appliance's storage controller has expired. |
| Appliance battery failed | The battery in the appliance's storage controller has failed. |
| Appliance battery has insufficient learned capacity | The battery in the appliance's storage controller has insufficient learned capacity. |
| Appliance battery near expiration | The battery in the appliance's storage controller is nearing expiration. |
| Appliance battery removed | The battery in the appliance's storage controller is missing. |
| Appliance battery too hot | The battery in the appliance's storage controller is overheated. |
| Appliance BMC communication error | Communication with the baseboard management controller (BMC) has been lost. |
| Appliance boot device fault detected | A problem was detected with the boot device in the appliance. |
| Appliance cache backup device failed | A persistent cache backup device has failed. |
| Appliance cache backup device insufficient capacity | There is insufficient cache backup device capacity. |
| Appliance cache backup device write-protected | A cache backup device is write-protected. |
| Appliance cache memory size mismatch | The two controllers in the appliance have different cache sizes. |
| Appliance CMOS battery fault | A problem was detected with the CMOS battery in the appliance. |
| Appliance compute controller chassis temperature too high | The temperature of the compute controller in a StorageGRID appliance has exceeded a nominal threshold. |
| Appliance compute controller CPU temperature too high | The temperature of the CPU in the compute controller in a StorageGRID appliance has exceeded a nominal threshold. |
| Appliance compute controller needs attention | A hardware fault has been detected in the compute controller of a StorageGRID appliance. |

| Alert name | Description |
| --- | --- |
| Appliance compute controller power supply A has a problem | Power supply A in the compute controller has a problem. |
| Appliance compute controller power supply B has a problem | Power supply B in the compute controller has a problem. |
| Appliance compute hardware monitor service stalled | The service that monitors storage hardware status has stalled. |
| Appliance DAS drive exceeding limit for data written per day | An excessive amount of data is being written to a drive each day, which might void its warranty. |
| Appliance DAS drive fault detected | A problem was detected with a direct-attached storage (DAS) drive in the appliance. |
| Appliance DAS drive locator light on | The drive locator light for one or more direct-attached storage (DAS) drives in an appliance Storage Node is on. |
| Appliance DAS drive rebuilding | A direct-attached storage (DAS) drive is rebuilding. This is expected if it was recently replaced or removed/reinserted. |
| Appliance fan fault detected | A problem with a fan unit in the appliance was detected. |
| Appliance Fibre Channel fault detected | A Fibre Channel link problem has been detected between the appliance storage controller and compute controller |
| Appliance Fibre Channel HBA port failure | A Fibre Channel HBA port is failing or has failed. |
| Appliance flash cache drives non-optimal | The drives used for the SSD cache are non-optimal. |
| Appliance interconnect/battery canister removed | The interconnect/battery canister is missing. |
| Appliance LACP port missing | A port on a StorageGRID appliance is not participating in the LACP bond. |
| Appliance NIC fault detected | A problem with a network interface card (NIC) in the appliance was detected. |
| Appliance overall power supply degraded | The power of a StorageGRID appliance has deviated from the recommended operating voltage. |
| Appliance SSD critical warning | An appliance SSD is reporting a critical warning. |

| Alert name | Description |
| --- | --- |
| Appliance storage controller A failure | Storage controller A in a StorageGRID appliance has failed. |
| Appliance storage controller B failure | Storage controller B in a StorageGRID appliance has failed. |
| Appliance storage controller drive failure | One or more drives in a StorageGRID appliance has failed or is not optimal. |
| Appliance storage controller hardware issue | SANtricity software is reporting "Needs attention" for a component in a StorageGRID appliance. |
| Appliance storage controller power supply A failure | Power supply A in a StorageGRID appliance has deviated from the recommended operating voltage. |
| Appliance storage controller power supply B failure | Power supply B in a StorageGRID appliance has deviated from the recommended operating voltage. |
| Appliance storage hardware monitor service stalled | The service that monitors storage hardware status has stalled. |
| Appliance storage shelves degraded | The status of one of the components in the storage shelf for a storage appliance is degraded. |
| Appliance temperature exceeded | The nominal or maximum temperature for the appliance’s storage controller has been exceeded. |
| Appliance temperature sensor removed | A temperature sensor has been removed. |
| Appliance UEFI secure boot error | An appliance has not been booted securely. |
| Disk I/O is very slow | Very slow disk I/O might be impacting grid performance. |
| Storage appliance fan fault detected | A problem with a fan unit in the storage controller for an appliance was detected. |
| Storage appliance storage connectivity degraded | There is a problem with one or more connections between the compute controller and storage controller. |
| Storage device inaccessible | A storage device cannot be accessed. |

**Audit and syslog alerts**

| Alert name | Description |
| --- | --- |
| Audit logs are being added to the in-memory queue | Node cannot send logs to the local syslog server and the in-memory queue is filling up. |
| External syslog server forwarding error | Node cannot forward logs to the external syslog server. |
| Large audit queue | The disk queue for audit messages is full. If this condition is not addressed, S3 or Swift operations might fail. |
| Logs are being added to the on-disk queue | Node cannot forward logs to the external syslog server and the on-disk queue is filling up. |

### Bucket alerts

| Alert name | Description |
| --- | --- |
| FabricPool bucket has unsupported bucket consistency setting | A FabricPool bucket uses the Available or Strong-site consistency level, which is not supported. |
| FabricPool bucket has unsupported versioning setting | A FabricPool bucket has versioning or S3 Object Lock enabled, which are not supported. |

### Cassandra alerts

| Alert name | Description |
| --- | --- |
| Cassandra auto-compactor error | The Cassandra auto-compactor has experienced an error. |
| Cassandra auto-compactor metrics out of date | The metrics that describe the Cassandra auto-compactor are out of date. |
| Cassandra communication error | The nodes that run the Cassandra service are having trouble communicating with each other. |
| Cassandra compactions overloaded | The Cassandra compaction process is overloaded. |
| Cassandra oversize write error | An internal StorageGRID process sent a write request to Cassandra that was too large. |
| Cassandra repair metrics out of date | The metrics that describe Cassandra repair jobs are out of date. |
| Cassandra repair progress slow | The progress of Cassandra database repairs is slow. |

| Alert name | Description |
| --- | --- |
| Cassandra repair service not available | The Cassandra repair service is not available. |
| Cassandra table corruption | Cassandra has detected table corruption. Cassandra automatically restarts if it detects table corruption. |

### Cloud Storage Pool alerts

| Alert name | Description |
| --- | --- |
| Cloud Storage Pool connectivity error | The health check for Cloud Storage Pools detected one or more new errors. |
| IAM Roles Anywhere end-entity certification expiration | IAM Roles Anywhere end-entity certificate is about to expire. |

### Cross-grid replication alerts

| Alert name | Description |
| --- | --- |
| Cross-grid replication permanent failure | A cross-grid replication error occurred that requires user intervention to resolve. |
| Cross-grid replication resources unavailable | Cross-grid replication requests are pending because a resource is unavailable. |

### DHCP alerts

| Alert name | Description |
| --- | --- |
| DHCP lease expired | The DHCP lease on a network interface has expired. |
| DHCP lease expiring soon | The DHCP lease on a network interface is expiring soon. |
| DHCP server unavailable | The DHCP server is unavailable. |

### Debug and trace alerts

| Alert name | Description |
| --- | --- |
| Debug performance impact | When debug mode is enabled, system performance might be negatively impacted. |
| Trace configuration enabled | When trace configuration is enabled, system performance might be negatively impacted. |

### Email and AutoSupport alerts

| Alert name | Description |
|---|---|
| AutoSupport message failed to send | The most recent AutoSupport message failed to send. |
| Domain name resolution failure | The StorageGRID node has been unable to resolve domain names. |
| Email notification failure | The email notification for an alert could not be sent. |
| SNMP inform errors | Errors sending SNMP inform notifications to a trap destination. |
| SSH or console login detected | In the past 24 hours, a user has logged in with Web Console or SSH. |

### Erasure coding (EC) alerts

| Alert name | Description |
|---|---|
| EC rebalance failure | The EC rebalance procedure has failed or has been stopped. |
| EC repair failure | A repair job for EC data has failed or has been stopped. |
| EC repair stalled | A repair job for EC data has stalled. |
| Erasure-coded fragment verification error | Erasure-coded fragments can no longer be verified. Corrupt fragments might not be repaired. |

### Expiration of certificates alerts

| Alert name | Description |
|---|---|
| Admin Proxy CA certificate expiration | One or more certificates in the admin proxy server CA bundle is about to expire. |
| Expiration of client certificate | One or more client certificates are about to expire. |
| Expiration of global server certificate for S3 and Swift | The global server certificate for S3 and Swift is about to expire. |
| Expiration of load balancer endpoint certificate | One or more load balancer endpoint certificates are about to expire. |
| Expiration of server certificate for Management interface | The server certificate used for the management interface is about to expire. |

| Alert name | Description |
| --- | --- |
| External syslog CA certificate expiration | The certificate authority (CA) certificate used to sign the external syslog server certificate is about to expire. |
| External syslog client certificate expiration | The client certificate for an external syslog server is about to expire. |
| External syslog server certificate expiration | The server certificate presented by the external syslog server is about to expire. |

### Grid Network alerts

| Alert name | Description |
| --- | --- |
| Grid Network MTU mismatch | The MTU setting for the Grid Network interface (eth0) differs significantly across nodes in the grid. |

### Grid federation alerts

| Alert name | Description |
| --- | --- |
| Expiration of grid federation certificate | One or more grid federation certificates are about to expire. |
| Grid federation connection failure | The grid federation connection between the local and remote grid is not working. |

### High usage or high latency alerts

| Alert name | Description |
| --- | --- |
| High Java heap use | A high percentage of Java heap space is being used. |
| High latency for metadata queries | The average time for Cassandra metadata queries is too long. |

### Identity federation alerts

| Alert name | Description |
| --- | --- |
| Identity federation synchronization failure | Unable to synchronize federated groups and users from the identity source. |
| Identity federation synchronization failure for a tenant | Unable to synchronize federated groups and users from the identity source configured by a tenant. |

### Information lifecycle management (ILM) alerts

| Alert name | Description |
|---|---|
| ILM placement unachievable | A placement instruction in an ILM rule cannot be achieved for certain objects. |
| ILM scan rate low | The ILM scan rate is set to less than 100 objects/second. |

### Key management server (KMS) alerts

| Alert name | Description |
|---|---|
| KMS CA certificate expiration | The certificate authority (CA) certificate used to sign the key management server (KMS) certificate is about to expire. |
| KMS client certificate expiration | The client certificate for a key management server is about to expire |
| KMS configuration failed to load | The configuration for the key management server exists but failed to load. |
| KMS connectivity error | An appliance node could not connect to the key management server for its site. |
| KMS encryption key name not found | The configured key management server does not have an encryption key that matches the name provided. |
| KMS encryption key rotation failed | All appliance volumes were successfully decrypted, but one or more volumes could not rotate to the latest key. |
| KMS is not configured | No key management server exists for this site. |
| KMS key failed to decrypt an appliance volume | One or more volumes on an appliance with node encryption enabled could not be decrypted with the current KMS key. |
| KMS server certificate expiration | The server certificate used by the key management server (KMS) is about to expire. |
| KMS server connectivity failure | An appliance node could not connect to one or more servers in the key management server cluster for its site. |

### Load balancer alerts

| Alert name | Description |
|---|---|
| Elevated zero-request load balancer connections | An elevated percentage of connections to load balancer endpoints disconnected without performing requests. |

### Local clock offset alerts

| Alert name | Description |
|---|---|
| Local clock large time offset | The offset between local clock and Network Time Protocol (NTP) time is too large. |

### Low memory or low space alerts

| Alert name | Description |
|---|---|
| Low audit log disk capacity | The space available for audit logs is low. If this condition is not addressed, S3 or Swift operations might fail. |
| Low available node memory | The amount of RAM available on a node is low. |
| Low free space for storage pool | The space available for storing object data in the Storage Node is low. |
| Low installed node memory | The amount of installed memory on a node is low. |
| Low metadata storage | The space available for storing object metadata is low. |
| Low metrics disk capacity | The space available for the metrics database is low. |
| Low object data storage | The space available for storing object data is low. |
| Low read-only watermark override | The storage volume soft read-only watermark override is less than the minimum optimized watermark for a Storage Node. |
| Low root disk capacity | The space available on the root disk is low. |
| Low system data capacity | The space available for /var/local is low. If this condition is not addressed, S3 or Swift operations might fail. |
| Low tmp directory free space | The space available in the /tmp directory is low. |

### Node or node network alerts

| Alert name | Description |
|---|---|
| Admin Network receive usage | The receive usage on the Admin Network is high. |
| Admin Network transmit usage | The transmit usage on the Admin Network is high. |
| Firewall configuration failure | Failed to apply firewall configuration. |

| Alert name | Description |
| --- | --- |
| Management interface endpoints in fallback mode | All management interface endpoints have been falling back to the default ports for too long. |
| Node network connectivity error | Errors have occurred while transferring data between nodes. |
| Node network reception frame error | A high percentage of the network frames received by a node had errors. |
| Node not in sync with NTP server | The node is not in sync with the network time protocol (NTP) server. |
| Node not locked with NTP server | The node is not locked to a network time protocol (NTP) server. |
| Non-appliance node network down | One or more network devices are down or disconnected. |
| Services appliance link down on Admin Network | The appliance interface to the Admin Network (eth1) is down or disconnected. |
| Services appliance link down on Admin Network port 1 | The Admin Network port 1 on the appliance is down or disconnected. |
| Services appliance link down on Client Network | The appliance interface to the Client Network (eth2) is down or disconnected. |
| Services appliance link down on network port 1 | Network port 1 on the appliance is down or disconnected. |
| Services appliance link down on network port 2 | Network port 2 on the appliance is down or disconnected. |
| Services appliance link down on network port 3 | Network port 3 on the appliance is down or disconnected. |
| Services appliance link down on network port 4 | Network port 4 on the appliance is down or disconnected. |
| Storage appliance link down on Admin Network | The appliance interface to the Admin Network (eth1) is down or disconnected. |
| Storage appliance link down on Admin Network port 1 | The Admin Network port 1 on the appliance is down or disconnected. |
| Storage appliance link down on Client Network | The appliance interface to the Client Network (eth2) is down or disconnected. |
| Storage appliance link down on network port 1 | Network port 1 on the appliance is down or disconnected. |

| Alert name | Description |
| --- | --- |
| Storage appliance link down on network port 2 | Network port 2 on the appliance is down or disconnected. |
| Storage appliance link down on network port 3 | Network port 3 on the appliance is down or disconnected. |
| Storage appliance link down on network port 4 | Network port 4 on the appliance is down or disconnected. |
| Storage Node not in desired storage state | The LDR service on a Storage Node cannot transition to the desired state because of an internal error or volume related issue |
| TCP connection usage | The number of TCP connections on this node is approaching the maximum number that can be tracked. |
| Unable to communicate with node | One or more services are unresponsive, or the node cannot be reached. |
| Unexpected node reboot | A node rebooted unexpectedly within the last 24 hours. |

**Object alerts**

| Alert name | Description |
| --- | --- |
| Object existence check failed | The object existence check job has failed. |
| Object existence check stalled | The object existence check job has stalled. |
| Objects lost | One or more objects have been lost from the grid. |
| S3 PUT object size too large | A client is attempting a PUT Object operation that exceeds S3 size limits. |
| Unidentified corrupt object detected | A file was found in replicated object storage that could not be identified as a replicated object. |

**Platform services alerts**

| Alert name | Description |
| --- | --- |
| Platform Services pending request capacity low | The number of Platform Services pending requests is approaching capacity. |
| Platform services unavailable | Too few Storage Nodes with the RSM service are running or available at a site. |

**Storage volume alerts**

| Alert name | Description |
|---|---|
| Storage volume needs attention | A storage volume is offline and needs attention. |
| Storage volume needs to be restored | A storage volume has been recovered and needs to be restored. |
| Storage volume offline | A storage volume has been offline for more than 5 minutes. |
| Storage volume remount attempted | A storage volume was offline and triggered an automatic remount. This could indicate a drive issue or filesystem errors. |
| Volume Restoration failed to start replicated data repair | Replicated data repair for a repaired volume couldn’t be started automatically. |

**StorageGRID services alerts**

| Alert name | Description |
|---|---|
| nginx service using backup configuration | The configuration of the nginx service is invalid. The previous configuration is now being used. |
| nginx-gw service using backup configuration | The configuration of the nginx-gw service is invalid. The previous configuration is now being used. |
| Reboot required to disable FIPS | The security policy does not require FIPS mode, but the NetApp Cryptographic Security Module is enabled. |
| Reboot required to enable FIPS | The security policy requires FIPS mode, but the NetApp Cryptographic Security Module is disabled. |
| SSH service using backup configuration | The configuration of the SSH service is invalid. The previous configuration is now being used. |

**Tenant alerts**

| Alert name | Description |
|---|---|
| Tenant quota usage high | A high percentage of quota space is being used. This rule is disabled by default because it might cause too many notifications. |

## Commonly used Prometheus metrics

Refer to this list of commonly used Prometheus metrics to better understand conditions in the default alert rules or to construct the conditions for custom alert rules.

You can also obtain a complete list of all metrics.

For details on the syntax of Prometheus queries, see Querying Prometheus.

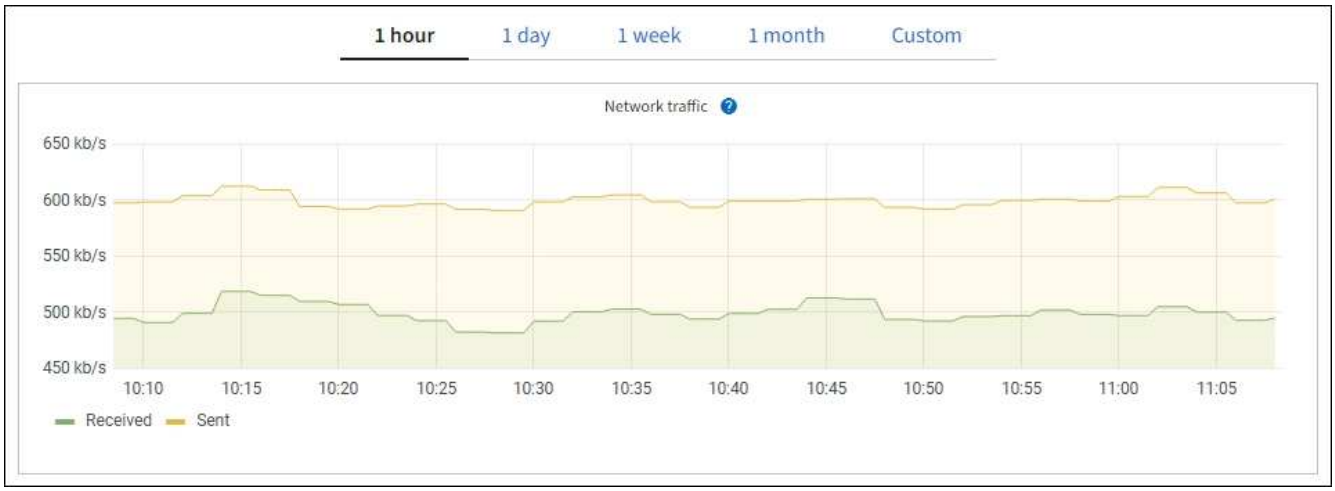
### What are Prometheus metrics?

Prometheus metrics are time series measurements. The Prometheus service on Admin Nodes collects these metrics from the services on all nodes. Metrics are stored on each Admin Node until the space reserved for Prometheus data is full. When the `/var/local/mysql_ibdata/` volume reaches capacity, the oldest metrics are deleted first.

### Where are Prometheus metrics used?

The metrics collected by Prometheus are used in several places in the Grid Manager:

- **Nodes page**: The graphs and charts on the tabs available from the Nodes page use the Grafana visualization tool to display the time-series metrics collected by Prometheus. Grafana displays time-series data in graph and chart formats, while Prometheus serves as the backend data source.




- **Alerts**: Alerts are triggered at specific severity levels when alert rule conditions that use Prometheus metrics evaluate as true.
- **Grid Management API**: You can use Prometheus metrics in custom alert rules or with external automation tools to monitor your StorageGRID system. A complete list of Prometheus metrics is available from the Grid Management API. (From the top of the Grid Manager, select the help icon and select **API documentation** > **metrics**.) While more than a thousand metrics are available, only a relatively small number are required to monitor the most critical StorageGRID operations.

> Metrics that include *private* in their names are intended for internal use only and are subject to change between StorageGRID releases without notice.

- The **SUPPORT** > **Tools** > **Diagnostics** page and the **SUPPORT** > **Tools** > **Metrics** page: These pages, which are primarily intended for use by technical support, provide several tools and charts that use the values of Prometheus metrics.

> Some features and menu items within the Metrics page are intentionally non-functional and are subject to change.

### List of most common metrics

The following list contains the most commonly used Prometheus metrics.

> Metrics that include *private* in their names are for internal use only and are subject to change without notice between StorageGRID releases.

**alertmanager_notifications_failed_total**
The total number of failed alert notifications.

**node_filesystem_avail_bytes**
The amount of file system space available to non-root users in bytes.

**node_memory_MemAvailable_bytes**
Memory information field MemAvailable_bytes.

**node_network_carrier**
Carrier value of `/sys/class/net/iface`.

**node_network_receive_errs_total**
Network device statistic `receive_errs`.

**node_network_transmit_errs_total**
Network device statistic `transmit_errs`.

**storagegrid_administratively_down**
The node is not connected to the grid for an expected reason. For example, the node, or services on the node, has been gracefully shut down, the node is rebooting, or the software is being upgraded.

**storagegrid_appliance_compute_controller_hardware_status**
The status of the compute controller hardware in an appliance.

**storagegrid_appliance_failed_disks**
For the storage controller in an appliance, the number of drives that aren't optimal.

**storagegrid_appliance_storage_controller_hardware_status**
The overall status of the storage controller hardware in an appliance.

**storagegrid_content_buckets_and_containers**
The total number of S3 buckets and Swift containers known by this Storage Node.

**storagegrid_content_objects**
The total number of S3 and Swift data objects known by this Storage Node. Count is valid only for data objects created by client applications that interface with the system through S3.

**storagegrid_content_objects_lost**
The total number of objects this service detects as missing from the StorageGRID system. Action should be taken to determine the cause of the loss and if recovery is possible.

Troubleshoot lost and missing object data

**storagegrid_http_sessions_incoming_attempted**

The total number of HTTP sessions that have been attempted to a Storage Node.

**storagegrid_http_sessions_incoming_currently_established**

The number of HTTP sessions that are currently active (open) on the Storage Node.

**storagegrid_http_sessions_incoming_failed**

The total number of HTTP sessions that failed to complete successfully, either due to a malformed HTTP request or a failure while processing an operation.

**storagegrid_http_sessions_incoming_successful**

The total number of HTTP sessions that have completed successfully.

**storagegrid_ilm_awaiting_background_objects**

The total number of objects on this node awaiting ILM evaluation from the scan.

**storagegrid_ilm_awaiting_client_evaluation_objects_per_second**

The current rate at which objects are evaluated against the ILM policy on this node.

**storagegrid_ilm_awaiting_client_objects**

The total number of objects on this node awaiting ILM evaluation from client operations (for example, ingest).

**storagegrid_ilm_awaiting_total_objects**

The total number of objects awaiting ILM evaluation.

**storagegrid_ilm_scan_objects_per_second**

The rate at which objects owned by this node are scanned and queued for ILM.

**storagegrid_ilm_scan_period_estimated_minutes**

The estimated time to complete a full ILM scan on this node.

**Note:** A full scan does not guarantee that ILM has been applied to all objects owned by this node.

**storagegrid_load_balancer_endpoint_cert_expiry_time**

The expiration time of the load balancer endpoint certificate in seconds since the epoch.

**storagegrid_metadata_queries_average_latency_milliseconds**

The average time required to run a query against the metadata store through this service.

**storagegrid_network_received_bytes**

The total amount of data received since installation.

**storagegrid_network_transmitted_bytes**

The total amount of data sent since installation.

**storagegrid_node_cpu_utilization_percentage**

The percentage of available CPU time currently being used by this service. Indicates how busy the service is. The amount of available CPU time depends on the number of CPUs for the server.

**storagegrid_ntp_chosen_time_source_offset_milliseconds**

Systematic offset of time provided by a chosen time source. Offset is introduced when the delay to reach a time source is not equal to the time required for the time source to reach the NTP client.

**storagegrid_ntp_locked**

The node is not locked to a Network Time Protocol (NTP) server.

**storagegrid_s3_data_transfers_bytes_ingested**

The total amount of data ingested from S3 clients to this Storage Node since the attribute was last reset.

**storagegrid_s3_data_transfers_bytes_retrieved**

The total amount of data retrieved by S3 clients from this Storage Node since the attribute was last reset.

**storagegrid_s3_operations_failed**

The total number of failed S3 operations (HTTP status codes 4xx and 5xx), excluding those caused by S3 authorization failure.

**storagegrid_s3_operations_successful**

The total number of successful S3 operations (HTTP status code 2xx).

**storagegrid_s3_operations_unauthorized**

The total number of failed S3 operations that are the result of an authorization failure.

**storagegrid_servercertificate_management_interface_cert_expiry_days**

The number of days before the Management Interface certificate expires.

**storagegrid_servercertificate_storage_api_endpoints_cert_expiry_days**

The number of days before the Object Storage API certificate expires.

**storagegrid_service_cpu_seconds**

The cumulative amount of time that the CPU has been used by this service since installation.

**storagegrid_service_memory_usage_bytes**

The amount of memory (RAM) currently in use by this service. This value is identical to that displayed by the Linux top utility as RES.

**storagegrid_service_network_received_bytes**

The total amount of data received by this service since installation.

**storagegrid_service_network_transmitted_bytes**

The total amount of data sent by this service.

**storagegrid_service_restarts**

The total number of times the service has been restarted.

**storagegrid_service_runtime_seconds**

The total amount of time that the service has been running since installation.

**storagegrid_service_uptime_seconds**

The total amount of time the service has been running since it was last restarted.

**storagegrid_storage_state_current**

The current state of the storage services. Attribute values are:

- 10 = Offline
- 15 = Maintenance
- 20 = Read-only
- 30 = Online

**storagegrid_storage_status**

The current status of the storage services. Attribute values are:

- 0 = No Errors
- 10 = In Transition
- 20 = Insufficient Free Space
- 30 = Volume(s) Unavailable
- 40 = Error

**storagegrid_storage_utilization_data_bytes**

An estimate of the total size of replicated and erasure-coded object data on the Storage Node.

**storagegrid_storage_utilization_metadata_allowed_bytes**

The total space on volume 0 of each Storage Node that is allowed for object metadata. This value is always less than the actual space reserved for metadata on a node, because a portion of the reserved space is required for essential database operations (such as compaction and repair) and future hardware and software upgrades.The allowed space for object metadata controls overall object capacity.

**storagegrid_storage_utilization_metadata_bytes**

The amount of object metadata on storage volume 0, in bytes.

**storagegrid_storage_utilization_total_space_bytes**

The total amount of storage space allocated to all object stores.

**storagegrid_storage_utilization_usable_space_bytes**

The total amount of object storage space remaining. Calculated by adding together the amount of available space for all object stores on the Storage Node.

**storagegrid_swift_data_transfers_bytes_ingested**

The total amount of data ingested from Swift clients to this Storage Node since the attribute was last reset.

**storagegrid_swift_data_transfers_bytes_retrieved**

The total amount of data retrieved by Swift clients from this Storage Node since the attribute was last reset.

**storagegrid_swift_operations_failed**

The total number of failed Swift operations (HTTP status codes 4xx and 5xx), excluding those caused by Swift authorization failure.

**storagegrid_swift_operations_successful**

The total number of successful Swift operations (HTTP status code 2xx).

**storagegrid_swift_operations_unauthorized**

The total number of failed Swift operations that are the result of an authorization failure (HTTP status codes 401, 403, 405).

**storagegrid_tenant_usage_data_bytes**

The logical size of all objects for the tenant.

**storagegrid_tenant_usage_object_count**

The number of objects for the tenant.

**storagegrid_tenant_usage_quota_bytes**

The maximum amount of logical space available for the tenant's objects. If a quota metric is not provided, an unlimited amount of space is available.

### Get a list of all metrics

To obtain the complete list of metrics, use the Grid Management API.

1. From the top of the Grid Manager, select the help icon and select **API documentation**.
2. Locate the **metrics** operations.
3. Execute the `GET /grid/metric-names` operation.
4. Download the results.

# Log files reference

## Log files reference

StorageGRID provides logs that are used to capture events, diagnostic messages, and error conditions. You might be asked to collect log files and forward them to technical support to assist with troubleshooting.

The logs are categorized as follows:

- StorageGRID software logs
- Deployment and maintenance logs
- About the bycast.log

> The details provided for each log type are for reference only. The logs are intended for advanced troubleshooting by technical support. Advanced techniques that involve reconstructing the problem history using the audit logs and the application log files are beyond the scope of these instructions.

### Access the logs

To access the logs, you can collect log files and system data from one or more nodes as a single log file archive. Or, if the primary Admin Node is unavailable or unable to reach a specific node, you can access individual log files for each grid node as follows:

1. Enter the following command: `ssh admin@grid_node_IP`

2. Enter the password listed in the `Passwords.txt` file.
3. Enter the following command to switch to root: `su -`
4. Enter the password listed in the `Passwords.txt` file.

### Export logs to the syslog server

Exporting the logs to the syslog server provides these capabilities:

- Receive a list of all Grid Manager and Tenant Manager requests, in addition to S3 and Swift requests.
- Better visibility into S3 requests that return errors, without the performance impact caused by audit logging methods.
- Access to HTTP-layer requests and error codes that are easy to parse.
- Better visibility into requests that were blocked by traffic classifiers at the load balancer.

To export the logs, refer to Configure audit messages and log destinations.

### Log file categories

The StorageGRID log file archive contains the logs described for each category and additional files that contain metrics and debug command output.

| Archive location | Description |
|---|---|
| `audit` | Audit messages generated during normal system operation. |
| `base-os-logs` | Base operating system information, including StorageGRID image versions. |
| `bundles` | Global configuration information (bundles). |
| `cassandra` | Cassandra database information and Reaper repair logs. |
| `ec` | VCSs information about the current node and EC group information by profile ID. |
| `grid` | General grid logs including debug (`bycast.log`) and `servermanager` logs. |
| `grid.json` | Grid configuration file shared across all nodes. Additionally, `node.json` is specific to the current node. |
| `hagroups` | High availability groups metrics and logs. |
| `install` | `Gdu-server` and install logs. |
| `Lambda-arbitrator` | Logs related to the S3 Select proxy request. |
| `lumberjack.log` | Debug messages related to log collection. |

| Archive location | Description |
| --- | --- |
| `Metrics` | Service logs for Grafana, Jaeger, node exporter, and Prometheus. |
| `miscd` | Miscd access and error logs. |
| `mysql` | The mariaDB database configuration and related logs. |
| `net` | Logs generated by networking-related scripts and the Dynip service. |
| `nginx` | Load balancer and grid federation configuration files and logs. Also includes Grid Manager and Tenant Manager traffic logs. |
| `nginx-gw` | • `access.log`: Grid Manager and Tenant manager request log messages.<br>◦ These messages are prefixed with `mgmt:` when exported using syslog.<br>◦ The format of these log messages is `[$time_iso8601] $remote_addr $status $bytes_sent $request_length $request_time "$endpointId" "$request" "$http_host" "$http_user_agent" "$http_referer"`<br>• `cgr-access.log.gz`: Inbound cross-grid replication requests.<br>◦ These messages are prefixed with `cgr:` when exported using syslog.<br>◦ The format of these log messages is `[$time_iso8601] $remote_addr $status $bytes_sent $request_length $request_time "$endpointId" "$upstream_addr" "$request" "$http_host"`<br>• `endpoint-access.log.gz`: S3 and Swift requests to load balancer endpoints.<br>◦ These messages are prefixed with `endpoint:` when exported using syslog.<br>◦ The format of these log messages is `[$time_iso8601] $remote_addr $status $bytes_sent $request_length $request_time "$endpointId" "$upstream_addr" "$request" "$http_host"`<br>• `nginx-gw-dns-check.log`: Related to the new DNS check alert. |
| `ntp` | NTP configuration file and logs. |
| Orphaned objects | Logs pertaining to orphaned objects. |
| `os` | Node and grid state file, including services `pid`. |
| `other` | Log files under `/var/local/log` that aren’t collected in other folders. |

| Archive location | Description |
|---|---|
| `perf` | Peformance information for CPU, networking, and disk I/O. |
| `prometheus-data` | Current Prometheus metrics, if the log collection includes Prometheus data. |
| `provisioning` | Logs related to grid provisioning process. |
| `raft` | Logs from Raft cluster used in platform services. |
| `ssh` | Logs related to SSH configuration and service. |
| `snmp` | SNMP agent configuration used for sending SNMP notifications. |
| `sockets-data` | Sockets data for network debug. |
| `system-commands.txt` | Output of StorageGRID container commands. Contains system information, such as networking and disk usage. |
| `synchronize-recovery-package` | Related to maintaining consistency of the latest Recovery Package across all Admin Nodes and Storage Nodes that host the ADC service. |

## StorageGRID software logs

You can use StorageGRID logs to troubleshoot issues.

> If you want to send your logs to an external syslog server or change the destination of audit information such as the `bycast.log` and `nms.log`, see Configure audit messages and log destinations.

### General StorageGRID logs

| File name | Notes | Found on |
|---|---|---|
| `/var/local/log/bycast.log` | The primary StorageGRID troubleshooting file. Select **SUPPORT** > **Tools** > **Grid topology**. Then select ***Site*** > ***Node*** > **SSM** > **Events**. | All nodes |
| `/var/local/log/bycast-err.log` | Contains a subset of `bycast.log` (messages with severity ERROR and CRITICAL). CRITICAL messages are also displayed in the system. Select **SUPPORT** > **Tools** > **Grid topology**. Then select ***Site*** > ***Node*** > **SSM** > **Events**. | All nodes |

| File name | Notes | Found on |
|---|---|---|
| `/var/local/core/` | Contains any core dump files created if the program terminates abnormally. Possible causes include assertion failures, violations, or thread timeouts.<br><br>**Note**: The file `` `/var/local/core/kexec_cmd `` usually exists on appliance nodes and does not indicate an error. | All nodes |

### Cipher-related logs

| File name | Notes | Found on |
|---|---|---|
| `/var/local/log/ssh-config-generation.log` | Contains logs related to generating SSH configurations and reloading SSH services. | All nodes |
| `/var/local/log/nginx/config-generation.log` | Contains logs related to generating nginx configurations and reloading nginx services. | All nodes |
| `/var/local/log/nginx-gw/config-generation.log` | Contains logs related to generating nginx-gw configurations (and reloading nginx-gw services). | Admin and Gateway Nodes |
| `/var/local/log/update-cipher-configurations.log` | Contains logs related to configuring TLS and SSH policies. | All nodes |

### Grid federation logs

| File name | Notes | Found on |
|---|---|---|
| `/var/local/log/update_grid_federation_config.log` | Contains logs related to generating nginx and nginx-gw configurations for grid federation connections. | All nodes |

### NMS logs

| File name | Notes | Found on |
| --- | --- | --- |
| `/var/local/log/nms.log` | • Captures notifications from the Grid Manager and the Tenant Manager.<br>• Captures events related to the operation of the NMS service. For example, email notifications and configuration changes.<br>• Contains XML bundle updates resulting from configuration changes made in the system.<br>• Contains error messages related to the attribute downsampling done once a day.<br>• Contains Java web server error messages, for example, page generation errors and HTTP Status 500 errors. | Admin Nodes |
| `/var/local/log/nms.errlog` | Contains error messages related to MySQL database upgrades.<br><br>Contains the Standard Error (stderr) stream of the corresponding services. There is one log file per service. These files are generally empty unless there are problems with the service. | Admin Nodes |
| `/var/local/log/nms.requestlog` | Contains information about outgoing connections from the Management API to internal StorageGRID services. | Admin Nodes |

**Server Manager logs**

| File name | Notes | Found on |
| --- | --- | --- |
| `/var/local/log/servermanager.log` | Log file for the Server Manager application running on the server. | All nodes |
| `/var/local/log/GridstatBackend.errlog` | Log file for the Server Manager GUI backend application. | All nodes |
| `/var/local/log/gridstat.errlog` | Log file for the Server Manager GUI. | All nodes |

**StorageGRID services logs**

| File name | Notes | Found on |
| --- | --- | --- |
| `/var/local/log/acct.errlog` | | Storage Nodes running the ADC service |
| `/var/local/log/adc.errlog` | Contains the Standard Error (stderr) stream of the corresponding services. There is one log file per service. These files are generally empty unless there are problems with the service. | Storage Nodes running the ADC service |
| `/var/local/log/ams.errlog` | | Admin Nodes |
| `/var/local/log/cassandra/system.log` | Information for the metadata store (Cassandra database) that can be used if problems occur when adding new Storage Nodes, or if the nodetool repair task stalls. | Storage Nodes |
| `/var/local/log/cassandra-reaper.log` | Information for the Cassandra Reaper service, which performs repairs of the data in the Cassandra database. | Storage Nodes |
| `/var/local/log/cassandra-reaper.errlog` | Error information for the Cassandra Reaper service. | Storage Nodes |
| `/var/local/log/chunk.errlog` | | Storage Nodes |
| `/var/local/log/cmn.errlog` | | Admin Nodes |
| `/var/local/log/cms.errlog` | This log file might be present on systems that have been upgraded from an older version of StorageGRID. It contains legacy information. | Storage Nodes |
| `/var/local/log/dds.errlog` | | Storage Nodes |
| `/var/local/log/dmv.errlog` | | Storage Nodes |
| `/var/local/log/dynip*` | Contains logs related to the dynip service, which monitors the grid for dynamic IP changes and updates local configuration. | All nodes |
| `/var/local/log/grafana.log` | The log associated with the Grafana service, which is used for metrics visualization in the Grid Manager. | Admin Nodes |

| File name | Notes | Found on |
| --- | --- | --- |
| `/var/local/log/hagroups.log` | The log associated with high availability groups. | Admin Nodes and Gateway Nodes |
| `/var/local/log/hagroups_events.log` | Tracks state changes, such as transition from BACKUP to MASTER or FAULT. | Admin Nodes and Gateway Nodes |
| `/var/local/log/idnt.errlog` | | Storage Nodes running the ADC service |
| `/var/local/log/jaeger.log` | The log associated with the jaeger service, which is used for trace collection. | All nodes |
| `/var/local/log/kstn.errlog` | | Storage Nodes running the ADC service |
| `/var/local/log/lambda*` | Contains logs for the S3 Select service. | Admin and Gateway Nodes<br><br>Only certain Admin and Gateway Nodes contain this log. See the S3 Select requirements and limitations for Admin and Gateway Nodes. |
| `/var/local/log/ldr.errlog` | | Storage Nodes |
| `/var/local/log/miscd/*.log` | Contains logs for the MISCd service (Information Service Control Daemon), which provides an interface for querying and managing services on other nodes and for managing environmental configurations on the node such as querying the state of services running on other nodes. | All nodes |
| `/var/local/log/nginx/*.log` | Contains logs for the nginx service, which acts as an authentication and secure communication mechanism for various grid services (such as Prometheus and Dynip) to be able to talk to services on other nodes over HTTPS APIs. | All nodes |

| File name | Notes | Found on |
| --- | --- | --- |
| `/var/local/log/nginx-gw/*.log` | Contains general logs related to the nginx-gw service, including error logs, and logs for the restricted admin ports on Admin Nodes. | Admin Nodes and Gateway Nodes |
| `/var/local/log/nginx-gw/cgr-access.log.gz` | Contains access logs related to cross-grid replication traffic. | Admin Nodes, Gateway Nodes, or both, based on the grid federation configuration. Only found on the destination grid for cross-grid replication. |
| `/var/local/log/nginx-gw/endpoint-access.log.gz` | Contains access logs for the Load Balancer service, which provides load balancing of S3 traffic from clients to Storage Nodes. | Admin Nodes and Gateway Nodes |
| `/var/local/log/persistence*` | Contains logs for the Persistence service, which manages files on the root disk that need to persist across a reboot. | All nodes |
| `/var/local/log/prometheus.log` | For all nodes, contains the node exporter service log and the ade-exporter metrics service log.<br><br>For Admin Nodes, also contains logs for the Prometheus and Alert Manager services. | All nodes |
| `/var/local/log/raft.log` | Contains the output of the library used by the RSM service for the Raft protocol. | Storage Nodes with RSM service |
| `/var/local/log/rms.errlog` | Contains logs for the Replicated State Machine Service (RSM) service, which is used for S3 platform services. | Storage Nodes with RSM service |
| `/var/local/log/ssm.errlog` | | All nodes |
| `/var/local/log/update-s3vs-domains.log` | Contains logs related to processing updates for the S3 virtual hosted domain names configuration.See the instructions for implementing S3 client applications. | Admin and Gateway Nodes |
| `/var/local/log/update-snmp-firewall.*` | Contain logs related to the firewall ports being managed for SNMP. | All nodes |

| File name | Notes | Found on |
|---|---|---|
| `/var/local/log/update-sysl.log` | Contains logs related to changes made to the system syslog configuration. | All nodes |
| `/var/local/log/update-traffic-classes.log` | Contains logs related to changes to the traffic classifiers configuration. | Admin and Gateway Nodes |
| `/var/local/log/update-utcn.log` | Contains logs related to Untrusted Client Network mode on this node. | All nodes |

**Related information**

- About the bycast.log
- Use S3 REST API

## Deployment and maintenance logs

You can use the deployment and maintenance logs to troubleshoot issues.

| File name | Notes | Found on |
|---|---|---|
| `/var/local/log/install.log` | Created during software installation. Contains a record of the installation events. | All nodes |
| `/var/local/log/expansion-progress.log` | Created during expansion operations. Contains a record of the expansion events. | Storage Nodes |
| `/var/local/log/pa-move.log` | Created while running the `pa-move.sh` script. | Primary Admin Node |
| `/var/local/log/pa-move-new_pa.log` | Created while running the `pa-move.sh` script. | Primary Admin Node |
| `/var/local/log/pa-move-old_pa.log` | Created while running the `pa-move.sh` script. | Primary Admin Node |
| `/var/local/log/gdu-server.log` | Created by the GDU service. Contains events related to provisioning and maintenance procedures managed by the primary Admin Node. | Primary Admin Node |
| `/var/local/log/send_admin_hw.log` | Created during installation. Contains debugging information related to a node's communications with the primary Admin Node. | All nodes |
| `/var/local/log/upgrade.log` | Created during software upgrade. Contains a record of the software update events. | All nodes |

## About the bycast.log

The file `/var/local/log/bycast.log` is the primary troubleshooting file for the StorageGRID software. There is a `bycast.log` file for every grid node. The file contains messages specific to that grid node.

The file `/var/local/log/bycast-err.log` is a subset of `bycast.log`. It contains messages of severity ERROR and CRITICAL.

Optionally, you can change the destination of audit logs and send audit information to an external syslog server. Local logs of audit records continue to be generated and stored when an external syslog server is configured. See Configure audit messages and log destinations.

### File rotation for bycast.log

When the `bycast.log` file reaches 1 GB, the existing file is saved, and a new log file is started.

The saved file is renamed `bycast.log.1`, and the new file is named `bycast.log`. When the new `bycast.log` reaches 1 GB, `bycast.log.1` is renamed and compressed to become `bycast.log.2.gz`, and `bycast.log` is renamed `bycast.log.1`.

The rotation limit for `bycast.log` is 21 files. When the 22nd version of the `bycast.log` file is created, the oldest file is deleted.

The rotation limit for `bycast-err.log` is seven files.

> If a log file has been compressed, you must not uncompress it to the same location in which it was written. Uncompressing the file to the same location can interfere with the log rotation scripts.

Optionally, you can change the destination of audit logs and send audit information to an external syslog server. Local logs of audit records continue to be generated and stored when an external syslog server is configured. See Configure audit messages and log destinations.

#### Related information

Collect log files and system data

### Messages in bycast.log

Messages in `bycast.log` are written by the ADE (Asynchronous Distributed Environment). ADE is the runtime environment used by each grid node's services.

Example ADE message:

```
May 15 14:07:11 um-sec-rg1-agn3 ADE: |12455685    0357819531
SVMR EVHR 2019-05-05T27T17:10:29.784677| ERROR 0906 SVMR: Health
check on volume 3 has failed with reason 'TOUT'
```

ADE messages contain the following information:

| Message segment | Value in example |
| --- | --- |
| Node ID | `12455685` |
| ADE process ID | `0357819531` |
| Module name | `SVMR` |
| Message identifier | `EVHR` |
| UTC system time | `2019-05-05T27T17:10:29.784677 (YYYY-MM-DDTHH:MM:SS.uuuuuu)` |
| Severity level | `ERROR` |
| Internal tracking number | `0906` |
| Message | `SVMR: Health check on volume 3 has failed with reason 'TOUT'` |

#### Message severities in bycast.log

The messages in `bycast.log` are assigned severity levels.

For example:

- **NOTICE** — An event that should be recorded has occurred. Most log messages are at this level.
- **WARNING** — An unexpected condition has occurred.
- **ERROR** — A major error has occurred that will impact operations.
- **CRITICAL** — An abnormal condition has occurred that has stopped normal operations. You should address the underlying condition immediately.

#### Error codes in `bycast.log`

Most of the error messages in `bycast.log` contain error codes.

The following table lists common non-numerical codes in `bycast.log`. The exact meaning of a non-numerical code depends on the context in which it is reported.

| Error code | Meaning |
| --- | --- |
| SUCS | No error |
| GERR | Unknown |
| CANC | Canceled |
| ABRT | Aborted |

| Error code | Meaning |
|---|---|
| TOUT | Timeout |
| INVL | Invalid |
| NFND | Not found |
| VERS | Version |
| CONF | Configuration |
| FAIL | Failed |
| ICPL | Incomplete |
| DONE | Done |
| SUNV | Service unavailable |

The following table lists the numerical error codes in `bycast.log`.

| Error number | Error code | Meaning |
|---|---|---|
| 001 | EPERM | Operation not permitted |
| 002 | ENOENT | No such file or directory |
| 003 | ESRCH | No such process |
| 004 | EINTR | Interrupted system call |
| 005 | EIO | I/O error |
| 006 | ENXIO | No such device or address |
| 007 | E2BIG | Argument list too long |
| 008 | ENOEXEC | Exec format error |
| 009 | EBADF | Bad file number |
| 010 | ECHILD | No child processes |
| 011 | EAGAIN | Try again |

| Error number | Error code | Meaning |
|---|---|---|
| 012 | ENOMEM | Out of memory |
| 013 | EACCES | Permission denied |
| 014 | EFAULT | Bad address |
| 015 | ENOTBLK | Block device required |
| 016 | EBUSY | Device or resource busy |
| 017 | EEXIST | File exists |
| 018 | EXDEV | Cross-device link |
| 019 | ENODEV | No such device |
| 020 | ENOTDIR | Not a directory |
| 021 | EISDIR | Is a directory |
| 022 | EINVAL | Invalid argument |
| 023 | ENFILE | File table overflow |
| 024 | EMFILE | Too many open files |
| 025 | ENOTTY | Not a typewriter |
| 026 | ETXTBSY | Text file busy |
| 027 | EFBIG | File too large |
| 028 | ENOSPC | No space left on device |
| 029 | ESPIPE | Illegal seek |
| 030 | EROFS | Read-only file system |
| 031 | EMLINK | Too many links |
| 032 | EPIPE | Broken pipe |
| 033 | EDOM | Math argument out of domain of func |

| Error number | Error code | Meaning |
|---|---|---|
| 034 | ERANGE | Math result not representable |
| 035 | EDEADLK | Resource deadlock would occur |
| 036 | ENAMETOOLONG | File name too long |
| 037 | ENOLCK | No record locks available |
| 038 | ENOSYS | Function not implemented |
| 039 | ENOTEMPTY | Directory not empty |
| 040 | ELOOP | Too many symbolic links encountered |
| 041 | | |
| 042 | ENOMSG | No message of desired type |
| 043 | EIDRM | Identifier removed |
| 044 | ECHRNG | Channel number out of range |
| 045 | EL2NSYNC | Level 2 not synchronized |
| 046 | EL3HLT | Level 3 halted |
| 047 | EL3RST | Level 3 reset |
| 048 | ELNRNG | Link number out of range |
| 049 | EUNATCH | Protocol driver not attached |
| 050 | ENOCSI | No CSI structure available |
| 051 | EL2HLT | Level 2 halted |
| 052 | EBADE | Invalid exchange |
| 053 | EBADR | Invalid request descriptor |
| 054 | EXFULL | Exchange full |
| 055 | ENOANO | No anode |

| Error number | Error code | Meaning |
|---|---|---|
| 056 | EBADRQC | Invalid request code |
| 057 | EBADSLT | Invalid slot |
| 058 | | |
| 059 | EBFONT | Bad font file format |
| 060 | ENOSTR | Device not a stream |
| 061 | ENODATA | No data available |
| 062 | ETIME | Timer expired |
| 063 | ENOSR | Out of streams resources |
| 064 | ENONET | Machine is not on the network |
| 065 | ENOPKG | Package not installed |
| 066 | EREMOTE | Object is remote |
| 067 | ENOLINK | Link has been severed |
| 068 | EADV | Advertise error |
| 069 | ESRMNT | Srmount error |
| 070 | ECOMM | Communication error on send |
| 071 | EPROTO | Protocol error |
| 072 | EMULTIHOP | Multihop attempted |
| 073 | EDOTDOT | RFS specific error |
| 074 | EBADMSG | Not a data message |
| 075 | EOVERFLOW | Value too large for defined data type |
| 076 | ENOTUNIQ | Name not unique on network |
| 077 | EBADFD | File descriptor in bad state |

| Error number | Error code | Meaning |
|---|---|---|
| 078 | EREMCHG | Remote address changed |
| 079 | ELIBACC | Can’t access a needed shared library |
| 080 | ELIBBAD | Accessing a corrupted shared library |
| 081 | ELIBSCN | |
| 082 | ELIBMAX | Attempting to link in too many shared libraries |
| 083 | ELIBEXEC | Can’t exec a shared library directly |
| 084 | EILSEQ | Illegal byte sequence |
| 085 | ERESTART | Interrupted system call should be restarted |
| 086 | ESTRPIPE | Streams pipe error |
| 087 | EUSERS | Too many users |
| 088 | ENOTSOCK | Socket operation on non-socket |
| 089 | EDESTADDRREQ | Destination address required |
| 090 | EMSGSIZE | Message too long |
| 091 | EPROTOTYPE | Protocol wrong type for socket |
| 092 | ENOPROTOOPT | Protocol not available |
| 093 | EPROTONOSUPPORT | Protocol not supported |
| 094 | ESOCKTNOSUPPORT | Socket type not supported |
| 095 | EOPNOTSUPP | Operation not supported on transport endpoint |
| 096 | EPFNOSUPPORT | Protocol family not supported |
| 097 | EAFNOSUPPORT | Address family not supported by protocol |
| 098 | EADDRINUSE | Address already in use |
| 099 | EADDRNOTAVAIL | Can’t assign requested address |

| Error number | Error code | Meaning |
|---|---|---|
| 100 | ENETDOWN | Network is down |
| 101 | ENETUNREACH | Network is unreachable |
| 102 | ENETRESET | Network dropped connection because of reset |
| 103 | ECONNABORTED | Software caused connection to terminate |
| 104 | ECONNRESET | Connection reset by peer |
| 105 | ENOBUFS | No buffer space available |
| 106 | EISCONN | Transport endpoint is already connected |
| 107 | ENOTCONN | Transport endpoint is not connected |
| 108 | ESHUTDOWN | Can’t send after transport endpoint shutdown |
| 109 | ETOOMANYREFS | Too many references: can’t splice |
| 110 | ETIMEDOUT | Connection timed out |
| 111 | ECONNREFUSED | Connection refused |
| 112 | EHOSTDOWN | Host is down |
| 113 | EHOSTUNREACH | No route to host |
| 114 | EALREADY | Operation already in progress |
| 115 | EINPROGRESS | Operation now in progress |
| 116 | | |
| 117 | EUCLEAN | Structure needs cleaning |
| 118 | ENOTNAM | Not a XENIX named type file |
| 119 | ENAVAIL | No XENIX semaphores available |
| 120 | EISNAM | Is a named type file |
| 121 | EREMOTEIO | Remote I/O error |

| Error number | Error code | Meaning |
|---|---|---|
| 122 | EDQUOT | Quota exceeded |
| 123 | ENOMEDIUM | No medium found |
| 124 | EMEDIUMTYPE | Wrong medium type |
| 125 | ECANCELED | Operation Canceled |
| 126 | ENOKEY | Required key not available |
| 127 | EKEYEXPIRED | Key has expired |
| 128 | EKEYREVOKED | Key has been revoked |
| 129 | EKEYREJECTED | Key was rejected by service |
| 130 | EOWNERDEAD | For robust mutexes: Owner died |
| 131 | ENOTRECOVERABLE | For robust mutexes: State not recoverable |

# Configure audit message and log destinations

## Considerations for using an external syslog server

An external syslog server is a server outside of StorageGRID you can use to collect system audit information in a single location. Using an external syslog server enables you to reduce network traffic on your Admin Nodes and manage the information more efficiently. For StorageGRID, the outbound syslog message packet format is compliant with RFC 3164.

The types of audit information you can send to the external syslog server include:

- Audit logs containing the audit messages generated during normal system operation
- Security-related events such as logins and escalations to root
- Application logs that might be requested if it is necessary to open a support case to troubleshoot an issue you have encountered

### When to use an external syslog server

An external syslog server is especially useful if you have a large grid, use multiple types of S3 applications, or want to retain all audit data. Sending audit information to an external syslog server enables you to:

- Collect and manage audit information such as audit messages, application logs, and security events more efficiently.

- Reduce network traffic on your Admin Nodes because audit information is transferred directly from the various Storage Nodes to the external syslog server, without having to go through an Admin Node.

> When logs are sent to an external syslog server, single logs greater than 8,192 bytes are truncated at the end of the message to conform with common limitations in external syslog server implementations.

> To maximize the options for full data recovery in the event of a failure of the external syslog server, up to 20 GB of local logs of audit records (`localaudit.log`) are maintained on each node.

### How to configure an external syslog server

To learn how to configure an external syslog server, see Configure audit messages and external syslog server.

If you plan to configure use the TLS or RELP/TLS protocol, you must have the following certificates:

- **Server CA certificates**: One or more trusted CA certificates for verifying the external syslog server in PEM encoding. If omitted, the default Grid CA certificate will be used.
- **Client certificate**: The client certificate for authentication to the external syslog server in PEM encoding.
- **Client private key**: Private key for the client certificate in PEM encoding.

> If you use a client certificate you must also use a client private key. If you provide an encrypted private key, you must also provide the passphrase. There is no significant security benefit from using an encrypted private key because the key and passphrase must be stored; using an unencrypted private key, if available, is recommended for simplicity.

### How to estimate the size of the external syslog server

Normally, your grid is sized to achieve a required throughput, defined in terms of S3 operations per second or bytes per second. For example, you might have a requirement that your grid handle 1,000 S3 operations per second, or 2,000 MB per second, of object ingests and retrievals. You should size your external syslog server according to your grid's data requirements.

This section provides some heuristic formulas that help you estimate the rate and average size of log messages of various types that your external syslog server needs to be capable of handling, expressed in terms of the known or desired performance characteristics of the grid (S3 operations per second).

#### Use S3 operations per second in estimation formulas

If your grid was sized for a throughput expressed in bytes per second, you must convert this sizing into S3 operations per second to use the estimation formulas. To convert grid throughput, you must first determine your average object size, which you can do using the information in existing audit logs and metrics (if any), or by using your knowledge of the applications that will use StorageGRID. For example, if your grid was sized to achieve a throughput of 2,000 MB/second, and your average object size is 2 MB, then your grid was sized to be able to handle 1,000 S3 operations per second (2,000 MB / 2 MB).

The formulas for external syslog server sizing in the following sections provide common-case estimates (rather than worst-case estimates). Depending on your configuration and workload, you might see a higher or lower rate of syslog messages or volume of syslog data than the formulas predict. The formulas are meant to be used as guidelines only.

#### Estimation formulas for audit logs

If you have no information about your S3 workload other than number of S3 operations per second your grid is expected to support, you can estimate the volume of audit logs your external syslog server will need to handle using the following formulas, under the assumption that you leave the Audit Levels set to the default values (all categories set to Normal, except Storage, which is set to Error):

```
Audit Log Rate = 2 x S3 Operations Rate
Audit Log Average Size = 800 bytes
```

For example, if your grid is sized for 1,000 S3 operations per second, your external syslog server should be sized to support 2,000 syslog messages per second and should be able to receive (and typically store) audit log data at a rate of 1.6 MB per second.

If you know more about your workload, more accurate estimations are possible. For audit logs, the most important additional variables are the percentage of S3 operations that are PUTs (vs. GETS), and the average size, in bytes, of the following S3 fields (4-character abbreviations used in the table are audit log field names):

| Code | Field | Description |
|---|---|---|
| SACC | S3 tenant account name (request sender) | The name of the tenant account for the user who sent the request. Empty for anonymous requests. |
| SBAC | S3 tenant account name (bucket owner) | The tenant account name for the bucket owner. Used to identify cross-account or anonymous access. |
| S3BK | S3 bucket | The S3 bucket name. |
| S3KY | S3 key | The S3 key name, not including the bucket name. Operations on buckets don’t include this field. |

Let’s use P to represent the percentage of S3 operations that are PUTs, where $0 \leq P \leq 1$ (so for a 100% PUT workload, P = 1, and for a 100% GET workload, P = 0).

Let’s use K to represent the average size of the sum of the S3 account names, S3 bucket, and S3 key. Suppose the S3 account name is always my-s3-account (13 bytes), buckets have fixed-length names like /my/application/bucket-12345 (28 bytes), and objects have fixed-length keys like 5733a5d7-f069-41ef-8fbd-13247494c69c (36 bytes). Then the value of K is 90 (13+13+28+36).

If you can determine values for P and K, you can estimate the volume of audit logs your external syslog server will need to handle using the following formulas, under the assumption that you leave the Audit Levels set to

the defaults (all categories set to Normal, except Storage, which is set to Error):

```
Audit Log Rate = ((2 x P) + (1 - P)) x S3 Operations Rate
Audit Log Average Size = (570 + K) bytes
```

For example, if your grid is sized for 1,000 S3 operations per second, your workload is 50% PUTs, and your S3 account names, bucket names, and object names average 90 bytes, your external syslog server should be sized to support 1,500 syslog messages per second and should be able to receive (and typically store) audit log data at a rate of approximately 1 MB per second.

#### Estimation formulas for non-default audit levels

The formulas provided for audit logs assume the use of default audit level settings (all categories set to Normal, except Storage, which is set to Error). Detailed formulas for estimating the rate and average size of audit messages for non-default audit level settings aren't available. However, the following table can be used to make a rough estimate of the rate; you can use the average size formula provided for audit logs, but be aware that it is likely to result in an over-estimate because the "extra" audit messages are, on average, smaller than the default audit messages.

| Condition | Formula |
|---|---|
| Replication: Audit levels all set to Debug or Normal | Audit log rate = 8 x S3 Operations Rate |
| Erasure coding: audit levels all set to Debug or Normal | Use same formula as for default settings |

#### Estimation formulas for security events

Security events aren't correlated with S3 operations and typically produce a negligible volume of logs and data. For these reasons, no estimation formulas are provided.

#### Estimation formulas for application logs

If you have no information about your S3 workload other than the number of S3 operations per second your grid is expected to support, you can estimate the volume of applications logs your external syslog server will need to handle using the following formulas:

```
Application Log Rate = 3.3 x S3 Operations Rate
Application Log Average Size = 350 bytes
```

So, for example, if your grid is sized for 1,000 S3 operations per second, your external syslog server should be sized to support 3,300 application logs per second and be able to receive (and store) application log data at a rate of about 1.2 MB per second.

If you know more about your workload, more accurate estimations are possible. For application logs, the most important additional variables are the data protection strategy (replication vs. erasure coding), the percentage of S3 operations that are PUTs (vs. GETs/other), and the average size, in bytes, of the following S3 fields (4-character abbreviations used in table are audit log field names):

| Code | Field | Description |
|---|---|---|
| SACC | S3 tenant account name (request sender) | The name of the tenant account for the user who sent the request. Empty for anonymous requests. |
| SBAC | S3 tenant account name (bucket owner) | The tenant account name for the bucket owner. Used to identify cross-account or anonymous access. |
| S3BK | S3 bucket | The S3 bucket name. |
| S3KY | S3 key | The S3 key name, not including the bucket name. Operations on buckets don’t include this field. |

### Example sizing estimations

This section explains example cases of how to use the estimation formulas for grids with the following methods of data protection:

- Replication
- Erasure coding

#### If you use replication for data protection

Let P represent the percentage of S3 operations that are PUTs, where 0 ≤ P ≤ 1 (so for a 100% PUT workload, P = 1, and for a 100% GET workload, P = 0).

Let K represent the average size of the sum of the S3 account names, S3 bucket, and S3 key. Suppose the S3 account name is always my-s3-account (13 bytes), buckets have fixed-length names like /my/application/bucket-12345 (28 bytes), and objects have fixed-length keys like 5733a5d7-f069-41ef-8fbd-13247494c69c (36 bytes). Then K has a value of 90 (13+13+28+36).

If you can determine values for P and K, you can estimate the volume of application logs your external syslog server will have to be able to handle using the following formulas.

```
Application Log Rate = ((1.1 x P) + (2.5 x (1 - P))) x S3 Operations Rate
Application Log Average Size = (P x (220 + K)) + ((1 - P) x (240 + (0.2 x K))) Bytes
```

So, for example, if your grid is sized for 1,000 S3 operations per second, your workload is 50% PUTs, and your S3 account names, bucket names, and object names average 90 bytes, your external syslog server should be sized to support 1800 application logs per second, and will be receiving (and typically storing) application data at a rate of 0.5 MB per second.

#### If you use erasure coding for data protection

Let P represent the percentage of S3 operations that are PUTs, where 0 ≤ P ≤ 1 (so for a 100% PUT workload,

P = 1, and for a 100% GET workload, P = 0).

Let K represent the average size of the sum of the S3 account names, S3 bucket, and S3 key. Suppose the S3 account name is always my-s3-account (13 bytes), buckets have fixed-length names like /my/application/bucket-12345 (28 bytes), and objects have fixed-length keys like 5733a5d7-f069-41ef-8fbd-13247494c69c (36 bytes). Then K has a value of 90 (13+13+28+36).

If you can determine values for P and K, you can estimate the volume of application logs your external syslog server will have to be able to handle using the following formulas.

```
Application Log Rate = ((3.2 x P) + (1.3 x (1 - P))) x S3 Operations Rate
Application Log Average Size = (P x (240 + (0.4 x K))) + ((1 - P) x (185 +
(0.9 x K))) Bytes
```

So, for example, if your grid is sized for 1,000 S3 operations per second, your workload is 50% PUTs, and your S3 account names, bucket names, and object names average 90 bytes, your external syslog server should be sized to support 2,250 application logs per second and should be able to receive (and typically store) application data at a rate of 0.6 MB per second.

## Configure audit messages and external syslog server

You can configure a number of settings related to audit messages. You can adjust the number of audit messages recorded; define any HTTP request headers you want to include in client read and write audit messages; configure an external syslog server; and specify where audit logs, security event logs, and StorageGRID software logs are sent.

Audit messages and logs record system activities and security events, and are essential tools for monitoring and troubleshooting. All StorageGRID nodes generate audit messages and logs to track system activity and events.

Optionally, you can configure an external syslog server to save audit information remotely. Using an external server minimizes the performance impact of audit message logging without reducing the completeness of audit data. An external syslog server is especially useful if you have a large grid, use multiple types of S3 applications, or want to retain all audit data. See Configure audit messages and external syslog server for details.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have the Maintenance or Root access permission.
- If you plan to configure an external syslog server, you have reviewed the considerations for using an external syslog server and ensured that the server has enough capacity to receive and store the log files.
- If you plan to configure an external syslog server using TLS or RELP/TLS protocol, you have the required server CA and client certificates and the client private key.

### Change audit message levels

You can set a different audit level for each of the following categories of messages in the audit log:

| Audit category | Default setting | More information |
|---|---|---|
| System | Normal | System audit messages |
| Storage | Error | Object storage audit messages |
| Management | Normal | Management audit message |
| Client reads | Normal | Client read audit messages |
| Client writes | Normal | Client write audit messages |
| ILM | Normal | ILM audit messages |
| Cross-grid replication | Error | CGRR: Cross-Grid Replication Request |

These defaults apply if you initially installed StorageGRID using version 10.3 or later. If you initially used an earlier version of StorageGRID, the default for all categories is set to Normal.

During upgrades, audit level configurations will not be effective immediately.

**Steps**

1. Select **CONFIGURATION** > **Monitoring** > **Audit and syslog server**.
2. For each category of audit message, select an audit level from the drop-down list:

| Audit level | Description |
|---|---|
| Off | No audit messages from the category are logged. |
| Error | Only error messages are logged—audit messages for which the result code was not "successful" (SUCS). |
| Normal | Standard transactional messages are logged—the messages listed in these instructions for the category. |
| Debug | Deprecated. This level behaves the same as the Normal audit level. |

The messages included for any particular level include those that would be logged at the higher levels. For example, the Normal level includes all of the Error messages.

If you don't require a detailed record of client read operations for your S3 applications, optionally change the **Client Reads** setting to **Error** to decrease the number of audit messages recorded in the audit log.

3. Select **Save**.

A green banner indicates your configuration has been saved.

### Define HTTP request headers

You can optionally define any HTTP request headers you want to include in client read and write audit messages. These protocol headers apply to S3 requests only.

**Steps**

1. In the **Audit protocol headers** section, define the HTTP request headers you want to include in client read and write audit messages.

   Use an asterisk (*) as a wildcard to match zero or more characters. Use the escape sequence (*) to match a literal asterisk.

2. Select **Add another header** to create additional headers, if needed.

   When HTTP headers are found in a request, they are included in the audit message under the field HTRH.

   > Audit protocol request headers are logged only if the audit level for **Client Reads** or **Client Writes** is not **Off**.

3. Select **Save**

   A green banner indicates your configuration has been saved.

### Use an external syslog server

You can optionally configure an external syslog server to save audit logs, application logs, and security event logs to a location outside of your grid.

> If you don't want to use an external syslog server, skip this step and go to Select audit information destinations.

> If the configuration options available in this procedure aren't flexible enough to meet your requirements, additional configuration options can be applied using the `audit-destinations` endpoints, which are in the private API section of the Grid Management API. For example, you can use the API if you want to use different syslog servers for different groups of nodes.

#### Enter syslog information

Access the Configure external syslog server wizard and provide the information StorageGRID needs to access the external syslog server.

**Steps**

1. From the Audit and syslog server page, select **Configure external syslog server**. Or, if you have previously configured an external syslog server, select **Edit external syslog server**.

   The Configure external syslog server wizard appears.

2. For the **Enter syslog info** step of the wizard, enter a valid fully qualified domain name or an IPv4 or IPv6 address for the external syslog server in the **Host** field.

3. Enter the destination port on the external syslog server (must be an integer between 1 and 65535). The default port is 514.
4. Select the protocol used to send audit information to the external syslog server.

   Using **TLS** or **RELP/TLS** is recommended. You must upload a server certificate to use either of these options. Using certificates helps secure the connections between your grid and the external syslog server. For more information, see Manage security certificates.

   All protocol options require support by, and configuration of, the external syslog server. You must choose an option that is compatible with the external syslog server.

   > Reliable Event Logging Protocol (RELP) extends the functionality of the syslog protocol to provide reliable delivery of event messages. Using RELP can help prevent the loss of audit information if your external syslog server has to restart.

5. Select **Continue**.
6. If you selected **TLS** or **RELP/TLS**, upload the server CA certificates, client certificate, and client private key.
   a. Select **Browse** for the certificate or key you want to use.
   b. Select the certificate or key file.
   c. Select **Open** to upload the file.

      A green check appears next to the certificate or key file name, notifying you that it has been uploaded successfully.

7. Select **Continue**.

#### Manage syslog content

You can select which information to send to the external syslog server.

**Steps**

1. For the **Manage syslog content** step of the wizard, select each type of audit information you want to send to the external syslog server.
   - **Send audit logs**: Sends StorageGRID events and system activities
   - **Send security events**: Sends security events such as when an unauthorized user attempts to sign in or a user signs in as root
   - **Send application logs**: Sends StorageGRID software log files useful for troubleshooting, including:
     - `bycast-err.log`
     - `bycast.log`
     - `jaeger.log`
     - `nms.log` (Admin Nodes only)
     - `prometheus.log`
     - `raft.log`
     - `hagroups.log`

- **Send access logs**: Sends HTTP access logs for external requests to Grid Manager, Tenant Manger, configured load balancer endpoints, and grid federation requests from remote systems.

2. Use the drop-down menus to select the severity and facility (type of message) for each category of audit information you want to send.

   Setting severity and facility values can help you aggregate the logs in customizable ways for easier analysis.

   a. For **Severity**, select **Passthrough**, or select a severity value between 0 and 7.

      If you select a value, the selected value will be applied to all messages of this type. Information about different severities will be lost if you override severity with a fixed value.

| Severity | Description |
|---|---|
| Passthrough | Each message sent to the external syslog to have the same severity value as when it was logged locally onto the node:<br>• For audit logs, the severity is "info."<br>• For security events, the severity values are generated by the Linux distribution on the nodes.<br>• For application logs, the severities vary between "info" and "notice," depending on what the issue is. For example, adding an NTP server and configuring an HA group gives a value of "info," while intentionally stopping the SSM or RSM service gives a value of "notice."<br>• For access logs, the severity is "info." |
| 0 | Emergency: System is unusable |
| 1 | Alert: Action must be taken immediately |
| 2 | Critical: Critical conditions |
| 3 | Error: Error conditions |
| 4 | Warning: Warning conditions |
| 5 | Notice: Normal but significant condition |
| 6 | Informational: Informational messages |
| 7 | Debug: Debug-level messages |

   b. For **Facilty**, select **Passthrough**, or select a facility value between 0 and 23.

      If you select a value, it will be applied to all messages of this type. Information about different facilities will be lost if you override facility with a fixed value.

| Facility | Description |
| --- | --- |
| Passthrough | Each message sent to the external syslog to have the same facility value as when it was logged locally onto the node:<br>• For audit logs, the facility sent to the external syslog server is "local7."<br>• For security events, the facility values are generated by the linux distribution on the nodes.<br>• For application logs, the application logs sent to the external syslog server have the following facility values:<br>◦ `bycast.log`: user or daemon<br>◦ `bycast-err.log`: user, daemon, local3, or local4<br>◦ `jaeger.log`: local2<br>◦ `nms.log`: local3<br>◦ `prometheus.log`: local4<br>◦ `raft.log`: local5<br>◦ `hagroups.log`: local6<br>• For access logs, the facility sent to the external syslog server is "local0." |
| 0 | kern (kernel messages) |
| 1 | user (user-level messages) |
| 2 | mail |
| 3 | daemon (system daemons) |
| 4 | auth (security/authorization messages) |
| 5 | syslog (messages generated internally by syslogd) |
| 6 | lpr (line printer subsystem) |
| 7 | news (network news subsystem) |
| 8 | UUCP |
| 9 | cron (clock daemon) |
| 10 | security (security/authorization messages) |
| 11 | FTP |

| Facility | Description |
|---|---|
| 12 | NTP |
| 13 | logaudit (log audit) |
| 14 | logalert (log alert) |
| 15 | clock (clock daemon) |
| 16 | local0 |
| 17 | local1 |
| 18 | local2 |
| 19 | local3 |
| 20 | local4 |
| 21 | local5 |
| 22 | local6 |
| 23 | local7 |

3. Select **Continue**.

#### Send test messages

Before starting to use an external syslog server, you should request that all nodes in your grid send test messages to the external syslog server. You should use these test messages to help you validate your entire log collection infrastructure before you commit to sending data to the external syslog server.

> Don't use the external syslog server configuration until you confirm that the external syslog server received a test message from each node in your grid and that the message was processed as expected.

**Steps**

1. If you don't want to send test messages because you are certain your external syslog server is configured properly and can receive audit information from all the nodes in your grid, select **Skip and finish**.

   A green banner indicates that the configuration has been saved.

2. Otherwise, select **Send test messages** (recommended).

   Test results continuously appear on the page until you stop the test. While the test is in progress, your audit messages continue to be sent to your previously configured destinations.

3. If you receive any errors during syslog server configuration or at runtime, correct them and select **Send test messages** again.

   See Troubleshoot an external syslog server to help you resolve any errors.

4. Wait until you see a green banner indicating all nodes have passed testing.
5. Check your syslog server to determine if test messages are being received and processed as expected.

   > If you are using UDP, check your entire log collection infrastructure. The UDP protocol does not allow for as rigorous error detection as the other protocols.

6. Select **Stop and finish**.

   You are returned to the **Audit and syslog server** page. A green banner indicates that the syslog server configuration has been saved.

   > StorageGRID audit information is not sent to the external syslog server until you select a destination that includes the external syslog server.

### Select audit information destinations

You can specify where audit logs, security event logs, and StorageGRID software logs are sent.

> StorageGRID defaults to local node audit destinations and stores the audit information in `/var/local/log/localaudit.log`.
>
> When using `/var/local/log/localaudit.log`, the Grid Manager and Tenant Manager audit log entries might be sent to a Storage Node. You can find which node has the most recent entries by using the `run-each-node --parallel "zgrep MGAU /var/local/log/localaudit.log | tail"` command.
>
> Some destinations are available only if you have configured an external syslog server.

**Steps**

1. On the Audit and syslog server page, select the destination for audit information.

   > **Local nodes only** and **External syslog server** typically provide better performance.

| Option | Description |
| --- | --- |
| Local nodes only (default) | Audit messages, security event logs, and application logs are not sent to Admin Nodes. Instead, they are saved only on the nodes that generated them ("the local node"). The audit information generated on every local node is stored in `/var/local/log/localaudit.log`.<br><br>**Note**: StorageGRID periodically removes local logs in a rotation to free up space. When the log file for a node reaches 1 GB, the existing file is saved, and a new log file is started. The rotation limit for the log is 21 files. When the 22nd version of the log file is created, the oldest log file is deleted. On average about 20 GB of log data is stored on each node. |
| Admin Nodes/local nodes | Audit messages are sent to the audit log on Admin Nodes, and security event logs and application logs are stored on the nodes that generated them. The audit information is stored in the following files:<br><br>• Admin Nodes (Primary and Non-Primary): `/var/local/audit/export/audit.log`<br>• All nodes: The `/var/local/log/localaudit.log` file is typically empty or missing. It might contain secondary information, such as an additional copy of some messages. |
| External syslog server | Audit information is sent to an external syslog server and saved on the local nodes (`/var/local/log/localaudit.log`). The type of information sent depends upon how you configured the external syslog server. This option is enabled only after you have configured an external syslog server. |
| Admin Node and external syslog server | Audit messages are sent to the audit log (`/var/local/audit/export/audit.log`) on Admin Nodes, and audit information is sent to the external syslog server and saved on the local node (`/var/local/log/localaudit.log`). The type of information sent depends upon how you configured the external syslog server. This option is enabled only after you have configured an external syslog server. |

2. Select **Save**.

   A warning message appears.

3. Select **OK** to confirm that you want to change the destination for audit information.

   A green banner indicates that the audit configuration has been saved.

   New logs are sent to the destinations you selected. Existing logs remain in their current location.

# Use SNMP monitoring

## Use SNMP monitoring

If you want to monitor StorageGRID using the Simple Network Management Protocol (SNMP), you must configure the SNMP agent that is included with StorageGRID.

- Configure the SNMP agent
- Update the SNMP agent

### Capabilities

Each StorageGRID node runs an SNMP agent, or daemon, that provides a MIB. The StorageGRID MIB contains table and notification definitions for alerts. The MIB also contains system description information such as platform and model number for each node. Each StorageGRID node also supports a subset of MIB-II objects.

See Access MIB files if you want to download the MIB files on your grid nodes.

Initially, SNMP is disabled on all nodes. When you configure the SNMP agent, all StorageGRID nodes receive the same configuration.

The StorageGRID SNMP agent supports all three versions of the SNMP protocol. It provides read-only MIB access for queries, and it can send two types of event-driven notifications to a management system:

**Traps**

Traps are notifications sent by the SNMP agent that don't require acknowledgment by the management system. Traps serve to notify the management system that something has happened within StorageGRID, such as an alert being triggered.

Traps are supported in all three versions of SNMP.

**Informs**

Informs are similar to traps, but they require acknowledgment by the management system. If the SNMP agent doesn't receive an acknowledgment within a certain amount of time, it resends the inform until an acknowledgment is received or the maximum retry value has been reached.

Informs are supported in SNMPv2c and SNMPv3.

Trap and inform notifications are sent in the following cases:

- A default or custom alert is triggered at any severity level. To suppress SNMP notifications for an alert, you must configure a silence for the alert. Alert notifications are sent by the preferred sender Admin Node.

  Each alert is mapped to one of three trap types based on the severity level of the alert: activeMinorAlert, activeMajorAlert, and activeCriticalAlert. For a list of the alerts that can trigger these traps, see the Alerts reference.

### SNMP version support

The table provides a high-level summary of what is supported for each SNMP version.

| | SNMPv1 | SNMPv2c | SNMPv3 |
|---|---|---|---|
| Queries<br><br>(GET and GETNEXT) | Read-only MIB queries | Read-only MIB queries | Read-only MIB queries |
| Query authentication | Community string | Community string | User-based Security Model (USM) user |
| Notifications<br><br>(TRAP and INFORM) | Traps only | Traps and informs | Traps and informs |
| Notification authentication | Default trap community or a custom community string for each trap destination | Default trap community or a custom community string for each trap destination | USM user for each trap destination |

#### Limitations

- StorageGRID supports read-only MIB access. Read-write access is not supported.
- All nodes in the grid receive the same configuration.
- SNMPv3: StorageGRID does not support the Transport Support Mode (TSM).
- SNMPv3: The only authentication protocol supported is SHA (HMAC-SHA-96).
- SNMPv3: The only privacy protocol supported is AES.

## Configure the SNMP agent

You can configure the StorageGRID SNMP agent to use a third-party SNMP management system for read-only MIB access and notifications.

#### Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have the Root access permission.

#### About this task

The StorageGRID SNMP agent supports SNMPv1, SNMPv2c, and SNMPv3. You can configure the agent for one or more versions. For SNMPv3, only User Security Model (USM) authentication is supported.

All nodes in the grid use the same SNMP configuration.

#### Specify basic configuration

As a first step, enable the StorageGRID SMNP agent and provide basic information.

#### Steps

1. Select **CONFIGURATION** > **Monitoring** > **SNMP agent**.

The SNMP agent page appears.

2. To enable the SNMP agent on all grid nodes, select the **Enable SNMP** checkbox.
3. Enter the following information in the Basic configuration section.

| Field | Description |
|---|---|
| System contact | Optional. The primary contact for the StorageGRID system, which is returned in SNMP messages as sysContact.<br><br>The System contact is typically an email address. This value applies to all nodes in the StorageGRID system. **System contact** can be a maximum of 255 characters. |
| System location | Optional. The location of the StorageGRID system, which is returned in SNMP messages as sysLocation.<br><br>The System location can be any information that is useful for identifying where your StorageGRID system is located. For example, you might use the street address of a facility. This value applies to all nodes in the StorageGRID system. **System location** can be a maximum of 255 characters. |
| Enable SNMP agent notifications | • If selected, the StorageGRID SNMP agent sends trap and inform notifications.<br>• If not selected, the SNMP agent supports read-only MIB access, but it doesn't send any SNMP notifications. |
| Enable authentication traps | If selected, the StorageGRID SNMP agent sends authentication traps if it receives improperly authenticated protocol messages. |

### Enter community strings

If you use SNMPv1 or SNMPv2c, complete the Community strings section.

When the management system queries the StorageGRID MIB, it sends a community string. If the community string matches one of the values specified here, the SNMP agent sends a response to the management system.

#### Steps

1. For **Read-only community**, optionally enter a community string to allow read-only MIB access on IPv4 and IPv6 agent addresses.

   To ensure the security of your StorageGRID system, don't use "public" as the community string. If you leave this field blank, the SNMP agent uses the grid ID of your StorageGRID system as the community string.

   Each community string can be a maximum of 32 characters and can't contain whitespace characters.

2. Select **Add another community string** to add additional strings.

Up to five strings are allowed.

### Create trap destinations

Use the Trap destinations tab in the Other configurations section to define one or more destinations for StorageGRID trap or inform notifications. When you enable the SNMP agent and select **Save**, StorageGRID sends notifications to each defined destination when alerts are triggered. Standard notifications are also sent for the supported MIB-II entities (for example, ifDown and coldStart).

**Steps**

1. For the **Default trap community** field, optionally enter the default community string you want to use for SNMPv1 or SNMPv2 trap destinations.

   As required, you can provide a different ("custom") community string when you define a specific trap destination.

   **Default trap community** can be a maximum of 32 characters and can’t contain whitespace characters.

2. To add a trap destination, select **Create**.
3. Select which SNMP version will be used for this trap destination.
4. Complete the Create trap destination form for the version you selected.

**SNMPv1**

If you selected SNMPv1 as the version, complete these fields.

| Field | Description |
|---|---|
| Type | Must be Trap for SNMPv1. |
| Host | An IPv4 or IPv6 address or a fully-qualified domain name (FQDN) to receive the trap. |
| Port | Use 162, which the standard port for SNMP traps unless you must use another value. |
| Protocol | Use UDP, which is the standard SNMP trap protocol unless you need to use TCP. |
| Community string | Use the default trap community, if one was specified, or enter a custom community string for this trap destination.<br><br>The custom community string can be a maximum of 32 characters and can’t contain whitespace. |

**SNMPv2c**

If you selected SNMPv2c as the version, complete these fields.

| Field | Description |
|---|---|
| Type | Whether the destination will be used for traps or informs. |
| Host | An IPv4 or IPv6 address or FQDN to receive the trap. |
| Port | Use 162, which is the standard port for SNMP traps unless you must use another value. |
| Protocol | Use UDP, which is the standard SNMP trap protocol unless you need to use TCP. |
| Community string | Use the default trap community, if one was specified, or enter a custom community string for this trap destination.<br><br>The custom community string can be a maximum of 32 characters and can’t contain whitespace. |

**SNMPv3**

If you selected SNMPv3 as the version, complete these fields.

| Field | Description |
| --- | --- |
| Type | Whether the destination will be used for traps or informs. |
| Host | An IPv4 or IPv6 address or FQDN to receive the trap. |
| Port | Use 162, which is the standard port for SNMP traps unless you must use another value. |
| Protocol | Use UDP, which is the standard SNMP trap protocol unless you need to use TCP. |
| USM user | The USM user that will be used for authentication.<br>• If you selected **Trap**, only USM users without authoritative engine IDs are shown.<br>• If you selected **Inform**, only USM users with authoritative engine IDs are shown.<br>• If no users are shown:<br>1. Create and save the trap destination.<br>2. Go to Create USM users and create the user.<br>3. Return to the Trap destinations tab, select the saved destination from the table, and select **Edit**.<br>4. Select the user. |

5. Select **Create**.

   The trap destination is created and added to the table.

### Create agent addresses

Optionally, use the Agent addresses tab in the Other configurations section to specify one or more "listening addresses." These are the StorageGRID addresses on which the SNMP agent can receive queries.

If you don’t configure an agent address, the default listening address is UDP port 161 on all StorageGRID networks.

**Steps**

1. Select **Create**.
2. Enter the following information.

| Field | Description |
| --- | --- |
| Internet protocol | Whether this address will use IPv4 or IPv6.<br><br>By default, SNMP uses IPv4. |

| Field | Description |
| --- | --- |
| Transport protocol | Whether this address will use UDP or TCP.<br><br>By default, SNMP uses UDP. |
| StorageGRID network | Which StorageGRID network the agent will listen on.<br><br>• Grid, Admin, and Client Networks: The SNMP agent will listen for queries on all three networks.<br>• Grid Network<br>• Admin Network<br>• Client Network<br><br>**Note**: If you use the Client Network for insecure data and you create an agent address for the Client Network, be aware that SNMP traffic will also be insecure. |
| Port | Optionally, the port number that the SNMP agent should listen on.<br><br>The default UDP port for an SNMP agent is 161, but you can enter any unused port number.<br><br>**Note**: When you save the SNMP agent, StorageGRID automatically opens the agent address ports on the internal firewall. You must ensure that any external firewalls allow access to these ports. |

3. Select **Create**.

   The agent address is created and added to the table.

### Create USM users

If you are using SNMPv3, use the USM users tab in the Other configurations section to define the USM users who are authorized to query the MIB or to receive traps and informs.

SNMPv3 *inform* destinations must have users with engine IDs. SNMPv3 *trap* destination can't have users with engine IDs.

These steps don't apply if you are only using SNMPv1 or SNMPv2c.

**Steps**

1. Select **Create**.
2. Enter the following information.

| Field | Description |
| --- | --- |
| Username | A unique name for this USM user.<br><br>Usernames can have a maximum of 32 characters and can't contain whitespace characters. The username can't be changed after the user is created. |
| Read-only MIB access | If selected, this user should have read-only access to the MIB. |
| Authoritative engine ID | If this user will be used in an inform destination, the authoritative engine ID for this user.<br><br>Enter 10 to 64 hex characters (5 to 32 bytes) with no spaces. This value is required for USM users that will be selected in trap destinations for informs. This value is not allowed for USM users that will be selected in trap destinations for traps.<br><br>**Note**: This field is not shown if you selected **Read-only MIB access** because USM users who have read-only MIB access can't have engine IDs. |
| Security level | The security level for the USM user:<br><br>• **authPriv**: This user communicates with authentication and privacy (encryption). You must specify an authentication protocol and password and a privacy protocol and password.<br>• **authNoPriv**: This user communicates with authentication and without privacy (no encryption). You must specify an authentication protocol and password. |
| Authentication protocol | Always set to SHA, which is the only protocol supported (HMAC-SHA-96). |
| Password | The password this user will use for authentication. |
| Privacy protocol | Shown only if you selected **authPriv** and always set to AES, which is the only privacy protocol supported. |
| Password | Shown only if you selected **authPriv**. The password this user will use for privacy. |

3. Select **Create**.

   The USM user is created and added to the table.

4. When you have completed the SNMP agent configuration, select **Save**.

   The new SNMP agent configuration becomes active.

## Update the SNMP agent

You can disable SNMP notifications, update community strings, or add or remove agent addresses, USM users, and trap destinations.

### Before you begin

- You are signed in to the Grid Manager using a supported web browser.
- You have the Root access permission.

### About this task

See Configure the SNMP agent for details about each field on the SNMP agent page. You must select **Save** at the bottom of the page to commit any changes you make on each tab.

### Steps

1. Select **CONFIGURATION** > **Monitoring** > **SNMP agent**.

   The SNMP agent page appears.

2. To disable the SNMP agent on all grid nodes, clear the **Enable SNMP** checkbox, and select **Save**.

   If you re-enable the SNMP agent, any previous SNMP configuration settings are retained.

3. Optionally, update the information in the Basic configuration section:
   a. As required, update the **System contact** and **System location**.
   b. Optionally, select or clear the **Enable SNMP agent notifications** checkbox to control whether the StorageGRID SNMP agent sends trap and inform notifications.

      When this checkbox is cleared, the SNMP agent supports read-only MIB access, but it doesn't send SNMP notifications.

   c. Optionally, select or clear the **Enable authentication traps** checkbox to control whether the StorageGRID SNMP agent sends authentication traps when it receives improperly authenticated protocol messages.
4. If you use SNMPv1 or SNMPv2c, optionally update or add a **Read-only community** in the Community strings section.
5. To update trap destinations, select the Trap destinations tab in the Other configurations section.

   Use this tab to define one or more destinations for StorageGRID trap or inform notifications. When you enable the SNMP agent and select **Save**, StorageGRID sends notifications to each defined destination when alerts are triggered. Standard notifications are also sent for the supported MIB-II entities (for example, ifDown and coldStart).

   For details about what to enter, see Create trap destinations.

   - Optionally, update or remove the default trap community.

     If you remove the default trap community, you must first ensure that any existing trap destinations use a custom community string.

   - To add a trap destination, select **Create**.
   - To edit a trap destination, select the radio button, and select **Edit**.

- To remove a trap destination, select the radio button, and select **Remove**.
- To commit your changes, select **Save** at the bottom of the page.

6. To update agent addresses, select the Agent addresses tab in the Other configurations section.

   Use this tab to specify one or more "listening addresses." These are the StorageGRID addresses on which the SNMP agent can receive queries.

   For details about what to enter, see Create agent addresses.

   - To add an agent address, select **Create**.
   - To edit an agent address, select the radio button, and select **Edit**.
   - To remove an agent address, select the radio button, and select **Remove**.
   - To commit your changes, select **Save** at the bottom of the page.

7. To update USM users, select the USM users tab in the Other configurations section.

   Use this tab to define the USM users who are authorized to query the MIB or to receive traps and informs.

   For details about what to enter, see Create USM users.

   - To add a USM user, select **Create**.
   - To edit a USM user, select the radio button, and select **Edit**.

     The username for an existing USM user can't be changed. If you need to change a username, you must remove the user and create a new one.

     > If you add or remove a user's authoritative engine ID and that user is currently selected for a destination, you must edit or remove the destination. Otherwise, a validation error occurs when you save the SNMP agent configuration.

   - To remove a USM user, select the radio button, and select **Remove**.

     > If the user you removed is currently selected for a trap destination, you must edit or remove the destination. Otherwise, a validation error occurs when you save the SNMP agent configuration.

   - To commit your changes, select **Save** at the bottom of the page.

8. When you have updated the SNMP agent configuration, select **Save**.

## Access MIB files

MIB files contain definitions and information about the properties of managed resources and services for the nodes in your grid. You can access MIB files that define the objects and notifications for StorageGRID. These files can be useful for monitoring your grid.

See Use SNMP monitoring for more information about SNMP and MIB files.

### Access MIB files

Follow these steps to access the MIB files.

**Steps**

1. Select **CONFIGURATION** > **Monitoring** > **SNMP agent**.
2. On the SNMP agent page, select the file you want to download:
   - **NETAPP-STORAGEGRID-MIB.txt**: Defines the alert table and notifications (traps) accessible on all Admin Nodes.
   - **ES-NETAPP-06-MIB.mib**: Defines objects and notifications for E-Series-based appliances.
   - **MIB_1_10.zip**: Defines objects and notifications for appliances with a BMC interface.

   > You can also access MIB files at the following location on any StorageGRID node: `/usr/share/snmp/mibs`

3. To extract the StorageGRID OIDs from the MIB file:
   a. Get the OID of the root of the StorageGRID MIB:

   ```
   root@user-adm1:~ # snmptranslate -On -IR storagegrid
   ```

   Result: `.1.3.6.1.4.1.789.28669` (`28669` is always the OID for StorageGRID)

   b. Grep for the StorageGRID OID in the entire tree (using `paste` to join lines):

   ```
   root@user-adm1:~ # snmptranslate -Tso | paste -d " " - - | grep 28669
   ```

> The `snmptranslate` command has many options that are useful for exploring the MIB. This command is available on any StorageGRID node.

### MIB file contents

All objects are under the StorageGRID OID.

| Object name | Object ID (OID) | Description |
|---|---|---|
| `.iso.org.dod.internet.private.enterprises.netapp.storagegrid` | `.1.3.6.1.4.1.789.28669` | The MIB module for NetApp StorageGRID entities. |

### MIB objects

| Object name | Object ID (OID) | Description |
|---|---|---|
| `activeAlertCount` | `.1.3.6.1.4.1.789.28669.1.3` | The number of active alerts in the activeAlertTable. |
| `activeAlertTable` | `.1.3.6.1.4.1.789.28669.1.4` | A table of active alerts in StorageGRID. |

| Object name | Object ID (OID) | Description |
|---|---|---|
| activeAlertId | .1.3.6.1.4.1.789.28669.1.4.1.1 | The ID of the alert. Only unique in the current set of active alerts. |
| activeAlertName | .1.3.6.1.4.1.789.28669.1.4.1.2 | The name of the alert. |
| activeAlertInstance | .1.3.6.1.4.1.789.28669.1.4.1.3 | The name of the entity that generated the alert, typically the node name. |
| activeAlertSeverity | .1.3.6.1.4.1.789.28669.1.4.1.4 | The severity of the alert. |
| activeAlertStartTime | .1.3.6.1.4.1.789.28669.1.4.1.5 | The date and time the alert was triggered. |

#### Notification types (Traps)

All notifications include the following variables as varbinds:

- activeAlertId
- activeAlertName
- activeAlertInstance
- activeAlertSeverity
- activeAlertStartTime

| Notification type | Object ID (OID) | Description |
|---|---|---|
| activeMinorAlert | .1.3.6.1.4.1.789.28669.0.6 | An alert with minor severity |
| activeMajorAlert | .1.3.6.1.4.1.789.28669.0.7 | An alert with major severity |
| activeCriticalAlert | .1.3.6.1.4.1.789.28669.0.8 | An alert with critical severity |

# Collect additional StorageGRID data

## Use charts and graphs

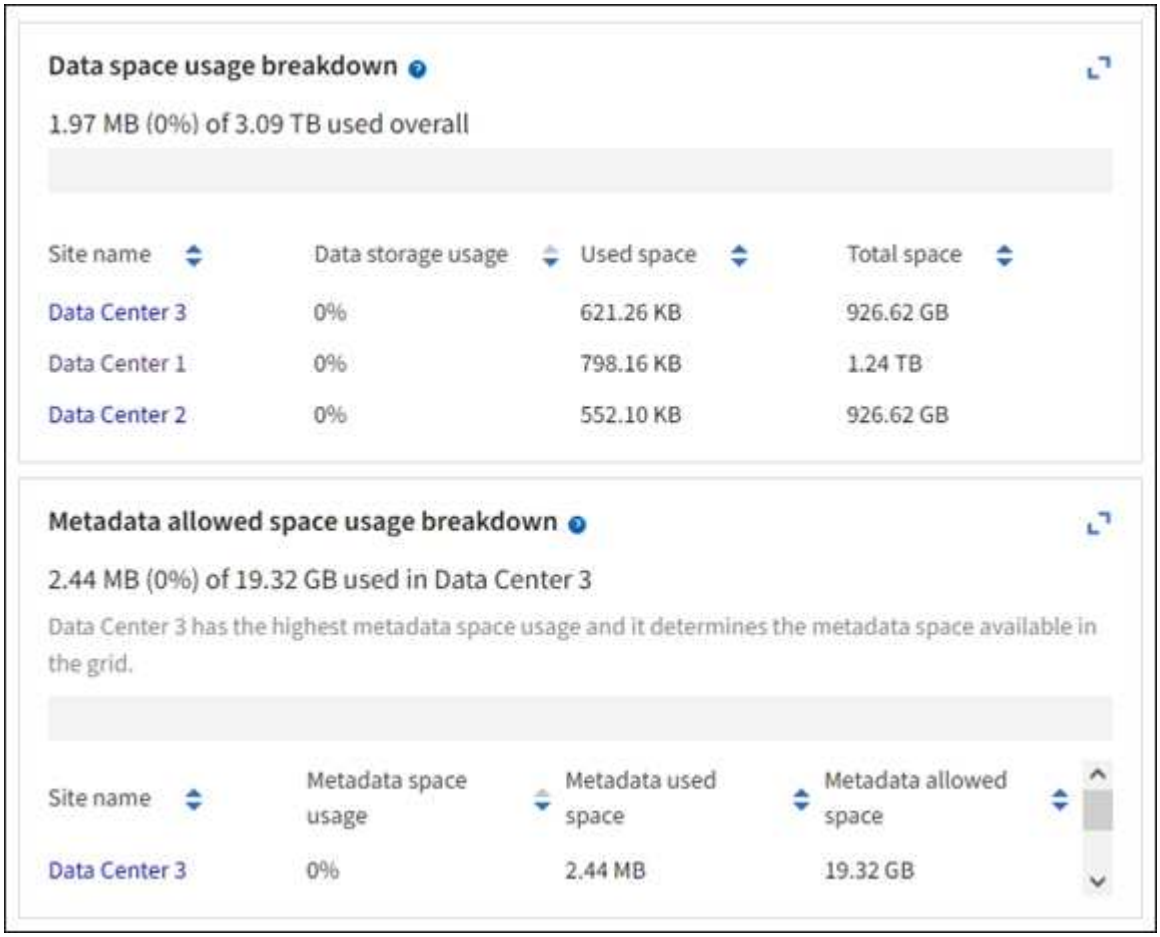
You can use charts and reports to monitor the state of the StorageGRID system and troubleshoot problems.

> The Grid Manager is updated with each release and might not match the example screenshots on this page.

#### Types of charts

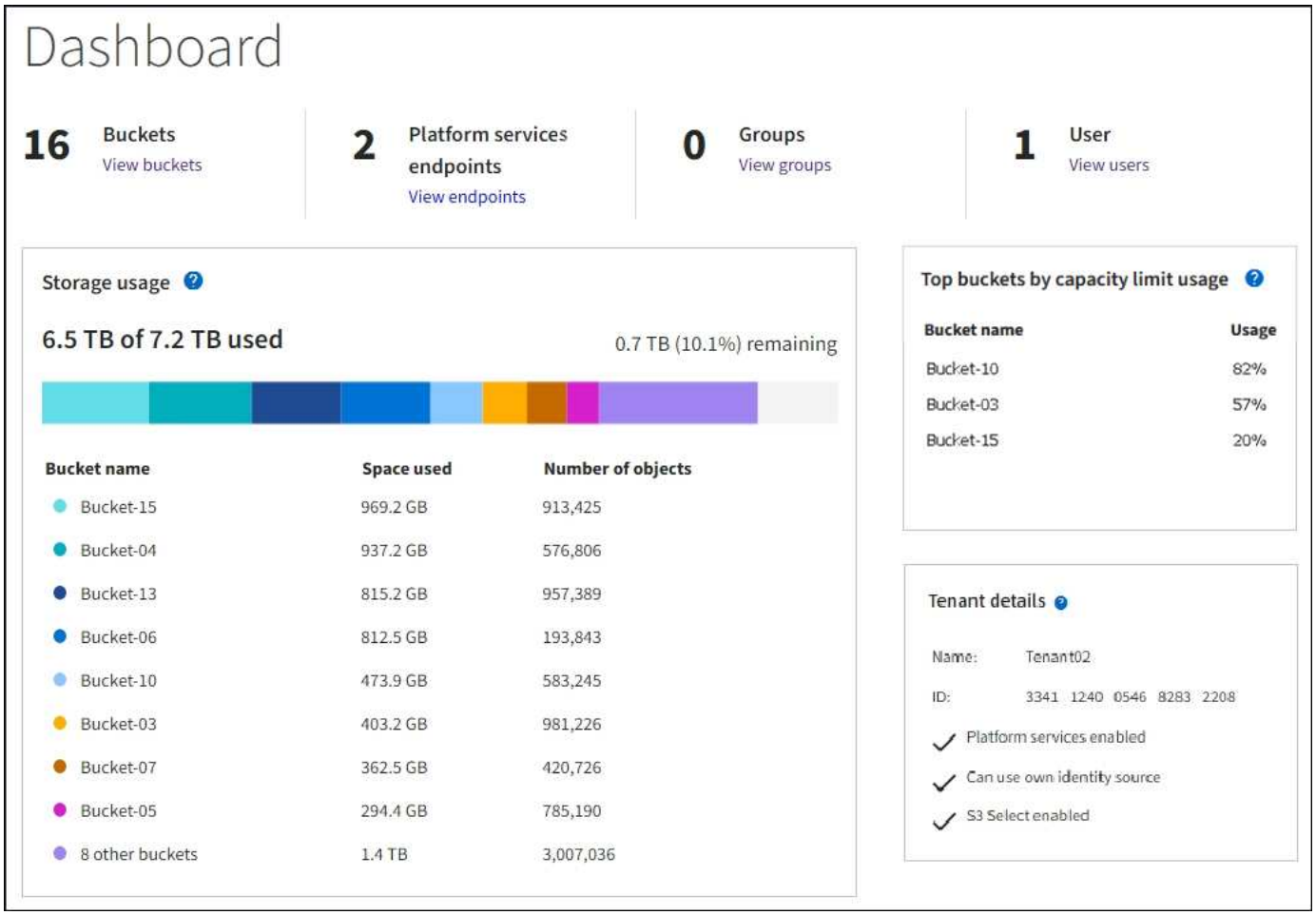
Charts and graphs summarize the values of specific StorageGRID metrics and attributes.

The Grid Manager dashboard includes cards that summarize available storage for the grid and each site.




The Storage usage panel on the Tenant Manager dashboard displays the following:

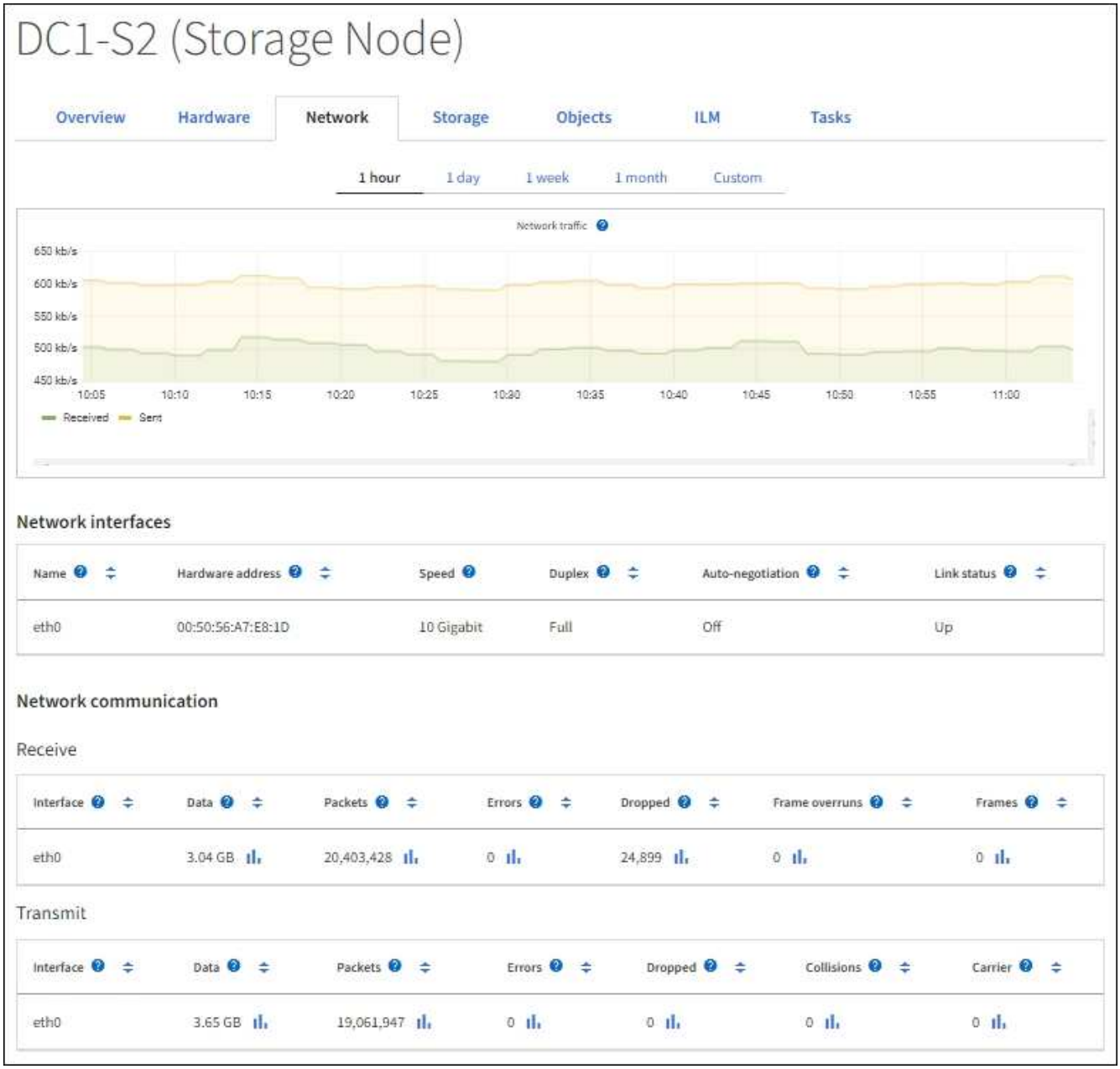
- A list of the largest buckets (S3) or containers (Swift) for the tenant
- A bar chart that represents the relative sizes of the largest buckets or containers
- The total amount of space used and, if a quota is set, the amount and percentage of space remaining




In addition, graphs that show how StorageGRID metrics and attributes change over time are available from the Nodes page and from the **SUPPORT** > **Tools** > **Grid topology** page.

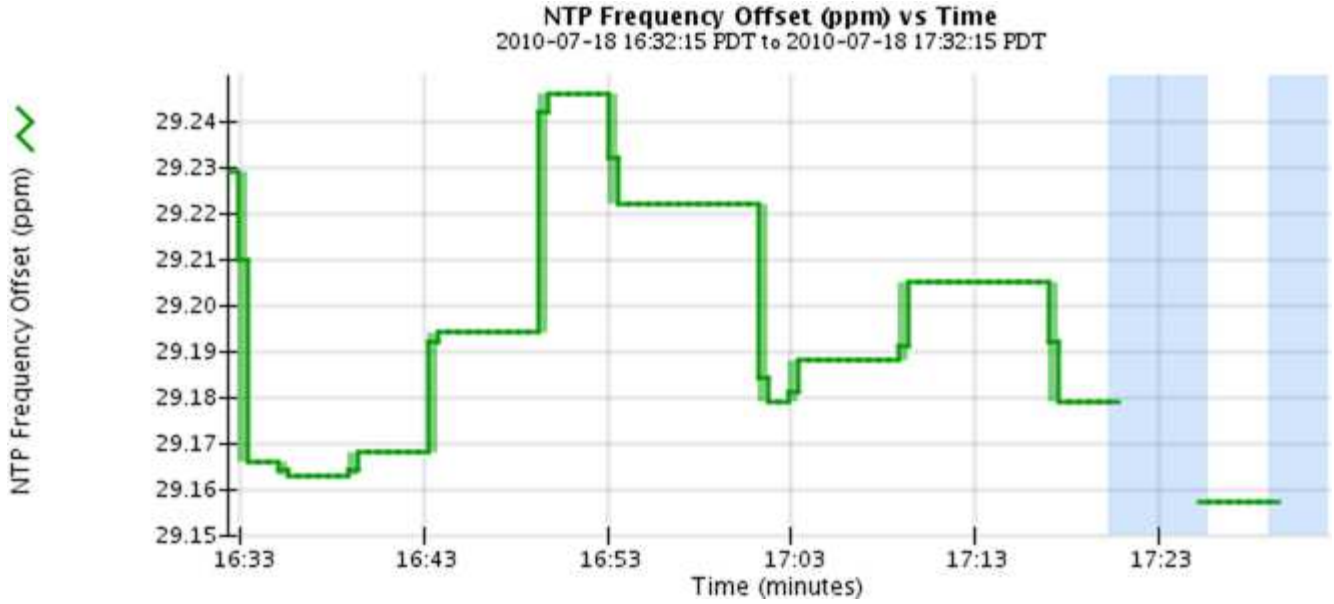
There are four types of graphs:

- **Grafana charts**: Shown on the Nodes page, Grafana charts are used to plot the values of Prometheus metrics over time. For example, the **NODES** > **Network** tab for a Storage Node includes a Grafana chart for network traffic.

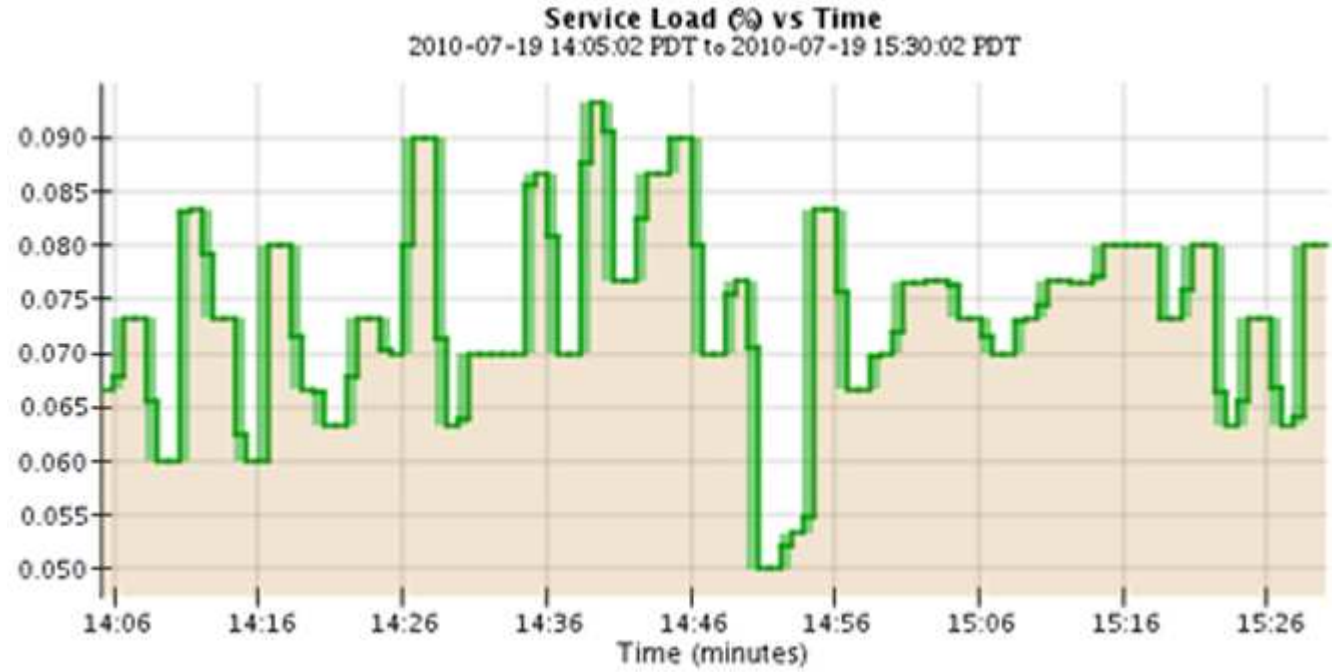



Grafana charts are also included on the pre-constructed dashboards available from the **SUPPORT** > **Tools** > **Metrics** page.

- **Line graphs**: Available from the Nodes page and from the **SUPPORT** > **Tools** > **Grid topology** page (select the chart icon after a data value), line graphs are used to plot the values of StorageGRID attributes that have a unit value (such as NTP Frequency Offset, in ppm). The changes in the value are plotted in regular data intervals (bins) over time.

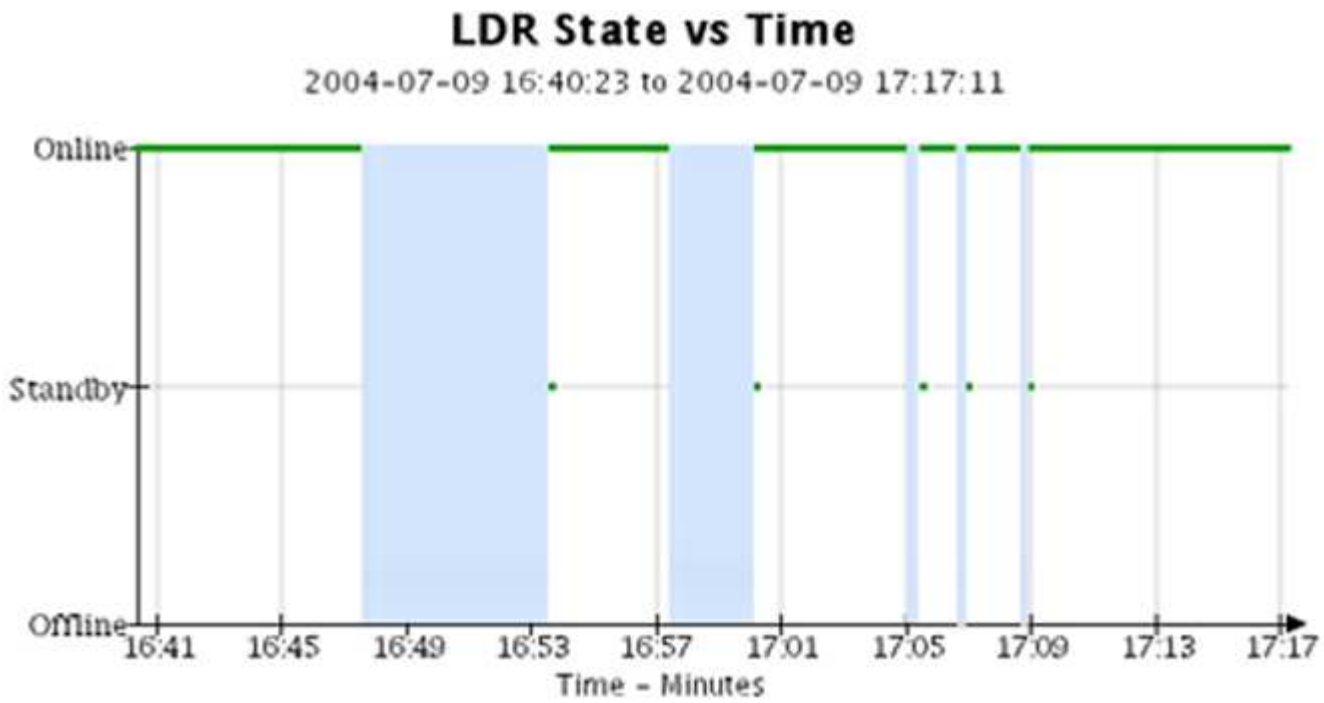



- **Area graphs**: Available from the Nodes page and from the **SUPPORT** > **Tools** > **Grid topology** page (select the chart icon after a data value), area graphs are used to plot volumetric attribute quantities, such as object counts or service load values. Area graphs are similar to line graphs, but include a light brown shading below the line. The changes in the value are plotted in regular data intervals (bins) over time.




- Some graphs are denoted with a different type of chart icon and have a different format:


- **State graph**: Available from the **SUPPORT** > **Tools** > **Grid topology** page (select the chart icon after a data value), state graphs are used to plot attribute values that represent distinct states such as a service state that can be online, standby, or offline. State graphs are similar to line graphs, but the transition is discontinuous; that is, the value jumps from one state value to another.

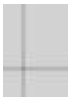



**Related information**

- View the Nodes page
- View the Grid Topology tree
- Review support metrics

### Chart legend

The lines and colors used to draw charts have specific meaning.

| Example | Meaning |
|---|---|
|  | Reported attribute values are plotted using dark green lines. |
|  | Light green shading around dark green lines indicates that the actual values in that time range vary and have been "binned" for faster plotting. The dark line represents the weighted average. The range in light green indicates the maximum and minimum values within the bin. Light brown shading is used for area graphs to indicate volumetric data. |
|  | Blank areas (no data plotted) indicate that the attribute values were unavailable. The background can be blue, gray, or a mixture of gray and blue, depending on the state of the service reporting the attribute. |
|  | Light blue shading indicates that some or all of the attribute values at that time were indeterminate; the attribute was not reporting values because the service was in an unknown state. |
|  | Gray shading indicates that some or all of the attribute values at that time were not known because the service reporting the attributes was administratively down. |
|  | A mixture of gray and blue shading indicates that some of the attribute values at the time were indeterminate (because the service was in an unknown state), while others were not known because the service reporting the attributes was administratively down. |

### Display charts and graphs

The Nodes page contains the charts and graphs you should access regularly to monitor attributes such as storage capacity and throughput. In some cases, especially when working with technical support, you can use the **SUPPORT** > **Tools** > **Grid topology** page to access additional charts.

#### Before you begin

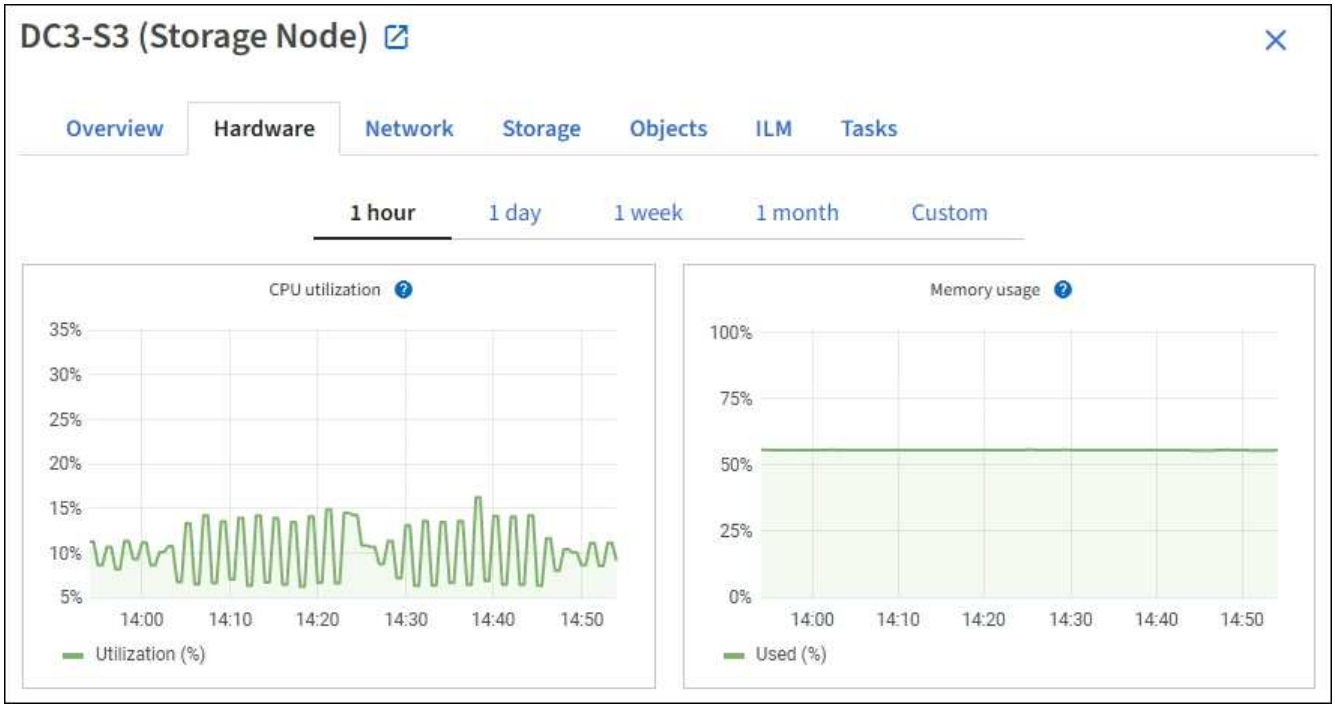
You must be signed in to the Grid Manager using a supported web browser.

#### Steps

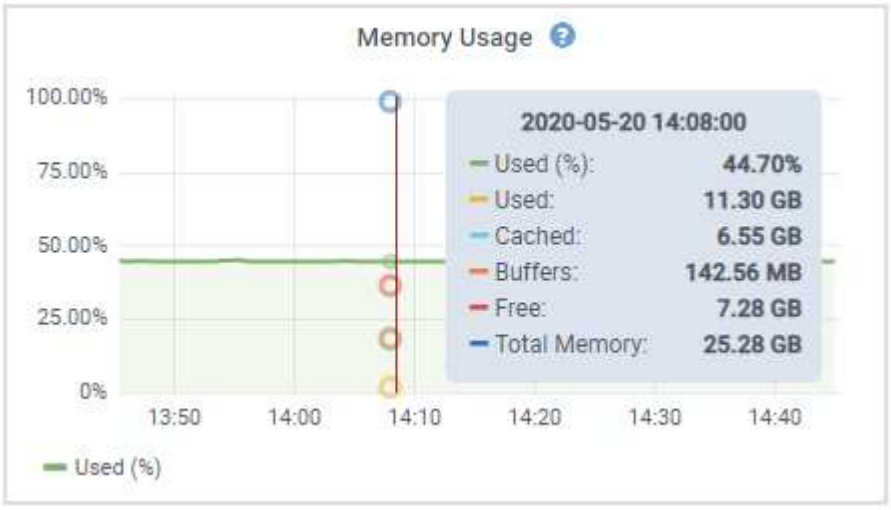
1. Select **NODES**. Then, select a node, a site, or the entire grid.
2. Select the tab for which you want to view information.

   Some tabs include one or more Grafana charts, which are used to plot the values of Prometheus metrics

over time. For example, the **NODES** > **Hardware** tab for a node includes two Grafana charts.



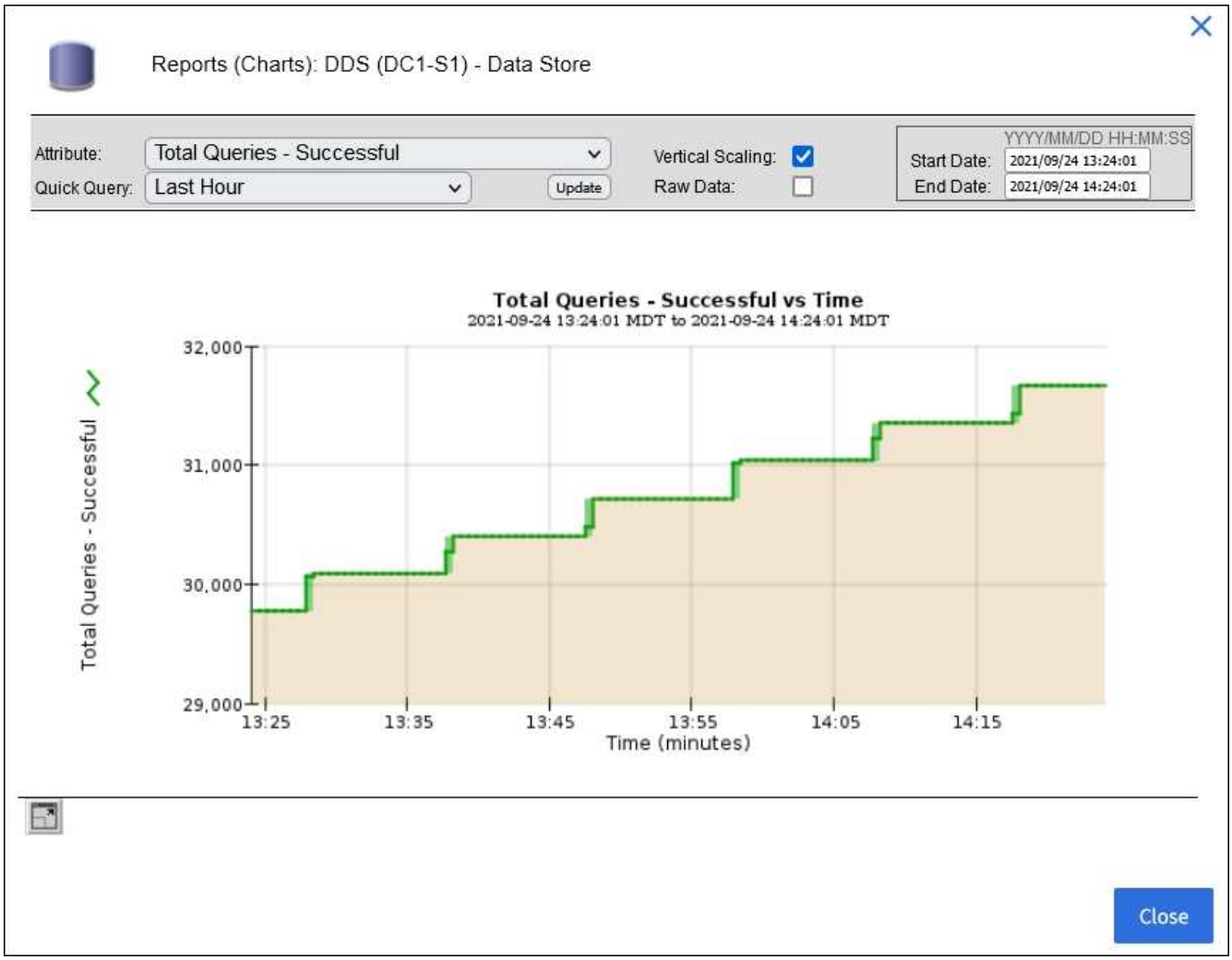

3. Optionally, position your cursor over the chart to see more detailed values for a particular point in time.

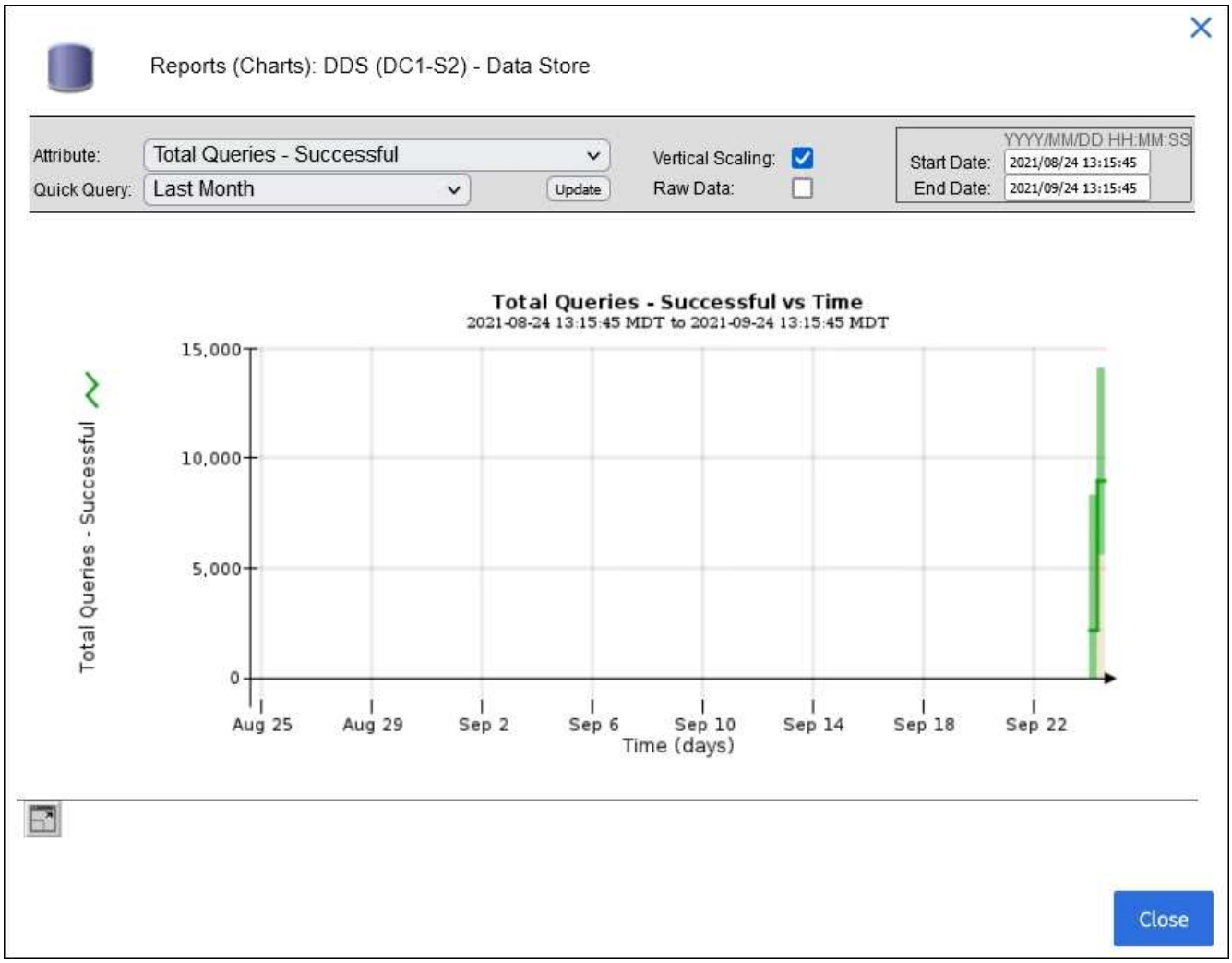



4. As required, you can often display a chart for a specific attribute or metric. From the table on the Nodes page, select the chart icon to the right of the attribute name.

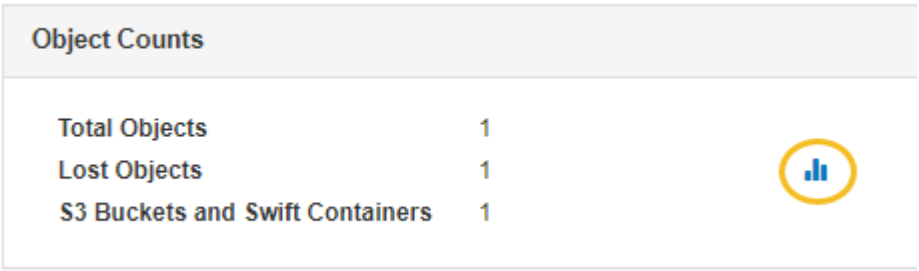
> Charts aren't available for all metrics and attributes.

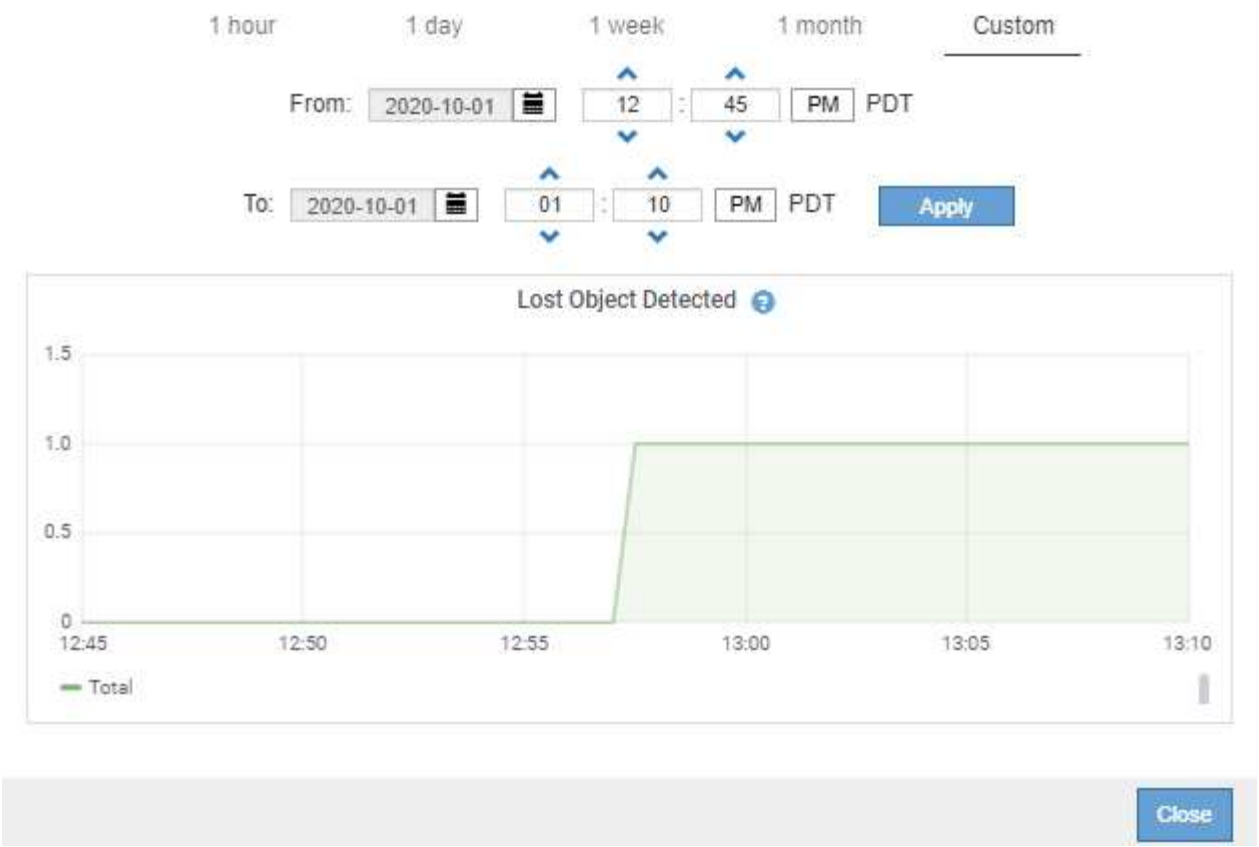
**Example 1**: From the Objects tab for a Storage Node, you can select the chart icon to see the total number of successful metadata store queries for the Storage Node.


Reports (Charts): DDS (DC1-S1) - Data Store
Attribute:
Total Queries - Successful
Quick Query:
Last Hour
Update
Vertical Scaling:
Raw Data:
YYYY/MM/DD HH:MM:SS
Start Date:
2021/09/24 13:24:01
End Date:
2021/09/24 14:24:01
Total Queries - Successful vs Time
2021-09-24 13:24:01 MDT to 2021-09-24 14:24:01 MDT
Total Queries - Successful
32,000
31,000
30,000
29,000
13:25
13:35
13:45
13:55
14:05
14:15
Time (minutes)
Close

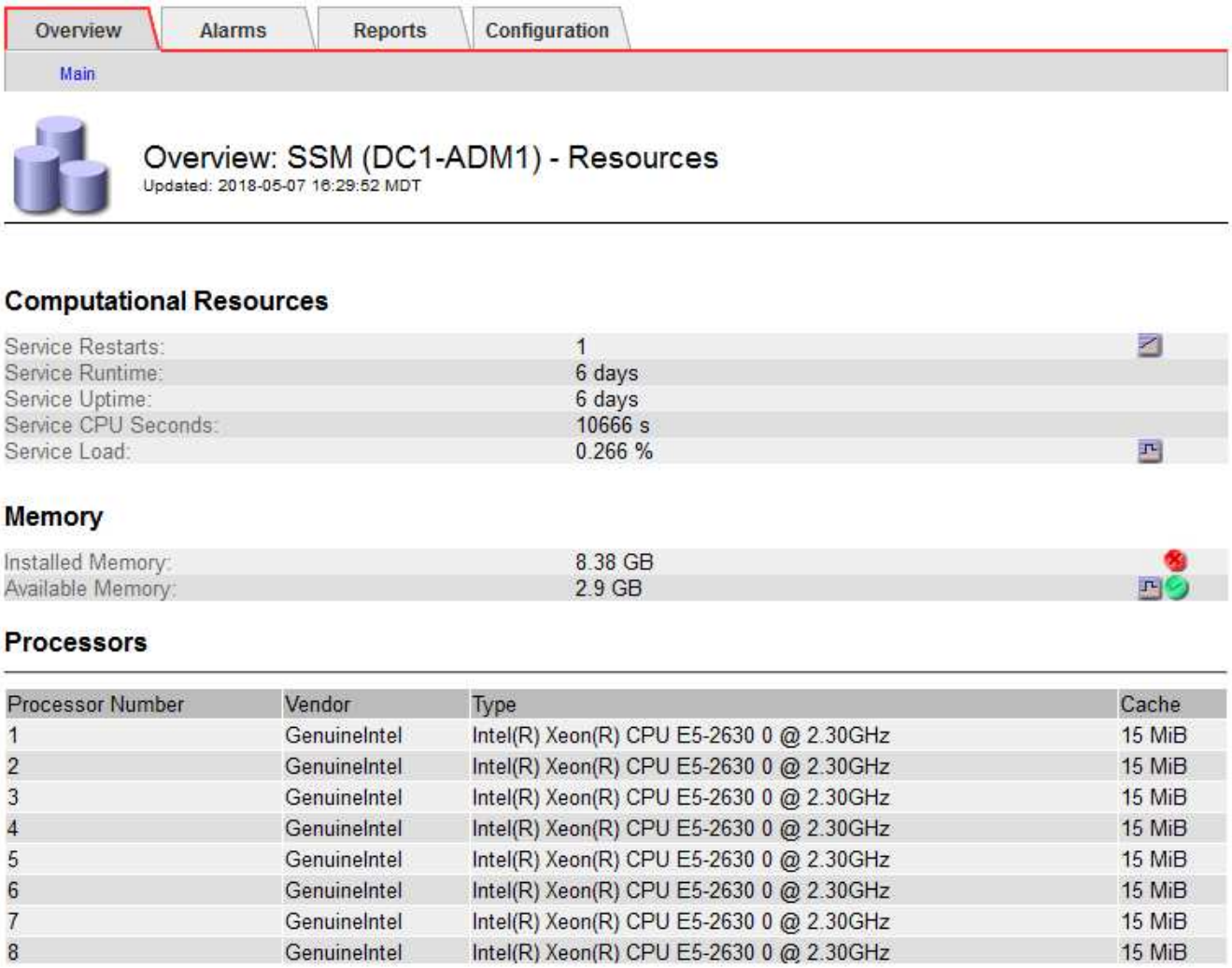



**Example 2**: From the Objects tab for a Storage Node, you can select the chart icon to see the Grafana graph of the count of lost objects detected over time.






5. To display charts for attributes that aren't shown on the Node page, select **SUPPORT** > **Tools** > **Grid topology**.
6. Select ***grid node*** > ***component or service*** > **Overview** > **Main**.




7. Select the chart icon next to the attribute.

   The display automatically changes to the **Reports** > **Charts** page. The chart displays the attribute's data over the past day.

### Generate charts

Charts display a graphical representation of attribute data values. You can report on a data center site, grid node, component, or service.

#### Before you begin

- You must be signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.

#### Steps

1. Select **SUPPORT** > **Tools** > **Grid topology**.
2. Select ***grid node*** > ***component or service*** > **Reports** > **Charts**.
3. Select the attribute to report on from the **Attribute** drop-down list.
4. To force the Y-axis to start at zero, clear the **Vertical Scaling** checkbox.
5. To show values at full precision, select the **Raw Data** checkbox, or to round values to a maximum of three

decimal places (for example, for attributes reported as percentages), clear the **Raw Data** checkbox.

6. Select the time period to report on from the **Quick Query** drop-down list.

   Select the Custom Query option to select a specific time range.

   The chart appears after a few moments. Allow several minutes for tabulation of long time ranges.

7. If you selected Custom Query, customize the time period for the chart by entering the **Start Date** and **End Date**.

   Use the format *YYYY/MM/DDHH:MM:SS* in local time. Leading zeros are required to match the format. For example, 2017/4/6 7:30:00 fails validation. The correct format is: 2017/04/06 07:30:00.

8. Select **Update**.

   A chart is generated after a few seconds. Allow several minutes for tabulation of long time ranges. Depending on the length of time set for the query, either a raw text report or aggregate text report is displayed.

## Use text reports

Text reports display a textual representation of attribute data values that have been processed by the NMS service. There are two types of reports generated depending on the time period you are reporting on: raw text reports for periods less than a week, and aggregate text reports for time periods greater than a week.

### Raw text reports

A raw text report displays details about the selected attribute:

- Time Received: Local date and time that a sample value of an attribute's data was processed by the NMS service.
- Sample Time: Local date and time that an attribute value was sampled or changed at the source.
- Value: Attribute value at sample time.

## Text Results for Services: Load - System Logging

2010-07-18 15:58:39 PDT To 2010-07-19 15:58:39 PDT

| Time Received | Sample Time | Value |
|---|---|---|
| 2010-07-19 15:58:09 | 2010-07-19 15:58:09 | 0.016 % |
| 2010-07-19 15:56:06 | 2010-07-19 15:56:06 | 0.024 % |
| 2010-07-19 15:54:02 | 2010-07-19 15:54:02 | 0.033 % |
| 2010-07-19 15:52:00 | 2010-07-19 15:52:00 | 0.016 % |
| 2010-07-19 15:49:57 | 2010-07-19 15:49:57 | 0.008 % |
| 2010-07-19 15:47:54 | 2010-07-19 15:47:54 | 0.024 % |
| 2010-07-19 15:45:50 | 2010-07-19 15:45:50 | 0.016 % |
| 2010-07-19 15:43:47 | 2010-07-19 15:43:47 | 0.024 % |
| 2010-07-19 15:41:43 | 2010-07-19 15:41:43 | 0.032 % |
| 2010-07-19 15:39:40 | 2010-07-19 15:39:40 | 0.024 % |
| 2010-07-19 15:37:37 | 2010-07-19 15:37:37 | 0.008 % |
| 2010-07-19 15:35:34 | 2010-07-19 15:35:34 | 0.016 % |
| 2010-07-19 15:33:31 | 2010-07-19 15:33:31 | 0.024 % |
| 2010-07-19 15:31:27 | 2010-07-19 15:31:27 | 0.032 % |
| 2010-07-19 15:29:24 | 2010-07-19 15:29:24 | 0.032 % |
| 2010-07-19 15:27:21 | 2010-07-19 15:27:21 | 0.049 % |
| 2010-07-19 15:25:18 | 2010-07-19 15:25:18 | 0.024 % |
| 2010-07-19 15:21:12 | 2010-07-19 15:21:12 | 0.016 % |
| 2010-07-19 15:19:09 | 2010-07-19 15:19:09 | 0.008 % |
| 2010-07-19 15:17:07 | 2010-07-19 15:17:07 | 0.016 % |

### Aggregate text reports

An aggregate text report displays data over a longer period of time (usually a week) than a raw text report. Each entry is the result of summarizing multiple attribute values (an aggregate of attribute values) by the NMS service over time into a single entry with average, maximum, and minimum values that are derived from the aggregation.

Each entry displays the following information:

- Aggregate Time: Last local date and time that the NMS service aggregated (collected) a set of changed attribute values.
- Average Value: The average of the attribute’s value over the aggregated time period.
- Minimum Value: The minimum value over the aggregated time period.
- Maximum Value: The maximum value over the aggregated time period.

**Text Results for Attribute Send to Relay Rate**

2010-07-11 16:02:46 PDT To 2010-07-19 16:02:46 PDT

| Aggregate Time | Average Value | Minimum Value | Maximum Value |
|---|---|---|---|
| 2010-07-19 15:59:52 | 0.271072196 Messages/s | 0.266649743 Messages/s | 0.274983464 Messages/s |
| 2010-07-19 15:53:52 | 0.275585378 Messages/s | 0.266562352 Messages/s | 0.283302736 Messages/s |
| 2010-07-19 15:49:52 | 0.279315709 Messages/s | 0.233318712 Messages/s | 0.333313579 Messages/s |
| 2010-07-19 15:43:52 | 0.28181323 Messages/s | 0.241651024 Messages/s | 0.374976601 Messages/s |
| 2010-07-19 15:39:52 | 0.284233141 Messages/s | 0.249982001 Messages/s | 0.324971987 Messages/s |
| 2010-07-19 15:33:52 | 0.325752083 Messages/s | 0.266641993 Messages/s | 0.358306197 Messages/s |
| 2010-07-19 15:29:52 | 0.278531507 Messages/s | 0.274984766 Messages/s | 0.283320999 Messages/s |
| 2010-07-19 15:23:52 | 0.281437642 Messages/s | 0.274981961 Messages/s | 0.291577735 Messages/s |
| 2010-07-19 15:17:52 | 0.261563307 Messages/s | 0.258318006 Messages/s | 0.266655787 Messages/s |
| 2010-07-19 15:13:52 | 0.265159147 Messages/s | 0.258318557 Messages/s | 0.26663986 Messages/s |

### Generate text reports

Text reports display a textual representation of attribute data values that have been processed by the NMS service. You can report on a data center site, grid node, component, or service.

#### Before you begin

- You must be signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.

#### About this task

For attribute data that is expected to be continuously changing, this attribute data is sampled by the NMS service (at the source) at regular intervals. For attribute data that changes infrequently (for example, data based on events such as state or status changes), an attribute value is sent to the NMS service when the value changes.

The type of report displayed depends on the configured time period. By default, aggregate text reports are generated for time periods longer than one week.

Gray text indicates the service was administratively down during the time it was sampled. Blue text indicates the service was in an unknown state.

#### Steps

1. Select **SUPPORT** > **Tools** > **Grid topology**.
2. Select ***grid node*** > ***component or service*** > **Reports** > **Text**.
3. Select the attribute to report on from the **Attribute** drop-down list.
4. Select the number of results per page from the **Results per Page** drop-down list.
5. To round values to a maximum of three decimal places (for example, for attributes reported as percentages), clear the **Raw Data** checkbox.
6. Select the time period to report on from the **Quick Query** drop-down list.

   Select the Custom Query option to select a specific time range.

   The report appears after a few moments. Allow several minutes for tabulation of long time ranges.

7. If you selected Custom Query, you need to customize the time period to report on by entering the **Start Date** and **End Date**.

   Use the format `YYYY/MM/DDHH:MM:SS` in local time. Leading zeros are required to match the format. For example, 2017/4/6 7:30:00 fails validation. The correct format is: 2017/04/06 07:30:00.

8. Click **Update**.

   A text report is generated after a few moments. Allow several minutes for tabulation of long time ranges. Depending on the length of time set for the query, either a raw text report or aggregate text report is displayed.

### Export text reports

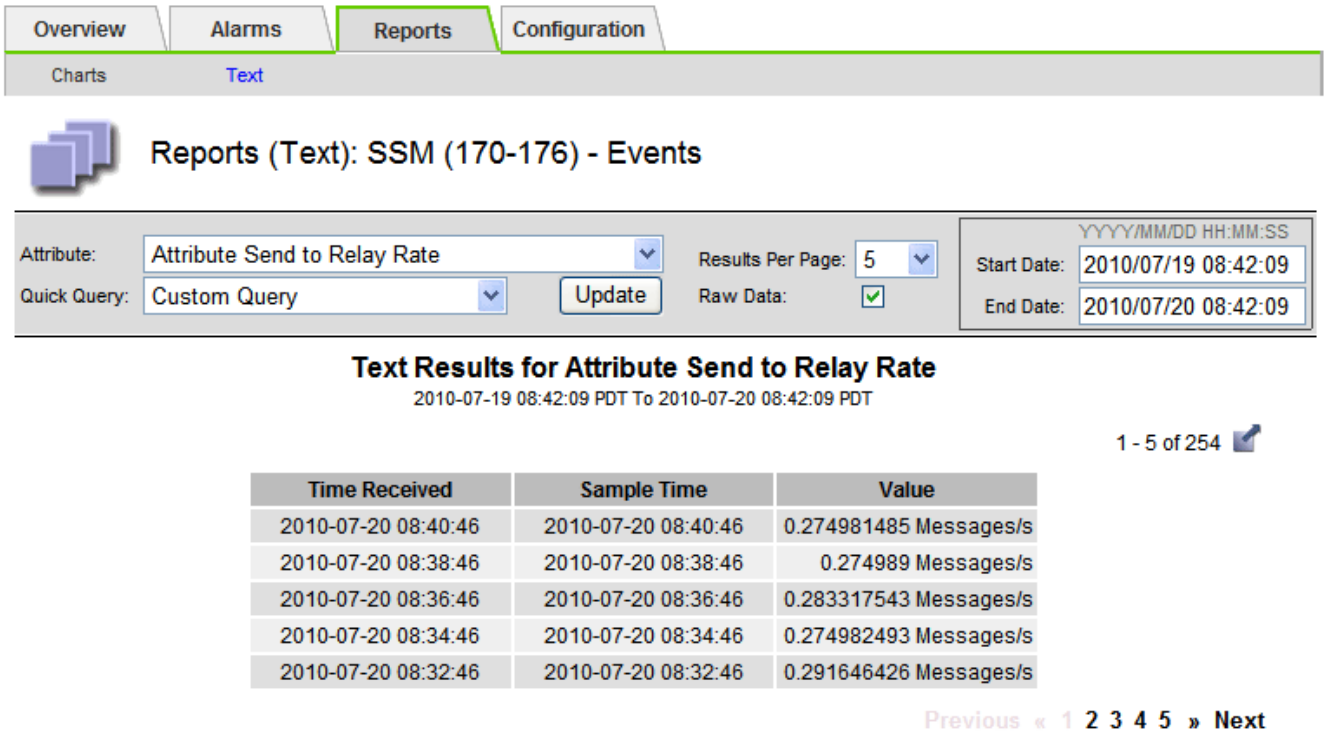
Exported text reports open a new browser tab, which enables you to select and copy the data.

#### About this task

The copied data can then be saved into a new document (for example, a spreadsheet) and used to analyze the performance of the StorageGRID system.

#### Steps

1. Select **SUPPORT** > **Tools** > **Grid topology**.
2. Create a text report.
3. Click *Export*.




   The Export Text Report window opens displaying the report.

Grid ID: 000 000
OID: 2.16.124.113590.2.1.400019.1.1.1.16996732.200
Node Path: Site/170-176/SSM/Events
Attribute: Attribute Send to Relay Rate (ABSR)
Query Start Date: 2010-07-19 08:42:09 PDT
Query End Date: 2010-07-20 08:42:09 PDT
Time Received,Time Received (Epoch),Sample Time,Sample Time (Epoch),Value,Type
2010-07-20 08:40:46,1279640446559000,2010-07-20 08:40:46,1279640446537209,0.274981485 Messages/s,U
2010-07-20 08:38:46,1279640326561000,2010-07-20 08:38:46,1279640326529124,0.274989 Messages/s,U
2010-07-20 08:36:46,1279640206556000,2010-07-20 08:36:46,1279640206524330,0.283317543 Messages/s,U
2010-07-20 08:34:46,1279640086540000,2010-07-20 08:34:46,1279640086517645,0.274982493 Messages/s,U
2010-07-20 08:32:46,1279639966543000,2010-07-20 08:32:46,1279639966510022,0.291646426 Messages/s,U
2010-07-20 08:30:46,1279639846561000,2010-07-20 08:30:46,1279639846501672,0.308315369 Messages/s,U
2010-07-20 08:28:46,1279639726527000,2010-07-20 08:28:46,1279639726494673,0.291657509 Messages/s,U
2010-07-20 08:26:46,1279639606526000,2010-07-20 08:26:46,1279639606490890,0.266627739 Messages/s,U
2010-07-20 08:24:46,1279639486495000,2010-07-20 08:24:46,1279639486473368,0.258318523 Messages/s,U
2010-07-20 08:22:46,1279639366480000,2010-07-20 08:22:46,1279639366466497,0.274985902 Messages/s,U
2010-07-20 08:20:46,1279639246469000,2010-07-20 08:20:46,1279639246460346,0.283253871 Messages/s,U
2010-07-20 08:18:46,1279639126469000,2010-07-20 08:18:46,1279639126426669,0.274982804 Messages/s,U
2010-07-20 08:16:46,1279639006437000,2010-07-20 08:16:46,1279639006419168,0.283315503 Messages/s,U

4. Select and copy the contents of the Export Text Report window.

   This data can now be pasted into a third-party document such as a spreadsheet.

## Monitor PUT and GET performance

You can monitor the performance of certain operations, such as object store and retrieve, to help identify changes that might require further investigation.

### About this task

To monitor PUT and GET performance, you can run S3 commands directly from a workstation or by using the open-source S3tester application. Using these methods allows you to assess performance independently of factors that are external to StorageGRID, such as issues with a client application or issues with an external network.

When performing tests of PUT and GET operations, use the following guidelines:

- Use object sizes comparable to the objects that you typically ingest into your grid.
- Perform operations against both local and remote sites.

Messages in the audit log indicate the total time required to run certain operations. For example, to determine the total processing time for an S3 GET request, you can review the value of the TIME attribute in the SGET audit message. You can also find the TIME attribute in the audit messages for the following S3 operations: DELETE, GET, HEAD, Metadata Updated, POST, PUT

When analyzing results, look at the average time required to satisfy a request, as well as the overall throughput that you can achieve. Repeat the same tests regularly and record the results, so that you can identify trends that might require investigation.

- You can download S3tester from github.

## Monitor object verification operations

The StorageGRID system can verify the integrity of object data on Storage Nodes, checking for both corrupt and missing objects.

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have the Maintenance or Root access permission.

**About this task**

Two verification processes work together to ensure data integrity:

- **Background verification** runs automatically, continuously checking the correctness of object data.

  Background verification automatically and continuously checks all Storage Nodes to determine if there are corrupt copies of replicated and erasure-coded object data. If problems are found, the StorageGRID system automatically attempts to replace the corrupt object data from copies stored elsewhere in the system. Background verification does not run on objects in a Cloud Storage Pool.

  > The **Unidentified corrupt object detected** alert is triggered if the system detects a corrupt object that can't be corrected automatically.

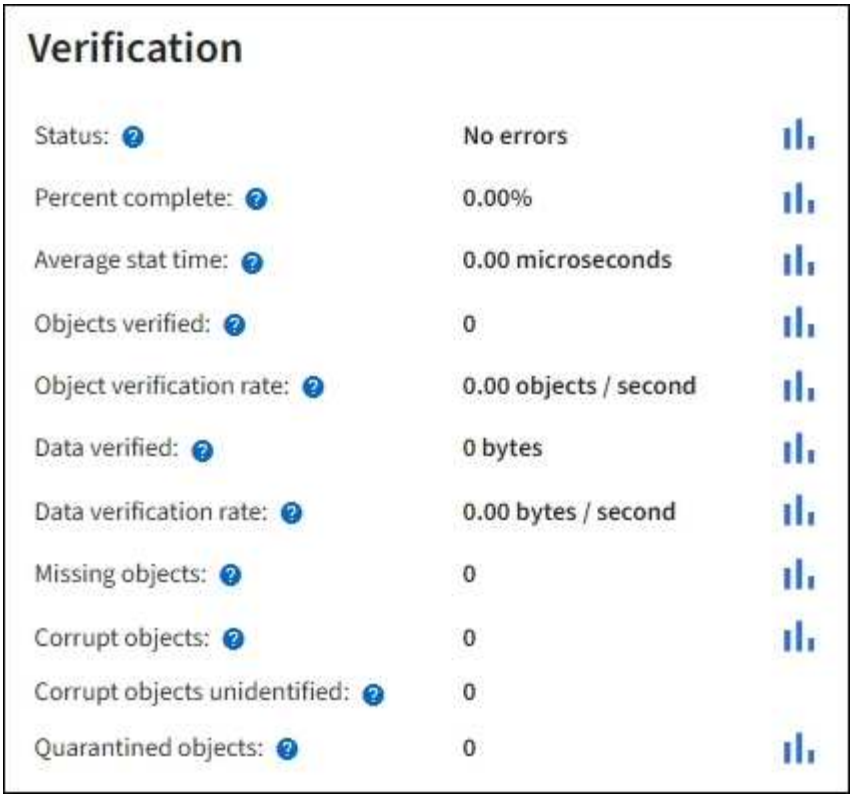
- **Object existence check** can be triggered by a user to more quickly verify the existence (although not the correctness) of object data.

  Object existence check verifies whether all expected replicated copies of objects and erasure-coded fragments exist on a Storage Node. Object existence check provides a way to verify the integrity of storage devices, especially if a recent hardware issue could have affected data integrity.

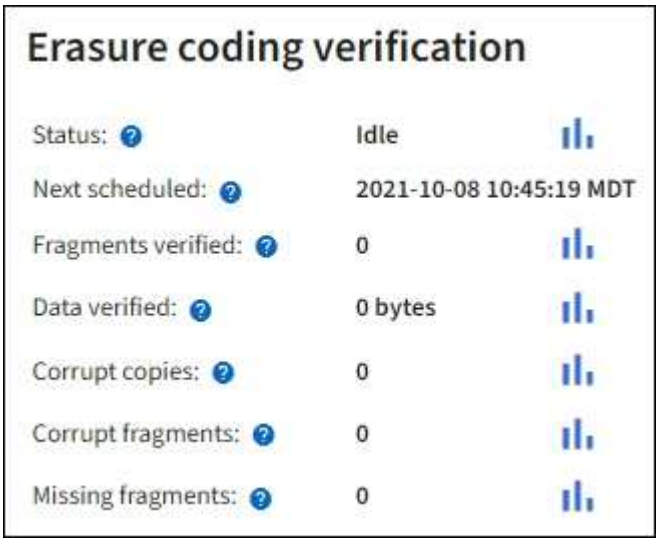
You should review the results from background verifications and object existence checks regularly. Investigate any instances of corrupt or missing object data immediately to determine the root cause.

**Steps**

1. Review the results from background verifications:
   a. Select **NODES** > ***Storage Node*** > **Objects**.
   b. Check the verification results:
      - To check replicated object data verification, look at the attributes in the Verification section.

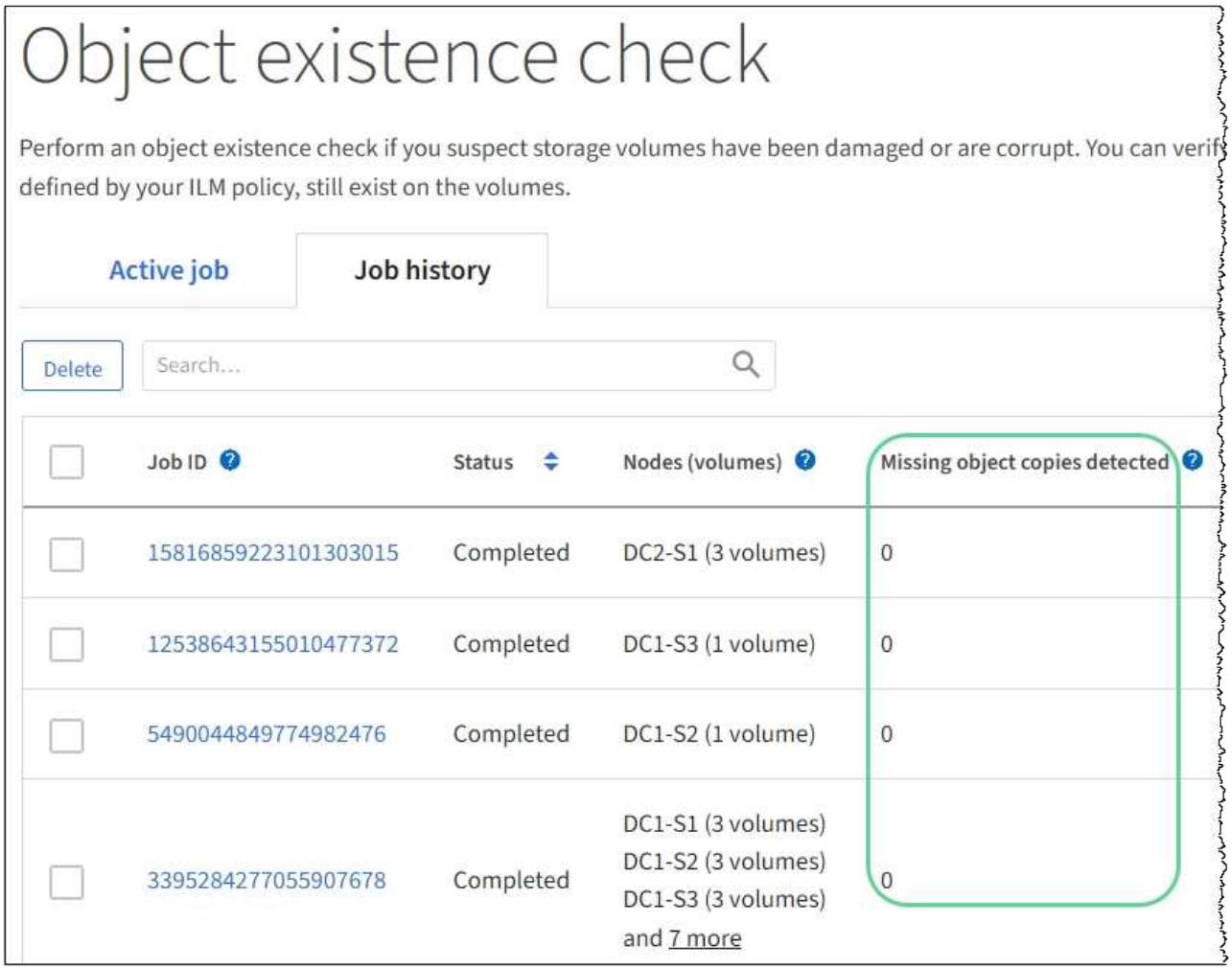



- To check erasure-coded fragment verification, select ***Storage Node*** > **ILM** and look at the attributes in the Erasure coding verification section.




Select the question mark next to an attribute's name to display help text.

2. Review the results from object existence check jobs:
   a. Select **MAINTENANCE** > **Object existence check** > **Job history**.
   b. Scan the Missing object copies detected column. If any jobs resulted in 100 or more missing object copies and the **Objects lost** alert has been triggered, contact technical support.




## Monitor events

You can monitor events that are detected by a grid node, including custom events that you have created to track events that are logged to the syslog server. The Last Event message shown in the Grid Manager provides more information about the most recent event.

Event messages are also listed in the `/var/local/log/bycast-err.log` log file. See the Log files reference.

The SMTT (Total events) alarm can be repeatedly triggered by issues such as network problems, power outages or upgrades. This section has information about investigating events so that you can better understand why these alarms have occurred. If an event occurred because of a known issue, it is safe to reset the event counters.

**Steps**

1. Review the system events for each grid node:
   a. Select **SUPPORT** > **Tools** > **Grid topology**.
   b. Select ***site*** > ***grid node*** > **SSM** > **Events** > **Overview** > **Main**.
2. Generate a list of previous event messages to help isolate issues that occurred in the past:

a. Select **SUPPORT** > **Tools** > **Grid topology**.

b. Select ***site*** > ***grid node*** > **SSM** > **Events** > **Reports**.

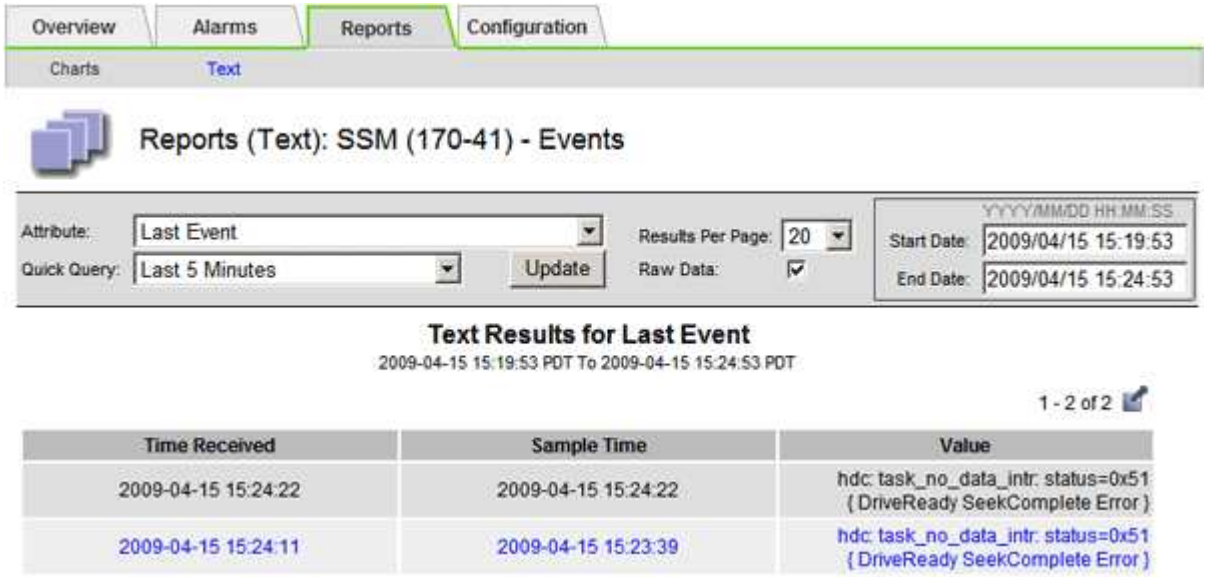
c. Select **Text**.

The **Last Event** attribute is not shown in the charts view. To view it:

d. Change **Attribute** to **Last Event**.

e. Optionally, select a time period for **Quick Query**.

f. Select **Update**.




### Create custom syslog events

Custom events allow you to track all kernel, daemon, error and critical level user events logged to the syslog server. A custom event can be useful for monitoring the occurrence of system log messages (and thus network security events and hardware faults).

#### About this task

Consider creating custom events to monitor recurring problems. The following considerations apply to custom events.

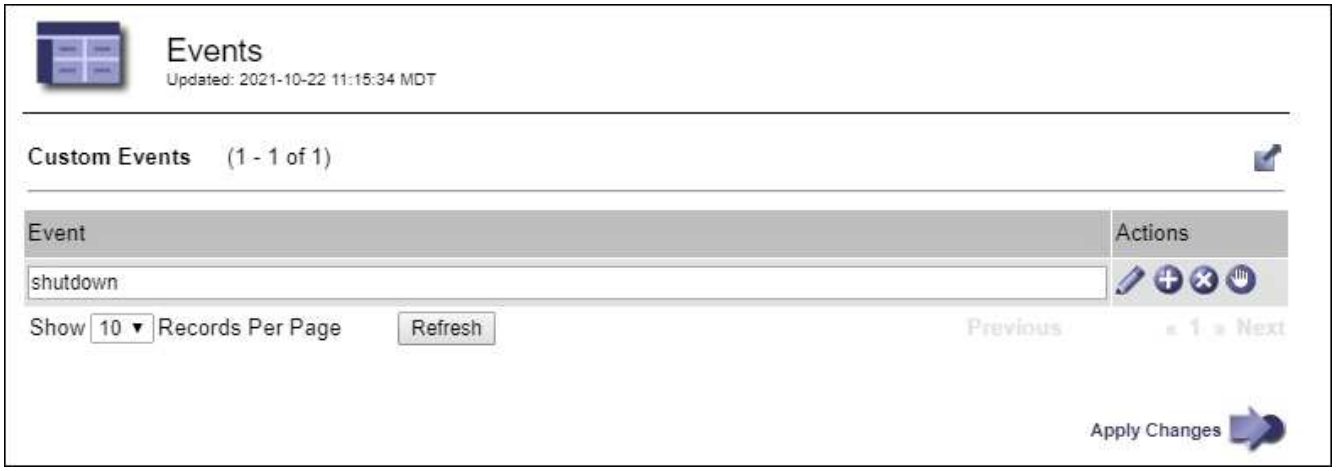
- After a custom event is created, every occurrence of it is monitored.
- To create a custom event based on keywords in the `/var/local/log/messages` files, the logs in those files must be:
  - Generated by the kernel
  - Generated by daemon or user program at the error or critical level

**Note:** Not all entries in the `/var/local/log/messages` files will be matched unless they satisfy the requirements stated above.

#### Steps

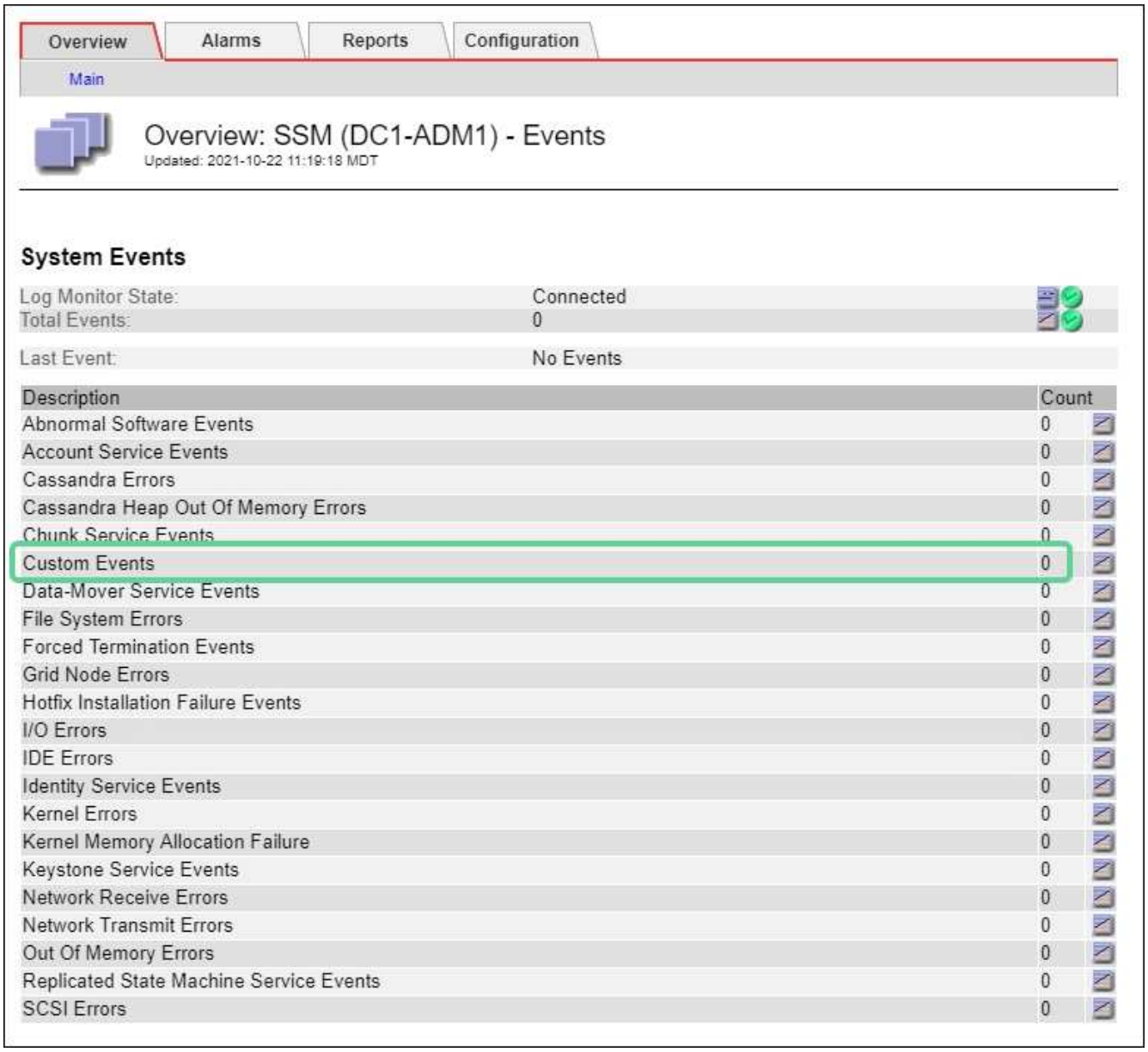
1. Select **SUPPORT** > **Alarms (legacy)** > **Custom events**.
2. Click **Edit** (or **Insert** if this is not the first event).

3. Enter a custom event string, for example, shutdown




4. Select **Apply Changes**.
5. Select **SUPPORT** > **Tools** > **Grid topology**.
6. Select ***grid node*** > **SSM** > **Events**.
7. Locate the entry for Custom Events in the Events table, and monitor the value for **Count**.

   If the count increases, a custom event you are monitoring is being triggered on that grid node.



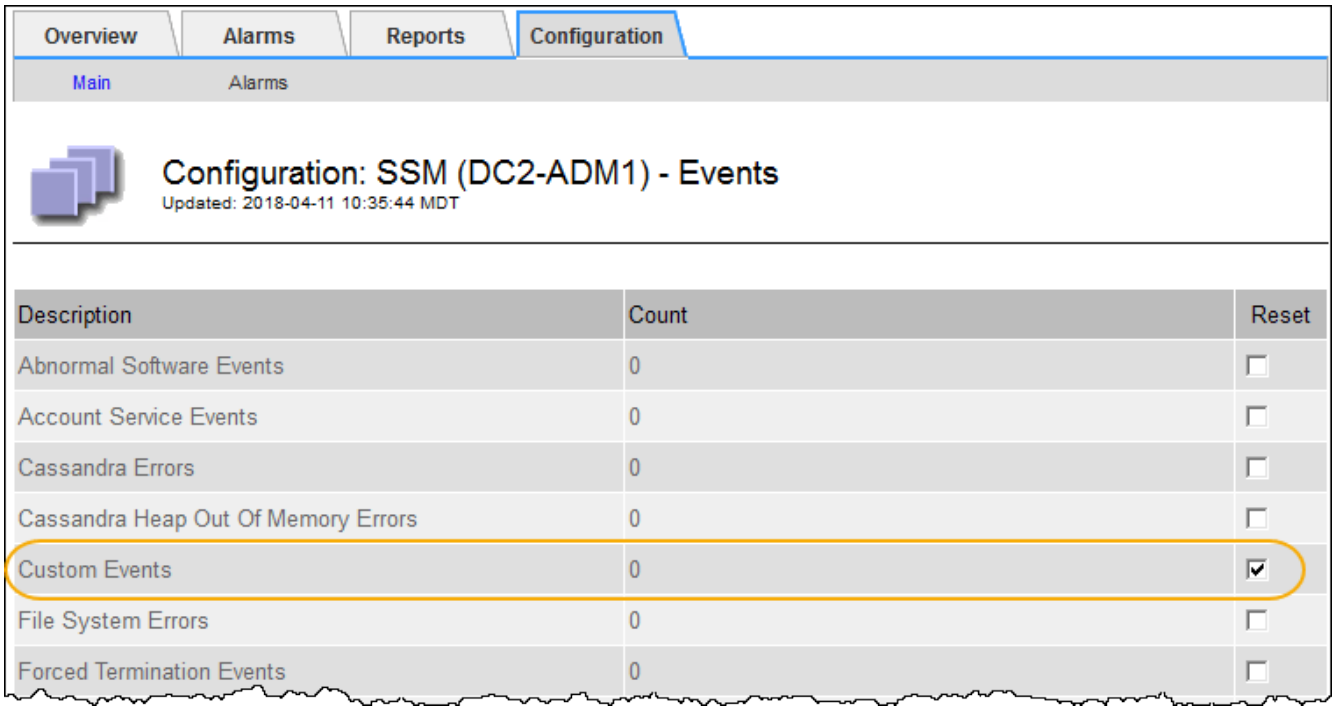

### Reset the count of custom events to zero

If you want to reset the counter only for custom events, you must use the Grid Topology page in the Support menu.

Resetting a counter causes the alarm to be triggered by the next event. In contrast, when you acknowledge an alarm, that alarm is only re-triggered if the next threshold level is reached.

#### Steps

1. Select **SUPPORT** > **Tools** > **Grid topology**.
2. Select ***grid node*** > **SSM** > **Events** > **Configuration** > **Main**.
3. Select the **Reset** checkbox for Custom Events.




4. Select **Apply Changes**.

## Review audit messages

Audit messages can help you get a better understanding of the detailed operations of your StorageGRID system. You can use audit logs to troubleshoot issues and to evaluate performance.

During normal system operation, all StorageGRID services generate audit messages, as follows:

- System audit messages are related to the auditing system itself, grid node states, system-wide task activity, and service backup operations.
- Object storage audit messages are related to the storage and management of objects within StorageGRID, including object storage and retrievals, grid-node to grid-node transfers, and verifications.
- Client read and write audit messages are logged when an S3 client application makes a request to create, modify, or retrieve an object.
- Management audit messages log user requests to the Management API.

Each Admin Node stores audit messages in text files. The audit share contains the active file (audit.log) as well as compressed audit logs from previous days. Each node in the grid also stores a copy of the audit information generated on the node.

You can access audit log files directly from the command line of the Admin Node.

StorageGRID can send audit information by default, or you can change the destination:

- StorageGRID defaults to local node audit destinations.
- Grid Manager and Tenant Manager audit log entries might be sent to a Storage Node.
- Optionally, you can change the destination of audit logs and send audit information to an external syslog server. Local logs of audit records continue to be generated and stored when an external syslog server is

configured.

- Learn about configuring audit messages and log destinations.

For details on the audit log file, the format of audit messages, the types of audit messages, and the tools available to analyze audit messages, see Review audit logs.

## Collect log files and system data

You can use the Grid Manager to retrieve log files and system data (including configuration data) for your StorageGRID system.

**Before you begin**

- You must be signed in to the Grid Manager on the primary Admin Node using a supported web browser.
- You have specific access permissions.
- You must have the provisioning passphrase.

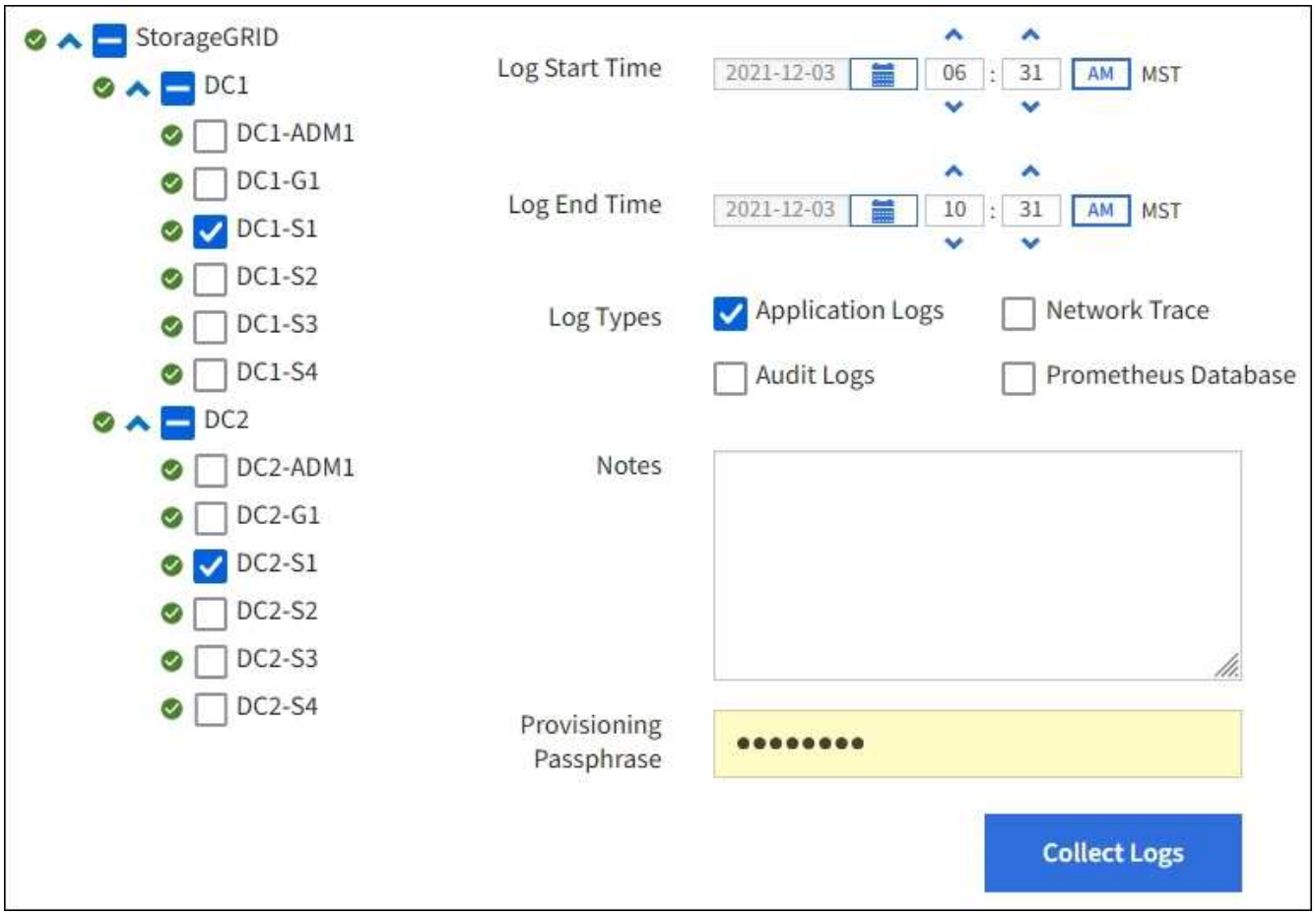
**About this task**

You can use the Grid Manager to gather log files, system data, and configuration data from any grid node for the time period that you select. Data is collected and archived in a .tar.gz file that you can then download to your local computer.

Optionally, you can change the destination of audit logs and send audit information to an external syslog server. Local logs of audit records continue to be generated and stored when an external syslog server is configured. See Configure audit messages and log destinations.

**Steps**

1. Select **SUPPORT** > **Tools** > **Logs**.




2. Select the grid nodes for which you want to collect log files.

   As required, you can collect log files for the entire grid or an entire data center site.

3. Select a **Start Time** and **End Time** to set the time range of the data to be included in the log files.

   If you select a very long time period or collect logs from all nodes in a large grid, the log archive could become too large to be stored on a node, or too large to be collected to the primary Admin Node for download. If this occurs, you must restart log collection with a smaller set of data.

4. Select the types of logs you want to collect.
   - **Application Logs**: Application-specific logs that technical support uses most frequently for troubleshooting. The logs collected are a subset of the available application logs.
   - **Audit Logs**: Logs containing the audit messages generated during normal system operation.
   - **Network Trace**: Logs used for network debugging.
   - **Prometheus Database**: Time series metrics from the services on all nodes.
5. Optionally, enter notes about the log files you are gathering in the **Notes** text box.

   You can use these notes to give technical support information about the problem that prompted you to collect the log files. Your notes are added to a file called `info.txt`, along with other information about the log file collection. The `info.txt` file is saved in the log file archive package.

6. Enter the provisioning passphrase for your StorageGRID system in the **Provisioning Passphrase** text box.

7. Select **Collect Logs**.

   When you submit a new request, the previous collection of log files is deleted.

   You can use the Logs page to monitor the progress of log file collection for each grid node.

   If you receive an error message about log size, try collecting logs for a shorter time period or for fewer nodes.

8. Select **Download** when log file collection is complete.

   The *.tar.gz* file contains all log files from all grid nodes where log collection was successful. Inside the combined *.tar.gz* file, there is one log file archive for each grid node.

**After you finish**

You can re-download the log file archive package later if you need to.

Optionally, you can select **Delete** to remove the log file archive package and free up disk space. The current log file archive package is automatically removed the next time you collect log files.

## Manually trigger an AutoSupport package

To assist technical support in troubleshooting issues with your StorageGRID system, you can manually trigger an AutoSupport package to be sent.

**Before you begin**

- You must be signed in to the Grid Manager using a supported web browser.
- You must have the Root access or Other grid configuration permission.

**Steps**

1. Select **SUPPORT** > **Tools** > **AutoSupport**.
2. On the **Actions** tab, select **Send User-Triggered AutoSupport**.

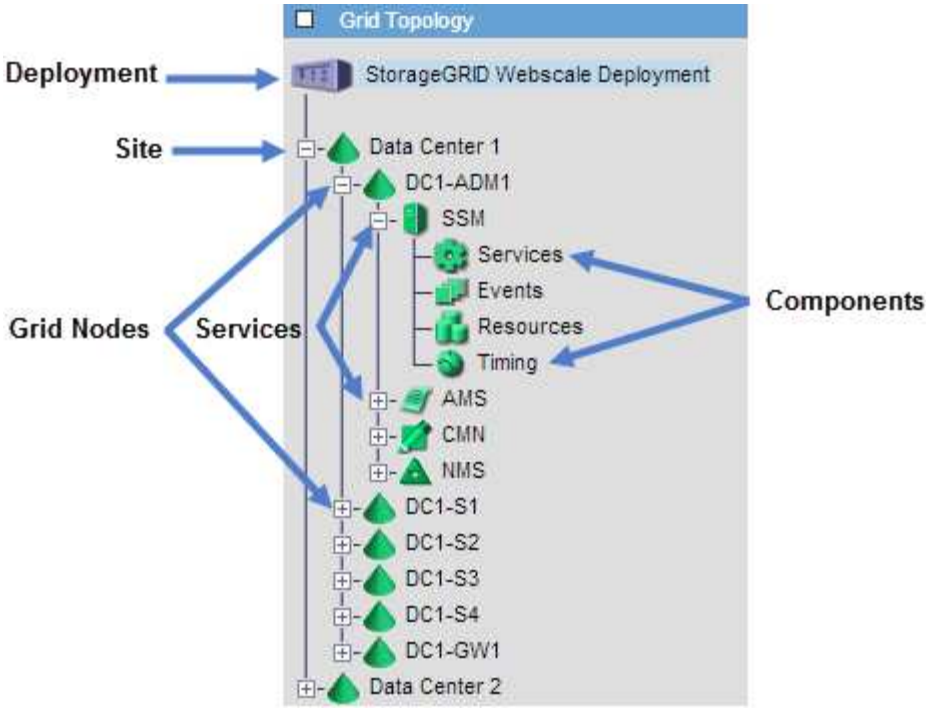
   StorageGRID attempts to send an AutoSupport package to the NetApp Support Site. If the attempt is successful, the **Most Recent Result** and **Last Successful Time** values on the **Results** tab are updated. If there is a problem, the **Most Recent Result** value updates to "Failed," and StorageGRID does not try to send the AutoSupport package again.

   > After sending a user-triggered AutoSupport package, refresh the AutoSupport page in your browser after 1 minute to access the most recent results.

## View the Grid Topology tree

The Grid Topology tree provides access to detailed information about StorageGRID system elements, including sites, grid nodes, services, and components. In most cases, you only need to access the Grid Topology tree when instructed in the documentation or when working with technical support.

To access the Grid Topology tree, select **SUPPORT** > **Tools** > **Grid topology**.




To expand or collapse the Grid Topology tree, click ⊞ or ⊟ at the site, node, or service level. To expand or collapse all items in the entire site or in each node, hold down the **<Ctrl>** key and click.

#### StorageGRID attributes

Attributes report values and statuses for many of the functions of the StorageGRID system. Attribute values are available for each grid node, each site, and the entire grid.

StorageGRID attributes are used in several places in the Grid Manager:

- **Nodes page**: Many of the values shown on the Nodes page are StorageGRID attributes. (Prometheus metrics are also shown on the Nodes pages.)
- **Grid Topology tree**: Attribute values are shown in the Grid Topology tree (**SUPPORT** > **Tools** > **Grid topology**).
- **Events**: System events occur when certain attributes record an error or fault condition for a node, including errors such as network errors.

##### Attribute values

Attributes are reported on a best-effort basis and are approximately correct. Attribute updates can be lost under some circumstances, such as the crash of a service or the failure and rebuild of a grid node.

In addition, propagation delays might slow the reporting of attributes. Updated values for most attributes are sent to the StorageGRID system at fixed intervals. It can take several minutes before an update is visible in the system, and two attributes that change more or less simultaneously can be reported at slightly different times.

## Review support metrics

When troubleshooting an issue, you can work with technical support to review detailed metrics and charts for your StorageGRID system.

#### Before you begin

- You must be signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.

**About this task**

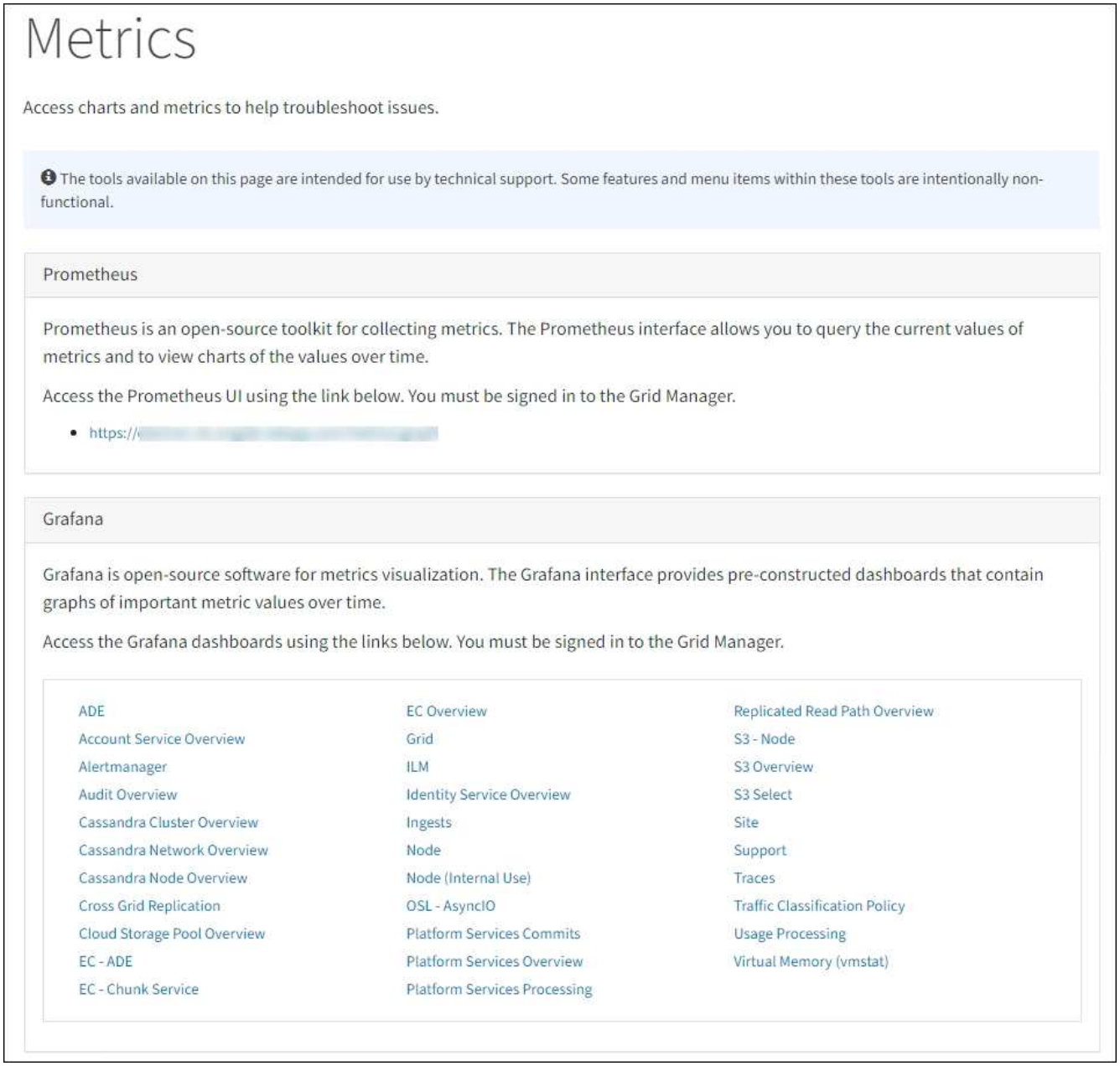
The Metrics page allows you to access the Prometheus and Grafana user interfaces. Prometheus is open-source software for collecting metrics. Grafana is open-source software for metrics visualization.

> The tools available on the Metrics page are intended for use by technical support. Some features and menu items within these tools are intentionally non-functional and are subject to change. See the list of commonly used Prometheus metrics.

**Steps**

1. As directed by technical support, select **SUPPORT** > **Tools** > **Metrics**.

   An example of the Metrics page is shown here:



2. To query the current values of StorageGRID metrics and to view graphs of the values over time, click the link in the Prometheus section.

   The Prometheus interface appears. You can use this interface to execute queries on the available StorageGRID metrics and to graph StorageGRID metrics over time.

   > Metrics that include *private* in their names are intended for internal use only and are subject to change between StorageGRID releases without notice.

3. To access pre-constructed dashboards containing graphs of StorageGRID metrics over time, click the links in the Grafana section.

   The Grafana interface for the link you selected appears.


## Run diagnostics

When troubleshooting an issue, you can work with technical support to run diagnostics on your StorageGRID system and review the results.

- Review support metrics
- Commonly used Prometheus metrics

**Before you begin**

- You are signed in to the Grid Manager using a supported web browser.
- You have specific access permissions.

**About this task**

The Diagnostics page performs a set of diagnostic checks on the current state of the grid. Each diagnostic check can have one of three statuses:

- **Normal**: All values are within the normal range.
- **Attention**: One or more of the values are outside of the normal range.
- **Caution**: One or more of the values are significantly outside of the normal range.

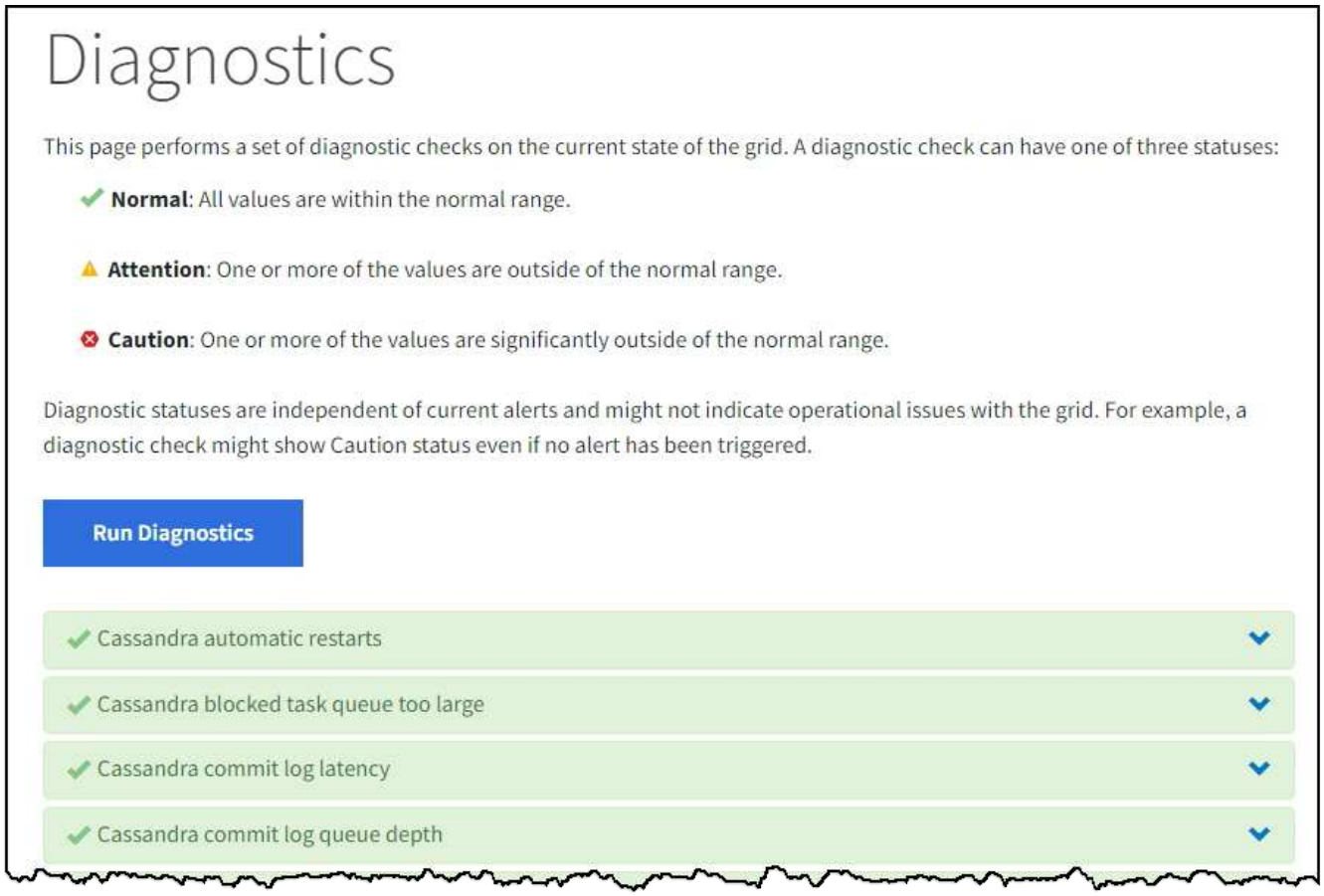
Diagnostic statuses are independent of current alerts and might not indicate operational issues with the grid. For example, a diagnostic check might show Caution status even if no alert has been triggered.

**Steps**

1. Select **SUPPORT** > **Tools** > **Diagnostics**.

   The Diagnostics page appears and lists the results for each diagnostic check. The results are sorted by severity (Caution, Attention, and then Normal). Within each severity, the results are sorted alphabetically.

   In this example, all diagnostics have a Normal status.



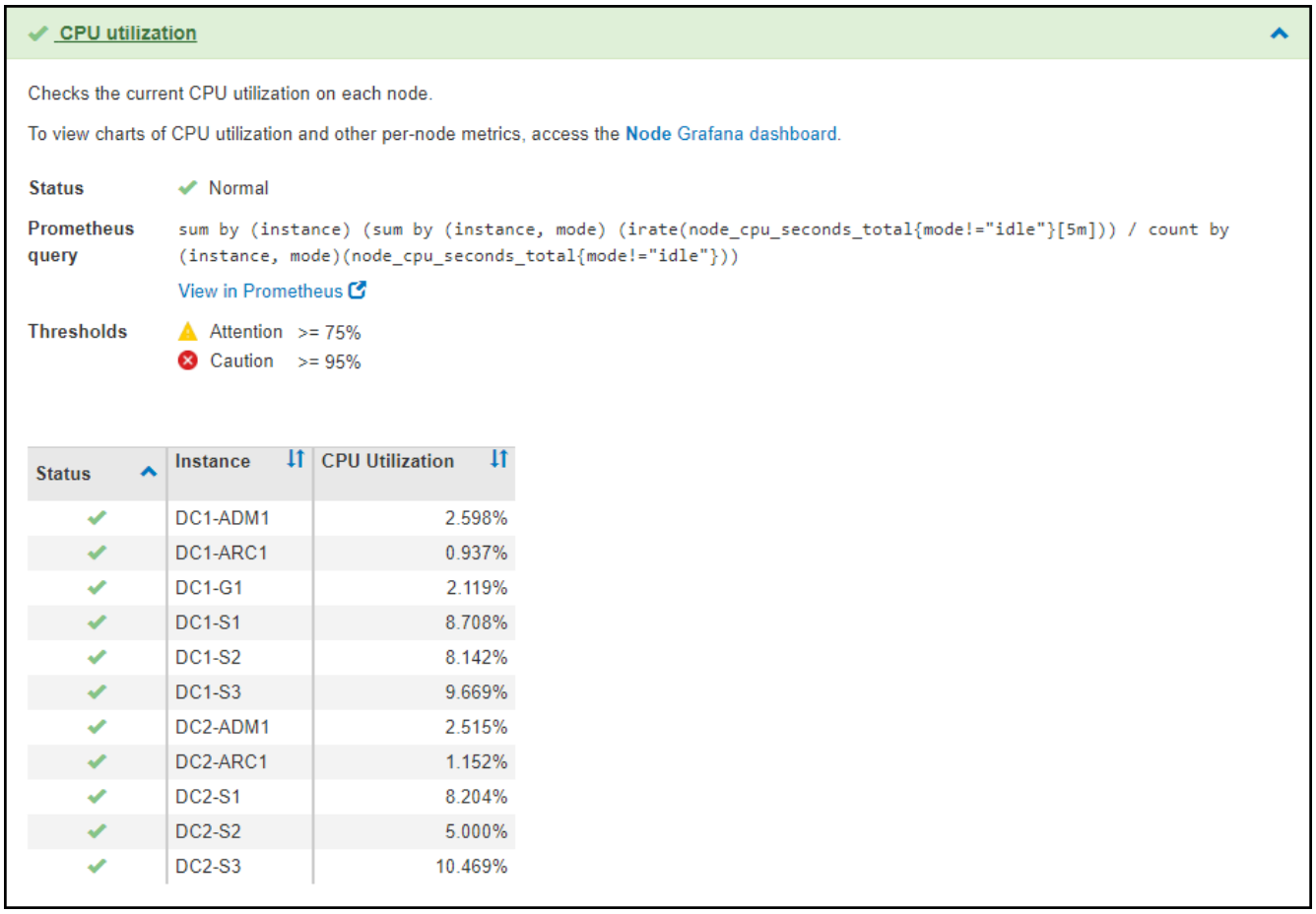

2. To learn more about a specific diagnostic, click anywhere in the row.

   Details about the diagnostic and its current results appear. The following details are listed:

   - **Status**: The current status of this diagnostic: Normal, Attention, or Caution.
   - **Prometheus query**: If used for the diagnostic, the Prometheus expression that was used to generate the status values. (A Prometheus expression is not used for all diagnostics.)
   - **Thresholds**: If available for the diagnostic, the system-defined thresholds for each abnormal diagnostic status. (Threshold values aren't used for all diagnostics.)

     You can't change these thresholds.

   - **Status values**: A table showing the status and the value of the diagnostic throughout the StorageGRID system. In this example, the current CPU utilization for every node in a StorageGRID system is shown. All node values are below the Attention and Caution thresholds, so the overall status of the diagnostic is Normal.




3. **Optional**: To see Grafana charts related to this diagnostic, click the **Grafana dashboard** link.

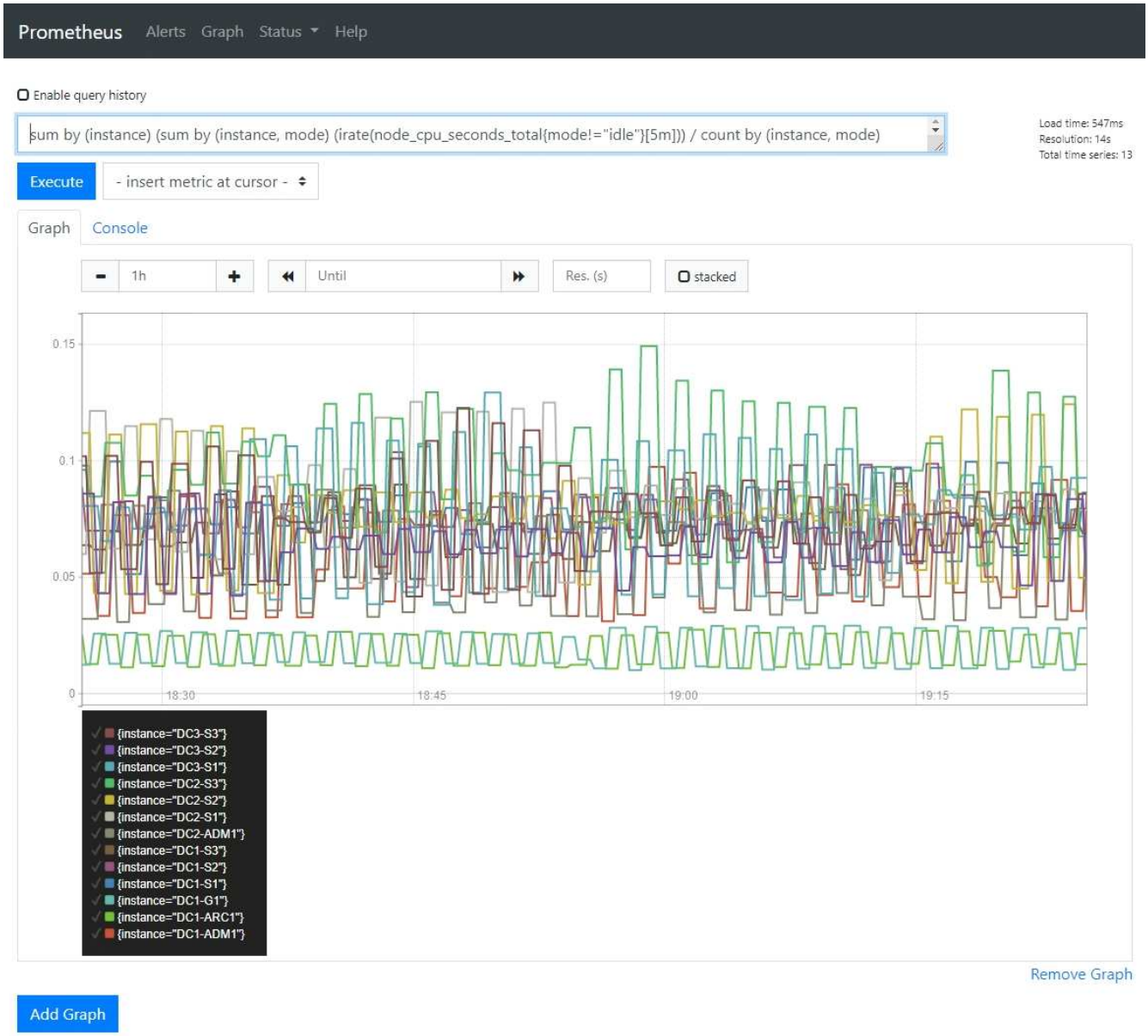
   This link is not displayed for all diagnostics.

   The related Grafana dashboard appears. In this example, the Node dashboard appears showing CPU Utilization over time for this node as well as other Grafana charts for the node.

   > You can also access the pre-constructed Grafana dashboards from the Grafana section of the **SUPPORT** > **Tools** > **Metrics** page.


4. **Optional**: To see a chart of the Prometheus expression over time, click **View in Prometheus**.

   A Prometheus graph of the expression used in the diagnostic appears.



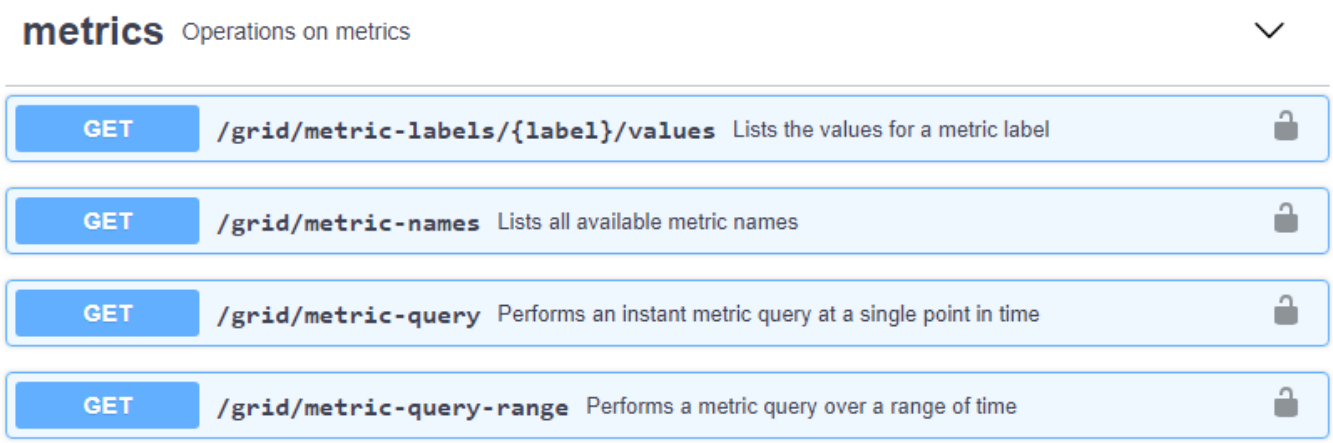

## Create custom monitoring applications

You can build custom monitoring applications and dashboards using the StorageGRID metrics available from the Grid Management API.

If you want to monitor metrics that aren't displayed on an existing page of the Grid Manager, or if you want to create custom dashboards for StorageGRID, you can use the Grid Management API to query StorageGRID metrics.

You can also access Prometheus metrics directly with an external monitoring tool, such as Grafana. Using an external tool requires that you upload or generate an administrative client certificate to allow StorageGRID to authenticate the tool for security. See the instructions for administering StorageGRID.

To view the metrics API operations, including the complete list of the metrics that are available, go to the Grid Manager. From the top of the page, select the help icon and select **API documentation** > **metrics**.




The details of how to implement a custom monitoring application are beyond the scope of this documentation.

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