



Monitoring performance using the Performance Inventory pages

Active IQ Unified Manager 9.12

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Table of Contents

Monitoring performance using the Performance Inventory pages	1
Viewing Performance inventory pages for all storage objects	1
Performance: All Clusters view	2
Performance: All Volumes view	2
Performance: All Aggregates view	3
Performance: All Nodes view	4
Performance: All Storage VMs view	4
Performance: All LUNs view	5
Performance: All NVMe Namespaces view	5
Performance: All Network Interfaces view	5
Performance: All Ports view	6
Performance: QoS Policy Groups view	6
Refining Performance inventory page contents	7
Searching on Object Inventory Performance pages	7
Sorting on the Object Inventory Performance pages	8
Filtering data in the Object Inventory Performance pages	8
Understanding the Unified Manager recommendations to tier data to the cloud	9

Monitoring performance using the Performance Inventory pages

The object inventory performance pages display performance information, performance events, and object health for all objects within an object type category. This provides you with an at-a-glance overview of the performance status of each object within a cluster, for example, for all nodes or all volumes.

Object inventory performance pages provide a high-level overview of object status, enabling you to assess the overall performance of all objects and compare object performance data. You can refine the content of object inventory pages by searching, sorting, and filtering. This is beneficial when monitoring and managing object performance, because it enables you to quickly locate objects with performance issues and to begin the troubleshooting process.

Nodes - Performance / All Nodes 

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Latency, IOPS, MBps, Utilization are based on hourly samples averaged over the previous 72 hours

View **All Nodes**   Search Nodes 

Assign Performance Threshold Policy		Clear Performance Threshold Policy								 Schedule Report	 	
	Status 	Node	Latency	IOPS	MBps	Flash Cache Reads	Perf. Capacity Used	Utilization	Free Capacity	Total Capacity	Cluster	
<input type="checkbox"/>		ocum-mobility-02	10.2 ms/op	18,884 IOPS	156 MBps	N/A	81%	35%	16.6 TB	23.2 TB	ocum-mobility-01-02	
<input checked="" type="checkbox"/>		opm-simplicity-01	2.01 ms/op	39,358 IOPS	153 MBps	< 1%	119%	88%	4.88 TB	18.3 TB	opm-simplicity	
<input type="checkbox"/>		ocum-mobility-01	0.018 ms/op	< 1 IOPS	18.2 MBps	N/A	23%	18%	8.69 TB	15.7 TB	ocum-mobility-01-02	
<input type="checkbox"/>		opm-simplicity-02	17 ms/op	14,627 IOPS	124 MBps	< 1%	29%	20%	212 GB	5.88 TB	opm-simplicity	

By default, objects on the performance inventory pages are sorted based on object performance criticality. Objects with new critical performance events are listed first, and objects with warning events are listed second. This provides an immediate visual indication of issues that must be addressed. All performance data is based on a 72-hour average.

You can easily navigate from the object inventory performance page to an object details page by clicking the object name in the object name column. For example, on the Performance/All Nodes inventory page, you would click a node object in the **Nodes** column. The object details page provides in-depth information and detail about the selected object, including side-by-side comparison of active events.

Viewing Performance inventory pages for all storage objects

You use the Performance inventory pages to see a summary of performance information about each of the available storage objects, such as clusters, aggregates, volumes, and so on. You can link to the Performance object detail pages to view detailed information for a particular object.

By default, objects in the view pages are sorted based on event criticality. Objects with critical events are listed first, and objects with warning events are listed second. This provides an immediate visual indication of issues that must be addressed.

You can export data from these pages to a comma-separated values (.csv) file, Microsoft Excel file (.xlsx),

or (.pdf) document by using the **Reports** button, and then use the exported data to build reports. Additionally, you can customize the page and then schedule a report to be created and emailed on a regular basis by using the **Scheduled Reports** button.

All the fields on these pages can be used in custom views and in reports. Some of the fields are linked to related pages enabling a more detailed view.

Performance: All Clusters view

The Performance: All Clusters view displays an overview of the performance events, data, and configuration information for each cluster that is monitored by an instance of Unified Manager. This page enables you to monitor the performance of your clusters, and to troubleshoot performance issues and threshold events.

You can assign performance threshold policies to, or clear threshold policies from, any object on the object inventory pages using the **Assign Performance Threshold Policy** and **Clear Performance Threshold Policy** buttons.

The following are some important fields in the Performance: All Clusters view.

- Cluster FQDN: The fully qualified domain name (FQDN) of the cluster.
- IOPS: The input/output operations per second on the cluster.
- MB/s: The throughput on the cluster, measured in MiB per second.
- Capacity fields: Free and total capacity in GiB.
- Host Name or IP Address: The host name or IP address (IPv4 or IPv6) of the cluster management LIF.
- OS Version: The version of ONTAP software that is installed on the cluster.



If different versions of ONTAP software are installed on the nodes in the cluster, the lowest version number is listed. You can view the ONTAP version that is installed on each node from the Performance: All Nodes view.

- Threshold Policy: The user-defined performance threshold policy, or policies, that are active on this storage object. You can position your cursor over policy names containing an ellipsis (...) to view the full policy name or the list of assigned policy names. The Assign Performance Threshold Policy and Clear Performance Threshold Policy buttons remain disabled until you select one or more objects by clicking the check boxes located at the far left.

Performance: All Volumes view

The Performance: All Volumes view displays an overview of the performance events, counter data, and configuration information for each FlexVol volume and FlexGroup volume that is being monitored by an instance of Unified Manager. This enables you to quickly monitor the performance of your volumes, and to troubleshoot performance issues and threshold events.

If you want to analyze the latency and throughput of a specific object, click the more options button then **Analyze Workload** and you can view performance and capacity charts on the Workload Analysis page. You can view the details on System Manager, given you have valid credentials for System Manager.



For data protection (DP) volumes, only counter values for user-generated traffic are displayed. Root volumes are not displayed on this page.

The following are some important fields in the Performance: All Volumes view.

- Style: Either FlexVol or FlexGroup.
- Latency: For FlexVol volumes, this is the average response time of the volume for all I/O requests, expressed in milliseconds per operation. For FlexGroup volumes, this is the average latency of all constituent volumes.
- IOPS/TB: The number of input/output operations processed per second based on the total space that is being consumed by the workload, in terabytes. This counter measures how much performance can be delivered by a given amount of storage capacity.
- IOPS: For FlexVol volumes, this is the number of input/output operations per second for the volume. For FlexGroup volumes, this is the sum of IOPS for all constituent volumes.
- MB/s: For FlexVol volumes, this is the throughput on the volume, measured in megabytes per second. For FlexGroup volumes, this is the sum of MB/s for all constituent volumes.
- Capacity fields: Free and total capacity in GiB.

See the following links for more information:

- [Assigning performance threshold policies to storage objects](#)
- [Removing performance threshold policies from storage objects](#)
- [Types of workloads monitored by Unified Manager](#)
- [Viewing the QoS policy group settings applied to specific volumes or LUNs](#)
- [Understanding the Unified Manager recommendations to tier data to the cloud](#)
- [Viewing performance charts to compare volumes or LUNs that are in the same QoS policy group](#)

Performance: All Aggregates view

The Performance: All Aggregates view displays an overview of the performance events, data, and configuration information for each aggregate that is monitored by an instance of Unified Manager. This page enables you to monitor the performance of your aggregates, and to troubleshoot performance issues and threshold events.

The following are some important fields in the Performance: All Aggregates view.

- Type: The type of aggregate:
 - HDD
 - Hybrid. Combines HDDs and SSDs, but Flash Pool has not been enabled.
 - Hybrid (Flash Pool). Combines HDDs and SSDs, and Flash Pool has been enabled.
 - SSD
 - SSD (FabricPool). Combines SSDs and a cloud tier
 - HDD (FabricPool). Combines HDDs and a cloud tier
 - VMDisk (SDS). Virtual disks within a virtual machine
 - VMDisk (FabricPool). Combines virtual disks and a cloud tier
 - LUN (FlexArray)
- Inactive Data Reporting: Whether the inactive data reporting capability is enabled or disabled on this aggregate. When enabled, volumes on this aggregate display the amount of cold data in the Performance: All Volumes view. The value in this field is "N/A" when the version of ONTAP does not support inactive data reporting.

- Threshold Policy: The user-defined performance threshold policy, or policies, that are active on this storage object. You can position your cursor over policy names containing an ellipsis (...) to view the full policy name or the list of assigned policy names. The Assign Performance Threshold Policy and Clear Performance Threshold Policy buttons remain disabled until you select one or more objects by clicking the check boxes located at the far left. See the following links for more information:

- [Assigning performance threshold policies to storage objects](#)
- [Removing performance threshold policies from storage objects](#)

Performance: All Nodes view

The Performance: All Nodes view displays an overview of the performance events, data, and configuration information for each node that is being monitored by an instance of Unified Manager. This enables you to quickly monitor the performance of your nodes, and to troubleshoot performance issues and threshold events.



Flash Cache Reads returns the percentage of read operations on the node that are satisfied by cache, instead of being returned from the disk. Flash Cache data is displayed only for nodes, and only when a Flash Cache module is installed in the node.

In the **Reports** menu, the **Hardware Inventory Report** option is provided when Unified Manager, and the clusters it is managing, are installed in a site with no external network connectivity. This button generates a .csv file that contains a complete list of cluster and node information; such as hardware model numbers and serial numbers, disk types and counts, installed licenses, and more. This reporting functionality is helpful for contract renewal within secure sites that are not connected to the NetApp Active IQ platform. You can assign performance threshold policies to, or clear threshold policies from, any object on the object inventory pages using the **Assign Performance Threshold Policy** and **Clear Performance Threshold Policy** buttons.

See the following links for more information:

- [Assigning performance threshold policies to storage objects](#)
- [Removing performance threshold policies from storage objects](#)
- [Generating a hardware inventory report for contract renewal](#)

Performance: All Storage VMs view

The Performance: All Storage VMs view displays an overview of the performance events, data, and configuration information for each storage virtual machine (SVM) that is being monitored by an instance of Unified Manager. This enables you to quickly monitor the performance of your SVMs, and to troubleshoot performance issues and threshold events. The Latency field on this page reports the average response time for all I/O requests, expressed in milliseconds per operation.



The SVMs that are listed on this page include only Data and Cluster SVMs. Unified Manager does not use or display Admin or Node SVMs.

See the following links for more information:

- [Assigning performance threshold policies to storage objects](#)
- [Removing performance threshold policies from storage objects](#)

Performance: All LUNs view

The Performance: All LUNs view displays an overview of the performance events, data, and configuration information for each LUN that is being monitored by an instance of Unified Manager. This enables you to quickly monitor the performance of your LUNs, and to troubleshoot performance issues and threshold events.

If you want to analyze the latency and throughput of a specific object, click the more icon  , then **Analyze Workload** and you can view performance and capacity charts on the **Workload Analysis** page.

See the following links for more information:

- [Monitoring LUNs in a Consistency Group relationship](#)
- [Provisioning LUNs](#)
- [Assigning performance threshold policies to storage objects](#)
- [Removing performance threshold policies from storage objects](#)
- [Viewing volumes or LUNs that are in the same QoS policy group.](#)
- [Viewing the QoS policy group settings applied to specific volumes or LUNs](#)
- [Provisioning LUNs by using APIs](#)

Performance: All NVMe Namespaces view

The Performance: All NVMe Namespaces view displays an overview of the performance events, data, and configuration information for each NVMe Namespace that is being monitored by an instance of Unified Manager. This enables you to quickly monitor the performance and health of your Namespaces, and to troubleshoot issues and threshold events.

The following information, among others is reported: The current state of the Namespace. * Offline - Read or write access to the Namespace is not allowed. * Online - Read and write access to the Namespace is allowed. * NVFail - The Namespace was automatically taken offline due to an NVRAM failure. * Space Error - The Namespace has run out of space.

See the following links for more information:

- [Assigning performance threshold policies to storage objects](#)
- [Removing performance threshold policies from storage objects](#)

Performance: All Network Interfaces view

The Performance: All Network Interfaces view displays an overview of the performance events, data, and configuration information for each network interface (LIF) that is being monitored by this instance of Unified Manager. This page enables you to quickly monitor the performance of your interfaces, and to troubleshoot performance issues and threshold events. The following are some important fields in the Performance: All Network Interfaces view.

- IOPS: The input/output operations per second. IOPS is not applicable to NFS LIFs and CIFS LIFs, and is displayed as N/A for these types.
- Latency: The average response time for all I/O requests, expressed in milliseconds per operation. Latency is not applicable to NFS LIFs and CIFS LIFs, and is displayed as N/A for these types.
- Home Location: The home location for the interface, displayed as node name and port name, separated by a colon (:). If the location is displayed with an ellipsis (...), you can position your cursor over the location

name to view the full location.

- Current Location: The current location for the interface, displayed as node name and port name, separated by a colon (:). If the location is displayed with an ellipsis (...), you can position your cursor over the location name to view the full location.
- Role: The interface role: Data, Cluster, Node Management, or Intercluster.



The interfaces that are listed on this page include Data LIFs, Cluster LIFs, Node Management LIFs, and intercluster LIFs. Unified Manager does not use or display System LIFs.

Performance: All Ports view

The Performance: All Ports view displays an overview of the performance events, data, and configuration information for each port that is being monitored by an instance of Unified Manager. This enables you to quickly monitor the performance of your ports, and to troubleshoot performance issues and threshold events. For a port role, the network port function is displayed, either Data or Cluster. FCP ports cannot have a role, and the role is displayed as N/A.



Performance counter values are displayed for physical ports only. Counter values are not displayed for VLANs or interface groups.

See the following links for more information:

- [Assigning performance threshold policies to storage objects](#)
- [Removing performance threshold policies from storage objects](#)

Performance: QoS Policy Groups view

The QoS Policy Groups view displays the QoS policy groups available on the clusters that Unified Manager is monitoring. This includes traditional QoS policies, adaptive QoS policies, and QoS policies assigned by using Performance Service Levels.

The following are some important fields in the Performance: QoS Policy Groups view.

- QoS Policy Group: The name of the QoS policy group. For NetApp Service Level Manager (NSLM) 1.3 policies that have been imported into Unified Manager 9.7 or greater, the name displayed here includes the SVM name and other information that is not in the name when the Performance Service Level was defined in NSLM. For example, the name "NSLM_vs6_Performance_2_0" means this is the NSLM system-defined "Performance" PSL policy created on SVM "vs6" with an expected latency of "2 ms/op".
- SVM: The storage VM (SVM) to which the QoS policy group belongs. You can click the storage VM name to navigate to that storage VM's details page. Note that this field is blank if the QoS policy has been created on the Admin storage VM as this storage VM type represents the cluster.
- Min Throughput: The minimum throughput, in IOPS, that the policy group will be guaranteed to provide. For adaptive policies this is the minimum expected IOPS per TB allocated to the volume or LUN, based on the storage object allocated size.
- Max Throughput: The throughput, in IOPS and/or MB/s, that the policy group must not exceed. When this field is blank it means the max throughput defined in ONTAP is infinite. For adaptive policies this is the maximum (peak) possible IOPS per TB allocated to the volume or LUN, based on either the storage object allocated size or the storage object used size.
- Absolute Minimum IOPS: For adaptive policies this is the absolute minimum IOPS value that is used as an override when the expected IOPS is less than this value.

- Block Size: The block size specified for the QoS adaptive policy.
- Min Allocation: Whether "allocated space" or "used space" is used to determine the maximum throughput (peak) IOPS.
- Expected Latency: The expected average latency for storage input/output operations.
- Shared: For traditional QoS policies, whether the throughput values defined in the policy group are shared among multiple objects.
- Associated Objects: The number of workloads that are assigned to the QoS policy group. You can click the expand button (▼) next to the QoS Policy Group Name to view more details about the policy group.
- Allocated Capacity: The amount of space that the objects that are in the QoS policy group are currently using.
- Associated Objects: The number of workloads that are assigned to the QoS policy group, separated into volumes and LUNs. You can click the number to navigate to a page that provides more details about the selected volumes or LUNs.

For more information see the topics under [Managing performance using QoS policy group information](#).

Refining Performance inventory page contents

The inventory pages for performance objects contain tools to help you refine object inventory data content, enabling you to locate specific data quickly and easily.

Information contained within the Performance object inventory pages can be extensive, often spanning multiple pages. This kind of comprehensive data is excellent for monitoring, tracking, and improving performance; however, locating specific data requires tools to enable you to quickly locate the data for which you are looking. Therefore, the Performance object inventory pages contain functionality for searching, sorting, and filtering. Additionally, searching and filtering can work together to further narrow your results.

Searching on Object Inventory Performance pages

You can search strings on Object Inventory Performance pages. Use the **Search** field located at the top right of the page to quickly locate data based on either object name or policy name. This enables you to quickly locate specific objects and their associated data, or to quickly locate policies and view associated policy object data.

Step

1. Perform one of the following options, based on your search requirements:

To locate this...	Type this...
A specific object	The object name into the Search field, and click Search . The object for which you searched and its related data is displayed.
A user-defined performance threshold policy	All or part of the policy name into the Search field, and click Search . The objects assigned to the policy for which you searched are displayed.

Sorting on the Object Inventory Performance pages

You can sort all data on Object Inventory Performance pages by any column in ascending or descending order. This enables you to quickly locate object inventory data, which is helpful when examining performance or beginning a troubleshooting process.

The selected column for sorting is indicated by a highlighted column heading name and an arrow icon indicating the sorting direction at the right of the name. An up arrow indicates ascending order; a down arrow indicates descending order. The default sort order is by **Status** (event criticality) in descending order, with the most critical performance events listed first.

Step

1. You can click a column name to toggle the sort order of the column in ascending or descending order.

The Object Inventory Performance page contents are sorted in ascending or descending order, based on the selected column.

Filtering data in the Object Inventory Performance pages

You can filter data in the Object Inventory Performance pages to quickly locate data based on specific criteria. You can use filtering to narrow the contents of the Object Inventory Performance pages to show only the results you have specified. This provides a very efficient method of displaying only the performance data in which you are interested.

You can use the Filtering panel to customize the grid view based on your preferences. Available filter options are based on the object type being viewed in the grid. If filters are currently applied, the number of applied filters displays at the right of the Filter button.

Three types of filter parameters are supported.

Parameter	Validation
String (text)	The operators are contains , starts with , ends with , and does not contain .
Number	The operators are greater than , less than , in the last , and between .
Enum (text)	The operators are is and is not .

The Column, Operator, and Value fields are required for each filter; the available filters reflect the filterable columns on the current page. The maximum number of filters you can apply is four. Filtered results are based on combined filter parameters. Filtered results apply to all pages in your filtered search, not just the page currently displayed.

You can add filters using the Filtering panel.

1. At the top of the page, click the **Filter** button. The Filtering panel displays.
2. Click the left drop-down list and select an object; for example, *Cluster*, or a performance counter.

3. Click the center drop-down list, and select the operator you want to use.
4. In the last list, select or enter a value to complete the filter for that object.
5. To add another filter, click **+Add Filter**. An additional filter field displays. Complete this filter using the process described in the preceding steps. Note that upon adding your fourth filter, the **+Add Filter** button no longer displays.
6. Click **Apply Filter**. The filter options are applied to the grid and the number of filters is displayed to the right of the Filter button.
7. Use the Filtering panel to remove individual filters by clicking the trash icon at the right of the filter to be removed.
8. To remove all filters, click **Reset** at the bottom of the filtering panel.

Filtering example

The illustration shows the Filtering panel with three filters. The **+Add Filter** button displays when you have fewer than the maximum of four filters.

The screenshot shows the Filtering panel with the following configuration:

- Filter 1: MBps (operator: greater than, value: 5)
- Filter 2: Node (operator: name starts with, value: test)
- Filter 3: Type (operator: is, value: FCP Port)

At the bottom of the panel are 'Cancel' and 'Apply Filter' buttons. The 'Apply Filter' button is highlighted in blue.

After clicking **Apply Filter**, the Filtering panel closes, applies your filters, and shows the number of filters applied ().

Understanding the Unified Manager recommendations to tier data to the cloud

The Performance: All Volumes view displays information related to the size of the user data stored on the volume that is inactive (cold). In some cases, Unified Manager identifies certain volumes that would benefit by tiering the inactive data to the cloud tier (cloud provider or StorageGRID) of a FabricPool-enabled aggregate.

 FabricPool was introduced in ONTAP 9.2, so if you are using a version of ONTAP software prior to 9.2, the Unified Manager recommendation to tier data requires upgrading your ONTAP software. Additionally, the **auto** tiering policy was introduced in ONTAP 9.4, and the **all** tiering policy was introduced in ONTAP 9.6, so if the recommendation is to use the auto tiering policy, you must upgrade to ONTAP 9.4 or greater.

The following three fields on Performance: All Volumes view provide information about whether you can improve your storage system's disk utilization and save space on the performance tier by moving inactive data to the cloud tier.

- **Tiering Policy**

The tiering policy determines whether the data on the volume remains on the performance tier or whether some of the data is moved from the performance tier to the cloud tier.

The value in this field indicates the tiering policy set on the volume, even if the volume does not currently reside on a FabricPool aggregate. The tiering policy takes effect only when the volume is on a FabricPool aggregate.

- **Cold Data**

The cold data displays the size of the user data stored on the volume that is inactive (cold).

A value is displayed here only when using ONTAP 9.4 or greater software because it requires that the aggregate on which the volume is deployed has the **inactive data reporting parameter** set to **enabled**, and that the minimum number of cooling days threshold has been met (for volumes that use the **snapshot-only** or **auto** tiering policy). Otherwise the value is listed as “N/A”.

- **Cloud Recommendation**

After enough information has been captured about the data activity on the volume, Unified Manager may determine there is no action required, or that you could save space on the performance tier by tiering inactive data to the cloud tier.

 The Cold Data field is updated every 15 minutes, but the Cloud Recommendation field is updated every 7 days when the cold data analysis is performed on the volume. Therefore, the exact amount of cold data may differ between the fields. The Cloud Recommendation field displays the date when the analysis was run.

When Inactive Data Reporting is enabled, the Cold Data field displays the exact amount of inactive data. Without the inactive data reporting capability Unified Manager uses performance statistics to determine if data is inactive on a volume. The amount of inactive data is not displayed in the Cold Data field in this case, but it is displayed when you hover your cursor over the word **Tier** to view the cloud recommendation.

The cloud recommendations you will see are:

- **Learning.** Not enough data has been collected to make a recommendation.
- **Tier.** Analysis has determined that the volume contains inactive (cold) data and that you should configure the volume to move that data to the cloud tier. In some cases this may require that you move the volume to a FabricPool-enabled aggregate first. In other cases where the volume is already on a FabricPool aggregate, you just have to change the tiering policy.
- **No Action.** Either the volume has very little inactive data, the volume is already set to the “auto” tiering policy on a FabricPool aggregate, or the volume is a data protection volume. This value is also displayed when the volume is offline or when it is being used in a MetroCluster configuration.

To move a volume, or to change the volume tiering policy or the aggregate inactive data reporting settings, use ONTAP System Manager, the ONTAP CLI commands, or a combination of these tools.

If you are logged in to Unified Manager with the Application Administrator or Storage Administrator role, the **Configure Volume** link is available in the cloud recommendation when you hover your cursor over the word **Tier**. Click this button to open the Volumes page in System Manager to make the recommended change.

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