



## **qos commands**

### **ONTAP 9.7 commands**

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# Table of Contents

- qos commands ..... 1
  - qos adaptive-policy-group commands ..... 1
  - qos policy-group commands ..... 7
  - qos settings commands ..... 13
  - qos statistics commands ..... 16
  - qos workload commands ..... 55

# qos commands

## qos adaptive-policy-group commands

### qos adaptive-policy-group create

Create an adaptive policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

#### Description

The `qos adaptive-policy-group create` command creates a new adaptive policy group. After the adaptive policy group is created, you can assign one or more storage objects to the policy. When a storage object is assigned to an adaptive policy group, the maximum throughput QoS setting automatically adjusts based on the storage object used space or the storage object allocated space. QoS minimum throughput setting is calculated from the expected-iops parameter and the storage object allocated size. It is set only for the storage objects that reside on AFF platforms.

After you create an adaptive policy group, use the storage object create command or storage object modify command to apply the adaptive policy group to a storage object.

#### Parameters

##### **-policy-group <text> - Name**

Specifies the name of the adaptive policy group. Adaptive policy group names must be unique and are restricted to 127 alphanumeric characters including underscores "\_" and hyphens "-". Adaptive policy group names must start with an alphanumeric character. Use the [qos adaptive-policy-group rename](#) command to change the adaptive policy group name.

##### **-vserver <vserver name> - Vserver**

Specifies the data Vserver to which this adaptive policy group belongs to. You can apply this adaptive policy group to only the storage objects contained in the specified Vserver. If the system has only one Vserver, then the command uses that Vserver by default.

##### **-expected-iops {<integer>[IOPS[/{GB|TB}]] (default: TB)} - Expected IOPS**

Specifies the minimum expected IOPS per TB or GB allocated based on the storage object allocated size.

##### **-peak-iops {<integer>[IOPS[/{GB|TB}]] (default: TB)} - Peak IOPS**

Specifies the maximum possible IOPS per TB or GB allocated based on the storage object allocated size or the storage object used size.

##### **[-absolute-min-iops <qos\_tput>] - Absolute Minimum IOPS**

Specifies the absolute minimum IOPS which is used as an override when the expected IOPS is less than this value. The default value is computed as follows:

if expected-iops  $\geq$  6144/TB, then absolute-min-iops = 1000IOPS; if expected-iops  $\geq$  2048/TB and expected-iops  $<$  6144/TB, then absolute-min-iops = 500IOPS; if expected-iops  $\geq$  1/MB and expected-iops  $<$  2048/TB, then absolute-min-iops = 75IOPS.

### **[`-expected-iops-allocation {used-space|allocated-space}`] - Expected IOPS Allocation**

Specifies the expected IOPS allocation policy. The allocation policy is either *allocated-space* or *used-space*. When the expected-iops-allocation policy is set to *allocated-space*, the expected IOPS is calculated based on the size of the storage object. When the expected-iops-allocation policy is set to *used-space*, the expected IOPS is calculated based on the amount of data stored in the storage object taking into account storage efficiencies. The default value is *allocated-space*.

### **[`-peak-iops-allocation {used-space|allocated-space}`] - Peak IOPS Allocation**

Specifies the peak IOPS allocation policy. The allocation policy is either *allocated-space* or *used-space*. When the peak-iops-allocation policy is set to *allocated-space*, the peak IOPS is calculated based on the size of the storage object. When the peak-iops-allocation policy is set to *used-space*, the peak IOPS is calculated based on the amount of data stored in the storage object taking into account storage efficiencies. The default value is *used-space*.

### **[`-block-size {ANY|4K|8K|16K|32K|64K|128K}`] - Block Size**

Specifies the I/O block size for the QoS adaptive policy group. The default value is "ANY". When block-size of "ANY" is specified, then control is by IOPS. When block-size other than "ANY" is specified, then control is by IOPS and bytes per second(bps). bps is the product of IOPS and block-size.

## **Examples**

```
cluster1::> qos adaptive-policy-group create p1 -vserver vs1
               -expected-iops 100IOPS/TB -peak-iops 1000/TB
```

Creates the "p1" adaptive policy group which belongs to Vserver "vs1" with expected-iops of 100IOPS/TB and peak-iops of 1000IOPS/TB with default value for absolute-min-iops

```
cluster1::> qos adaptive-policy-group create p2 -vserver vs1
               -expected-iops 100IOPS/GB -peak-iops 1000IOPS/GB
               -absolute-min-iops 200IOPS
```

Creates the "p1" adaptive policy group which belongs to Vserver "vs1" with expected-iops of 100IOPS/TB and peak-iops of 1000IOPS/TB with the absolute-min-iops set to 200IOPS.

## **Related Links**

- [qos adaptive-policy-group rename](#)

## **qos adaptive-policy-group delete**

Delete an adaptive policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

## **Description**

The `qos adaptive-policy-group delete` command deletes an adaptive policy group from a cluster. You cannot delete a policy group if a QoS workload associated with a storage object is assigned to it unless you

use the `-force` parameter. Using the `-force` parameter will delete all the QoS workloads for storage objects associated with the specified adaptive policy groups .

Only user created adaptive policy groups can be deleted. Default adaptive policy groups are read only and cannot be deleted.

## Parameters

### **-policy-group <text> - Name**

Specifies the name of the adaptive policy group that you want to delete.

### **[-force <true>] - Force Delete Workloads for the QoS adaptive policy group (privilege: advanced)**

Specifies whether to delete an adaptive policy group along with any underlying workloads.

## Examples

The following example deletes "p1" adaptive policy group:

```
cluster1::> qos adaptive-policy-group delete p1
```

Deletes the "p1" adaptive policy group along with any underlying QoS workloads.

```
cluster1::> qos adaptive-policy-group delete p1 -force
```

## qos adaptive-policy-group modify

### Modify an adaptive policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

## Description

The `qos adaptive-policy-group modify` command modifies an adaptive policy group.

Only user-created adaptive policy groups can be modified. Default adaptive policy groups are read-only and cannot be modified.

## Parameters

### **-policy-group <text> - Name**

Specifies the name of the adaptive policy group. Adaptive policy group names must be unique and are restricted to 127 alphanumeric characters including underscores "\_" and hyphens "-". Adaptive policy group names must start with an alphanumeric character. Use the [qos adaptive-policy-group rename](#) command to change the adaptive policy group name.

### **[-expected-iops {<integer>[IOPS[/{GB|TB}]] (default: TB)}] - Expected IOPS**

Specifies the minimum expected IOPS per TB or GB allocated based on the storage object allocated size.

QoS minimum throughput setting is calculated from the expected-iops parameter. It is set only for the storage objects that reside on AFF platforms.

**`[-peak-iops {<integer>[IOPS[/{GB|TB}]] (default: TB)}] - Peak IOPS`**

Specifies the maximum possible IOPS per TB or GB allocated based on the storage object allocated size or the storage object used size.

**`[-absolute-min-iops <qos_tput>] - Absolute Minimum IOPS`**

Specifies the absolute minimum IOPS which is used as an override when the expected IOPS is less than this value. The default value is computed as follows:

if expected-iops >= 6144/TB, then absolute-min-iops = 1000IOPS; if expected-iops >= 2048/TB and expected-iops < 6144/TB, then absolute-min-iops = 500IOPS; if expected-iops >= 1/MB and expected-iops < 2048/TB, then absolute-min-iops = 75IOPS.

**`[-expected-iops-allocation {used-space|allocated-space}] - Expected IOPS Allocation`**

Specifies the expected IOPS allocation policy. The allocation policy is either *allocated-space* or *used-space*. When the expected-iops-allocation policy is set to *allocated-space*, the expected IOPS is calculated based on the size of the storage object. When the expected-iops-allocation policy is set to *used-space*, the expected IOPS is calculated based on the amount of data stored in the storage object taking into account storage efficiencies. The default value is *allocated-space*.

**`[-peak-iops-allocation {used-space|allocated-space}] - Peak IOPS Allocation`**

Specifies the peak IOPS allocation policy. The allocation policy is either *allocated-space* or *used-space*. When the peak-iops-allocation policy is set to *allocated-space*, the peak IOPS is calculated based on the size of the storage object. When the peak-iops-allocation policy is set to *used-space*, the peak IOPS is calculated based on the amount of data stored in the storage object taking into account storage efficiencies. The default value is *used-space*.

**`[-block-size {ANY|4K|8K|16K|32K|64K|128K}] - Block Size`**

Specifies the I/O block size for the QoS adaptive policy group. The default value is "ANY". When block-size of "ANY" is specified, then control is by IOPS. When block-size other than "ANY" is specified, then control is by IOPS and bytes per second(bps). bps is the product of IOPS and block-size.

## Examples

The following example modifies the "p1" adaptive policy group with specified values.

```
cluster1:> qos adaptive-policy-group modify -policy-group p1
          -expected-iops 200IOPS/TB -peak-iops 2000IOPS/TB
          -absolute-min-iops 100IOPS
```

## Related Links

- [qos adaptive-policy-group rename](#)

## qos adaptive-policy-group rename

Rename an adaptive policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos adaptive-policy-group rename` command changes the name of an existing adaptive policy group.

### Parameters

#### **-policy-group <text> - Name**

Specifies the existing name of the adaptive policy group that you want to rename.

#### **-new-name <text> - New adaptive policy group name**

Specifies the new name of the adaptive policy group. Adaptive policy group names must be unique and are restricted to 127 alphanumeric characters including underscores "\_" and hyphens "-". Adaptive policy group names must start with an alphanumeric character.

### Examples

```
cluster1::> qos adaptive-policy-group rename -policy-group p1 -new-name  
p1_new
```

Renames the adaptive policy group from "p1" to "p1\_new".

## qos adaptive-policy-group show

Display a list of adaptive policy groups

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos adaptive-policy-group show` command shows the current settings of the adaptive policy groups on a cluster. You can view the list of adaptive policy groups and also the detailed information about a specific adaptive policy group.

### Parameters

**{ [-fields <fieldname>,...]**

If you specify the `-fields <fieldname>, ...` parameter, the command output also includes the specified field or fields. You can use `-fields ?` to display the fields to specify.

**| [-instance ] }**

If you specify the `-instance` parameter, the command displays detailed information about all fields.

**[`-policy-group <text>`] - Name**

Selects the adaptive policy groups that match this parameter value.

Adaptive policy groups define measurable service level objectives (SLOs) that adjust based on the storage object used space or the storage object allocated space.

**[`-vserver <vserver name>`] - Vserver**

If this parameter is specified, the command displays information only about the adaptive policy groups with a matching vservers.

**[`-uuid <UUID>`] - Uuid**

If this parameter is specified, the command displays information only about the adaptive policy groups with the specified UUID.

**[`-pgid <integer>`] - ID**

If this parameter is specified, the command displays information only about the adaptive policy groups that match the given policy group ID, which is an integer that uniquely identifies the adaptive policy group.

**[`-expected-iops {<integer>[IOPS[/{GB|TB}]] (default: TB)}`] - Expected IOPS**

If this parameter is specified, the command displays information only about the adaptive policy groups with the specified minimum expected IOPS per TB or GB.

**[`-peak-iops {<integer>[IOPS[/{GB|TB}]] (default: TB)}`] - Peak IOPS**

If this parameter is specified, the command displays information only about the adaptive policy groups with the specified maximum possible IOPS per TB or GB.

**[`-absolute-min-iops <qos_tput>`] - Absolute Minimum IOPS**

If this parameter is specified, the command displays information only about the adaptive policy groups with the specified absolute minimum IOPS.

**[`-expected-iops-allocation {used-space|allocated-space}`] - Expected IOPS Allocation**

If this parameter is specified, the command displays information only about the adaptive policy groups with the specified expected IOPS allocation policy used to compute the expected IOPS per TB or GB.

**[`-peak-iops-allocation {used-space|allocated-space}`] - Peak IOPS Allocation**

If this parameter is specified, the command displays information only about the adaptive policy groups with the specified peak IOPS allocation policy used to compute the maximum possible IOPS per TB or GB.

**[`-block-size {ANY|4K|8K|16K|32K|64K|128K}`] - Block Size**

Specifies the I/O block size for the QoS adaptive policy group. The default value is "ANY". When block-size of "ANY" is specified, then control is by IOPS. When block-size other than "ANY" is specified, then control is by IOPS and bytes per second(bps). bps is the product of IOPS and block-size.

**[`-num-workloads <integer>`] - Number of Workloads**

If this parameter is specified, the command displays information only about the adaptive policy groups with the specified number of workloads.

## Examples

The example above displays all adaptive policy groups on the cluster.



```
cluster1::> qos adaptive-policy-group show
qos adaptive-policy-group show
Expected      Peak      Minimum  Block
Name          Vserver Wklds   IOPS      IOPS      IOPS      Size
-----
apg1          vs1      1       100IOPS/MB 1000IOPS/MB 75IOPS    8K
apg2          vs1      1       100IOPS/MB 1000IOPS/MB 75IOPS    4K
extreme       clus-1   0       6144IOPS/TB 12288IOPS/TB 1000IOPS  ANY
performance   clus-1   0       2048IOPS/TB 4096IOPS/TB 500IOPS   ANY
value         clus-1   0       128IOPS/TB 512IOPS/TB 75IOPS    ANY
5 entries were displayed.
```

## qos policy-group commands

### qos policy-group create

Create a policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

#### Description

The `qos policy-group create` command creates a new policy group. You can use a QoS policy group to control a set of storage objects known as "workloads" - LUNs, volumes, files, or Vservers. Policy groups define measurable service level objectives (SLOs) that apply to the storage objects with which the policy group is associated.

After you create a policy group, you use the storage object create command or the storage object modify command to apply the policy group to a storage object.

#### Parameters

##### **-policy-group <text> - Policy Group Name**

Specifies the name of the policy group. Policy group names must be unique and are restricted to 127 alphanumeric characters including underscores "\_" and hyphens "-". Policy group names must start with an alphanumeric character. You use the [qos policy-group rename](#) command to change the policy group name.

##### **-vserver <vserver name> - Vserver**

Specifies the data Vserver to which this policy group belongs. You can apply this policy group to only the storage objects contained in the specified Vserver. For example, if you want to apply this policy group to a volume, that volume must belong to the specified Vserver. Using this parameter does not apply the policy group's SLOs to the Vserver. You need to use the vserver modify command if you want to apply this policy group to the Vserver. If the system has only one Vserver, then the command uses that Vserver by default.

##### **[-max-throughput <qos\_tput>] - Maximum Throughput**

Specifies the maximum throughput for the policy group. A maximum throughput limit specifies the throughput that the policy group must not exceed. It is specified in terms of IOPS or MB/s, or a combination of comma separated IOPS and MB/s. The range is one to infinity. A value of zero is accepted but is

internally treated as infinity.

The values entered here are case-insensitive, and the units are base ten. There should be no space between the number and the units. The default value for max-throughput is infinity, which can be specified by the special value "INF". Note that there is no default unit - all numbers except zero require explicit specification of the units.

Two reserved keywords, "none" and "INF", are available for the situation that requires removal of a value, and the situation that needs to specify the maximum available value.

Examples of valid throughput specifications are: "100B/s", "10KB/s", "1gb/s", "500MB/s", "1tb/s", "100iops", "100iops,400KB/s", and "800KB/s,100iops"

#### **[-min-throughput <qos\_tput>] - Minimum Throughput**

Specifies the minimum throughput for the policy group. A minimum throughput specifies the desired performance level for a policy group. It is specified in terms of IOPS.

The values entered here are case-insensitive, and the units are base ten. There should be no space between the number and the units. The default value for min-throughput is "0". The default unit is IOPS.

One reserved keyword, 'none' is available for the situation that requires removal of a value.

Examples of valid throughput specifications are: "100iops" and "100".

#### **[-is-shared {true|false}] - Is Shared**

Specifies whether the policy group can be shared or not. The default value is "true". This parameter specifies if the SLOs of the policy group are shared between the workloads or if the SLOs are applied separately to each workload.

### **Examples**

```
cluster1::> qos policy-group create p1 -vserver vs1
```

Creates the "p1" policy group which belongs to Vserver "vs1" with default policy values.

```
cluster1::> qos policy-group create p2 -vserver vs1 -max-throughput  
500MB/s
```

Creates the "p2" policy group which belongs to Vserver "vs1" with the maximum throughput set to 500 MB/s.

```
cluster1::> qos policy-group create p3 -vserver vs1 -max-throughput  
500MB/s -is-shared false
```

Creates the "p3" policy group which belongs to Vserver "vs1" with the maximum throughput set to 500 MB/s and shared set to false.

## Related Links

- [qos policy-group rename](#)

## qos policy-group delete

Delete an existing QoS Policy Group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos policy-group delete` command deletes a policy group from a cluster. You cannot delete a policy group if a qos workload associated with storage object is assigned to it unless you use "-force". Using "-force" will delete all the qos workloads for storage objects associated with the specified policy groups .

You can only delete user-defined policy groups. You cannot delete preset policy groups.

### Parameters

**-policy-group <text> - Policy Group Name**

Specifies the name of the policy group that you want to delete.

**[-force <true>] - Force Delete Workloads for the QoS Policy Group (privilege: advanced)**

Specifies whether to delete a policy group along with any underlying workloads.

### Examples

```
cluster1::> qos policy-group delete p1
```

Deletes the "p1" policy group.

```
cluster1::> qos policy-group delete p1 -force
```

Deletes the "p1" policy group along with any underlying qos workloads.

## qos policy-group modify

Modify a policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos policy-group modify` command modifies a user-created policy group.

### Parameters

### **-policy-group <text> - Policy Group Name**

Specifies the name of the policy group that you want to modify.

### **[-max-throughput <qos\_tput>] - Maximum Throughput**

Specifies the maximum throughput for the policy group. A maximum throughput limit specifies the throughput that the policy group must not exceed. It is specified in terms of IOPS or MB/s, or a combination of comma separated IOPS and MB/s. The range is one to infinity. A value of zero is accepted but is internally treated as infinity.

The values entered here are case-insensitive, and the units are base ten. There should be no space between the number and the units. The default value for max-throughput is infinity, which can be specified by the special value "INF". Note there is no default unit - all numbers except zero require explicit specification of the units.

Two reserved keywords, "none" and "INF", are available for the situation that requires removal of a value, and the situation that needs to specify the maximum available value.

Examples of valid throughput specifications are: "100B/s", "10KB/s", "1gb/s", "500MB/s", "1tb/s", and "100iops".

### **[-min-throughput <qos\_tput>] - Minimum Throughput**

Specifies the minimum throughput for the policy group. A minimum throughput specifies the desired performance level for a policy group. It is specified in terms of IOPS.

The values entered here are case-insensitive, and the units are base ten. There should be no space between the number and the units. The default value for min-throughput is "0". The default unit is IOPS.

One reserved keyword, 'none' is available for the situation that requires removal of a value.

Examples of valid throughput specifications are: "100iops" and "100".

## **Examples**

```
cluster1::> qos policy-group modify p1 -max-throughput 10IOPS
```

Modifies the "p1" policy group and sets its max throughput value to 10 IOPS.

## **qos policy-group rename**

Rename a policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### **Description**

The `qos policy-group rename` command changes the name of an existing policy group.

### **Parameters**

**-policy-group <text> - Policy Group Name**

Specifies the existing name of the policy group that you want to rename.

**-new-name <text> - New Policy Group Name**

Specifies the new name of the policy group. Policy group names must be unique and are restricted to 127 alphanumeric characters including underscores "\_" and hyphens "-". Policy group names must start with an alphanumeric character.

**Examples**

```
cluster1::> qos policy-group rename -policy-group p1 -new-name p1_new
```

Renames the policy group from "p1" to "p1\_new".

**qos policy-group show**

Display a list of policy groups

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

**Description**

The `qos policy-group show` command shows the current settings of the policy groups on a cluster. You can display a list of the policy groups and you can view detailed information about a specific policy group.

**Parameters**

**{ [-fields <fieldname>,...]**

If you specify the `-fields <fieldname>, ...` parameter, the command output also includes the specified field or fields. You can use `'-fields ?'` to display the fields to specify.

**| [-instance ] }**

If you specify the `-instance` parameter, the command displays detailed information about all fields.

**[-policy-group <text>] - Policy Group Name**

Selects the policy groups that match this parameter value

Policy groups define measurable service level objectives (SLOs) that apply to the storage objects with which the policy group is associated.

**[-vserver <vserver name>] - Vserver**

Selects the policy groups that match this parameter value

**[-uuid <UUID>] - Uuid**

Selects the policy groups that match this parameter value

**[-class <QoS Configuration Class>] - Policy Group Class**

Selects the policy groups that match this parameter value

### **[-pgid <integer>] - Policy Group ID**

Selects the policy groups that match this parameter value

This uniquely identifies the policy group

### **[-max-throughput <qos\_tput>] - Maximum Throughput**

Selects the policy groups that match this parameter value

A maximum throughput limit specifies the throughput (in IOPS or MB/s) that the policy group must not exceed.

### **[-min-throughput <qos\_tput>] - Minimum Throughput**

Selects the policy groups that match this parameter value

A minimum throughput specifies the desired performance level for a policy group.

### **[-num-workloads <integer>] - Number of Workloads**

Selects the policy groups that match this parameter value.

### **[-throughput-policy <text>] - Throughput Policy**

Selects the policy groups that match this parameter value. You can specify the throughput range in terms of IOPS or data rate. For example, 0-INF, 0-400IOPS, 0-200KB/s, 0-400MB/s .

### **[-is-shared {true|false}] - Is Shared**

Selects the policy groups that match this parameter value.

The shared value specifies whether the policy group is a shared policy group or not.

### **[-is-auto-generated {true|false}] - Is Policy Auto Generated**

Selects the policy groups that match this parameter value.

The auto-generated value specifies whether the policy group is an automatically generated policy group or not.

## **Examples**

```
cluster1::> qos policy-group show
Name           Vserver      Class           Wklds Throughput
-----
pg1             vs4          user-defined    0      0-200IOPS
pg2             vs0          user-defined    0      0-500IOPS
pg5             vs0          user-defined    0      0-300IOPS
pg6             vs0          user-defined    0      0-INF
4 entries were displayed.
```

The example above displays all policy groups on the cluster.

# qos settings commands

## qos settings throughput-floors-v2

Enable/Disable throughput floors v2 on AFF

**Availability:** This command is available to *cluster* administrators at the *advanced* privilege level.

### Description

The `qos settings throughput-floors-v2` command is used to enable or disable floors v2 on AFF. The default is enabled. With floors v2 enabled, throughput floors can be met when controllers are heavily utilized at the expense of higher latency on other workloads. Floors v2 applies to both QoS and Adaptive QoS.

### Parameters

**-enable {true|false} - enable or disable throughput floors v2 on AFF (privilege: advanced)**

This specifies if floors v2 is enabled or disabled. If this parameter is specified with *false* floors v2 will be disabled.

### Examples

The following example disables floors v2 on AFF.

```
cluster1::*> qos settings throughput-floors-v2 -enable false
```

## qos settings cache modify

Modify the cache policy

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos settings cache modify` command modifies the existing default caching-policy. The list of caching policies can be obtained from the `qos setting cache show -fields cache-setting` command.

### Parameters

**-cache-setting <text> - Cache Policy Name**

Valid inputs to this parameter include any one of the listed caching-policies. This command is to be used together with the default parameter. If you use this parameter, the command modifies the specified caching-policy based on the default parameter.

**[-default {true|false}] - Is Default?**

Valid inputs to this parameter are true and false. Together with cache-setting, this parameter helps set or unset a caching-policy as default.

## Examples

```
cluster1::> qos settings cache modify -default true -cache-setting  
random_read_write-random_write
```

Sets caching-policy `random_read_write-random_write` as default.

## qos settings cache show

Display list of cache policies

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The ``qos settings cache show`` shows the current caching-policies, class to which they belong, the number of workloads associated with each of the policies, and whether or not they are set to default. The following external-cache policies are available:

- none - Does not cache any user data or metadata blocks.
- auto - Read caches all metadata and randomly read user data blocks, and write caches all randomly overwritten user data blocks.
- all - Read caches all data blocks read and written. It does not do any write caching.
- all-random\_write - Read caches all data blocks read and written. It also write caches randomly overwritten user data blocks.
- all\_read - Read caches all metadata, randomly read, and sequentially read user data blocks.
- all\_read-random\_write - Read caches all metadata, randomly read, and sequentially read user data blocks. It also write caches randomly overwritten user data blocks.
- all\_read\_random\_write - Read caches all metadata, randomly read, sequentially read and randomly written user data.
- all\_read\_random\_write-random\_write - Read caches all metadata, randomly read, sequentially read, and randomly written user data blocks. It also write caches randomly overwritten user data blocks.
- meta - Read caches only metadata blocks.
- meta-random\_write - Read caches all metadata and write caches randomly overwritten user data blocks.
- noread-random\_write - Write caches all randomly overwritten user data blocks. It does not do any read caching.
- random\_read - Read caches all metadata and randomly read user data blocks.
- random\_read\_write - Read caches all metadata, randomly read and randomly written user data blocks.
- random\_read\_write-random\_write - Read caches all metadata, randomly read, and randomly written user data blocks. It also write caches randomly overwritten user data blocks.



Note that in a caching-policy name, a hyphen (-) separates read and write caching policies.



## Parameters

**{ [-fields <fieldname>,...]**

The input to this parameter is one of the following: {cache-setting|class|default|num-workloads}. If you use this parameter, the command displays information related to the specified input field.

**| [-instance ] }**

If you use this parameter, the command displays information about the caching-policies in a list format.

**[-cache-setting <text>] - Cache Policy Name**

The input to this parameter is any one of the above listed caching-policies. If you use this parameter, the command displays information corresponding to the specified caching-policy.

**[-class <QoS Configuration Class>] - Cache Policy Class**

The input to this parameter is one of the following: {undefined|preset|user-defined|system-defined|autovolume}. If you use this parameter, the command displays information corresponding to the specified policy-group class.

**[-default {true|false}] - Is Default?**

The input to this parameter is true and false. If you use this parameter, the command displays information corresponding to entries that have the specified default value.

**[-num-workloads <integer>] - Number Of Workloads With This Policy**

The input to this parameter is an integer. If you use this parameter, the command displays information about policy-groups matching the specified number of workloads.

## Examples

```
cluster1::> qos settings cache show
```

Policy Name	Class	Num Workloads	Default
-----	-----	-----	-----
all	preset	0	false
all-random_write			
	preset	0	false
all_read	preset	0	false
all_read-random_write			
	preset	0	false
all_read_random_write			
	preset	0	false
all_read_random_write-random_write			
	preset	0	false
auto	preset	2	false
meta	preset	0	false
meta-random_write			
	preset	0	false
none	preset	0	false
noread-random_write			
	preset	0	false
random_read	preset	25	false
random_read_write			
	preset	0	false
random_read_write-random_write			
	preset	28	true

14 entries were displayed.

Shows QoS settings for the caching policies.

## qos statistics commands

### qos statistics characteristics show

Display QoS policy group characterization

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

#### Description

The `qos statistics characteristics show` command displays data that characterizes the behavior of QoS policy groups.

The command displays the following data:

- The QoS policy group name (Policy Group)
- Input/output operations performed per second (IOPS)

- Throughput achieved in kilobytes per second (KB/s) or megabytes per second (MB/s) as appropriate (Throughput)
- Request size in bytes (B) (Request size)
- Read percentage from total I/O (Read)
- Concurrency, which indicates the number of concurrent users generating the I/O traffic (Concurrency)

The results displayed per iteration are sorted by IOPS. Each iteration starts with a row that displays the total IOPS used across all QoS policy groups. Other columns in this row are either totals or averages.

## Parameters

### **`[-node {<nodename>|local}]` - Node**

Selects the policy groups that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **`[-iterations <integer>]` - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **`{ [-rows <integer>] }` - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### **`| [-policy-group <text>] - QoS Policy Group Name }`**

Selects the QoS policy group whose name matches the specified value. If you do not specify this parameter, the command displays data for all QoS policy groups.

### **`[-refresh-display {true|false}]` - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

## Examples

```
cluster1::> qos statistics characteristics show -iterations 100 -rows 4
Policy Group          IOPS      Throughput Request size  Read
Concurrency
-----
-----
-total-              31      304.00KB/s      10041B    0%
16
_System-Best-Effort   15           0KB/s           0B      0%
0
vol1                 11      44.00KB/s      4096B    0%
40
vol2                  4      256.00KB/s      65536B    0%
14
vs1vol0              1       4.00KB/s      4096B    0%
4
-total-              37      808.00KB/s      22361B    2%
3
_System-Best-Effort   15           0KB/s           0B      0%
0
vol2                 12      768.00KB/s      65536B    0%
9
vs1vol0              8      32.00KB/s      4096B    12%
1
vol1                  2       8.00KB/s      4096B    0%
1
```

The example above displays the characteristics of the 4 QoS policy groups with the highest IOPS values and refreshes the display 100 times before terminating.

```
cluster1::> qos statistics characteristics show -iterations 100 -policy
-group pg1
Policy Group          IOPS          Throughput Request size Read
Concurrency
-----
-----
-total-              293          3.02MB/s          10783B  54%
0
pg1                  118          470.67KB/s           4096B 100%
0
-total-              181          478.14KB/s           2700B  65%
0
pg1                  117          469.33KB/s           4096B 100%
0
-total-              226          525.78KB/s           2382B  60%
1
pg1                  110          440.00KB/s           4096B 100%
1
-total-              233          1.67MB/s           7527B  49%
1
pg1                  112          446.67KB/s           4096B 100%
1
```

The example above displays the system characteristics of the QoS policy group *pg1* and refreshes the display *100* times before terminating.

## qos statistics latency show

Display latency breakdown data per QoS policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics latency show` command displays the average latencies for QoS policy groups across the various Data ONTAP subsystems.

The command displays the following data:

- The QoS policy group name (Policy Group)
- Total latency observed per I/O operation (Latency)
- Latency observed per I/O operation in the Network subsystem (Network)
- Latency observed per I/O operation across the internally connected nodes in a Cluster (Cluster)
- Latency observed per I/O operation in the Data management subsystem (Data)
- Latency observed per I/O operation in the Storage subsystem (Disk)

- Latency observed per I/O operation for QoS Policy Group Ceiling (QoS Max)
- Latency observed per I/O operation for QoS Policy Group Floor (QoS Min)
- Latency observed per I/O operation for NVRAM transfer (NVRAM)
- Latency observed per I/O operation for Object Store (Cloud) operations
- Latency observed per I/O operation for FlexCache (FlexCache) operations
- Latency observed per I/O operation for Synchronous Snapmirror (SM Sync) operations
- Latency observed per I/O operation for Volume Activation (VA) operations

The results displayed per iteration are sorted by the Latency field. Each iteration starts with a row that displays the average latency, in microseconds (us) or milliseconds (ms), observed across all QoS policy groups.

## Parameters

### **[`-node {<nodename>|local}`] - Node**

Selects the policy groups that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **[`-iterations <integer>`] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **{ [`-rows <integer>`] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### **| [`-policy-group <text>`] - QoS Policy Group Name }**

Selects the QoS policy group whose name matches the specified value. If you do not specify this parameter, the command displays data for all QoS policy groups.

### **[`-refresh-display {true|false}`] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

## Examples

```
cluster1::> qos statistics latency show -iterations 100 -rows 3
Policy Group          Latency      Network      Cluster      Data
Disk      QoS Max    QoS Min      NVRAM        Cloud  FlexCache    SM Sync
VA
-----
-----
-----
-total-              110.35ms    110.02ms          0ms    327.00us
0ms           0ms        0ms        0ms        0ms        0ms        0ms
0ms
vs1vol10              167.82ms    167.22ms          0ms    603.00us
0ms           0ms        0ms        0ms        0ms        0ms        0ms
```

```

0ms
vol1          117.76ms  117.56ms      0ms  191.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vol2          44.24ms  44.05ms      0ms  190.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
-total-       38.89ms  38.63ms      0ms  256.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vol2          64.47ms  64.20ms      0ms  266.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vol1          27.28ms  27.03ms      0ms  253.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vs1vol0       23.72ms  23.47ms      0ms  249.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
-total-       409.81ms 409.65ms      0ms  169.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vol1          816.92ms 816.80ms      0ms  120.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vol2          407.88ms 407.66ms      0ms  219.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vs1vol0       3.68ms   3.49ms      0ms  193.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
-total-       1169.00us 107.00us      0ms  1062.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms
vol2          1169.00us 107.00us      0ms  1062.00us
0ms          0ms      0ms      0ms      0ms      0ms
0ms

```

The example above displays latencies for the 3 QoS policy groups with the highest latencies and refreshes the display 100 times before terminating.

```

cluster1::> qos statistics latency show -iterations 100 -policy-group pg1
Policy Group          Latency      Network      Cluster      Data
Disk    QoS Max      QoS Min      NVRAM        Cloud  FlexCache  SM Sync
VA
-----
-total-              5.88ms      308.00us      0ms      434.00us
5.14ms              0ms          0ms          0ms          0ms          0ms
0ms
pg1                  5.88ms      308.00us      0ms      434.00us
5.14ms              0ms          0ms          0ms          0ms          0ms
0ms
-total-              4.17ms      280.00us      0ms      477.00us
3.42ms              0ms          0ms          0ms          0ms          0ms
0ms
pg1                  4.17ms      280.00us      0ms      477.00us
3.42ms              0ms          0ms          0ms          0ms          0ms
0ms
-total-              4.43ms      274.00us      0ms      656.00us
3.50ms              0ms          0ms          0ms          0ms          0ms
0ms
pg1                  4.43ms      274.00us      0ms      656.00us
3.50ms              0ms          0ms          0ms          0ms          0ms
0ms
-total-              4.89ms      276.00us      0ms      699.00us
3.92ms              0ms          0ms          0ms          0ms          0ms
0ms
pg1                  4.89ms      276.00us      0ms      699.00us
3.92ms              0ms          0ms          0ms          0ms          0ms
0ms

```

The example above displays latencies for the QoS policy group *pg1* and refreshes the display *100* times before terminating.

## qos statistics performance show

Display system performance data per QoS policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics performance show` command shows the current system performance levels that QoS policy groups are achieving.

The command displays the following data:



- The QoS policy group name (Policy Group)
- Input/output operations performed per second (IOPS)
- Throughput in kilobytes per second (KB/s) or megabytes per second (MB/s) as appropriate (Throughput)
- Latency observed per request in microseconds (us) or milliseconds (ms) as appropriate (Latency)

The results displayed per iteration are sorted by IOPS. Each iteration starts with a row that displays the total IOPS used across all QoS policy groups. Other columns in this row are either totals or averages.

## Parameters

### **[`-node` <nodename>|local}] - Node**

Selects the policy groups that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **[`-iterations` <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **{ [`-rows` <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### **[`-policy-group` <text>] - QoS Policy Group Name }**

Selects the QoS policy group whose name matches the specified value. If you do not specify this parameter, the command displays data for all QoS policy groups.

### **[`-refresh-display` {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

## Examples

```
cluster1::> qos statistics performance show -iterations 100 -rows 4
Policy Group          IOPS      Throughput    Latency
-----
-total-              79      1296.00KB/s    337.41ms
_System-Best-Effort   25           0KB/s         0ms
vol1                  24      96.00KB/s     193.72ms
vol2                  18     1152.00KB/s    750.98ms
vs1vol0               12      48.00KB/s     707.38ms
-total-             109      1.99MB/s     133.27ms
_System-Best-Effort   35           0KB/s         0ms
vol2                  29      1.81MB/s     249.27ms
vs1vol0               24      96.00KB/s     48.32ms
vol1                  21      84.00KB/s     292.30ms
```

The example above displays the system performance for the 4 QoS policy groups with the highest IOPS and it

refreshes the display *100* times before terminating.

```
cluster1::> qos statistics performance show -iterations 100 -policy-group
pg1
Policy Group          IOPS          Throughput    Latency
-----
-total-               2833          10.66MB/s     924.00us
pg1                   2655          10.37MB/s     917.00us
-total-               2837          10.65MB/s     923.00us
pg1                   2655          10.37MB/s     917.00us
-total-               2799          10.73MB/s     802.00us
pg1                   2737          10.69MB/s     815.00us
-total-               2930          13.33MB/s     905.00us
pg1                   2720          10.62MB/s     858.00us
```

The example above displays the system performance for the QoS policy group *pg1* and refreshes the display *100* times before terminating.

## qos statistics resource cpu show

Display CPU resource utilization data per QoS policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics resource cpu show` command displays the CPU utilization for QoS policy groups per node.

The command displays the following data:

- The QoS policy group name (Policy Group)
- CPU utilization observed in percentage (CPU)

The results displayed per iteration are sorted by total CPU utilization. Each iteration starts with a row that displays the total CPU utilization across all QoS policy groups.

### Parameters

**-node {<nodename>|local} - Node**

Selects the policy groups that match this parameter value.

**[-iterations <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

**{ [-rows <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### | [-policy-group <text>] - QoS Policy Group Name }

Selects the QoS policy group whose name matches the specified value. If you do not specify this parameter, the command displays data for all QoS policy groups.

### [-refresh-display {true|false}] - Toggle Screen Refresh Between Each Iteration

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

## Examples

```
cluster1::> qos statistics resource cpu show -node nodeA -iterations 100
-rows 3
```

Policy Group	CPU
-----	----
-total- (100%)	9%
fast	1%
slow	3%
medium	5%
-total- (100%)	8%
slow	1%
fast	3%
medium	3%

The example above displays the total CPU utilization for the 3 QoS policy groups with the highest CPU utilization and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics resource cpu show -node local -iterations 100
-policy-group pg1
```

Policy Group	CPU
-----	----
-total- (100%)	7%
pg1	1%
-total- (100%)	7%
pg1	1%
-total- (100%)	7%
pg1	1%
-total- (100%)	10%
pg1	1%

The example above displays the total CPU utilization for the QoS policy group *pg1* and refreshes the display 100 times before terminating.

## qos statistics resource disk show

Display disk resource utilization data per QoS policy group

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

## Description

The `qos statistics resource disk show` command displays the disk utilization for QoS policy groups per node. The disk utilization shows the percentage of time spent on the disk during read and write operations. The command displays disk utilization for system-defined policy groups; however, their disk utilization is not included in the total utilization. The command only supports hard disks.

The command displays the following data:

- The QoS policy group name (Policy Group)
- Disk utilization (Disk)
- The number of HDD data disks utilized (Number of HDD Disks)

The results displayed are sorted by total disk utilization. Each iteration starts with a row that displays the total disk utilization across all QoS policy groups.

## Parameters

**-node {<nodename>|local} - Node**

Selects the policy groups that match this parameter value.

**[-iterations <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

**{ [-rows <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

**| [-policy-group <text>] - QoS Policy Group Name }**

Selects the QoS policy group whose name matches the specified value. If you do not specify this parameter, the command displays data for all QoS policy groups.

**[-refresh-display {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

## Examples

```
cluster1::> qos statistics resource disk show -node nodeA -iterations 100
-rows 3
```

Policy Group	Disk	Number of HDD Disks
-----	-----	-----
-total-	40%	27
pg1	22%	5
slow	10%	10
fast	8%	12
_System_Default	7%	20
-total-	42%	27
pg1	22%	5
slow	12%	10
fast	8%	12
_System_Default	7%	20

The example above displays the total disk utilization for the 3 QoS policy groups with the highest disk utilization and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics resource disk show -node local -iterations 100
-policy-group pg1
```

Policy Group	Disk	Number of HDD Disks
-----	-----	-----
-total-	3%	10
pg1	1%	24
-total-	3%	10
pg1	1%	24
-total-	3%	10
pg1	1%	24
-total-	3%	10
pg1	1%	24

The example above displays the total disk utilization for the QoS policy group *pg1* and refreshes the display 100 times before terminating.

## qos statistics volume characteristics show

### Display volume characteristics

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics volume characteristics show` command displays data that characterizes the behavior of volumes.

The command displays the following data:

- QoS volume name (Workload)
- QoS workload ID (ID)
- Input/output operations per second (IOPS)
- Throughput achieved in kilobytes per second (KB/s) or megabytes per second (MB/s) as appropriate (Throughput)
- Request size in bytes (B) (Request size)
- Read percentage from total IOPS (Read)
- Concurrency, which indicates the number of concurrent users generating the I/O traffic (Concurrency)

The results displayed per iteration are sorted by IOPS. Each iteration starts with a row that displays the total IOPS used across all volumes. Other columns in this row are either totals or averages.

## Parameters

### **[`-node {<nodename>|local}`] - Node**

Selects the volumes that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **{ [`-rows <integer>`] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. The default setting is 10. The allowed range of values is 1 to 20.

### **| `-vserver <vserver name>` - Vserver Name**

Specifies the Vserver to which the volume belongs.

### **`-volume <volume name>` - Volume Name }**

Selects the characteristic data that match this parameter value. Enter a complete volume name or press the <Tab> key to complete the name. Wildcard query characters are not supported.

### **[`-iterations <integer>`] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **[`-refresh-display {true|false}`] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

### **[`-show-flexgroup-as-constituents {true|false}`] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```
cluster1::> qos statistics volume characteristics show -iterations 100
-rows 3
Workload          ID      IOPS      Throughput Request size Read
Concurrency
-----
-----
-total-          -        68      176.00KB/s      2650B    7%
8
vs1vol0-wid102    102      24      96.00KB/s      4096B   20%
13
vol_1-wid103      103      20      80.00KB/s      4096B    0%
12
vol_2-wid104      104       1         0KB/s         0B     0%
0
-total-          -       157     528.00KB/s     3443B    3%
4
vol_2-wid104      104      48     192.00KB/s     4096B    0%
9
vol_1-wid103      103      43     172.00KB/s     4096B    0%
0
vs1vol0-wid102    102      41     164.00KB/s     4096B   14%
6
-total-          -       274    1016.00KB/s     3797B    2%
2
vs1vol0-wid102    102      85     340.00KB/s     4096B    8%
4
vol_2-wid104      104      85     340.00KB/s     4096B    0%
1
vol_1-wid103      103      84     336.00KB/s     4096B    0%
3
```

The example above displays characteristics for the 3 volumes with the highest IOPS and it refreshes the display 100 times before terminating.

```

cluster1::> qos statistics volume characteristics show -vserver vs0
-volume vs0_vol0 -iterations 100
Workload          ID      IOPS      Throughput Request Size Read
Concurrency
-----
-----
-total-           -      1567      783.33KB/s      512Kb  90%
2
vs0_vol0-wid1..  15658      785      392.33KB/s      512Kb  89%
1
-total-           -      1521      760.50KB/s      512Kb  90%
1
vs0_vol0-wid1..  15658      982      491.17KB/s      512Kb  90%
0
-total-           -      1482      741.00KB/s      512Kb  89%
0
vs0_vol0-wid1..  15658      945      472.50KB/s      512Kb  90%
0
-total-           -      1482      741.00KB/s      512Kb  89%
0
vs0_vol0-wid1..  15658      945      472.50KB/s      512Kb  90%
0
-total-           -      1702      850.83KB/s      512Kb  90%
0
vs0_vol0-wid1..  15658     1018      509.00KB/s      512Kb  90%
0

```

The example above displays characteristics for volume `vs0_vol0` in Vserver `vs0` and it refreshes the display `100` times before terminating.

## qos statistics volume latency show

Display latency breakdown data per volume

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics volume latency show` command displays the average latencies for volumes on Data ONTAP subsystems.

The command displays the following data:

- The QoS volume name (Workload)
- The QoS workload ID (ID)
- Total latency observed per I/O operation (Latency)



- Latency observed per I/O operation in the Network subsystem (Network)
- Latency observed per I/O operation across the internally connected nodes in a Cluster (Cluster)
- Latency observed per I/O operation in the Data management subsystem (Data)
- Latency observed per I/O operation in the Storage subsystem (Disk)
- Latency observed per I/O operation for QoS Policy Group Ceiling (QoS Max)
- Latency observed per I/O operation for QoS Policy Group Floor (QoS Min)
- Latency observed per I/O operation for NVRAM transfer (NVRAM)
- Latency observed per I/O operation for Object Store(Cloud) operations
- Latency observed per I/O operation for FlexCache (FlexCache) operations
- Latency observed per I/O operation for Synchronous Snapmirror (SM Sync) operations
- Latency observed per I/O operation for Volume Activation (VA) operations

The results displayed per iteration are sorted by the total latency field. Each iteration starts with a row that displays the average latency, in microseconds (us) or milliseconds (ms) observed across all volumes.

## Parameters

### **[`-node <nodename>|local`]] - Node**

Selects the volumes that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **{ [`-rows <integer>`]} - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. The default setting is 10. The allowed range of values is 1 to 20.

### **| `-vserver <vserver name>` - Vserver Name**

Specifies the Vserver to which the volume belongs.

### **`-volume <volume name>` - Volume Name }**

Selects the latency data that match this parameter value. Enter a complete volume name or press the <Tab> key to complete the name. Wildcard query characters are not supported.

### **[`-iterations <integer>`]] - Number of Iterations**

Specifies the number of times that the command refreshes the display with updated data before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **[`-refresh-display {true|false}`]] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

### **[`-show-flexgroup-as-constituents {true|false}`]] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```

cluster1::> qos statistics volume latency show -iterations 100 -rows 3
Workload          ID Latency      Network Cluster      Data      Disk
Qos Max      Qos Min      NVRAM      Cloud FlexCache      SM Sync      VA
-----
-total-          110.35ms  110.02ms      0ms      327.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vs1vol0        111 167.82ms  167.22ms      0ms      603.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vol1          1234 117.76ms  117.56ms      0ms      191.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vol2          999  44.24ms   44.05ms      0ms      190.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
-total-          -   38.89ms   38.63ms      0ms      256.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vol2          999  64.47ms   64.20ms      0ms      266.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vol1          1234  27.28ms   27.03ms      0ms      253.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vs1vol0        111  23.72ms   23.47ms      0ms      249.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
-total-          - 409.81ms  409.65ms      0ms      169.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vol1          1234 816.92ms  816.80ms      0ms      120.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vol2          999 407.88ms  407.66ms      0ms      219.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms
vs1vol0        111   3.68ms    3.49ms      0ms      193.00us      0ms
0ms            0ms          0ms          0ms          0ms          0ms

```

The example above displays latencies for the 3 volumes with the highest latencies and it refreshes the display 100 times before terminating.

```

cluster1::> qos statistics volume latency show -vserver vs0 -volume
vs0_vol0 -iterations 100
Workload          ID      Latency      Network      Cluster      Data
Disk      Qos Max    Qos Min      NVRAM        Cloud  FlexCache    SM Sync
VA
-----
-----
-----
-total-          -    455.00us    158.00us          0ms    297.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
vs0_vol0-wid1..  15658    428.00us    155.00us          0ms    273.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
-total-          -    337.00us    130.00us          0ms    207.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
vs0_vol0-wid1..  15658    316.00us    128.00us          0ms    188.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
-total-          -    464.00us    132.00us          0ms    332.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
vs0_vol0-wid1..  15658    471.00us    130.00us          0ms    341.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
-total-          -    321.00us    138.00us          0ms    183.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
vs0_vol0-wid1..  15658    302.00us    137.00us          0ms    165.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
-total-          -    418.00us    142.00us          0ms    276.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms
vs0_vol0-wid1..  15658    424.00us    143.00us          0ms    281.00us
0ms              0ms          0ms          0ms          0ms          0ms
0ms

```

The example above displays latencies for volume `vs0_vol0` in Vserver `vs0` and it refreshes the display 100 times before terminating.

## **qos statistics volume performance show**

Display system performance data per volume

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

## Description

The `qos statistics volume performance show` command shows the current system performance that each volume is achieving.

The command displays the following data:

- The QoS volume name (Workload)
- The QoS workload ID (ID)
- Input/output operations performed per second (IOPS)
- Throughput in kilobytes per second (KB/s) or megabytes per second (MB/s) as appropriate (Throughput)
- Latency observed per request in microseconds (us) or milliseconds (ms) as appropriate (Latency)

The results displayed per iteration are sorted by IOPS. Each iteration starts with a row that displays the total IOPS used across all volumes. Other columns in this row are either totals or averages.

## Parameters

### **[`-node` {<nodename>|local}] - Node**

Selects the volumes that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **{ [`-rows` <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. The default setting is 10. The allowed range of values is 1 to 20.

### **| `-vserver` <vserver name> - Vserver Name**

Specifies the Vserver to which the volume belongs.

### **`-volume` <volume name> - Volume Name }**

Selects the performance data that match this parameter value. Enter a complete volume name or press the <Tab> key to complete the name. Wildcard query characters are not supported.

### **[`-iterations` <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **[`-refresh-display` {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

### **[`-show-flexgroup-as-constituents` {true|false}] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```
cluster1::> qos statistics volume performance show -iterations 100 -rows 3
```

Workload	ID	IOPS	Throughput	Latency
-total-	-	97	1.90MB/s	216.87ms
vol_2-wid104	104	28	1.75MB/s	412.78ms
vol_1-wid103	103	25	100.00KB/s	169.16ms
vs1vol0-wid102	102	13	52.00KB/s	403.78ms
-total-	-	98	1276.00KB/s	89.98ms
vs1vol0-wid102	102	28	112.00KB/s	80.70ms
vol_1-wid103	103	19	76.00KB/s	114.72ms
vol_2-wid104	104	17	1088.00KB/s	257.60ms
-total-	-	78	1152.00KB/s	225.22ms
vol_1-wid103	103	17	68.00KB/s	452.27ms
vol_2-wid104	104	16	1024.00KB/s	419.93ms
vs1vol0-wid102	102	15	60.00KB/s	210.63ms

The example above displays the system performance for the 3 volumes with the highest IOPS and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics volume performance show -vserver vs0 -volume vs0_vol0 -iterations 100
```

Workload	ID	IOPS	Throughput	Latency
-total-	-	1278	639.17KB/s	404.00us
vs0_vol0-wid1..	15658	526	263.17KB/s	436.00us
-total-	-	1315	657.33KB/s	86.00us
vs0_vol0-wid1..	15658	528	264.17KB/s	88.00us
-total-	-	1220	609.83KB/s	418.00us
vs0_vol0-wid1..	15658	515	257.33KB/s	531.00us
-total-	-	1202	600.83KB/s	815.00us
vs0_vol0-wid1..	15658	519	259.67KB/s	924.00us
-total-	-	1240	620.17KB/s	311.00us
vs0_vol0-wid1..	15658	525	262.50KB/s	297.00us

The example above displays the system performance for volume `vs0_vol0` in Vserver `vs0` and it refreshes the display 100 times before terminating.

## qos statistics volume resource cpu show

Display CPU resource utilization data per volume

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

## Description

The `qos statistics volume resource cpu show` command displays the CPU utilization for volumes per node.

The command displays the following data:

- The QoS volume name (Workload)
- The QoS workload ID (ID)
- CPU utilization observed in percentage (CPU)

The results displayed per iteration are sorted by total CPU utilization. Each iteration starts with a row that displays the total CPU utilization across all volumes.

## Parameters

**-node {<nodename>|local} - Node**

Selects the volumes that match this parameter value.

**{ [-rows <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. The default setting is 10. The allowed range of values is 1 to 20.

**| -vserver <vserver name> - Vserver Name**

Specifies the Vserver to which the volume belongs.

**-volume <volume name> - Volume Name }**

Selects the CPU utilization data that match this parameter value. Enter a complete volume name or press the <Tab> key to complete the name. Wildcard query characters are not supported.

**[-iterations <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

**[-refresh-display {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

**[-show-flexgroup-as-constituents {true|false}] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```
cluster1::> qos statistics volume resource cpu show -node nodeA
-iterations 100 -rows 3
```

Workload	ID	CPU
-----	-----	-----
--total- (100%)	-	9%
vs0vol1-wid-102	102	5%
vs0vol2-wid-121	121	2%
vs2_vol0-wid-..	212	2%
-total- (100%)	-	8%
vs0vol1-wid-102	102	5%
vs0vol2-wid-121	121	2%
vs2_vol0-wid-..	212	1%

The example above displays total CPU utilization for the 3 volumes with the highest CPU utilization and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics volume resource cpu show -node local -vserver
vs0 -volume vs0_vol1 -iterations 100
```

Workload	ID	CPU
-----	-----	-----
-total- (100%)	-	2%
vs0_vol1-wid7..	7916	2%
-total- (100%)	-	2%
vs0_vol1-wid7..	7916	2%
-total- (100%)	-	1%
vs0_vol1-wid7..	7916	1%
-total- (100%)	-	2%
vs0_vol1-wid7..	7916	1%
-total- (100%)	-	2%
vs0_vol1-wid7..	7916	2%

The example above displays total CPU utilization for volume `vs0_vol1` in Vserver `vs0` and it refreshes the display 100 times before terminating.

## qos statistics volume resource disk show

Display disk resource utilization data per volume

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics volume resource disk show` command displays the disk utilization for volumes per node. The disk utilization shows the percentage of time spent on the disk during read and write operations. The command only supports hard disks.

The command displays the following data:

- The QoS volume name (Workload)
- The QoS workload ID (ID)
- Disk utilization (Disk)
- The number of HDD data disks utilized (Number of HDD Disks)

The results displayed are sorted by total disk utilization. Each iteration starts with a row that displays the total disk utilization across all volumes.

## Parameters

**-node {<nodename>|local} - Node**

Selects the volumes that match this parameter value.

**{ [-rows <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. The default setting is 10. The allowed range of values is 1 to 20.

**| -vserver <vserver name> - Vserver Name**

Specifies the Vserver to which the volume belongs.

**-volume <volume name> - Volume Name }**

Selects the disk utilization data that match this parameter value. Enter a complete volume name or press the <Tab> key to complete the name. Wildcard query characters are not supported.

**[-iterations <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

**[-refresh-display {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

**[-show-flexgroup-as-constituents {true|false}] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples



```
cluster1::> qos statistics volume resource disk show -node nodeB
-iterations 100 -rows 3
```

Workload	ID	Disk	Number of HDD	Disks
-total- (100%)	-	30%		4
vs0vol1-wid101	101	12%		2
vs0vol2-wid121	121	10%		1
vol0-wid1002	1002	8%		1
-total- (100%)	-	30%		4
vs0vol1-wid101	101	12%		2
vs0vol2-wid121	121	10%		1
vol0-wid1002	1002	8%		1

The example above displays total disk utilization for the 3 volumes with the highest disk utilization and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics volume resource disk show -node local -vserver
vs0 -volume vs0_vol0 -iterations 100
```

Workload	ID	Disk	Number of HDD	Disks
-total-	-	5%		10
vs0_vol0-wid1..	15658	1%		6
-total-	-	5%		10
vs0_vol0-wid1..	15658	1%		6
-total-	-	6%		10
vs0_vol0-wid1..	15658	2%		6
-total-	-	6%		10
vs0_vol0-wid1..	15658	2%		6
-total-	-	6%		10
vs0_vol0-wid1..	15658	2%		6

The example above displays total disk utilization for volume `vs0_vol0` in Vserver `vs0` and it refreshes the display 100 times before terminating.

## qos statistics workload characteristics show

### Display QoS workload characterization

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics workload characteristics show` command displays data that characterizes the behavior of QoS workloads.

The command displays the following data:

- The QoS workload name (Workload)
- The QoS workload ID (ID)
- Input/output operations performed per second (IOPS)
- Throughput achieved in kilobytes per second (KB/s) or megabytes per second (MB/s) as appropriate (Throughput)
- Request size in bytes (B) (Request size)
- Read percentage from total IOPS (Read)
- Concurrency, which indicates the number of concurrent users generating the I/O traffic (Concurrency)

The results displayed per iteration are sorted by IOPS. Each iteration starts with a row that displays the total IOPS used across all QoS workloads. Other columns in this row are either totals or averages.

## Parameters

### **[`-node` {<nodename>|local}] - Node**

Selects the QoS workloads that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **[`-iterations` <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **[`-refresh-display` {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

### **{ [`-rows` <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### **[`-policy-group` <text>] - QoS Policy Group Name**

Selects the QoS workloads that belong to the QoS policy group specified by this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### **| [`-workload` <text>] - QoS Workload Name**

Selects the QoS workload that match this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### **| [`-workload-id` <integer>] - QoS Workload ID }**

Selects the QoS workload that match the QoS workload ID specified by this parameter value.

### **[`-show-flexgroup-as-constituents` {true|false}] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```

cluster1::> qos statistics workload characteristics show -iterations 100
-rows 4
Workload          ID      IOPS      Throughput Request size Read
Concurrency
-----
-----
-total-          -        68      176.00KB/s      2650B    7%
8
vs1vol0-wid102    102      24      96.00KB/s      4096B   20%
13
_Scan_Besteff...  101      23           0KB/s           0B    0%
0
vol_1-wid103      103      20      80.00KB/s      4096B    0%
12
vol_2-wid104      104       1           0KB/s           0B    0%
0
-total-          -       157     528.00KB/s      3443B    3%
4
vol_2-wid104      104      48     192.00KB/s      4096B    0%
9
vol_1-wid103      103      43     172.00KB/s      4096B    0%
0
vs1vol0-wid102    102      41     164.00KB/s      4096B   14%
6
_Scan_Besteff...  101      25           0KB/s           0B    0%
0
-total-          -       274    1016.00KB/s      3797B    2%
2
vs1vol0-wid102    102      85     340.00KB/s      4096B    8%
4
vol_2-wid104      104      85     340.00KB/s      4096B    0%
1
vol_1-wid103      103      84     336.00KB/s      4096B    0%
3
_Scan_Besteff...  101      20           0KB/s           0B    0%
0

```

The example above displays characteristics for the 4 QoS workloads with the highest IOPS and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload characteristics show -iterations 100
-rows 2 -policy-group pg1
```

	Workload	ID	IOPS	Throughput	Request size	Read
Concurrency						
	-total-	-	243	546.86KB/s	2307B	61%
1	file-test1_a-..	6437	34	136.00KB/s	4096B	100%
0	file-test1_c-..	5078	33	133.33KB/s	4096B	100%
0	-total-	-	310	3.09MB/s	10428B	55%
1	file-test1_a-..	6437	36	142.67KB/s	4096B	100%
0	file-test1_b-..	9492	35	138.67KB/s	4096B	100%
0	-total-	-	192	575.71KB/s	3075B	71%
1	file-test1-wi..	7872	39	157.33KB/s	4096B	100%
0	file-test1_c-..	5078	38	153.33KB/s	4096B	100%
0						

The example above displays the characteristics for the 2 QoS workloads belonging to QoS policy group *pg1* with the highest IOPS and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload characteristics show -iterations 100
-workload-id 9492
```

	Workload	ID	IOPS	Throughput	Request size	Read
	Concurrency					
	-----	-----	-----	-----	-----	-----
	-total-	-	737	2.14MB/s	3045B	79%
1						
	file-test1_b-..	9492	265	1058.67KB/s	4096B	100%
0						
	-total-	-	717	4.26MB/s	6235B	80%
1						
	file-test1_b-..	9492	272	1086.67KB/s	4096B	100%
1						
	-total-	-	623	2.50MB/s	4202B	86%
0						
	file-test1_b-..	9492	263	1050.67KB/s	4096B	100%
0						
	-total-	-	595	2.11MB/s	3712B	89%
0						
	file-test1_b-..	9492	266	1064.00KB/s	4096B	100%
0						

The example above displays the characteristics for the QoS workload with QoS workload ID *9492* and it refreshes the display *100* times before terminating.

## qos statistics workload latency show

Display latency breakdown data per QoS workload

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics workload latency show` command displays the average latencies for QoS workloads on Data ONTAP subsystems.

The command displays the following data:

- The QoS workload name (Workload)
- The QoS workload ID (ID)
- Total latency observed per I/O operation (Latency)
- Latency observed per I/O operation in the Network subsystem (Network)
- Latency observed per I/O operation across the internally connected nodes in a Cluster (Cluster)
- Latency observed per I/O operation in the Data management subsystem (Data)

- Latency observed per I/O operation in the Storage subsystem (Disk)
- Latency observed per I/O operation for QoS Policy Group Ceiling (QoS Max)
- Latency observed per I/O operation for QoS Policy Group Floor (QoS Min)
- Latency observed per I/O operation for NVRAM transfer (NVRAM)
- Latency observed per I/O operation for Object Store(Cloud) operations
- Latency observed per I/O operation for FlexCache (FlexCache) operations
- Latency observed per I/O operation for Synchronous Snapmirror (SM Sync) operations
- Latency observed per I/O operation for Volume Activation (VA) operations

The results displayed per iteration are sorted by the total latency field. Each iteration starts with a row that displays the average latency, in microseconds (us) or milliseconds (ms) observed across all QoS workloads.

## Parameters

### **[`-node {<nodename>|local}`] - Node**

Selects the QoS workloads that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **[`-iterations <integer>`] - Number of Iterations**

Specifies the number of times that the command refreshes the display with updated data before terminating. If you do not specify this parameter, the command continues to run until you interrupt it by pressing Ctrl-C.

### **[`-refresh-display {true|false}`] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

### **{ [`-rows <integer>`] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### **[`-policy-group <text>`] - QoS Policy Group Name**

Selects the QoS workloads that belong to the QoS policy group specified by this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### **| [`-workload <text>`] - QoS Workload Name**

Selects the QoS workload that match this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### **| [`-workload-id <integer>`] - QoS Workload ID }**

Selects the QoS workload that match the QoS workload ID specified by this parameter value.

### **[`-show-flexgroup-as-constituents {true|false}`] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

cluster1::> qos statistics workload latency show -iterations 100 -rows 3							
Workload		ID	Latency	Network	Cluster	Data	Disk
Qos Max	Qos Min		NVRAM	Cloud	FlexCache	SM Sync	VA
-----			-----	-----	-----	-----	-----
-total-			110.35ms	110.02ms	0ms	327.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vslvol0		111	167.82ms	167.22ms	0ms	603.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vol1		1234	117.76ms	117.56ms	0ms	191.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vol2		999	44.24ms	44.05ms	0ms	190.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
-total-		-	38.89ms	38.63ms	0ms	256.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vol2		999	64.47ms	64.20ms	0ms	266.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vol1		1234	27.28ms	27.03ms	0ms	253.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vslvol0		111	23.72ms	23.47ms	0ms	249.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
-total-		-	409.81ms	409.65ms	0ms	169.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vol1		1234	816.92ms	816.80ms	0ms	120.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vol2		999	407.88ms	407.66ms	0ms	219.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms
vslvol0		111	3.68ms	3.49ms	0ms	193.00us	0ms
0ms	0ms	0ms	0ms	0ms	0ms	0ms	0ms

The example above displays latencies for the 3 QoS workloads with the highest latencies and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload latency show -iterations 100 -rows 2
-policy-group pg1
```

Workload	ID	Latency	Network	Cluster	Data
Disk Qos Max	Qos Min	NVRAM	Cloud	FlexCache	SM Sync
VA					
-total-	-	4.80ms	287.00us	0ms	427.00us
4.08ms	0ms	0ms	0ms	0ms	0ms
0ms					
file-test1-wi..	7872	9.60ms	265.00us	0ms	479.00us
8.85ms	0ms	0ms	0ms	0ms	0ms
0ms					
file-test1_a-..	6437	8.22ms	262.00us	0ms	424.00us
7.53ms	0ms	0ms	0ms	0ms	0ms
0ms					
-total-	-	4.20ms	296.00us	0ms	421.00us
3.48ms	0ms	0ms	0ms	0ms	0ms
0ms					
file-test1-wi..	7872	8.70ms	211.00us	0ms	489.00us
8.00ms	0ms	0ms	0ms	0ms	0ms
0ms					
file-test1_a-..	6437	6.70ms	297.00us	0ms	464.00us
5.94ms	0ms	0ms	0ms	0ms	0ms
0ms					
-total-	-	5.90ms	303.00us	0ms	1.71ms
3.88ms	0ms	0ms	0ms	0ms	0ms
0ms					
file-test1-wi..	7872	11.36ms	263.00us	0ms	2.06ms
9.04ms	0ms	0ms	0ms	0ms	0ms
0ms					
file-test1_a-..	6437	9.48ms	250.00us	0ms	2.30ms
6.93ms	0ms	0ms	0ms	0ms	0ms
0ms					

The example above displays latencies for the 2 QoS workloads belonging to QoS policy group *pg1* with the highest IOPS and it refreshes the display 100 times before terminating.



```
cluster1::> qos statistics workload latency show -iterations 100 -workload
-id 9492
```

Workload			ID	Latency	Network	Cluster	Data
Disk	Qos	Max	Qos	Min	NVRAM	Cloud	FlexCache
VA							SM Sync
-----							
-----							
-----							
-total-			-		443.00us	273.00us	0ms
0ms		0ms	0ms		0ms	0ms	170.00us
0ms							0ms
file-test1_b-..			9492		440.00us	272.00us	0ms
0ms		0ms	0ms		0ms	0ms	168.00us
0ms							0ms
-total-			-		577.00us	313.00us	0ms
0ms		0ms	0ms		0ms	0ms	264.00us
0ms							0ms
file-test1_b-..			9492		607.00us	316.00us	0ms
0ms		0ms	0ms		0ms	0ms	291.00us
0ms							0ms
-total-			-		475.00us	291.00us	0ms
0ms		0ms	0ms		0ms	0ms	184.00us
0ms							0ms
file-test1_b-..			9492		476.00us	293.00us	0ms
0ms		0ms	0ms		0ms	0ms	183.00us
0ms							0ms
-total-			-		628.00us	284.00us	0ms
0ms		0ms	0ms		0ms	0ms	344.00us
0ms							0ms
file-test1_b-..			9492		591.00us	281.00us	0ms
0ms		0ms	0ms		0ms	0ms	310.00us
0ms							0ms

The example above displays the latencies for the QoS workload with QoS workload ID *9492* and it refreshes the display *100* times before terminating.

## qos statistics workload performance show

Display system performance data per QoS workload

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics workload performance show` command shows the current system performance that each QoS workload is achieving.

The command displays the following data:

- The QoS workload name (Workload)
- The QoS workload ID (ID)
- Input/output operations performed per second (IOPS)
- Throughput in kilobytes per second (KB/s) or megabytes per second (MB/s) as appropriate (Throughput)
- Latency observed per request in microseconds (us) or milliseconds (ms) as appropriate (Latency)

The results displayed per iteration are sorted by IOPS. Each iteration starts with a row that displays the total IOPS used across all QoS workloads. Other columns in this row are either totals or averages.

## Parameters

### **[`-node {<nodename>|local}`] - Node**

Selects the QoS workloads that match this parameter value. If you do not specify this parameter, the command displays data for the entire cluster.

### **[`-iterations <integer>`] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

### **[`-refresh-display {true|false}`] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

### **{ [`-rows <integer>`] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### **[`-policy-group <text>`] - QoS Policy Group Name**

Selects the QoS workloads that belong to the QoS policy group specified by this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### **| [`-workload <text>`] - QoS Workload Name**

Selects the QoS workload that match this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### **| [`-workload-id <integer>`] - QoS Workload ID }**

Selects the QoS workload that match the QoS workload ID specified by this parameter value.

### **[`-show-flexgroup-as-constituents {true|false}`] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```
cluster1::> qos statistics workload performance show -iterations 100 -rows 4
```

Workload	ID	IOPS	Throughput	Latency
-total-	-	97	1.90MB/s	216.87ms
_Scan_Besteff..	101	31	0KB/s	0ms
vol_2-wid104	104	28	1.75MB/s	412.78ms
vol_1-wid103	103	25	100.00KB/s	169.16ms
vs1vol0-wid102	102	13	52.00KB/s	403.78ms
-total-	-	98	1276.00KB/s	89.98ms
_Scan_Besteff..	101	34	0KB/s	0ms
vs1vol0-wid102	102	28	112.00KB/s	80.70ms
vol_1-wid103	103	19	76.00KB/s	114.72ms
vol_2-wid104	104	17	1088.00KB/s	257.60ms
-total-	-	78	1152.00KB/s	225.22ms
_Scan_Besteff..	101	30	0KB/s	0ms
vol_1-wid103	103	17	68.00KB/s	452.27ms
vol_2-wid104	104	16	1024.00KB/s	419.93ms
vs1vol0-wid102	102	15	60.00KB/s	210.63ms

The example above displays the system performance for the 4 QoS workloads with the highest IOPS and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload performance show -iterations 100 -rows 2 -policy-group pg1
```

Workload	ID	IOPS	Throughput	Latency
-total-	-	2598	9.96MB/s	1223.00us
file-testfile..	4228	650	2.54MB/s	1322.00us
file-testfile..	11201	635	2.48MB/s	1128.00us
-total-	-	2825	10.89MB/s	714.00us
file-testfile..	4228	707	2.76MB/s	759.00us
file-testfile..	11201	697	2.72MB/s	693.00us
-total-	-	2696	10.13MB/s	1149.00us
file-testfile..	4228	645	2.52MB/s	945.00us
file-testfile..	6827	634	2.48MB/s	1115.00us

The example above displays the system performance for the 2 QoS workloads belonging to QoS policy group *pg1* with the highest IOPS and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload performance show -iterations 100
-workload-id 11201
```

Workload	ID	IOPS	Throughput	Latency
-total-	-	2866	10.92MB/s	905.00us
file-testfile..	11201	674	2.63MB/s	889.00us
-total-	-	2761	10.55MB/s	1054.00us
file-testfile..	11201	638	2.49MB/s	1055.00us
-total-	-	2810	10.58MB/s	832.00us
file-testfile..	11201	685	2.68MB/s	909.00us
-total-	-	2593	9.86MB/s	1092.00us
file-testfile..	11201	632	2.47MB/s	964.00us

The example above displays the system performance for the QoS workload with QoS workload ID *11201* and it refreshes the display *100* times before terminating.

## qos statistics workload resource cpu show

Display CPU resource utilization data per QoS workload

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics workload resource cpu show` command displays the CPU utilization for QoS workloads per node.

The command displays the following data:

- The QoS workload name (Workload)
- The QoS workload ID (ID)
- CPU utilization observed in percentage (CPU)

The results displayed per iteration are sorted by total CPU utilization. Each iteration starts with a row that displays the total CPU utilization across all QoS workloads.

### Parameters

**-node {<nodename>|local} - Node**

Selects the QOS workloads that match this parameter value.

**[-iterations <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

**[-refresh-display {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

### { [-rows <integer>] - Number of Rows in the Output

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

### [-policy-group <text>] - QoS Policy Group Name

Selects the QoS workloads that belong to the QoS policy group specified by this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### [-workload <text>] - QoS Workload Name

Selects the QoS workload that match this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

### [-workload-id <integer>] - QoS Workload ID }

Selects the QoS workload that match the QoS workload ID specified by this parameter value.

### [-show-flexgroup-as-constituents {true|false}] - Display Flexgroups as Constituents

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```
cluster1::> qos statistics workload resource cpu show -node nodeA
-iterations 100 -rows 3
  Workload          ID    CPU
  -----
--total- (100%)    -     9%
vs0-wid-102        102    5%
file-bigvmdk-..    121    2%
vs2_vol0-wid-..    212    2%
-total- (100%)    -     8%
vs0-wid-101        102    5%
file-bigvmdk-..    121    2%
vs2_vol0-wid-..    212    1%
```

The example above displays total CPU utilization for the 3 QoS workloads with the highest CPU utilization and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload resource cpu show -node local
-iterations 100 -rows 2 -policy-group pg1
```

Workload	ID	CPU
-----	-----	-----
-total- (100%)	-	41%
file-test1_b-..	9492	16%
file-test1_c-..	5078	16%
-total- (100%)	-	43%
file-test1_c-..	5078	17%
file-test1_b-..	9492	16%
-total- (100%)	-	40%
file-test1_c-..	5078	16%
file-test1_b-..	9492	15%

The example above displays total CPU utilization for the 2 QoS workloads belonging to QoS policy group *pg1* with the highest IOPS and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload resource cpu show -node local
-iterations 100 -workload-id 9492
```

Workload	ID	CPU
-----	-----	-----
-total- (100%)	-	15%
file-test1_b-..	9492	3%
-total- (100%)	-	14%
file-test1_b-..	9492	3%
-total- (100%)	-	14%
file-test1_b-..	9492	2%
-total- (100%)	-	13%
file-test1_b-..	9492	3%

The example above displays total CPU utilization for the QoS workload with QoS workload ID 9492 and it refreshes the display 100 times before terminating.

## qos statistics workload resource disk show

Display disk resource utilization data per QoS workload

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

### Description

The `qos statistics workload resource disk show` command displays the disk utilization for QoS workloads per node. The disk utilization shows the percentage of time spent on the disk during read and write operations. The command displays disk utilization for system-defined workloads; however, their disk utilization is not included in the total utilization. The command only supports hard disks.

The command displays the following data:

- The QoS workload name (Workload)
- The QoS workload ID (ID)
- Disk utilization (Disk)
- The number of HDD data disks utilized (Number of HDD Disks)

The results displayed are sorted by total disk utilization. Each iteration starts with a row that displays the total disk utilization across all QoS workloads.

## Parameters

**-node {<nodename>|local} - Node**

Selects the QOS workloads that match this parameter value.

**[-iterations <integer>] - Number of Iterations**

Specifies the number of times the display is refreshed before terminating. If you do not specify this parameter, the command iterates until interrupted by Ctrl-C.

**[-refresh-display {true|false}] - Toggle Screen Refresh Between Each Iteration**

Specifies the display style. If true, the command clears the display after each data iteration. If false, the command displays each data iteration below the previous one. The default is false.

**{ [-rows <integer>] - Number of Rows in the Output**

Specifies the number of busiest QoS policy groups to display. Valid values are from 1 to 20. The default value is 10.

**[-policy-group <text>] - QoS Policy Group Name**

Selects the QoS workloads that belong to the QoS policy group specified by this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

**| [-workload <text>] - QoS Workload Name**

Selects the QoS workload that match this parameter value. If you do not specify this parameter, the command displays data for all QoS workloads.

**| [-workload-id <integer>] - QoS Workload ID }**

Selects the QoS workload that match the QoS workload ID specified by this parameter value.

**[-show-flexgroup-as-constituents {true|false}] - Display Flexgroups as Constituents**

If the parameter is specified and if the value is true, it will display data for FlexVols and Flexgroup Constituents. Otherwise it will display data for FlexVols and Flexgroups.

## Examples

```
cluster1::> qos statistics workload resource disk show -node nodeB
-iterations 100 -rows 3
```

Workload	ID	Disk	Number of HDD	Disks
-total- (100%)	-	30%		4
_RAID	-	20%		4
vs0-wid101	101	12%		2
file-1-wid121	121	10%		1
vol0-wid1002	1002	8%		1
_WAFL	-	7%		3
-total- (100%)	-	30%		4
vs0-wid101	101	12%		2
file-1-wid121	121	10%		1
_RAID	-	10%		4
vol0-wid1002	1002	8%		1
_WAFL	-	7%		3

The example above displays total disk utilization for the 3 QoS workloads with the highest disk utilization and it refreshes the display 100 times before terminating.

```
cluster1::> qos statistics workload resource disk show -node local
-iterations 100 -rows 2 -policy-group pg1
```

Workload	ID	Disk	Number of HDD	Disks
-total-	-	3%		10
file-test1_a-..	6437	6%		6
file-test1-wi..	7872	6%		6
-total-	-	3%		10
file-test1_a-..	6437	5%		6
file-test1-wi..	7872	5%		6
-total-	-	3%		10
file-test1_a-..	6437	6%		6
file-test1-wi..	7872	6%		6

The example above displays total disk utilization for the 2 QoS workloads belonging to QoS policy group *pg1* with the highest IOPS and it refreshes the display 100 times before terminating.



```
cluster1::> qos statistics workload resource disk show -node local
-iterations 100 -workload-id 6437
Workload          ID  Disk Number of HDD Disks
-----
-total-           -    3%                      10
file-test1_a-..   6437    6%                      6
-total-           -    3%                      10
file-test1_a-..   6437    5%                      6
-total-           -    3%                      10
file-test1_a-..   6437    6%                      6
```

The example above displays total disk utilization for the QoS workload with QoS workload ID *6437* and it refreshes the display *100* times before terminating.

## qos workload commands

### qos workload show

Display a list of workloads

**Availability:** This command is available to *cluster* administrators at the *admin* privilege level.

#### Description

Shows the current status of workloads on a cluster. Use this command to determine the types of workloads that are currently on a cluster. The types of workloads include: system-defined, preset, and user-defined. The system generates system-defined and preset workloads. You cannot create, modify, or delete these workloads. Also, you can only modify or delete a user-defined workload , but cannot create one

#### Parameters

**{ [-fields <fieldname>,...]**

If you specify the `-fields <fieldname>, ...` parameter, the command output also includes the specified field or fields. You can use `'-fields ?'` to display the fields to specify.

**| [-instance ] }**

If you specify the `-instance` parameter, the command displays detailed information about all fields.

**[-workload <text>] - Workload Name**

If you use this parameter, the command displays the workloads that contain the specified workload name.

**[-uuid <UUID>] - Workload UUID (privilege: advanced)**

If you use this parameter, the command displays the workloads that contain the specified UUID.

**[-class <QoS Configuration Class>] - Workload Class**

If you use this parameter, the command displays the workloads that contain the specified class. The Class options include system-defined, preset, and user-defined.

**[-wid <integer>] - Workload ID**

If you use this parameter, the command displays the workloads that contain the specified internal workload ID.

**[-category <text>] - Workload Category**

If you use this parameter, the command displays the workloads that contain the specified category. The category options include Scanner and Efficiency.

**[-policy-group <text>] - Policy Group Name**

If you use this parameter, the command displays the workloads that match the specified policy group name.

**[-read-ahead <text>] - Read-ahead Tunables**

If you use this parameter, the command displays the workloads that contain the specified read-ahead cache tunable.

**[-vserver <vserver name>] - Vserver**

If you use this parameter, the command displays the workloads that match the specified Vserver.

**[-volume <volume name>] - Volume**

If you use this parameter, the command displays the workloads that match the specified volume.

**[-qtree <qtree name>] - Qtree Name**

If you use this parameter, the command displays the workloads that match the specified Qtree name.

**[-lun <text>] - LUN Name**

If you use this parameter, the command displays the workloads that match the specified LUN name.

**[-file <text>] - File Path**

If you use this parameter, the command displays the workloads that match the specified file path.

**[-max-throughput <qos\_tput>] - Maximum Throughput**

Selects the workloads that match this parameter value

A maximum throughput limit specifies the throughput in IOPS that the workload must not exceed.

**[-min-throughput <qos\_tput>] - Minimum Throughput**

Selects the workloads that match this parameter value

A minimum throughput specifies the desired performance level for a workload in IOPS.

**[-is-adaptive {true|false}] - Adaptive**

If you use this parameter, the command displays only adaptive workloads.

**[-is-constituent {true|false}] - Is Constituent Volume**

If this parameter is specified, the command displays information only about storage objects that either are or are not constituents of a FlexGroup, depending on the value provided.

## Examples

```
cluster1::> qos workload show -class user-defined
```

Workload Path	Wid	Policy	Group	Vserver	Volume	LUN	Qtree	File
vs2-widl100	100	pg1		vs2	-	-	-	-

Shows all user-defined workloads and the corresponding storage objects on the "cluster1" cluster.

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