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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 >= 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

```
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/GB and peak-iops of 1000IOPS/GB 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:

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

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

```bash
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 vserver.

[-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

<table>
<thead>
<tr>
<th>Name</th>
<th>Vserver</th>
<th>Wklds</th>
<th>Expected IOPS</th>
<th>Peak IOPS</th>
<th>Minimum IOPS</th>
<th>Block Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>apg1</td>
<td>vs1</td>
<td>1</td>
<td>100IOPS/MB</td>
<td>1000IOPS/MB</td>
<td>75IOPS</td>
<td>8K</td>
</tr>
<tr>
<td>apg2</td>
<td>vs1</td>
<td>1</td>
<td>100IOPS/MB</td>
<td>1000IOPS/MB</td>
<td>75IOPS</td>
<td>4K</td>
</tr>
<tr>
<td>extreme</td>
<td>clus-1</td>
<td>0</td>
<td>6144IOPS/TB</td>
<td>12288IOPS/TB</td>
<td>1000IOPS</td>
<td>ANY</td>
</tr>
<tr>
<td>performance</td>
<td>clus-1</td>
<td>0</td>
<td>2048IOPS/TB</td>
<td>4096IOPS/TB</td>
<td>500IOPS</td>
<td>ANY</td>
</tr>
<tr>
<td>value</td>
<td>clus-1</td>
<td>0</td>
<td>128IOPS/TB</td>
<td>512IOPS/TB</td>
<td>75IOPS</td>
<td>ANY</td>
</tr>
</tbody>
</table>

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 can 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 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 limit 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
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"

```bash
[-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 or MB/s, or a combination of comma separated IOPS and MB/s.

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: "100B/s", "10KB/s", "1gb/s", "500MB/s", "1tb/s", "100iops", "100iops,400KB/s", and "800KB/s,100iops"

```bash
[-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

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

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

```bash
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.

```bash
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.
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.

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

Examples

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

Deletes the "p1" policy group.

```bash
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 or MB/s, or a combination of comma
   separated IOPS and MB/s.

   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: "100B/s", "10KB/s", "1gb/s", "500MB/s", "1tb/s", "100iops",
   "100iops,400KB/s", and "800KB/s,100iops"

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.

<i>Note that in a caching-policy name, a hyphen (-) separates read and write caching policies.</i>
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
### 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.

[-adaptive-policy-group <text>] - Adaptive QoS Policy Group Name
Selects the QoS adaptive 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
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.
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.

[-adaptive-policy-group <text>] - Adaptive QoS Policy Group Name
   Selects the QoS adaptive 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
```

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

<table>
<thead>
<tr>
<th>Policy Group</th>
<th>Latency</th>
<th>Network</th>
<th>Cluster</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disk</td>
<td>QoS Max</td>
<td>QoS Min</td>
<td>NVRAM</td>
<td>Cloud</td>
</tr>
<tr>
<td>---------------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td></td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>-total-</td>
<td>5.88ms</td>
<td>308.00us</td>
<td>0ms</td>
<td>434.00us</td>
</tr>
<tr>
<td>5.14ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td>pg1</td>
<td>5.88ms</td>
<td>308.00us</td>
<td>0ms</td>
<td>434.00us</td>
</tr>
<tr>
<td>5.14ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td>-total-</td>
<td>4.17ms</td>
<td>280.00us</td>
<td>0ms</td>
<td>477.00us</td>
</tr>
<tr>
<td>3.42ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td>pg1</td>
<td>4.17ms</td>
<td>280.00us</td>
<td>0ms</td>
<td>477.00us</td>
</tr>
<tr>
<td>3.42ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td>-total-</td>
<td>4.43ms</td>
<td>274.00us</td>
<td>0ms</td>
<td>656.00us</td>
</tr>
<tr>
<td>3.50ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td>pg1</td>
<td>4.43ms</td>
<td>274.00us</td>
<td>0ms</td>
<td>656.00us</td>
</tr>
<tr>
<td>3.50ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td>-total-</td>
<td>4.89ms</td>
<td>276.00us</td>
<td>0ms</td>
<td>699.00us</td>
</tr>
<tr>
<td>3.92ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td>pg1</td>
<td>4.89ms</td>
<td>276.00us</td>
<td>0ms</td>
<td>699.00us</td>
</tr>
<tr>
<td>3.92ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
<td>0ms</td>
</tr>
<tr>
<td></td>
<td>---------</td>
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</tr>
</tbody>
</table>

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.

[-adaptive-policy-group <text>] - Adaptive QoS Policy Group Name }
Selects the QoS adaptive 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
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.

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.

- **{-adaptive-policy-group <text>}** - Adaptive QoS Policy Group Name
  Selects the QoS adaptive 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.
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.

{-adaptive-policy-group <text>} - Adaptive QoS Policy Group Name
   Selects the QoS adaptive 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

<table>
<thead>
<tr>
<th>Policy Group</th>
<th>Disk</th>
<th>Number of HDD Disks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-total-</td>
<td>40%</td>
<td>27</td>
</tr>
<tr>
<td>pg1</td>
<td>22%</td>
<td>5</td>
</tr>
<tr>
<td>slow</td>
<td>10%</td>
<td>10</td>
</tr>
<tr>
<td>fast</td>
<td>8%</td>
<td>12</td>
</tr>
<tr>
<td>_System_Default</td>
<td>7%</td>
<td>20</td>
</tr>
<tr>
<td>-total-</td>
<td>42%</td>
<td>27</td>
</tr>
<tr>
<td>pg1</td>
<td>22%</td>
<td>5</td>
</tr>
<tr>
<td>slow</td>
<td>12%</td>
<td>10</td>
</tr>
<tr>
<td>fast</td>
<td>8%</td>
<td>12</td>
</tr>
<tr>
<td>_System_Default</td>
<td>7%</td>
<td>20</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Policy Group</th>
<th>Disk</th>
<th>Number of HDD Disks</th>
</tr>
</thead>
<tbody>
<tr>
<td>-total-</td>
<td>3%</td>
<td>10</td>
</tr>
<tr>
<td>pg1</td>
<td>1%</td>
<td>24</td>
</tr>
<tr>
<td>-total-</td>
<td>3%</td>
<td>10</td>
</tr>
<tr>
<td>pg1</td>
<td>1%</td>
<td>24</td>
</tr>
<tr>
<td>-total-</td>
<td>3%</td>
<td>10</td>
</tr>
<tr>
<td>pg1</td>
<td>1%</td>
<td>24</td>
</tr>
</tbody>
</table>

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

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
$qos$ statistics volume resource cpu show -node nodeA -iterations 100 -rows 3

<table>
<thead>
<tr>
<th>Workload</th>
<th>ID</th>
<th>CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>-total-  (100%)</td>
<td>-</td>
<td>9%</td>
</tr>
<tr>
<td>vs0vol1-wid-102</td>
<td>102</td>
<td>5%</td>
</tr>
<tr>
<td>vs0vol2-wid-121</td>
<td>121</td>
<td>2%</td>
</tr>
<tr>
<td>vs2_vol0-wid-..</td>
<td>212</td>
<td>2%</td>
</tr>
<tr>
<td>-total-  (100%)</td>
<td>-</td>
<td>8%</td>
</tr>
<tr>
<td>vs0vol1-wid-102</td>
<td>102</td>
<td>5%</td>
</tr>
<tr>
<td>vs0vol2-wid-121</td>
<td>121</td>
<td>2%</td>
</tr>
<tr>
<td>vs2_vol0-wid-..</td>
<td>212</td>
<td>1%</td>
</tr>
</tbody>
</table>

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.

$qos$ statistics volume resource cpu show -node local -vserver vs0 -volume vs0_vol1 -iterations 100

<table>
<thead>
<tr>
<th>Workload</th>
<th>ID</th>
<th>CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>-total-  (100%)</td>
<td>-</td>
<td>2%</td>
</tr>
<tr>
<td>vs0_vol1-wid7..</td>
<td>7916</td>
<td>2%</td>
</tr>
<tr>
<td>-total-  (100%)</td>
<td>-</td>
<td>2%</td>
</tr>
<tr>
<td>vs0_vol1-wid7..</td>
<td>7916</td>
<td>2%</td>
</tr>
<tr>
<td>-total-  (100%)</td>
<td>-</td>
<td>1%</td>
</tr>
<tr>
<td>vs0_vol1-wid7..</td>
<td>7916</td>
<td>1%</td>
</tr>
<tr>
<td>-total-  (100%)</td>
<td>-</td>
<td>2%</td>
</tr>
<tr>
<td>vs0_vol1-wid7..</td>
<td>7916</td>
<td>1%</td>
</tr>
<tr>
<td>-total-  (100%)</td>
<td>-</td>
<td>2%</td>
</tr>
<tr>
<td>vs0_vol1-wid7..</td>
<td>7916</td>
<td>2%</td>
</tr>
</tbody>
</table>

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
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.

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.

[-adaptive-policy-group <text>] - Adaptive QoS Policy Group Name
Selects the QoS workloads that belong to the QoS adaptive 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.
```
cluster1::> qos statistics workload characteristics show -iterations 100 -rows 4
Workload ID IOPS Throughput Request size Read Concurrency
--------------- ------- -------------------- ------------ -----
-vtotal- - 68  176.00KB/s 2650B  7%
-vs1vol0-wid102 102  24  96.00KB/s 4096B 20%
-Scan_Besteff.. 101  23  0KB/s 0B 0%
-vol_1-wid103 103  20  80.00KB/s 4096B 0%
-vol_2-wid104 104  1  0KB/s 0B 0%
-vtotal- - 157  528.00KB/s 3443B 3%
-vol_2-wid104 104  48  192.00KB/s 4096B 0%
-vol_1-wid103 103  43  172.00KB/s 4096B 0%
-vs1vol0-wid102 102  43  164.00KB/s 4096B 14%
-Scan_Besteff.. 101  25  0KB/s 0B 0%
-vtotal- - 274  1016.00KB/s 3797B 2%
-vs1vol0-wid102 102  85  340.00KB/s 4096B 8%
-vol_2-wid104 104  85  340.00KB/s 4096B 0%
-vol_1-wid103 103  84  336.00KB/s 4096B 0%
-Scan_Besteff.. 101  20  0KB/s 0B 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

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

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.
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.

[-adaptive-policy-group <text>] - Adaptive QoS Policy Group Name
Selects the QoS workloads that belong to the QoS adaptive 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

<table>
<thead>
<tr>
<th>Workload</th>
<th>ID</th>
<th>Latency</th>
<th>Network</th>
<th>Cluster</th>
<th>Data</th>
<th>Disk</th>
</tr>
</thead>
<tbody>
<tr>
<td>-total-</td>
<td>110.35ms</td>
<td>110.02ms</td>
<td>0ms</td>
<td>327.00us</td>
<td>0ms</td>
<td></td>
</tr>
<tr>
<td>vs1vol0</td>
<td>111</td>
<td>167.82ms</td>
<td>167.22ms</td>
<td>0ms</td>
<td>603.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>vol1</td>
<td>1234</td>
<td>117.76ms</td>
<td>117.56ms</td>
<td>0ms</td>
<td>191.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>vol2</td>
<td>999</td>
<td>44.24ms</td>
<td>44.05ms</td>
<td>0ms</td>
<td>190.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>-total-</td>
<td>-</td>
<td>38.89ms</td>
<td>38.63ms</td>
<td>0ms</td>
<td>256.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>vol1</td>
<td>1234</td>
<td>27.28ms</td>
<td>27.03ms</td>
<td>0ms</td>
<td>253.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>vs1vol0</td>
<td>111</td>
<td>23.72ms</td>
<td>23.47ms</td>
<td>0ms</td>
<td>249.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>-total-</td>
<td>-</td>
<td>409.81ms</td>
<td>409.65ms</td>
<td>0ms</td>
<td>169.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>vol1</td>
<td>1234</td>
<td>816.92ms</td>
<td>816.80ms</td>
<td>0ms</td>
<td>120.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>vol2</td>
<td>999</td>
<td>407.88ms</td>
<td>407.66ms</td>
<td>0ms</td>
<td>219.00us</td>
<td>0ms</td>
</tr>
<tr>
<td>vs1vol0</td>
<td>111</td>
<td>3.68ms</td>
<td>3.49ms</td>
<td>0ms</td>
<td>193.00us</td>
<td>0ms</td>
</tr>
</tbody>
</table>

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

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

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.
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.

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

Selects the QoS workloads that belong to the QoS adaptive 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
```

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

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
```

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

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.
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.

[-adaptive-policy-group <text>] - Adaptive QoS Policy Group Name
Selects the QoS workloads that belong to the QoS adaptive 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

```
ccluster1::> 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.
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.

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.

- **[-adaptive-policy-group <text>] - Adaptive QoS Policy Group Name**
  Selects the QoS workloads that belong to the QoS adaptive 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
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.

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.
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 delete**

Delete workload

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

**Description**

Deletes a workload from a cluster. When you delete a workload, the associated data object is no longer controlled by its policy group.

You can only delete user-defined workloads. You cannot delete system-defined or preset workloads.

**Parameters**

- `-workload <text>` - Workload Name
  
  Specifies the name of the workload that you want to delete.

**Examples**

```bash
cluster1::> qos workload delete workload1
```

Deletes the "workload1" user-defined workload from the "cluster1" cluster.

**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  Wid  Policy Group Vserver Volume  LUN  Qtree  File Path
------------ ----- ------------ -------- -------- ------ ------ -------
          --------           --------
vs2-wid100  100  pg1          vs2      -        -      -      -
```

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