Provision and manage workloads

Active IQ Unified Manager

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Provision and manage workloads

Provision and manage workloads in Active IQ Unified Manager

The active management feature of Active IQ Unified Manager provides Performance Service Levels, Storage Efficiency Policies, and storage provider APIs for provisioning, monitoring, and managing storage workloads in a data center.

Unified Manager provides this functionality by default. You can disable it from **Storage Management** > **Feature Settings** if you do not plan to use this functionality.

When enabled, you can provision workloads on the ONTAP clusters managed by your instance of Unified Manager. You can also assign policies, such as Performance Service Levels and Storage Efficiency Policies on the workloads and manage your storage environment based on those policies.

This feature enables the following functions:

- Automatic discovery of storage workloads on the added clusters enabling easy storage workload evaluation and deployment
- Provisioning NAS workloads supporting NFS and CIFS protocols
- Provisioning SAN workloads supporting iSCSI and FCP protocols
- Support for both NFS and CIFS protocols on the same file share
- Management of Performance Service Levels and Storage Efficiency Policies
- Assigning Performance Service Levels and Storage Efficiency Policies to storage workloads

The **Provisioning**, **Storage** > **Workloads**, and **Policies** options on the left pane of the UI enable you to modify various configurations.

You can perform the following functions by using these options:

- View storage workloads on the **Storage** > **Workloads** page
- Create storage workloads from the Provision Workload page
- Create and manage Performance Service Levels from Policies
- Create and manage Storage Efficiency Policies from Policies
- Assign policies to storage workloads from the Workloads page

Related information

Policy-based storage management

Workloads overview

Learn about the workloads dashboard in Active IQ Unified Manager

A workload represents the input/output (I/O) operations of a storage object, such as a

volume or LUN. The way the storage is provisioned is based on the expected workload requirements. Workload statistics are tracked by Active IQ Unified Manager only after there is traffic to and from the storage object. For example, the workload IOPS and latency values are available after users start using a database or email application.

The Workloads page displays a summary of the storage workloads of the ONTAP clusters managed by Unified Manager. It provides cumulative at-a-glance information about the storage workloads that conform to the Performance Service Level, as well as the non-conforming storage workloads. It also enables you to assess the total, available, and used capacity and performance (IOPS) of the clusters across your data center.

It is recommended that you assess the number of storage workloads that are non-conforming, unavailable, or not managed by any Performance Service Level, and take the necessary actions to ensure their conformance, capacity usage, and IOPS.

The Workloads page has the following two sections:

- Workloads overview: Provides an overview of the number of storage workloads on the ONTAP clusters managed by Unified Manager.
- Data center overview: Provides an overview of the capacity and IOPS of the storage workloads in the data center. The relevant data is displayed at a data center level and for individual .

Workloads overview section

The workloads overview section provides cumulative at-a-glance information of the storage workloads. The status of the storage workloads is displayed based on assigned and unassigned Performance Service Levels.

- **Assigned**: The following statuses are reported for storage workloads on which Performance Service Levels have been assigned:
  - **Conforming**: Performance of storage workloads is based on the Performance Service Levels assigned to them. If the storage workloads are within the threshold latency defined in the associated Performance Service Levels, they are marked as “conforming”. The conforming workloads are marked in blue.
  - **Non-conforming**: During performance monitoring, storage workloads are marked as “non-conforming” if the storage workloads latency exceeds the threshold latency defined in the associated Performance Service Level. The non-conforming workloads are marked in orange.
  - **Unavailable**: Storage workloads are marked as “unavailable” if they are offline, or if the corresponding cluster is unreachable. The unavailable workloads are marked in red.
- **Unassigned**: Storage workloads that do not have a Performance Service Level assigned to them, are reported as “unassigned”. The number is conveyed by the information icon.

The total workload count is the sum total of the assigned and unassigned workloads.

You can click the total number of workloads displayed in this section, and view them on the Workloads page.

The Conformance by Performance Service Levels subsection displays the total number of available storage workloads:

- Conforming to each type of Performance Service Level
- For which there is a mismatch between the assigned and the recommended Performance Service Levels

Data center overview section

The data center overview section graphically represents the available and used capacity, and IOPS for all of the clusters in the data center. By using this data, you should manage the capacity and IOPS of the storage workloads. The section also displays the following information for the storage workloads across all of the clusters:

- The total, available, and used capacity for all of the clusters in your data center
- The total, available, and used IOPS for all of the clusters in your data center
- The available and used capacity based on each Performance Service Level
- The available and used IOPS based on each Performance Service Level
- The total space and IOPS used by the workloads that have no Performance Service Level assigned

How data center capacity and performance is calculated based on Performance Service Levels

The used capacity and IOPS is retrieved in terms of the total used capacity and performance of all of the storage workloads in the clusters.

The available IOPS is calculated based on the expected latency and recommended Performance Service Levels on the nodes. It includes the available IOPS for all of the Performance Service Levels whose expected latency is less than or equal to their own expected latency.

The available capacity is calculated based on the expected latency and recommended Performance Service Levels on aggregates. It includes the available capacity for all of the Performance Service Levels whose expected latency is less than or equal to their own expected latency.

View workloads in Active IQ Unified Manager

When you add clusters to Unified Manager, the storage workloads on each cluster are automatically discovered and displayed on the Workloads page.

Unified Manager begins to analyze the workloads for recommendation (recommended PSLs) only after I/O operations start on the storage workloads.

FlexGroup volumes and its constituents are excluded.

Workloads overview

The Workloads Overview page displays the overview of the workloads in the data center and the space and performance overview of the data center.

- **Workloads Overview** panel: Displays the total number of workloads and the number of workloads with or without PSLs assigned on them. The break-up of the workload count for each PSL is also displayed. Clicking the counts takes you to the **All Workloads** view with the filtered workloads. You can also view the number of workloads that do not conform with the system recommendation and assign the system-recommended PSLs to them by clicking the **Assign System-Recommended PSLs** button.
- **Data Center Overview** panel: Displays the available and used space (TiB) and performance (IOPS) of the data center. A break-up of the available and used space (TiB) and performance (IOPS) of all the workloads under each PSL is also displayed.

All workloads view

The **Storage > Workloads > All Workloads** page lists the storage workloads associated with the ONTAP clusters managed by Unified Manager.

For the newly-discovered storage workloads on which there have been no I/O operations, the status is “Waiting for I/O”. After I/O operations begin on the storage workloads, Unified Manager begins the analysis and the workload status changes to “Learning…”. After the analysis is complete (within 24 hours from the beginning of the I/O operations), the recommended PSLs are displayed for the storage workloads.

The page also enables you to assign Storage Efficiency Policies (SEPs) and Performance Service Levels (PSLs) to storage workloads. You can perform multiple tasks:

- Add or provision storage workloads
- View and filter the list of workloads
- Assign PSLs to storage workloads
- Evaluate system-recommended PSLs and assign them to workloads
- Assign SEPs to storage workloads

Adding or provisioning storage workloads

You can add or provision the storage workloads to supported LUNs (supporting both iSCSI and FCP protocols), NFS file shares, and SMB shares.

Steps

1. Click **Storage > Workloads > All Workloads > Create**.
2. Create workloads. For information, see Provisioning and managing workloads.

Viewing and filtering workloads

On the All Workloads screen, you can view all the workloads in your data center or search for specific storage workloads based on either their PSLs or names. You can use the filter icon to enter specific conditions for your search. You can search by different filter conditions, such as by the host cluster or storage VM. The **Capacity Total** option allows filtering by the total capacity of the workloads (by MB). However, in this case, the number of workloads returned might vary, because the total capacity is compared at a byte level.

For each workload, information, such as the host cluster and storage VM is displayed, along with the assigned PSL and SEP.

The page also enables you to view the performance details of a workload. You can view detailed information about the IOPS, capacity, and latency of the workload by clicking the **Choose / Order Columns** button and selecting specific columns to view. The Performance View column displays the average and peak IOPS for a workload, and you can click the workload analyser icon to view the detailed IOPS analysis.

Analyzing performance and capacity criteria for a workload

The **Analyze Workload** button on the **IOPS Analysis** pop-up takes you to the Workload Analysis page, where you can select a time range and view the latency, throughput, and capacity trends for the selected workload. For more information about workload analyzer, see Troubleshooting workloads using the workload analyzer.

You can view performance information about a workload to help with troubleshooting by clicking the bar chart icon in the **Performance View** column. To view performance and capacity charts on the Workload Analysis page to analyze the object, click the **Analyze Workload** button.

For more information, see What data does the workload analyzer display.

Assign policies to workloads in Active IQ Unified Manager

You can assign Storage Efficiency Policies (SEPs) and Performance Service Levels (PSLs) to storage workloads from the All Workloads page by using the different navigation options.

Assign policies to a single workload

You can assign either a PSL or an SEP or both, to a single workload. Follow these steps:

1. Select the workload.
2. Click the edit icon next to the row, and then click **Edit**.

   The **Assigned Performance Service Level** and **Storage Efficiency Policy** fields are enabled.

3. Select the required PSL or SEP, or both.
4. Click the check icon to apply the changes.

You can also select a workload and click **More Actions** to assign the policies.

Assign policies to multiple storage workloads

You can assign a PSL or an SEP to multiple storage workloads together. Follow these steps:

1. Select the check boxes for the workloads to which you want to assign the policy, or select all the workloads in your data center.
2. Click **More Actions**.
3. For assigning a PSL, select **Assign Performance Service Level**. For assigning an SEP, select **Assign Storage Efficiency Policy**. A pop-up is displayed for you to select the policy.
4. Select the appropriate policy and click **Apply**. The number of workloads on which the policies are assigned are displayed. The workloads on which the policies are not assigned are also listed, with the cause.

Applying policies on workloads in bulk might take some time depending on the number of workloads selected. You can click the **Run in background** button and continue with other tasks while the operation runs in the background. When the bulk assignment is complete, you can view the completion status. If you are applying a PSL on multiple workloads, you cannot trigger another request when the previous job of bulk assignment is running.

Assign system-recommended PSLs to workloads

You can assign system-recommended PSLs to those storage workloads in a data center that have no PSLs assigned, or the assigned PSLs do not match the system recommendation. To use this functionality, click the **Assign System Recommended PSLs** button. You do not have to select specific workloads.

The recommendation is internally determined by system analytics, and is skipped for those workloads whose IOPS and other parameters do not coincide with the definitions of any available PSL. Storage workloads with `Waiting for I/O` and Learning statuses are also excluded.

There are special keywords that Unified Manager looks for in the workload name to override the system analytics and recommend a different PSL for the workload. When the workload has the letters “ora” in the name, the **Extreme Performance**PSL is recommended. And when the workload has the letters “vm” in the name, the **Performance**PSL is recommended.

Also see the knowledge base (KB) article ActiveIQ Unified Manager 'Assign System Recommended Performance Service Level' is not adaptive to a highly variable workload

Provision file share volumes in Active IQ Unified Manager

You can create file share volumes that support CIFS/SMB and NFS protocols, on an existing cluster and Storage Virtual Machine (storage VM) from the Provision Workload page.

Before you begin

- The storage VM must have space for provisioning the file share volume.
- Either or both of the SMB and NFS services should be enabled on your storage VM.
- For selecting and assigning the Performance Service Level (PSL) and Storage Efficiency Policy (SEP) on the workload, the policies must have been created before you start creating the workload.

Steps

1. On the **Provision Workload** page, add the name of the workload that you want to create, and then select the cluster from the available list.
2. Based on the cluster that you have selected, the **STORAGE VM** field filters the available storage VMs for that cluster. Select the required storage VM from the list.

   Based on the SMB and NFS services supported on the storage VM, the NAS option is enabled in the Host Information section.

3. In the Storage and Optimization section, assign the storage capacity and PSL, and optionally, an SEP for the workload.

   The specifications for the SEP are assigned to the LUN and the definitions for the PSL are applied to the workload when it is created.

4. Select the **Enforce performance limits** check box if you want to enforce the PSL that you have assigned to the workload.

   Assigning a PSL to a workload ensures that the aggregate on which the workload is created can support the performance and capacity objectives defined in the respective policy. For example, if a workload is assigned "Extreme Performance "PSL, the aggregate on which the workload is to be provisioned should have the capability of supporting the performance and capacity objectives of the "Extreme Performance" policy, such as SSD storage.

   Unless you select this check box, the PSL is not applied to the workload, and the status of the workload on the dashboard appears as unassigned.

5. Select the **NAS** option.

   If you cannot see the **NAS** option enabled, verify whether the storage VM that you have selected supports either SMB or NFS, or both.

If your storage VM is enabled for both SMB and NFS services, you can select the **Share by NFS** and **Share by SMB** check boxes and create a file share that supports both NFS and SMB protocols. If you want to create either an SMB or a CIFS share, select only the respective check box.

6. For NFS file share volumes, specify the IP address of the host or network to access the file share volume. You can enter comma-separated values for multiple hosts.

   On adding the host IP address, an internal check runs for matching the host details with the storage VM and the export policy for that host is created, or in case there is an existing policy, it is reused. If there are several NFS shares created for the same host, then an available export policy for the same host with matching rules is reused for all the files shares. The function of specifying rules of individual policies or reusing policies by providing specific policy keys is available when you provision the NFS share by using APIs.

7. For an SMB share, specify which users or user groups can access the SMB share and assign the required permissions. For each group of users, a new access control list (ACL) is generated during the file share creation.
8. Click **Save**.

   The workload is added to the list of storage workloads.

Provision LUNs in Active IQ Unified Manager

You can create LUNs that support CIFS/SMB and NFS protocols, on an existing cluster and Storage Virtual Machine (storage VM) from the Provision Workload page.

Before you begin

- The storage VM must have space for provisioning the LUN.
- Both iSCSI and FCP must be enabled on the storage VM on which you create the LUN.
- For selecting and assigning the Performance Service Level (PSL) and Storage Efficiency Policy (SEP) on the workload, the policies must have been created before you start creating the workload.

Steps

1. On the **Provision Workload** page, add the name of the workload that you want to create, and then select the cluster from the available list.

   Based on the cluster that you have selected, the **STORAGE VM** field filters the available storage VMs for that cluster.

2. Select the storage VM from the list that supports the iSCSI and FCP services.

   Based on your selection, the SAN option is enabled in the Host Information section.

3. In the **Storage and Optimization** section, assign the storage capacity and PSL, and optionally, the SEP for the workload.

   The specifications for the SEP are assigned to the LUN and the definitions for the PSL are applied to the workload when it is created.

4. Select the **Enforce performance limits** check box if you want to enforce the assigned PSL on the workload.

Assigning a PSL to a workload ensures that the aggregate on which the workload is created can support the performance and capacity objectives defined in the respective policy. For example, if a workload is assigned the "Extreme Performance" PSL, the aggregate on which the workload is to be provisioned should have the capability of supporting the performance and capacity objectives of the "Extreme Performance" policy, such as SSD storage.

Unless you select this check box, the PSL is not applied to the workload, and the status of the workload on the dashboard appears as `unassigned`.

5. Select the **SAN** option. If you cannot see the **SAN** option enabled, verify whether the storage VM that you have selected supports iSCSI and FCP.
6. Select the host OS.
7. Specify the host mapping to control access of the initiators to the LUN. You can assign existing initiator groups (igroups), or define and map new igroups.

   If you create a new igroup while provisioning the LUN, you need to wait till the next discovery cycle (up to 15 minutes) for using it. It is therefore recommended that you use an existing igroup from the list of available igroups.

   If you want to create a new igroup, select the **Create a new initiator group** button, and enter the information for the igroup.

8. Click **Save**.

   The LUN is added to the list of storage workloads.

Manage Performance Service Levels

Manage Performance Service Levels in Active IQ Unified Manager

A Performance Service Level (PSL) enables you to define the performance and storage objectives for a workload. You can assign a PSL to a workload when initially creating the workload, or afterwards by editing the workload.

The management and monitoring of storage resources are based on Service Level Objectives (SLOs). SLOs are defined by service level agreements that are based on required performance and capacity. In Unified Manager, SLOs refer to the PSL definitions of the applications that are running on NetApp storage. Storage services are differentiated based on the performance and utilization of the underlying resources. A PSL is a description of the storage service objectives. A PSL enables the storage provider to specify the performance and capacity objectives for the workload. When you assign a PSL on a workload, the corresponding workload on ONTAP is managed by its performance and capacity objectives. Each PSL is governed by peak, expected, and absolute minimum IOPs, and expected latency.

Unified Manager has the following types of PSLs:

- **System-defined**: Unified Manager provides a few canned policies that cannot be changed. These predefined PSLs are:
  - Extreme Performance
  - Performance

- Value

  The Extreme Performance, Performance, and Value PSLs are applicable for most of the common storage workloads in a data center.

  Unified Manager also offers three Performance Service Levels for database applications. These are extremely high-performance PSLs that support bursty IOPS and are appropriate for database applications with the highest throughput demand.

- Extreme for Database Logs
- Extreme for Database Shared Data
- Extreme for Database Data

- **User-defined**: If the predefined Performance Service Levels do not meet your requirements, then you can create new PSLs to meet your needs. For information, see Create and edit Performance Service Levels.
- **Beyond Extreme**: The Beyond Extreme PSLs are the system-recommended PSLs that are suggested for workloads that demand IOPs higher than Extreme. The workloads are internally analyzed based on their IOPS, capacity, and latency, and a Beyond Extreme PSL is recommended for each of these workloads on the **Storage > Workloads > All Workloads** screen. You can apply the PSLs to the workloads to ensure an optimum performance.

  The IOPs parameters for the workloads are dynamically generated, depending on the workload behavior, and appended to the name of the Beyond Extreme PSL in the format `Beyond Extreme <number-(peak IOPS/TB)> <number(expected IOPS/TB)>`. For example, if the system determines a workload to have the peak and expected IOPs as `106345` and `37929` respectively, the Beyond Extreme PSL that is generated for the workload is named as `Beyond Extreme 106345 37929`. Though these PSLs are recommended by the system, when you assign them to workloads, these PSLs are labeled as `User-defined` in type.

Manage workloads by assigning PSLs

You can access PSLs from the **Policies** > **Performance Service Levels** page and by using the storage provider APIs. Managing storage workloads by assigning PSLs to them is convenient as you do not have to individually manage the storage workloads. Any modifications can also be managed by reassigning another PSL rather than managing them individually. Unified Manager helps you to assign PSLs on your workloads based on internal assessment and recommendations.

For information on assigning system-recommended PSLs to workloads, see Assign system-recommended PSLs to workloads

The Performance Service Levels page lists the available PSL policies and enables you to add, edit, and delete them.

You cannot modify a PSL that is system-defined or that is currently assigned to a workload. You cannot delete a PSL that is assigned to a workload, or if it is the only available PSL.

This page displays the following information:

Field	Description
Name	Name of the PSL.
Type	Whether the policy is system-defined or user-defined.

Field	Description
Expected IOPS/TB	Minimum number of IOPS that an application is expected to perform on a LUN or file share. Expected IOPS specifies the minimum expected IOPS allocated, based on the storage object allocated size.
Peak IOPS/TB	Maximum number of IOPS that an application can perform on a LUN or file share. Peak IOPS specifies the maximum possible IOPS allocated, based on the storage object allocated size or the storage object used size. Peak IOPS are based on an allocation policy. The allocation policy is either allocated-space or used-space. When the allocation policy is set to allocated-space, the peak IOPS is calculated based on the size of the storage object. When the 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. By default, the allocation policy is set to used-space.
Absolute minimum IOPS	The absolute minimum IOPS is used as an override, when the expected IOPS is less than this value. The default values of the system-defined PSLs are the following: • Extreme Performance: If expected IOPS >= 6144/TB, then absolute minimum IOPS = 1000 • Performance: If expected IOPS >= 2048/TB and < 6144/TB, then absolute minimum IOPS = 500 • Value: If expected IOPS >= 128/TB and < 2048/TB, then absolute minimum IOPS = 75 The default values of the system-defined database PSLs are the following: • Extreme for Database Logs: If expected IOPS >= 22528, then absolute minimum IOPS = 4000 • Extreme for Database Shared Data: If expected IOPS >= 16384, then absolute minimum IOPS = 2000 • Extreme for Database Data: If expected IOPS >= 12288, then absolute minimum IOPS = 2000 The higher value of the absolute minimum IOPS for custom PSLs can be a maximum of 75000. The lower value is calculated as the following: 1000/expected latency
Expected latency	Expected latency for storage IOPS in milliseconds per operation (ms/op).

Field	Description
Capacity	Total available and used capacity in the clusters.
Workloads	Number of storage workloads that have been assigned the PSL.

For information about how the peak IOPS and expected IOPs help in achieving consistent differentiated performance on ONTAP clusters, see the following KB article: What is Performance Budgeting?

Events generated for workloads breaching the threshold defined by PSLs

Note that if workloads exceed the expected latency value for 30% of the time during the previous hour, Unified Manager generates one of the following events to notify you of a potential performance issue:

- Workload Volume Latency Threshold Breached as defined by Performance Service Level Policy
- Workload LUN Latency Threshold Breached as defined by Performance Service Level Policy.

You may want to analyze the workload to see what may be causing the higher latency values.

For more information, see the following links:

- Volume events
- What happens when a performance threshold policy is breached
- How Unified Manager uses workload latency to identify performance issues
- What performance events are

System-defined PSLs

The following table provides information about the system-defined PSLs:

Performance Service Level	Description and use case	Expected latency (ms/op)	Peak IOPS	Expected IOPS	Absolute minimum IOPS
Extreme Performance	Provides extremely high throughput at a very low latency Ideal for latency-sensitive applications	1	12288	6144	1000
Performance	Provides high throughput at a low latency Ideal for database and virtualized applications	2	4096	2048	500

Performance Service Level	Description and use case	Expected latency (ms/op)	Peak IOPS	Expected IOPS	Absolute minimum IOPS
Value	Provides high storage capacity and moderate latency Ideal for high-capacity applications such as email, web content, file shares, and backup targets	17	512	128	75
Extreme for Database Logs	Provides maximum throughput at the lowest latency. Ideal for database applications supporting database logs. This PSL provides the highest throughput because database logs are extremely bursty and logging is constantly in demand.	1	45056	22528	4000
Extreme for Database Shared Data	Provides very high throughput at the lowest latency. Ideal for database applications data that is stored in a common data store, but is shared across databases.	1	32768	16384	2000

Performance Service Level	Description and use case	Expected latency (ms/op)	Peak IOPS	Expected IOPS	Absolute minimum IOPS
Extreme for Database Data	Provides high throughput at the lowest latency. Ideal for database applications data, such as database table information and metadata.	1	24576	12288	2000

Create and edit Performance Service Levels in Active IQ Unified Manager

When the system-defined Performance Service Levels do not match your workload requirements, you can create your own Performance Service Levels that are optimized for your workloads.

Before you begin

- You must have the Application Administrator role.
- The Performance Service Level name must be unique, and you cannot use the following reserved keywords:

  `Prime`, `Extreme`, `Performance`, `Value`, `Unassigned`, `Learning`, `Idle`, `Default`, and `None`.

You create and edit custom Performance Service Levels from the Performance Service Levels page by defining the service level objectives you require for the applications that will access storage.

You cannot modify a Performance Service Level if it is currently assigned to a workload.

Steps

1. In the left navigation pane under **Settings**, select **Policies** > **Performance Service Levels**.
2. In the **Performance Service Levels** page, click the appropriate button depending on whether you want to create a new Performance Service Level or if you want to edit an existing Performance Service Level.

To…	Follow these steps…
Create a new Performance Service Level	Click **Add**.
Edit an existing Performance Service Level	Select an existing Performance Service Level, and then click **Edit**.

   The page to add or edit a Performance Service Level is displayed.

3. Customize the Performance Service Level by specifying the performance objectives, and then click **Submit** to save the Performance Service Level.

You can apply the new or changed Performance Service Level to workloads (LUNs, NFS File Shares, CIFS Shares) from the Workloads page or when provisioning a new workload.

Manage Storage Efficiency Policies

Manage Storage Efficiency Policies in Active IQ Unified Manager

A Storage Efficiency Policy (SEP) enables you to define the storage efficiency characteristics of a workload. You can assign an SEP to a workload when initially creating the workload, or afterwards by editing the workload.

Storage efficiency includes using technologies, such as thin provisioning, deduplication, and data compression that increase storage utilization and decrease storage costs. While creating SEPs, you can use these space-saving technologies either individually or together to achieve maximum storage efficiency. When you associate the policies with your storage workloads, the specified policy settings are assigned to them. Unified Manager enables you to assign system-defined and user-defined SEPs to optimize storage resources in your data center.

Unified Manager provides two system-defined SEPs: High and Low. These SEPs are applicable to most of the storage workloads in a data center, however, you can create your own policies if the system-defined SEPs do not meet your requirements.

You cannot modify an SEP that is system-defined or that is currently assigned to a workload. You cannot delete an SEP that is assigned to a workload, or if it is the only available SEP.

The Storage Efficiency Policies page lists the available SEPs and enables you to add, edit, and delete customized SEPs. This page displays the following information:

Field	Description
Name	Name of the SEP.
Type	Whether the policy is system-defined or user-defined.
Space Reserve	Whether the volume is thin-provisioned or thick-provisioned.
Deduplication	Whether deduplication is enabled on the workload: • Inline: Deduplication occurs while being written on the workload • Background: Deduplication occurs in the workload • Disable: Deduplication is disabled on the workload
Compression	Whether data compression is enabled on the workload: • Inline: Data compression occurs while being written on the workload • Background: Data compression occurs in the workload • Disable: Data compression is disabled on the workload
Workloads	Number of storage workloads that have been assigned the SEP

Guidelines for creating a custom Storage Efficiency Policy

If the existing SEPs do not meet policy requirements for your storage workloads, you can create a custom SEP. However, it is recommended that you attempt to use the system-defined SEPs for your storage workloads, and only create custom SEPs if necessary.

You can view the SEP assigned to workloads in the All Workloads page and in the Volume / Health details page. You can view the cluster-level data reduction ratio (without Snapshot copies) based on these storage efficiencies in the Capacity panel on the Dashboard and in the Capacity: All Clusters view.

Create and edit Storage Efficiency Policies in Active IQ Unified Manager

When the system-defined Storage Efficiency Policies do not match your workload requirements, you can create your own Storage Efficiency Policies that are optimized for your workloads.

Before you begin

- You must have the Application Administrator role.
- The Storage Efficiency Policy name must be unique, and you cannot use the following reserved keywords:

  `High`, `Low`, `Unassigned`, `Learning`, `Idle`, `Default`, and `None`.

You create and edit custom Storage Efficiency Policies from the Storage Efficiency Policies page by defining the storage efficiency characteristics you require for the applications that will access storage.

You cannot modify a Storage Efficiency Policy if it is currently assigned to a workload.

Steps

1. In the left navigation pane under **Settings**, select **Policies** > **Storage Efficiency**.
2. In the **Storage Efficiency Policies** page, click the appropriate button depending on whether you want to create a new Storage Efficiency Policy or if you want to edit an existing Storage Efficiency Policy.

To…	Follow these steps…
Create a new Storage Efficiency Policy	Click **Add**
Edit an existing Storage Efficiency Policy	Select an existing Storage Efficiency Policy and click **Edit**

   The page to add or edit a Storage Efficiency Policy is displayed.

3. Customize the Storage Efficiency Policy by specifying the storage efficiency characteristics, and then click **Submit** to save the Storage Efficiency Policy.

You can apply the new or changed Storage Efficiency Policy to workloads (LUNs, NFS File Shares, CIFS Shares) from the Workloads page or when provisioning a new workload.

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