



# AnyStor-E

Online Manual 2.0.8

Gluesys Co., Ltd.

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# AnyStor-E Administrator Manual

## Preface

- Version : 2.0.8
- This manual provides the functionalities and instructions of **AnyStor Enterprise** that is based on GUI configuration.
- For any questions or opinions on the manual, please make an inquiry to the email below.
  - ac2@gluesys.com support@gluesys.com

## Introduction to AnyStor-E Cluster Storage

AnyStor-E is a **Scale-Out Storage Appliance Software**.

As a **Software-Defined Storage**, it is free to install and manage without any restrictions on the hardware.

Build a system starting from a **single node** and install extra node seamlessly with **zero downtime**.

You can prepare your storage followed by the service needs by the **linear improvement** on the performance.

### AnyStor-E Product Introduction

SCALE UP	VS.	SCALE OUT
	Composition	
Able to raise performance by changing the CPU or adding more RAM Expands vertically within the limit	Scalability	Divides the work load to multiple devices Expands horizontally almost to infinity
Sharp increase of cost along with the performance	Cost	Relatively lower cost when upgrading
Vulnerable to the failure due to the concentrated load on a single server	Failure	Distributes read/write to multiple servers Lower possibility of entire server failure

**AnyStor-E Administrator** integrates scattered resources around the cluster to **simplify the administration and fault handling procedure**.

AnyStor-E provides standard network protocol services, which are **NFS** and **CIFS**, to support diverse OS clients and suggests storage services in virtual environments such as OpenStack through **Native API**.

## AnyStor-E Software Operating Environment

### Hardware Requirements

Component	Minimum	Recommended	Notes
CPU	4 cores	8 cores or above	16 cores if requiring bandwidth above 1 GB/s.
Memory	4 GB	16 GB	Extension required due to clients.
NIC	2	5	Due to management/service/storage network configurations.
Storage		LSI RAID Controller	The storage configuration depends on the type of service.

## Network Requirements

Component	Specification	Number of Ports	Necessity	Description
Service Network	1G / 10G	1 - 4	Essential	Connect NFS/CIFS services through client network.
Storage Network	1G / 10G / IB	1 - 4	Essential	For exchanging cluster status and replicating data between nodes.
Management Network	100M / 1G	1	Optional	For accessing the CLI or GUI. If not present, the service network will take the place.

Basically, **Service Network** and **Storage Network** will be configured as a bond to secure the availability, and can be extended from a single port to 4 ports.

**Service Network** and **Management Network** can be used for the same purpose.

The **Service Network** provides service continuity by allocating IP pools for the failover.

## AnyStor-E Architecture

### AnyStor-E Basic Architecture

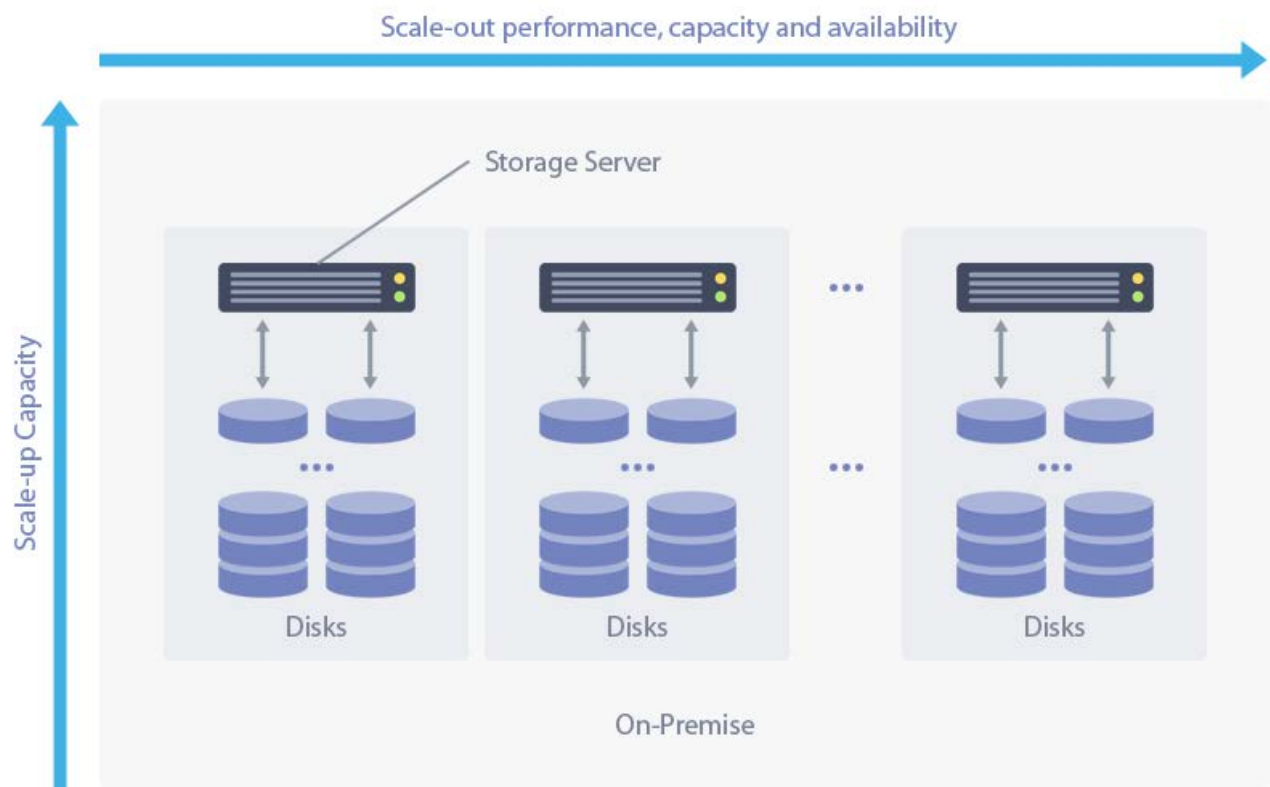


AnyStor-E **integrates all the software component to a single node** to manage the service.

Component	Description
<b>Top Layer</b>	The layer controls MDS/Manager/GW modules which <b>manages the hardware and software of your cluster and node and provides file and block services.</b>
--> MDS	As a module that loads up to three nodes, it synchronizes the configuration and status of a cluster and configures a quorum to check the stability of a cluster.
--> Manager	Selects and manages a node from one of the first three nodes and manages time server and event history database for cluster synchronization.
--> GW	It is loaded on every node, providing the NFS/CIFS service along with HA clustering.
<b>Bottom Layer</b>	The layer which loads the back end cluster file system, which can hold file systems such as <b>GlusterFS, Ceph, and MAHA-FS.</b>
--> DS	A module which can be loaded in every node, managing the connection between back end file system and GW module.

## RedHat GlusterFS Adaptation

### GlusterFS for On-Premise Architecture



**GlusterFS** is a type of cluster file system.

Feature	Purpose
Linear Extension Architecture	An architecture for distributed metadata provides exceptional performance and stability by avoiding the centralized bottleneck.
Assuring Localization	The legacy file system architecture built in every node guarantees superior performance predictability and data integrity.
Hash-based File Distribution Architecture	Data will be accessed by using a hash to filenames and gives high performance on large data processes. It might show performance loss when processing data lower than 10 KB.

# 1 Cluster Management

## 1.1 Preface

**AnyStor Enterprise** provides cluster and node management features through GUI.

Through this, it can verify and respond on **various events and performance data** that takes place across the entire cluster.

You can control the client's access and easily configure several distributed nodes through time settings and power management.

### About Cluster Management Section

Category	Description
<b>Overview</b>	A dashboard presenting the summary of system informations of all nodes of the cluster.
<b>Cluster Node Management</b>	View the information and status of all active or standby physical nodes. Used for shifting them as active or maintenance mode.
<b>Event</b>	Audits all events and tasks occurred in the entire node along with the adjustment in hardwares and softwares.
<b>Network Settings</b>	Manages the overall network configuration on service IP pool, DNS, routing, and security zone.

<b>Email Settings</b>	Manages email settings to receive notification on events and tasks occurred in the system.
<b>Time Settings</b>	Manages time synchronization of all nodes through NTP or manual time settings.
<b>Power Management</b>	Manages the power of all nodes in the cluster.
<b>Log Backup</b>	Provides download options on the system log.
<b>License Management</b>	Provides license search, license registration, and product code verification of your cluster.

### Caution

Some actions can be restricted if a node is down while managing the cluster. However, the configurations will be automatically synchronized with the cluster information through reloading the configuration information when the node is recovered.

## 1.2 Overview

Overview page shows the overall status of the cluster through collecting and summarizing every information from the entire node.

In this section, it features the list of node status, usage and available space of cluster volume, client access status, and the list of the recent event.

Category	Location	Description
Cluster Status	Top left	Shows the status of the entire cluster.
Node Status	Top left	Summarizes the status of each node, resource usage, and the performance.
Client Connection Status	Middle left	Shows the number of clients of each node and I/O status graph.
Recent Events	Bottom left	Displays recently occurred events.
Cluster Usage	Top Right	Displays the usage and available space of each cluster volume in a bar graph.
Performance Statistics	Bottom Right	Shows a graph on CPU, network, and disk I/O usage of a cluster.

### Tip

Check the status light of **Cluster Status**. If it is not green, look for its cause from the event page or the task page.  
Check **Cluster Usage**. If the volume usage exceeds 95%, performance might fall.  
Check **Cluster CPU**. If it exceeds 75%, the resource needs to be checked.

### 1.2.1 Node Status Table

- About Node Status Table
  - The information on the node will be described in a single row.
  - There is a status bar showing a status light and a status message on the top of the table.
  - A single row shows the node status, network speed, storage speed, and disk status of a node.
  - The bottom row of the table shows the sum of network and storage speed and disk usage of all node.
- Cluster Status
  - The status light and status message on the cluster will be displayed.
  - **The status light will display the color red, yellow, and green which indicates the status Error, Warning, and OK of the cluster.**



- When an error occurs among the nodes, the cluster status will show the word Error. When there is a node in a Warning status and no error, the cluster status will show as Warning.
- When neither of the nodes has Error or Warning status, the cluster status will show as OK.
- The status message will display the cause of Error or Warning status.
- Node Status
  - From this menu, it will display the node's status, ID, management IP, and service IP.

Category	Description
<b>Status</b>	Displays a node's condition The menu will be composed of status light and stage value of a node. The status light will display the color red, yellow, and green which indicates the status Error, Warning, and OK of the cluster. Stage value is a value marking the current node for the user's convenience. For more information, refer to <a href="#">1.3.5.2 Node Stage</a> .
<b>ID</b>	Unique ID of a node
<b>Management IP</b>	IP for the management which will be statically allocated to the node.
<b>Service IP</b>	Allocated IP for the service Service IP is allocated from one of the IPs from service IP pool on the <b>Service IP Settings</b> tab located on the Cluster Management > Network Settings page and will be dynamically distributed depending on the node's condition. Therefore, if the client is connected through service IP, it automatically connects to another available node in the cluster when the system failure occurs. Service IP may exist more than one per node or none.

- Network Speed
  - Network speed is displayed in input speed and output speed.
  - Network speed refers to the amount of network data processed by the node per second.

Category	Description
<b>Input Speed</b>	The speed of data entering the cluster node's network.
<b>Output Speed</b>	The speed of data going out from the cluster node's network.

- Storage Speed
  - Storage speed is displayed in input speed and output speed.
  - Storage speed refers to the amount of data going in and out of the storage device per second.
  - A sub volume, which consists the cluster volume, will be a target to measure data I/O speed.

Category	Description
<b>Input Speed</b>	The speed of data entering the cluster node's storage device.
<b>Output Speed</b>	The speed of data going out from the cluster node's storage device.

- Disk
  - This part displays disk pool usage, overall space, and the usage in a percentage from each node.

Category	Description
<b>Usage</b>	Amount of space allocated to compose the cluster volume from the disk pool of a node
<b>Usage (%)</b>	Percentage of space allocated to compose the cluster volume from the disk pool of a node
<b>Total Space</b>	Overall space of disk pool of a node

## 1.2.2 Client Connection Status Graph

- About Client Connection Status Graph
  - Displays a graph (blue) showing the number of clients connected to the node and another graph (orange) showing the service performance.
- Client
  - Shows the number of a client connected to each node in a blue bar graph.
  - The criterion of the graph will be displayed on the left.
  - The client connection will imply that the cluster volume has been mounted through NFS or CIFS network file system service.
  - NFS and CIFS are shown as an identical connection.
  - When the cluster volume is mounted from an external node, the value of a node operated with NFS or CIFS server used by the client will increase.
- Performance Graph
  - Shows the service performance of each node in an orange bar graph.
  - The criterion of the graph will be displayed on the right.
  - The service performance will be measured by consolidating the sum of I/O per criteria between client and server of each node.

### 1.2.3 Recent Events

- About Recent Events
  - Generates recently occurred events.
  - Information on each event will be shown in a single row.
  - Each row shows the status, occurred time, description, device name, and type of the event.

Category	Description
Status	One of the three event level, Error, Warning, and Info will appear and each level is shown as red, yellow, and green light.
Time	Shows when the event occurred. Displayed as "yyyy/mm/dd hh : mm : ss".
Contents	Describes the details of the event.
Device	Shows the name of the device where the event occurred. If it occurs in a specific node, it shows the node ID, and if it is from the entire node of the cluster, it shows the text 'cluster'.
Type	Indicates which function the event is from and if the cause is not specified, it will show the text 'DEFAULT'.

- Sorting Events
  - The default setting is to display in order by setting the recent event on the top (in reverse chronological order) but also can be modified by its needs.
  - If you click the header at the top that lists column names, the data below will be sorted in alphabetical or chronological order depending on its content.
- Event Details
  - Each event will show its details as you select.
  - The details will be displayed in a form of a dictionary of key-value.
  - Categories are ID, Scope, Level, Category, Message, Details, Time, and Quiet.

Category	Description
ID	The identifier of the event.
Scope	View the location where the event occurred. When it happened in a node, it will show the node ID and if it is the cluster, it will show the text, "cluster".
Level	Shows one of the three event level: Error, Warning, and Info.

<b>Category</b>	Indicates which function the event is from and if the cause is not specified, it will show the text 'DEFAULT'.
<b>Message</b>	The text describing the content of the event.
<b>Details</b>	Displays more information on the event than Message. It is shown in a form of a dictionary of key-value.
<b>Time</b>	Shows when the event occurred. Displayed as "yyyy/mm/dd hh : mm : ss".
<b>Quiet</b>	If the value is not 0, it will be displayed as an event but will not be informed by email.

## 1.2.4 Cluster Usage Graph

- Displays the usage and available space of each cluster volume in a bar graph.
- Each bar graph indicates each existing cluster volume.
- When there is no cluster volume to show, it will display a message "There is no data for the cluster usage."

## 1.2.5 Performance Statistics

- About Performance Statistics
  - Generates the progress of CPU usage, volume, and network I/O of the entire cluster in a line graph.
  - The chronological range can be selected between 1 Hour, 1 Day, 1 Week, 1 Month, 6 Months, and 1 Year.
  - In case of 1 Hour and 1 Day, the statistics will be refreshed every 10 seconds.
  - There are three graphs, Cluster CPU, Cluster Disk I/O, and Cluster Service Network I/O.
- Cluster CPU Graph
  - Displays the CPU usage of the nodes in the cluster.
  - Each CPU statistics will display its graph in different colors.
  - Types of CPU statistics are the system, user, iowait, irq, softirq, and nice.

Name	Description
<b>system(Green)</b>	CPU spent running the kernel
<b>user(Yellow)</b>	CPU spent running user processes that have been un-niced
<b>iowait(Light blue)</b>	CPU spent while the process is waiting for the data I/O to finish
<b>irq(Orange)</b>	CPU spent processing the interrupt request from the hardware
<b>softirq(Red)</b>	CPU spent processing the interrupt request from the software
<b>nice(Blue)</b>	CPU spent running user processes that have been niced

- Cluster Disk I/O Graph
  - Displays the sum of all data I/O of every cluster volume existing in the cluster.
  - The graph will display read (green) and write (yellow) of the disks.
- Cluster Service Network I/O Graph
  - **Displays the sum of network data going through service network interface of every node from the cluster.**
  - Service network interface is a network that can mount storages through NFS/CIFS protocols.
  - The graph will display send (yellow) and receive (green) of a network.

## 1.3 Cluster Node Management

### 1.3.1 About Cluster Node Management

**Cluster Node Management** page gathers and displays the information for the management of the cluster node and modifies stages.

A stage is a value that shows the status of your cluster and node designated by its needs from the cluster management software or the user.

When the stage of a cluster or node is set as **Support**, its state will be **Read Only** (unable to create, modify, or delete).

## 1.3.2 Contents of Cluster Node Management Page

### 1.3.2.1 Cluster Management

- Located at the top of the **Cluster Node Management** page.
- Provides information on cluster management.
- The column name of the header rows are Cluster Name, Stage, Status Report, Total Size, Usage, and Action.

### 1.3.2.2 Node Management

- Located at the bottom of the **Cluster Node Management** page.
- Gathers information on each node and shows in a single row.
- The column name of the header row are Node Name, Stage, Status, Version, Management IP, Service IP, and Action.

## 1.3.3 Cluster Management

### 1.3.3.1 About Cluster Management

The information on the cluster management will be described in a single row. Information such as cluster name, cluster stage, cluster status, overall volume size, and volume usage will be presented. Also, there will be an action menu at the end where you can get a remote technical support.

Category	Description
<b>Cluster Name</b>	Shows the name of a cluster which is managed by the cluster management software.
<b>Stage</b>	The designated value by the cluster management software or the user. (For more details, refer to " <a href="#">1.3.5.1 Cluster Stage</a> ".)
<b>Status Report</b>	Shows the status of a cluster.
<b>Total Size</b>	Shows the total amount of volume which the cluster can use.
<b>Usage</b>	Shows the amount of volume which the cluster is using.
<b>Action</b>	Shows the list of commands for the cluster management. The types of command vary on the stage of a cluster. For more information, refer to " <a href="#">1.3.5.1 Cluster Stage</a> ".

## 1.3.4 Node Management

### 1.3.4.1 About Node Management

The information on the node management will be described in a single row. Information such as a name, stage, status, version, management IP, and service IP of a node will be presented. Also, there will be an action menu at the end where you can get a remote technical support.

Category	Description
<b>Node Name</b>	Shows the name of a node in a form of "{Cluster Name}-{Number}".

<b>Stage</b>	The designated value by the cluster management software or the user. (For more details, refer to " <a href="#">1.3.5.2 Node Stage</a> ".)
<b>Status</b>	Shows the status of a node.
<b>Version</b>	Shows the version of the cluster management software of a node.
<b>Management IP</b>	Shows management IP that is statically allocated on each node.
<b>Service IP</b>	Shows service IP that is allocated to each node. Service IP is allocated from one of the IPs listed on the Service IP Settings tab on Cluster Management > Network Settings page and will be dynamically allocated depending on the status of a node. Therefore, when a service node is no longer available, a client will be automatically connected to another node in the cluster as long as the client is connected to the service IP. There can be more than one IP per node or none.
<b>Action</b>	Shows the list of commands for the node management. The types of command vary on the stage of a node. For more information, refer to " <a href="#">1.3.5.2 Node Stage</a> ".

## 1.3.5 Staging

### 1.3.5.1 Cluster Stage

- Cluster Stage List

Stage	Condition	Cluster Status	Available Control	Changeable Stage
<b>running</b>	When the stage of every node is currently running	OK	No restriction	support
<b>support</b>	When the stage of one or more node is on support	WARN	Read only	running
<b>upgrading</b>	When the stage of one or more node is in upgrade	WARN	View message: 'upgrading'	None
<b>booting</b>	When the stage of one or more node is booting	ERR	View message: 'booting'	None
<b>initializing</b>	When the cluster is on initialization	WARN	View creation progress	None
<b>expanding</b>	When the cluster is expanding	WARN	View expansion progress	None
<b>fatal</b>	When it is unable to load the stage value	ERR	Read only	None

- [Read only]:** The API can be accessed, but not writable.
- [View creation progress]:** Shows the progress bar for cluster creation.
- [support]:** Change the stage value of a cluster as 'support'.
- [running]:** Change the stage value of a cluster as 'running'.

### 1.3.5.2 Node Stage

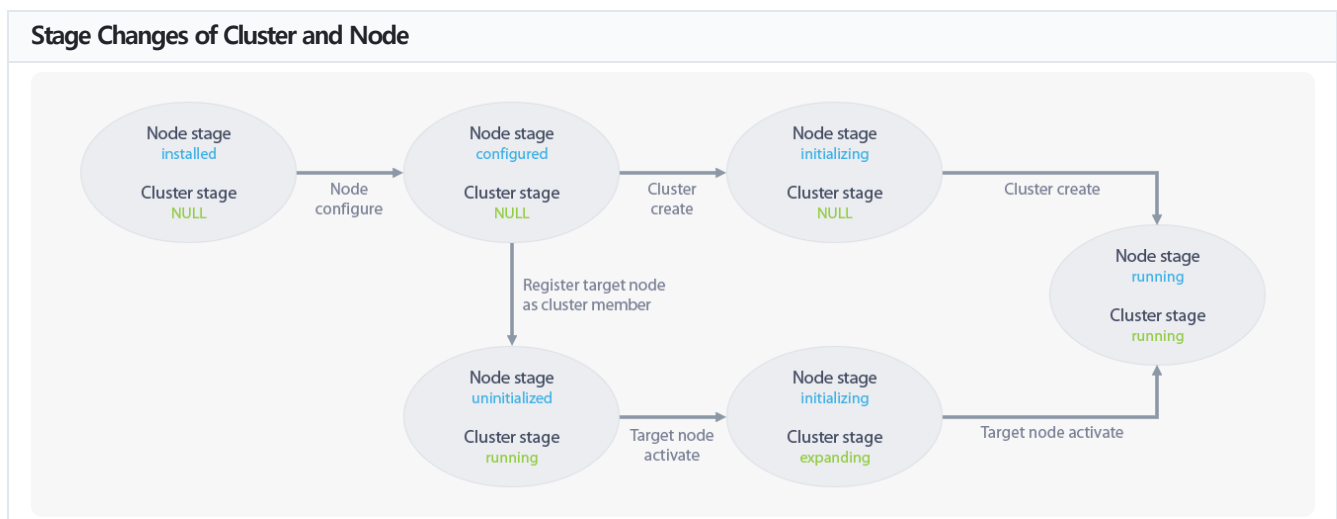
- Node Stage List

Stage	Condition	Node Status	Available Control	Changeable Stage
<b>running</b>	When every services need for cluster management are normal.	OK	No restriction	support
<b>support</b>	When it is changed to technical support mode	WARN	View message: 'support'	running

<b>upgrading</b>	When a node is upgrading	WARN	View message: 'upgrading'	None
<b>booting</b>	When the cluster management software is in preparation	ERR	View message: 'booting'	None
<b>initializing</b>	When the node is in initialization process	WARN	View initialization progress	None
<b>fatal</b>	When it is unable to load the stage value of a node	ERR	Read only	None
<b>installed</b>	When the cluster management software is installed to a node.		View message: 'node_config'	None
<b>configured</b>	When the node system setting is completed		View message: 'init/join'	None
<b>uninitialized</b>	When the node is registered to the cluster but not ready to operate		View message: 'uninitialized'	activate

- **[Read only]:** The API can be accessed, but not writable.
- **[View initialization progress]:** Shows the progress bar for node initialization.
- **[support]:** Change the stage value of a node as 'support'.
- **[running]:** Change the stage value of a node as 'running'.
- **[activate]:** It activates a node which is not ready to fully operate, but is only operating in the cluster.

### 1.3.5.3 Stage Changes After Cluster Initialization



#### 1.3.5.3.1 After installing the cluster management software

- Cluster management software and its related packages are already installed in the cluster node.
- No stage for the cluster, but the node stage will be set as 'installed'.

#### 1.3.5.3.2 Cluster node system settings

- This is a process to adjust the system settings on a cluster node to use the cluster management software.
- From the system settings, you will be configuring the service/storage/management interface, disk for the cluster volume, and management/storage IP of the node.
- When the system setting is over, there will be no stage for the cluster but the node stage will be set as 'configured'.
- Then, the process will be divided into "[1.3.5.3.3 Creating Cluster](#)" and "[1.3.5.3.4 Expanding Cluster](#)".

#### 1.3.5.3.3 Creating Cluster

- This is a process to create a new cluster including the node you have configured.
- Select the range of service IP pool for the client to access the cluster.
- There is no stage for the cluster, but the node stage will be set as 'initializing' when creating a cluster.
- After creating the cluster, the cluster stage and node stage will be set as 'running'.
- When the cluster creation is done, there will be a single-node cluster with the node you have configured.

#### 1.3.5.3.4 Expanding Cluster

- This is a process to add an additional node to the cluster you have built.
- Cluster expansion will have "Registering a Node to the Cluster" and "Activating the Node" process.
- **Registering a Node to the Cluster**
  - It informs the cluster that the new node will be added.
  - When the process is finished, the cluster will recognize the stage of the added node as "uninitialized".
  - **Activating the Node**
  - Initialize the node to make it available for the cluster.
  - The cluster stage will be set as 'expanding' and the node stage as 'initializing'.
  - When it is finished, the node will be available for the cluster with the stage set as 'running'.

## 1.4 Events

Event page provides users the integrated information on events and alerts that happened in the cluster and the tasks done by cluster management software.

The page shows a list of event logs and the list of ongoing tasks.

You can sort only the parts that need confirmation, or can see more results on one page by selecting the number of events that will be displayed on the list.

#### Contents

Category	Location	Description
Event History	Top	Able to browse event logs that occurred from cluster and node
Task	Bottom	Lists ongoing tasks and its status

### 1.4.1 Event History

- About Event History
  - Event History list gathers information on the occurred event and displays each events in a single row.
  - You can set the search conditions using the search tool from the top of the list.
  - You can browse the page by number by using the page control button from the bottom of the list.
  - The column names on the header row are Status, Range, Type, Category, Time, and Contents.

Category	Description
<b>Status</b>	Shows one of the three event level: Error, Warning, and Info. The color of each level are shown as red, yellow, and green.
<b>Range</b>	View the range where the event occurred. If it was occurred in the node, it will show the node's ID. If it is the cluster, it will show the text, "cluster".
<b>Type</b>	View whether the event happened from the monitoring component or the management component.
<b>Category</b>	View which functions the event is related and if the event does not have any type, it will show the text "DEFAULT".

<b>Time</b>	Shows the time when the event occurred. Displayed as "yyyy/mm/dd hh : mm : ss".
<b>Contents</b>	Describes the details of the event.

- Sorting Events
  - The default option is to sort the events in reverse chronological order but can be modified.
  - If you click one of the categories from the header row, the data below will be sorted in alphabetical or chronological order depending on its content.
- Event Details
  - Each event will show its details as you select.
  - The details will be displayed in a form of a dictionary of key-value.
  - Categories are ID, Scope, Level, Category, Message, Details, Time, and Quiet.

Category	Description
<b>ID</b>	The identifier of the event.
<b>Scope</b>	View the location where the event occurred. When it happened in a node, it will show the node ID and if it is the cluster, it will show the text, "cluster".
<b>Level</b>	Shows one of the three event level: Error, Warning, and Info.
<b>Type</b>	View whether the event happened from the monitoring component or the management component.
<b>Category</b>	View which functions the event is related and if the event does not have any type, it will show the text "DEFAULT".
<b>Message</b>	The text describing the content of the event.
<b>Details</b>	Displays more information on the event than Message. It is shown in a form of a dictionary of key-value.
<b>Time</b>	Shows when the event occurred. Displayed as "yyyy/mm/dd hh : mm : ss".
<b>Quiet</b>	If the value is not 0, it will be displayed as an event but will not be informed by email.

## 1.4.2 Task Status

- About Task Status
  - Located on the Event History page.
  - View the progress and unsolved issues on the task operated by the cluster management software.
  - The contents of the header row are Status, Start Time, End Time, Contents, Range, Type, and Progress.
  - You can browse the page by number by using the page control button from the bottom of the list.

Category	Description
<b>Status</b>	Shows one of the three task level: Error, Warning, and Info. The color of each level are shown as red, yellow, and green.
<b>Start Time</b>	Shows the start time of a task or the issue. Displayed as "yyyy/mm/dd hh : mm : ss".
<b>End Time</b>	Shows the end time of a task. As for the issues, the section itself will disappear not having the end time when the issue is solved. Displayed as "yyyy/mm/dd hh : mm : ss".
<b>Contents</b>	View the content of a task. Displays the contents of the process in the background by the cluster management software or the issues remaining in the cluster.
<b>Range</b>	View the location where the task or the issue happened. When it happened in a node, it will show the node ID and if it is the cluster, it will show the text, "cluster".
<b>Type</b>	View which functions the task is related and if the task does not have any type, it will show the text "DEFAULT".



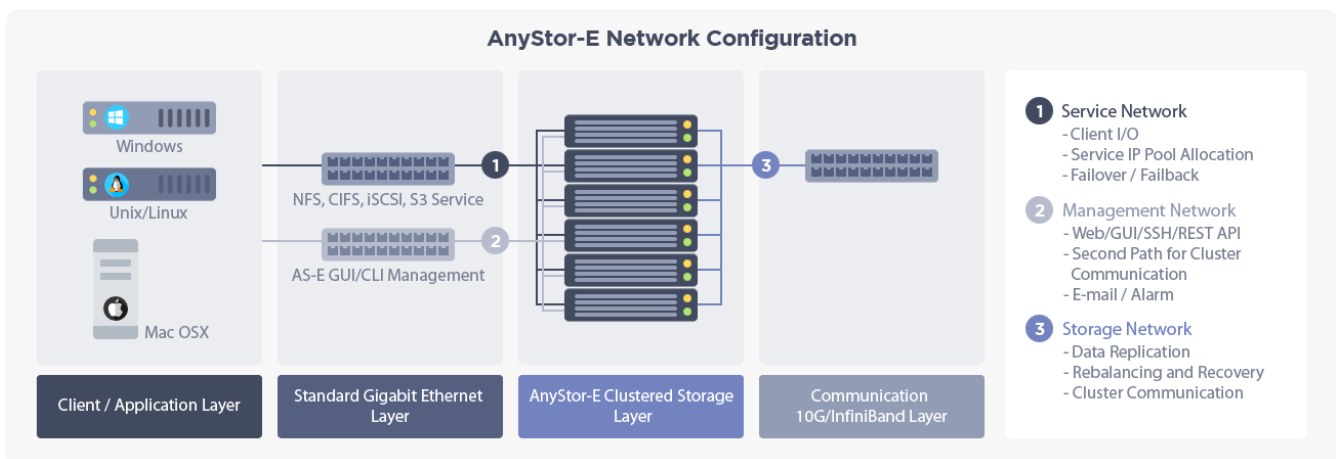
<b>Progress</b>	View the progress of a task in percentage. When it is an issue, it will be displayed as 0%.
-----------------	--

- Sorting Tasks
  - The default option is to sort the events in alphabetical order but can be modified.
  - If you click one of the categories from the header row, the data below will be sorted in alphabetical or chronological order depending on its content.
- Task Details
  - Each task will show its details as you select.
  - The details will be displayed in a form of a dictionary of key-value.
  - Categories are Scope, Level, Category, Message, Details, Time, and Quiet.

Category	Content
<b>Scope</b>	View the location where the task has been processed. When it happened in a node, it will show the node ID and if it is the cluster, it will show the text, "cluster".
<b>Level</b>	Shows one of the three task level: Error, Warning, and Info.
<b>Category</b>	View which functions the task is related and if the task does not have any type, it will show the text "DEFAULT".
<b>Message</b>	The text describing the content of the task.
<b>Details</b>	Displays more information on the task than Message. It is shown in a form of a dictionary of key-value.
<b>Start</b>	Shows when the task has started. Displayed as "yyy/mm/dd hh : mm : ss".
<b>Finish</b>	Shows when the task has ended. Displayed as "yyy/mm/dd hh : mm : ss". When the task has not yet finished, the value will be "null".
<b>Quiet</b>	If the value is not 0, it will be displayed as an event but will not be informed by email.

## 1.5 Network Settings

This menu is for the configuration on the network that is applied all across the cluster.  
It will allow users to configure and search for the features such as service address pool, routing and DNS that are applied across all cluster node, and access controls on the service.



### Storage Network

A network between cluster nodes for data replication and heartbeat.  
It is recommended to cluster the nodes for the availability and use 10G or InfiniBand for high performance.

## Service Network

A network used for client services. Network addresses from the service IP pool will be bound to each node.  
When a node fails, IP failover will activate the normal node and it will take 5 ~ 30 seconds depending on the failure.

## Management Network

A network to configure and monitor the cluster which can be used with the service network.  
Management network address will be statically allocated to each cluster nodes.

### • Contents

Name	Location	Description
Service IP Settings	First tab	For configurations on the service IP pool. Needs at least one configuration to use service IP.
Routing	Second tab	For configurations on routing.
DNS	Third tab	For DNS server settings.
Security	Fourth tab	For configurations on IP-based access controls for share services. Please refer to " <a href="#">4.3 Share Settings</a> "

## 1.5.1 Service IP Settings

- About Service IP Settings
  - Service IP List displays the information on service IPs in a single row.
  - The column names on the header row are First IP, Last IP, Netmask, and Interface.
  - A service IP pool includes every IP addresses between first IP and last IP.

Category	Description
<b>First IP</b>	The first IP address of the service IP pool.
<b>Last IP</b>	The last IP address of the service IP pool.
<b>Netmask</b>	Subnet mask for all addresses in service IP pool.
<b>Interface</b>	Shows the network interface of a node which the service IP is allocated. Due to the current policy, the value will be fixed as bond1 and every node should have a bond1 device to fully operate.

### 1.5.1.1 Creating Service IP Pool

#### Note

By creating a service IP pool, the client will be able to access a wide range of network band.  
An IP pool is a range of IP addresses that are automatically allocated to each node.  
If the addresses in an IP pool exceeds the number of nodes in the cluster, extra IP addresses will be automatically distributed to the nodes.  
Service to the clients will not be provided unless the service IP pool is allocated.

- **[Interface]**
  - The interface refers to the network device which has the IP address from the service IP pool.
  - It will be fixed as bond1 based on the policy by cluster management software.
- **[VLAN Tag]**
  - VLAN tag for network interface should be a number between 1 to 4094.
  - VLAN tag is to distinguish the virtual LAN from the interface.
  - The field is not for mandatory and if it is left blank, there will be no VLAN tag on the interface.
  - If the field is entered, the VLAN tag of the field will be attached to the interface.
- **[IP Address Range]**
  - Enter the service IP pool range as "xxxxxxx ~ yy".
  - As for the previous form, xx should have same or smaller value than yy, and both xx and yy should be in the number between 0 to 255.
- **[Netmask]**
  - Enter the subnet mask where it will be used from the entire address in service IP pool.

### 1.5.1.2 Modifying Service IP Pool

#### Caution

If you modify currently using service IP pool, the client might experience temporary disconnection from the service.

- **[Interface]**
  - The interface refers to the network device which has the IP address from the service IP pool.
  - It will be fixed as bond1 based on the policy by cluster management software.
- **[VLAN Tag]**
  - VLAN tag for network interface should be a number between 1 to 4094.
  - VLAN tag is to distinguish the virtual LAN from the interface.
  - If you delete the tag, it will be completely removed if the tag is not used from other service IP pool.
  - If the field is filled in, the VLAN tag of the field will be attached to the interface.
- **[IP Address Range]**
  - Enter the IP pool range as "xxxxxxx ~ yy".
  - xx should have same or smaller value than yy, and both xx and yy should be having the number between 0 to 255.
- **[Netmask]**
  - Enter the subnet mask where it will be used from the entire address in service IP pool.

### 1.5.1.3 Deleting Service IP Pool

You can delete the existing service IP pool by pressing **Delete** button from **Service IP Settings** tab in **Network Settings** page.  
 You can also delete multiple service IP pools at once  
 by selecting multiple service IP pools before pressing **Delete** button.

#### Caution

If you delete currently using service IP pool, it will disconnect every client from the service.

## 1.5.2 Routing Settings

### Target device of the routing entries are identical across all nodes

Created target device of the routing entry should have the same name across all nodes.

For instance, if the network device of the routing entry is eth1, every node in the cluster should have an eth1 device.

### Only one default gateway for the routing entry

The default gateway for the routing entry will be limited to 1.

\* About Routing List

\* The information on the route will be described in a single row.

\* If there are an incoming packet and its destination to the cluster node, it will compare with the information that is configured from the list and will send the packet to the destination if there is a matched routing entry.

\* If there is an information on the gateway when sending packets referring to the routing information, it will also send the packet to the gateway.

\* If there is no routing information on the received packet, it will transmit the packet to the default gateway.

\* The information on the route includes the destination, subnet mask, gateway, properties, and the name of the device.

| Category | Description |

| :---: | :--- |

| **Destination** | View the address of the destination for the packet to accomplish the routing entry.

If the routing entry is default gateway, it will show the text 'Default GW'. |

| **Subnet Mask** | View the subnet mask for the checking packets that need to apply routing entries. |

| **Gateway** | View the network address to send packets that match the condition. |

| **Properties** | U(When the path is available), G(When the path is to the gateway), H(When the path is to the host) |

| **Device** | View the name of the network device which transmits packets that are fit to the condition. |

### 1.5.2.1 Creating Routing Entries

Go to **Network Settings > Routing** and click **Create** button to create a new routing entry.

- **[Routing Destination]**

- The network address for the comparison with the destination of the incoming packet.
- Enter a notation of "xxxx.xxx", and each subset should be having the number between 0 to 255.

- **[Default Gateway]**

- Select whether the routing entry is the default gateway or not.
- If you select the box, the [Routing Destination] and [Subnet Mask] will be fixed to '0.0.0.0'.
- Only one routing entry can be set as the default gateway.

- **[Network Device]**

- Select a network device to send packets that fit the condition.
- The list will only show the device which is not included in the network bond.
- I/O device will be excluded from the list.

- **[Subnet Mask]**

- The subnet mask for the comparison with the destination of the incoming packet and [Routing Destination].
- Enter a notation of "xxxx.xxx", and each subset should be having the number between 0 to 255.

- **[Gateway]**
  - Enter the IP address of a node for receiving the packet that fits the condition.
  - If you do not set the gateway, it will send the packet to every node that is connected to the [Network Device].
  - It must be filled if [Default Gateway] is selected.

### 1.5.2.2 Modifying Routing Entries

Go to **Network Settings > Routing** and click **Modify** button to modify the routing entry.

- **[Routing Destination]**
  - The network address for the comparison with the destination of the incoming packet.
  - Enter a notation of "xx.xx.xx.xx", and each subset should be having the number between 0 to 255.
- **[Default Gateway]**
  - Select whether the routing entry is the default gateway or not.
  - If you select the box, the [Routing Destination] and [Subnet Mask] will be fixed to '0.0.0.0'.
  - Only one routing entry can be set as a default gateway.
- **[Network Device]**
  - Select a network device to send packets that fit the condition.
  - The list will only show the device which is not included in the network bond.
  - I/O device will be excluded from the list.
- **[Subnet Mask]**
  - The subnet mask for the comparison with the destination of the incoming packet and [Routing Destination].
  - Enter a notation of "xx.xx.xx.xx", and each subset should be having the number between 0 to 255.
- **[Gateway]**
  - Enter the IP address of a node for receiving the packet that fits the condition.
  - If you do not set the gateway, it will send the packet to every node that is connected to the [Network Device].
  - It must be filled if [Default Gateway] is selected.

### 1.5.2.3 Deleting Routing Entries

Go to **Network Settings > Routing** and click **Delete** button to delete the routing entry.

Select more than one routing entries and click **Delete** button to delete multiple routing entries.

## 1.5.3 DNS Settings

DNS tab shows Cluster Name, Primary DNS Address, and Secondary DNS Address.

#### Note

The cluster name will be displayed, however, cannot be modified.  
If the DNS is not configured, the email notification will not be sent.  
Go to **Network Settings > DNS**, enter the information, and press **\*\*Apply\*\*** button to configure DNS.

Category	Description
----------	-------------

<b>Cluster Name</b>	The name of the cluster that is managed by the cluster management software.
<b>Primary DNS Address</b>	The DNS address.
<b>Secondary DNS Address</b>	Additional DNS address apart from the primary DNS address.

- **[Primary DNS Address]**
  - Enter DNS address.
  - Enter in the notation of "xx.xx.xx.xx".
  - When no values are entered, DNS will be disabled.
- **[Secondary DNS Address]**
  - Refers to the additional DNS address apart from [Primary DNS Address].
  - When [Primary DNS Address] cannot be accessed, [Secondary DNS Address] will be used as the DNS.
  - Enter in the notation of "xx.xx.xx.xx".
  - When no values are entered, secondary DNS will be disabled.

## 1.5.4 Security Settings

### Caution

It is recommended to configure this option to **fortify the security** of your NAS.  
It can control the accessing hosts per share by designating the host IP range to access the share.  
It can be applied to CIFS and NFS share.  
Security information of the share cannot be deleted.

- **Security Information List**
  - The list is located on the top and provides security information in a single row.
  - Security zone indicates an access path where the security policy is applied.
  - Access controls on each security zone can be configured from "[4.3 Share Settings](#)".
  - Information on the security zone includes zone name, description, type, and network address.

Category	Description
<b>Zone Name</b>	A zone name designated by the administrator.
<b>Description</b>	Description of the zone written by the administrator.
<b>Type</b>	View types of zone. There are "IP Address", "IP Address Range", "Subnet Mask", and "Domain".
<b>Zone Address</b>	View the range of the security zone. It is displayed in a way the zone is formed.

- **Share Information List**
  - The list is located on the bottom and provides information on security zone used by share.
  - Information on the share includes zone name and address, usage information, item, and permission.

Category	Description
<b>Zone Name</b>	Displays the name of the zone used in share.
<b>Zone Address</b>	View the zone range used by the shared service.
<b>Usage Information</b>	Shows which share the zone is used.
<b>Item</b>	It is the one which uses the security zone. It will only display 'share'.

### 1.5.4.1 Creating Security Zone

Go to **Network Settings > Security** tab and click **Create** to create a new security zone.

- **[Zone Name]**
  - Enter the name for the new security zone.
- **[Description]**
  - Enter the description for the new security zone.
- **[IP Address]**
  - If [IP Address] is selected, only a single IP address will be set as the security zone.
  - Enter a notation of "xx.xx.xx.xx", and each subset should be having the number between 0 to 255.
- **[IP Address Range]**
  - If [IP Address Range] is selected, a range of IP addresses will be set as the security zone.
  - Enter the IP pool range as "xx.xx.xx.xx ~ yy".
  - xx should have same or smaller value than yy, and both xx and yy should be having the number between 0 to 255.
- **[Subnet Mask]**
  - If [Subnet Mask] is selected, every IP band from the combination of subnet mask and IP address will be set as the security zone.
  - Enter a notation of "xx.xx.xx.xx", and each subset should be having the number between 0 to 255.
  - Every IP address will be set as security zone when "0.0.0.0/0.0.0.0" is entered.
- **[Domain]**
  - If [Domain] is selected, the selected domain name will be set as the security zone.
  - It will be designated by the administrator.

### 1.5.6.2 Deleting Security Zone

Go to **Network Settings > Security** tab

and click **Delete** to delete the security zone.

Select more than one security zone and click **Delete** button to delete multiple security zones.

Security zones that are in use by the share cannot be deleted.

## 1.6 Email Settings

### Tip

You can receive the information on the events and tasks that occurred in the cluster by email.

If you set the Alert Level as ERROR or WARN, you can only be notified of the important information.

If the DNS or gateway settings were inappropriate, you will not be able to receive any emails.

Use **Send Test Mail** button to check whether you can receive the email.

### • Checklist for the Email Configuration

Category	Description
SMTP Server	SMTP configuration on the email service you are currently using

Authentication	Authentication support such as SSL, TLS, and StartTLS
Alert Level	Notification by email according to the alert level Error/Warning/Info
Notification	The notification will only be sent once when the event or task occurred from the system
Email Address	Email must follow RFC821 address format. Name, (e.g. AnyStore <a href="mailto:admin@gluesys.com">admin@gluesys.com</a> )

## 1.6.1 Email Settings

- Check **Enable Email** on the top to activate email notification.
- Enter the following information on the activated page.

Category	Description
<b>Admin Email Address</b>	Enter the email address where you will receive information on events and tasks occurred in the cluster.
<b>Sender Email Address</b>	Enter the email address to reply.
<b>SMTP Address</b>	Enter the domain address of SMTP server.
<b>SMTP Port</b>	Enter SMTP port number of SMTP server.
<b>Alert Level</b>	Select the alert level you wish to receive by email.
<b>SSL Authentication</b>	Select security authentication method for the email.
<b>SMTP Authentication</b>	<b>SMTP ID</b> - Enter SMTP ID. <b>SMTP Password</b> - Enter the password. <b>Confirm SMTP Password</b> - Enter the same password to check once more.

- Send Test Mail
  - If you click the button, a simple test mail will be sent to the registered administrator's email.
  - It is recommended to verify whether the email notification works properly.
- Save Email Settings
  - After the configuration, click **Save** button at the bottom.
  - The configuration will be saved to the cluster. Therefore, every event or task happened in any node will be notified by email.

## 1.7 Time Settings

Synchronizes the time setting of every node in the cluster.

You can set the time using the external time server (such as NTP) or by manual.

By using the NTP server, it can synchronize the cluster's time settings to the standard time.

### Synchronizing Time with the Cluster

From heartbeat, which diagnoses the node error and downtime, to journaling file system, which updates the newest changes, cluster shares information between nodes by miscellaneous software components.

In other words, the cluster might malfunction if there is a time mismatch between nodes.

AnyStor-E provides cluster-wide time synchronization through its embedded NTP master.



When the time is changed manually, it may cause issues in the monitoring system.  
It can also cause an error in the performance statistics.

## 1.7.1 Contents

Category	Description
Current System Time	View the current time of the cluster.
Universal Time	Able to set the standard time zone for the local region.
Manual Setting	Able to set the date and time manually.
Time Synchronization	Able to synchronize the time by designating the external time server.

- **Time Synchronization**
  - Synchronizes the time with the uppermost NTP server.
  - If the connection with the main NTP server is invalid, it will be synchronized with the other NTP server you have configured previously.
  - It can be added up to 5 servers.

## 1.8 Power Management

This feature provides power management on every node in the cluster.

### Recommended Boot Order

When turning on the cluster, starting off from the first node will make it faster to change the stage to RUNNING.  
It will be considered as normal when **Cluster Status** from "[[1.2 Overview](#)]" is set as RUNNING.  
However, the service will not start when the cluster quorum is not fulfilled.

### 1.8.1 Power Management

It manages cluster's power.

Every node in the cluster will be involved when you use system shut-down or system restart option.

System shut-down and restart will proceed in an order designated by the system.

- **System Shut-down**
  - Shuts down all node in the cluster.
- **System Restart**
  - Restarts all node in the cluster.

## 1.9 Log Backup

You can download system logs.

This function will be used for analyzing the system when in technical support.

While backing up, it compresses the recent data in real time which will take a few minutes depending on its size.

## 1.9.1 Functionalities of Log Backup

- Log Backup
  - Click **Log Backup Button** to download the system log.
  - System configuration and log files will be compressed and downloaded in ZIP format.

## 1.10 License Management

This menu offers you to manage the license for the cluster management function. This menu will help you to register new license and browse the list of registered licenses.

### Demo License Policy

After the cluster is created, the demo license will be enabled and will last for a period of time.

While the demo license is enabled, every feature of AnyStor-E will be available.

When the demo license is expired, all the features, except for License Management, will be unavailable.

To use the features of AnyStor-E after the expiration of demo license, please make an inquiry to Gluesys.

### Restriction of Features by License

Some features which requires a license will be restricted to use when it is not registered.

### • Contents

Name	Location	Description
License List	License Management page	Able to browse the registered license from the list
License Registration	License Management page	Able to register a new license

### 1.10.1 Type of License

- Licenses are classified as system, restriction, and activation.
- System license
  - A license which has the system type such as AnyStor-E, Support, or Demo.
  - A system license cannot be used after the expiration.
  - AnyStor-E: A license to use AnyStor-E. The name may vary due to the type of the software.
  - Support: A warranty license of the technical support on AnyStor-E.
  - Demo: A demo version license of AnyStor-E. It will be enabled immediately after the cluster is built and can use every features for a period of time. When the demo license is expired, all features will be restricted to use.
- Restriction license
  - A license for the restrictions such as the number of nodes or volume sizes.
  - The resources related with the license will be displayed from the permission section.
  - A restriction license key may expire if it is not registered in a certain period of time.
  - Nodes: Shows the number of maximum nodes which can be attached to the cluster.

- VolumeSize: The maximum size of cluster volume which can be created.
- Activation license
  - A license which determines whether to enable CIFS, NFS, and ADS.
  - An activation license key may expire if it is not registered in a certain period of time.
  - CIFS: A license which enables CIFS.
  - NFS: A license which enables NFS.
  - ADS: A license which enables ADS.

## 1.10.2 License Configuration

- Contents
  - The information on the license will be listed in each row.
  - A single row includes license name, status, enabled date, expiration date, permission, and registered date.

Category	Description
License Name	View the name of a license.
Status	View the status of a license. It will show either "Active", "Inactive", or "Expired".
Enabled Date	View the date on when the license is enabled.
Expiry Date	View the date on when the license will expire.
Permission	View the permission on which the license allows.
Registered Date	View the date on when the license is registered.

### 1.10.2.1 License Registration

Go to **License Management** and press **Register** button to register a new license.

- **[Product Key]**
  - An automatically generated key for cluster depending on the system's status.
  - The key consists of four random uppercase alphabets connected with four hyphens. ex) ASNC-VJCV-RGYE-GHCU
  - The product key will be used for validation of the license when the license key is issued.
  - To acquire the license, you must send the product key to Gluesys.
- **[License Key]**
  - Able to enter the license key issued by Gluesys.
  - When the entered license key is found valid, the registered license will be added to the license list and will be allowed to use every features related with the registered license.

## 2 Cluster Volume Management

### AnyStor-E Volume Architecture

To configure the performance and stability of storage services, AnyStor-E embedded Linux Logical Volume Manager and RedHat **GlusterFS** file system.

Volume pool is used by managing the local LVM space of the cluster node through the cluster and volumes will be managed by virtual cluster volumes using GlusterFS volumes.

You can configure **thin provisioned and tiered volume including the snapshot**, and **network RAID volumes** to increase the

storage utilization when performing a backup or archiving.

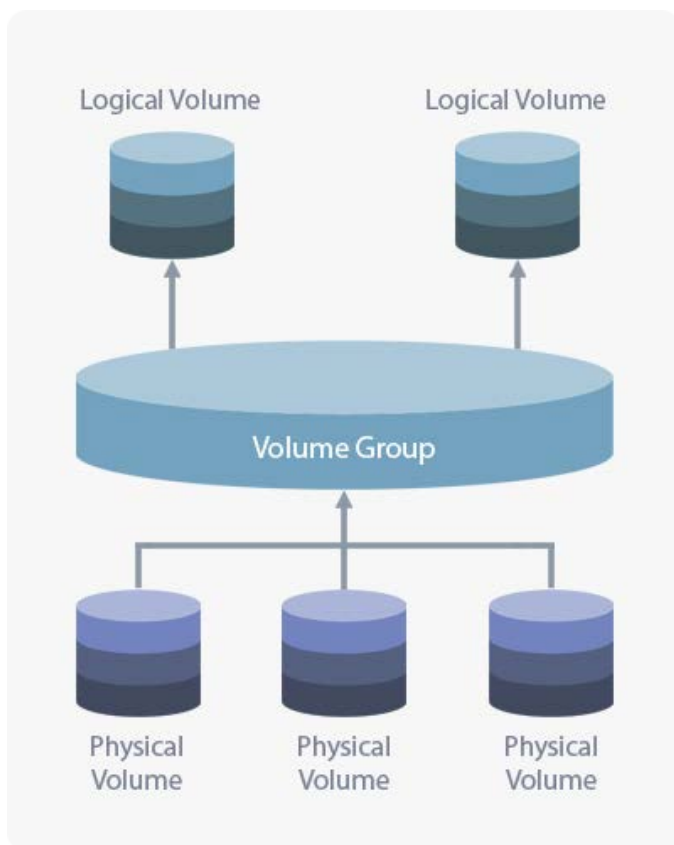
Menu	Description
<b>Volume Pool</b>	For the management on physical volume, volume group, and logical volume of LVM across nodes. It should be created and configured before using <b>Volume</b> menu.
<b>Volume</b>	For creating, deleting, and expanding the cluster volume using the logical volume from volume pool of each node. It has additional features such as snapshot and tiering.
<b>Snapshot Scheduling</b>	For setting and deleting schedules which periodically creates snapshots of the cluster volume.

## 2.1 About Volume Pool Management

**Volume Pool** menu manages LVM-based physical volume, volume group, and the logical volume of each node in the cluster. Volume pool is a group of volumes consisted of the selected disks across nodes and can also configure the dynamic allocation. The space for dynamic allocation is utilized for supplementing the available space on the cluster volume exclusive for dynamic allocation.

You can use tiering on the cluster volume by creating the additional volume pool exclusive for the tiering.

### 2.1.1 About LVM



#### Composition of Volume Manager

Name	Description
Physical Volume	The physical block devices such as HDDs and SSDs should be registered as physical volume to be used in LVM. Disk devices that are registered as physical volumes can be combined as a volume group which can be a bigger block device.
Volume Group	To use the space of a volume group, you should create a logical volume that allocates an amount of space from the volume group.

	A volume group can be divided into more than one logical volume.
Logical Volume	The actual volume which is the basic resource to form a cluster volume and that are used by users to read and write data. The data that are written in a logical volume will be written on physical volume that is mapped through a volume group. There are average logical volumes and thin provisioned logical volumes.

### Types of Logical Volumes

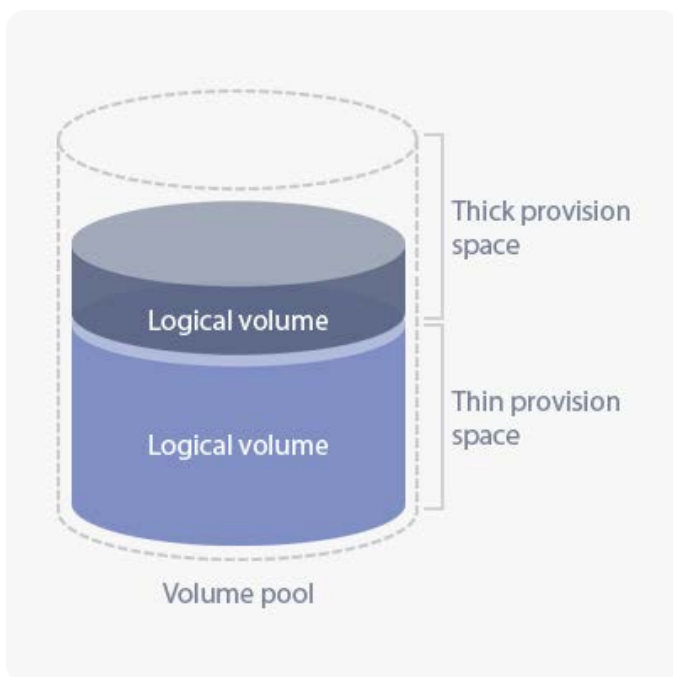
Type	Description
LV	The generally used logical volume which takes a static space of the volume group regardless of the data size that has been written in.
ThinPoolLV	It occupies a static space of the volume group as it is with LV. ThinPoolLV should be organized prior to creating ThinLV and it provides a space as much as a written data of ThinLV.
ThinLV	View the logical volume for thin provisioning and there are no limits on size when creating one. As the volume group allocates space to LV, ThinPoolLV allocates space to ThinLV. When the size of ThinLV is decreased or deleted, it will return the allocated space to ThinPoolLV.

### Configuring a Volume Pool

Volume pool has static allocation and dynamic allocation on the space.

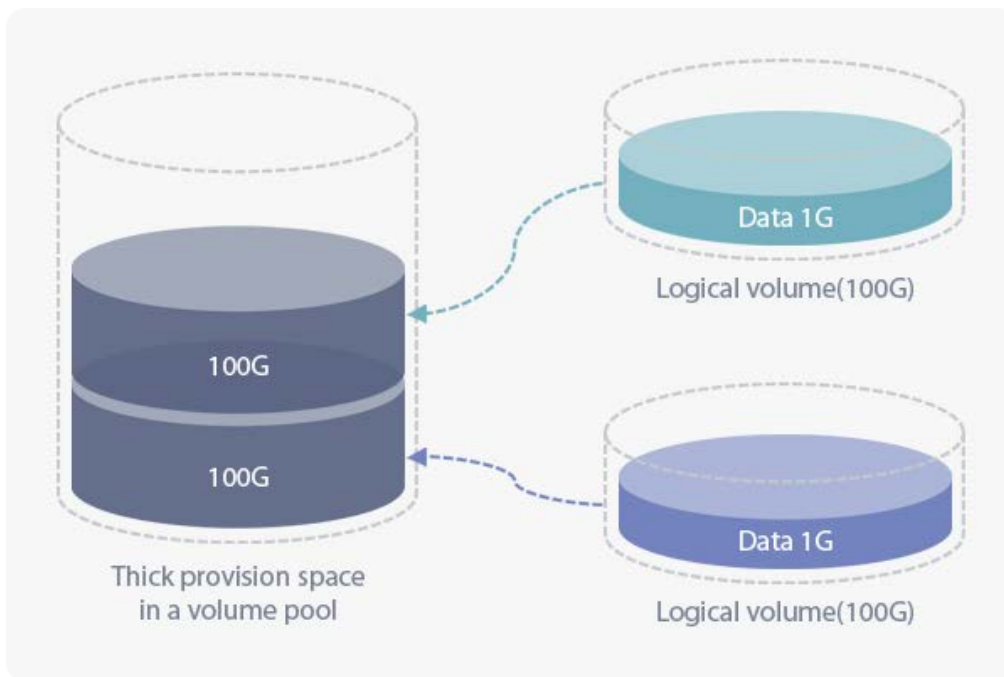
Static space (pool) allocation: A volume or space (pool) for the static allocation.

Dynamic space (pool) allocation: Able to create a **dynamic volume** for thin provisioning and snapshot volume.



### Space for Static Allocation

AnyStor-E can integrate all the volume group from each node to create a space (pool) for static allocation. Regardless of the internal data size, it will occupy the space through static allocation to the size of a logical volume.

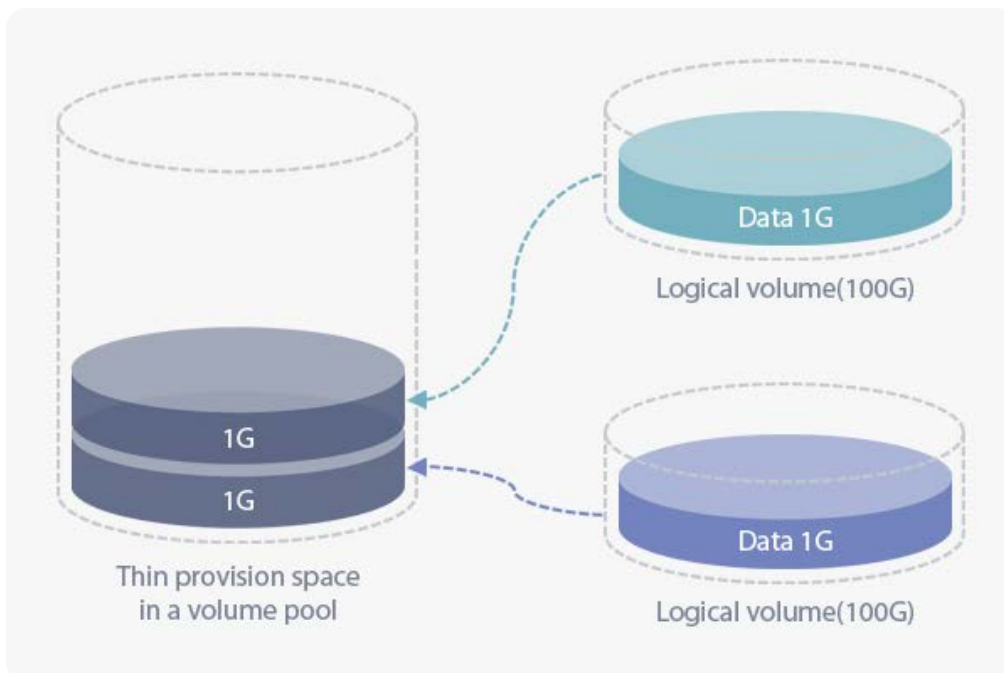


#### When do you use a static allocation?

It is for the service when there should be a steady file transaction speed and where the snapshot is not needed.  
Great for the service which occasionally deletes files with a small capacity.

#### Space for Dynamic Allocation

A logical volume that is created in the space used for dynamic allocation will only occupy the size that had been written. It will only occupy the size that is actually used which makes it more efficient than static allocation.



#### When do you use a dynamic allocation?

It is recommended to use snapshot features to fortify the data integrity.  
It will be appropriate to use thin provisioning when there is a great number of users or volumes.

## 2.2 Volume Pool

The **Volume Pool** page will show the overall status of the created volume pool.  
It will have a default volume pool for data storage when the system is initially installed.

### Volume Pool Management List

Category	Description
Volume Pool Name	Name of a volume pool. <b>vg_cluster</b> is a volume pool to create volumes and <b>vg_tier</b> is a volume pool for tiering.
Purpose	View the purpose of use of the volume pool. <b>Data Storage</b> - A volume pool for creating a volume. <b>Tiering</b> - A volume pool for the tiering of a volume.
Node	List of node forming the volume pool.
Status	The status value of a volume pool will be shown as <b>OK</b> and <b>WARN</b> . <b>OK</b> - Shows the status is normal. <b>Warn</b> - Warns which the volume group usage has reached 95%.
Volume Pool Size	Shows the total volume group size per node forming the volume pool.
Volume Pool Usage	Shows the total volume group usage per node forming the volume pool.
No. of Volumes	View the number of cluster volume which the volume pool is using.
Dynamic Allocation Size	Size of a dynamically allocated volume pool for thin provisioned volume.
Action	Can apply additional process on the volume pool. <b>THIN_PROVISION</b> - Configure or delete dynamic allocation on the volume pool. <b>Change</b> - Expand or reduce the space of a volume pool by choosing the disks for the node.

### 2.2.1 Creating Volume Pool

vg\_cluster which is statically allocated pool will be created as a default after the initial installation of AnyStor-E. A vg\_cluster pool will expand its capacity when nodes are added. Every volume will be created through a vg\_cluster pool.

#### 2.2.1.1 Creating Tiered Volume Pool

Press **Create** button on the top left side of the page to create a tiered volume pool.  
Select each disk per node to form a volume pool.

#### About Tiered Volume Pool

While creating a tiered volume pool, you may add SSDs or NVMeS to enhance the performance.  
Performance enhancement is optimized on workloads with a lot of random accesses and will show a relatively lower performance enhancement when creating or searching small files lower than 10K.

### Contents

Category	Description
Volume Pool Name	Name of a volume pool.
Purpose	It can only create the volume pool for the tiered cluster volume.
Volume Pool Size	Volume pool size will be reflected by the disks you have selected.
Device(s) by Node	Lists of unused disk devices to create volume pool.

## List of Device per Node

Category	Description
Node Name	Hostname of a node.
Physical Disk	Name of a disk device.
Media Type	View the type of the disk. <b>HDD</b> - Hard Disk Drive. <b>SSD</b> - Solid State Drive.
Device Size	Total space of the device.

### 2.2.1.2 Creating Dynamic Volume Pool

Select **THIN\_PROVISION** from the drop-down list of the **Action** column on the **Volume Pool Management** list.

#### When lacking space on your dynamic volume pool

From this menu, it is possible to expand dynamic volume pool as much as the space that is available in static volume pool. Once it is expanded, it cannot be reduced.

When your dynamic volume pool hits the limit, the **performance may dramatically fall** and the **\*\*metadata allocation on the file system might fail\*\***.

For these reasons, AnyStor-E will interfere the writing process and switch to **Read-Only** mode on the volume when the capacity reaches 95%.

It will switch back to **Read-Write** mode when the space in the volume is available due to the deleting or relocating the files.

## Contents

Category	Description
Available space per node for dynamic allocation	View the available space of the selected node to set as dynamic volume pool.
Size of dynamic volume pool per node	Enter the space for the dynamic volume pool you are about to create.
Node List	View the list of nodes that are available to create dynamic volume pool.

## Node List

Category	Description
Name	Hostname of a node.
Device Status	Displays the status of a node.
Service Status	Displays whether it can be used as a volume pool.
Pool Usage	Displays the usage of a volume pool in percentage.
Available Space	Displays the available space that can be used.

## 2.2.2 Volume Pool Settings

This menu provides modification and deletion of the created volume pool.

### 2.2.2.1 Static Volume Pool Settings

Go to `vg_cluster` from the volume pool list and select **Change** from the drop-down list of the **Action** column to change the configuration on the volume pool.



Category	Description
Volume Pool Name	Name of the volume pool.
Purpose	View the purpose of the volume pool. <b>Data Storage</b> - A volume pool that are used when the cluster volume is created. <b>Tiering</b> - A volume pool that is used exclusively for tiering.
Volume Pool Size	Estimated volume pool size after the configuration.
Device(s) by Node	Select disks to change the size of a volume pool.

## Contents

The disk including logical volumes cannot be deleted from the list.  
Select disk devices to change the volume pool size. Only the disks that are included, or unused will be listed.

Category	Description
Node Name	Hostname of a node.
Physical Device	Name of a physical disk device.
Media Type	View the type of the disk. <b>HDD</b> - Hard Disk Drive. <b>SSD</b> - Solid State Drive.
Device Size	Total space of the device.
Status	View whether it is used in the current volume pool.

### 2.2.2.2 Dynamic Volume Pool Settings

If the dynamic allocation is applied on a volume pool, you can modify its configuration by selecting **Thin\_Provisioning** from the drop-down list on the **Action** column.

## Contents

Category	Description
Available space per node for dynamic allocation	View the available space of the selected node to set as dynamic volume pool.
Size of dynamic volume pool per node	Enter the space for the dynamic volume pool you are about to create.
Node List	View the list of nodes that are available to create dynamic volume pool.

## Node List

Category	Description
Name	Hostname of a node.
Device Status	Displays the status of a node.
Service Status	Displays whether it can be used as a volume pool.
Pool Usage	Displays the usage of a volume pool in percentage.
Available Space	Displays the available space that can be used.
Status	View whether it is using the dynamic allocation.

### 2.2.3 Deleting Volume Pool

The volume pool, **vg\_cluster**, cannot be deleted.  
Also, the volume pools which are dynamically allocated or includes logical volume cannot be deleted.

### 2.2.3.1 Deleting Tiered Volume Pool

Choose the volume pool from the list and select **Delete** from the drop-down list on the **Action** column to delete the volume pool.

### 2.2.3.2 Removing Dynamic Allocation from the Volume Pool

Choose the volume pool from the list and select **Delete** from the drop-down list on the **Action** column to remove dynamic allocation.

## 2.3 Volume Management

### 2.3.1 About Volume Management

This page manages **creation/deletion/expansion, snapshot, and tiering** of the cluster volume.  
The cluster volume is a distributed file system used as a storage space of the selected nodes.  
To ensure the availability of the saved data, you can set the number of replications and the number of allowable node failures.

#### Note

When a cluster is created, distribution method and type will be defined due to the distribution policy which affects the stability and performance.  
Use the snapshot to backup data from each volume without any downtime and tier the data to improve the performance through the accessibility.  
The cluster volume that is set as share cannot be deleted. It can be deleted only after removing the share.

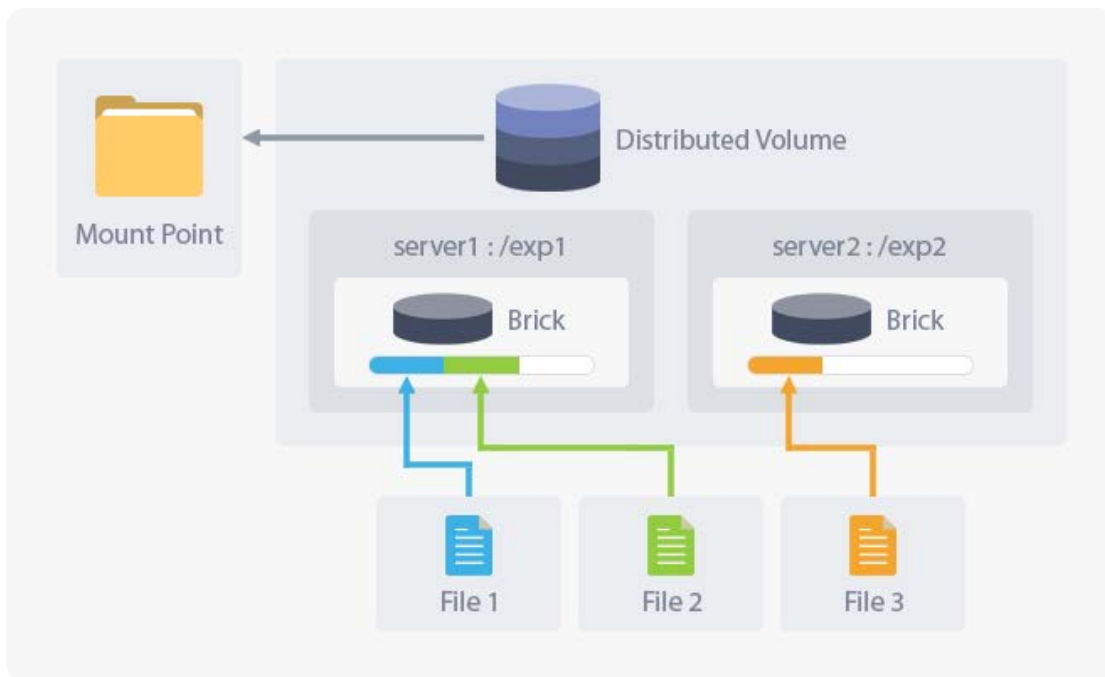
### 2.3.2 Technical Factors

#### 2.3.2.1 Distributed Volume

The distribution method between nodes based on file name hashing without centralized metadata server. You can improve the data availability by configuring the number of copies of original data.  
The minimum number of a required node for the expansion is the same as the number of copies.

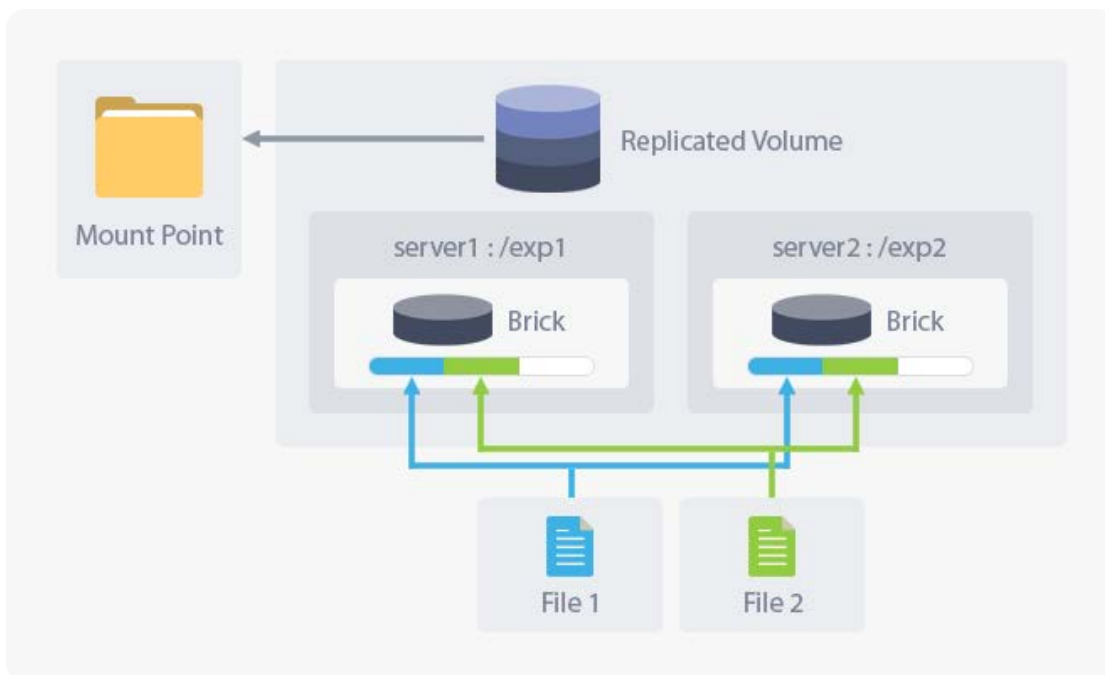
#### About Distributed Volume

When there is a single replica, there will be a new volume distributing data across all node in the cluster.  
It is used where the distributed file system is necessary and the data integrity is not required.  
There are no copies between nodes and some data might be inaccessible when the node fails.



### Replicated Volume

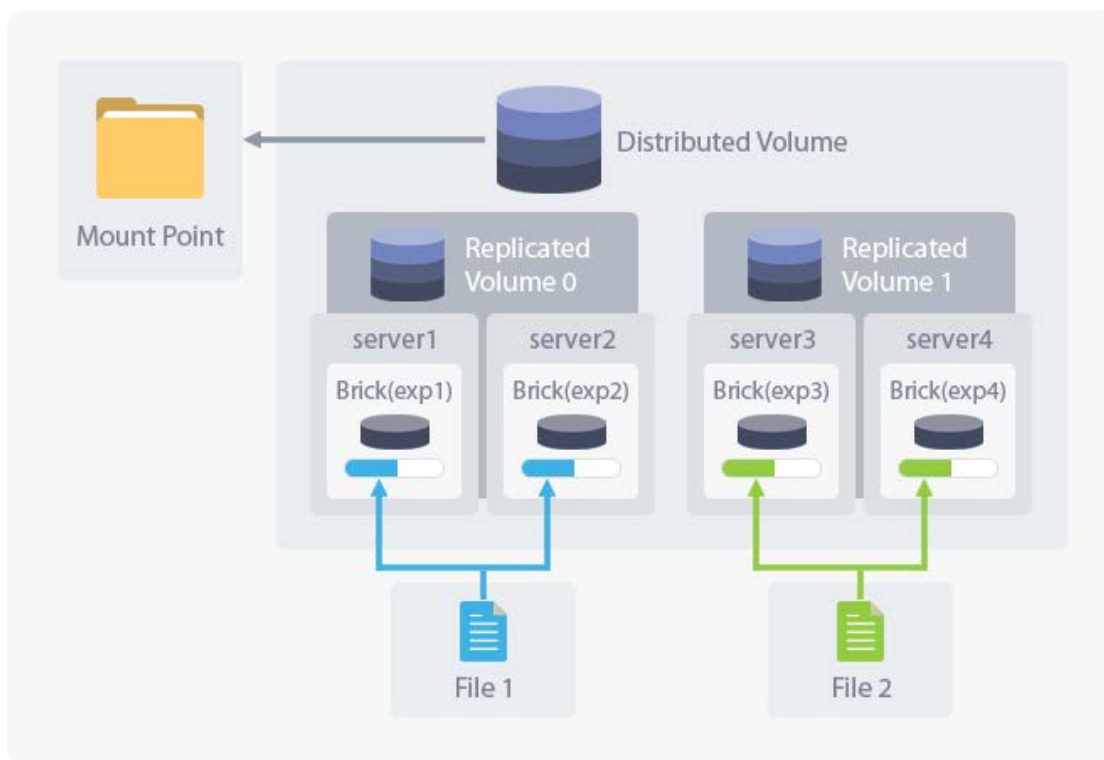
When the number of replications and nodes are the same, there will be a volume replicating data to all selected nodes. Distributed file system will not be needed and data integrity will be ensured. As there will be a replica on each node, the data can be accessed even some node fails.



### Distributed-Replicated Volume

The composition will change into **Distributed-Replicated Volume** when the node expands through Scale-Out while having the **Replicated Volume**. Otherwise, set more than two copies and select nodes, in a multiple of the number of copies you have set, to create a **Distributed-Replicated Volume**.

It is used in the environment where both distributed file system and data integrity is needed.  
However, if the node including a replica fails, the data will be inaccessible.



### Distributed-Replicated Chain Volume

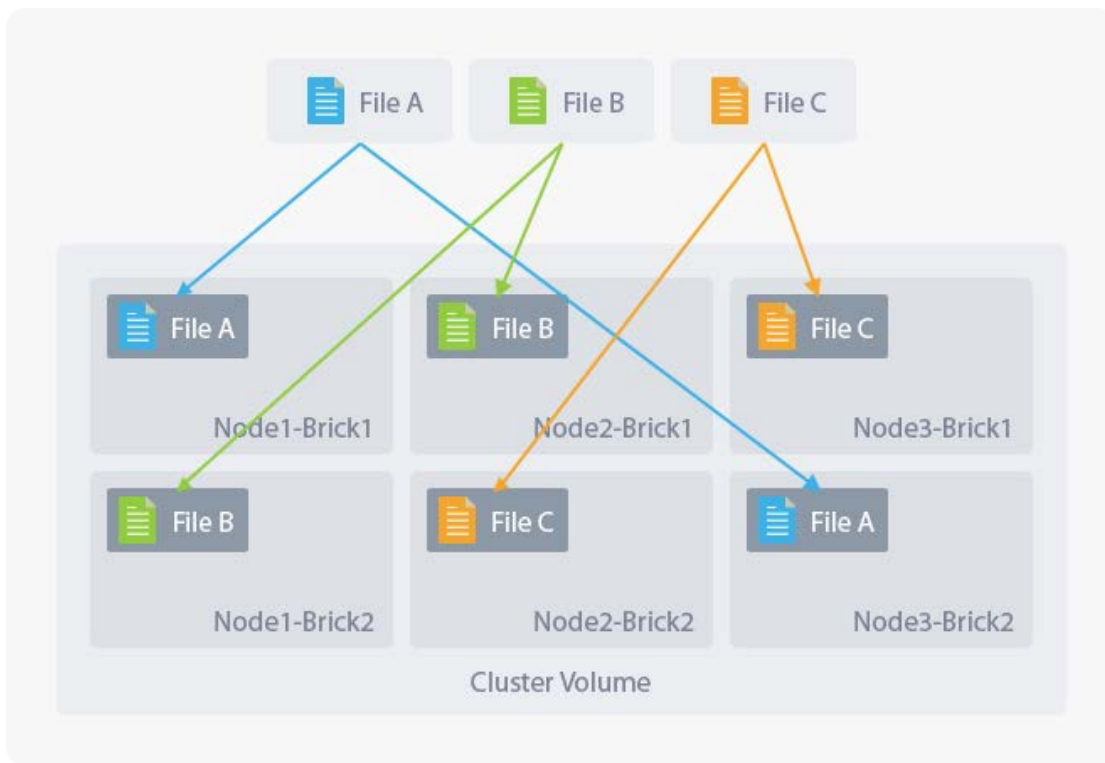
A configuration of replicating the data between neighboring nodes by creating two logical volumes to store the data to every selected node.

It can be composed of three nodes while initializing the system and has an advantage of saving the cost comparing to **Distributed-Replicated Volume** composition.

It is used in the environment where both distributed file system and data integrity is needed.

However, if the node including a replica fails, the data will be inaccessible.

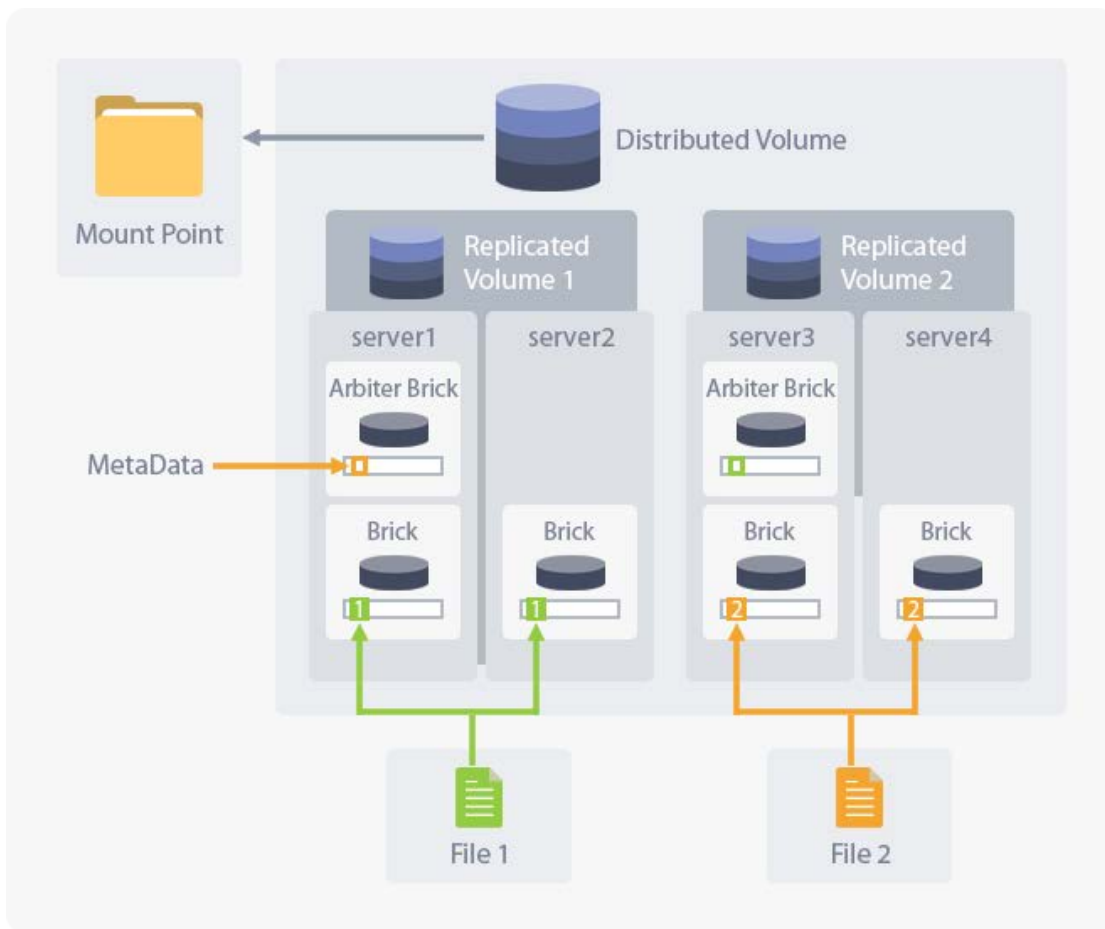
**Distributed-Replicated Chain Volume** does not support Scale-Out node expansion and only supports Scale-Up expansion.



### Distributed-Replicated Arbitrator Volume

A composition which can minimize the chance of data loss when the number of replica is 2. It will be composed of 2 data replicas and additionally 1 replica will be added. This additional replica will be composed only with metadata and other 2 replicas will lower the possibility of data loss.

It is possible to make the arbitrator composition by adding 2 replicas while making **Distributed-Replicated Volume** or **Distributed-Replicated Chain Volume**.



### 2.3.2.2 Shard Volume

A **Distributed-Replicated** method, which the original data is divided and distributed into a certain size (shard block size), it is a useful composition when using a data which has a huge single file size.

It is used with iSCSI and VMStore volumes, and I/O will be processed across several nodes. It also can improve the data availability by configuring the number of replica of original data as it was in **distributed volume**.

It should be composed more than three nodes and the minimum number of nodes required for the expansion are identical with the number of nodes configured from the system initialization.

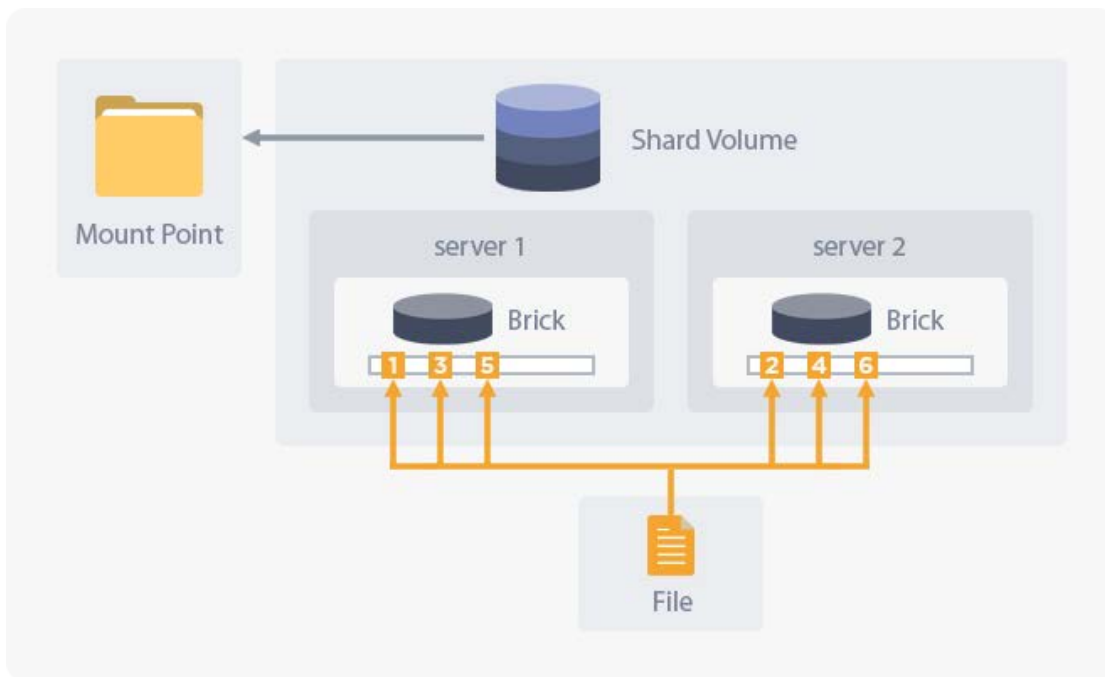
#### Note

The node cannot scale out if the shard volume is created.

### Distributed-Shard Volume

A volume to distribute data into a certain size (shard block size) will be created to every selected node which requires a single replica.

It can be used in an environment which has huge file processing with multiple access and less data safety required. It is useful where a large amount of data (video, image, and VM) is used. However, if the node including a replica fails, the data will be unavailable.

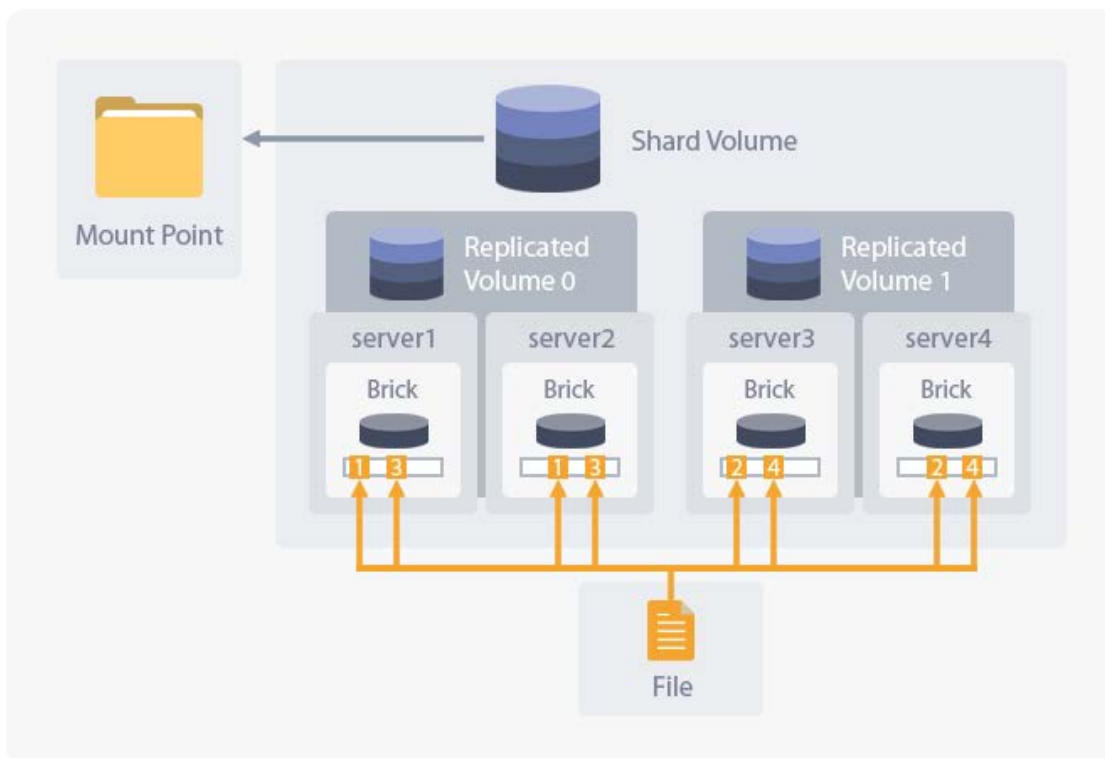


### Distributed-Shard-Replicated Volume

A **Shard-Replicated Volume** can be composed when there is more than 2 replicas.

Divides the data into a certain size (shared block size) and distributes the replica to some nodes.

It is useful where a large amount of data (video, image, and VM) is used.



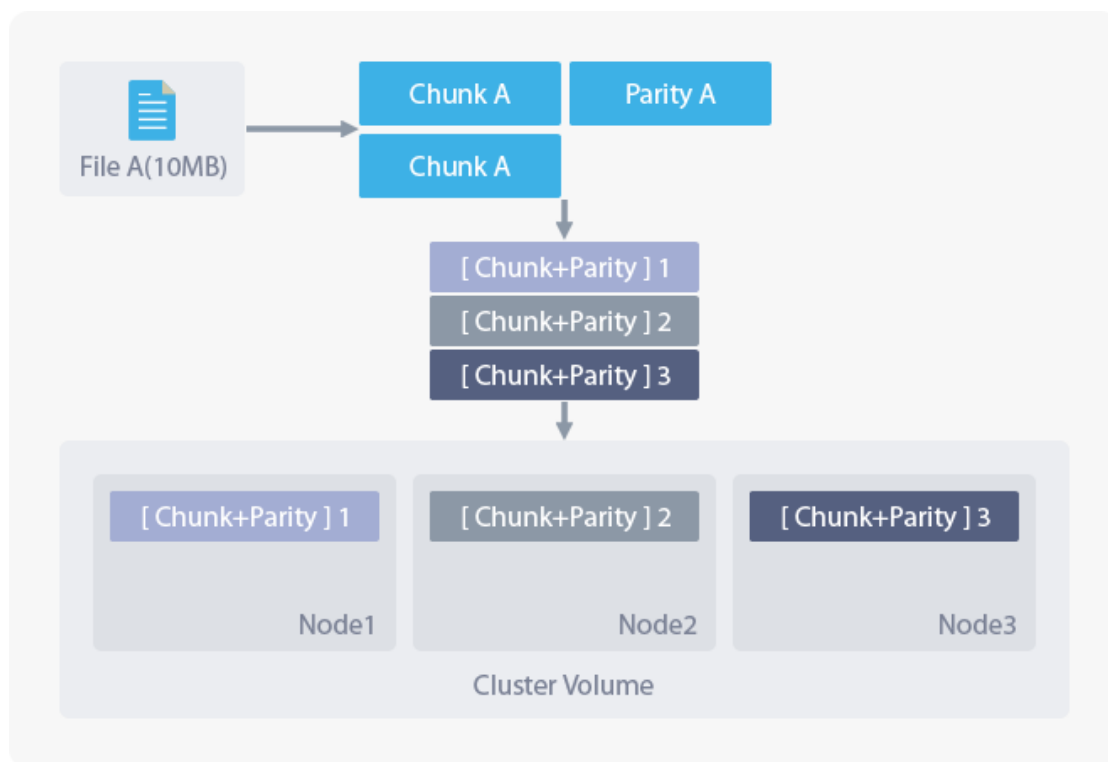
### 2.3.2.3 Network RAID / EC Volume

The space will be used effectively by not creating a replica of the original data.

Capable of backup and archiving, the performance on re-write is relatively low, comparing to the **Distributed Volume**. Minimum two nodes for data storage and a node for the parity are needed.

### About Network RAID

The original data will be divided into chunks and will be saved with the number of erasure code nodes along with the parity.

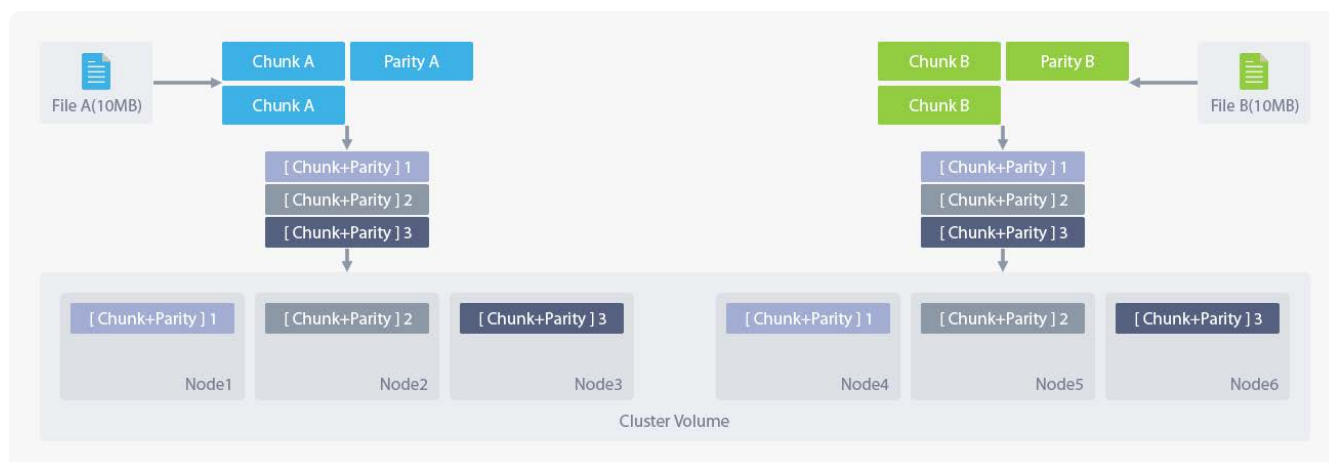


#### Note

There might be a performance loss due to the parity process when reading or recovering the data while in node failure (degrade). When the node fails which exceeds the number of erasure code node, the data will not be able to access. The minimum number of node required for node extension should be equal to the number of nodes you have selected while creating volume.

### Distributed-Network RAID Volume

When a **Network RAID Volume** expands the node through scale-out, it will become the **Distributed-Network RAID Volume**.



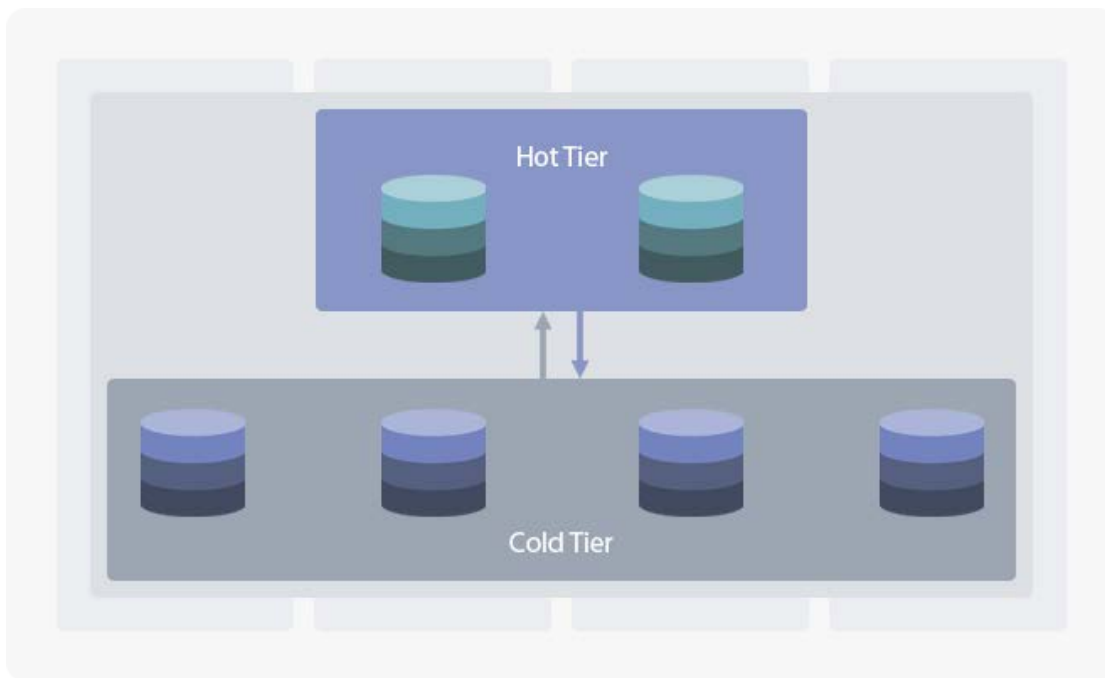


### 2.3.2.4 Tiered Volume

To boost the volume performance, you can tier the volume using the high-speed storage device such as SSD/NVMe. The **Hot Tier**, which requires frequent and quick access, will be composed of flash media as the **Cold Tier** will be mainly composed of HDDs. The files will automatically drift between the **Hot Tier** and **Cold Tier** by the frequency of its usage.

#### Standard Migration Policy

The file I/O will primarily operate from **Hot Tier** or else it will work in the **Cold Tier** if the file is not present in **Hot Tier**. The files with frequent access will stay in **Hot Tier** and if not, it will be migrated (demoted) to **Cold Tier**. On the contrary, if the file in the **Cold Tier** is frequently accessed, it will migrate (promote) to **Hot Tier**.



#### Creating Tiered Volume Pool

To create a tiered volume pool, refer to [\[2.2.1 Creating Volume Pool\]](#). When the volume type of the cluster volume is configured as dynamic allocation, you should also configure the tiered volume pool as dynamic allocation. Refer to [\[2.2.1.2 Creating Dynamic Volume Pool\]](#) and create a dynamic volume pool.

#### Limitations on Tiered Volumes




It only supports NFSv3 share. CIFS service is not supported. As it is optimized in **cache friendly** workload, the performance might fall when processing small files less than 10 KB such as emails. Tiered volume cannot be expanded without downtime and it is only possible after removing the **Hot Tier** volume.

## 2.3.3 Cluster Volume List

### 2.3.3.1 Volume List

This list shows the status and condition of each generated cluster volume.

Use **Create** and **Action** button to proceed additional task on the volume.

Category	Description
Volume Name	View the name of a cluster volume.
Node	View the name of nodes forming the cluster.
Status	View the volume's status on the service and operation. Please refer to <a href="#">2.3.3.1.1 Volume Status</a> .
Volume Type	View whether the cluster volume uses thin provisioning. <b>Static Allocation</b> - A cluster volume not using thin provisioning. <b>Dynamic Allocation</b> - A cluster volume using thin provisioning. Available to use snapshot.
Volume Size	View the capacity of a cluster volume.
Usage	View the usage of a cluster volume.
Volume Configuration	Generates additional options for the cluster volume. <b>Tiering</b> (  ) - The icon will be activated if the tiering option is available. <b>Chain Mode</b> (  ) - The icon will be activated if the <b>Distributed-Replicated</b> chain method is available. <b>Arbiter</b> (  ) - Able to check whether the arbiter is set by checking the icon
Distribution Policy	View the <b>Distributed-Replicated</b> policy on a cluster volume. Please refer to <a href="#">2.3.2 Technical Factors</a> .
Distributed Node	The node forming the cluster volume can be defined as a group of nodes replicating and saving the duplicate data. The number of a distributed node shows the maximum number of a node group, which replicates the data to one of the group if the client uses the data.
Number of Copy	View the number of replica in the cluster volume which is used for the data availability.
Action	View additional options for the cluster volume. Please refer to <a href="#">2.3.3.1.2 Volume Options</a> .

#### 2.3.3.1.1 Volume Status

The status of the volumes shown in [2.3.3.1 Volume List](#) can be changed by API requests and background operations.

Category	Description
OK	Shows the status is normal.
ERROR	Shows the service is not available.
Creating	View the volume is currently in creation.
Creation Failed	When it fails to create a volume, proceed the volume deletion to remove the remaining resources.
Deleting	View the volume is currently in deletion.
Deletion Failed	When it fails to delete a volume, try again to remove the remaining resources.
Node Expanding	View the node is currently expanding as Scale-Out.
Node Expansion Failed	When it fails the Scale-Out expansion, retry the expansion or delete the volume.
Volume Expanding	View the node is currently expanding as Scale-Up.
Volume Expansion Failed	When it fails the Scale-Up expansion, retry the expansion or delete the volume.
Creating a Snapshot...	Shows the status which creating a snapshot for the cluster volume is currently in progress. No other actions are possible.

#### 2.3.3.1.2 Volume Options

From the volumes in [2.3.3.1 Volume List](#), you can click **Action** button to list the options for the additional tasks on the volume.

Category	Description
View	View the details on the node forming the cluster volume.
Delete	Perform deletion on the cluster volume. Please refer to <a href="#">2.3.3.3 Deleting Volume</a> .
Expand	Adds a node for scaling-out and expand volume for scaling-up. Please refer to <a href="#">2.3.3.4 Expanding Volume</a> .
SNAPSHOT	Manage snapshot of a cluster volume. Please refer to <a href="#">2.3.3.5 Managing Snapshot</a> .

### 2.3.3.2 Creating Cluster Volume

Click **Create** button from top left of the page to create a cluster volume.

If the system failed to create a cluster volume, proceed the deletion to remove the remaining resources.

#### 2.3.3.2.1 Selecting Volume Type

Select how the cluster volume should distribute and replicate.

Category	Description
Distribution Policy	Determine how the cluster volume should distribute and replicate. Choose between <b>Distributed</b> , <b>Shard</b> , and <b>Network RAID</b> . Please refer to <a href="#">2.3.2 Technical Factors</a> .
Number of Copy	Set the number of duplicate data in the cluster volume for data availability. It can be selected only when the distribution policy is set as <b>Distributed</b> or <b>Shard</b> .
Chain Mode	Create a cluster volume in <b>Distributed-Replicated Chain Mode</b> . It can be selected only when the distribution policy is set as <b>Distributed</b> and the number of replica will be fixed to 2.
No. of Code Node	It can be selected when the distribution policy is set as <b>Network RAID</b> . If the node fails by exceeding the number of erasure codes, the data will be inaccessible.
Arbiter	Adds the arbiter brick which only has the metadata. It can be selected when the number of replica is 2.
Block Size for Sharding	Able to select the data size which will be distributed to each node from the shard volume.

#### 2.3.3.2.2 Configuring Volume Size

Configures the type and size of node and volume that consists the cluster volume.

If the dynamic allocation is not configured on **vg\_cluster** volume pool, you will not be able to select dynamic allocation as the volume type.

Please refer to [\[2.2.1.2 Creating Dynamic Volume Pool\]](#) to configure dynamic allocation on the volume pool.

Category	Description
Volume Type	Select whether a cluster volume should use thin provisioning. <b>Static Allocation</b> - A cluster volume will not use thin provisioning. <b>Dynamic Allocation</b> - A cluster volume will use thin provisioning. Snapshot will be also available.
Volume Size	Configure the total size of a cluster volume. Numbers can be entered up to second decimal places. If the volume type is set as static allocation, there will be a size limit for the volume when you create one.
Node List	Select one or more node to form a cluster.

#### Node List

Select one or more nodes when [2.3.3.2.2 Configuring Volume Size](#) for the cluster.

Category	Description
Name	Hostname of a node.
Device Status	Displays the status of a node.
Service Status	When the volume type is set as <b>static allocation</b> , it will show whether the service on <b>vg_cluster</b> is available. When the volume type is set as <b>dynamic allocation</b> , it will show whether the dynamic volume pool service on <b>vg_cluster</b> is available.
Pool Usage	When the volume type is set as <b>static allocation</b> , it will show the usage of <b>vg_cluster</b> . When the volume type is set as <b>dynamic allocation</b> , it will show the dynamic volume pool usage of <b>vg_cluster</b> .
Available Space	When the volume type is set as <b>static allocation</b> , it will show the remaining space of <b>vg_cluster</b> . When the volume type is set as <b>dynamic allocation</b> , it will show the remaining dynamic volume pool space of <b>vg_cluster</b> .

### 2.3.3.2.3 Creating Volume

Enter a name and select a transfer type for the cluster volume.

Category	Description
Volume Name	Enter a name for the cluster volume. Enter the name in alphanumeric between 4 to 20 characters. Allowed special characters are "-" and "_".
Transfer Type	Select the data transfer type between nodes in the cluster.

### 2.3.3.2.4 Transfer Type

Lists the transfer type when [2.3.3.2.3 Creating Volume](#).

Category	Description
tcp	Use TCP network between nodes to transfer data.
rdma	Send data between nodes through Remote DMA. RDMA device driver takes over the data transfer process between nodes which will minimize the CPU load.
tcp,rdma	Use two modules at once.

### 2.3.3.3 Deleting Volume

Select a volume from [2.3.3.1 Volume List](#) and select **Delete** from the drop-down list on **Action** column to delete the volume.  
ceed the deletion to remove the remaining resources.

The cluster volume that has a share cannot be deleted. Proceed the deletion after removing all share.

Category	Description
Reason	Enter the reason for the deletion.
Password	Enter the password for the administrator's account.

### 2.3.3.4 Expanding Volume

Select **Expand** from **Action** column in [2.3.3.1 Volume List](#) to expand the cluster volume.

There are two types of expansion, the Scale-Out, which adds an additional node to the cluster, and the Scale-Up, which extends the size of a volume.

## Data Rebalancing

After scaling out, the administrator can transfer data to the added node to evenly distribute the data and I/O.

The rebalancing will proceed in the background which will take time in proportion to the amount of data, and in some circumstances, the service performance might drop.

You can monitor the progress through **Task** section in **\*\*Event\*\*** menu.

Category	Description
Volume Name	The name of the cluster volume.
Status	View the service status and active status of the volume. The status will be displayed such as <b>OK</b> , <b>Error</b> , and <b>Expansion Failed</b> . Please refer to <a href="#">2.3.3.1.1 Volume Status</a> .
Volume Type	View whether it uses thin provisioning of the cluster volume. <b>Static Allocation</b> - The cluster volume that does not use thin provisioning. <b>Dynamic Allocation</b> - The cluster volume that uses thin provisioning. Snapshot is also available.
Distribution Policy	View the distribution and replication policy of the cluster volume. Please refer to <a href="#">2.3.2 Technical Factors</a> .
Distributed Node	The node that forms the cluster volume are distinguished into node groups which stores replication of the identical data. The number of distributed nodes will show the total number of node group and if a client uses the data, it will replicate and store the data to one of the group from the node group.
Number of Copy	The number of identical data in the cluster volume for data availability.
Expansion Type	Able to select the expansion type of the cluster volume. <b>Increase Size</b> - Proceeds scale-up volume expansion. <b>Add Node</b> - Proceeds scale-out node expansion. A cluster volume which is tiered or created with chain mode only supports scale-in expansion. The distribution and replication policy of the cluster volume might be changed.
Current Volume Size	View the total capacity of the cluster volume before the expansion.
Available Volume Size	View the total capacity of the cluster volume after the expansion. If the expansion type is configured as <b>Add Node</b> , the volume size will be automatically calculated after the expansion according to the selected nodes from the bottom list. If the expansion type is configured as <b>Increase Size</b> , you will be able to set the expanded cluster volume size.
Node List	View the list of status and condition of the node that will be used for expanding the cluster volume.

## Node List

You can verify the status and condition of the node forming the cluster.

If the expansion type is set to **Increase Size**, it will display the information on the node forming the cluster volume.

If the expansion type is set to **Add Node**, it will display the information on the node that can be added to the cluster volume.

Category	Description
Name	View the hostname of a node.
Brick Size	If the expansion type is set as <b>Increase Size</b> , it will display the size of a logical volume forming the cluster volume.
Pool Usage	When the volume type is set as <b>static allocation</b> , it will show the usage of the volume pool.
Device Status	View the status of a node.
Service Status	View whether the volume pool service of a node is available.
Available Space	View the availability of the volume pool of a node.

### 2.3.3.5 Managing Snapshot

The snapshot is a technique of saving the volume image at a certain point and can be accessed later on in case there is a corruption or modification of the original data.

You can use the Snapshot Scheduler to easily create or rotate a snapshot.

Go to [2.3.3.1 Volume List](#) and select **Snapshot** from the drop-down list of the **Action** column to manage the snapshot option of your cluster volume.



#### Online Snapshot

- Snapshot available for a volume at a certain point of time.
- Snapshot can be created during service.

#### Snapshot Barrier

- Data crash prevented when snapshot is created.  
(to prevent clash with file operation)

#### Snapshot Crash Consistency

- A snapshot is created at the point of time that it is taken without clashing with the snapshot which was created before.

#### Note

The snapshot option only activates if the cluster volume is using dynamic allocation.

The number of the snapshot you can create per node is **255**.

The snapshot creation might be canceled if it exceeds the specified time in some circumstances such as I/O overload.

The snapshot creation will fail when rebalancing the cluster volume.

Category	Description
Snapshot Name	The snapshot name will be composed with the requested name and the time of creation converted to GMT. In case of the snapshots created by the Snapshot Scheduler, the name will be specified as "auto".
Schedule Name	View the name of the Snapshot Scheduler that created the snapshot. If the snapshot is created manually, it will display <b>No Schedule</b> .
Node	The name of a node forming the cluster volume.
Status	View the status of a snapshot.
Enable	View whether the snapshot is activated. Please refer to <a href="#">2.3.3.5.3 Snapshot Activation/Deactivation</a> .
Date Created	The date of creation converted to the web-based time.
Action	Able to proceed additional tasks on a snapshot. <b>Delete</b> - Delete the selected snapshot. <b>Activate/Deactivate</b> - Change the activation of a snapshot.

#### 2.3.3.5.1 Creating Snapshot

Press **Create** button from **Snapshot Management** pop-up to create a snapshot for the cluster volume.

Category	Description
Snapshot Name	Enter the name of the snapshot.
Available Thin Volume Pool Space	Creating a snapshot expends the volume pool space that is dynamically allocated.

### 2.3.3.5.2 Deleting Snapshot

Go to [2.3.3.5 Snapshot Management](#) and select **Delete** from **Action** column to delete a snapshot.

### 2.3.3.5.3 Activating/Deactivating Snapshot

Go to [2.3.3.1 Volume List](#) and select **Activate** or **Deactivate** from **Action** column to use the snapshot.

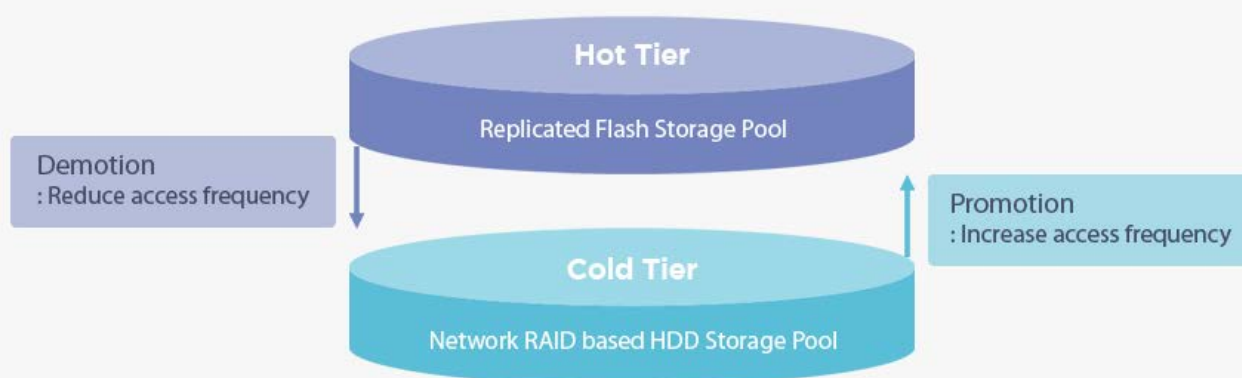
A client can access the snapshot data only when the snapshot is activated.

- **Snapshot Path for the Client**
  - `<MOUNT_DIR>/snaps/<ACTIVATED_SNAPSHOT_NAME>`

### 2.3.3.6 Managing Tiering

Select **Tiering** from **Action** column to configure or delete the tiering from the cluster volume.

If there is no volume pool for the tiering, please refer to [2.2.1.1 Creating Tiered Volume Pool](#) and create it beforehand.  
If the volume type of the cluster volume is set as dynamic allocation, you must create a dynamic volume pool for the tiering.  
Please refer to [2.2.1.2 Creating Dynamic Volume Pool](#) to proceed the configuration of the dynamic volume pool.



#### Examples on the Tier

Hot Tier: A tiered, distributed-replicated volume pool composed of SSD/NVMe disk or SAS 15K RPM.

Cold Tier: Large space SATA HDD configured with network RAID.

#### 2.3.3.6.1 Configuring Tier

Select the space for the tier, number of replica, and the node to configure. The created tier will work as a distributed-replicated volume.

Select the node in multiples of the number of replica.

Category	Description
Volume Name	A name for the cluster volume which will be tiered.
Number of Copy	A configuration for the availability of the data which will be stored in the tier. Determines the number of identical data it will store.

Node List	The list of node you can select for tiering.
-----------	--

## Node List

Select the node to apply tiering referring to [2.3.3.6.1 Configuring Tier](#).

Category	Description
Name	View the hostname of a node.
Device Status	View the status of a node.
Service Status	View whether the node's volume pool service is available.
Pool Usage	View the usage of a tiered volume pool.
Available Space	View the availability of the node's volume pool.

## 2.3.3.6.2 Tier Management

Select **Tiering** from **Action** column to verify the tiering status of a cluster volume.

Category	Description
Volume Name	A name for the cluster volume which is tiered.
Number of Copy	A number of identical data saved in the tiered volume.
Tier Size	Total space of the tiered volume.
Tier Option	Configuration option on the tier. Please refer to <a href="#">2.3.3.6.3 Modifying Tiering Option</a> .
Node List	A list of node composing the tier.

## Node List

You can verify the status and condition of the nodes composing the tier from [2.3.3.6.2 Tier Management](#).

Category	Description
Name	View the hostname of the node.
Device Status	View the status of the node.
Service Status	View whether the node's tiered volume pool service is available.
Tier Usage	View the usage of the node's tiered logical volume.
Tier Size	View the total space of the node's tiered logical volume.
Available Space	View the availability of the node's tiered volume pool.

## 2.3.3.6.3 Modifying Tiering Option

The automated file transfer between the hot tier and cold tier is called the **Migration** and you will be able to configure the settings from this option.

Category	Description
Tiering Mode	<b>Cache</b> - Executes the migration according to the values that have been set on Watermark, I/O Threshold, and Migration Frequency. <b>Test</b> - Executes the migration according to the values that have been set on I/O Threshold and Migration Frequency, excluding the Watermark.
Available data capacity	Limit the total capacity of the file while migrating them.
Number of Available File	Limit the total number of files while migrating them.
Watermark/Promotion	Stop the promotion when the usage of hot tier exceeds the entered value.



Frequency	
Watermark/Demote Prevention Frequency	Stop the demotion when the usage of hot tier is below the entered value.
IO Threshold/Promotion Read Count	If the number of <b>read</b> on a file in the cold tier exceeds the entered value, it will be selected as a target to be promoted.
IO Threshold/Promotion Write Count	If the number of <b>write</b> on a file in the cold tier exceeds the entered value, it will be selected as a target to be promoted.
Migration Frequency/Promotion Cycle	Set the cycle in seconds which will proceed the promotion.
Migration Frequency/Demotion Cycle	Set the cycle in seconds which will proceed the demotion.

## Glossary

Term	Description
Promote	The transfer of file from cold tier to hot tier.
Demote	The transfer of file from hot tier to cold tier.
Migration	The transfer such as promotion and demotion.
Watermark	The promotion and demotion will be decided depending on the usage of the tier. There are low and high watermark which will be determined by the fullness of hot tier. If the usage on the tier exceeds high watermark, it will stop the promotion and will decrease the usage on the tier. Oppositely, if the usage on the tier falls behind the low watermark, it will stop the demotion and will increase the usage on the tier.
I/O Threshold	Configure the access frequency on the file to determine it as a target to be promoted or demoted if the frequency exceeds the defined value.
Migration Frequency	Configure how many times of promotion and demotion should be proceeded.

## 2.4. Snapshot Scheduling Management

### 2.4.1 About Snapshot Scheduling Management

Schedule the periodic snapshot creation on the cluster volume with dynamic allocation.

You can set multiple schedules in one cluster volume, and each schedule can repetitively be created and deleted by the number of snapshots.

A scheduling can be set as hourly, daily, weekly, and monthly.

When the scheduling fails to create a snapshot, it will retry every five minutes, over three times at most.  
After failing all three times, it will retry the procedure on the next scheduled time.  
The maximum number of snapshot per cluster volume is 255.  
The sum of all snapshots of every schedule in a single cluster volume cannot exceed **255**.

### 2.4.2 Managing Snapshot Scheduling

#### 2.4.2.1 Snapshot Schedule Management

You can verify the status and condition of the snapshot schedule per cluster volume.

Category	Description
----------	-------------

Schedule Name	The name of the schedule. Confirm the name from the snapshot management page to see which snapshot is automatically created in which schedule. Verify the list of snapshot referring to <a href="#">2.3.3.5 Managing Snapshot</a> .
Volume Name	The name of the cluster volume that will create snapshot.
No. of Snapshot	The total number of snapshot created through the scheduling.
Start Date	View the date when it will start creating the snapshot.
End Date	View the date when it will end creating the snapshot.
Repeat Interval	View the interval of snapshot creation. Please refer to <a href="#">2.4.2.2 Creating Snapshot Schedule</a> .
Next Run Time	View the date and time when it will proceed the next schedule for the snapshot.
Last Executed Time	View the date and time of the most recently executed schedule.
Last Executed Status	View whether the most recently executed schedule has created a snapshot. <b>OK</b> - Snapshot created successfully <b>Error</b> - Snapshot failed to create
Activation	View whether the scheduling is working. When deactivated, the snapshot will not be created. <b>Enable</b> - Enable scheduling <b>Disable</b> - Disable scheduling
Action	Additional option for the scheduling. <b>Change</b> - Change the settings on the schedule <b>Delete</b> - Delete the schedule

## 2.4.2.2 Creating Snapshot Schedule

Go to **Snapshot Schedule Management** page and press **Create** button to start the scheduling.

You can configure the time interval for the schedule on the left corner of the **Create a Snapshot Schedule** window.

The interval for the schedule can be set as hourly, daily, weekly, and monthly.

### General Settings

Category	Description
Schedule Name	The name of a schedule. Enter the name in alphanumeric between 4 to 20 characters. Allowed special characters are "-" and "_".
Volume Name	The name of a cluster volume where the snapshot will be created.
Start Date	Set the date of the schedule on when it will start creating snapshots. The default setting will be the current date.
End Date	Set the date of the schedule on when it will stop creating snapshots.
No. of Snapshot	Set the maximum number of snapshot which the schedule will create. If a snapshot is created over the limit, the oldest snapshots will be deleted. The sum of all snapshots of every schedule in a single cluster volume cannot exceed 255.
Enable Scheduling	Configure the activation of a schedule. When deactivated, the snapshot will not be created.
Enable Snapshot	The snapshot will be activated when it is created. Please refer to <a href="#">2.3.3.5.3 Activating/Deactivating Snapshot</a> .

### 2.4.2.2.1 Hourly Snapshot Scheduling

Set a schedule which will create a snapshot at the specific time every day.

Please refer to the **General Settings** of [2.4.2.2 Creating Snapshot Schedule](#).

Category	Description
Time	Set the time between 00:00~23:00 to create a snapshot at the exact hour.

#### 2.4.2.2.2 Daily Snapshot Scheduling

Set a schedule which will create a snapshot of the selected day.  
The snapshot will be created at the scheduled time and day.  
Please refer to the **General Settings** of [2.4.2.2 Creating Snapshot Schedule](#).

Category	Description
Interval	Set how many daily intervals the schedule will be executed.
Time	Set the time between 00:00~23:00 to create a snapshot at the exact hour.

#### 2.4.2.2.3 Weekly Snapshot Scheduling

Set a schedule which will create a snapshot of the selected week.  
The snapshot will be created at the scheduled time, day, and week.  
Please refer to the **General Settings** of [2.4.2.2 Creating Snapshot Schedule](#).

Category	Description
Interval	Set how many weekly intervals the schedule will be executed.
Day	Set the day of when the schedule will be executed in the selected week.
Time	Set the time between 00:00~23:00 to create a snapshot at the exact hour.

#### 2.4.2.2.4 Monthly Snapshot Scheduling

Set a schedule which will create a snapshot of the selected month.  
The snapshot will be created within the scheduled time, day, week, and month.  
Please refer to the **General Settings** of [2.4.2.2 Creating Snapshot Schedule](#).

Category	Description
Interval	Set how many monthly intervals the schedule will be executed.
Week	Set the week of when the schedule will be executed in the selected month.
Day	Set the day of when the schedule will be executed in the selected week.
Time	Set the time between 00:00~23:00 to create a snapshot at the exact hour.

### 2.4.2.3 Modifying Snapshot Schedule

Select **Change** from the drop-down list on the **Action** column to modify the settings on the schedule.  
For more information on the configuration, refer to [2.4.2.2 Creating Snapshot Schedule](#).

**Volume Name** cannot be modified from the settings.  
When the schedule is modified, **Next Run Time** will be reconfigured to the modified value.

#### 2.4.2.4 Deleting Snapshot Schedule

Select **Delete** from the drop-down list on the **Action** column to delete the schedule.

When a schedule is deleted, the snapshots created by the schedule will not be deleted.

## 3 Account and Authentication

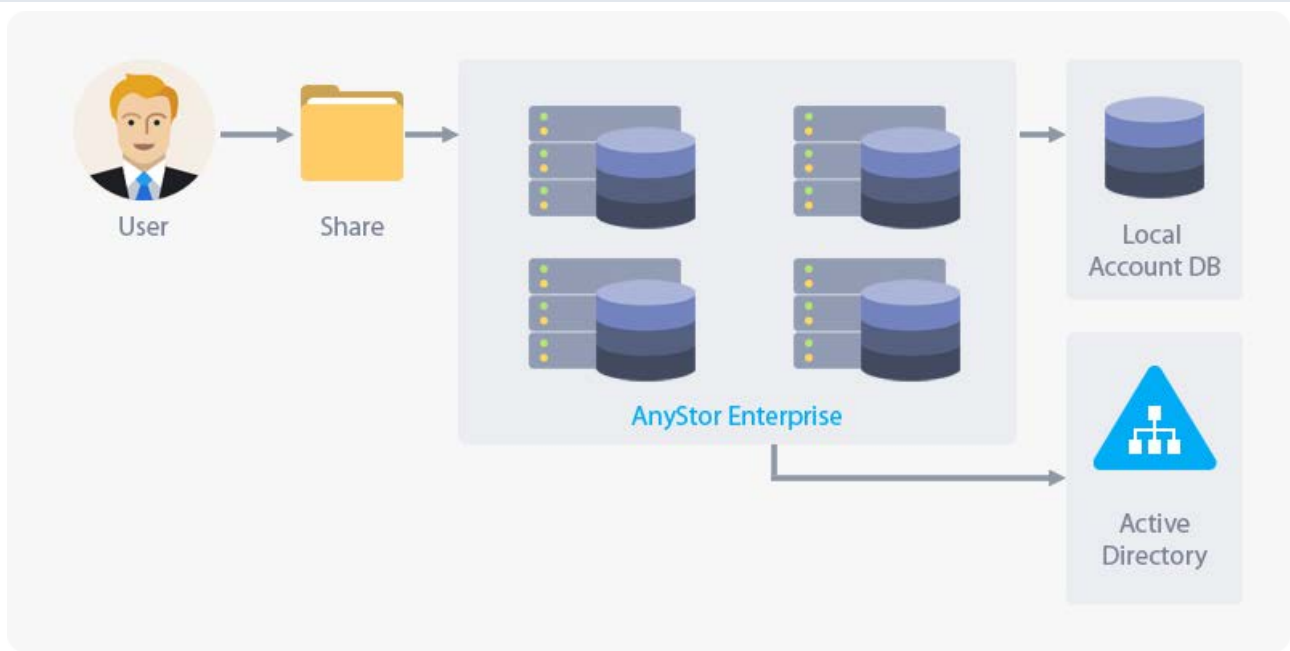
### 3.1 About Account and Authentication

AnyStor-E provides local and AD (Active Directory) authentication system for the security on your cluster.

It provides Unix/Linux-style access controls and Extended ACLs along with Windows-style access controls when using the AD authentication.

Through the local authentication, all cluster nodes can share the identical user UID and share access controls.

#### Authentication for AnyStor-E



- **Security Layer for the Access**

- Administrator: Access to AnyStor-E cluster manager to manage the cluster.
- User: As it is mostly accessed by Windows user, CIFS protocol can also be used.
- Security Zone: The IP range that can access to the volume used when accessing through NFS/CIFS. Please refer to [1.5.4 Security Settings](#).

- **Contents**

Menu	Description
User	View the list of user accounts which can be created, modified, deleted, and added to groups.
Group	View the list of groups which can be created, modified, and deleted.
External Authentication	Provides configuration of directory services.
Administrator	Provides modifiable information on the cluster administrator such as changing passwords.

Supports user and group ACL, which the maximum number of entry is 64.  
Compatible with the standard Unix file permission tools such as ls, chmod, and chown.  
However, you will not be able to use Unix and Windows style permission in the same volume, and the same file locking on different clients is not supported.

## 3.2 User

### 3.2.1 About User Menu

Use CIFS service to manage the user information which can access the cluster volume.  
If the service is based on Windows, administrators can manage the service using the local or active directory authentication.  
The user function is based on **local authentication**.

- **Contents**

Category	Description
User ID	View the registered account name on the cluster.
Description	View the description which is entered while creating the user.
Home Directory	View the path of the user's home directory.
Email	View the registered email.
Group Information	View the information on the group where the user belongs to. <b>Group Name</b> - View the group name which is entered while creating the group. <b>Group Description</b> - View the description which is entered while creating the group. <b>Authentication</b> - View the authentication which is registered while creating the group.

- **Tip**

If it is hard to find each local users from the list, use the search option from **User Information** list to browse the user by user ID, email, and the description.

#### NFS and Local User Permission

When connecting to NFS, the file permission will be created due to the permission of the **accessed host's user ID and group ID**.  
In this case, it can be mixed with the user ID and group ID appointed by AnyStor-E's local authentication.  
To avoid the crash, it is not recommended to use the same volume as CIFS/NFS in case of the service that needs permission control.

### 3.2.2 Creating User

Go to Account >> User page and click **Create** button in the top left corner to execute the user creation wizard.  
Enter the details on the user, select the group, and press **OK** to complete the creation.  
The created user will be affiliated to the local authentication domain and will be able to use the share through user access control when accessing through CIFS.

#### Tips

IDs contain at least 5 characters and cannot start with numbers.  
You must enter the email address of a user and must use the standard form (e.g. example@example.com).  
Passwords contain at least 5 alphanumeric characters.  
Group session can be skipped.

- **Entering User Information**

Category	Description
User ID	An account name must contain at least 5 alphanumeric characters.
Description	Enter the description of the user. This part can be skipped.
Email	Enter the email address of a user.
Password	The password for a user's account contains at least 4 alphanumeric characters.
Confirm Password	Enter the same password to check once more.

- **Selecting Group**

Category	Description
Group Name	View the name of the group.
Description	View the description of the group.
Authentication	View the information on the authentication of the group.

- **Tips**

A user can be in multiple groups.

You can browse the group you are looking for from the search panel on the top of the list.

If there is a crash between users and groups with the CIFS share access permission, the restriction on the access permission will be prioritized, therefore it is recommended to separate groups and users in this matter.

### 3.2.3 Deleting User

Select the checkbox on the left from the user list to activate the **Delete** button.

You can delete multiple users by selecting more than one checkbox on the left.

#### Note

When deleting the user, CIFS users will maintain the connection until it is disconnected.

The deleted user's file will preserve the information on the UID, in case if the new user is appointed to have the same UID to obtain the permission on the ownership of the file.

### 3.2.4 Modifying User

Select the checkbox on the left from the user list to activate **Modify** button for the user modification.

You can modify its description, email address, password, and the group.

- **Contents**

Category	Description
User ID	Once the user ID is registered, it cannot be modified.
Description	The description of the user can be modified.
Email	The email address of the user can be modified.
Password	The password on the user can be modified. If not entered, it will use the previous password.
Confirm Password	Enter the same password to check once more.

- **Modifying Group Selection**

Select one or more group by the checkbox on the left of the group list to reorganize where the user will belong to.

#### Note

Even after the modification, the old information will still be displayed until the CIFS user ends the connection.

## 3.3 Group

### 3.3.1 About Group Management

You can manage the group of a user which accesses the cluster volume through CIFS protocol.

The group permissions are compatible with the standard Unix tool such as chgrp. You can create, modify, and delete the group information.

- **Category**

Category	Description
Group Name	View the name of a group.
Description	View the description which is entered while creating the group.
User Information	View the information on the user.

- **Tip**

In Windows environment, it will be convenient to allow the access to a CIFS share for the group.

A group name must be at least 5 alphanumeric characters and symbols. However, it should not be starting with numbers.

You can use the search option on the top right of the list to browse the group by its ID and description.

### 3.3.1 Creating Group

Go to Account >> Group page and click **Create** button on the top left corner to execute the group creation wizard. Enter the details on the group, select the user, and press **OK** to complete the creation.

The created group will be affiliated to the local authentication domain and will be able to use the share through group access control when accessing through CIFS.

- **Entering Group Information**

Category	Description
Group Name	The name of a group.
Description	The description of a group.

- **Selecting User**

Select one or more users by the checkbox on the left.

### 3.3.2 Deleting Group

Select one or more group by the check box on the left to activate the **Delete** button.

Click **Delete** button to delete the selected group.

#### Note

When deleting the group, CIFS users will maintain the connection until it is disconnected.  
The deleted group's file will preserve the information on the GID, in case if the new group is appointed to have the same GID to obtain the permission on the ownership of the file.

### 3.3.3 Modifying Group

Select the checkbox on the left from the group list to activate **Modify** button for the group modification.  
You can modify the group description and the user.

- **Contents**

Category	Description
Group Name	Once the group ID is registered, it cannot be modified.
Description	The description of the group can be modified.

- **Modifying User Selection**

Select one or more user by the checkbox on the left of the user list to register.

**Note**

Even after the modification, the old information will still be displayed until the CIFS user ends the connection.

## 3.4 External Authentication

### 3.4.1 About External Authentication

This feature is for committing the user/group management, which is used for accessing the cluster volume, to the authentication server on the network.

AnyStor-E supports Microsoft's **Active Directory** service.

It can also synchronize the external authentication server with the local authentication when it is needed.

### 3.4.2 Definition

A fair number of organizations these days use centralized organization management services, such as directory services, to flexibly administer the members of the organization.

AnyStor-E utilizes user/group information that is managed in these management services through the network and this information are occasionally used for providing the interlock, which is specified on organization management such as restricting the access permission to the storage resources of the individual user or group.

These functionalities benefit the administrators not to have the same user/group management task repetitively and perseveres high level of security on the resources on whether it implements organization management service through upgraded authentication.

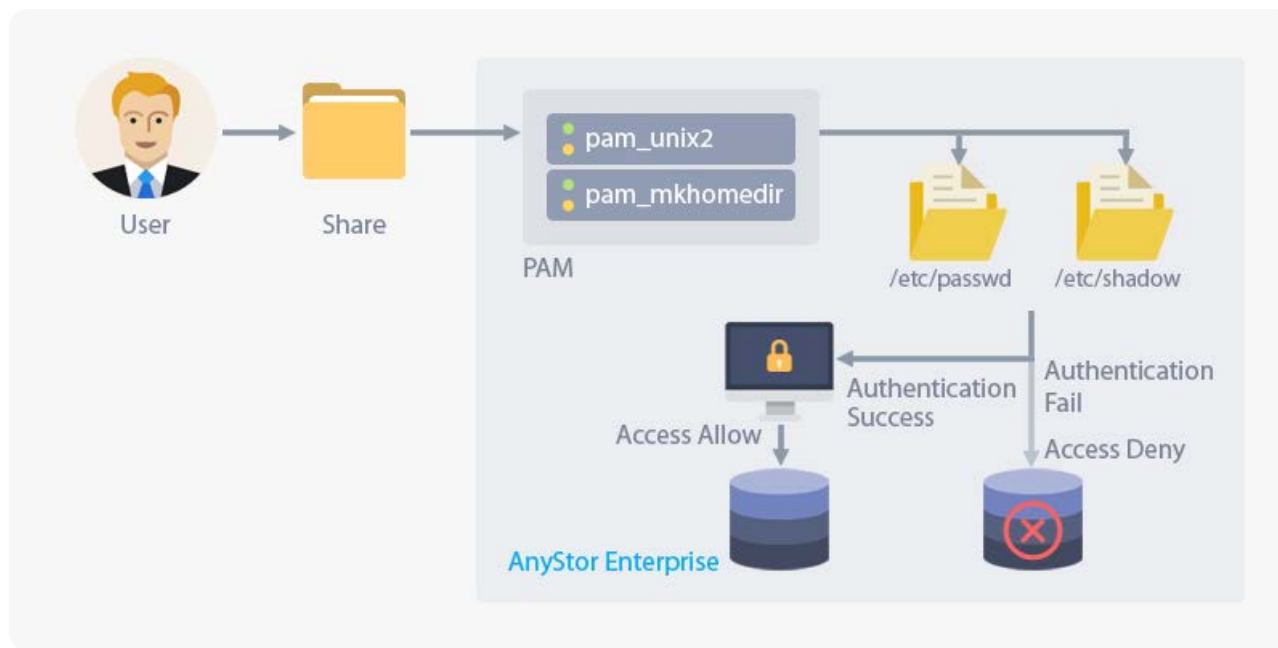
### 3.4.3 Description and Configuration

#### 3.4.3.1 Local Authentication

**Local Authentication** carries out user/group authentication through account information managed by AnyStor-E local system and PAM subsystem without using external authentication service.



## Local Authentication of AnyStor-E



Go to Account >> External Authentication page, select **Local User** option and press **Save** to apply the configuration.

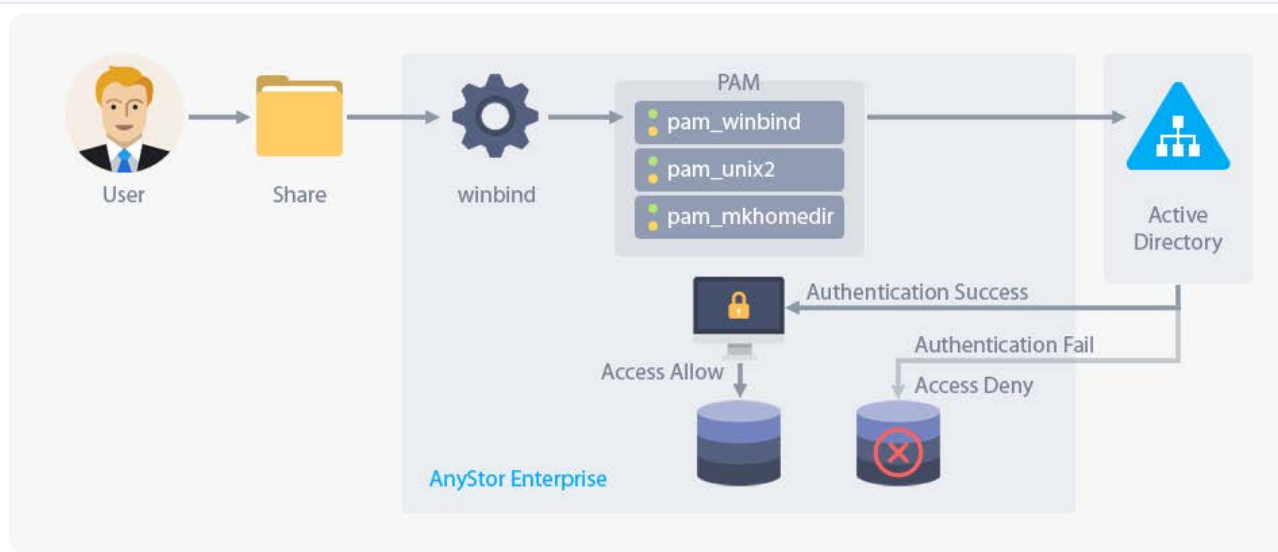
In this case, the previous external authentication will not be applied and might cancel all user/group access control on each share.

### 3.4.3.2 Active Directory

The information on the local authentication will still be valid even after activating the external authentication through active directory.

**Active Directory** is a classic Windows system-based organization/authentication management service presented by Microsoft. Through this, AnyStor-E launches user/group authentication interlocking with active directory through Windbind and PAM subsystem.

## Active Directory Authentication of AnyStor-E



Go to Account >> External Authentication page and select **Active Directory** option. Then the configuration menu will be displayed with the following items.

Item	Description
<b>Domain Name</b>	Enter the ADS domain address following the FQDN(Fully Qualified Domain Name) format.
<b>Domain Controller</b>	Enter the FQDN of the domain controller which will provide ADS domain service.
<b>ADS Account Name</b>	Enter the user's name which will access the domain controller.
<b>ADS Account Password</b>	Enter the password for the user account.

Select **Enable Active Directory** checkbox and save the progress to enable the external authentication.

+ The current version of AnyStor-E supports external authentication only through the SMB file sharing protocol. Therefore, if you wish to use NFS file sharing protocol, you must use it through the local system's authentication information.

## 3.4.4 Confirming External Authentication

### 3.4.4.1 Create User

Please refer to [3.2.2 Creating User](#) to add a new user.

### 3.4.4.2 Create Volume

Please refer to [2.3.3.2 Creating Cluster Volume](#) to create a new volume.

### 3.4.4.3 Create and Configure Share

- 1 Please refer to [4.3.3.2 Creating Share](#) to create a new share.
- 2 When the share is created, refer to [4.3.4.2.2 For Users Accessing Through CIFS](#) and configure the access permissions of the added users that were created in [3.4.4.1 Creating User](#).

### 3.4.4.4 Verify the Authentication

The current version of AnyStor-E supports external authentication only through the SMB file sharing protocol.

#### 1 Windows

- Go to **Start >> Run(R)** or press **Windows key + R** to open the **Run** window.
- Enter `\\<AnyStor-E Service IP>\<Share Name>` and press **OK** to access the share that was created through [3.4.4.3 Creating and Configuring Share](#).
- As the pop-up screen requires the user's name and password, enter the information you have acquired to access the share.
- If the Windows File Explorer appears, it signifies that the authentication was successful. Verify whether you can access the file or the directory as you have configured from the path.

#### 2 Linux

- Install the SMB client.
  - Arch**: `pacman -Sy cifs-utils`
  - CentOS**: `yum install -y cifs-utils`
  - OpenSuse**: `zypper -n install samba-client`
  - Ubuntu/Mint**: `sudo apt-get install -y cifs-utils`
- Execute the mount command as follows.
  - `mount -t cifs //<AnyStor-E Service IP>/<Share Name> <Mount Path> -ouser=<User Name>,password=<User Password>,uid=<User ID>,gid=<Group Name>,iocharset=utf8`

The option of this command might differ depending on the Linux distributions or the package versions. If it is the case, please refer to `man mount.cifs`. Also, depending on the client's environment, you must check whether you use incompatible security protocol or protocol version. For more details, check the `sec=` option and `vers=` option that is described in `man mount.cifs`.

If the command is executed without error, verify whether the mount path is viewed from the output of the `mount` command. If it is displayed, it means that the authentication was successful. Then navigate to the path ( `cd <Mount Path>` ) and check whether the file/directory is accessible.

### 3. Mac OS X

- Refer to [3.4.3 Reference](#) and learn how to connect using the file share in Mac and try to access.

## 3.4.5 Reference

- [Active Directory Technology Abstract \(Korean\) - Microsoft Technet](#)
- [How to connect with File Sharing on your Mac - Apple Support](#)
- [mount.cifs - mount using the Common Internet File System \(CIFS\)](#)

## 3.5 Administrator

### Role of Administrator

The administrator possesses full authority over the service and management of AnyStor-E. They identify the overall cluster status through periodic overviews and monitors the ongoing tasks and system failures through notification of events and tasks. The administrators are also constantly being notified of the emergency situations and background tasks by email.

### 3.5.1 About Administrator Menu

The menu will provide basic account settings of the cluster administrator. The entered information will be used as an alarm option on the event/task which will be informed by email.

### Note

The administrator ID cannot be modified.  
The email address of administrator and engineer must follow the designated email format(e.g. example@example.com)  
The initial password will be 'admin'.

### 3.5.2 Configuring Administrator Information

- Super Administrator Information

Category	Description
ID	View administrator's account ID.
Company Name	View the company name.
Admin Phone	View the administrator's phone number.
Admin Email	View the administrator's email address.
Engineer	View the engineer's name.

<b>Engineer Phone</b>	View the engineer's phone number.
<b>Engineer Email</b>	View the engineer's email address.
<b>Change Password</b>	<b>Password</b> - Modify to the new password. <b>Confirm Password</b> - Enter the same password for confirmation.

After the configuration, click **Save** button to save the modified information.

## 4 Service Protocol

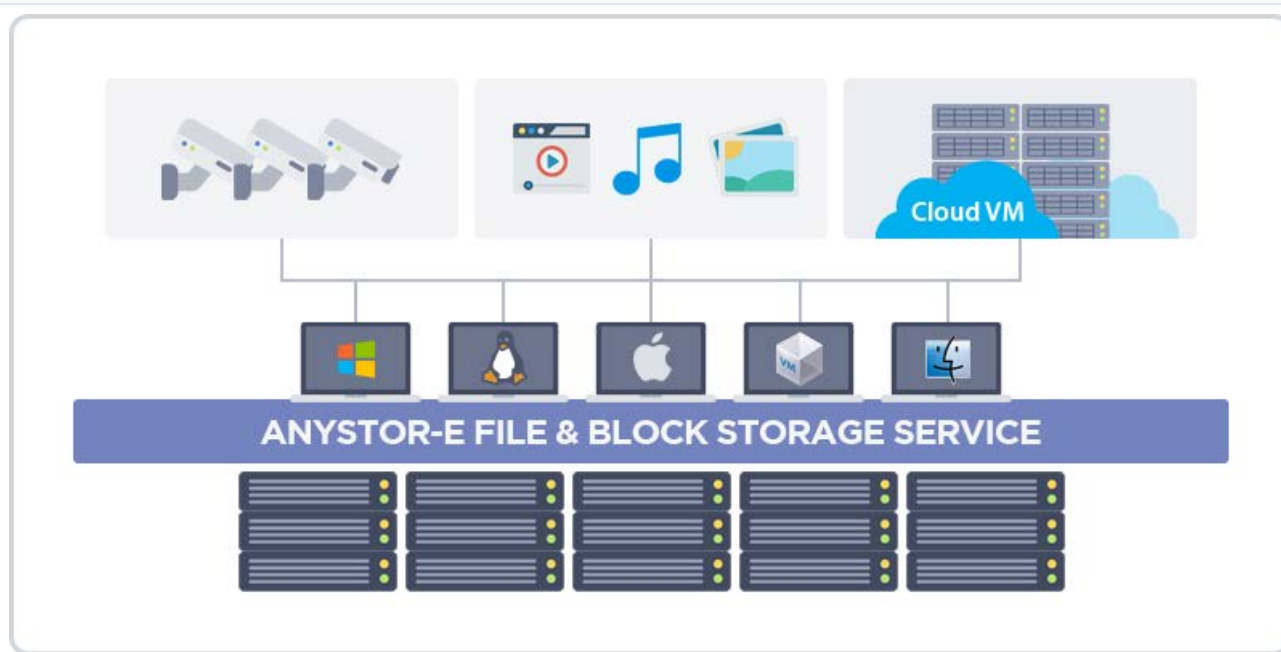
AnyStor-E supports the standard file and block service protocols along with the Filesystem in Userspace (FUSE).

File service is supported through **NFS v3**, **CIFS/SMB v2**, and **CIFS/SMB v3**.

As for the block service, it is supported through **LIO-based iSCSI and iSER**, and FC and FCoE as an optional extension.

As it fundamentally uses GlusterFS, the main connection will be done through **FUSE and gfapi**.

### Compatibility and Utilization of AnyStor-E



#### Limitations of GUI

AnyStor-E management GUI can only configure **NFS and CIFS** and the rest of the functions are done manually through CLI. This manual only described the configuration done in GUI. For the manual configuration, please refer to other documents.

- The supported configurations in GUI are as follows.

Category	Description
<b>Protocol Settings</b>	The menu for enabling/disabling share protocols.
<b>Share Settings</b>	You can configure share for each volume and set access control list with its detailed configuration.

## 4.1 About Service Protocol

### Multi-Protocol Support

AnyStor-E has multi-protocol access.  
However, lock and ACL policies are not shared between protocols.

Every node of AnyStor-E will have **/export/(Volume Name)** folder created and will have access to the identical file system image.

The folder can be shared through NFS and CIFS/SMB protocols along with the export option.

AnyStor-E Manager only supports tested and tuned configuration. Further configuration can be done through the technical support.

## 4.1.1 Technical Description on the Protocol

This chapter shows the basic technical description on NFS/CIFS service protocols.

### 4.1.1.1 CIFS / SMB (Common Internet File System)

AnyStor-E supports SMB 1.0, 2.0, and 3.0. The details are as follows.

SMB version	Supported Operating System
1	Windows 2000 or later Windows XP or later Mac OS X 10.5 or later
2	Windows Vista or later Windows Server 2008 or later
2.1	Windows 7 or later Windows Server 2008 R2 or later
3	Windows 8 or later Windows Server 2012 or later Mac OS X 10.11 or later

- **About CIFS/SMB Protocol**

- CIFS/SMB is a protocol that allows accessing files or data of remote computer through the network.
- Through CIFS/SMB protocol, it can control the access by users, domains, and IP ranges.
- AnyStor-E supports Windows and Linux along with MacOS environment.

- **NetBIOS Name**

- NetBIOS(Network Base Input/Output System): A communication protocol used when the software communicates with the remote computer through the network.
- NetBIOS Name is a standard character string of fewer than 16 letters for defining a software which becomes the subject for the communication by the NetBIOS protocol.

- **WINS (Windows Internet Naming Service)**

- WINS is a service used in Windows client.
- It associates the NetBIOS name and the IP address which will notify the appropriate network address for the NetBIOS name provided by the Windows client when needed.

- **CIFS Security Mode**

- CIFS protocol supports all types of access controls on the file system and these types are known as the **security mode**.

Security Mode	Description
user	This will be the default setting if the user does not designate any security mode. It will allow or deny the request by checking the user's name and password of the client who is making the request.

<b>ads</b>	The authentication module of CIFS protocol which uses Microsoft ADS(Active Directory Service). For more information on ADS, please refer to <a href="#">3.4 External Authentication</a> .
<b>domain</b>	The option to read and write the user or group using CIFS protocol concentrating into a single shared space. A single server inside the domain (a workgroup), which is known as the <b>domain controller</b> , will proceed the authentication of all clients. The server will be designated by its user or automatically by the domain's own internal decision.

#### 4.1.1.2 NFS (Network File System)

- **About NFS Protocol**

- NFS is a protocol mostly used in Unix/Linux environment.
- NFS protocol provides access control on the share by the IP range.

- **Protocol Comparison**

Feature	NFS	CIFS	FUSE
Performance	Capable in both small and large files	Better in large files	Better in large files and parallel reading
Stability	Reconnects the session when it is disconnected	Interrupts I/O of file service when failover/failback occurs	Good
Compatibility	Unix, Linux, VMware	Windows, MacOS	Linux

- **NFS Compatibility**

**NFS v3 protocol** based on TCP is fundamentally built-in to AnyStor-E.

The access to the share will not be seamless if there is a problem on **MTU configuration** or **network environment**.

## 4.2 Configuring Service Protocols

To share the cluster volume to the client, you have to configure the storage sharing server (Daemon) from **Protocol Settings** page.

Supported protocol services are CIFS and NFS.

The configuration will be applied to all shares using the protocol.

### 4.2.1 CIFS Settings

Go to **Protocols >> Protocol Settings** page from the menu list and click **CIFS Settings** tab for its configuration.

You can enable, disable, and restart the CIFS service.

While restarting CIFS, the file that was in transfer will not redo after the reset.

- **[Enable Service]**

- Select the check box to enable the CIFS server to all nodes in the cluster.

- **[Service Status]**

- Shows on/off status of the CIFS server.

- **[Restart Service]**

- Click the button to restart the CIFS server. **[NetBIOS Name]**
- Shows the NetBIOS name allocated to all CIFS server in the entire cluster.
- The cluster management software will automatically designate hostname from one of the cluster nodes.

- **[Mode]**

- Shows the security mode that is currently used by the CIFS protocol.

Go to "[3.4 External Authentication](#)" for the configuration.

- **[Workgroup]**
  - Set the workgroup for the CIFS server of the cluster.
- **[WINS Server]**
  - Set the WINS server for the CIFS servers of the cluster.

## 4.2.2 NFS Settings

Go to **Protocols >> Protocol Settings** page from the menu list and click **NFS Settings** tab for its configuration.  
You can enable, disable, and restart the NFS service.

### Note

The default configuration for NFS service is **On**.  
When restarting the service, the client might experience a slight latency on the connection.

- **[Enable Service]**
  - Select the check box to enable the NFS server to all nodes in the cluster.
- **[Service Status]**
  - Shows on/off status of the NFS server.
- **[Restart Service]**
  - Click the button to restart the NFS server.
- **[Common Options]**
  - Set the option that is applied to all NFS server.

## 4.3 Share Settings

### 4.3.1 About Share Settings Menu

This menu is for managing and configuring shared objects provided by the cluster volume.  
You can configure the CIFS and NFS shares.

**It is recommended to set one NFS share per one cluster volume**

If the share is in the same cluster volume, it will mean that it also shares the same NFS configuration.

### 4.3.2 Contents of Share Settings Menu

#### 4.3.2.1 About Share Settings Tab

- Provides the list and the configuration menu for all shares.
- A shared object is an aggregate of information including basic information on the share such as the share path or the cluster volume of the share.
- A shared object will be displayed on the list of CIFS Share tab or NFS Share tab depending on its service protocol configuration.

#### 4.3.2.2 About CIFS Share Tab

- Provides the list and the configuration menu for CIFS shared objects.
- Only shows the shared object that has selected the CIFS service protocol.

#### 4.3.2.3 About NFS Share Tab

- Provides the list and the configuration menu for NFS shared objects.
- Only shows the shared object that has selected the NFS service protocol.

### 4.3.3 Share Settings Tab

#### 4.3.3.1 Contents of Share Settings Tab

- The list displays the details on each shared object.
- The information includes a share's name, description, status, path, volume, modified date, and service protocol.

Category	Description
Share Name	View the name for identification of a shared object.
Description	View the description of the shared object.
Status	View the status of a shared object. It will display ' <b>Normal</b> ' if the status is normal.
Path	View the path of a file system inside the volume provided to the client by the shared object.
Volume	View the cluster volume provided to the client by the shared object.
Modified Date	The time of creation/modification of the shared object.
Service Protocol	View the service protocol provided by the shared object. You can select either or both CIFS and NFS.

#### 4.3.3.2 Creating Shared Object

Select **Share Settings** tab from **Share Settings** menu and click **Create** button to create a new shared object.

##### 4.3.3.2.1 Contents of the Shared Object

- **[Share Name]**
  - A name of the shared object to be created.
  - 4~20 alphanumeric characters.
- **[Volume]**
  - A volume that will be shared by the shared object.
  - Select a cluster volume created from "[2.3 Volume Management](#)".
- **[Share Path]**
  - Enter the path of the shared space which will be provided to the clients.
  - The root('/') will be the uppermost directory of the volume.
  - If you do not enter the path, '/' will be set as a default setting.
- **[Share Description]**
  - Enter the description of the shared object.
- **[Service]**



Select whether the shared object will be providing the shared space to the clients using which protocol.

- You can select either or both CIFS and NFS.
- If CIFS is selected, the created shared object will appear on the CIFS share tab.
- If NFS is selected, the created shared object will appear on the NFS share tab.

#### 4.3.3.3 Modifying Shared Object

Navigate to **Share Settings** tab from **Share Settings** menu and click **Modify** button to modify the selected shared object.

##### 4.3.3.3.1 Contents of the Shared Object

- **[Share Path]**
  - Enter the path of the shared space which will be provided to the clients.
  - The root('/') will be the uppermost directory of the volume.
  - If you do not enter the path, '/' will be set as a default setting.
- **[Share Description]**
  - Enter the description of the shared object.
- **[Service]**
  - Select whether the shared object will be providing the shared space to the clients using which protocol.
  - You can select either or both CIFS and NFS.
  - If CIFS is selected, the created shared object will appear on the CIFS share tab.
  - If NFS is selected, the created shared object will appear on the NFS share tab.

#### 4.3.3.4 Deleting Shared Object

Navigate to **Share Settings** tab from **Share Settings** menu and click **Delete** button to delete the selected shared object.  
Select one or more shared object from the list and press **Delete** to delete multiple shared object at once.

### 4.3.4 CIFS Share

#### 4.3.4.1 Contents of CIFS Share Tab

- CIFS share list displays the details of each shared object that uses CIFS.
- The information includes a share's name, description, path, permission, guests, hide status, and activation.

Category	Description
Share Name	View the name for identification of a CIFS shared object.
Description	View the description of the CIFS shared object.
Path	View the path of a file system inside the volume provided to the client by the CIFS shared object.
Permission	View the access permission on the CIFS share.
Guests	View the status of whether the CIFS shared object allows 'guest' accounts.
Hide	View the status of whether the share is configured to be hidden from Windows clients.
Enable	View on whether the CIFS shared object is available. If the status is 'on', it means that the share is enabled.

#### 4.3.4.2 Modifying CIFS Shared Object

#### 4.3.4.2.1 Contents of the CIFS Shared Object

- **[Access Permission]**
  - Configure the access permission on the CIFS shared object.
  - Select either 'read' or 'read/write'.
- **[Share Administrator]**
  - Enter the name of the administrator who will manage the CIFS shared object.
- **[Enable]**
  - Select whether the CIFS share should be enabled.
  - If **Enable** is selected, the CIFS share will be activated.
- **[Guests]**
  - Select whether the CIFS share should use 'guest' accounts.
  - If **Guests** is selected, it will allow the 'guest' accounts.
  - If the 'guest' accounts are allowed, an individual can access the CIFS share by just entering the user ID as 'guest'.
  - The 'guest' accounts will follow the configured **access permission** of the CIFS share.
- **[Hide]**
  - Select whether the CIFS share should be hidden from the Windows client.
  - If **Hide** is selected, the Windows client will be unable to search the CIFS share.
  - However, even if the share is hidden from Windows client, it can be accessed if its address is entered.

#### 4.3.4.2.2 Users Accessing CIFS Share

- **[User Name/Description]**
  - The name and description of the user account registered in the cluster.
  - To create/modify/delete the user, go to "[3.2 User](#)" or "[3.4 External Authentication](#)" to proceed the task.
- **[Authentication]**
  - The authentication method of the user.
  - The methods are used either local authentication or ADS.
- **[Permission]**
  - Configure access permission of CIFS share for each user.
  - The access permission on the user can be selected among 'allow', 'disallow', 'read-only', 'read/write', and 'deny'.

Permission	Description
<b>allow</b>	Allows the users from accessing the CIFS share. The read/write permission of the user follows the <b>permission</b> configured in " <a href="#">4.3.4.2.1 Contents of the CIFS Shared Object</a> ".
<b>disallow</b>	Limits the users from accessing the CIFS share. If the user belongs to a group, the user will follow the <b>permission</b> configured in " <a href="#">4.3.4.2.3 Groups Accessing CIFS Share</a> ".
<b>read-only</b>	Allows the users from accessing the CIFS share. The user will only have read permission.
<b>read/write</b>	Allows the users from accessing the CIFS share. The user will have both read and write permission.
<b>deny</b>	Forbids all users from accessing the CIFS share.

#### 4.3.4.2.3 Groups Accessing CIFS Share

- **[Group Name/Description]**
  - The name and description of a group in the cluster.
  - To create/modify/delete the group, go to "[3.3 Group](#)" or "[3.4 External Authentication](#)" to proceed the task.
- **[Authentication]**
  - The authentication method of the group.
  - The methods are used either local authentication or ADS.
- **[Permission]**
  - Configure access permission of CIFS share for each group.
  - The access permission on the zone can be selected among 'allow', 'disallow', 'read-only', 'read/write', and 'deny'.

Permission	Description
<b>allow</b>	Allows the users in the group from accessing the CIFS share. The read/write permission of the user follows the <b>permission</b> configured in " <a href="#">4.3.4.2.1 Contents of the CIFS Shared Object</a> ".
<b>disallow</b>	Limits the users in the group from accessing the CIFS share.
<b>read-only</b>	Allows the users in the group from accessing the CIFS share. The user will only have the permission to read.
<b>read/write</b>	Allows the users in the group from accessing the CIFS share. The user will have both read and write permission.
<b>deny</b>	Forbids the users in the group from accessing the CIFS share.

#### 4.3.4.2.4 Configuring CIFS Security Zone

- **[Zone Name/Allowed Address]**
  - The name of a security zone and its address.
  - To create and delete the security zone, go to "[1.5.4 Security Settings](#)" tab to proceed the task.
- **[Permission]**
  - Configure access permission of CIFS share for each zone.
  - The access permission on the zone can be selected among 'allow', 'disallow', and 'deny'.

Permission	Description
<b>allow</b>	Allows the clients in the security zone from accessing the CIFS share.
<b>disallow</b>	Limits the clients in the security zone from accessing the CIFS share.
<b>deny</b>	Forbids the clients in the security zone from accessing the CIFS share.

- For instance, if the permission is set as "deny" on the security zone having the IP of "1.2.3.4", the server will block all requests coming from the IP "1.2.3.4".

### 4.3.5 NFS Share

#### 4.3.5.1 Contents of NFS Share Tab

- NFS share list displays the details of each shared object that uses NFS.
- The information includes a share's name, description, path, and activation.

Category	Description

<b>Share Name</b>	View the name for identification of an NFS shared object.
<b>Description</b>	View the description of the NFS shared object.
<b>Path</b>	View the path of a file system inside the volume provided to the client by the NFS shared object.
<b>Enable</b>	View on whether the NFS shared object is available. If the status is 'on', it means that the share is enabled.

#### 4.3.5.2 Modifying NFS Shared Object

Go to **NFS Share** tab from **Share Settings** menu and click **Modify** button to modify the selected shared object.

##### 4.3.5.2.1 Contents of the NFS Shared Object

- **[Enable]**
  - Select whether the NFS share should be enabled.
  - If **Enable** is selected, the NFS share will be activated.

##### 4.3.5.2.2 Configuring NFS Security Zone

- **[Zone Name/Allowed Address]**
  - The name of a security zone and its address.
  - To create and delete the security zone, go to "[1.5.4 Security Settings](#)" tab to proceed the task.
- **[Permission]**
  - Configure access permission of CIFS share for each zone.
  - The access permission on the zone can be selected among 'disallow', 'read-only', and 'read/write'.

Permission	Description
<b>disallow</b>	Limits the clients in the security zone from accessing the NFS share.
<b>read-only</b>	Allows the clients in the security zone from accessing the NFS share. The clients will only have read permission.
<b>read/write</b>	Allows the clients in the security zone from accessing the NFS share. The clients will have both read and write permission.

- For instance, if the permission is set as "deny" on the security zone having the IP of "1.2.3.4", the server will block all requests coming from the IP "1.2.3.4".
- **[NoRootSquashing]**
  - Decides whether the permission of the client root should be considered as the same with the NFS server root.
  - If [NoRootSquashing] is 'on', the client root will have the root permission in the shared space provided by the NFS share.
- **[Insecure]**
  - Decides whether it will allow the Internet port(~1024).
  - If [Insecure] is 'on', it will allow the Internet port(~1024).

## 5 Node Management

This menu allows you to monitor the status of each node inside your cluster and is mostly used when checking the resources of each node.

**Note**

## 5.1 Introducing Node Management Menu

Category	Description
<b>Node Status</b>	View overall status and performance of the cluster node by collecting and summarizing its system information.
<b>Disk Settings</b>	Manage logical disk (LVM volume group) per node.
<b>Volume Settings</b>	Manage logical volume per node.
<b>Process</b>	View every process in the node.
<b>RAID Information</b>	View information and status of each RAID controller.
<b>Network Bonding</b>	View the list of network bonding and their status. You can also create, modify, and delete network bonds.
<b>Network Device</b>	View the list of network devices and their status. You can also modify the options of network devices.
<b>Network Address</b>	You can create, modify, and delete network address with their list of allocation status.
<b>Power</b>	Control the shutdown and restart of your node.

## 5.2 Node Status

### 5.2.1 About Node Status Menu

AnyStor-E collects and abstracts system information of a selected node and displays the status and performance through **Node Status** menu.

**Node Status** menu presents the overall status of a selected node: the basic information of the node, the list of recent events that occurred in the node, the list of clients that are connected to the node, the usage and available capacity in a bar graph, and the performance statistics.

The node can be selected from the drop-down list on the top left corner of the **Node Status** page.

### 5.2.2 Contents of Node Status Menu

#### 5.2.2.1 About Node Information List

- Located on the top left side of the page.
- Displays the hardware information, version of the cluster management software, and the composition status of the node.

#### 5.2.2.2 About Recent Event List

- Located on the top right side of the page.
- The events will be displayed in order by setting the most recent event on the top (in reverse chronological order).

#### 5.2.2.3 About Client Connection Status List

- Located on the middle center side of the page.
- Shows the list of clients connected to the node.

### 5.2.2.4 About Node Usage Graph

- Located on the middle right side of the page.
- Shows the usage and available capacity of the node's cluster volume in a bar graph.

### 5.2.2.5 About Performance Statistics

- Located on the bottom of the page.
- Shows the change of CPU usage, volume I/O, and service network I/O over time in a line graph.
- The time scale of the graph can be configured through the drop-down list located on the top right corner of the section.

## 5.2.3 Node Information List

### 5.2.3.1 Contents of Node Information List

- The information is displayed in the manner of "{Key}:{Value}".
- **The information on the hardware includes the following items:**
  - A name, manufacturer, and model of the main board
  - A name, manufacturer, model, and performance of the CPU
  - The size of memory
- **The cluster management software version includes the following items:**
  - The released/committed version
  - The branch
  - The packaged date
- The list of compositions of the node includes the status of daemons and hardware which are needed for the node's management.

## 5.2.4 Recent Event List

### 5.2.4.1 Contents of Event List

- Lists the event that recently occurred.
- The information on each event will be listed in each row.
- A single row includes the event's status, occurred time, description, range, and type.

Category	Description
Status	Shows one of the three event level: Error, Warning, and Info. The color of each level are shown as red, yellow, and green.
Time	Shows the time when the event occurred. Displayed as "yyyy/mm/dd hh : mm : ss".
Contents	Describes the details of the event.
Range	View the location where the event occurred. It will show the ID(Hostname) of the node.
Type	Indicates which function the event is from and if the cause is not specified, it will show the text 'DEFAULT'.

### 5.2.4.2 Sorting Events

- The default setting is to display in order by setting the recent event on the top (in reverse chronological order) but also can be modified by its needs.

If you click the header at the top that lists column names, the data below will be sorted in alphabetical or chronological order depending on its content.

### 5.2.4.3 Event Details

- Each event will show its details as you double-click.
- The details will be displayed in a form of a dictionary of key-value.
- Categories are ID, Scope, Level, Category, Message, Details, Time, and Quiet.

Category	Description
ID	The identifier of the event.
Scope	View the location where the event occurred. It will show the ID(Hostname) of the node.
Level	Shows one of the three event level: Error, Warning, and Info.
Category	Indicates which function the event is from and if the cause is not specified, it will show the text 'DEFAULT'.
Message	The text describing the content of the event.
Details	Displays more information on the event than Message. It is shown in a form of a dictionary of key-value.
Time	Shows when the event occurred. Displayed as "yyy/mm/dd hh : mm : ss".
Quiet	If the value is not 0, it will be displayed as an event but will not be informed by email.

## 5.2.5 Client Connection Status List

### 5.2.5.1 Contents of Client Connection Status List

- View the list of clients connected to the node.
- The information on each client will be displayed in each row.
- It will relate the client's network(IP) address with the client's type.
- The client's type will show which protocol (NFS or CIFS) the client is approaching with.

## 5.2.6 Cluster Usage Graph

- Displays the usage and available space of each cluster volume in a bar graph.
- Each bar graph indicates each existing cluster volume.
- When there is no cluster volume to show, it will display a message "There is no data for the cluster usage".

## 5.2.7 Performance Statistics

### 5.2.7.1 Contents of Performance Statistics

- Generates the progress of CPU usage, volume, and network I/O of the entire node in a line graph.
- The chronological range can be selected between 1 Hour, 1 Day, 1 Week, 1 Month, 6 Months, and 1 Year.
- In case of 1 Hour and 1 Day, the statistics will be refreshed every 10 seconds.
- There are three graphs, Node CPU, Node Disk I/O, and Node Service Network I/O.

### 5.2.7.2 Node CPU Graph

- Displays the overall CPU usage of the node.
- Each CPU statistics will display its graph in different colors.
- Type of CPU statistics are the system, user, iowait, irq, softirq, and nice.

Name	Description
system(Green)	CPU spent running the kernel
user(Yellow)	CPU spent running user processes that have been un-niced
iowait(Light blue)	CPU spent while the process is waiting for the data I/O to finish
irq(Orange)	CPU spent processing the interrupt request from the hardware
softirq(Red)	CPU spent processing the interrupt request from the software
nice(Blue)	CPU spent running user processes that have been niced

### 5.2.7.3 Node Disk I/O Graph

- Displays the sum of all data I/O of every cluster sub-volume existing in the node.
- The graph will display read (green) and write (yellow) of the disks.

### 5.2.7.4 Node Service Network I/O Graph

- **Displays the sum of network data going through service network interface of the node.**
  - Service network interface: An interface to proceed NFS/CIFS service.
- The graph will display send (yellow) and receive (green) of a network.

## 5.3 Configuring Disks

### 5.3.1 About Disk Settings Menu

Disk Settings menu provides the management on the logical disk (LVM volume group) of each node.

#### Creating and Expanding Logical Disks

To expand an LVM volume group, you need an LVM physical volume. First, create an LVM physical volume through CLI from the node you wish to configure.

### 5.3.2 Technical Factors

#### 5.3.2.1 LVM (Logical Volume Manager)

The disk configuration of the node internally uses LVM.

Please refer to [5.3.2.1 LVM \(Logical Volume Manager\)](#).

#### 5.3.3.1 Logical Disk List

Shows the list of logical disk and their details which are in the selected node.

Category	Description
Name	View the name of the logical disk.
Full Size	View the full capacity of the logical disk.
Quota	View the current usage of the logical disk.
Allocation Rate	View the allocation rate of the logical disk.



### 5.3.3.1.1 Creating Logical Disk

Go to [5.3.3.1 Logical Disk List](#) and click **Create** to create a logical disk.

You will need an LVM physical volume to create an LVM volume group. First, create an LVM physical volume through CLI from the node you wish to configure.

Category	Description
Logical Disk Name	Enter a new logical disk name. Enter 4 ~ 20 alphanumeric letters starting with alphabet. As for symbols, only "-", "_ " are allowed.
Available Physical Disks	View the list of physical disk that are available for the task. <b>Name</b> - Name of the physical disk. <b>Disk Size</b> - The total size of the physical disk. <b>Assigned Logical Disk</b> - View the name of the logical disk which is currently using the physical disk.

### 5.3.3.1.2 Expanding Logical Disk

Go to [5.3.3.1 Logical Disk List](#) and click **Expand** to expand the size of the selected logical disk.

You will need an LVM physical volume to expand an LVM volume group. First, create an LVM physical volume through CLI from the node you wish to configure.

Category	Description
Logical Disk Name	View the name of the logical disk you wish to expand.
Available Physical Disks	View the list of physical disk that is available for the task. <b>Name</b> - Name of the physical disk. <b>Disk Size</b> - The total size of the physical disk. <b>Assigned Logical Disk</b> - View the name of the logical disk which is currently using the physical disk.

### 5.3.3.1.3 Deleting Logical Disk

Go to [5.3.3.1 Logical Disk List](#) and click **Delete** to delete the selected logical disk.

## 5.3.3.2 Physical Disk List

Shows the list of physical disks (LVM physical volume) and their details which are registered to the selected node.

Some of the new devices, which are not updated to the PCI database, may not show their SCSI ID, manufacturer, and product name, and will soon be available for the newest update.

Category	Description
Name	View the name of a physical disk.
SCSI ID	View an SCSI ID allocated to the physical disk.
Manufacturer	View the manufacturer of a physical disk.
Product Name	View the product name of a physical disk.
Size	View the total size of a physical disk.

Logical Disk Name	View the name of a logical disk which is currently using the physical disk.
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## 5.4 Configuring Volumes

### 5.4.1 About Volume Settings Menu

The **Volume Settings** menu provides LVM logical volume management between nodes.

### 5.4.2 Technical Factors

#### 5.4.2.1 LVM (Logical Volume Manager)

The volume configuration of the node internally uses LVM.

Please refer to [2.1.1 About LVM](#)).

### 5.4.3 Contents of Volume Settings Menu

You can select the node from the drop-down list on the top left corner of the page to manage its logical volume (LVM logical volume).

There is a [5.4.3.1 Logical Disk List](#) which manages LVM volume groups, and a [5.4.3.2 Logical Volume List](#) which manages LVM logical volumes that are under LVM volume groups.

#### 5.4.3.1 Logical Disk List

Presents the list of logical disks which are located in the selected node and their details.

Category	Description
Name	View the name of a volume group.
Full Size	View the total size of a volume group.
Usage	View the current usage of a volume group.
Usage (%)	View the current usage of a volume group in percentage.

#### 5.4.3.2 Logical Volume List

Select a logical disk from [5.4.3.1 Logical Disk List](#) to list the assigned logical volumes from [5.4.3.2 Logical Volume List](#).

You can create, modify, delete, mount, and format logical volumes.

Category	Description
Name	View the name of a logical volume.
Mount Information	View the path where the logical volume is mounted.
Size	View the total size of a logical volume.
Usage (%)	View the usage of the logical volume in percentage.

##### 5.4.3.2.1 Creating Logical Volume

Press **Create** button from [5.4.3.2 Logical Volume List](#) to create a logical volume.

Category	Description
Logical Disk Name	Select a logical disk from the drop-down list.
Volume Name	Enter a new logical volume name. Enter 4 ~ 20 alphanumeric letters starting with an alphabet. As for symbols, only "-" and "_" are allowed.
Volume Type	Select the allocation type for the new logical disk. <b>Static Allocation</b> - Creates a default logical volume (LV). <b>Dynamic Allocation</b> - Creates a thin provisioned logical volume (ThinLV). You can select this option only when the logical disk has dynamic allocation configured.
Available Space	View the available space of the selected logical disk. It shows only when the volume type is configured as static allocation.
Volume size after expansion	Set the size of the new logical volume. The number can be set up to two decimal places.

#### 5.4.3.2.2 Modifying Logical Volume

Press **Modify** button from [5.4.3.2 Logical Volume List](#) to configure the size of the selected logical volume.

Only the mounted logical volume can be modified.

Category	Description
Logical Disk Name	View the name of a logical disk where the logical volume is at.
Volume Name	View the name of a logical volume.
Volume Type	View whether it is a default logical volume (LV) or thin provisioned logical volume (ThinLV).
Volume Size	Configure the size of the logical volume.

#### 5.4.3.2.3 Formatting Logical Volume

Press **Format** button from [5.4.3.2 Logical Volume List](#) to format the selected logical volume.

Cannot format logical volumes that are mounted.

#### 5.4.3.2.4 Mounting Logical Volume

Press **Mount** button from [5.4.3.2 Logical Volume List](#) to mount the selected logical volume.

Cannot mount logical volumes that are already mounted.

#### 5.4.3.2.5 Unmounting Logical Volume

Press **Unmount** button from [5.4.3.2 Logical Volume List](#) to unmount the selected logical volume.

Cannot unmount logical volumes that are not mounted.

#### 5.4.3.2.6 Deleting Logical Volume

Press **Delete** button from [5.4.3.2 Logical Volume List](#) to delete the selected logical volume.

## 5.5 Process

### 5.5.1 About Process Menu

Process menu of AnyStor-E shows the ongoing process of a node.

### 5.5.2 Contents of Process Menu

- **Process**
  - You can select the node from the drop-down list on the top left corner of the page to view its processes.

Category	Description
Process ID	View the ID of a process.
Process Name	View the name of a process.
Status	View the current status of a process.
CPU Occupancy	View the CPU occupancy of a process.
Memory Occupancy	View the memory occupancy of a process.
Run Time	View the total run time of a process until now.
RSS	View the number of physical pages related to the process.
VSS	View the virtual memory size related to the process.

## 5.6 RAID Information

### 5.6.1 What is RAID?

**RAID(Redundant Array of Independent Disks)** is a technique of distributing data to several hard disks, and a device managing it is called RAID controller. Generally, due to its characteristics, a storage or storage server mounts multiple hard disks. To efficiently utilize these hard disks, RAID controllers are commonly embedded to these servers.

### 5.6.2 RAID in AnyStor-E

AnyStor-E provides the information on the composition and status of a connected RAID controller and these information helps when a flexible and immediate response is required on a situation when a failure such as hard disk failure or disconnection occurs.

### 5.6.3 Contents of RAID Information Menu

Navigate to **Node Management >> RAID Information** from the left **Administrator** menu and select a node from the drop-down list on the top left corner of the page.

The page will be refreshed with the overall summary of the RAID controller. You will be able to find the details from the following table.

#### 5.6.3.1 RAID Information

Category	Description
<b>Adapter ID</b>	View the adapter ID of a RAID controller adapter.
<b>Logical Disk(s)</b>	View the total number of logical disks and their normal and abnormal disks.
<b>Physical Disk(s)</b>	View the total number of physical disks and their normal and abnormal disks.
<b>Disk Information</b>	Press the button to open a pop-up screen showing details on the connected logical and physical disk. For more information, please refer to <a href="#">5.6.3.2 Details on Physical Disk</a> and <a href="#">5.6.3.3 Details on Logical Disk</a> .
<b>Adapter Information</b>	Press the button to open a pop-up screen showing the firmware and configuration of a controller or adapter. For more information, please refer to <a href="#">5.6.3.4 Adapter Information</a> .

### 5.6.3.2 Details on Physical Disk

Press **View** button from **Disk Information** header in [5.6.3.1 RAID Information](#) to see the details on the physical disk embedded to the adapter.

Category	Description
<b>Logical Disk ID</b>	View the ID of a logical disk composed by the physical disk.
<b>Physical Disk ID</b>	View the ID of a physical disk.
<b>Physical Disk Size</b>	View the size of a physical disk.
<b>Status</b>	View the current status of a physical disk. For more information on the status, please refer to <a href="#">5.6.3.2.1 Physical Disk Status</a> .
<b>Slot Number</b>	View the number of controller slot connected to the physical disk.
<b>Interface Type</b>	View the type of protocol of the controller slot connected to the physical disk.
<b>Disk Type</b>	View the type of physical disk which will be either HDD or SSD.

#### 5.6.3.2.1 Physical Disk Status

Status	Description
<b>Online</b>	Indicates that it is fully operative for composing a logical disk.
<b>Offline</b>	Indicates that the I/O process is unavailable for reasons such as disk failures.
<b>Foreign</b>	The status of saving the configuration from another adapter.
<b>Missing</b>	Indicates which the media is not recognized through the port for reasons such as dismounted media.
<b>Unconfigured Good</b>	The status that it is ready for configurations such as composing a new logical disk or adding a hot spare.
<b>Unconfigured Bad</b>	The status that the configuration is no longer available due to errors.
<b>Dedicated Hot Spare</b>	Indicates that the disk is dedicated as a spare for a specific logical disk.
<b>Global Hot Spare</b>	Indicates that the disk is used as a spare for all logical disks.

### 5.6.3.3 Details on Logical Disk

Press **View** button from **Disk Information** header in [5.6.3.1 RAID Information](#) to see the details on the logical disk allocated to the adapter.

Category	Description
<b>Logical Disk ID</b>	View the ID of a logical disk managed by the adapter.
<b>Logical Disk</b>	View the name of a logical disk. This may not be visible due to configurations.

<b>Name</b>	
<b>RAID Level</b>	View the RAID level of a logical disk. Please check <a href="#">5.6.4 RAID Levels</a> for more information.
<b>Size</b>	View the size of a logical disk. The size may differ from the RAID level or the number of physical disks composing the logical disk.
<b>Status</b>	View the current status of a logical disk. For more information, go to <a href="#">5.6.3.3.1 Logical Disk Status</a> .
<b>Physical Disk(s)</b>	View the number of physical disks composing the logical disk.

#### 5.6.3.3.1 Logical Disk Status

Status	Description
<b>Optimal</b>	Shows that the state is normal.
<b>Partially Degraded</b>	Indicates that the I/O speed is degraded due to the damage from one of the physical disks composing the logical disk.
<b>Degraded</b>	Indicates that it no longer guarantees the integrity due to the damage from one of the physical disks composing the logical disk.
<b>Rebuilding</b>	The status that the logical disk is currently recovering/reconfiguring from the state of <b>Partially Degraded</b> or <b>Degraded</b> .
<b>Migrating</b>	The status which the composition of the physical disk is in modification for the reasons such as changing the RAID level of a logical disk.

#### 5.6.3.4 Adapter Information

Press **View** button from the **Adapter Information** header in [5.6.3.1 RAID Information](#) to see the details on the adapter.

The feature includes the information on the firmware and configurations of the controller/adapter.

Category	Description
<b>Manufacturer</b>	View the model name and ID of a RAID controller.
<b>Firmware</b>	View the firmware version of a RAID controller.
<b>Input/Output</b>	View the information on the I/O such as the stripe size, data transfer size, a number of parallel processing, and a length of SGE queues.
<b>Reconfiguration</b>	View the information on reconfiguration settings such as the allocation rate of RAID controller processing for fault recovery when the logical disk fails.

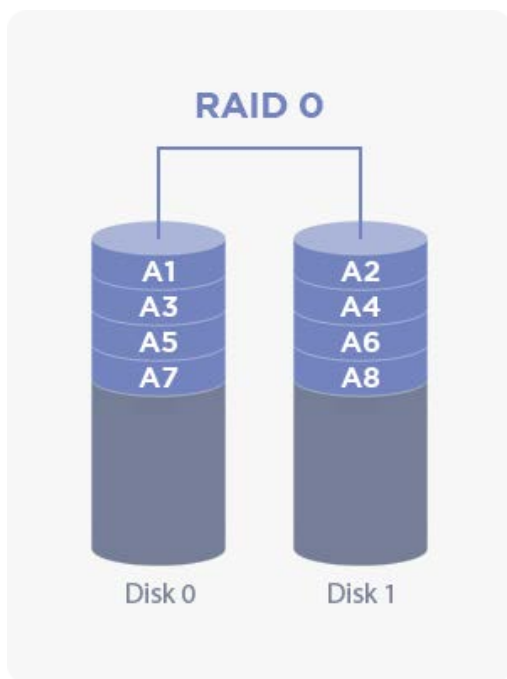
#### 5.6.4 RAID Levels

There is a series of RAID levels and this manual is focused on levels that are being used the most.

For the additional information on RAID levels, please refer to [5.6.5 References](#).

##### 5.6.4.1 RAID 0

RAID 0 Diagram



Reference: [https://en.wikipedia.org/wiki/Standard\\_RAID\\_levels](https://en.wikipedia.org/wiki/Standard_RAID_levels)

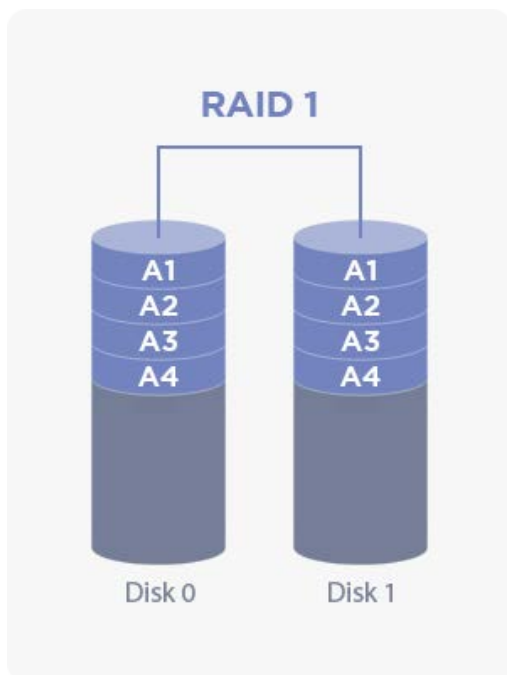
**RAID 0** has a structure of distributing and storing the data sequentially in **at least two** physical disks forming a logical disk. This technique is called striping.

The capacity of a logical disk expands as the number of physical disk increases. Moreover, since the I/O speed will multiply by the number of physical disks, the I/O speed will escalate as the number of physical disk increases.

However, as it does not use any parity, the integrity of logical disk will be damaged when one of the physical disks fails.

#### 5.6.4.2 RAID 1

**RAID 1 Diagram**



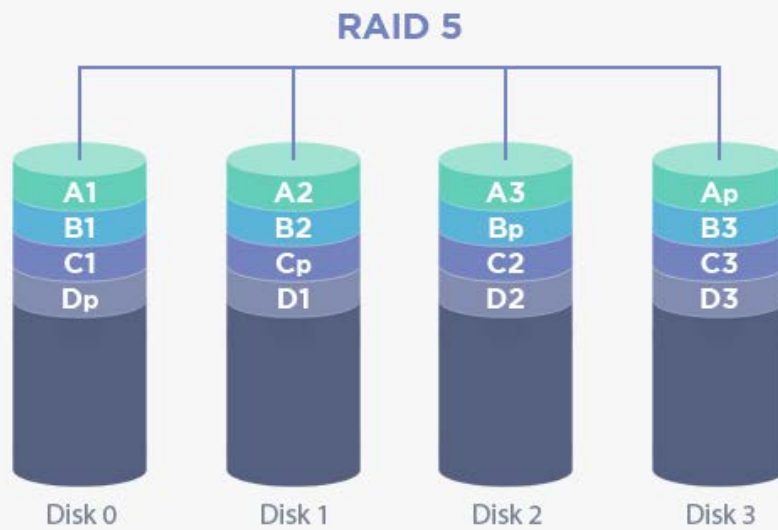
Reference: [https://en.wikipedia.org/wiki/Standard\\_RAID\\_levels](https://en.wikipedia.org/wiki/Standard_RAID_levels)

**RAID 1** has a structure of replicating and storing the data in **at least two** physical disk forming a logical disk. This technique is called mirroring.

The capacity of logical disk will not expand as the number of physical disk increases, although the write speed will rather slow down.

### 5.6.4.3 RAID 5

RAID 5 Diagram



Reference: [https://en.wikipedia.org/wiki/Standard\\_RAID\\_levels](https://en.wikipedia.org/wiki/Standard_RAID_levels)

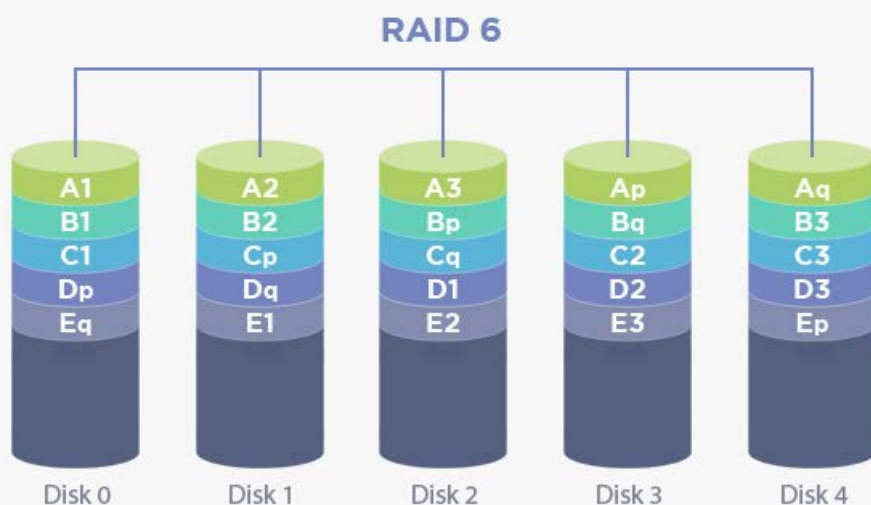
**RAID 5** has a structure of distributing and storing the data along with parity blocks for integrity in **at least three** physical disk forming a logical disk, ensuring the stability.

The available size of RAID 5 will be  $**(number\ of\ physical\ disks - 1) * size\ of\ a\ physical\ disk$ . Although the write performance will be slightly lower than RAID 0 since there is an extra processing on the parity block.

Additionally, the integrity is only guaranteed for the single disk failure because there is only a single parity block written.

### 5.6.4.4 RAID 6

RAID 6 Diagram



Reference: [https://en.wikipedia.org/wiki/Standard\\_RAID\\_levels](https://en.wikipedia.org/wiki/Standard_RAID_levels)

**RAID 6** has a similar structure with [RAID 5](#), yet it stripes additional parity for P and Q method using the parity and Reed-Solomon error correction.

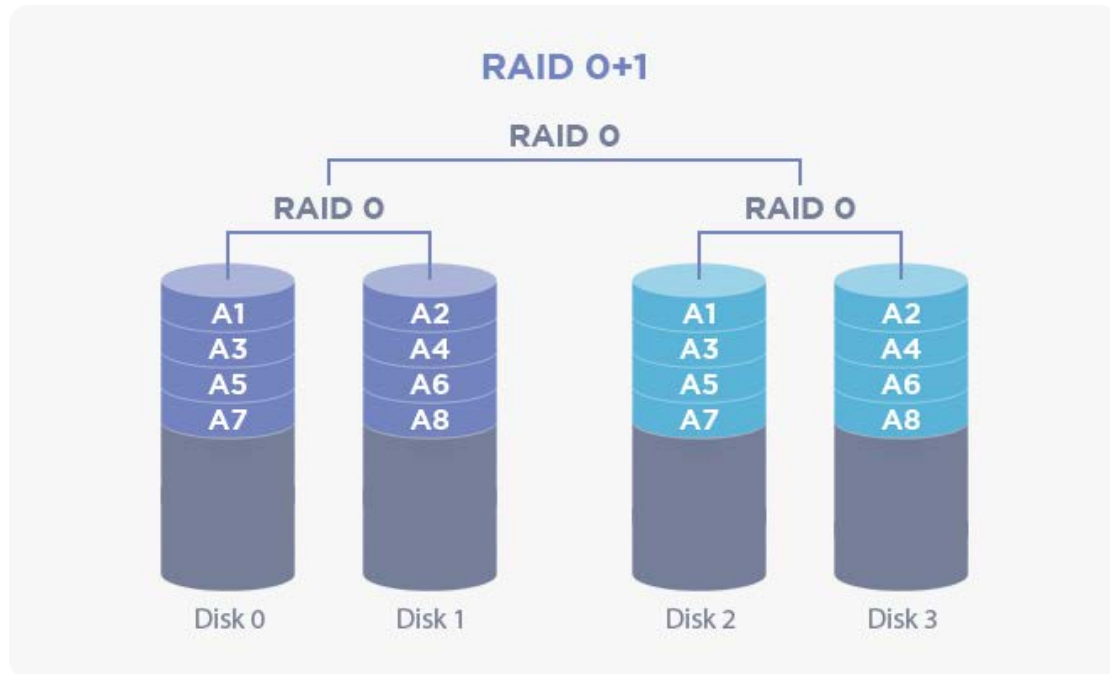


Therefore, **at least four** physical disk is required for adding another parity, and the available size will be **(number of physical disks - 2) \* size of physical disk**.

Moreover, although it has better fault tolerance than RAID 5 since it can recover two disk failures, the installation cost is higher due to the minimum disk requirement, and the write speed will be relatively slow as there is an additional parity block.

#### 5.6.4.5 RAID 0+1

RAID 0+1 Diagram



Reference: [https://en.wikipedia.org/wiki/Nested\\_RAID\\_levels](https://en.wikipedia.org/wiki/Nested_RAID_levels)

**RAID 0+1** consists of [5.6.4.1 RAID 0](#) striping and [5.6.4.2 RAID 1](#) mirroring combined, forming a structure of two levels.

**At least two** physical disk is used for striping, and are mirrored which will be eventually having **at least four** physical disk.

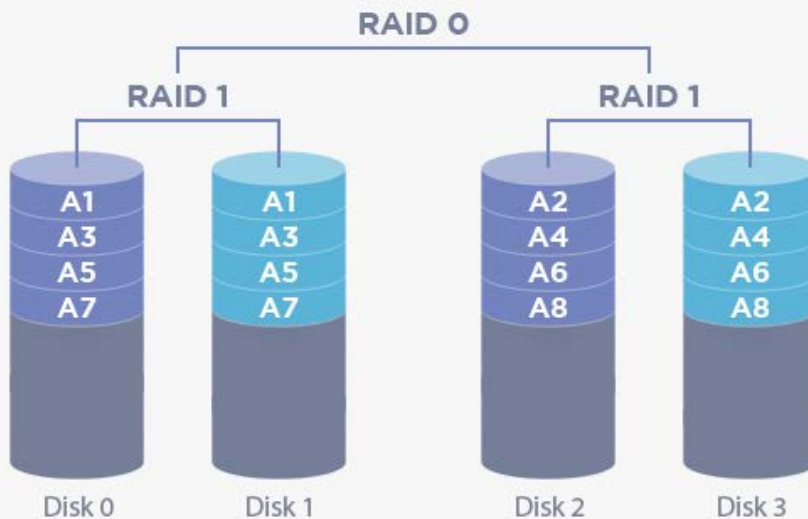
The purpose is to have speed from striping and fault tolerance from mirroring.

However, if the striped logical disk on the lower level is failed, the logical disk has to be fully replaced.

#### 5.6.4.6 RAID 1+0

RAID 1+0 Diagram

## RAID 1+0



Reference: [https://en.wikipedia.org/wiki/Nested\\_RAID\\_levels](https://en.wikipedia.org/wiki/Nested_RAID_levels)

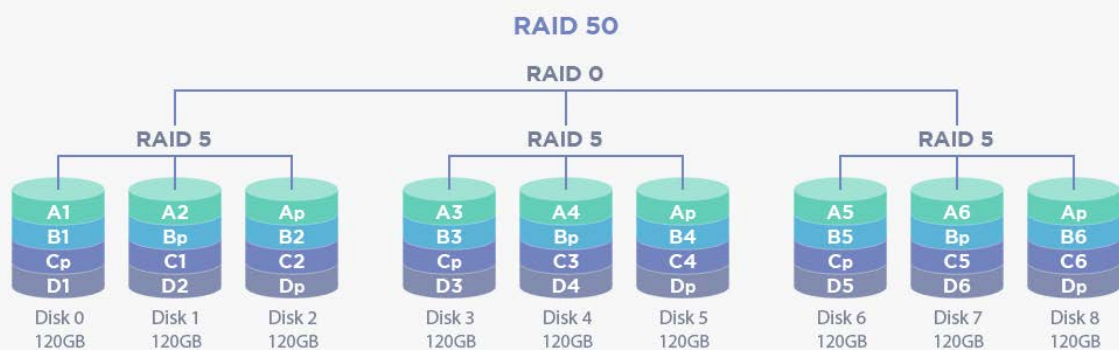
**RAID 1+0** is similar to the previous [5.6.4.5 RAID 0+1](#), but has a reverse structure level.

**At least two** physical disk is used for mirroring, and are striped which will be eventually having **at least four** physical disk.

Unlike RAID 0+1, it can be recovered by only replacing the failed disk on the mirrored logical disk from the lower level, which is relatively cheaper.

### 5.6.4.7 RAID 5+0

#### RAID 5+0 Diagram



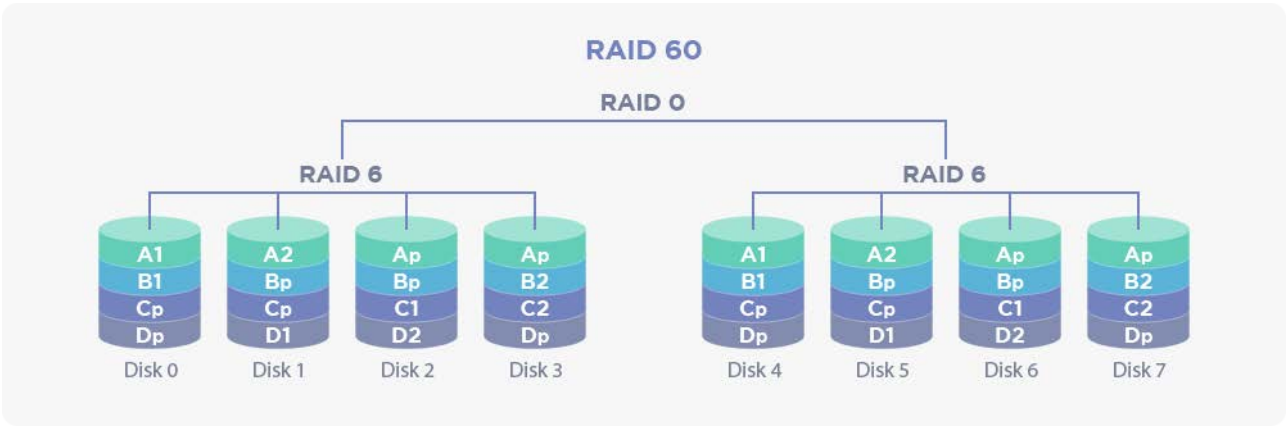
Reference: [https://en.wikipedia.org/wiki/Nested\\_RAID\\_levels](https://en.wikipedia.org/wiki/Nested_RAID_levels)

**RAID 5+0** consists of [5.6.4.6 RAID 1+0](#) having the lower level in structure with [5.6.4.3 RAID 5](#).

Therefore, it has higher performance and fault tolerance on the lower level compared to RAID 1+0.

### 5.6.4.8 RAID 6+0

#### RAID 6+0 Diagram



Reference: [https://en.wikipedia.org/wiki/Nested\\_RAID\\_levels](https://en.wikipedia.org/wiki/Nested_RAID_levels)

RAID 6+0 consist of [5.6.4.6 RAID 1+0](#) having the lower level in structure with [5.6.4.4 RAID 6](#). Therefore, it has higher performance and fault tolerance on the lower level compared to RAID 1+0.

### 5.6.5 References

- [RAID - Wikipedia](#)
- [Standard RAID levels - Wikipedia](#)

## 5.7 Network Bonding

### 5.7.1 About Network Bonding Menu

You can verify the network bonding status of the cluster node along with creation, modification, and deletion options.

#### Limitations on the activation and deactivation of service and storage network device

Service and storage network device cannot be deactivated.

#### Limitations on the modification of network device status

The network device that is used in bonding cannot be modified individually.  
If the status of the bond is modified, all the network devices that are in the bond will also be modified.

### 5.7.2 Contents of Network Bonding Menu

- Generates a list of network bonding.
- Network bonding list reflects the operating system's status of the storage.

### 5.7.3 Bonding Information Page

#### 5.7.3.1 Contents of Bonding Information Page

Category	Description
Name	View the name of a bond.

<b>MAC Address</b>	View the MAC address of a bond.
<b>Physical Device</b>	View the slave network device of a bond.
<b>PrimarySlave</b>	View the primary slave network device of a bond. If the primary slave is not present, it will show a blank. The slave network device, which is designated as the primary slave, has a high possibility of being utilized as a network device which the bond uses as the main communication device.
<b>ActiveSlave</b>	View the slave network device in active slave state. If the active slave is not present, it will show a blank.
<b>Active</b>	View whether the network bonding is enabled or disabled. If there is a difference in activation and connection status, the task on the issue will be triggered on the <b>Event</b> page.
<b>Connection Status</b>	View the connection status of the network device.

### 5.7.3.2 Details on Physical Devices

- Select a network bonding from the list and press **Device Details** button to verify the details on the physical device that is used on the bond.
- The pop-up screen will inform the name of the device and its MAC address.

### 5.7.3.3 Creating Network Bonding

Go to **Bonding Information** page and press **Create** button to create a network bonding.

#### 5.7.3.3.1 Choosing Bonding Mode

- **[Round-Robin]**
  - Sequentially sends the data to the network device. Provides load balancing and fault tolerance.
  - Mode number: 0
- **[Active Backup]**
  - Activates only one device. Other devices will be activated when the issue occurs on the currently activated device.
  - Mode number: 1
- **[Balance-XOR]**
  - Selects a device which transmit packets using XOR operation.
  - Mode number: 2
- **[IEEE 802.3ad]**
  - A bond supporting EtherChannel or LACP(Link Aggregation Control Protocol). Requires a network device (switch) for the support.
  - Mode number: 4
- **[Balance-tlb]**
  - The load balancing is configured only in the transmitted packets. Received packets will only be sent to the activated devices.
  - Mode number: 5
- **[Balance-alb]**
  - The load balancing is configured in both transmitted and received packets. It is sent to the bonding device that has less traffic.
  - Mode number: 6

### 5.7.3.3.2 Selecting Network Device for Bonding

- **[Enable]**
  - Activates the network bonding.
  - If the option is enabled, the network bonding and the slave device will be activated.
  - If the option is disabled, the network bonding and the slave device will be deactivated.
- **[Primary Slave]**
  - Select a device from one of the slave network devices which will be used as a primary slave from the drop-down list.
- **[Available Network Device(s)]**
  - View the list of network devices that can be composed of a network bonding.
  - Only shows the network devices that are not currently used as a network bonding.
  - The selected network device will be designated as a slave.

### 5.7.3.4 Modifying Network Bonding

Select a bond from **Bonding Information** page and press **Modify** button to modify the network bonding.

#### 5.7.3.4.1 Choosing Bonding Mode

- **[Round-Robin]**
  - Sequentially sends the data to the network device. Provides load balancing and fault tolerance.
  - Mode number: 0
- **[Active Backup]**
  - Activates only one device. Other devices will be activated when the issue occurs on the currently activated device.
  - Mode number: 1
- **[Balance-XOR]**
  - Selects a device which transmit packets using XOR operation.
  - Mode number: 2
- **[IEEE 802.3ad]**
  - A bond supporting EtherChannel or LACP(Link Aggregation Control Protocol). Requires a network device (switch) for the support.
  - Mode number: 4
- **[Balance-tlb]**
  - The load balancing is configured only in the transmitted packets. Received packets will only be sent to the activated devices.
  - Mode number: 5
- **[Balance-alb]**
  - The load balancing is configured in both transmitted and received packets. It is sent to the bonding device that has less traffic.
  - Mode number: 6

#### 5.7.3.4.2 Selecting Network Device for Bonding

- **[Enable]**
  - Activates the network bonding.
  - If the option is enabled, the network bonding and the slave device will be activated.
  - If the option is disabled, the network bonding and the slave device will be deactivated.

- **[Primary Slave]**
  - Select a device from one of the slave network devices which will be used as a primary slave from the drop-down list.
- **[Available Network Device(s)]**
  - View the list of network devices that can be composed of a network bonding.
  - Only shows the network devices that are not currently used as a network bonding.
  - The selected network device will be designated as a slave.

### 5.7.3.5 Deleting Network Bonding

Select one or more bond from **Bonding Information** page, and press **Delete** button to delete the network bonding.

## 5.8 Network Device

### 5.8.1 About Network Device Menu

The menu presents the status of network devices of the cluster node, along with the option of modifying their status.

#### Limitations on the activation and deactivation of service and storage network device

Service and storage network device cannot be deactivated.

#### Limitations on the modification of network device status

The network device that is used in bonding cannot be modified individually.  
If the status of the bonding is modified, all the network devices that are in the bond will also be modified.

### 5.8.2 Contents of Network Device Menu

#### 5.8.2.1 About Network Device Page

- The page is located all across the screen.
- Generates a list of network devices.
- Each network device from the list includes information such as its name, description, MAC address, connection speed, MTU, activation, connection status, IP address allocation method, and the information on network bonding.
- Network device list reflects the system's status.

### 5.8.3 Network Device Page

#### 5.8.3.1 Contents of Network Device Page

Category	Description
<b>Name</b>	View the name of a network device.
<b>Description</b>	View the model name of a network device. As bonding device is a virtual hardware, it will be displayed as "Unknown".
<b>MAC Address</b>	View the MAC address of a network device.

<b>Connection Speed</b>	View the connection speed of a network device. If the network device is not enabled, it will not be displayed on the list.
<b>MTU</b>	View the MTU (Maximum Transmission Unit) of a network device. MTU is the maximum size of data that can be sent by a network device.
<b>Active</b>	View whether the network device is enabled or disabled. If there is a difference in activation and connection status, the task on the issue will be triggered on the <b>Event</b> page.
<b>Connection Status</b>	View the connection status of the network device.
<b>Allocation Method</b>	View whether the allocation method of IP address is through DHCP or STATIC.
<b>Bonding Information</b>	View the network bonding name which the network device belongs to. If the device belongs to nowhere, it will be displaying a blank.

### 5.8.3.2 Details on Network Devices

- Select a network device and press **Show Details** button to check the detailed information on the device.
- The pop-up screen will show several charts on the network device.
- It includes the chart on the basic information on the network device, network device address, and received and transmitted data on the network device.

#### 5.8.3.2.1 Network Device Chart

- Shows the basic information on the network device.
- It shows the device's name, traffic update time, last update time, MAC address, connection speed, MTU, activation, and connection status.

Category	Description
<b>Device</b>	View the name of a network device.
<b>MAC Address</b>	View the MAC address of a network device.
<b>Speed</b>	View the connection speed of a network device. If the network device is not enabled, it will not be displayed on the list.
<b>MTU</b>	View the MTU (Maximum Transmission Unit) of a network device. MTU is the maximum size of data that can be sent by a network device.
<b>Active</b>	View whether the network device is enabled or disabled. If there is a difference in activation and connection status, the task on the issue will be triggered on the <b>Event</b> page.
<b>Status</b>	View the connection status of the network device.

#### 5.8.3.2.2 Network Device Address Chart

- Shows the IP address allocated to the device.
- If the device has no IP address allocated, it will show a blank.
- It shows the device's IP address, subnet mask, gateway, and connection status.

Category	Description
<b>IP Address</b>	View the IP address allocated to the device.
<b>Subnet Mask</b>	View the IP's subnet mask. It will be displayed in the form of "xx.xxx.xxx [xx]".
<b>Gateway</b>	View the IP's gateway. If the gateway is not configured, the content will be empty.
<b>Connection Status</b>	View the connection status of the network device.

#### 5.8.3.2.3 Network Receive (Rx) Chart

- Shows the statistics on the data being received by the device.
- Displayed information are bytes, packets, dropped, and errors.

Category	Description
bytes	View the total size of data received by the device.
packets	View the total number of packets received by the device.
dropped	View the number of packets that were failed to reach the device.
errors	View the number of packets that had errors during the process after receiving them.

#### 5.8.3.2.4 Network Transmit (Tx) Chart

- Shows the statistics on the data being transmitted from the device.
- Displayed information are bytes, packets, dropped, and errors.

Category	Description
bytes	View the total size of data transmitted from the device.
packets	View the total number of packets transmitted from the device.
dropped	View the number of packets that were failed to transmit from the device.
errors	View the number of packets that had errors during the process when transmitting them.

#### 5.8.3.3 Modifying Network Device

You will be able to change its active status and MTU (Maximum Transmission Unit).

- **[Network Device Name]**
  - The name of the network device you have selected.
  - The device name cannot be changed.
- **[Enable]**
  - Activates the network device.
  - If the option is enabled, the network device will be activated.
  - If the option is disabled, the network device will be deactivated.
- **[MTU]**
  - Changes the MTU of the network device.
  - You can enter the number to change the MTU.

## 5.9 Network Address

### 5.9.1 About Network Address Menu

You can check the list of network address status of the cluster node along with creation, modification, and deletion options.

#### Limitations on storage network address modification and deletion

You cannot modify or delete the storage network address.



### Limitations on modification and deletion of addresses in service address pool

The network addresses included in the service address pool are configured internally in the cluster management software and are automatically allocated to each node. Although it can be browsed by users, it cannot be modified or deleted. For more information on the service address pool, please refer to "[[1.5.1 Service IP Settings](#)]".

## 5.9.2 Contents of Network Address Menu

- The page is located all across the screen.
- Displays the list of network addresses and their details.
- The details are IP address, subnet mask, gateway, IP address allocation method, device name, activation, and connection status.
- Network address list reflects the system's status.

## 5.9.3 Network Address Information Page

### 5.9.3.1 Contents of Network Address Information Page

Category	Description
IP Address	View the network address allocated to the cluster node.
Subnet Mask	View the subnet mask of the network address. A subnet mask indicates which part is the network identifier and which part is host identifier.
Gateway	View the gateway of the network address. If the gateway is not configured, the content will be empty.
Allocation Method	View whether the allocation method of IP address is through DHCP or STATIC.
Device	View the network device where the network address is allocated.
Active	View whether the network device is enabled or disabled.
Connection Status	View the connection status of the network device.

### 5.9.3.2 Creating Network Address

Press **Create** button from **Network Address Information** page to create a new network address.

#### 5.9.3.2.1 Entering Network Address Information

- **[Device Name]**
  - Select a network device from the drop-down list to allocate network address.
  - It will only display the device with no assigned address or composed as a network bond.
- **[Enable]**
  - Activates the network device.
  - If the option is enabled, the network device will be activated.
  - If the option is disabled, the network device will be deactivated.
- **[IP Address]**
  - Fill in a new IP address to allocate.
- **[Subnet Mask]**
  - Fill in a new subnet mask of the address to allocate.

A subnet mask will be in a form of "xxxxxx", and each subset will be a number between 0 to 255.

- **[Gateway]**
  - Fill in a new gateway address to allocate.
  - If the value is not entered, it will not configure a gateway for this address.

### 5.9.3.3 Modifying Network Address

Select an address from the list and press **Modify** button to modify the information in the network address.

#### 5.9.3.3.1 Changing Network Address Information

- **[Device Name]**
  - The name of the network device where the network address is allocated.
  - The device cannot be modified.
- **[Enable]**
  - Activates the network device.
  - If the option is enabled, the network device will be activated.
  - If the option is disabled, the network device will be deactivated.
- **[IP Address]**
  - Fill in the IP address to allocate if need to be changed.
- **[Subnet Mask]**
  - Fill in the subnet mask of the address to allocate if need to be changed.
  - A subnet mask will be in a form of "xxxxxx", and each subset will be a number between 0 to 255.
- **[Gateway]**
  - Fill in the gateway address to allocate if need to be changed.
  - If the value is not entered, it will not configure a gateway for this address.

### 5.9.3.4 Deleting Network Address

Select one or more address from **Network Address Information** page, and press **Delete** button to delete the network address.

## 5.10 Power

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### 5.10.1 About Power Menu

If a node is shut down without discretion, the cluster might not operate normally.  
Verify whether the node status from the dashboard is at **RUNNING** after restarting a node.  
The status changing to **RUNNING** might take a few minutes depending on the node's performance and status.

### 5.10.2 Power Management

Manages the power of the selected node.

### 5.10.3 Power Mode

- **Shutdown**
  - Select a node from the drop-down list on the top left corner of the page.
- **System Off**
  - Turns off the selected node.
- **Restart**
  - Restarts the selected node.

## General Troubleshooting Tips

These are the common checklists when there is a problem with NFS/CIFS service or cluster management.

Most of the hardware failures can be detected and notified by AnyStor-E management software. If it is not detected, please refer to **Checking your Hardware Configuration** below.

## 1. Checking your Network Configuration

There are various possible causes of access issues on AnyStor-E cluster manager or the malfunction of I/O on the client.

This section goes through the basic configurations on AnyStor-E network environment.

- Network Status Checklist

Item	Method (CLI)	Description
Cluster ping	'ping {IP address}'	Do a ping test on the cluster management IP or service IP from the client you are currently using.
Cluster port	'nmap {IP address}' or 'telnet (IP address)'	Verify whether the cluster port (management:80, NFS:2049,111,38465, CIFS:139,445) is available in firewall.

## 2. Checking your Software Configuration

To check your cluster's status, you can verify it from "[1.2 Overview](#)", and for the details on each node, please check "[5.2.3 Node Information List](#)".

- Status Checklist through Cluster Manager

Item	Method	Description
Cluster overview	Cluster Management >> Overview >> Node Status	If there is a warning or error on the hardware and software of the entire cluster or a node, the status field value will be changed. For the related issue, check <b>Dashboard Monitoring</b> section of this manual.
Cluster node status	Node Management >> Node Status	Verify the type and status of the resources you wish to monitor.
Task	Cluster Management >> Event >> Task	Check the tasks that require notification or problem solving on the hardware and software resources of the cluster.

## 3. Checking your Hardware Configuration

There are several ways to check your hardware depending on its manufacturer or model and this manual presents its basic

description. For more information, refer to the manual of the **hardware manufacturer**.

It may help to check the system event which is unidentified from the status check by the cluster manager.

- Hardware Notification Check (LED and alarm)

Item	Method	Description
NIC LED	Check NIC LED	If the LED is turned off or denied by the switch, you should suspect an error on the card or the switch port.
Disk LED	Check disk LED	If the LED turns red, it means that there is a possible disk failure. In case there is no RAID composed, it will fail to access its file system.
RAID Controller	Check beep sound or the message when the system starts	RAID Controller will make a beep sound when an error occurs.
System LED	Check LED on the front system panel	When the status of the hardware, such as CPU, mainboard, voltage, and fan are not normal, the LED will turn red which indicates the system failure.

- Internal System Check (SSH/Console)

Item	Method (CLI)	Description
IPMI sensor data	ipmitool	Check the hardware status using the IPMI command line to find the hardware error.
MCE log	mcelog	Check the MCEs (Machine Check Event) reported by x86 CPU to investigate the system error. You may be able to find the cause of an instant system restart or shutdown.
RAID Controller	Check beep sound or the message when the system starts	RAID Controller will make a beep sound when an error occurs.
System LED	Check LED on the front system panel	When the status of the hardware, such as CPU, mainboard, voltage, and fan are not normal, the LED will turn red which indicates the system failure.

## Diagnosing Event Warning

You can check the event history of the cluster manager to verify various logs of events and processes occurred from the system.

When an event is detected from "[1.4.2 Task Status](#)", you may take action by following the guide below.

The warnings and error messages can be displayed by the user's intention and it is recommended to check using the guide on whether the message is generated by the intention or the actual error.

## NIC eth(x) state is down

Analysis	Description
Severity	High
Event	The network connection of the cluster node is not working properly.
Version	All
Cause	It usually occurs when the node's NIC is physically damaged or the cable is dislocated and also often happens when an error occurs on the NIC kernel driver.
Related Issue	It might cause a system failure when the network using the NIC has no redundancy.
Solution	Replace the part that is causing the trouble.

## NIC bond(0|1) is degraded

Analysis	Description
Severity	Middle
Event	The storage or the service network connection of the cluster node is in degradation.
Version	All
Cause	It usually occurs when one of the redundant NIC of the node is physically damaged or the cable is dislocated and also often happens when an error occurs on the NIC kernel driver.
Related Issue	It would not affect the service, however, it requires an action.
Solution	Replace the part that is causing the trouble.

## NIC eth4 does not use maximum speed link (link speed: xxx Mb/s),

Analysis	Description
Severity	Middle
Event	The network connection of the cluster node is not configured for a full performance.
Version	All
Cause	It mostly happens when a NIC of the node fails the auto-negotiation with the switch, or when it has a physical problem, or when the cable connection is unstable. It occasionally happens when an error occurs on the NIC kernel driver.
Related Issue	It would not affect the service, however, it requires an action due to the possible performance loss.
Solution	Replace the part that is causing the trouble.

## OSDISK\_HIGH: VolGroup-lv\_root

Analysis	Description
Severity	High
Event	The availability of the OS disk went below 20%.
Version	All
Cause	It happens in cases when the debug level is too high, when the custom package is installed, and when there is a log overload due to the system software error.
Related Issue	When the OS disk lack space, some of the system configuration file and disk buffer might not function properly and will cause a failure on connecting new service client or the malfunction of the monitoring software.
Solution	You should delete unnecessary files to secure the OS disk space. Check the usage of each directory through the command below and delete the unnecessary files.

1. Access the system console using SSH and use the "df" command to verify the actual OS disk availability.

```
$ df -h /
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/VolGroup-lv_root 50G  48G   2G   96%    /

$ cd / ; du -sh `ls | egrep -v 'proc|sys|export|volume'`
... Omitted ...
196M    opt
617M    root
```

```
1.4G    usr
40G     var
... Omitted ...
```

2. Check the capacity of the major log directories of AnyStor-E.

```
$ cd /var/log; du -sh `ls`
... Omitted ...
1.3G    /var/log/gsm
374M    /var/log/gms
1.8G    /var/log/glusterfs
... Omitted ...
```

3. Look for old log files from the directories and delete them.

```
$ ls -alt /var/log/gsm/

644M    /var/log/gsm/publisher.log-20171109.gz
656M    /var/log/gsm/publisher.log-20171111.gz
628M    /var/log/gsm/publisher.log-20171113.gz
648M    /var/log/gsm/publisher.log-20171115.gz

$ rm -rf /var/log/gsm/publisher.log-20171028.gz
```

4. Check whether the OS disk space is secured.

```
$ df -h /
Filesystem                Size  Used Avail Use% Mounted on
/dev/mapper/VolGroup-lv_root 50G   24G   26G   48%   /
```

## Troubleshooting via Status and Stage

- Follow the instructions according to the status of a cluster, stage, and node.

## If a cluster status is 'Manage: UNHEALTHY'

### System Environment

Item	Description
AnyStor-E Version	2.0.6.3 or above
OS	CentOS 6.9 or above
GlusterFS Version	3.10.7 or above

### Cause of Issue

- It occurs when some of the components for the cluster management are in abnormal status.

### Verify the Issue

- Check "[1.2.1 Node Status Table](#)" to verify the node with the issue.
- Go to Node Management page and check the component status of the node which was mentioned in "[5.2.2.1 About Node Information List](#)".
- The status of a component will be displayed as 'Status (xxx)'. If the status is not shown as 'OK', go to **Event** page mentioned at "[1.4 Event](#)" whether there is an event related to the component.

## If the cluster status is 'Service: DEGRADED'

### System Environment

Item	Description
AnyStor-E Version	2.0.6.3 or above
OS	CentOS 6.9 or above
GlusterFS Version	3.10.7 or above

### Cause of Issue

- It occurs when the component for I/O service is in abnormal status in some nodes.

### Verify the Issue

- Check "[1.2.1 Node Status Table](#)" to verify the node with the issue.
- Go to Node Management page and check the component status of the node which was mentioned in "[5.2.2.1 About Node Information List](#)".

## Diagnosing Service I/O

When a failure is detected while using the CIFS and NFS service, follow the instructions below.

### Recommendations

Check on the general troubleshoots on whether the status of the network configuration or the device is normal.  
If the same symptom is not seen in other nodes, the problem might be dependent on the client environment.

## NFS: Input/Output error occurs when accessing specific files or directories

Analysis	Description
Version	All
Symptom	A message "Input/Output error" appears and unable to access when accessing to a specific file/directory from the volume mounted through NFS.
Cause	The file might be affected by the split-brain status. Split-brain is a status which causes an error on the system auto-recovery by metadata discord of the files between replicated nodes.
Solution	Fix the split-brain issue using the mtime (modified time of a file) or source recovery referred in the guide below.

1. Verify the issue

```
$ ls /mnt/nfs/test_file
ls: reading directory .: Input/output error
```

2. Access SSH or console of AnyStor-E device and proceed the following command to check the volume status.

```
$ gluster volume heal {volume_name} info split-brain
Brick 10.10.59.65:/volume/{volume_name}
Status: Connected
Number of entries in split-brain: 0

Brick 10.10.59.66:/volume/{volume_name}
Status: Connected
Number of entries in split-brain: 0
```

3. Select a file at mtime and recover

```
$ gluster volume heal {volume_name} split-brain latest-mtime {file_path}
```

\* {file\_path} is a lower path of a mount path.

\* For instance, if a mount path is set as '/mnt/volume/', to recover '/mnt/volume/a.file' you should enter '/a.file'.

4. Select a source file and recover

- \* When it is unable to recover at `mtime`, you can designate a node which has the original file for the recovery.
- \* To designate a node for the recovery, you must know the IP(`{storage_ip}`) of each node.
- \* `{storage_ip}` is an IP address which designates each node in the cluster file system and can be confirmed using a command.
- \* You can use the hostname as a `{storage_ip}` from the example of a command below.

```
$ gluster pool list
```

UUID	Hostname	State
2856591b-a6e7-4479-9a68-77ba6d4ce497	10.10.59.67	Connected
71ceb5ec-a3cf-49d6-b1c6-be6a0aaf76e9	10.10.59.68	Connected
036d30f8-c6f3-481e-bddf-e284c270b3ab	10.10.59.66	Connected
2d4bf849-9da3-4b05-8dfc-4e22dabec37b	localhost	Connected

```
>+ **This recovery method will recover the file to the previous state.**
```

>+ As the file is recovered using the designated node, it is possible that the file might not be the one you are expecting.

\* You can recover the file through designated node using the information such as {storage\_ip}, {volume\_name}, and {file\_path} which were verified by the commands earlier.

```
$ gluster volume heal {volume_name} split-brain source-brick {storage ip}:/volume/{volume_name} {file_path}
```