EonStor CS Family Storage Configuration Best Practice

This guideline provides recommendation of best practice for installation and configuration to meet customer's performance and availability requirements.

Version: 1.3

Updated: April 2020



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Summary

The purpose of this practice is to focus on how to propose and configure the maximum performance and high availability architecture with Infortrend storage system. Performance and high availability play an important role when we deploy a solution. The guideline covers most of the general cases. We strongly recommend following these principles to deploy Infortrend products. However, some exception cases are not addressed and covered in this guide. Therefore, this guide is not absolutely correct for every situation. In a mixed business environment, some practices of the third-party application should be taken into consideration that will be mentioned in another specific application guide.

Audience

This guide is intended for the Infortrend partners, customers, and employees who are proposing and configuring the Infortrend system. We assume the audience is familiar with the Infortrend CS storage operation.

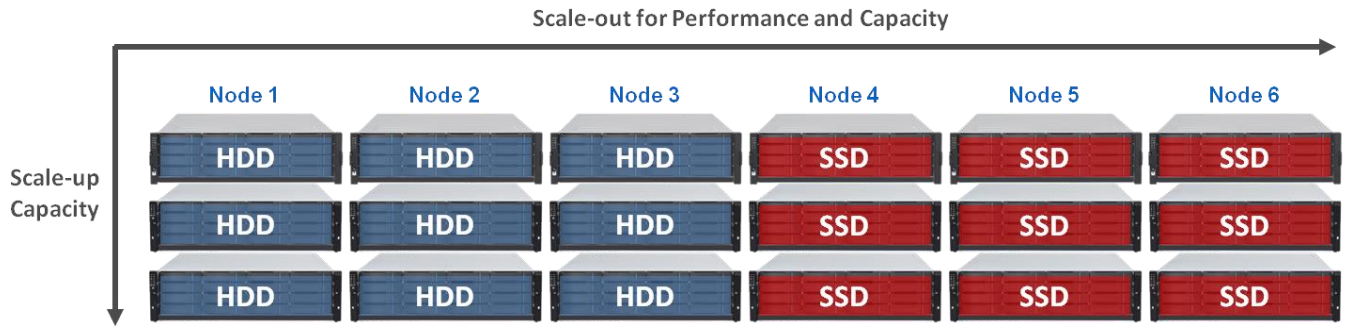
Terminology

- **EonStor CS** – Scale-out NAS product provided by Infortrend.
- **Infortrend Distributed File System (IDFS)** – A distributed file system designed by Infortrend.
- **Storage controller** – A storage node provides the computing resource to provide the I/O service between storage and hosts. There are processor, memory, cache backup module, and connectivity on it.
- **Storage system** – An enclosure including controllers, fans, and power supplies.
- **Node** – A storage system that may also include an expansion enclosure.
- **Cluster** – A collection of multiple nodes.
- **Expansion enclosure** – An enclosure with drive slots that are used to expand additional drives for a storage system.
- **RAID (Redundant Array of Independent Disks)** – Storage virtualization technology that integrates multiple disks to provide better performance and data redundancy.
- **Logical Drive** – The basic unit of RAID group created by the controller.
- **Disk pool** – The integration of logical drives where a shared folder can be created.
- **Shared folder** – A location for shared storage access via file system protocol.
- **File system** – A mechanism to control how data is stored and retrieved via file system protocol, such as CIFS and NFS.

EonStor CS Configuration Architecture

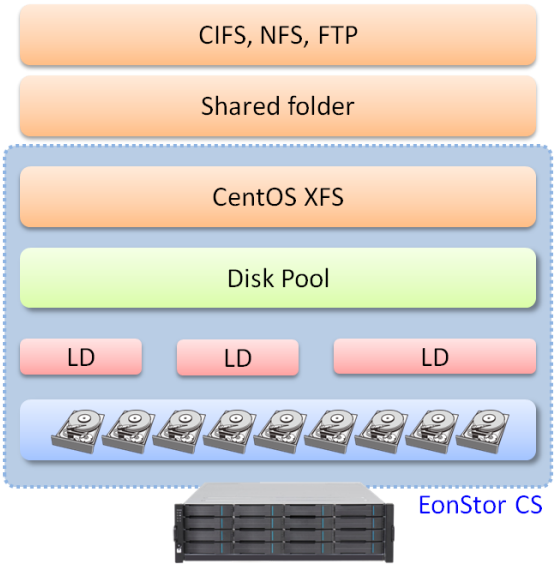
EonStor CS is an enterprise-level scale-out NAS storage system that provides an efficient and cost-effective way to allocate storage resources to meet the capacity, availability, and performance requirements of different applications. Scale-out NAS is now the trend in the enterprise-level storage field. Scale-out NAS expands the system by adding new nodes which provides not only capacity but also computing power and network bandwidth. In a traditional scale-up NAS, users can only expand the system by adding expansion enclosures to the storage system. As the system grows, it may meet the performance bottleneck, since the scale-up NAS cannot provide extra computing power and network bandwidth. However, this will no longer be a problem for a scale-out NAS.

Most of the scale-out NAS in the market can only expand the system by scale-out. Unlike other scale-out NAS, EonStor CS can expand the system not only by scale-out but also by scale-up. Users can choose to add an expansion enclosure to their nodes for extra capacity. This can be a more cost-effective way to expand their system if there is no need for extra performance. EonStor CS provides not only high and stable performance but also more flexibility for our customers.



Scale-out and Scale-up of EonStor CS Cluster

Infortrend Distributed File System (IDFS) adopts disk pool-based storage management system. During the first installation, users will have to choose which RAID level they desire. After the RAID level is decided, Infortrend Distributed File System will automatically establish Logical Drives (LDs) in the background. Users will only have to create shared folder(s) and disk pool(s) and leave the other works to the system. There are several choices of the data protection level. It will be introduced in the following chapter.



EonStor CS Configuration Architecture

Proposed Solutions

You can enjoy the high and stable performance offered by EonStor CS, and also the configuration flexibility that it brings to you. This section will list some customer requirements information and illustrate solution design steps to meet those requirements

Requirements

Capacity

Capacity is one of the most important factors when choosing the data protection level. Generally, customers will provide the capacity requirements for raw capacity or usable capacity in advance. In Infortrend Distributed File System, we adopt erasure coding/replica technology to protect data across the nodes. For the capacity-sensitive applications, users should implement the erasure coding to protect the data, since erasure coding can offer better capacity usage. For critical data applications, the replica would be more suitable.

Protection Type	Protection Level (N+M)	Description
Distributed	1	Configured with 1 node. Each data will be stored in a single node.
Erasure code	2+1	Needs at least 3 nodes to configure. Allows losing 1 node.
	4+1	Needs at least 5 nodes to configure. Allows losing 1 node.
	4+2	Needs at least 6 nodes to configure. Allows losing 2 nodes.
	8+1	Needs at least 9 nodes to configure. Allows losing 1 node.
	8+2	Needs at least 10 nodes to configure. Allows losing 2 nodes.
Replica	X2	Needs at least 3 nodes to configure, replicates 2 copies. Allows losing 1 node.
	X3	Needs at least 3 nodes to configure, replicates 3 copies. Allows losing 2 nodes.

Protection Levels

EonStor also reserves Infortrend RAID technology to protect the data within a single node and maintains the excellent performance for scale-up. EonStor CS has 3 RAID levels to choose from.

- Optimal Performance – Provides the highest performance among all the RAID modes. Consists of RAID5.
- Balance – Consists of RAID5. Reserves drive(s) for spare to provide better data protection and remain good capacity usage.
- Optimal Protection – Consists of RAID6. Provides the best data protection among all the RAID modes.

Users can deploy the EonStor CS cluster with 1 node for the lowest protection level (Distributed), and users can expand the cluster up to 144 nodes for scale-out. For scale-up, there are 3 kinds of form factors of expansion enclosures: 3U 16-bay, 4U 60-bay and 2U 25-bay. An HDD node can connect to up to 3 expansion enclosures for 3U 16-bay or 1 for 4U 60-bay, and an SSD node can connect to up to 3 2U 25-bay expansion enclosures.

Drive Type

Inevitably, there is always a trade-off between performance, capacity, and cost for different drive types. Hence, the drive type will be a key element that affects the expected workload. According to the drive type, EonStor CS offers 2 types of configuration.

- HDD Node – Using all HDD in the node
- SSD Node – Using all SSD in the node

Each node can also expand by adding expansion enclosure via SAS 12 Gb/s interface. The expansion enclosure must use the same drive type configuration with the head node.

Drive Type	Configuration	Profile
HDD	HDD * 16/24/60	Archive, backup
SSD	SSD * 25	High performance, low latency

Node Configuration

Infortrend provides 3 series of EonStor CS Family. Different series of CS will provide you a different level of performance because of the different numbers of CPU cores. The form below shows each CS series' corresponding number of CPU cores and available form factors.

Series	CPU Core	Model
CS 4000	12	CS 4016G (3U 16-bay) CS 4024G (4U 24-bay) CS 4025B (2U 25-bay) CS 4060D/4060G (4U 60-bay)
CS 3000	8	CS 3016G (3U 16-bay) CS 3024G (4U 24-bay) CS 3060D/3060G (4U 60-bay)
CS 2000	4	CS 2060D/2060G (4U 60-bay)

EonStor CS Family Model

Note:

- G/D indicates the controller configuration. G is a single node within single chassis, and D stands for dual node within single chassis.
- CS 4025B supports SSD only.

Disk Pool

According to different types of nodes, the system can create 2 different kinds of disk pools.

- HDD Pool – HDD pools are for large capacity applications, such as archive, since the HDD is cheaper and able to provide larger capacity.
- SSD Pool – SSD pools consists of all SSD nodes. It is built for high performance and low latency applications, such as database.

When users expand the disk pool by adding nodes to the system, the disk pool can automatically assign the node to the corresponding disk pool based on their drive configuration.



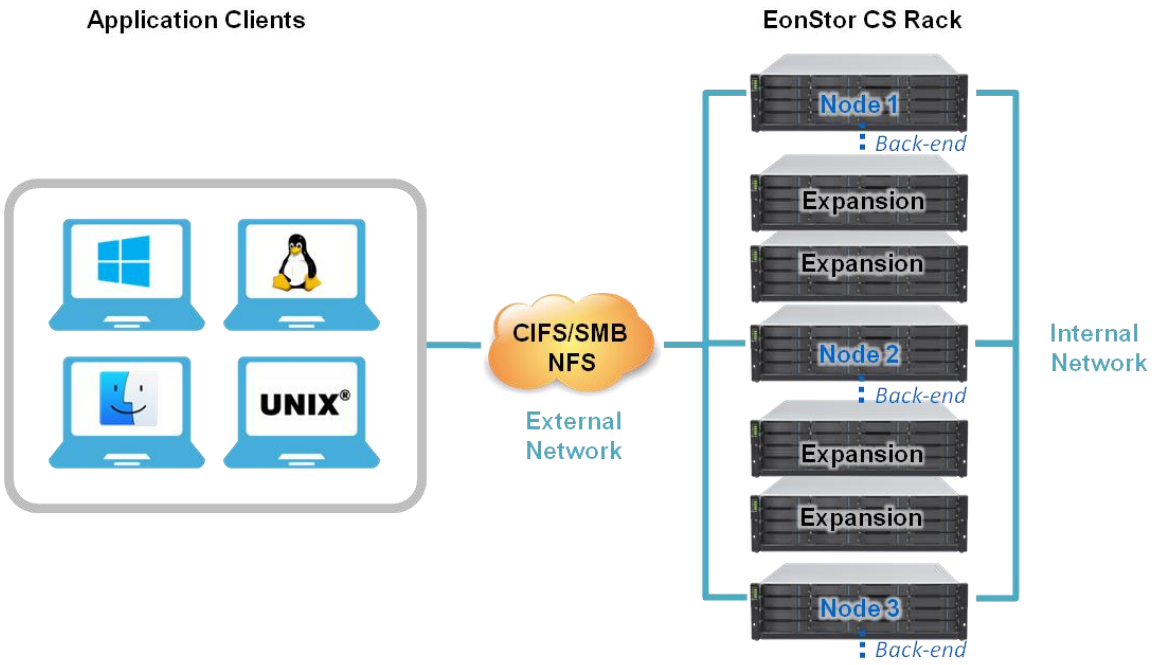
Disk pool and Shared folder

Front-end Network and Internal Network

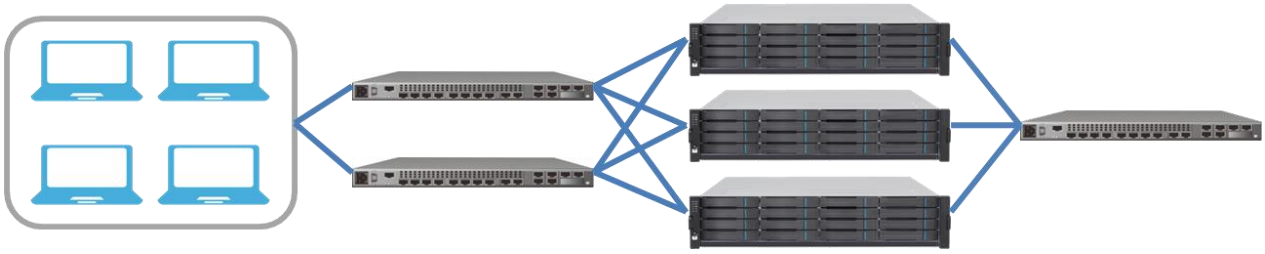
The network of EonStor CS can be divided into 2 parts – front-end network and internal network. Front-end network is responsible for the connectivity between the nodes and the clients, while internal network is responsible for communication between the nodes.

- Front-end network – Client can connect to all usable nodes to access the cluster through 10GbE (SFP+)/25GbE (SFP28)/40GbE (QSFP+). The supported protocols include NFSv3, CIFS/SMB and FTP. Users can deploy a redundant switch for high availability architecture. Front-end network also supports trunk group to increase performance and failure tolerance.
- Internal network – All nodes can communicate with each other via 10GbE (SFP+)/25GbE (SFP28)/40GbE (QSFP+) interfaces. In order to lower the latency and improve the failure tolerance, RDMA and trunk group are also supported in internal network.

Note: RDMA is supported in 25GbE and 40GbE for internal network only.



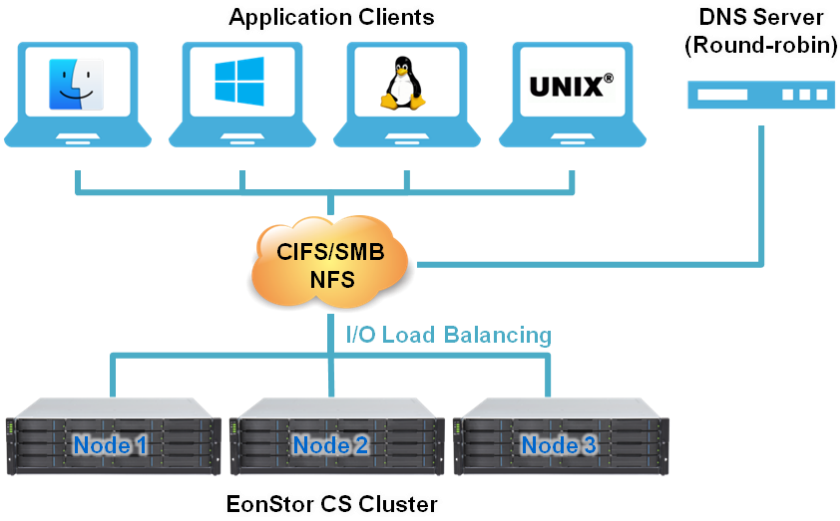
Network of EonStor CS Cluster



Redundant Switch for High Availability

External I/O Balancing

In order to balance the ***I/O traffic***, EonStor CS supports DNS Round-Robin mode. With load balancing, the traffic can be fully distributed to different nodes, so that it will not be stuck in the same node causing bottleneck.



DNS Round-Robin for I/O Balancing

Storage Configuring Principle

In this section, we will provide detailed configuration guidelines based on customer's requirements of the previous sections. Infortrend and its partners can propose appropriate solutions by following the principles.

Calculating Usable Capacity

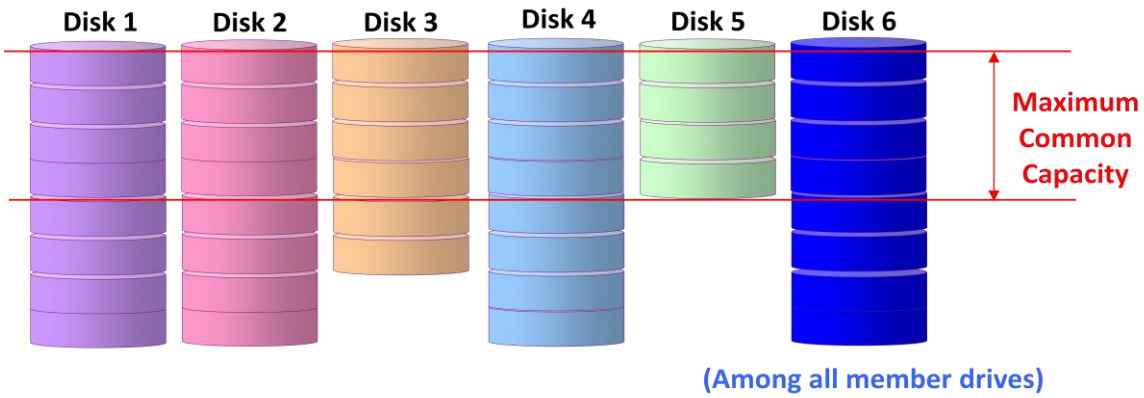
Infortrend Distributed File System adopts erasure coding/replica and Infortrend RAID technology to protect the data. Adopting different protection levels causes the usable capacity to be different. The following table shows all the RAID configuration and usable capacity of the EonStor CS family. We use N to indicate the capacity of the drive. When calculating usable capacity, the raw capacity should multiply by 0.9 because of the reserved capacity in the drive.

Mode \ Model		CS 3016G CS 4016G (16*drives)	CS 3024G CS 4024G (24*drives)	CS 4025G (25*drives)	CS 2060D CS 3060D CS 4060D (30*drives)	CS 2060G CS 3060G CS 4060G (60*drives)
Optimal Performance	RAID Configuration	RAID5 (8 drives)	RAID5 (8 drives)	LD1 – RAID5 (8 drives) LD2 – RAID5 (9 drives)	RAID5 (10 drives)	RAID5 (10 drives)
	Number of LD	2*LD	3*LD	2*LD1 + 1*LD2	3*LD	6*LD
	Usable Capacity	12.6N	18.9N	19.8N	24.3N	48.6N
Balance	RAID Configuration	RAID5 (15 drives)	LD1 – RAID5 (11 drives) LD2 – RAID5 (12 drives)	RAID5 (12 drives)	LD1 – RAID5 (14 drives) LD2 – RAID5 (15 drives)	LD1 – RAID5 (14 drives) LD2 – RAID5 (15 drives)
	Number of LD	1*LD + 1*spare	1*LD1 + 1*LD2 + 1*spare	2*LD + 1*spare	1*LD1 + 1*LD2 + 1*spare	2*LD1 + 2*LD2 + 2*spare
	Usable Capacity	12.6N	18.9N	19.8N	24.3N	48.6N
Optimal Protection	RAID Configuration	RAID6 (16 drives)	RAID6 (12 drives)	LD1 – RAID6 (12 drives) LD2 – RAID6 (13 drives)	RAID6 (15 drives)	RAID6 (15 drives)
	Number of LD	1*LD	2*LD	1*LD1 + 1*LD2	2*LD	4*LD
	Usable Capacity	12.6N	18N	18.9N	23.4N	46.8N

RAID Configuration and Usable Capacity of EonStor CS Family

Note: G indicates there is 1 node in the appliance, and D indicates there are 2 nodes in the appliance.

When using drives with different capacities, the RAID group will only use the minimum capacity among all the drives for every drive, which is a waste of unused capacity. We strongly recommend using the same drives when deploying the EonStor CS cluster.



Mixing Drives with Different Capacity

Now, we have the usable capacity of a single node. We are going to further introduce the usable capacity of the cluster with erasure coding/replica.

For replica, the data is copied from node to node, so the calculation is easy. If you adopt replica for data protection, all the nodes are saving the same data. The usable capacity will be capacity of a single node. If total capacity of the disk pool is N, then the usable capacity with replica is shown below.

Protection Level	Usable Capacity (Raw Capacity of Cluster: C)
X2	C/2
X3	C/3

Usable Capacity with Replica

For erasure coding, there is some capacity for parity which is used for retrieving data when failure occurs. Now, EonStor CS supports N+1 and N+2 protection levels. In N+1, there is roughly 1 node that will be used for parity. And so on, N+2 use roughly 2 nodes for parity.

Protection Level (N+M)	Usable Capacity (Raw Capacity of Cluster: C)
2+1	C*2/3
4+1	C*4/5
4+2	C*4/6
8+1	C*8/9
8+2	C*8/10

Usable Capacity with Erasure Coding

Calculating Performance

The EonStor CS 4000 highest performance can reach around 3GB/2GB Read/Write per node with SSD, and around 2GB/1.5GB Read/Write per node with HDD. The minimum number of drives to meet performance requirements can be referred from Infortrend performance report. To meet your requirements of performance and capacity, please contact Infortrend or its partners for the best configuration.

Controller Cache Memory

Controller cache memory also has an impact on performance. Customers should evaluate how much memory they need for their applications.

- CS 2000/3000/4000 – Default DDR4 64 GB, expandable to 128/256 GB.

If the system meets the performance bottleneck caused by memory size, users can also add new memory to the node.

Storage Configuring Example

In this section, we are going to give you a simple example of how to configure the EonStor CS cluster. We hope this example can help you better understand how to configure the EonStor CS cluster.

This is just an example for CS configuration. For the real performance numbers and other details, please contact Infortrend pre-sales team.

When configuring a storage system, users will provide their requirements, such as capacity and read/write performance. Based on the information users provided, we can evaluate how to fulfill these requirements with our storage system.

When you receive requirements from users, there are a few principles that help you configure the storage system.

- How many nodes do users need based on their performance requirements?
- How many and what kinds of drives do users need based on their capacity requirement?
- Do users need other licensed features for their storage system?

For example, users have the following requirements:

- 15GB/10GB Read/Write performance
- 2PB capacity

To meet user's performance requirement, you can contact Infortrend pre-sales team for performance report to calculate how many nodes you need. In this example, EonStor CS 4000 performance can supposedly reach 1.5 GB/s read and 1 GB/s write for each node with 32 HDDs in balance mode and erasure code 4+1. Since the user needs 15GB/10GB read/write performance, we need to deploy 10 nodes to meet the requirement. Then we move on to calculate the capacity. RAID and erasure code/replica will reserve space for parity or replica. We adopt the 4+1 protection level of erasure code in this example, and the RAID mode is balance mode.

- If we use the 10TB HDD, capacity of an HDD node with RAID 5 and 1 spare drive would be: (16-1-1) *10TB*0.9 = 126TB. Remember to multiply by 0.9 for the drive overhead.
- With JBOD 3016 connected to each node, the total capacity would be: 126TB*20 = 2520TB = 2.5PB
- Erasure code 4+1: 2.5PB*4/5 = 2PB

Now, the system can meet performance and capacity requirements. Finally, we can offer users the configuration of EonStor CS cluster as shown below.

Component	Quantity
EonStor CS 4016	10
Expansion Enclosure 3U 16-bay	10
HDD 10TB	320

EonStor CS configuration Example

This is just a simple example of how to configure a storage system with EonStor CS. For more details about CS configuration, please contact Infortrend pre-sales team.

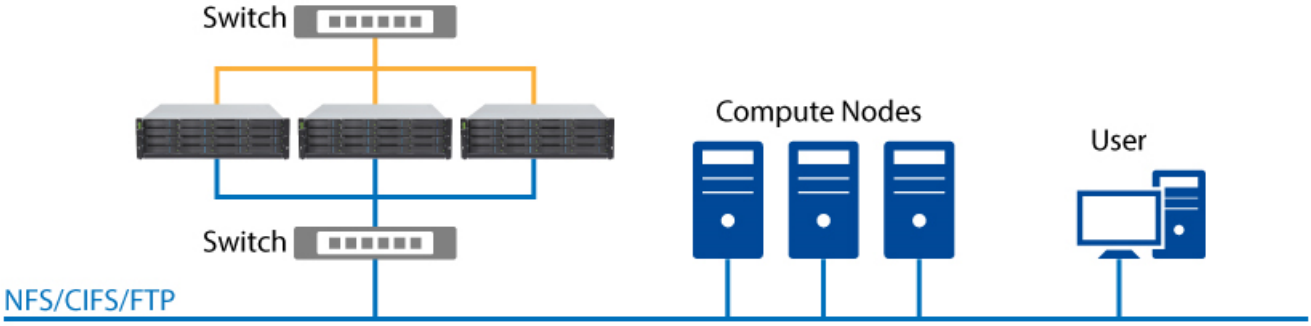
Application

In this section, we are going to introduce 3 applications – High Performance Computing (HPC), Media & Entertainment and Backup. For the first 2 applications, not only high performance and capacity are needed, but also the performance and capacity requirements may both grow in the future, which means that the scale-out NAS is a much more suitable solution than traditional scale-up NAS.

High-Performance Computing

High-performance computing requires continuous computing, fast data reading, data file sharing, etc. As time goes by, data grows rapidly. Scale-up NAS may soon be not able to provide enough performance since capacity keeps growing and performance is not. EonStor CS is a scale-out NAS system that can provide efficient and stable bandwidth and improve performance as the system grows. EonStor CS can also do load balancing between nodes and achieve data sharing. EonStor CS provides a unified system namespace and GB-level bandwidth, PB-level capacity.

- High Performance – EonStor CS provides stable aggregated bandwidth, reduces data I/O time, and improves cluster work efficiency. By increasing nodes, performance can be linearly increased to meet large-scale data-parallel read/write requirements.
- Massive Storage Capacity with Expansion Enclosure – Expanding with nodes costs high. However, expansion with expansion enclosure can save much budget and provide mass storage space. With expansion enclosure, a high-performance computing cluster can store a large number of data and calculation results at a reasonable price.
- Global Data Sharing – All nodes share the same data file, support load balancing, and improve cluster efficiency.
- Full Data Protection – With erasure coding/replica and Infortrend RAID technology, users will not need to worry about data loss in case of a disk failure.
- Backup – Research data is critical, so CS provides Rsync and other backup mechanisms to prevent data loss from any unexpected accident.
- Security – SED hard disk encryption, Write Once Read Many (WORM), SSL encryption.

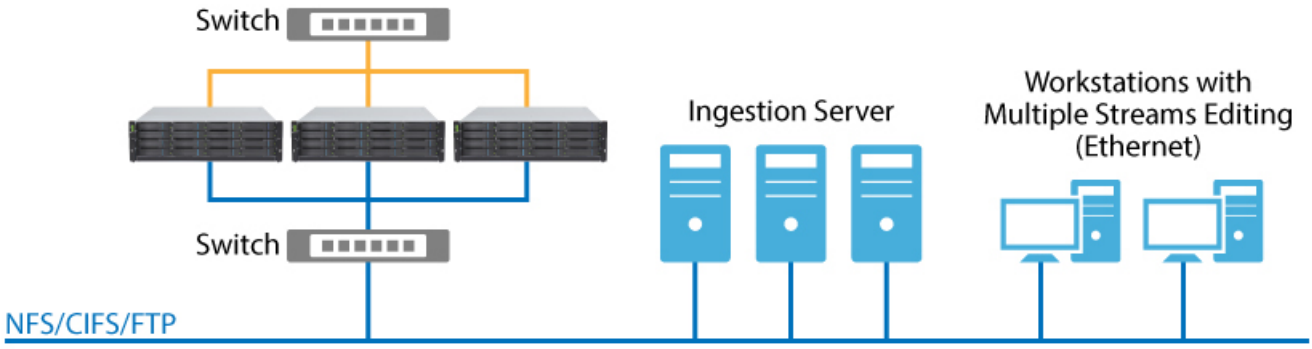


High Performance Computing Architecture

Media & Entertainment

EonStor CS can be used in high-definition (HD) editing and media production system, since EonStor CS not only provides high performance, large capacity, and good scalability but also extremely high data security and good TCO. EonStor CS solves the core problem of insufficient back-end storage bandwidth, weak capacity expansion, and high construction and maintenance costs in HD editing and television users. EonStor CS can be applied to radio and television HD non-linear sharing, high-speed rendering synthesis, media asset archiving, and media asset data disaster recovery backup.

- Elastic Scaling – Storage nodes can expand seamlessly online without interrupting services, and performance grows linearly as a number of nodes increases.
- Massive Data Storage – Not only scale-out but also scale-up! Customers can scale up to achieve massive data according to their needs. This can save you much budget!
- High performance I/O – Multiple nodes can be accessed simultaneously, bringing you the ultimate experience of high-speed storage.
- Load Balancing – EonStor CS supports DNS Round-Robin mode to achieve load balancing between nodes and optimize cluster resources.
- Easy-to-use Web GUI – users can easily manage their cluster with our user-friendly Web GUI.

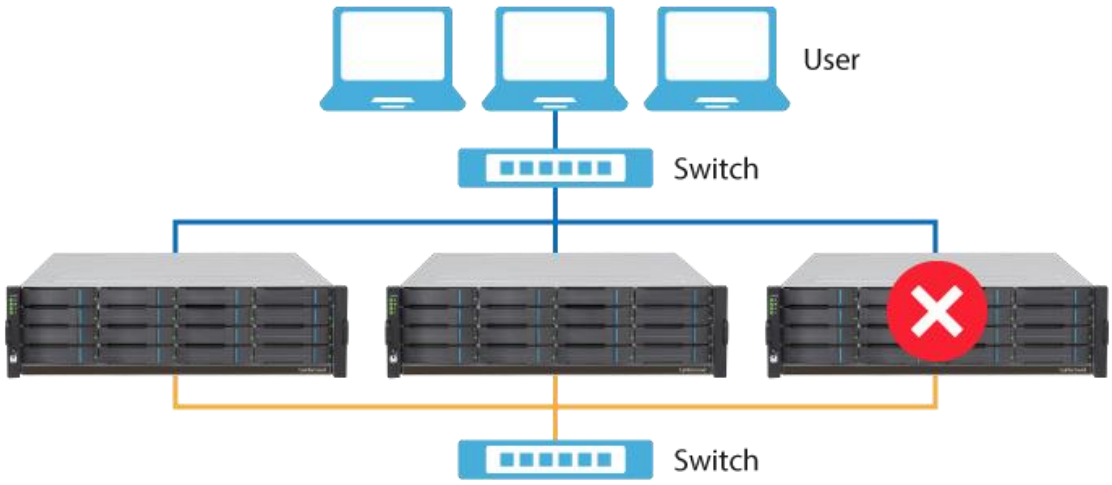


Media & Entertainment Architecture

Backup and Archive

EonStor CS can be a perfect solution for high-performance requirement cases, as well as for backup and archiving. With the full data protection techniques, users can have no worries about data loss under any circumstances. EonStor CS cluster can realize the true non-stop service, even when a node failure occurs. For those industries that need 24/7 non-stop data service, EonStor CS can prevent system downtime from any kind of disaster.

- Scaling-Out – Scaling-out can provide both capacity and performance while expanding the system. As the system grows, the EonStor CS cluster can still provide the ultimate user experience.
- Scaling-Up – EonStor CS focuses on the user experience while providing great cost-effectiveness for cost-conscious users. When the current performance is enough, users can also expand by scale-up for massive data storage.
- Full Data Protection – For large amount of data, users can adopt erasure coding to protect their data which provides better capacity usage. Users can implement replica configuration to store critical data like transaction records for the highest level of protection.
- High Availability – With Infortrend Distributed File System, users can access their data from any available node. Even when node failure occurs, there are still other nodes working.
- Security – EonStor CS supports SED hard disk encryption and SSL encryption to protect your data from malicious users.



EonStor CS Serves without downtime

Conclusion

EonStor CS provides users with high and stable performance and great deployment flexibility. Unlike most of the scale-out NAS in the market, EonStor can do both scale-out and scale-up without service interruption, which reduces the management complexity and scaling costs. On top of performance, Infortrend RAID technology, and erasure coding/replica can fully protect your data from any kinds of failure. EonStor CS also has full backup solutions that can protect your data from any unexpected physical disasters. With rich software support and easy-to-use web GUI, EonStor CS brings you excellent user experience.

EonStor CS solutions suit HPC and Media & Entertainment applications perfectly. With its great flexibility and performance, EonStor CS can meet any kind of requirement from the users.

Reference

Category	Technical document
Document	EonStor CS Data Sheet
Document	EonStor CS Best Practice
Document	EonStor CS Expansion Guide

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