

Synology SA3400D Storage Best Practices Guide



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Chapter 1: Introduction

Synology SA3400D is a high-performance and scalable shared storage solution designed for small and medium-sized businesses and enterprises. With its active-passive dual controller design, hardware redundancy mechanism, and scalable architecture, SA3400D provides a reliable and secure platform for data storage, management, and protection.

This guide provides best practices for deploying SA3400D, including information on the features and capabilities of the SA3400D and recommendations for storage management, performance enhancement, and data protection. Whether you are a new or experienced user, this guide will help you maximize the benefits of your SA3400D and ensure its optimal performance and security.

By following the best practices outlined in this guide, you can ensure that your SA3400D is deployed and configured in a manner that meets the unique needs of your business or enterprise. Whether you are looking to increase storage capacity, improve performance, or enhance security, this guide will help you achieve your goals and ensure the success of your SA3400D deployment.

The guidelines presented in this guide are recommendations for the majority of use cases and should be implemented on an as-needed basis.

Terminology

The following terms are used throughout this paper and are essential for understanding your Synology storage system.

- **File system:** A method of organizing and storing data on a storage system, including how data is named, stored, and accessed.
- **Firmware:** The software embedded in a hardware device that provides low-level control and functionality. It can be updated to add new features, fix bugs, and improve performance.
- **High-availability cluster:** A group of servers or storage devices configured to provide continuous availability and redundancy, ensuring that services remain accessible even if individual components fail.
- **iSCSI LUN:** iSCSI Logical Unit Number, a unique identifier assigned to a logical unit of storage presented over an iSCSI network, allowing servers to access storage resources remotely.
- **Latency:** The time delay between the initiation of a network request and the receipt of a response, often measured in milliseconds.
- **Link Aggregation:** A method of combining multiple network interfaces into a single logical interface to increase bandwidth and improve network performance.
- **Load Balancing:** The distribution of network traffic across multiple network interfaces or paths to optimize performance and prevent bottlenecks.

- **Network interface:** A hardware or software component that enables a device to connect to a network and transmit/receive data.
- **Performance bottleneck:** A point in a system where the capacity or throughput of a resource is limiting overall performance.
- **RAID:** Redundant Array of Independent Disks, a method of combining multiple hard disk drives into a single logical unit for data protection and/or performance improvement.
- **SAN:** A storage area network that provides block-level access to data over a dedicated network.
- **SATA DOM:** A small flash memory module connected to the motherboard via a SATA interface. SATA DOM stores the DSM operating system and boot loader, ensuring a fast and reliable booting process while also offering increased durability and resilience to vibration and shocks.
- **Snapshot:** A read-only, point-in-time copy of a file system, volume, or data set. Snapshots provide a quick and efficient way to restore data to a previous state or retrieve specific versions of files.
- **SSD:** Solid-state drive, a type of storage device that uses NAND-based flash memory instead of spinning disks.
- **Storage pool:** A collection of physical storage resources that can be allocated to logical volumes as needed.
- **Thin provisioning:** A storage technique that allows physical storage resources to be allocated to logical volumes as needed, rather than allocating the full capacity up front.
- **Throughput:** The rate at which data is transmitted over a network or a specific connection, typically measured in bits or bytes per second.
- **Virtualization:** The process of creating a virtual version of a physical resource, such as a server, storage device, or network.
- **Volume:** A logical unit of storage that can be accessed by a host system, often used to store a file system or application data.
- **Workload:** The amount of processing, memory, storage, and network resources required to run an application or group of applications.
- **WORM:** Write Once Read Many, a storage technology that allows data to be written once and read multiple times, ensuring the immutability and integrity of the stored information.

Chapter 2: SA3400D Product Highlights and Features

Synology SA3400D is an enterprise-level storage solution designed to meet the demands of modern businesses through the use of several key features.

Active-passive dual controller design

SA3400D has a dual controller architecture in a single machine, providing real-time protection and service continuity. In an active-passive dual controller design, one controller is active and handles all incoming data traffic, while the other controller is passive and remains on standby. Through the use of built-in **Synology High Availability (SHA)** SA3400D can automatically fail over to the passive controller in under one minute, ensuring the availability of your data and maximizing service up-time.

Additionally, SA3400D is designed with a high-speed **Non-Transparent Bridge (NTB)**, ensuring reliable, high-speed, and low latency connectivity between controllers.

Hardware redundancy and stability mechanisms

SA3400D is designed with hardware redundancy mechanisms to ensure high uptime and reliability. It features modularized power supplies and fans for easy maintenance and replacement, and dual fan modules for each controller. Additionally, the controllers are modularized and swappable, providing an extra layer of redundancy. To ensure stability and higher throughput, the system also includes **SATA DOM**, which isolates the DSM operating system files from stored data.

Scalable shared storage architecture

SA3400D's shared-storage design means that data replication is not necessary, saving valuable rack space and reducing setup time when compared to using two separate devices to achieve high-availability. This also means that there is no need for a separate storage replication network, reducing the time and effort required to set up and maintain the system. Additionally, since data replication is not needed, SA3400D saves valuable network bandwidth that would otherwise be used for storage replication.

Plus, with a raw capacity of 500 TB, SA3400D is a highly-scalable solution. It has one expansion port per controller (Mini-SAS HD port), and can be further scaled up to 576 TB using 2 expansion

units (RXD1219sas). This makes it ideal for businesses that need to expand their storage capacity over time.

High performance design

SA3400D offers cost-effective RJ45 networking interface options, including two 1 GbE ports and one 10 GbE port. It also has a PCIe 3.0 slot that supports 10 GbE and 25 GbE network interface cards, allowing for higher throughput and better performance.

SA3400D is also equipped with cutting-edge RAID technology, including the **RAID bitmap** feature. This powerful tool, also known as **Write-intent bitmap**, continuously records and updates areas in the RAID that may not maintain data consistency during writing. Without RAID bitmap, it can take a long time to execute scrubbing on the entire RAID when the risk of data inconsistency is detected. However, with the bitmap function enabled, users can significantly reduce scrubbing time by detecting areas with the risk of inconsistency and performing scrubbing only where necessary.

SA3400D leverages the NTB technology to save the bitmap in the memory of another controller. This allows users to enjoy the benefits of bitmap reduction of scrubbing time while maintaining high write performance.

Advanced data protection features

SA3400D is packed with advanced data protection features that give businesses peace of mind, knowing that their important data is always protected even in the event of unexpected system failures. One of these features is the **Btrfs cache protection technology**, which utilizes the dual-controller NTB channel to synchronize all write operations of the active node to the memory of the passive node. This prevents the loss of file system cache data that has not yet been written back to the hard disk in the event of a machine failure, ensuring that your data is always protected.

Additionally, SA3400D extends its cache protection capabilities to all write operations on the file system, making it an ideal choice for businesses that need reliable data protection and access.

Chapter 3: General Best Practices

In this section, we will cover essential and practical tips for keeping your system up-to-date, using supported and tested configurations, setting up basic security, enabling notifications, conducting regular system checks, and planning ahead for future storage needs.

By following these general best practices, you can avoid potential issues, ensure your system's reliability and availability, and optimize its performance for your needs.

Keep your system up-to-date

Keeping your Synology SA3400D system up-to-date is critical in order to optimize performance and security. We recommend you to regularly check to make sure that your system is running the latest software and firmware.

Important: Normally, updates will not affect the data on your Synology NAS. However, to ensure data security, we recommend you to back up your data before you start.

DSM system updates

Synology frequently releases system updates that include performance improvements and security fixes. Make sure to regularly [check for DSM system updates](#) or configure automatic updates to keep your system up-to-date.

You can also enable the [Fast Update](#) feature on SA3400D, which utilizes the switchover function during updates, allowing you to quickly and easily update to the latest version with minimal downtime.

DSM package updates

Along with DSM updates, it's important to keep your Synology packages up-to-date as well. Synology packages include applications and services that extend the functionality of your SA3400D, such as **Synology Drive** and **Virtual Machine Manager**. You can check for updates and configure automatic updates in the DSM [Package Center](#).

Use supported and tested configurations

To ensure optimal performance and stability, we strongly recommend you to use devices and components that are officially supported and tested with SA3400D. You will find a list of these devices on the [Synology Product Compatibility List](#).

The following devices and components are included on the compatibility list:

- HDDs and SSDs (SATA)
- UPS
- Network Interface Cards
- FC Host Bus Adapters
- RAM Modules
- Rail Kits
- Expansion Units

It is important to note that using devices or components that are [not on the compatibility list](#) may result in degraded system performance, data loss, or other unexpected issues. Therefore, always refer to the compatibility list prior to the purchase or installation of any devices or components.

Set up basic security

Synology devices are designed with security in mind, but there are still some basic security measures that you should implement to protect your data. By following these best practices, you can significantly increase the security of your SA3400D and protect your data from unauthorized access.

Refer to the [Security Measures Quick Start Guide](#) for more details and security recommendations.

Protect your sign-in information

- Choose a strong password and change it regularly.
- Use a custom administrator account and disable the default **admin** and **guest** accounts.
- Enable [advanced user settings](#) like password strength rules, password expiration, or [2-Factor Authentication](#) for an extra layer of security.

Account protection

- Enable [Auto-Block](#) and [Account Protection](#) to help improve the security of your NAS by blocking IP addresses or untrusted clients with too many failed login attempts.
- Restrict users' access privileges to only the shared folders and services they need.

Set up notifications

Another important part of managing your SA3400D is setting up notifications. By setting up notifications, you can proactively monitor your SA3400D to ensure that it operates at peak performance as well as detect and resolve any issues before they impact your system or data.

System notifications

Enable email or Push Service notifications

You can [configure email or Push Service notifications](#) to receive alerts when the system detects any changes. These notifications can help you stay informed of system events, such as when software updates become available, power failures occur, available shared folder quotas become low, storage volumes run out of space, or backup/restoration tasks fail to complete.

Sign up for Active Insight

[Synology Active Insight](#) is a cloud-based monitoring and analysis service that allows you to safeguard the health and performance of your NAS deployments across multiple sites through automated real-time monitoring, protection, and troubleshooting advice.

By signing up for Active Insight, you'll get access to a single portal, where you can get notified of critical system events, monitor your system health, and access a variety of data and reports to help you optimize your system performance.

Storage notifications

Set the low volume capacity alarm

You can [set up a low volume capacity alarm](#) to receive notifications when the available storage space falls below a certain threshold value.

Enable drive health reports

If enabled, DSM can [send you a drive health report](#) every month to help you keep track of the health of all of your drives and inform you of any potential problems.

Enable SSD estimated lifespan notifications

If you are using SSDs, we recommend you to enable the [SSD estimated lifespan notification](#) to receive alerts when the estimated life expectancy of an SSD reaches a specified value, allowing you to take action as soon as possible. This option is enabled by default, but is supported only on certain SSDs.

Conduct regular system checks

To further ensure optimal performance, maintain security, and stay on top of the health of your SA3400D device, it is important to conduct regular system checks in different areas.

Schedule security scans

To help protect your system from potential threats, we suggest [scheduling regular security scans in Security Advisor](#). **Security Advisor** will check your system for vulnerabilities, outdated packages, and other security-related issues.

Review system logs

Log Center allows you to view all system logs in one centralized location, including warning and error logs. We strongly recommend reviewing your logs on a regular basis, so that you can quickly identify potential issues before they become serious problems. You can also [enable notifications](#) in Log Center, so that you'll be automatically notified when specific events occur.

To get the most out of Log Center, we also suggest that you enable transfer logs for the file protocols you're using. This can help you keep track of file transfers and detect any issues related to them. Refer to the respective articles for details:

- [SMB](#)
- [AFP](#)
- [FTP](#)
- [File Station](#)
- [WebDAV](#)

Monitor system usage

Resource Monitor is another valuable tool for monitoring the usage of your system that provides real-time information about the CPU and memory usage, network usage, and disk usage. We recommend regularly checking your CPU and memory usage to make sure that they don't exceed certain threshold values.

Additionally, you can [create performance alarm rules](#) in Resource Monitor for different system resources to receive notifications when they exceed the set threshold values. By staying up-to-date on your CPU and memory usage, you can ensure that they don't exceed a certain amount and potentially cause performance issues.

Monitor high-availability clusters (SHA)

Regularly [monitor the status of your Synology High Availability \(SHA\) cluster](#) to ensure that it is functioning as expected.

When using SHA, we recommend **only** setting up [monitoring](#) for **enabled** services and network interfaces. This can help you avoid receiving false alarms and ensure that your monitoring is focused on the most important aspects of your system.

Plan ahead

Investing time and effort into storage planning can help you avoid potential problems and ensure that your organization's data is protected and easily accessible.

By having a clear understanding of your storage requirements, such as the physical environment, storage capacity needs, and infrastructure costs, you can accurately project growth, prevent potential capacity issues, and ultimately reduce overall expenses in the long run. A comprehensive storage strategy must also consider network and memory capacity to provide an optimal storage environment that meets your organization's needs.

Overall, keeping these factors in mind will help you create a comprehensive storage plan that meets your organization's storage needs while optimizing your resources and reducing expenses in the long run.

Storage capacity planning

When it comes to planning your storage capacity, it's important to consider not only your current needs but also your **future data growth**. This will help ensure that your storage solution can accommodate your organization's evolving needs. Understanding your data growth rate and storage requirements can help you determine the optimal storage capacity for your system.

Once you've figured out how much storage you need, you can use our [RAID calculator](#) to determine the optimal RAID configuration for your storage system. Refer to [How to calculate the largest storage configuration for your NAS](#) for more information. Make sure to take into consideration the storage requirements for any DSM packages that you plan to use.

Another important factor to keep in mind is whether you will need to expand your storage system in the future. You can do this by adding or replacing drives or with expansion units.

Regardless of the storage solution you choose, it's important to regularly monitor your usage and adjust your capacity as needed. By doing so, you can avoid running out of storage space or experiencing performance issues that could impact your organization's productivity.

Network capacity planning

Another important area to consider is your network capacity. You should make sure that you have enough bandwidth to support the number of users and devices that will be accessing the system. Refer to [Chapter 7: Network Configuration and Management](#) for related best practices.

Memory capacity planning

Your system's memory capacity is also a key factor to consider, especially if you plan to use features like SSD cache or implement virtualization. You should make sure that you have enough memory to support the features and applications that you plan to use. Check the memory requirements for any packages or applications you plan to install, and make sure that your system meets or exceeds those requirements.

Refer to the [Upgrade memory capacity](#) section of **Chapter 5: Performance Enhancement** for more information.

Environmental planning

Environmental planning is also an important factor to consider prior to installing and setting up your device. Overheating due to poor ventilation or inadequate cooling can lead to hardware failures and data loss, so it is important to ensure that the device is located in a well-ventilated area with adequate air conditioning or cooling. You should also regularly monitor the temperature of your device to ensure it stays within the recommended range.

Similarly, other factors, such as high humidity and dust, can contribute to poor hardware performance due to damage to the device itself. To prevent this, it's important to maintain a moderate humidity level (between 40-60%) and to keep the area around the device clean.

It is also important to consider the physical location of the device. The device should be placed in a secure location where it is protected from physical damage or theft, but should be easily accessible for maintenance and repair.

By considering these environmental factors and planning for the device's location and environment, you can ensure optimal performance and longevity of your Synology SA3400D.

Chapter 4: Storage Configuration and Management

Effective storage management is key to ensuring the reliability, availability, and performance of your Synology SA3400D. In this chapter, we will provide guidance on understanding your storage system, choosing the right drives, configuring RAID types, setting up hot spares, and optimizing for virtualization.

By following these best practices, you can maximize the value and longevity of your storage infrastructure, and minimize the risk of data loss or downtime due to hardware failure or user error.

Understanding your storage system

To effectively configure and manage your Synology SA3200D storage system, it's essential to understand its components and how they work together.

SA3400D consists of multiple drive bays that can house either a SAS hard disk drive (HDD) or a SAS solid-state drive (SSD). It's important to consider which type of drive is best for your needs, since each has its own advantages and disadvantages. These drives will be combined into a **storage pool** using **RAID** technology. You should choose the right RAID type for your needs, since different types provide varying levels of performance, storage capacity, and data protection.

After setting up your storage pool, you'll need to create at least one **volume** to store your data. Depending on how you'll be using your data and how much storage space you'll need, you can choose to create multiple volumes on your device. On a volume, you can create **shared folders** to organize your files and folders and create **LUNs** to connect to specific volumes over a storage area network (SAN) or via other high-priority network protocols like iSCSI or Fibre Channel.

Choose the right drives

Choosing the right drives is crucial for ensuring the performance, reliability, and longevity of your storage system.

HDDs vs. SSDs

When setting up a Synology NAS or SAN, it's important to choose the right type of drives. Synology provides a [list of compatible and tested drives](#) to help users make the right decision. However, the choice between hard disk drives (HDDs) and solid-state drives (SSDs) is one that users must consider.

HDDs are more cost-effective and can offer a large amount of raw storage capacity, making them suitable for data storage, cold data archiving, data backup, or surveillance. The cost effectiveness, high capacity, and reliability of HDDs also makes them ideal for mass deployment scenarios. However, HDDs can be limited in terms of random input and output operations per second (IOPS) due to their mechanical design.

On the other hand, SSDs store data in flash memory and offer faster random IOPS access, making them ideal for I/O-intensive environments such as server virtualization, high-performance computing, multimedia post-production, enterprise resource planning (ERP), customer relationship management (CRM), or online transaction processing (OLTP).

Ultimately, the choice between HDDs and SSDs should depend on your specific requirements. If cost-per-gigabyte is your primary concern, then HDDs may be the way to go. However, if you need high IOPS for an I/O-intensive workload, then SSDs are likely the better choice. Keep in mind that both types of drives have their strengths and weaknesses, and the right choice for you will depend on your specific needs.

Install enterprise-level drives

We suggest installing enterprise-level drives for high performance, reliability, and endurance, making them ideal for mission-critical applications. These drives typically have higher MTBF (Mean Time Between Failures) and lower error rates than consumer-grade drives, ensuring better data protection and durability.

Manage 4K native (4Kn) hard drives separately

If you plan to use 4K native (4Kn) hard drives in your storage system, we strongly recommend managing them separately from other drives. This is because 4Kn hard drives use a different logical block size than traditional 512-byte hard drives, which can cause issues if mixed in the same storage pool.

Use drives of the same type and form factors

Mixing different drive types is not allowed within a single storage pool, SSD cache, or SSD cache group. To ensure optimal performance and data protection, make sure to use drives that are of the same type and the same form factors.

Choose a RAID type

The number of drives and how they are configured in a storage system like Synology NAS/SAN can also influence the system's overall performance. You can take advantage of RAID technology and combine multiple physical drives into one or more logical groups to realize data redundancy, performance improvement, or both.

RAID types such as RAID 1, RAID 5, RAID 6, and RAID 10 provide varying levels of data protection and performance, but may have different trade-offs in terms of capacity, speed, and rebuild time. For example, RAID 5 or 6 may be appropriate for workloads that require a balance between capacity and performance, whereas RAID 10 may be more appropriate for workloads that require higher performance and data redundancy.

When creating a storage pool with 6 or more drives, we recommend using **RAID 6**. RAID 6 provides fault tolerance by allowing for up to two disks to fail without any data loss. This level of protection is also recommended for businesses that have critical data or applications that cannot be down for any significant amount of time.

[RAID group](#) is also supported on SA3400D. Having a RAID group can help you avoid RAID failure when drives are added to a single RAID array for storage expansion. With this feature, you can configure multiple RAID arrays in a storage pool to balance your device's storage capacity and data security. When using **RAID group** on SA3400D, we also recommend using **RAID 6**.

The recommended RAID type may vary depending on the specific use case and workload. See the **RAID Type** section of [Increasing the System Performance of Synology NAS/SAN](#) for more information about different RAID types supported on Synology servers.

Choose a file system

When setting up your Synology storage system, it's important to choose the right file system to ensure optimal performance and reliability. Synology SA3400D supports two main file systems: [Btrfs and ext4](#).

For the majority of cases, we recommend using **Btrfs**. [Btrfs provides advanced features](#) such as snapshot and data checksums, which can help protect against data corruption. It also offers better performance in some cases, especially when it comes to dealing with large files and directories.

Set up hot spare drives

One of the best practices for storage configuration and management is to set up **hot spare drives**. A [hot spare](#) is a standby drive. When a drive crashes and results in storage pool degradation, the hot spare drive can automatically take the place of the defective drive. This allows the storage pool to repair itself and return to a healthy status in a shorter amount of time.

We recommend setting up at least one hot spare drive for each storage pool. For high-availability configurations, a **dedicated hot spare** drive is preferred to ensure that the spare is always available when needed. However, if you have limited drive slots available, a **shared hot spare** drive can provide additional protection to multiple storage pools. Keep in mind that a shared hot spare drive may not be available to protect all storage pools simultaneously in case of multiple drive failures.

We also recommend you to enable **auto-replacement** for failed disks. Once [auto-replacement](#) is enabled, a hot spare drive will automatically replace a defective drive that is in **Critical** status. This eliminates the need to worry about storage pool degradation caused by a crashed drive, since a defective drive will be replaced while its corresponding storage pool continues to function normally.

Optimize storage for virtualization

Virtualization is a widely-used technology that allows multiple operating systems and applications to run on a single physical server. This allows you to maintain a secure environment where you can run sensitive applications or isolate certain services for testing and development purposes, which can help increase hardware utilization and reduce costs.

Your Synology device can be configured as file-based or block-level storage for VMware, Hyper-V, and other leading hypervisor virtual machines.

When doing this, it's important to configure your storage environment appropriately to ensure optimal performance.

Use SSDs or SSD cache for optimal performance

To optimize storage performance for virtualization, we recommend using Solid State Drives (SSDs) instead of traditional Hard Disk Drives (HDDs). SSDs provide faster access to data and can handle random I/O operations better than HDDs, which can result in faster data access and improved overall performance. For a more cost-effective option, we suggest implementing **SSD cache**. For more information on implementing all-SSD environments and SSD cache, refer to the related sections in [Chapter 5: Performance Enhancement](#).

Ensure hypervisor compatibility

Before implementing virtualization with your NAS, make sure that your hypervisor is compatible with SA3400D. Synology storage solutions are compatible and certified for use with leading hypervisors (VMware vSphere®, Microsoft Hyper-V®, Citrix®, OpenStack®), ensuring a smooth integration with virtualization platforms. Refer to [SA3400D's Datasheet](#) for detailed information.

Choose the right protocol

When virtualizing workloads, it's important to choose the right networking protocol depending on the needs of your virtual environment. Synology storage solutions support NFS, iSCSI, and Fibre Channel protocols to provide flexibility when connecting to virtualization hosts.

Refer to the following table for a comparison of these three protocols.

	NFS	iSCSI	Fibre Channel
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Features	• Easy to set up and use • Supports cross-platform access for sharing virtual machine files between different operating systems • May not perform well with high I/O workloads	• Data can be accessed at the block-level • Provides high performance for virtual workloads requiring low latency and high IOPS • Supports establishing multiple connections to the same target for high availability • Requires more configuration and setup than NFS • May require more CPU resources on the virtualization host than Fibre Channel • Management is more complex	• Data can be accessed at the block-level • Provides high performance and low-latency • Ideal for large, complex virtual environments requiring high data throughput • Supports establishing multiple connections to the same target for high availability • Requires dedicated hardware, such as Fibre Channel switches and HBAs • Can be expensive to implement • Management may require specialized skills
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Utilize Synology iSCSI storage

For virtual environments, you can also [set up iSCSI LUNs](#) (Logical Unit Numbers) to improve storage performance and provide greater flexibility when allocating storage to virtual machines. iSCSI LUNs allow single volumes to be partitioned and presented to different hosts as separate LUNs, which can simplify management and improve performance.

When setting up an iSCSI LUN on your Synology NAS, consider the following:

- Make sure to choose an appropriate block size for your workload and configure the **CHAP (Challenge-Handshake Authentication Protocol)** authentication to ensure data security.
- Use thin or thick provisioning depending on the specific requirements of your virtual environment:

- Use **thin provisioning** to allocate storage resources more efficiently. Thin provisioning allows storage resources to be allocated on an as-needed basis, rather than allocating all storage space up-front. This can help reduce wasted storage capacity and provide greater flexibility for storage resource management.
- Use **thick provisioning** for workloads that require guaranteed performance and capacity. Thick provisioning pre-allocates all storage space up front, which can improve performance for applications that require high levels of disk I/O. However, it can result in wasted storage capacity if not managed properly.

Utilize Synology Storage Console

To improve the management efficiency of your virtual machines, we recommend installing **Synology Storage Console** for [VMware](#) or [Windows](#), which allows you to manage your Synology storage systems right from your hypervisor. Additionally, application-consistent snapshots can be taken directly from DSM after installation. This helps to ensure data consistency while streamlining the management process.

Chapter 5: Performance Enhancement

Performance is a crucial aspect of any storage system. A high-performance storage system can help you save time, increase productivity, and improve user satisfaction. Additionally, it can ensure that your data is accessible and available when you need it.

By implementing these best practices for your SA3400D, you can maximize its performance to meet your specific needs and requirements.

Why performance is important

When your storage infrastructure is not optimized for performance, you may experience slow response times, decreased application performance, and reduced productivity. Making sure that your storage system's performance is optimized, on the other hand, has many advantages:

- **Improved application response times:** Applications will run faster and more efficiently, which translates to improved user experience and productivity. This also allows for smoother virtual machine migration and better overall virtualization performance.
- **Increased data transfer speeds:** Faster data transfer speeds mean that data can be accessed more quickly, leading to faster data processing and improved system responsiveness.
- **Increased data backup speeds:** Improved performance allows for faster and more efficient data backups, reducing the time required to complete backups and ensuring that critical data is backed up in a timely manner. This is especially important for businesses with large amounts of data that require frequent backups.
- **Better resource utilization:** System resources such as CPU and memory can be used more efficiently, leading to better overall system utilization.

Implement all-flash SSD storage

One of the most effective ways to enhance performance on SA3400D is to use only all-flash SSDs in your storage system, which can be referred to as an **all-flash array (AFA)**. By replacing traditional HDDs with all-flash SSDs, you can experience faster read and write speeds, reduced latency, and improved overall system responsiveness.

An AFA storage system can benefit a wide range of workloads, including databases, virtual machines, and applications that require high IOPS and low latency. With no moving parts, SSDs provide faster access times than traditional hard drives, resulting in significantly improved performance for both sequential and random access workloads.

Although implementing such a storage system can be a significant investment, it has more long-term benefits in terms of improved performance, reliability, and overall efficiency. If your

organization requires high-performance storage for critical workloads, an all-flash SSD storage system is definitely worth considering.

For more information on the types of drives to use for your device, refer to the [Choose the right drives](#) section of **Chapter 4: Storage Configuration and Management**.

Utilize SSD cache

If implementing an entirely SSD storage system is not within your budget, another option to consider is **SSD cache**. SSD cache is a feature that allows you to cache frequently accessed data, providing faster access times and reducing latency.

SSD cache is a more cost-effective option compared to implementing an all-SSD storage system, as you can deploy it on an all-HDD storage pool. Therefore, even if your environment is not entirely made up of SSDs, you can still get the most out of your device by decreasing the time it takes to retrieve data and thereby improving overall system performance.

If you decide to implement SSD cache on your storage system, make sure to consider the following best practices:

- **Configure a reasonable cache size:** To achieve optimal SSD cache performance, we recommend configuring a cache size that is only slightly larger than the size of frequently accessed data without exceeding it. Adding excess cache space won't improve performance and will only be used to store cold data. Refer to [How to determine the optimal SSD cache size for volumes](#) for more information.
- **Plan your memory size:** When configuring SSD cache, consider the RAM size and cache-to-memory ratio, as more SSD cache requires more system memory. Generally, every 1 GB of SSD cache requires around 400 KB of system memory, so make sure to upgrade your memory size accordingly.
- **Use SSD Cache Advisor:** We recommend using the [SSD Cache Advisor](#) feature in **Storage Manager** to calculate the total size and number of recently accessed files on a selected volume within a specific period, and then determine a proper cache size for that volume.

Applications on the system that can benefit from using SSD cache include virtual machine deployments, database processing, video editing, file indexing, and Synology packages like Snapshot Replication, Synology MailPlus, and Web Station. On the other hand, large sequential read or write operations, such as high-definition video streaming or surveillance services, may not see a significant increase in performance with SSD cache.

For more technical information and best practices for SSD cache, refer to the [Synology SSD Cache White Paper](#).

Upgrade memory capacity

To enhance overall system performance, consider upgrading the memory capacity of your Synology NAS to form a dual-channel or multi-channel memory configuration. This can increase data transmission speed and improve the system response time when running multitasking applications.

Upgrading the system memory capacity also has the following benefits:

- Improved system response time for multitasking applications such as Synology services, such as Synology Chat, Synology MailPlus, Synology Drive, Synology Office, and Active Backup for Business.
- More virtual machines using higher memory capacity can be run.
- With at least 32 GB of memory installed, SA3400D can support a maximum single volume size of 200 TB.

For more detailed information and tested scenarios, refer to the **Upgrading Memory Capacity** section of [Increasing the System Performance of Synology NAS/IP SAN](#).

Keep controller configurations balanced

Balancing the configurations between the two controllers is an essential best practice to get the best performance out of your SA3400D. Making sure that configurations are equally balanced between the two controllers can help achieve faster throughput and ensure that there is no bottleneck in the system.

We recommend that the following aspects be **identical on each controller** to ensure consistent system performance and successful failovers:

- **Drive capacity and number of drives**
- **Memory capacity**
- **Network configurations**

Other best practices to enhance performance

There are several other best practices you can implement to enhance the performance of your Synology SA3400D storage system, including the following:

- Regularly update your system software and applications to the latest versions. This ensures that you have access to the latest features and bug fixes, as well as improved performance optimizations. Refer to the [Keep your system up-to-date](#) section of **Chapter 3: General Best Practices** for related best practices.
- Use RAID configurations that offer the best balance of storage capacity and data protection. See the [Choose a RAID type](#) section in **Chapter 4: Storage Configuration and Management** for related best practices.

- Keep your system organized by removing unnecessary files, duplicates, and outdated data. This can be done manually, or with the help of Storage Manager's built-in features like **Storage Analyzer** and **Data Scrubbing**.
- Use compatible and high-quality drives to ensure the best performance and reliability. Refer to the [Choose the right drives](#) section of **Chapter 4: Storage Configuration and Management** for related best practices.
- Optimize network settings and configurations to reduce latency and improve data transfer rates. This includes using quality network switches and cables, as well as enabling features like jumbo frames and link aggregation. Refer to [Chapter 7: Network Configuration and Management](#) for related best practices.

Chapter 6: Data Protection

Data protection is one of the most important aspects of any storage solution, and the Synology SA3400D offers a variety of features to help you keep your data safe and secure.

Whether you're looking to implement a backup strategy, protect your volumes with encryption, or ensure that your data can't be tampered with using WriteOnce, SA3400D has you covered.

Backup strategies and disaster recovery

Data backup is an essential part of data protection. Synology offers several solutions to help you implement a solid backup strategy and ensure disaster recovery.

Plan for backup and recovery

Before implementing backups, it's essential to first develop a comprehensive backup strategy and disaster recovery plan to protect your data and ensure business continuity. To do this, we recommend you to take the following into consideration:

1. **Come up with a backup strategy:** Start by assessing your business needs and identifying what data needs to be backed up, how often, and where it should be stored. Follow the [3-2-1 backup rule](#) and implement multiple backup locations, such as cloud storage or offsite backups, to ensure redundancy and protect against hardware failure, cyberattacks, or natural disasters. Choose a backup solution that best suits your needs. We particularly recommend using **Snapshot Replication**, **Hyper Backup**, and **Active Backup for Business** due to their flexibility, efficiency, and ability to reduce downtime and ensure data consistency.
2. **Plan your disaster recovery:** In addition to backups, you need a disaster recovery plan to ensure your business can recover from catastrophic events. Develop a plan that outlines key recovery procedures, identifies critical systems and data, and assigns responsibilities to key personnel. Consider using built-in tools like **Synology High Availability (SHA)** and **Snapshot Replication** to ensure near-instantaneous failover and data recovery.
3. **Conduct regular tests:** Finally, it's essential to regularly test your backup and disaster recovery plans to ensure they are effective and up-to-date. Schedule regular tests and simulations to identify and address any issues or gaps in your strategy. Regular testing can also help you evaluate the performance of your backup solution and identify areas for improvement.

Snapshot Replication

[Snapshot Replication](#) is a powerful feature on Synology SA3400D that allows you to create point-in-time copies of your data, helping you protect your data from accidental deletion, file corruption,

or malicious attacks. Snapshots can be stored on the same storage system or a remote one, providing flexibility in terms of backup location.

For high-traffic files or iSCSI LUNs, snapshots and replication tasks can be defined as frequently as every five minutes. One-to-many and multi-step replication paths allow system administrators to build out multi-device and multi-site disaster recovery plans, ensuring data availability and business continuity.

For virtualized environments, Snapshot Replication can be integrated with VMware vSphere and Microsoft Hyper-V to ensure data consistency and reduce downtime for virtual machines. Additionally, using the **Synology Snapshot Manager** plugin (available in the [Download Center](#) for VMware and Windows) helps ensure that your data is in a consistent state before being backed up.

Hyper Backup

[Hyper Backup](#) is another backup solution available on the Synology SA3400D. With extensive backup destinations, Hyper Backup allows you to conveniently back up your NAS data, applications, system configurations, as well as the entire system to local shared folders, external devices, other Synology NAS, rsync servers, or public cloud services like Google Drive, S3-compatible storage, and C2 Storage for Businesses.

You can schedule backup tasks and choose from various backup modes, including incremental backup, full backup, and multi-versioning. Hyper Backup also supports data compression and deduplication to greatly reduce the amount of storage required for your backups. However, keep in mind that restoration with Hyper Backup may require twice the amount of storage capacity because of its copy-on-write mechanism used to prevent data loss during the restoration process.

Active Backup for Business

[Active Backup for Business](#) is a comprehensive backup solution that lets you create bare-metal copies of your Synology system to shorten recovery time objectives (RTOs) in the event of total site failure, or to quickly clone them. Data deduplication, compression, intelligent scheduling, and advanced permission settings are just a few of the features that Active Backup for Business offers to help you backup your data and use your storage more efficiently.

Other backup options

SA3400D also offers other backup solutions that you can consider for your device backup strategy.

One option you can consider is [USB Copy](#). USB Copy allows you to back up files from your Synology NAS to a USB drive, or vice versa. This feature is useful if you need to transfer large

amounts of files between devices quickly, as it can be automatically triggered whenever an external drive is plugged in to your NAS.

Another option for file-only protection is [Cloud Sync](#), which lets you synchronize your data between your Synology NAS and various cloud services, including Dropbox, Google Drive, OneDrive, and more. With Cloud Sync, you can easily access your data from anywhere, and ensure that it's always up-to-date with one-way or two-way synchronization.

Encrypt your volumes

[Encrypting your volumes](#) is an important step in securing your data and protecting it from unauthorized access in case your drives are lost or stolen. SA3400D supports volume encryption for **data-at-rest**, which ensures that all data stored on the encrypted volume, including LUNs and package data, are protected by an encryption key during storage.

SA3400D allows for the secure storage of encryption keys in an **Encryption Key Vault** either locally on the device, or remotely on a **Key Management Interoperability Protocol (KMIP) server**. Storing keys locally provides a secure storage option within the SA3400D itself, while the KMIP server offers the added advantage of storing the encryption keys in a separate, remote environment. This configuration separates the encryption key from the storage system, mitigating the risk of unauthorized access to the key in the event of a physical breach. The KMIP server option is especially recommended for organizations handling highly sensitive data that require stringent security measures.

Whether you choose the local or remote Encryption Key Vault, encrypting your volumes on your SA3400D allows you to optimize the security and overall protection of your data.

Utilize the WriteOnce feature

WriteOnce is a feature available on select Synology NAS devices, including SA3400D. This feature is based on the **Write Once, Read Many (WORM)** technology, which helps protect your data from accidental or intentional deletion.

Enable WriteOnce when [creating shared folders](#) to prevent files within them from being modified, deleted, or renamed for specified period. You can also [create immutable snapshots](#) to restrict any changes or deletions of your data within a certain period of time.

Utilizing both of these features helps to ensure data integrity and authenticity while also protecting against tampering or accidental deletions. Therefore, we recommend using them for shared folders containing critical data that need to be preserved for long periods, such as financial records, medical records, or legal documents.

Chapter 7: Network Configuration and Management

A crucial aspect of managing a storage system is ensuring that it is properly configured and optimized for its network environment. This involves appropriately configuring network protocols and security and implementing certain functions or tools to optimize network performance.

In this chapter, we will explore best practices for configuring and managing network settings on the Synology SA3400D. By following these guidelines, you can ensure that your storage system is fully optimized for your network environment and is operating at peak performance and security levels.

Configure network protocols and security

Configuring network protocols and security properly is critical to ensuring your network is secure and operates efficiently. To achieve this, we recommend considering the following network configurations.

Choose the appropriate network protocol

SA3400D supports various network protocols, including SMB, NFS, iSCSI, Fibre Channel, TCP/IP, FTP, SNMP, LDAP, and CalDAV. Choose the protocol that best suits your needs and ensure that it is properly configured for optimal performance. Also, make sure to disable any unnecessary protocols to reduce the attack surface of your network and improve overall network performance.

Use the latest network protocols and security standards

Keeping up-to-date with the latest network protocols and security standards is crucial to maintain the integrity and safety of your network. Make sure to check for updates regularly and implement the latest recommended protocols and standards for optimal performance and security.

Use firewalls and access control lists

[Firewalls](#) and [access control lists \(ACLs\)](#) are vital tools for securing your network. By controlling network access, you can limit potential security risks and protect sensitive data. Ensure that your firewalls and ACLs are properly configured and up-to-date.

Implement network monitoring tools

Monitoring your network traffic and behavior can help you detect potential issues and security threats. Implementing network monitoring tools can provide you with real-time insights into network performance and security, allowing you to take action quickly if needed.

Optimize network performance

Optimizing network performance is a key part of making sure that your device's service can run as smoothly as possible. To achieve this, we recommend considering the following network configurations.

Configure Link Aggregation

[Link Aggregation](#) allows you to combine multiple network interfaces into a single virtual interface, effectively increasing the available bandwidth. With Link Aggregation, you can also configure the system to continue functioning even if one or more of the network interfaces fail to increase data redundancy.

Synology supports various Link Aggregation modes, including **Adaptive Load Balancing (ALB)**, **Balance XOR**, **IEEE 802.3ad**, and **Balance-TCP**, and more. The mode you should use depends on your specific network environment and usage.

For enhancing performance specifically for SMB for a single client, consider enabling SMB3 Multichannel instead. Refer to [What is SMB3 Multichannel](#) for recommended deployment configurations and other information.

Implement load balancing

Load balancing distributes network traffic evenly across multiple network interfaces to avoid overloading any single interface. This helps optimize network performance and prevent bottlenecks. Additionally, setting up load balancing can also provide redundancy in case one of the network interfaces fails, ensuring that your network traffic can continue to flow without interruption.

Use dedicated network interfaces

To ensure that high-priority services operate efficiently without any interference, we recommend utilizing dedicated network interfaces. This can be achieved by configuring [VLANs](#) or separate physical network adapters.

Utilize jumbo frames

[Jumbo frames](#) can increase network performance by reducing the number of packets required to transmit data. This can be especially beneficial for large data transfers and virtualized

environments. However, all the computers and devices across the network accessing your Synology NAS must support it and use the same MTU value to ensure Jumbo Frame works properly.

Enable Traffic Control

[Traffic Control](#) can prevent packet loss and improve network performance by allowing devices to slow down transmission when network congestion occurs. We recommend enabling Traffic Control on all network interfaces to ensure smooth data transmission.