QNAP

QuTS hero 5.1.0

Boosted performance, flexible management, and higher security.

QuTS hero:
The best Unified Hybrid Storage

Data Self-healing

Most Affordable Hybrid Storage

ZFS on Linux

Cloud Ready

Flash Endurance

Unified

Virtualization Ready

Google Azure aws 阿里云

Microsoft vmware

65,536 Snapshots

QuTS hero Highlights

Data Integrity

- QuTS hero no longer needs file system checks (FSCK), with ZFS Mirror layer, COW (copy on Write) could keep the data integrity.

Data Protection

- The native ZFS snapshot feature allows max 65,536 snapshots (supports folder/LUN)
- SnapSync
- More RAID types available
- WORM (write once read many)
- SMB signing and Encryption AES-NI Acceleration
- SMB Signing with GMAC
- Authenticator and Passwordless

Data Efficiency

- Offers inline compression, inline compaction & inline deduplication for better storage utilization
- ZIL & L2ARC
- Write Coalescing
- Pool over provisioning
- SMB Multichannel
- iSCSI Read Zero Copy
- Enhanced performance on encrypted LUN/folder

Stability & Scalability

- Easily expanded to PB-level storage space.
- Provide ECC RAM supported model to reach the enterprise level stability
- Expand/Upgrade RAID
- Provide the service of SSD/HDD life prediction
- Predictive Migration

Management & Application

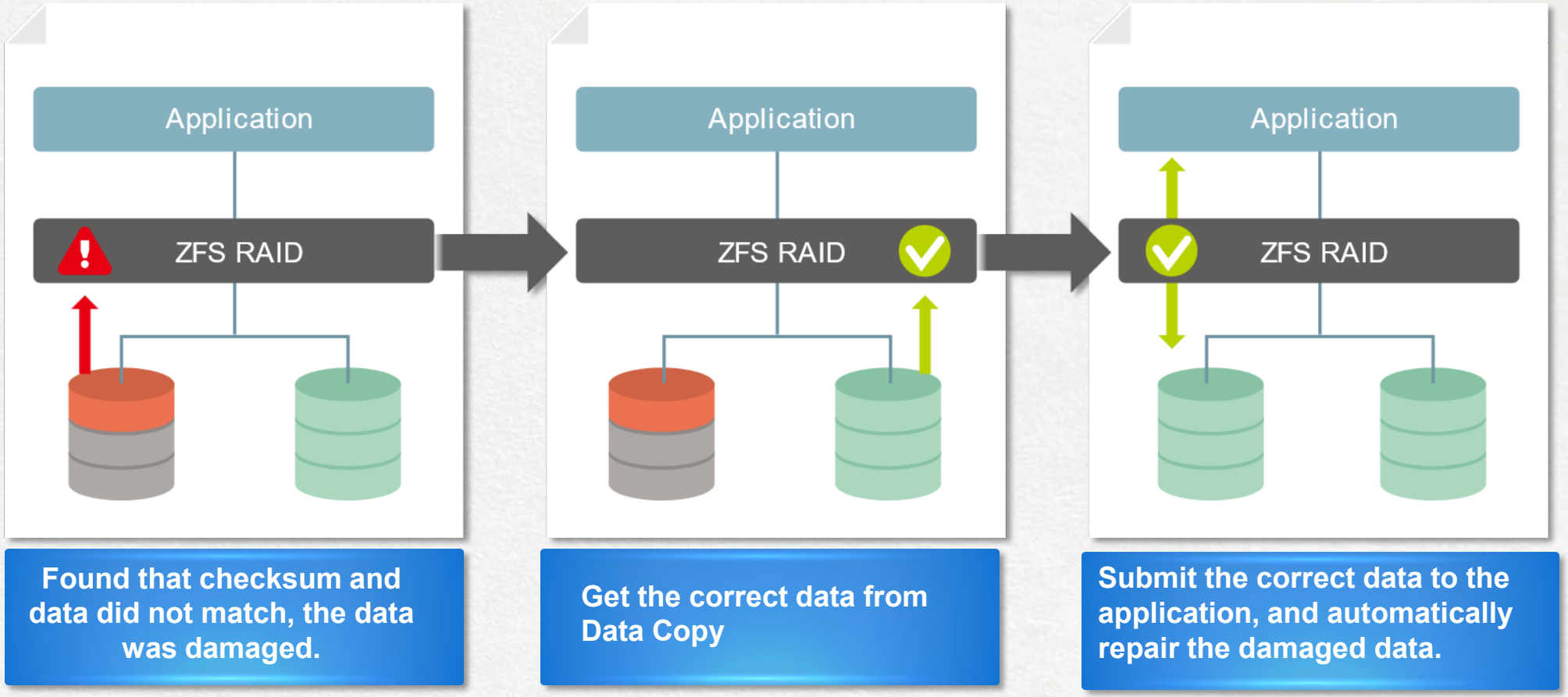
- Detailed ACL
- Protocols & Connection
- Delegated Administration
- AMIZ cloud
- NFS Fixed Ports

Chapter

01

DATA INTEGRITY

Data Integrity and Self Healing



Found that checksum and data did not match, the data was damaged.

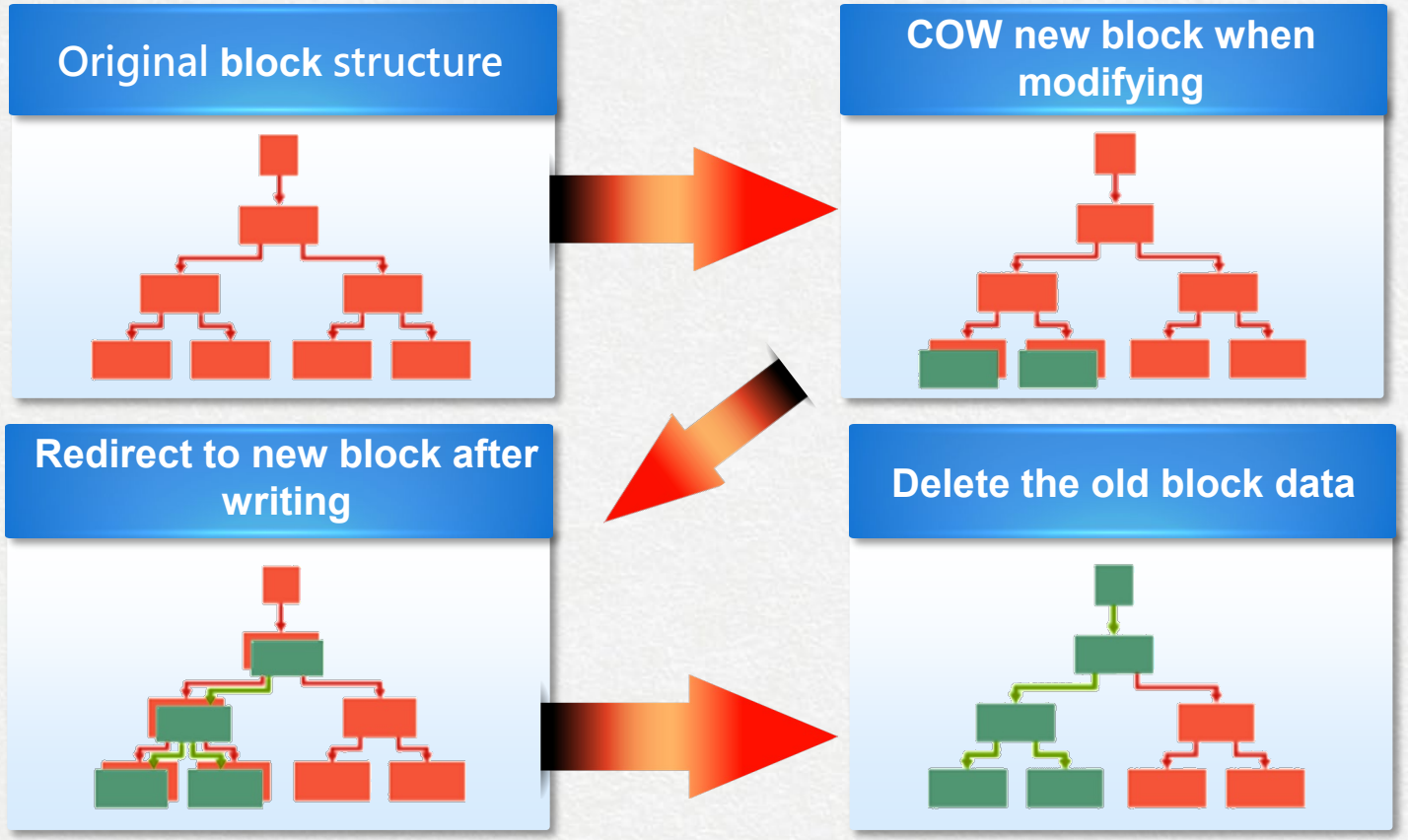
Get the correct data from Data Copy

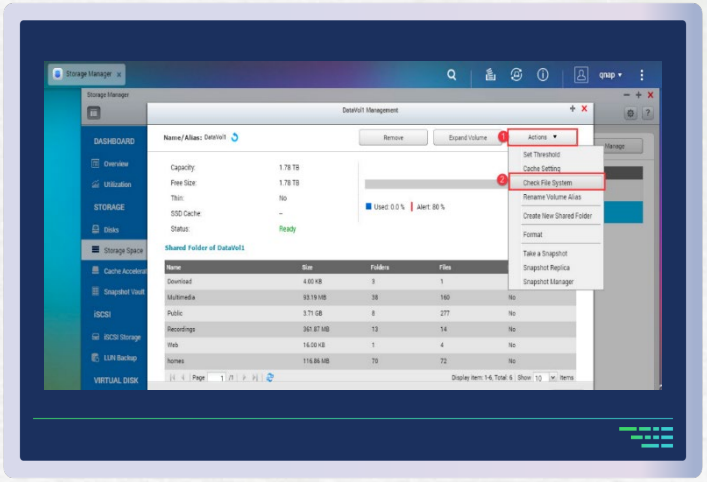
Submit the correct data to the application, and automatically repair the damaged data.

Avoid data silent corruption that occurred on running system

COW (copy on write) avoid data loss that occurred on power outage

- ZFS has no need to use traditional journal to protect metadata, because they are never updated in-place.
- COW mechanism will copy the written data to the new block and redirect the index to the new block after writing.





No more “check file system”

Chapter

02

DATA PROTECTION

Snapshot Protection (65,536)

Shared Folder Snapshot

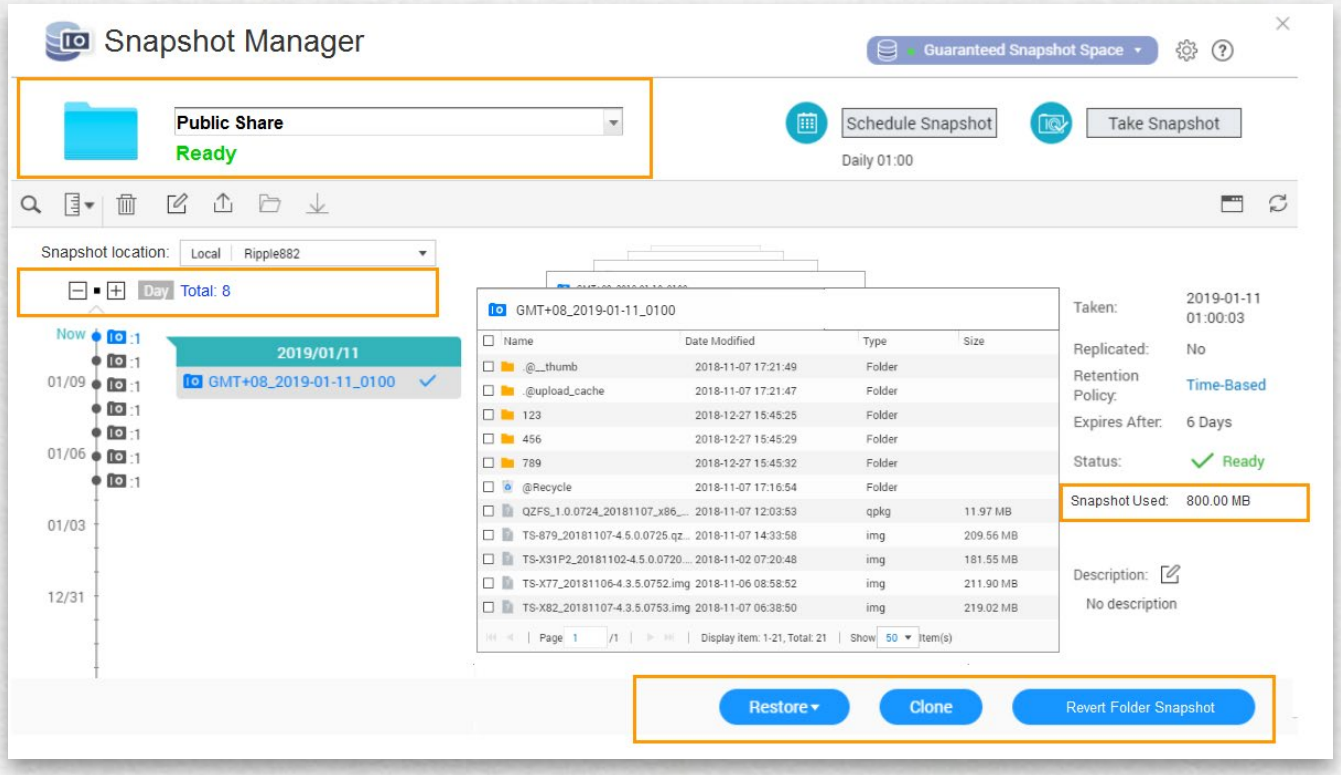
LUN Snapshot

NAS Maximum Snapshot **65,536**

Shared Folder Snapshot

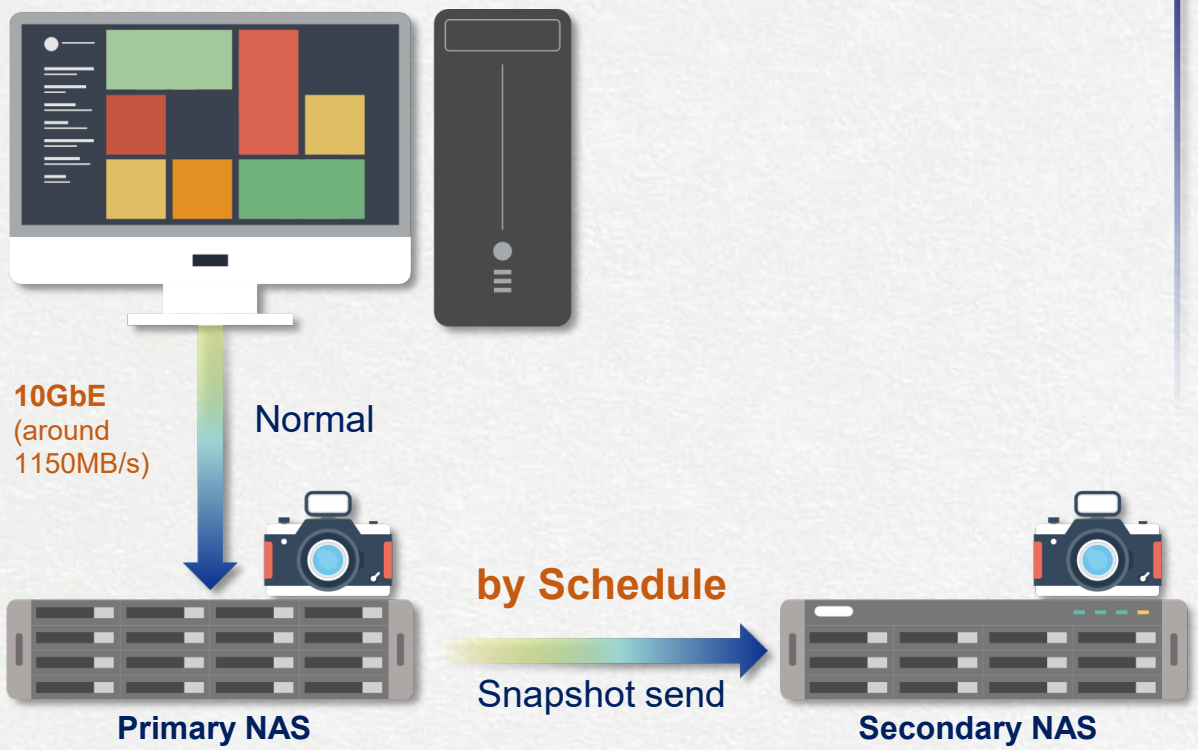
iSCSI LUN Snapshot

Snapshot Manager is operated based on shared folder. With [Clone], [Restore] & [Folder Revert] support.

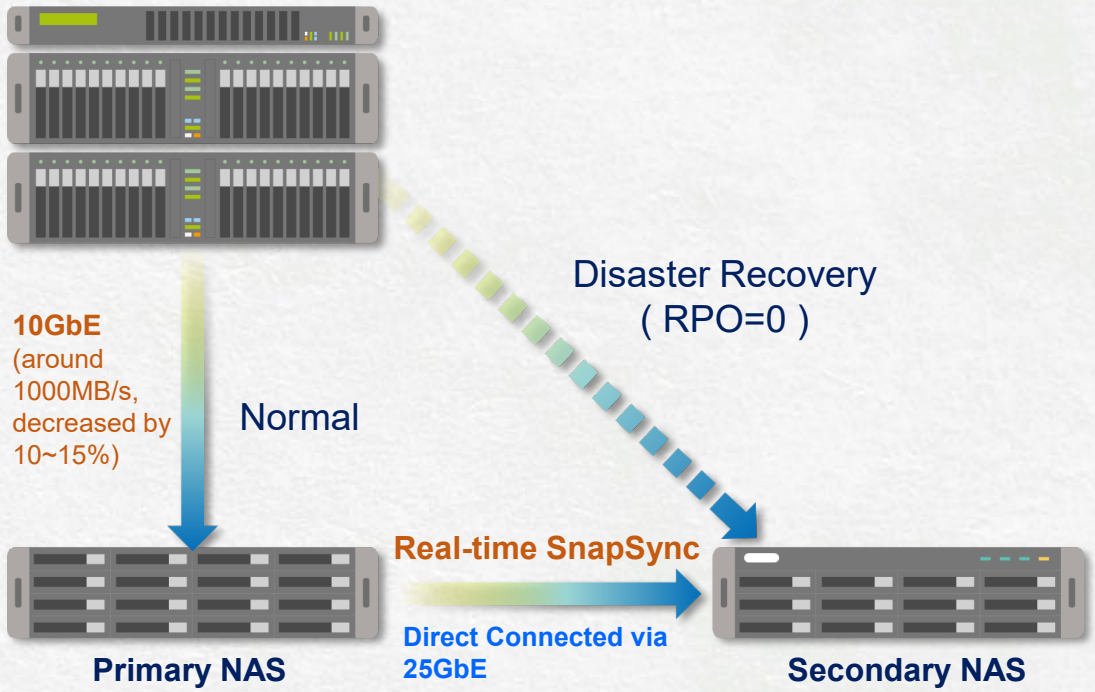


SnapSync – cost-effective replication solution for backup, data protection & disaster recovery

Scheduled SnapSync: 5min~60min



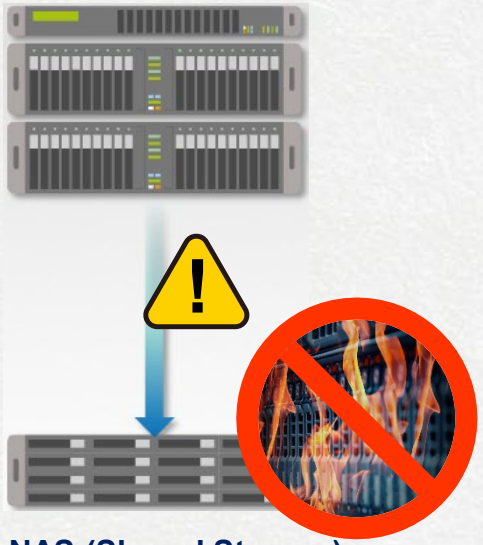
Realtime SnapSync: RPO=0



How to do when disasters happen

If unfortunately a disaster happens

Production Server

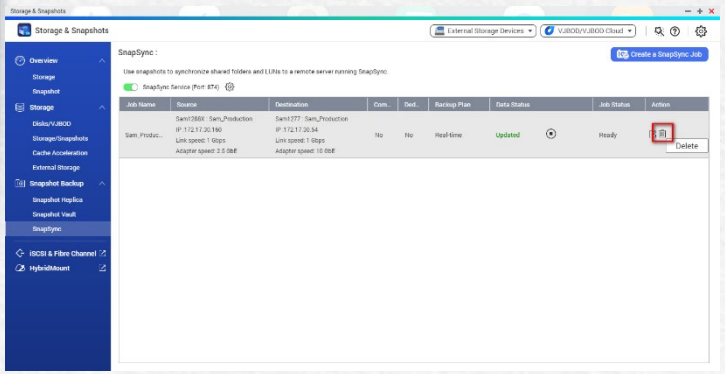


NAS (Shared Storage)

(1) Delete SnapSync task

Primary NAS
192.168.100.100

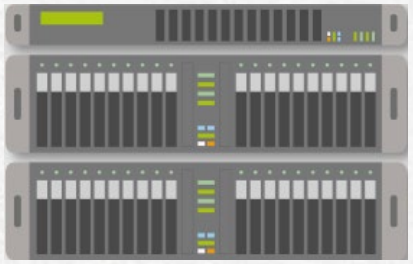
Secondary NAS
192.168.100.200



- The exclusive permissions of the folder will be removed when deleting the SnapSync task.

(2-A) Remount to secondary NAS IP

Production Server



Mount Target = 192.168.100.200

Or

(2-B) Change the secondary NAS IP as same as original primary NAS.

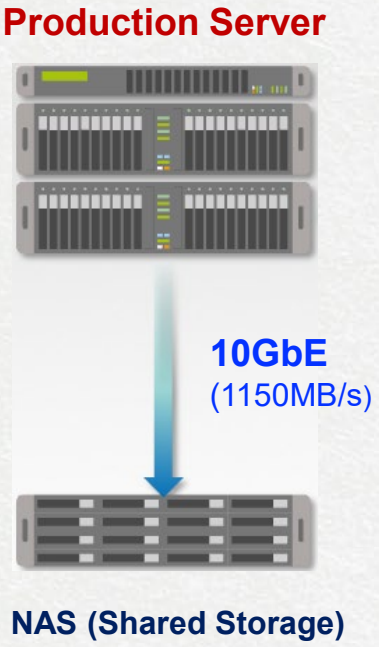
Secondary NAS
192.168.100.200 => 192.168.100.100

COMING SOON

Note: Disaster Recovery automation via VMware SRM will be supported in the future.

Best Practices for the configuration of Realtime SnapSync

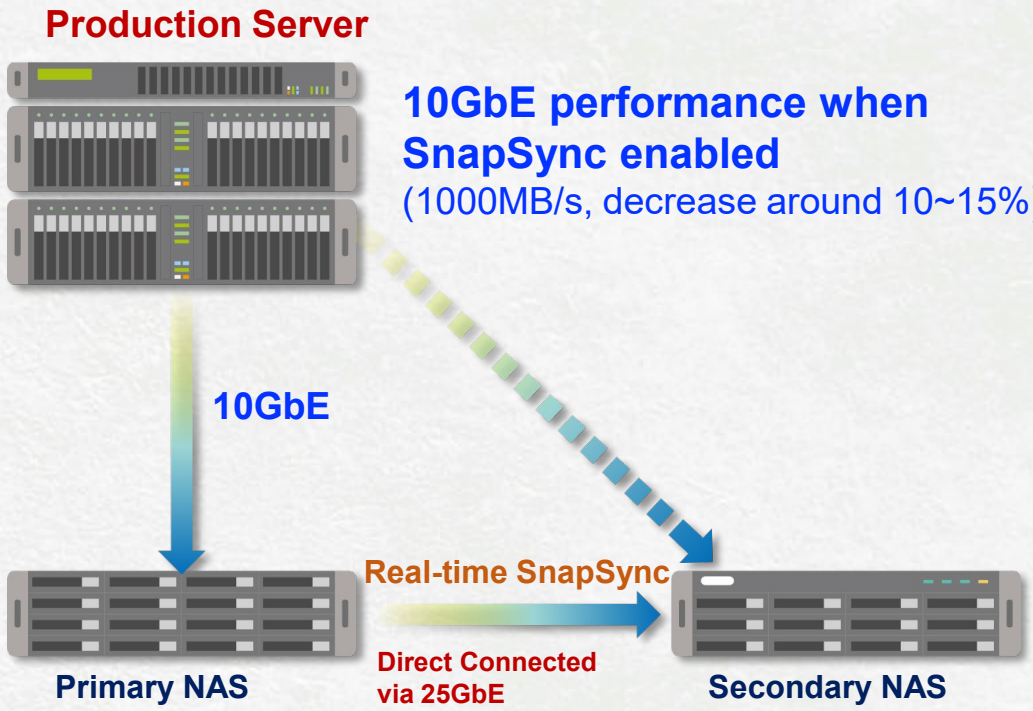
Before SnapSync Protection



Best Practices for Configuration

1. The I/O performance of the secondary NAS should be the same as the primary NAS.
2. Recommended to connect the two networks directly to avoid interference and reduce latency. (If it is a long-distance transmission, the latency should be less than 5ms, and the maximum cannot exceed 10ms, otherwise you can also consider using schedule SnapSync)
3. QNAP 25GbE is recommended (slightly higher than the transfer rate of production server)

After Realtime SnapSync enabled

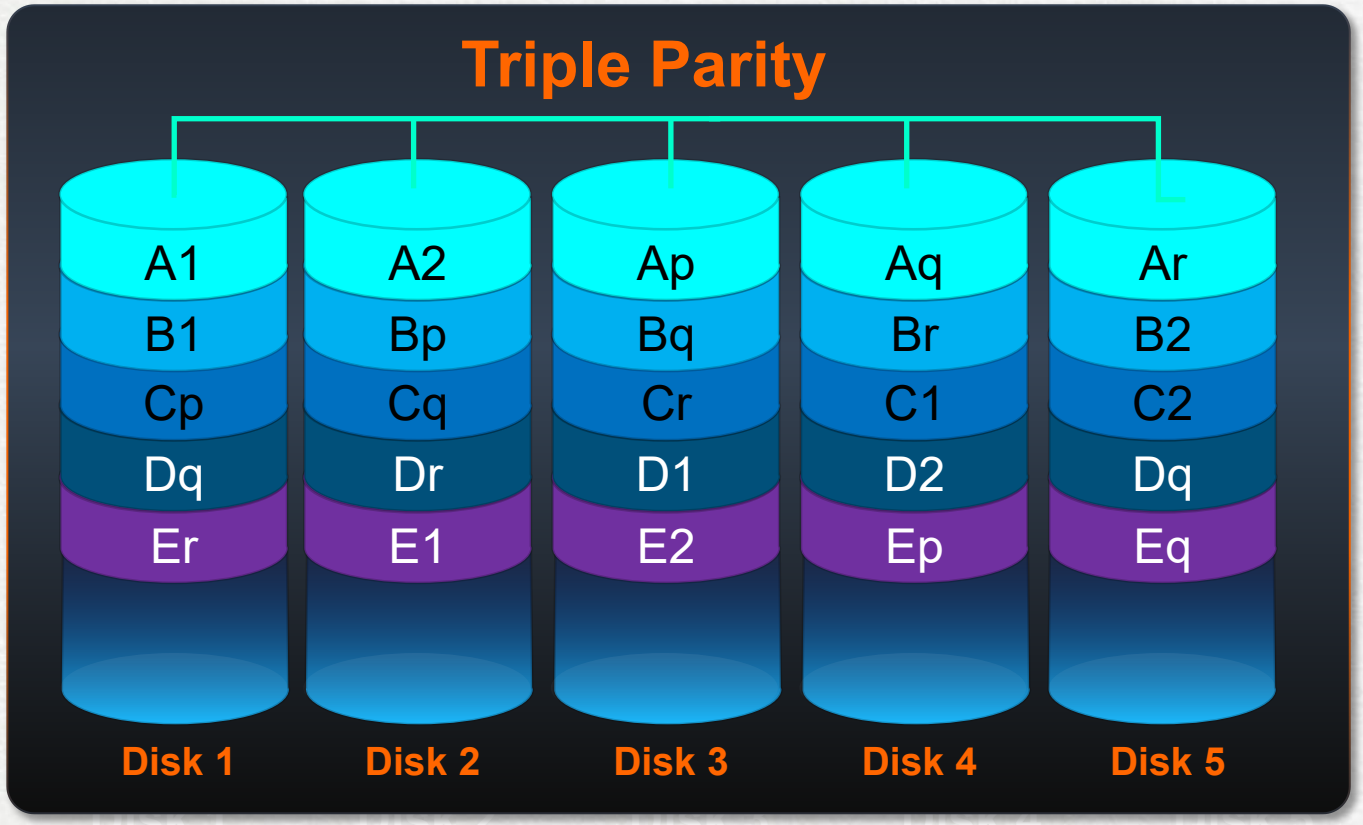


QNAP Lab Test Environment:
IO mode: sync = standard, Block size = 128K, Jumbo Frame (MTU) = 9000

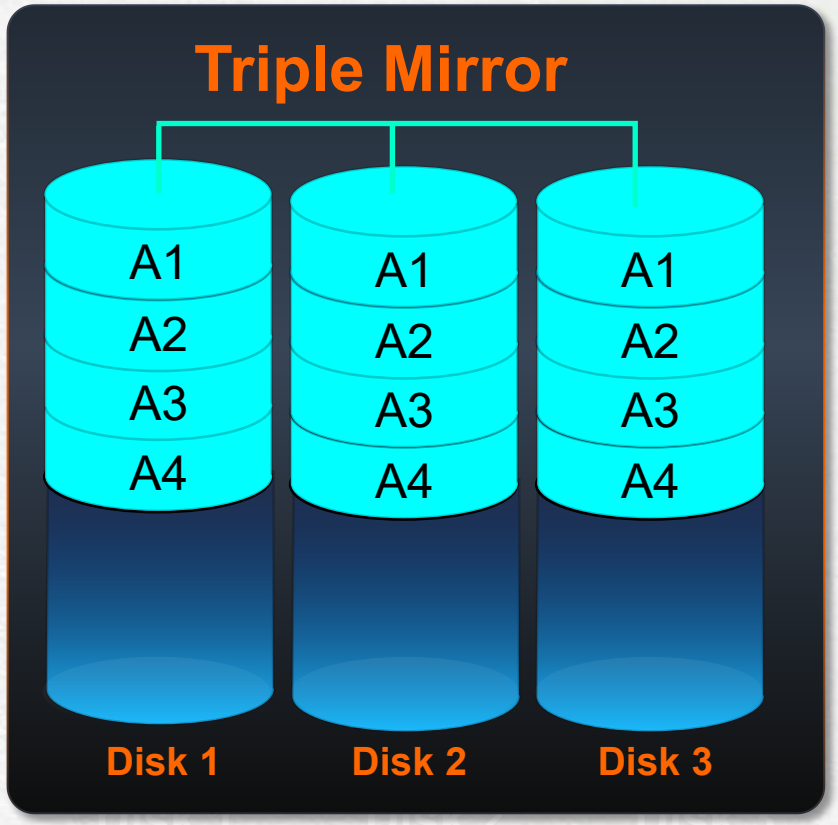
Also supports QES NAS SnapSync to QuTS hero NAS

Safer RAID types: Triple Parity & Triple Mirror

Even if three hard disks are damaged at the same time, this RAID service can keep going (redundant tolerance of 3 sets of parity information)



3 sets of identical data for redundant tolerances, will give you 3 times the protection.



Three-layer backup solution:

Provide you the most complete data backup protection

RPO: daily / schedule

RPO: hourly

RPO: Realtime

HBS 3:
File level, multi-version management

Snapshot & Replica:
Block level, multi-version management, ZFS provides the most lightweight snapshot without affecting storage performance at all.

SnapSync:
Block level, Mirror the data copy and always kept up to date.

New Backup Golden Rule

Backup 3-2-1-1-0

At least **3** copies of your data.

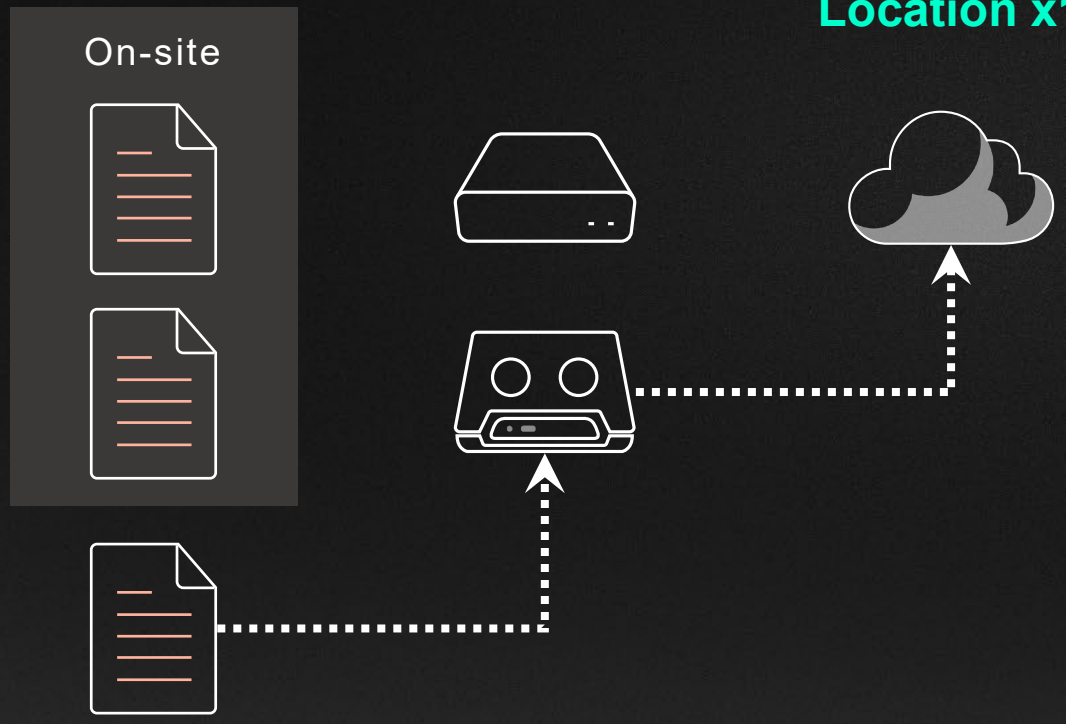
Store the backups on **2** different media.

At least **1** of the copies at an offsite location.

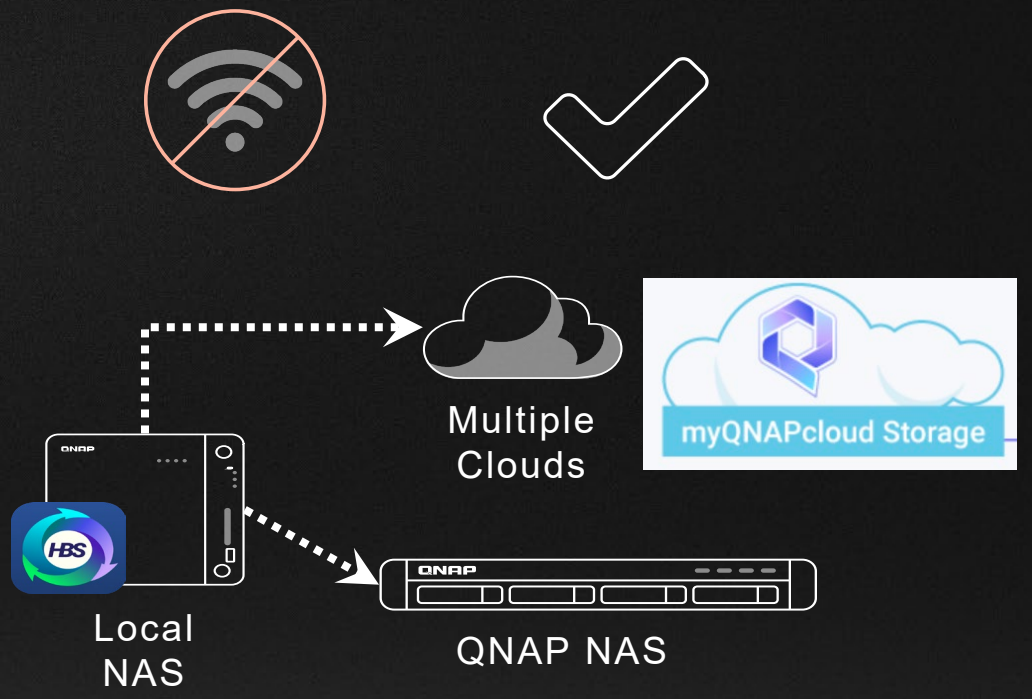
At least **1** of the copies offline(immutable backup).

Verified backups **without** errors.

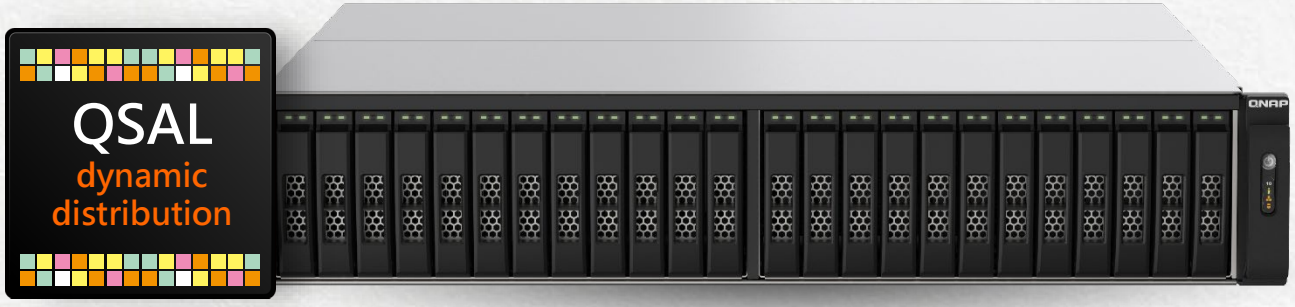
Copies x3 **Media x2** **Off-site Location x1**



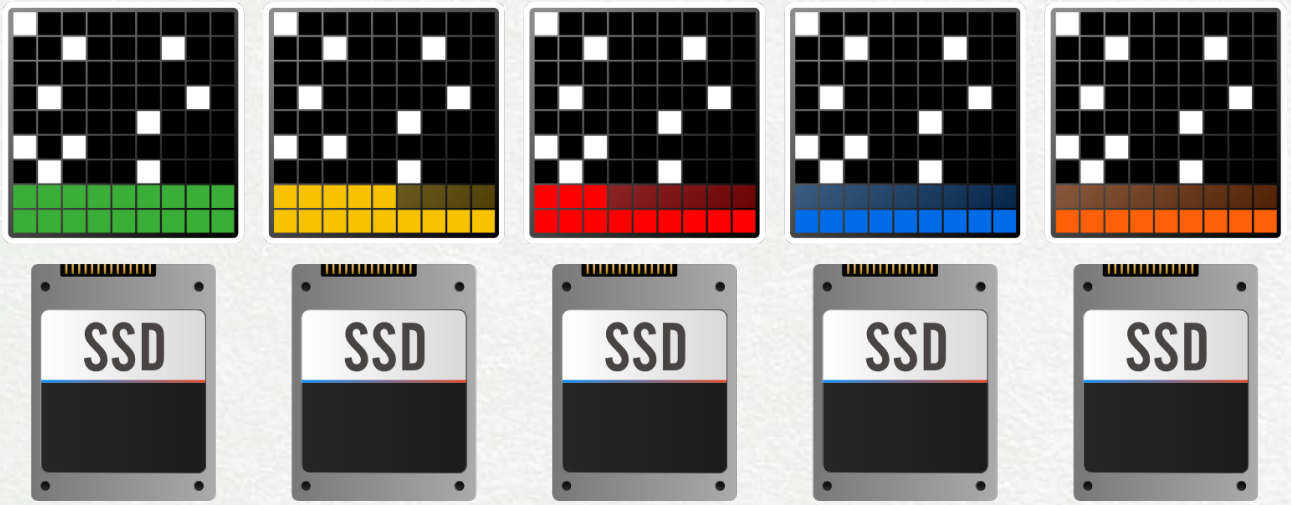
Offline x1 **Error = O**

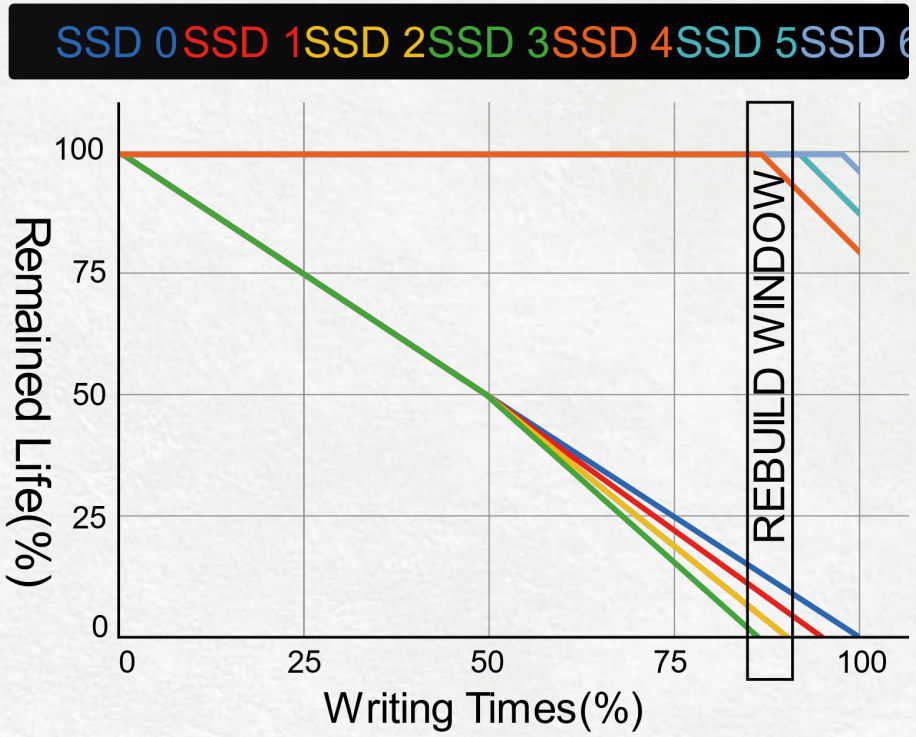


QNAP Patented QSAL technology: preventing multiple SSD malfunctioning at the same time



QSAL (QNAP SSD Anti-wear Leveling) When SSD life falls below 50%, the SSD OP would be dynamically adjusted to achieve the life control of each SSD, and to ensure that there is enough rebuild time at the end of the previous SSD life to avoid RAID damage.





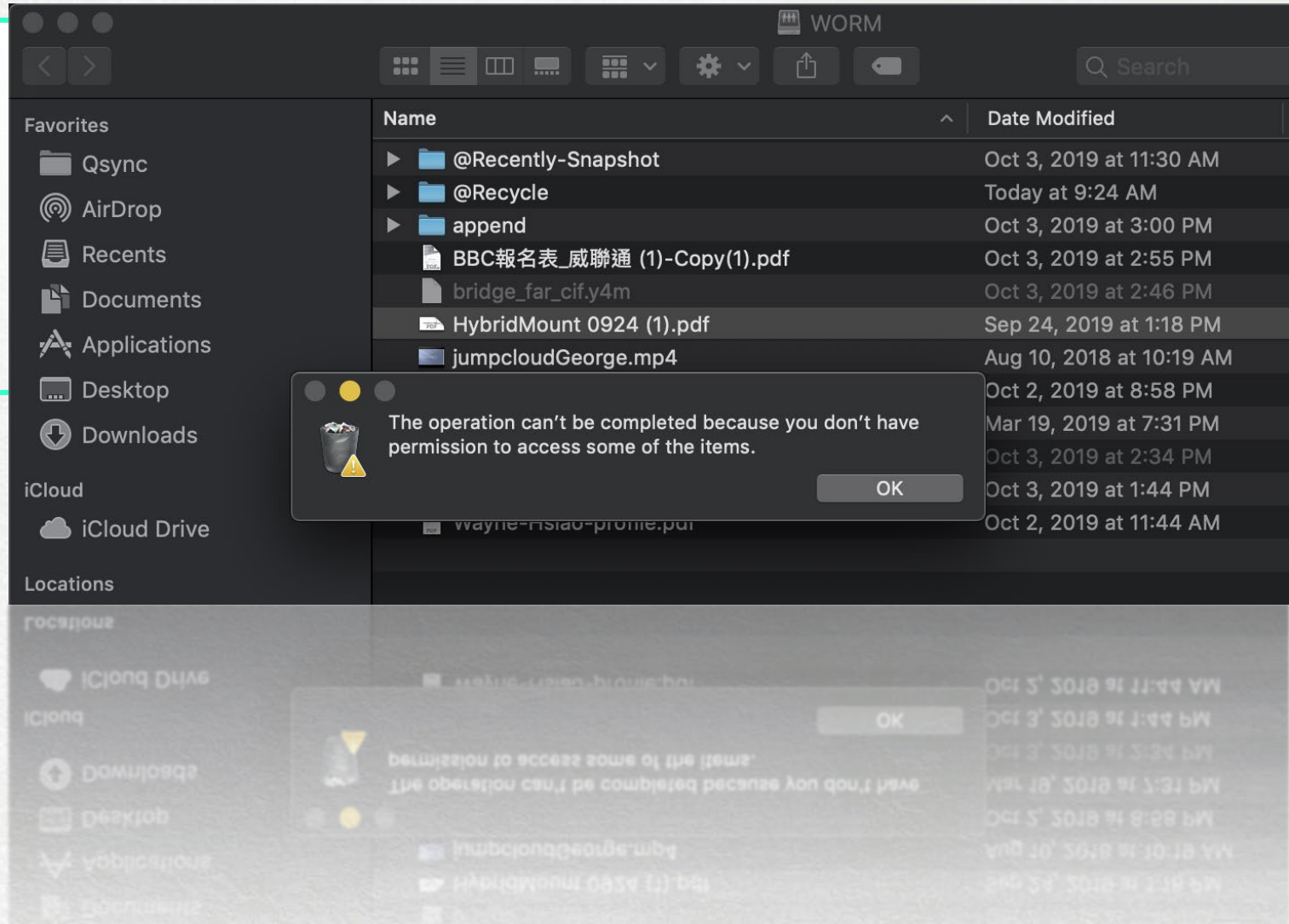
For SSD RAID 5 / 6 / 50 / 60 / TP (Triple Parity), QSAL will be enabled by default automatically.

WORM (Write Once Read Many times)

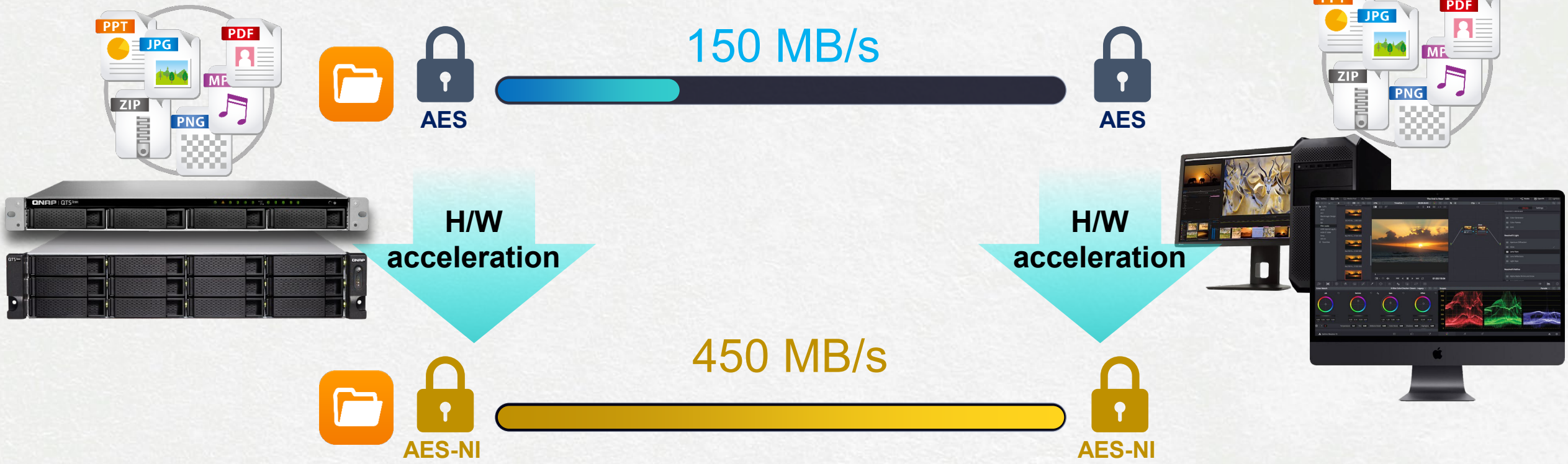
WORM is used to avoid modification of saved data. Once this feature is enabled, data in shared folders can only be read and cannot be deleted or modified to ensure data integrity.

Enterprise Mode: remove the shared folder through QuTS hero UI or SSH commands (QCLI).

Compliance Mode: Have to take the Storage Pool offline and remove the Pool if want to destroy data.



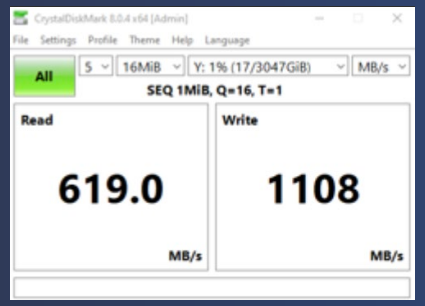
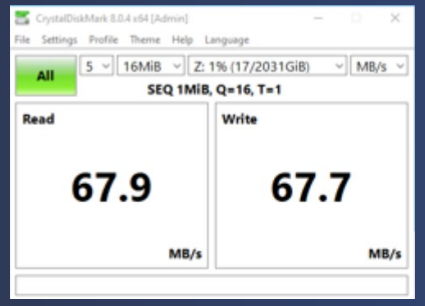
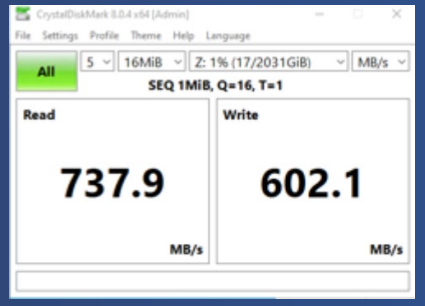
AES-NI accelerated for SMB3 Signing and Encryption



AES-NI accelerated for SMB3 Signing and Encryption

SMB Signing with GMAC: Secure and Fast!

In 10 GBs network, AES-NI enabled CPU, **new GMAC algorithm** outperforms the former CMAC one significantly.

	CMAC	GMAC	
x86			X2 Faster
ARM 64			X10 Faster

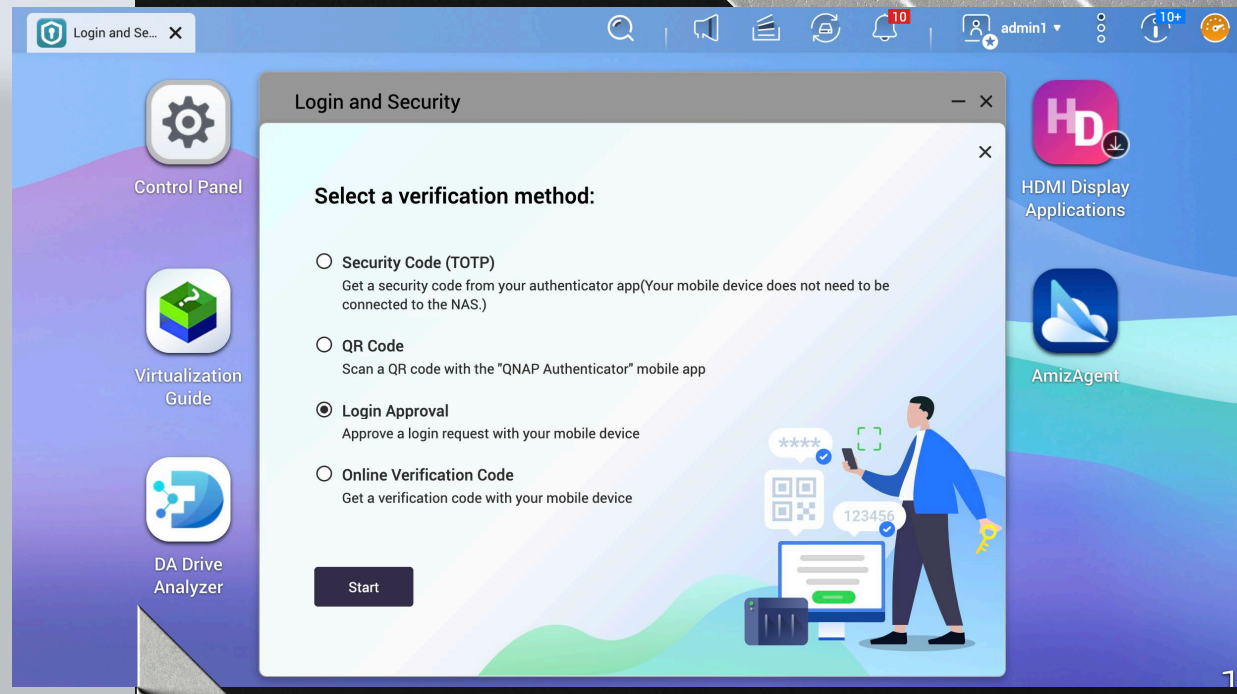
TS-h1887XU

TS-1232PXU

QNAP Authenticator

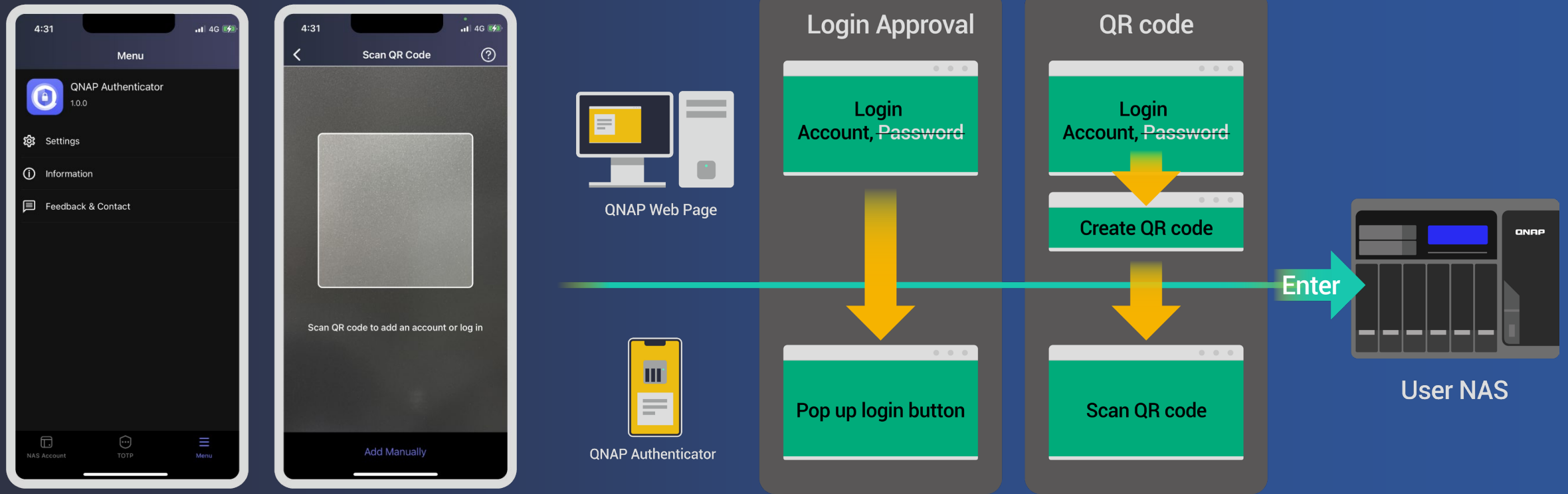
New 2 Step Verification

1. **Password**
2. **Options with**
   - Security Code (TOTP, Time-based One-Time Password; Mobile device does not need to connect to NAS)
   - QR Code
   - Login Approval
   - Online Verification Code

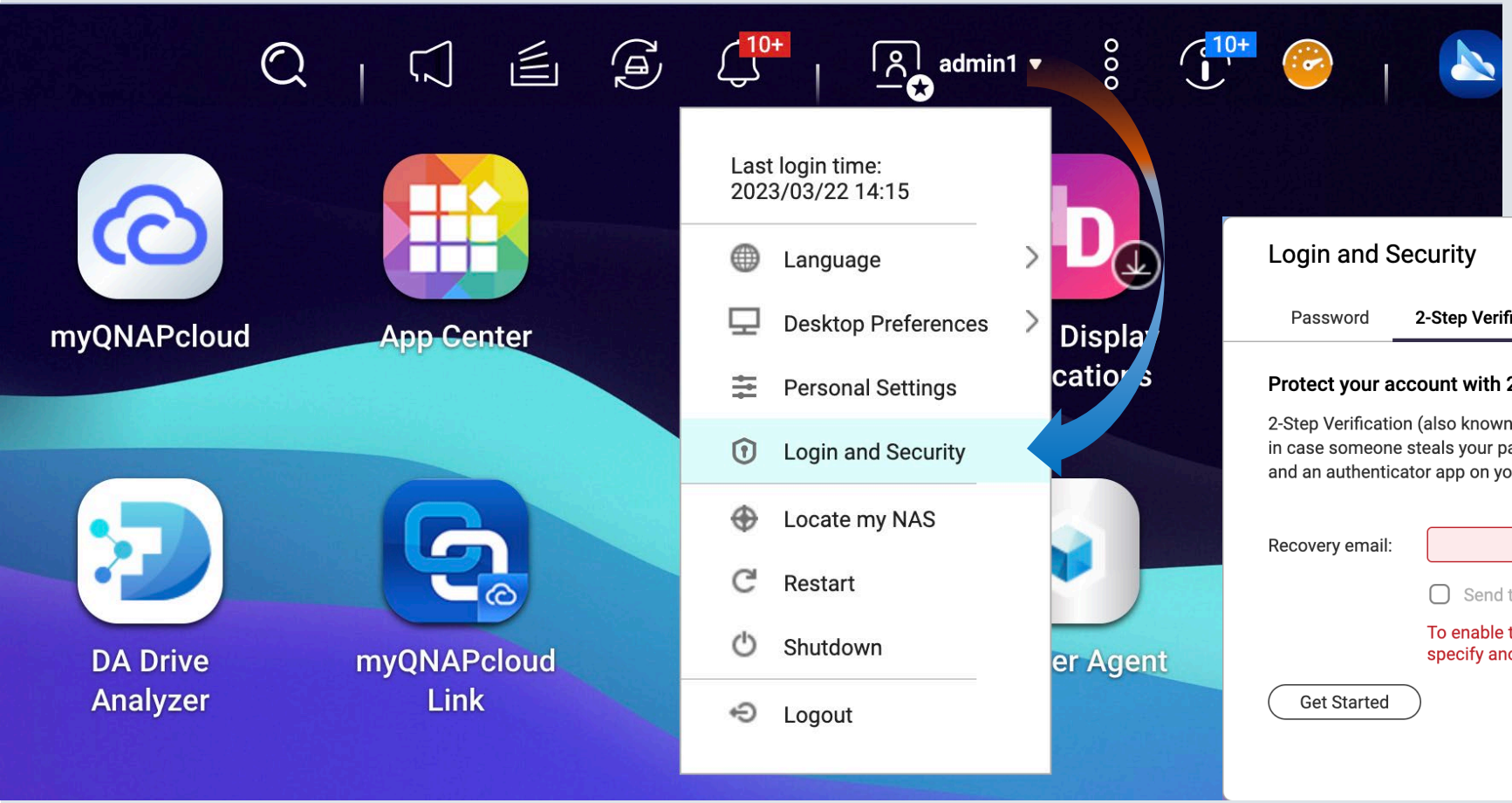


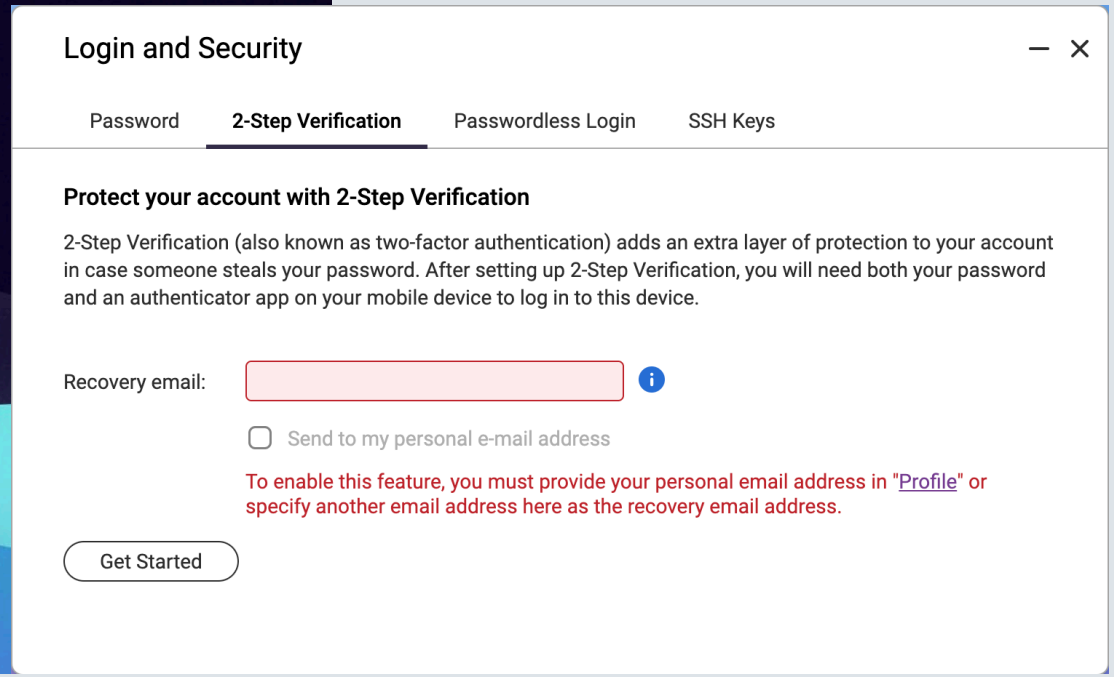
QNAP Authenticator: Passwordless

If 2 Step Verification is not necessary, QNAP Authenticator can still let you not to memorize password by “Log-in Approval” or QR Code



Configure from “Login & Security”





[Note] to send a recovery email, the QTS should **login to QNAP ID**, or the **SMTP service** should be enabled on Notification Center

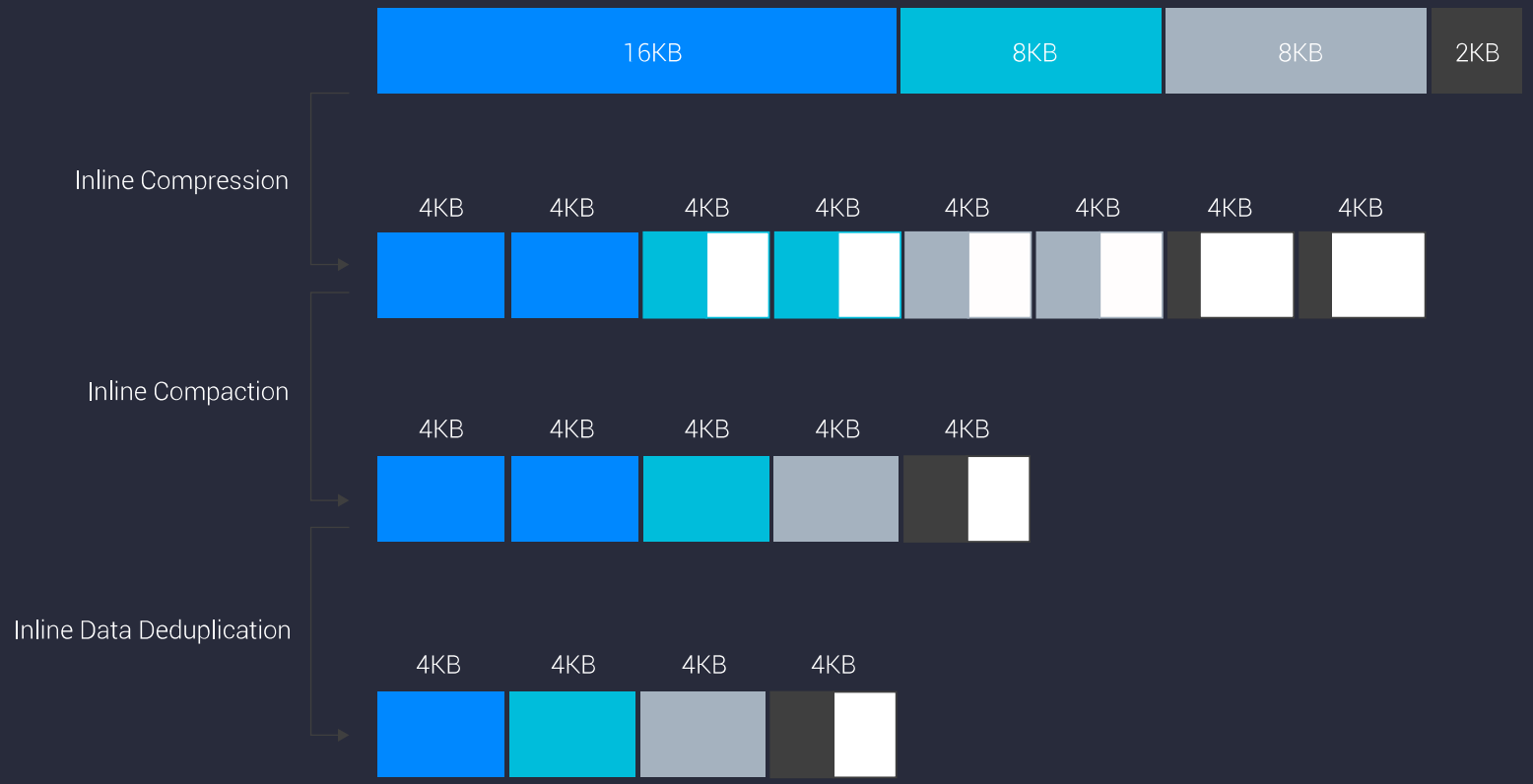
Chapter

03

DATA EFFICIENCY

Data Efficiency with Powerful Data Reduction

Inline data deduplication is block-based and runs before data is written to storage. This greatly optimizes storage usage while significantly decreasing storage capacity requirements. Coupled with inline compression and inline compaction technologies, ZFS significantly reduces the overall storage footprint - especially helpful for increasing SSD storage efficiency when highly-repetitive data or massive small files are generated. All-flash solutions thus achieve higher cost efficiency while improving both random write performance and SSD lifespan.



Deduplication requirement:

- **minimum 16GB RAM**
- **Recommended 64GB RAM or more**

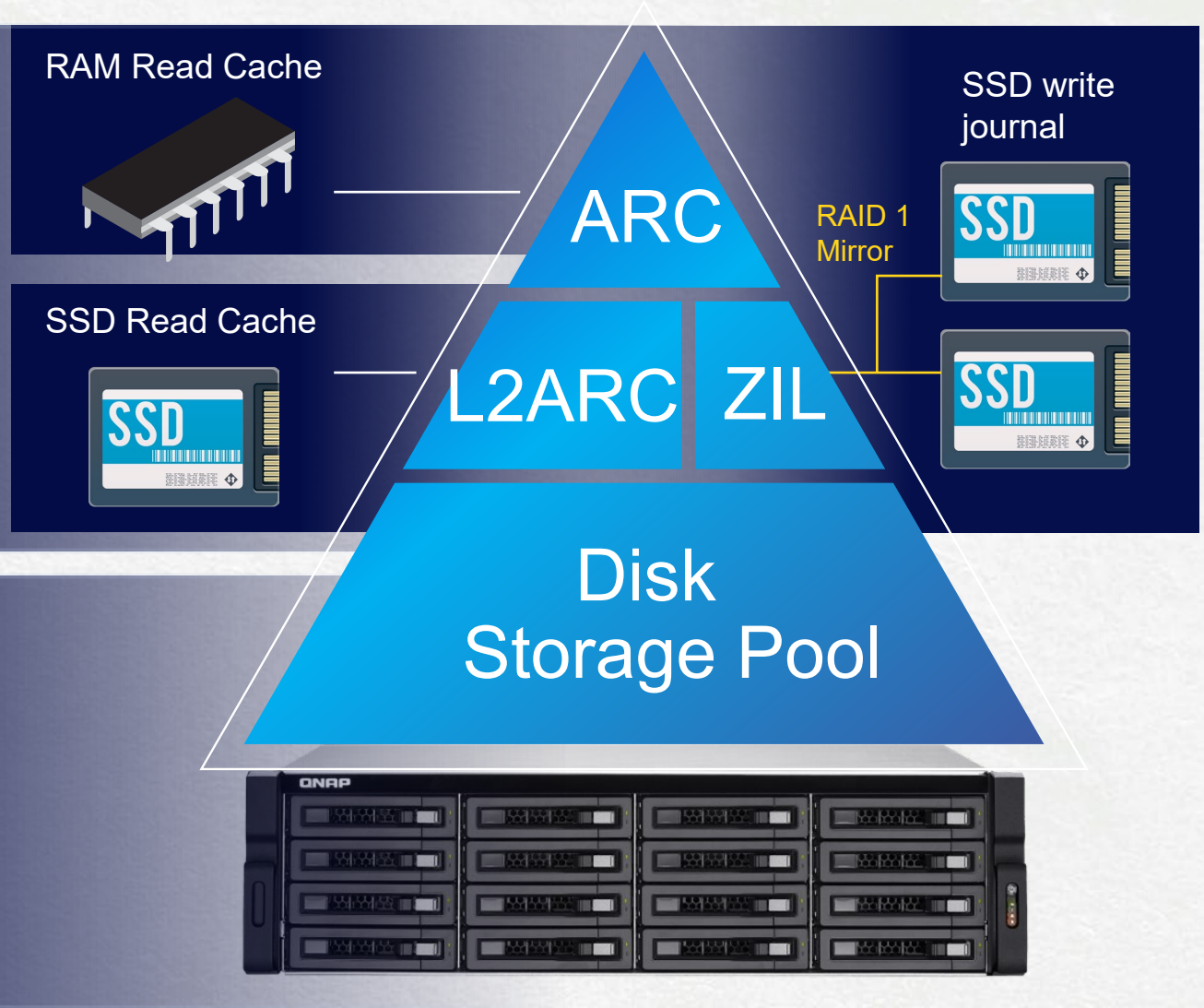
L2ARC cache, and ZIL which provide power loss protection

Layer-2 Adaptive Replacement Cache: (L2ARC)

- Ideal for SSD read cache
- Large "hybrid" cache
- Read performance enhancements

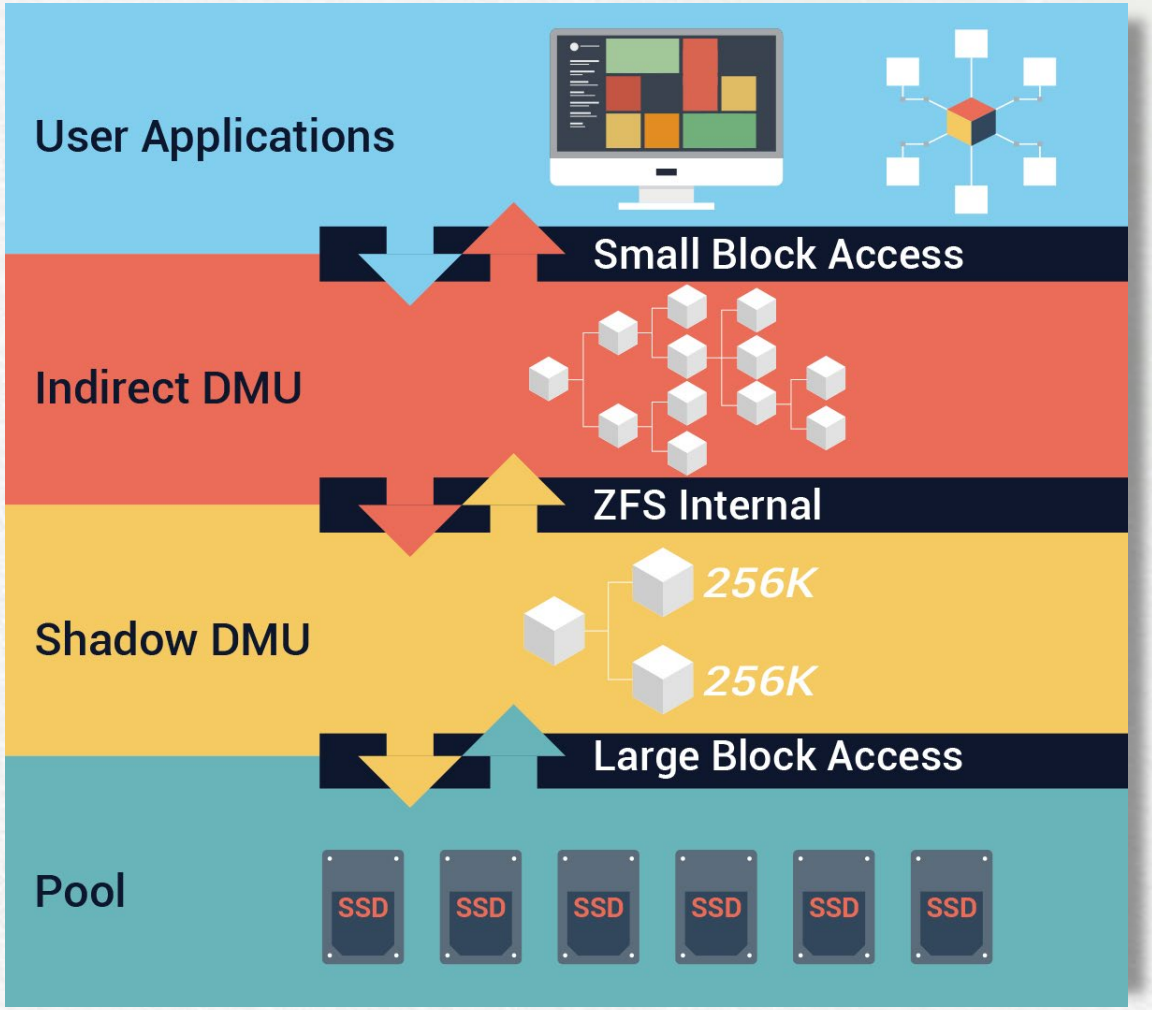
ZFS Intent Log: (ZIL)

- Ideal for SSD write log
- Write Data integrity (COW)
- Provides the power loss protection for writing data.

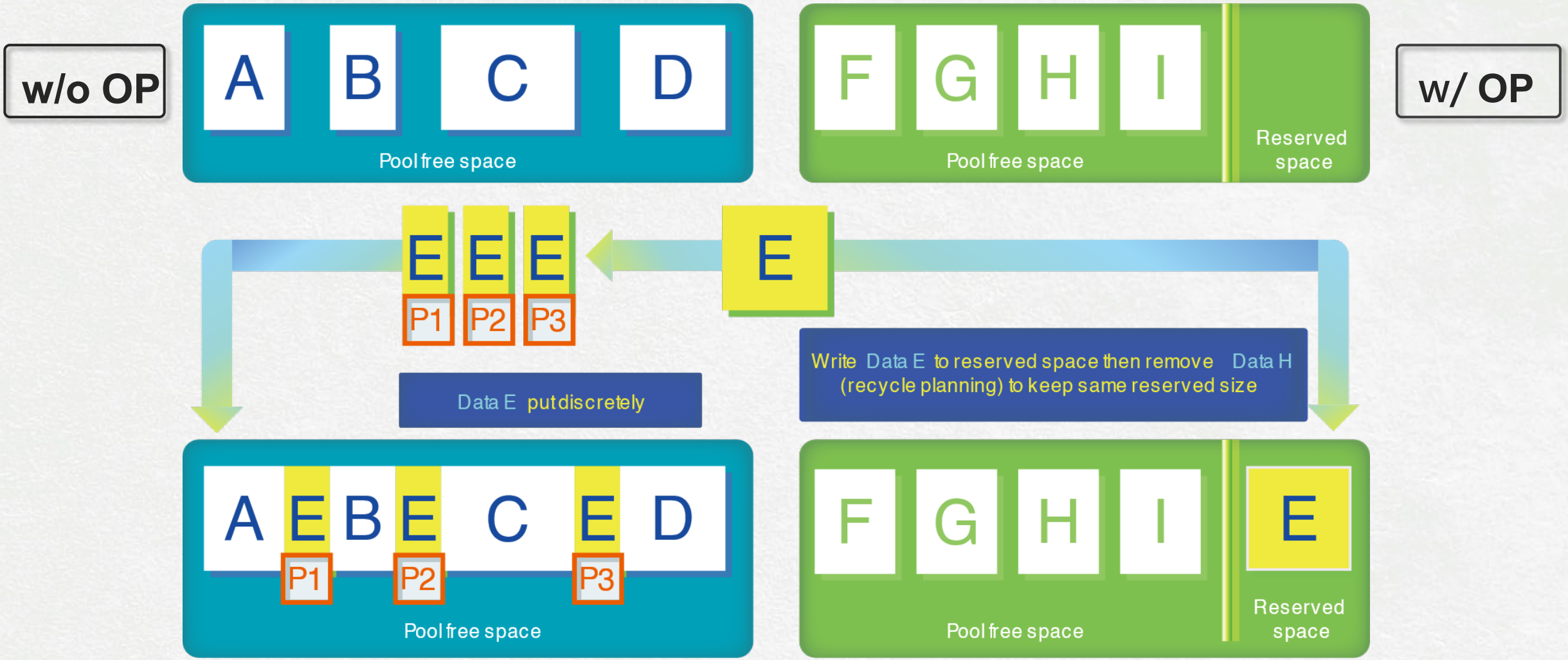


Write Coalescing: improve the random access

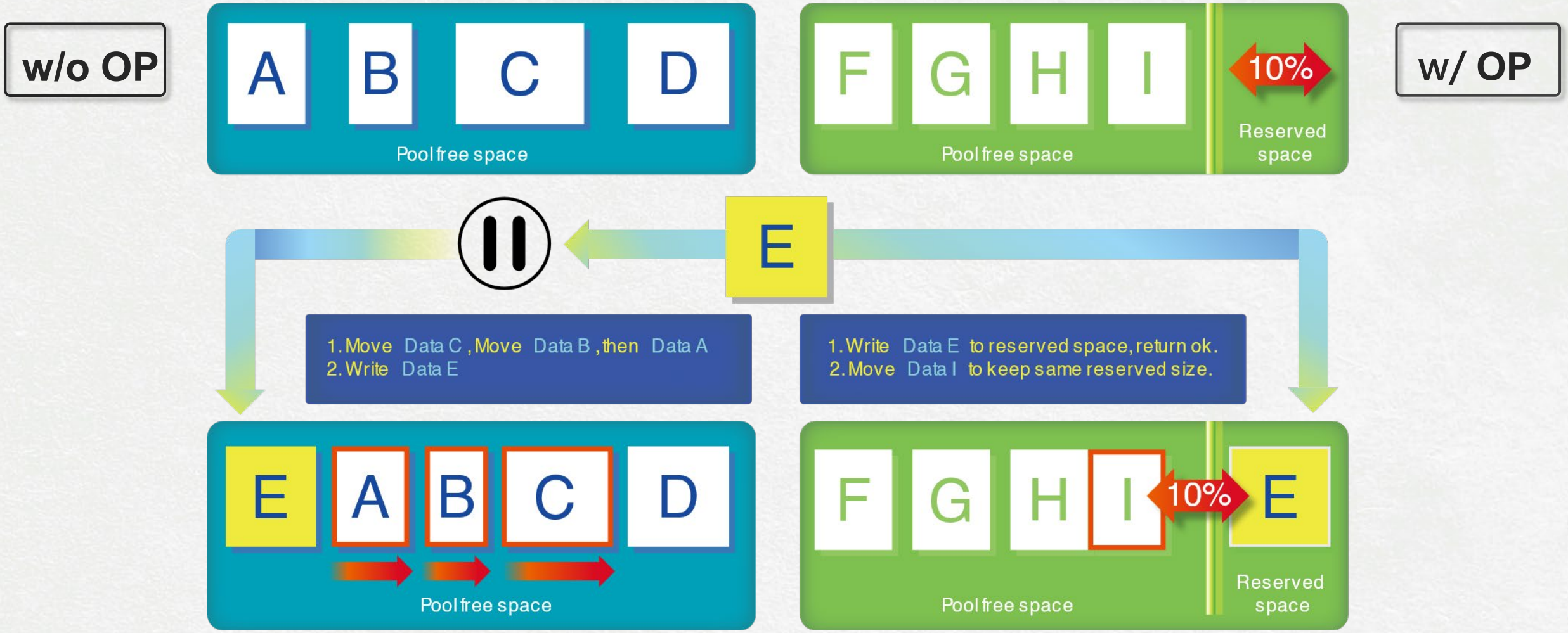
QNAP exclusive Write Coalescing algorithm that transform all random write to sequential writes along with reduced I/O.



Pool over-provisioning: Improve the performance for fragmented pool (The scenario when big block write to HDD)



Pool over-provisioning: Improve the performance for fragmented pool (The scenario when big block write to HDD)

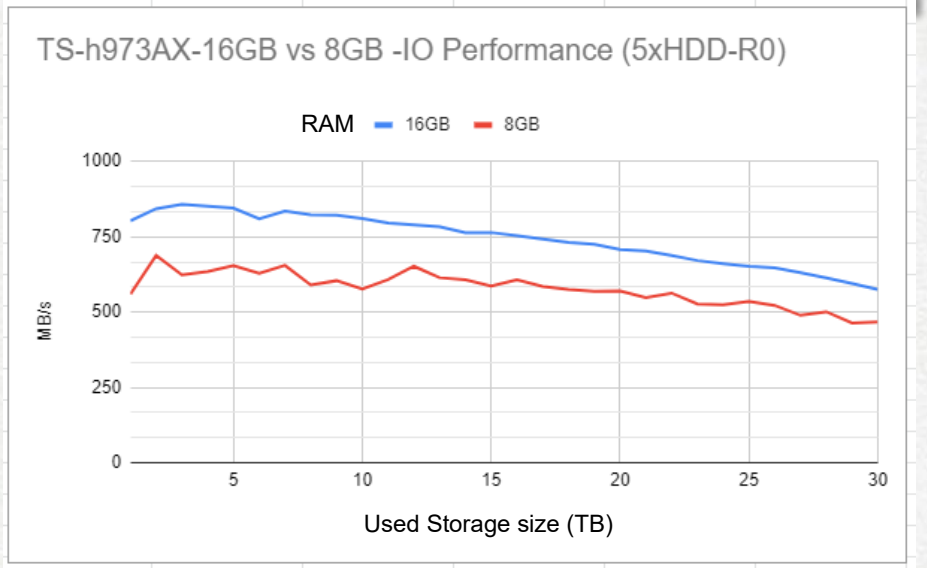


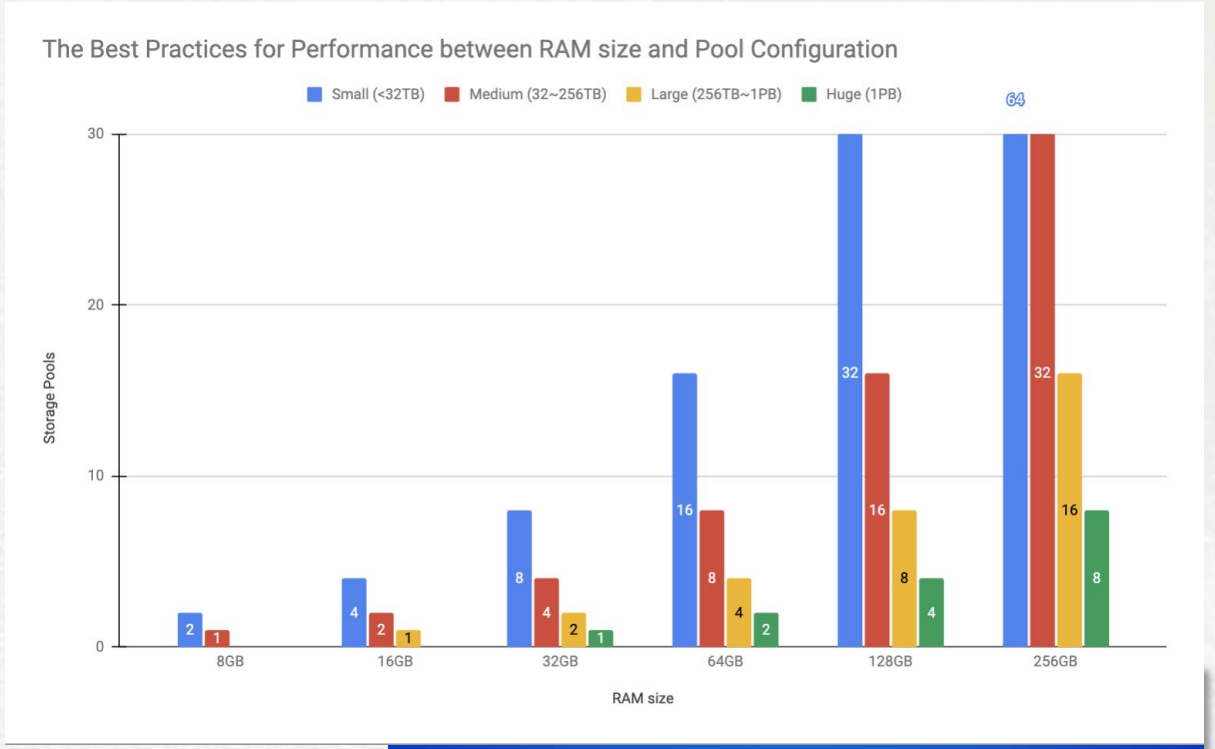
ZFS structure consideration:

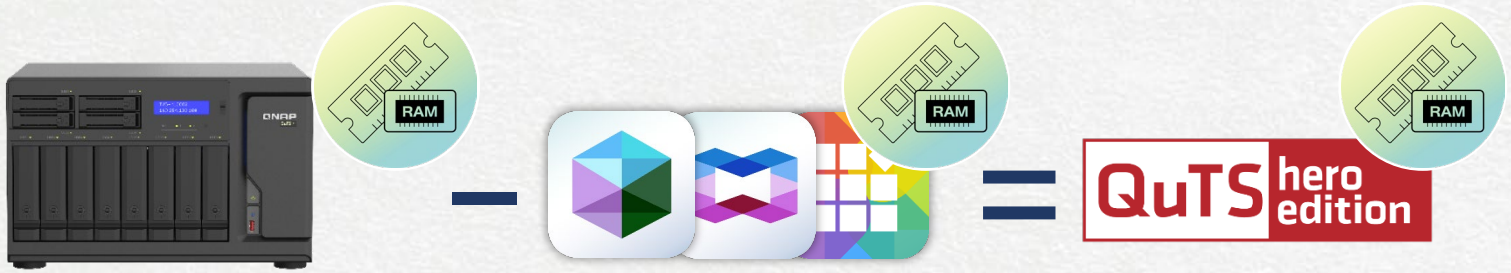
Performance dependency between memory size and storage pools

Using entry-level model TS-973AX as a reference,

We already created one SSD pool and one HDD pool around 35TB. The performance difference of the HDD pool is displayed





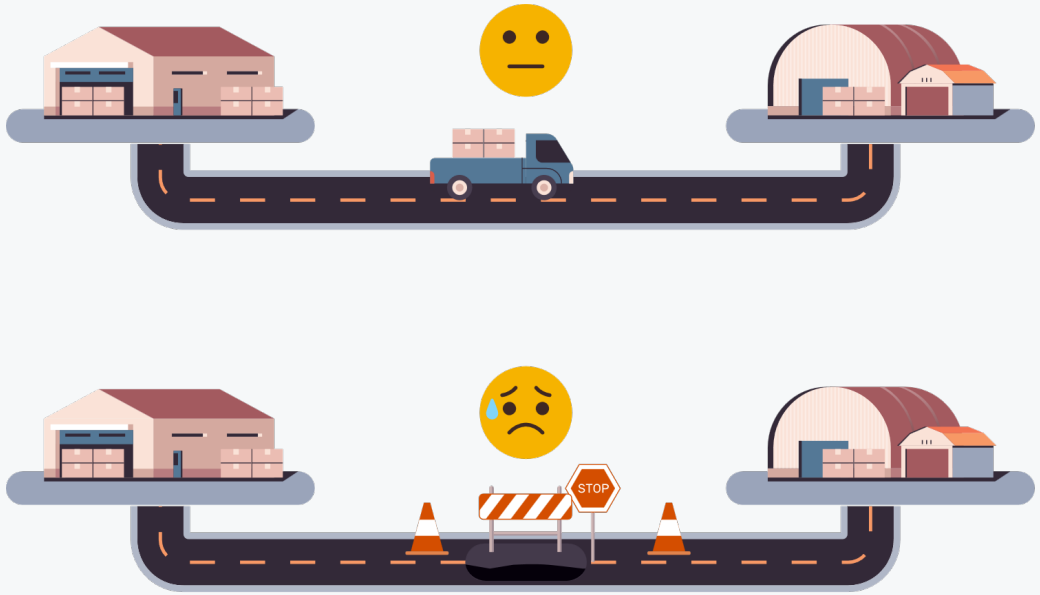


Choose sufficient memory for different storage configurations for better performance.

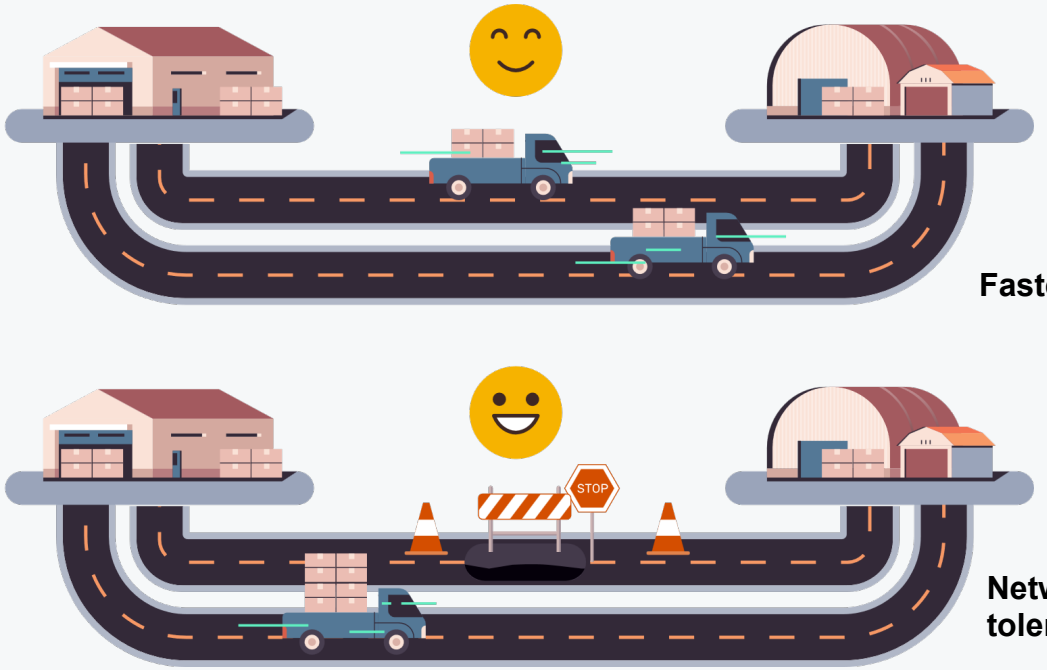
SMB Multichannel

A SMB 3 client automatically establishes multiple connections to the SMB server for single SMB session, and with the multiple connections achieves bandwidth aggregation and netowork fault tolerence.

Without Multichannel



With Multichannel

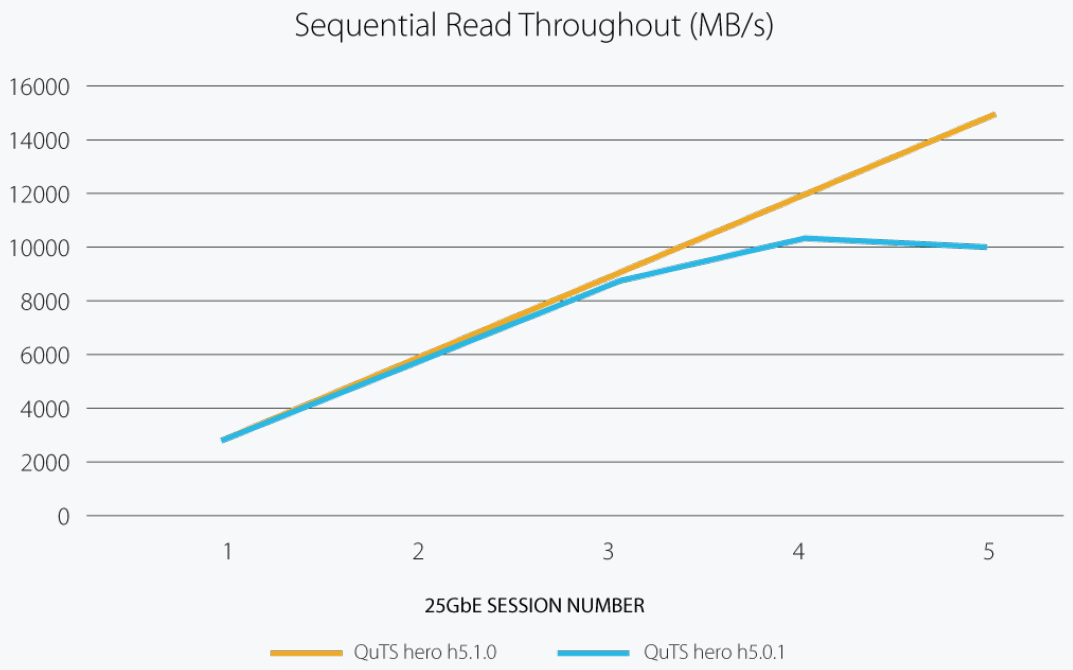


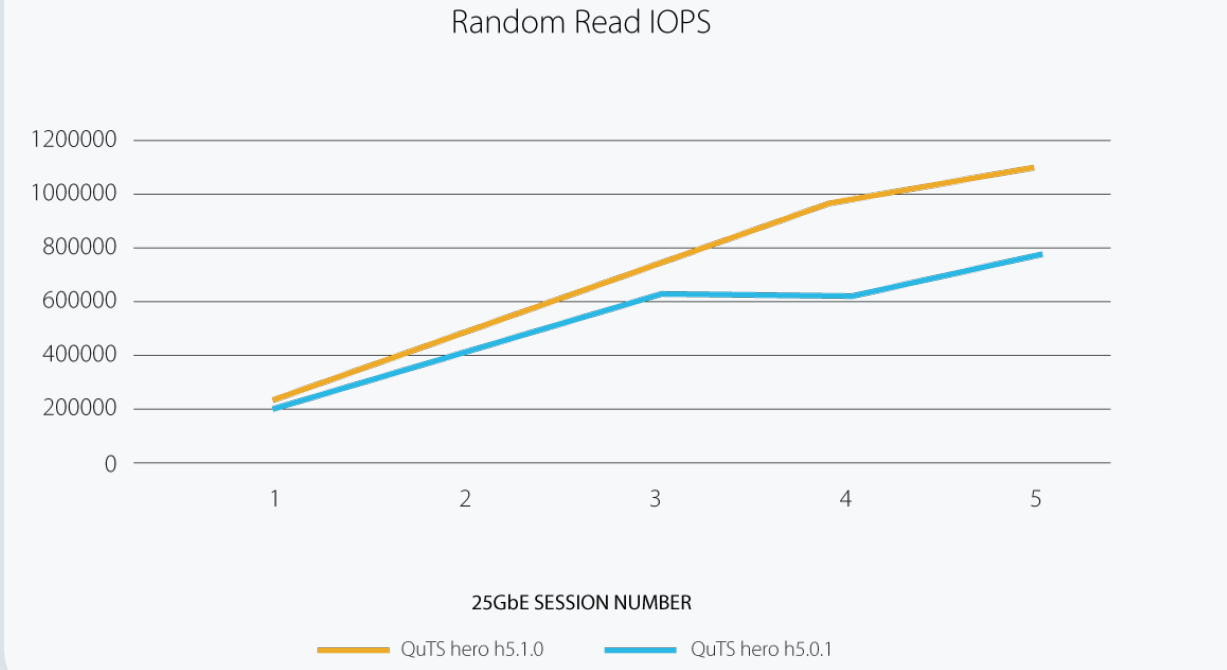
Faster!

Network fault tolerance!

Improved iSCSI read performance by socket zero-copy

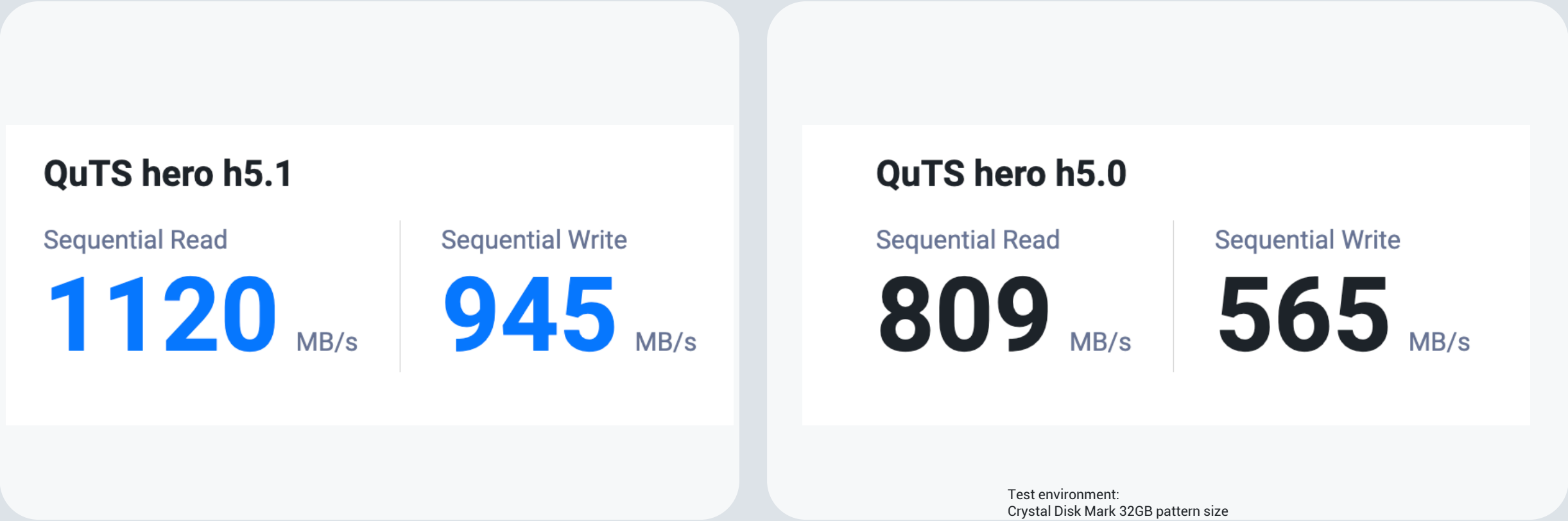
In high-speed data transmission, iSCSI performance is possibly affected by CPU overhead. QuTS hero 5.1 supports socket zero-copy technology that significantly offloads CPU resources, thus improving read performance for iSCSI LUN.





Enhance the performance of encrypted folders/LUNs

You can encrypt the contents of specific shared folders and LUNs to prevent unauthorized access. From QuTS h5.1, the performance of encrypted shared folders and LUNs has been greatly enhanced.



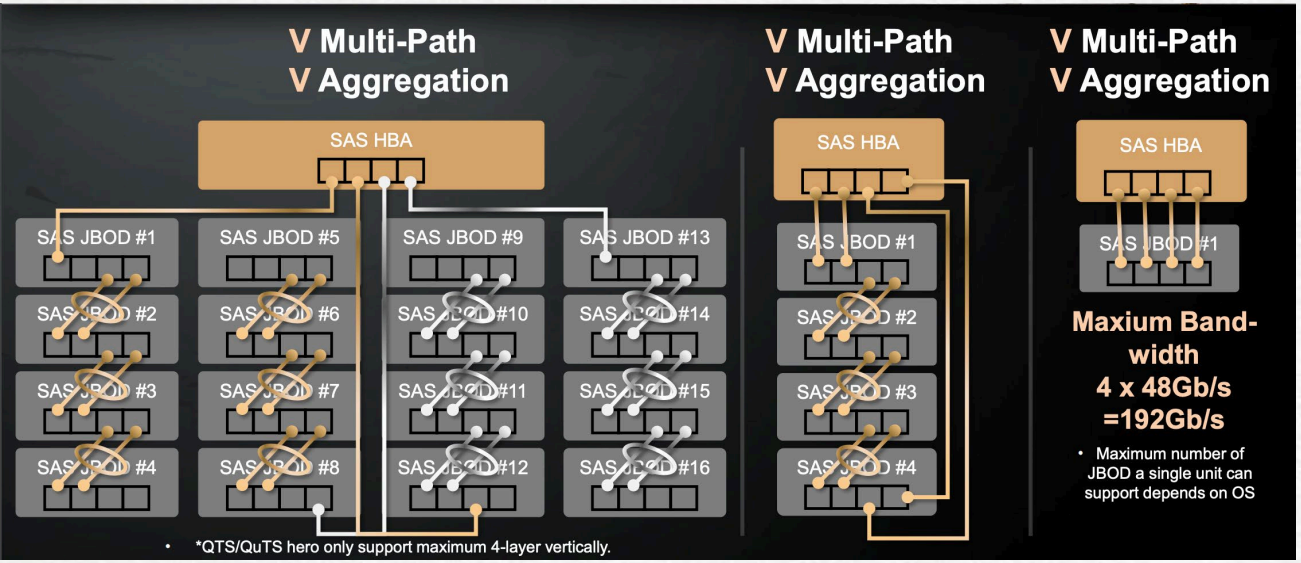
Test environment:
Crystal Disk Mark 32GB pattern size
Client: Windows Server 2022 (AMD EPYC 7232P 3.0GHz, DDR4 128GB) with 1 x 25GbE NIC
NAS: TVS-h474, QuTS hero h5.1, M.2 SSDx2 Raid1 Pool / share folder / encrypt share folder

Chapter

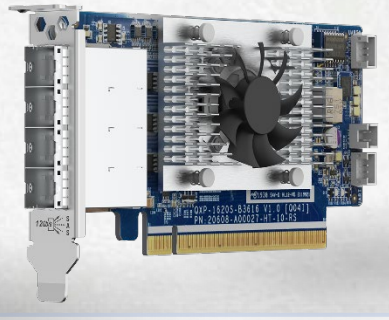
04

STABILITY & SCALABILITY

SAS 12Gb/s JBOD Expansion



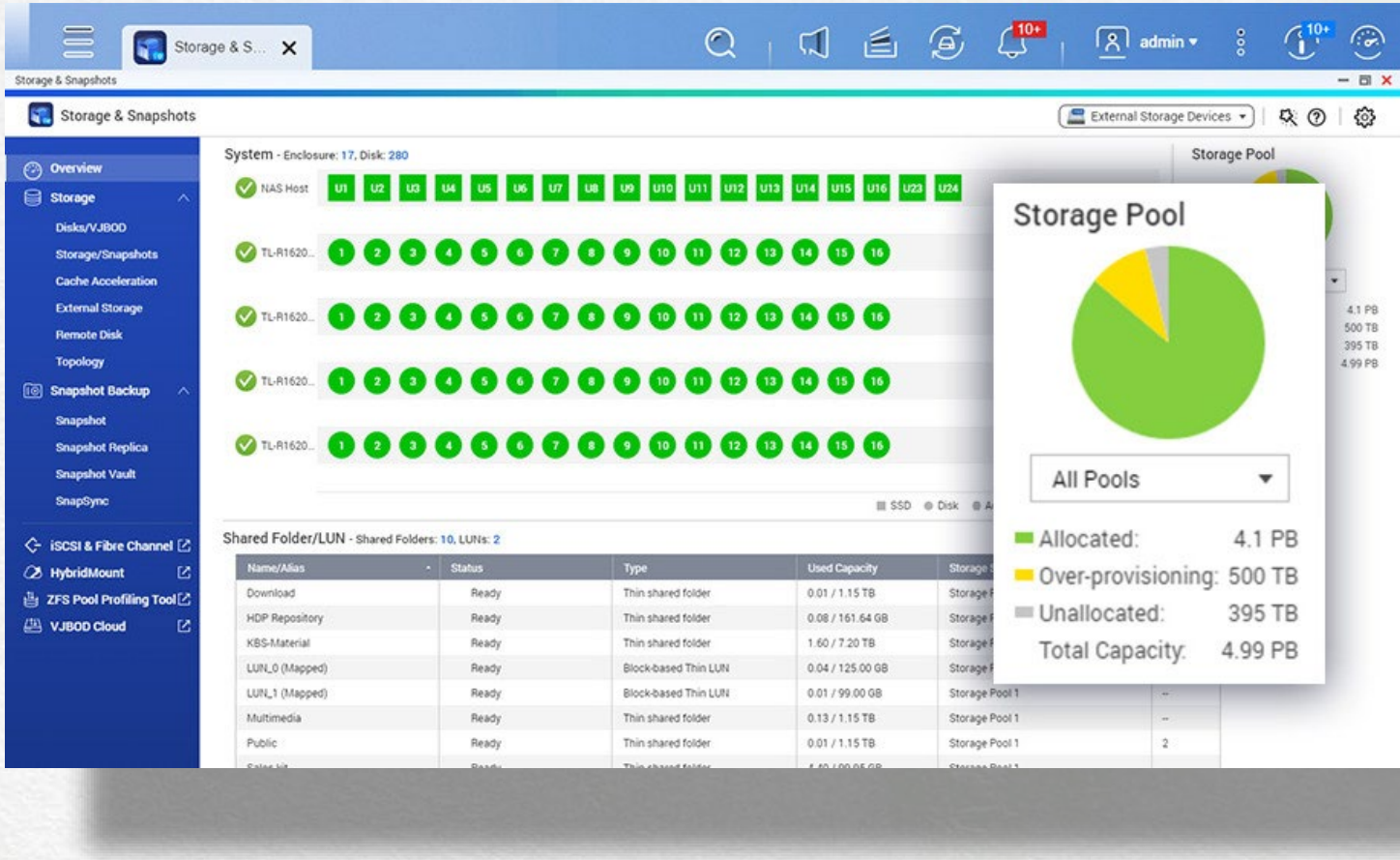
QXP-1620S SAS HBA (Optional)



- Each NAS can connect up to 16 JBODs (REXP/TL-R1220Sep/TL-R1620Sep)
- Each NAS supports 256 HDD Drives for 4.6PB of raw capacity

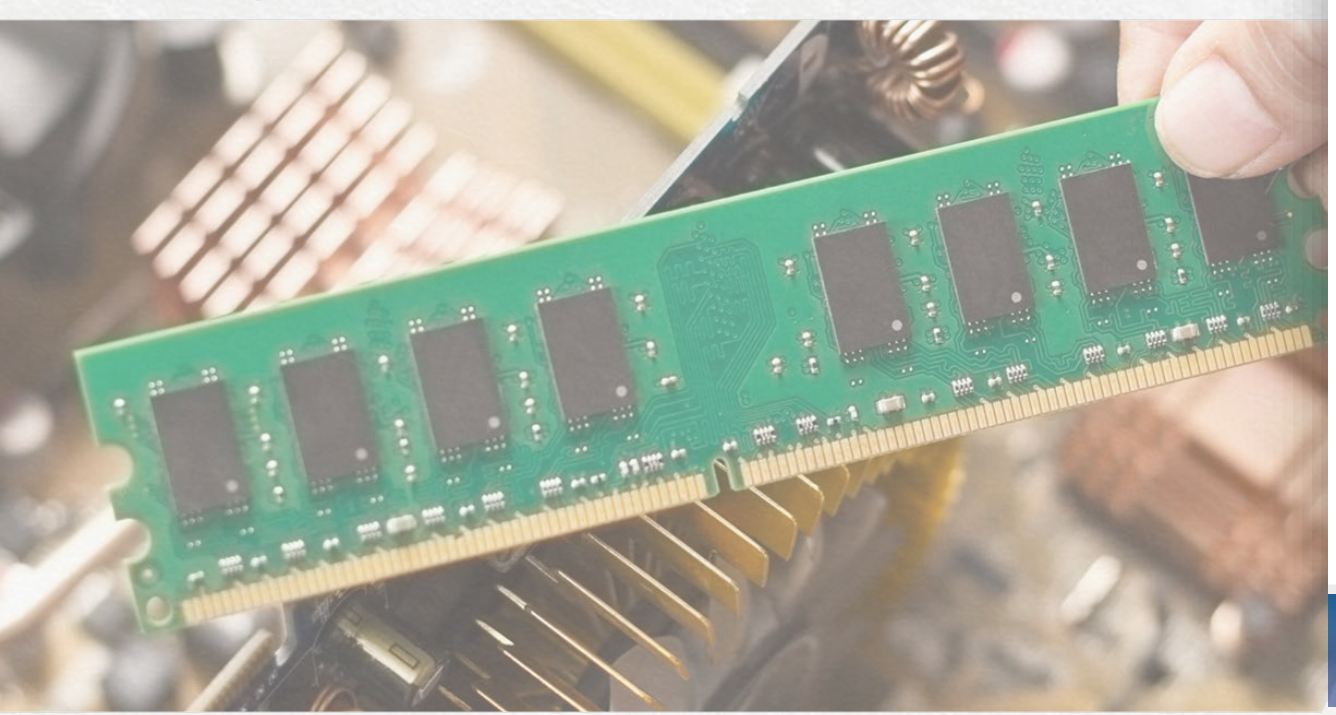
Up to 5 petabytes capacity per shared folder

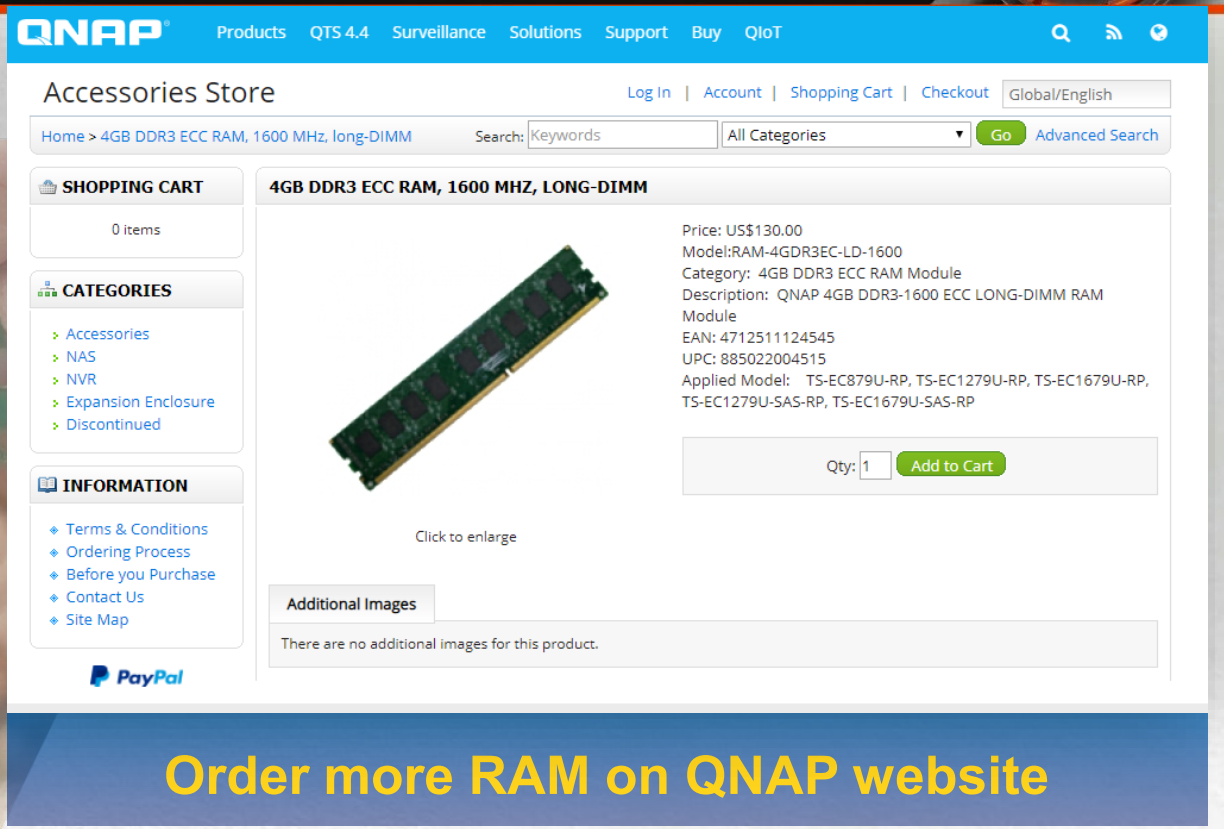
The 128-bit ZFS filesystem has huge capacity potential and supports native handling of standard RAID levels and additional ZFS RAID layouts (RAID Z). ZFS-based QNAP storage solutions provide up to 5 PB capacity for individual shared folders, enabling enterprises to tackle storage-demanding applications including Big Data analysis, edge computing, and AI. Designed to deal with petabytes of data, RAID Z quickly handles creating ready-to-use high-capacity RAID.



Recommended to use ECC Memory (Error Correcting Code)

ECC Higher reliability and data integrity





Order more RAM on QNAP website

The NAS supports ECC memory for auto error correction. ECC is not mandatory for ZFS. It's just a really, really good idea. It allows ZFS to make its data integrity guarantees that it claims to make. Any data storage on any filesystem will benefit from ECC RAM.

Expand ZFS RAID-Z capacity

Expanding the capacity of a ZFS RAID-Z previously required adding another RAID group. Now, you can simply add a single disk to an existing RAID-Z for storage expansion, or conveniently add 2 to 3 disks for upgrading RAID level with Parity.

The minimum number of disks for expanding RAID capacity:

Current RAID level	New RAID level	Minimum disks required
RAID 5 (Z)	RAID 6 (Z2)	2
RAID 5 (Z)	RAID TP (Z3)	3
RAID 6 (Z2)	RAID TP (Z3)	2
RAID 5 (Z)	RAID 5 (Z)	1
RAID 6 (Z2)	RAID 6 (Z2)	1
RAID 1	RAID Triple Mirror	1 (only 1 disk can be added)

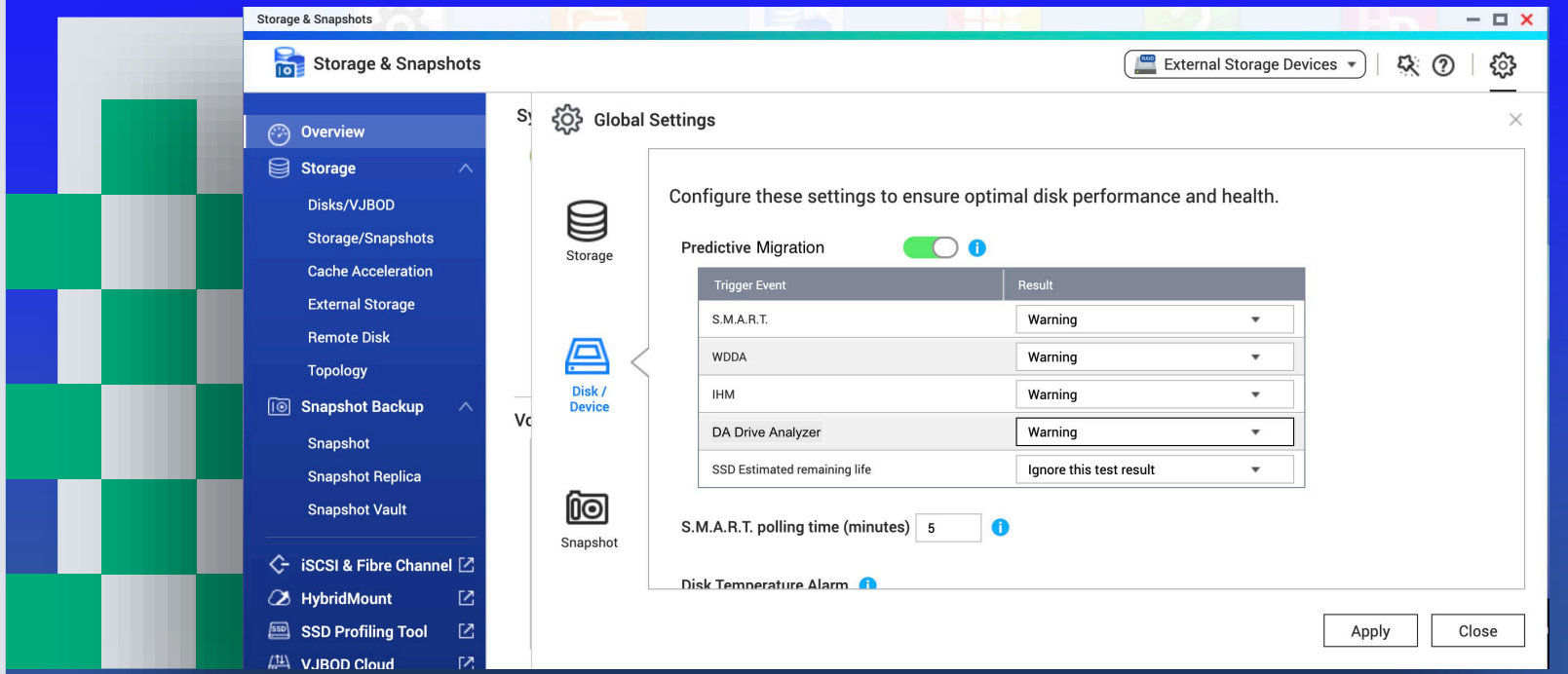
AI Prediction for Drive Health - DA Drive Analyzer

Prevent the long service down time or data loss because of the sudden failure of the drive. New improvement to arrive!

Predictive Migration

Depending on the drive health analytical tools, selected conditions can trigger data migration to the spare disk.

- S.M.A.R.T.
- WDDA
- IHM
- DA Drive Analyzer
- SSD Estimated remaining life



Predictive Migration: Protect Your Data Before Drive Fails.

- When a drive has failed, RAID will rebuild its data to the new drive. Depending on the CPU or Drive bottlenecks, RAID rebuild can take days to weeks to complete, due to the process of heavy calculation.

- On the other hand, before a drive fails, when the system can detect the risk of drive failing, it may start to migrate the data to the spare drive. Such process should complete within hours, because it copies the files and synchronizes without calculating from the RAID strips.

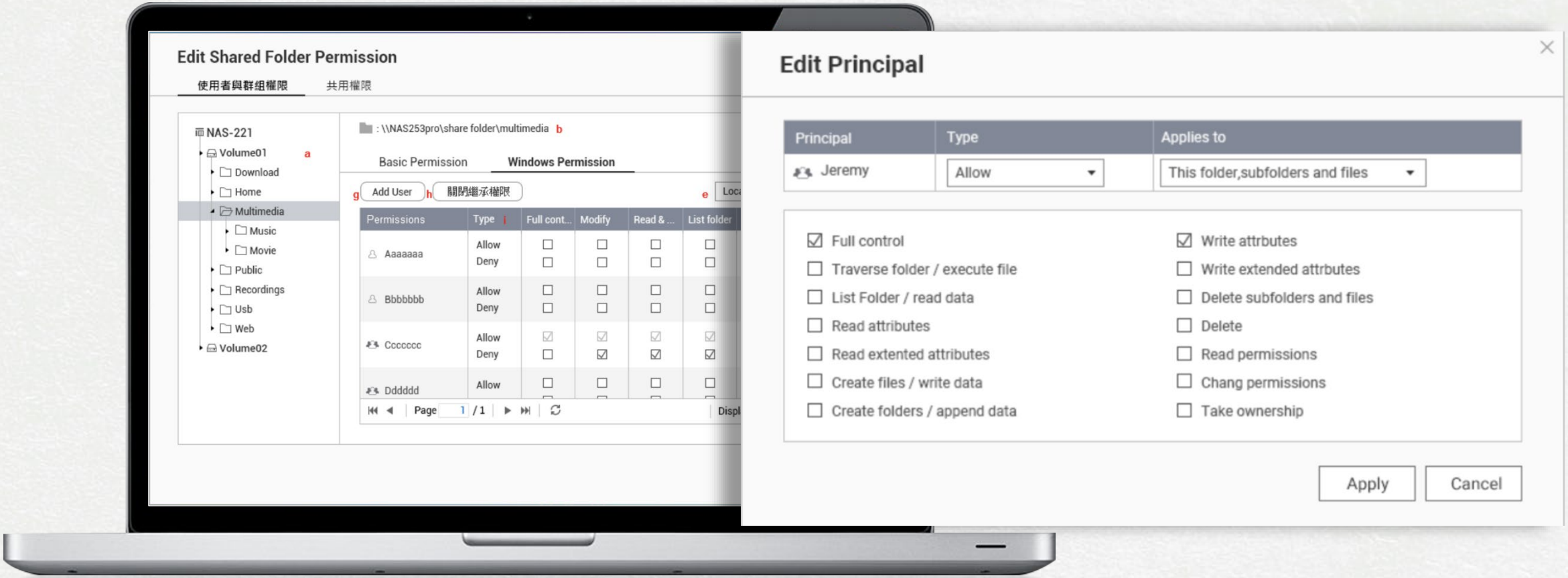
Chapter

05

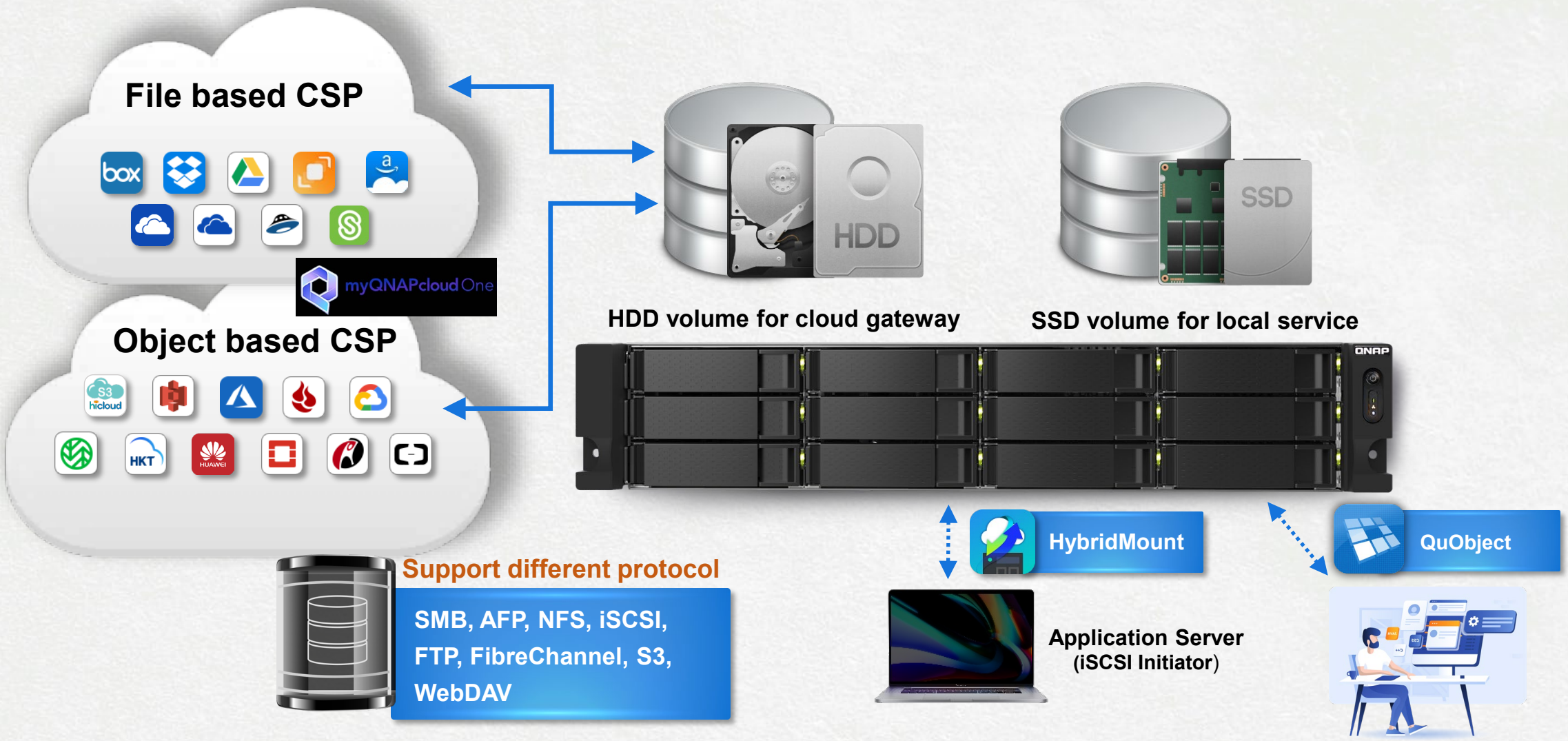
Management & Application

More detailed Access Control

14 Windows ACL Permission



Convert your local storage to public cloud with different protocols



Delegated Administration

- Administrator group users have the highest privileges including access sensitive data.
- User group users have almost none administrative privileges.

- Sole administrator may cause heavy workloads and poor responsiveness.
- Many administrators may cause improper authority and pose the risk of data leakage.

New 8 Roles delegateable to the User group users

Administrator

Have full authority of the NAS, and the only role who can delegate roles.

System Management

Have the most administrative capability under Administrator including all privilege of other delegated roles.

Backup Management

Manage and monitor backup jobs of the NAS.

Backup Operation

Execute backup jobs of specified shared folders.

User and Group Management

Create or delete local accounts for individual users and groups.

Shared Folder Management

Manage shared folders and grant access rights for users or groups.

Application Management

Install, update, and manage apps in the App Center.

Access Management

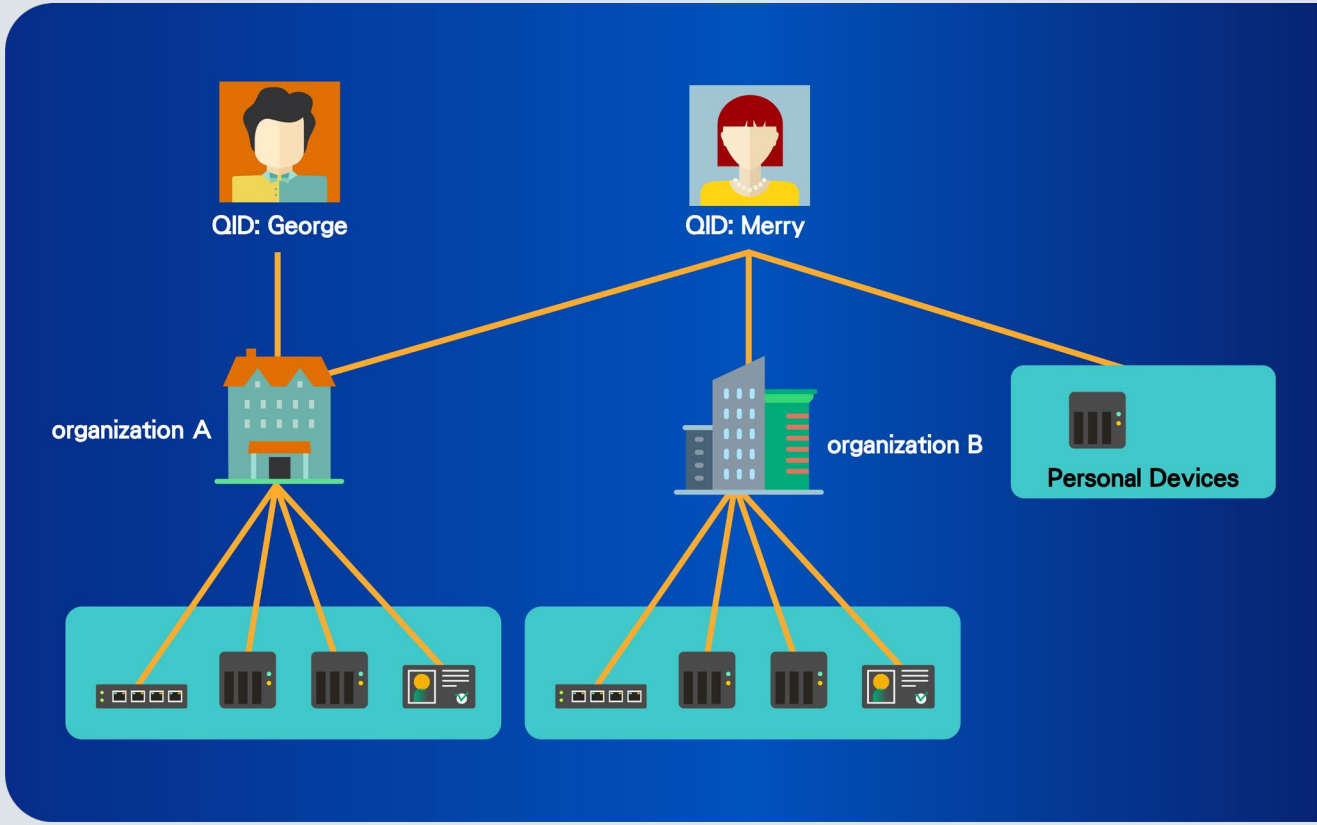
Manage overall accessibility of the NAS.

System Monitoring

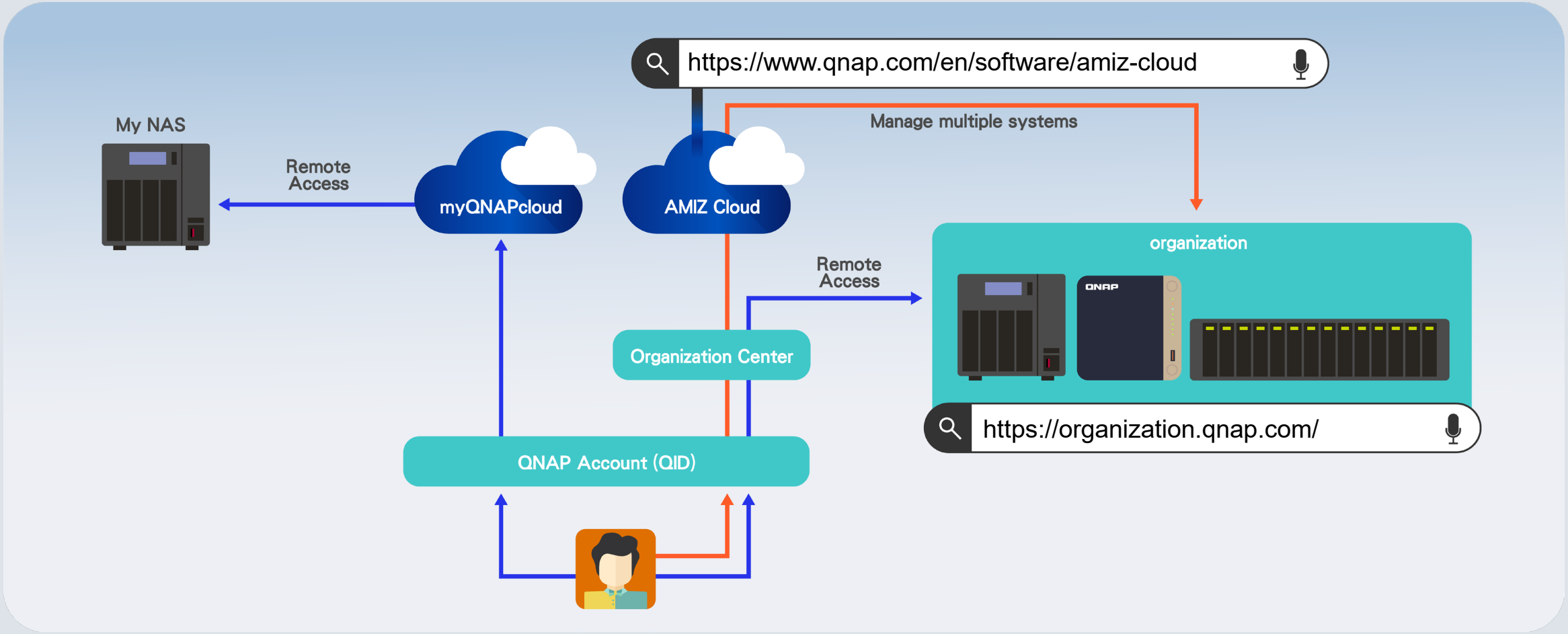
Oversee utilization of NAS system and storage resources.

AMIZ Cloud

- One portal, multiple systems.
- Organized management (via Organization Center).
- Dashboard of system health
- Customized threshold alerts with various notification methods
- Central App management
- Basic system management

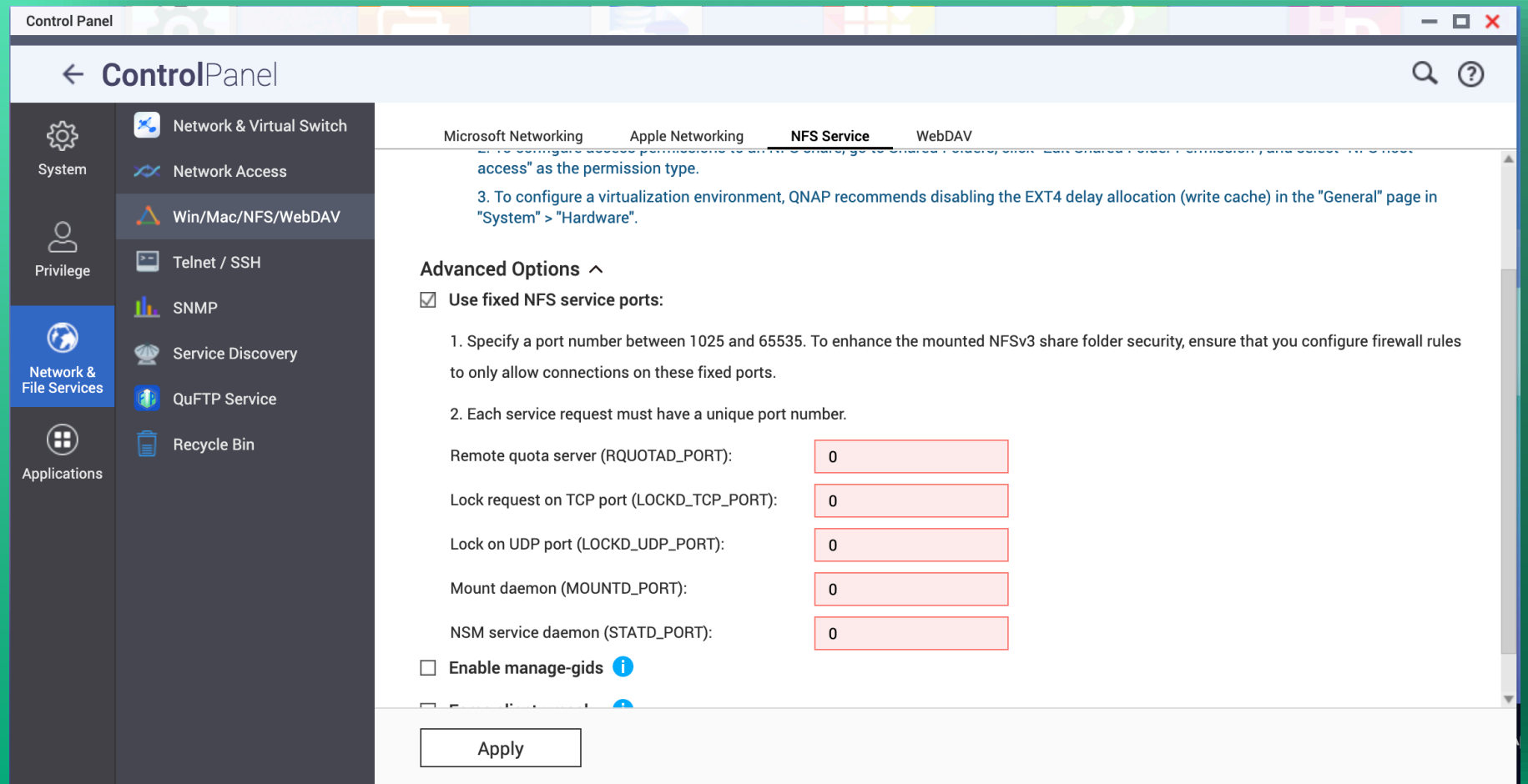


Grouped by Organization Center, Managed in Amiz Cloud



Option for Fixed NFS Service Ports

NFS dynamically assigns service ports which can cause problem of firewall configuration. New advanced option to set the static ports saves the trouble of firewall reconfiguration when NFS restarts.



Recomended Models

TS-h2490FU

TS-h1290FX

TS-h3087XU-RP

TVS-h874T

TBS-574TX

QNAP

hero 5.1.0

Boosted performance, flexible management, and higher security.