
QNAP
QuTS hero NAS
TS-h3088XU-RP
2U 30-bay SATA all-flash Enterprise ZFS NAS
with Intel® Xeon® W CPUs and dual 25GbE ports
for multiteam private cloud storage/VM/AI/8K
multimedia applications
intel XEON inside
SATA 6Gb/s
25GbE 2.5GbE
QuTS hero edition
HDMI
Intel® Xeon® W-1250 6-core 3.3 GHz (burst up to 4.7 GHz)
Intel® Xeon® W-1270 8-core 3.4 GHz (burst up to 5.0 GHz)

Enterprise-Grade Storage

Hardware Overview

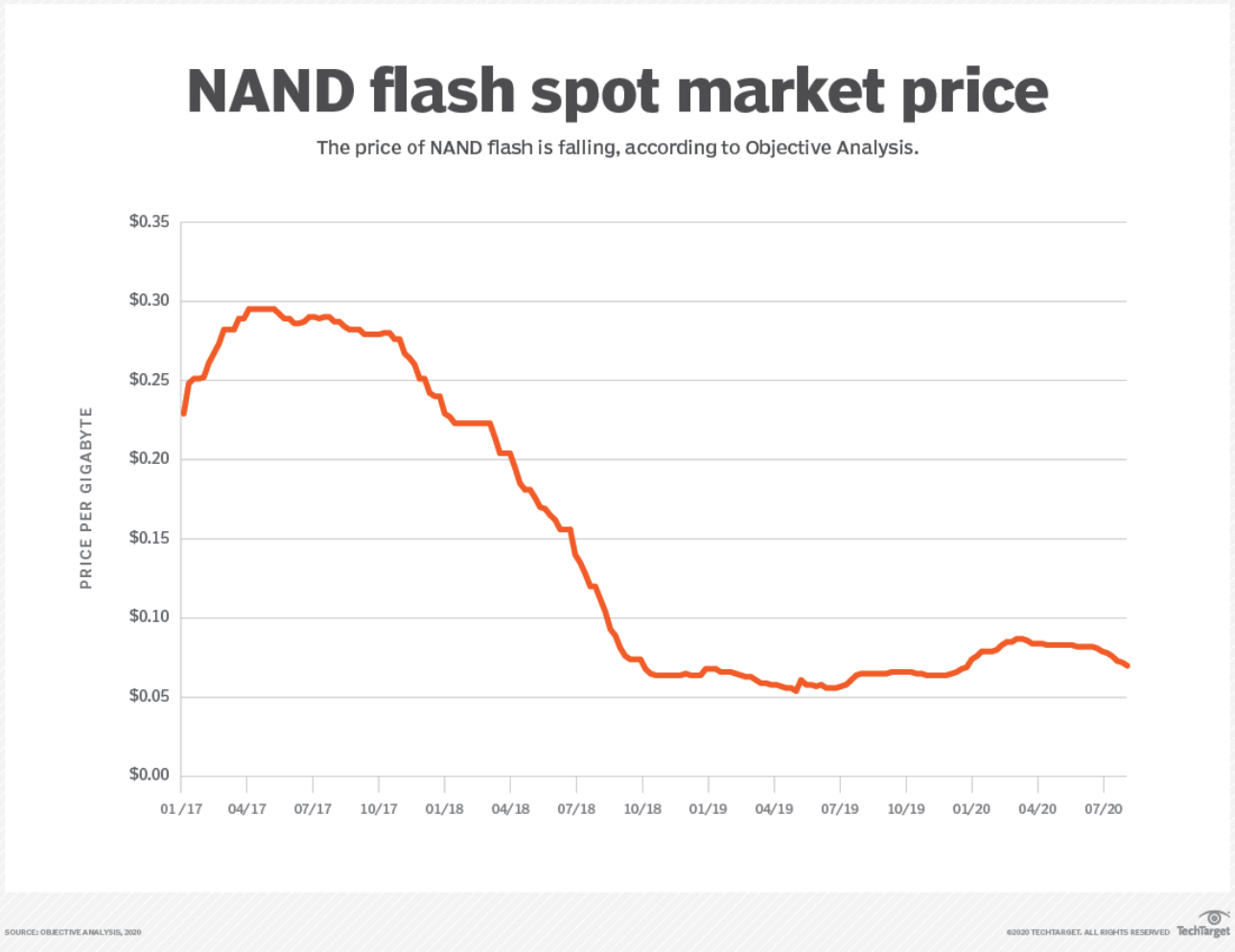
QuTS hero h4.5.1

Accessories

TS-h3088XU-RP

30-bay all flash NAS
with 30 x 2.5" SATA drive bays

Businesses start to adapt all flash storage arrays (AFA) because SSD's per-GB cost is dropping quickly.



- Market research company Gartner predicts 2020 Q4 to 2021 Q2 enterprise SSD price will continue to fall by 10% ~ 15% ·
- Accompanying the falling prices of SSDs, businesses begin to buy more efficient all flash arrays (AFA) for Storage as a Service) 、hybrid cloud、AI、edge computing、Software Defined Storage (SDS) and other new types of storage functions.

Source: https: //searchstorage.techtarget.com/news/252487918/SSD-and-NAND-flash-prices-will-decline-through-start-of-2021

2U 30-bay all flash storage array (AFA)

TS-h3088XU-RP

2U 30-bay
2.5-inch SATA SSD
ZFS file system

- **Up to 596K / 345K IOPS 4K random read & write performance**
- **ZFS file system for data integrity**
- **Data reduction technologies**
  - Increasing storage efficiency and ROI
  - De-duplication、inline compression、data compaction
- **Unified Storage for iSCSI/ FC/ NFS/ CIFS/ FTP / S3 protocols**
- **Storage and application servers**
  - Container Station and Virtualization Station for running virtualized operating systems and apps on the NAS

TS-h3088XU-RP available models

TS-h3088XU-RP-W1270-64G

- Intel Xeon W-1270 8-core/16-thread, 3.4 GHz (Max. 5.0 GHz)
- 64GB DDR4 UDIMM ECC memory (4 x 16GB)
- 2 x SFP28 25GbE ports (25GbE/10GbE/1GbE)

TS-h3088XU-RP-W1250-32G

- Intel Xeon W-1250 6-core/12-thread, 3.3 GHz (Max. 4.7 GHz)
- 32GB DDR4 UDIMM ECC memory (2 x 16GB)
- 2 x SFP28 25GbE ports (25GbE/10GbE/1GbE)

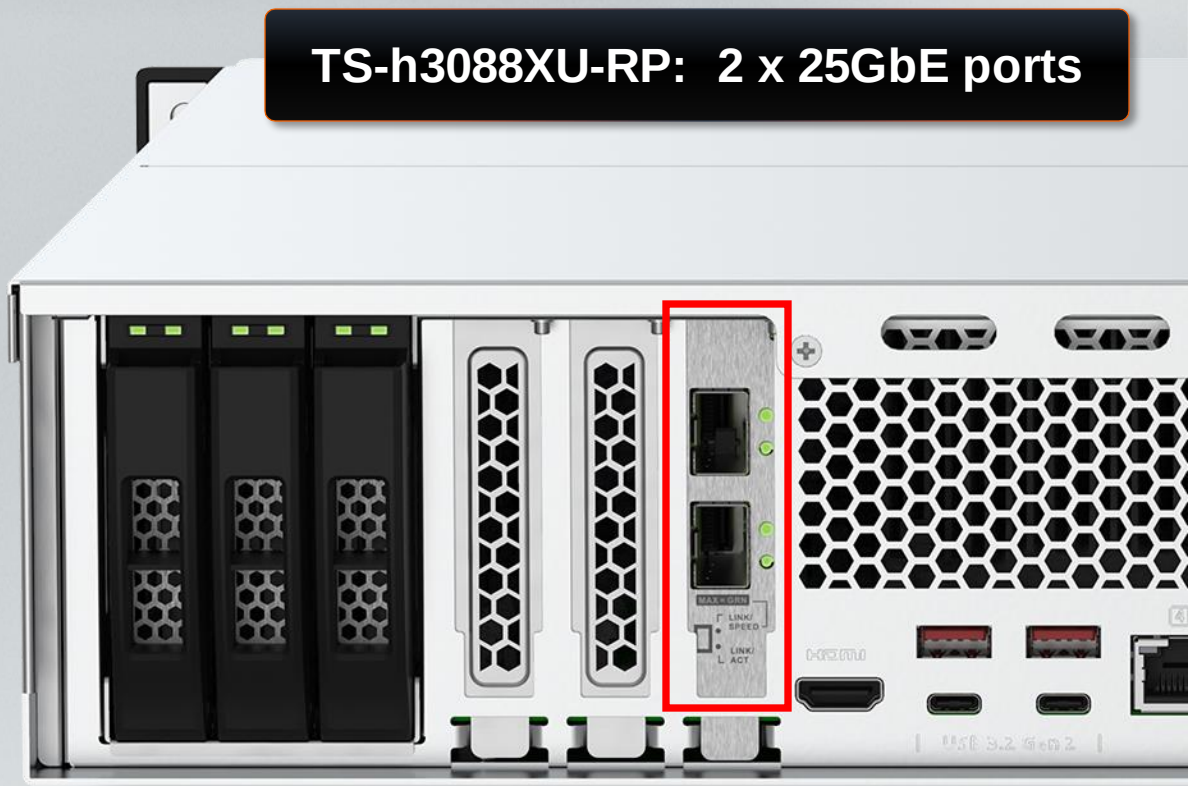
Supercharged with superb configurations over the competition

	QNAP Wins	TS-h3088XU-RP	Other brand FS-series NAS
Processor	**Ultra-high performance per core**	Xeon W-1270 8-core **3.4 GHz**, boost up to **5.0 GHz** Xeon W-1250 6-core **3.3 GHz**, boost up to **4.7 GHz**	Intel Xeon D-1541 8-core 2.1 GHz, boost up to 2.7 GHz
Memory	**More default RAM for more concurrent user connections and more apps**	W-1270 SKU: **64GB** W-1250 SKU: **32GB** Supporting up to 128GB	Default 16GB Supporting up to 128GB
Storage	**Higher single NAS capacity**	**30** x 2.5-inch	24 x 2.5-inch
Network	**Best performance out of the box, save costs**	**2 x 25GbE** SmartNIC + **4 x 2.5GbE**	2 x 10GbE + 4 x 1GbE
PCIe #	**Various SAS, QM2, or FC PCIe adapters**	**3** (1 slot is pre-installed with a 2-port 25GbE NIC)	1
Expansion	**4 x the raw capacity**	Up to **286** drives (30 + 16 x TL-R1620Sep-RP 16-bay expansion units)	Up to 72 drives (24 + 2 x 24-bay expansion units)

Shipped with 2 x 25GbE SFP28 ports

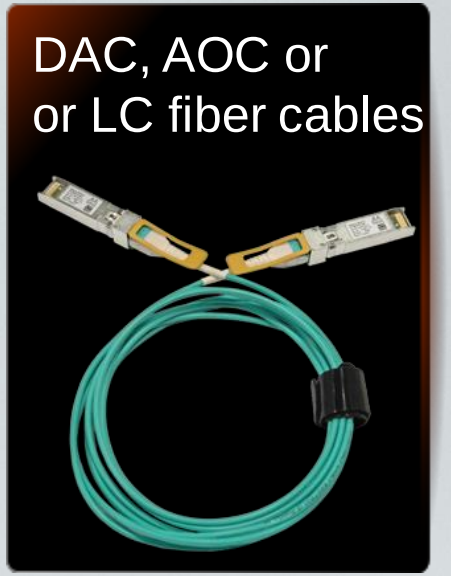
- Bundled with Mellanox® **ConnectX®-4 Lx dual-port 25GbE** SmartNIC network card
- SmartNIC with network offload capability for enhancing the network processing efficiency
  - Remote Direct Memory Access (RDMA)
  - RDMA over Converged Internet (RoCE)
- Supporting **iSCSI Extensions for RDMA (iSER)**, increasing VMware ESXi and VJBOD transfer performance
- Link Aggregation for added bandwidth

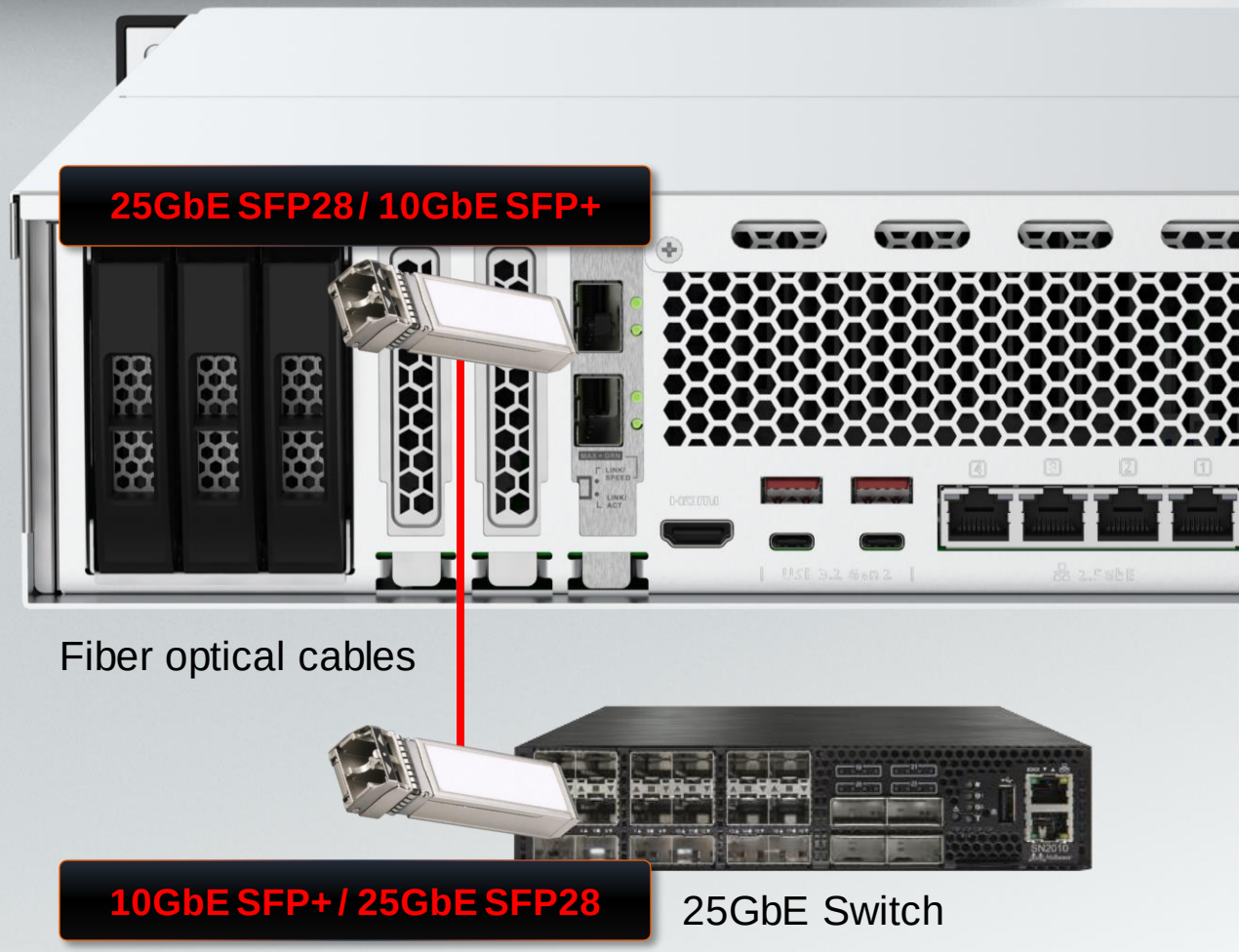
Mellanox® TECHNOLOGIES



Flexible network speeds, 25GbE can be compatible with 10GbE/1GbE via transceivers

- The 25GbE SmartNIC supports SFP28 transceivers
- Compatible with 1GbE and 10GbE networks (requiring optional SFP/SFP+/SFP28 transceivers)
- Auto-negotiation the link speed





TS-h3088XU-RP NAS front side view

30 x 2.5-inch SATA 6Gbps SSD trays
- Supporting up to 15mm height SSD / HDD

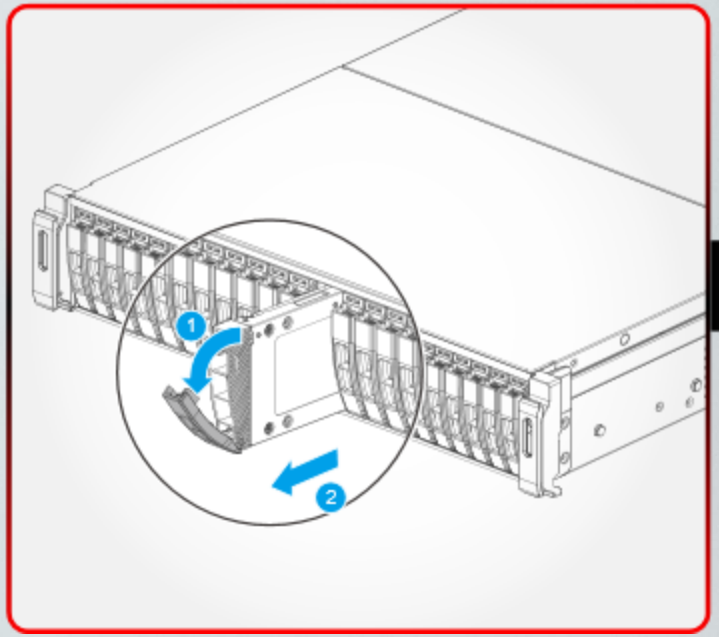
Optional Purchase

RAIL-A03-57 Rail Kit

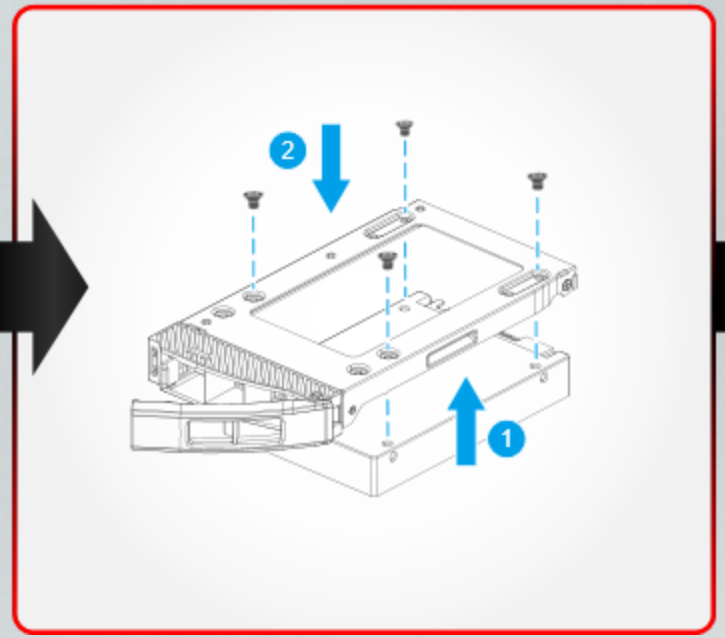
- Power button
- LED indicators
  - System status
  - Network status
  - Expansion unit connection

2.5-inch SATA SSD/HDD installation steps

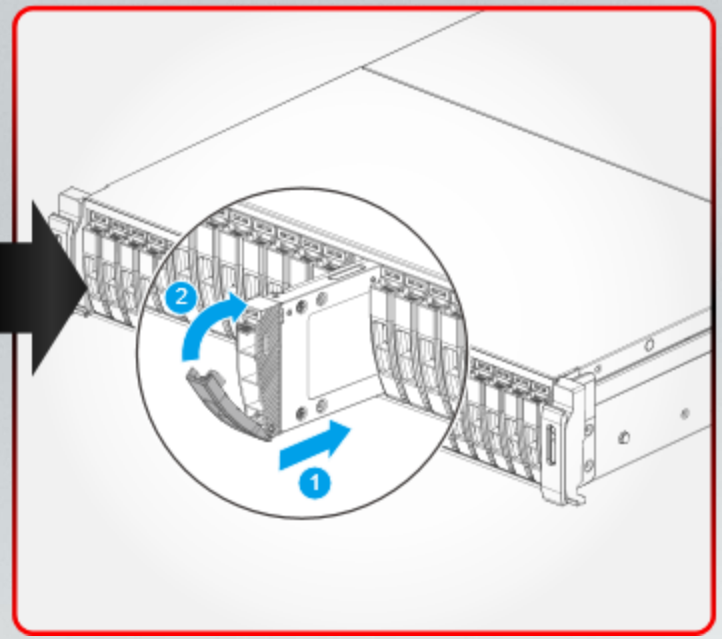
1. Remove the drive tray



2. Use a screwdriver



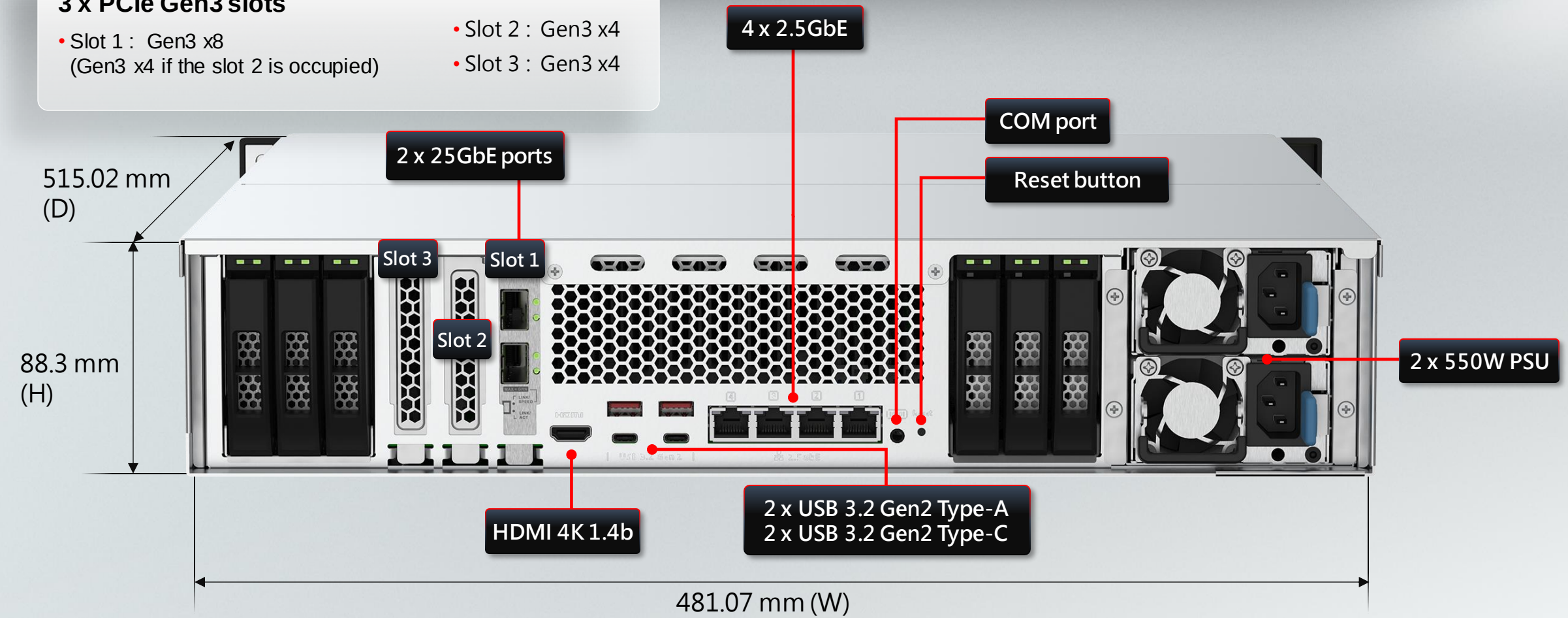
3. Insert the drive tray



TS-h3088XU-RP NAS rear view

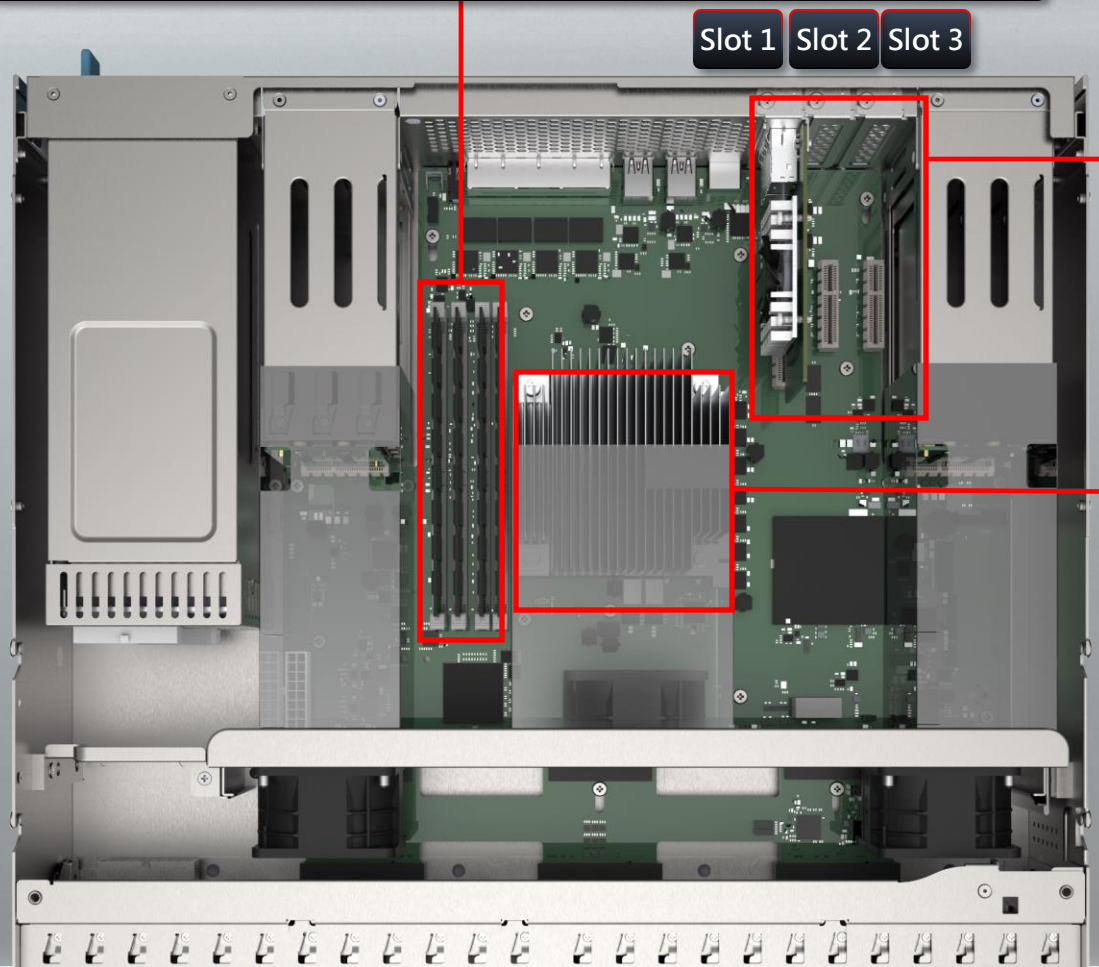
3 x PCIe Gen3 slots

- Slot 1 : Gen3 x8
  (Gen3 x4 if the slot 2 is occupied)
- Slot 2 : Gen3 x4
- Slot 3 : Gen3 x4



Geared for large businesses with high-performance components

4 x DDR4 UDIMM ECC RAM slots, up to 128GB



3 x PCIe Gen3 slots

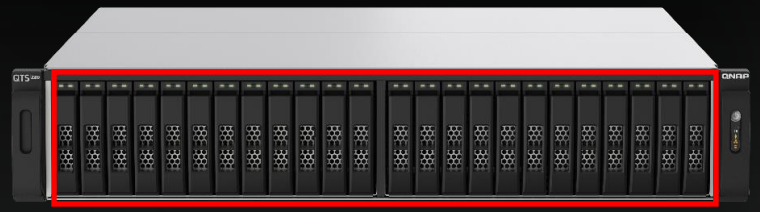
- Slot 1: Gen3 x8 (Gen3 x4 if the slot 2 is occupied)
- Slot 2: Gen3 x4
- Slot 3: Gen3 x4

Intel Xeon W 6-core and 8-core CPUs

- Xeon® W-1250 6C / 12T
  3.3 GHz processor (boost up to 4.7 GHz)
- Xeon® W-1270 8C / 16T
  3.4 GHz processor (boost up to 5.0 GHz)

Performance Test Environment

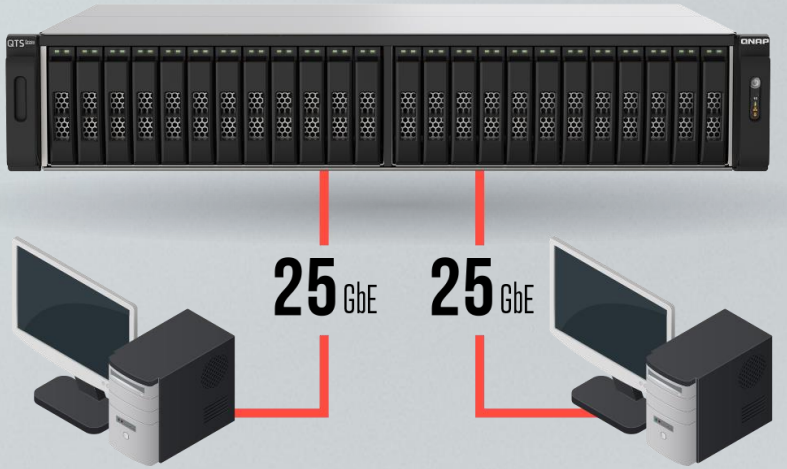
Best configuration of storage



The front 24 SSDs configured as data pool 2 in RAID 6 or 60. (yields the best performance)

The rear 6 SSDs configured as pool 1 in RAID 6 (as system and app pool/small data storage)

TS-h3088XU-RP-W1270



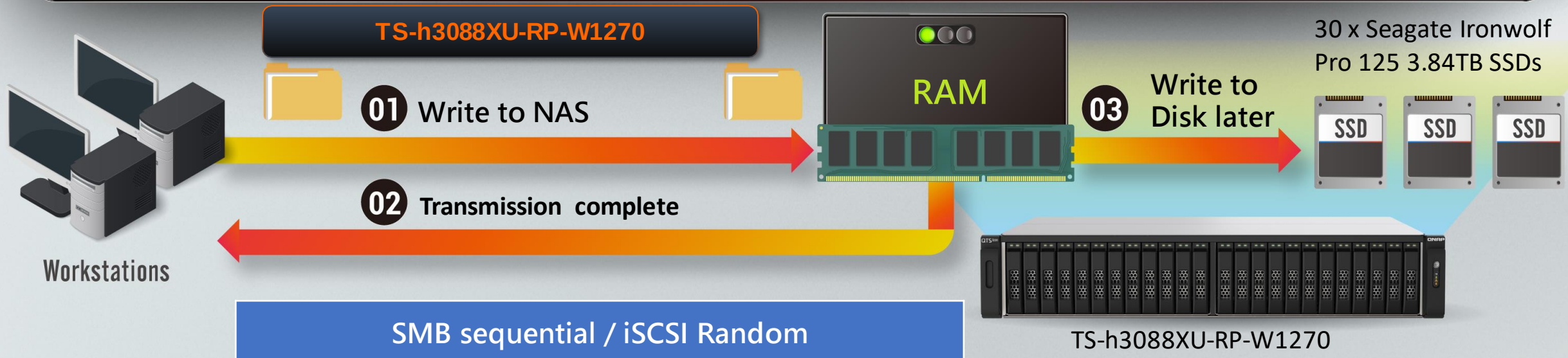
Random I/O test 4K block size LUN
Sequential I/O test 128K block size LUN

2 workstations, connected to TS-h3088XU through 25G:

(1) Simultaneously read and write 8GB file (= 16GB totally)

(2) Simultaneously read and write 64GB file (= 128GB totally)

File size < RAM: cache hit

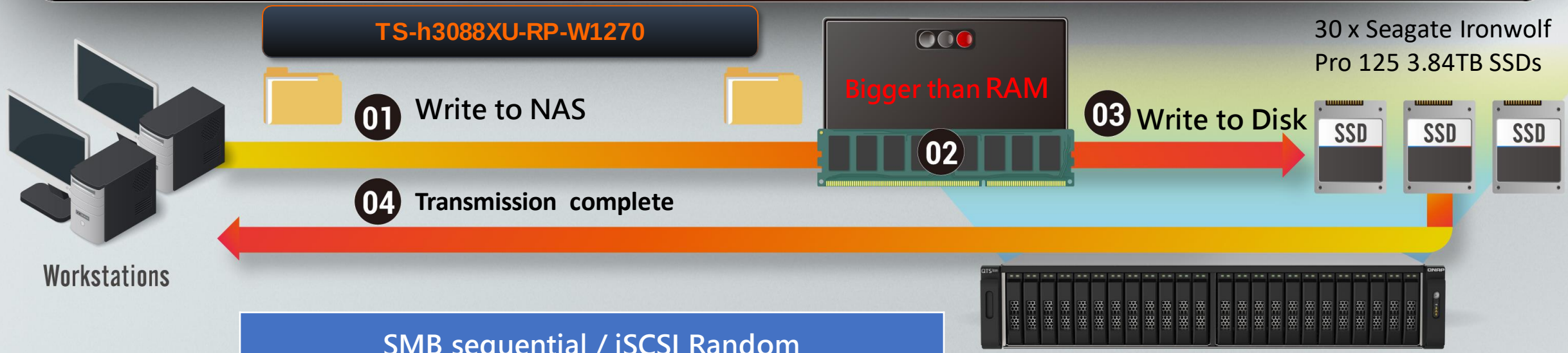


SMB sequential / iSCSI Random			
	IOPS / throughput	CPU loading (%)	Latency
Seq. read 512K (MB/s)	5438	16%	24
Seq. write 512K (MB/s)	4937	21%	26
Random read 4K (IOPS)	596,000	55%	0.43
Random write 4K (IOPS)	345,000	91%	0.74

Compared with the old Xeon-D AFA, the performance is improved more than 50%.

- Simultaneously read and write **8GB** file, the total amount is **16 GB** still less than NAS RAM size.
- Can get relatively high performance

File size > RAM: direct access to SSD



UP

Compared with the old Xeon-D AFA, the performance is improved more than 50%.

SMB sequential / iSCSI Random			
	IOPS / throughput	CPU loading (%)	Latency
Seq. read 512K (MB/s)	3867	60 %	17
Seq. write 512K (MB/s)	2226	75 %	29
Random read 4K (IOPS)	267,000	73 %	0.96
Random write 4K (IOPS)	236,000	91 %	1.08

- Simultaneously read and write **64GB** file, the total amount is **128 GB,** much larger than the RAM size.
- The direct access performance of this SSD array.

Maximize Data's Potential

Seagate Enterprise Storage Solution

Exos E

Capacity	**1, 2TB**
Interface	**SATA, SAS**
Format	**512N, 512e, 4Kn**
Workload Rating	**550TB/yr**
RR 4KQ16 Operating Power	**5.22W**
RPM	**7200**
Power Supply	**5 and 12V**
Warranty	**5 years**

Nytro 1351

Capacity	**3840, 1920, 960, 480, 240**
NAND Type	**3D TLC**
SR/SW Sust. (MB/s) (up to)	**564 / 536**
RR/RW Sust. Max IOPS (up to)	**94,000 / 59,000**
DWPD	**1**
TBW (TB)	**12,300**
Warranty	**5y**

IronWolf Pro 125 SSD

Capacity	**3840, 1920, 960, 480, 240**
NAND Type	**3D TLC**
SR/SW Sust. (MB/s) (up to)	**545/520**
RR/RW Sust. Max IOPS (up to)	**94,000 / 30,000**
DWPD	**1**
Warranty	**5y**
Rescue Plan	**3y**

Enterprise Hard Drives

Exos E Series Hard Drives

Purpose-built for enterprise applications and workloads

Exos 7E2000

The Datasphere's Only 2.5-Inch NL Hard Drive

TRUSTED

- 2M Hr MTBF, 5yr Warranty
- 6th generation 15K SFF HDD
- Full Security & Data Protection portfolio

EFFICIENT

- Accelerate performance with Enhanced Caching
- Cost effective alternative to SSD
- 12Gb/s SAS

VERSATILE

- Up to 2TB Capacity with 512N support
- TurboBoost™
- Fast Format™

Enterprise SSDs

Nytro SATA SSD Series

Designed for Data Center and Cloud Server Applications

Nytro 1351

More Computing, Better Value

GENERAL

- 3840, 1920, 960, 480, 240 GB
- SATA 6Gb/s interface, 2.5” & robust enterprise feature set
  - PLDP & end-to-end data protection
  - Seagate SHIELD™
- 2 endurance options
  - Nytro 1351: 1 DWPD for read intensive workloads

KEY FEATURES

- BIC write performance with Seagate DuraWrite™
- Easy deployment in legacy storage infrastructures
- High power efficiency with BIC IOPS/W
- Seagate Secure
- 2 million-hours MTBF and 5-year warranty

RUN WITH THE FASTEST

IRONWOLF NAS

Up to 25% more speed than other NAS drives.

IronWolf Pro 125 SSD

World's First High Endurance NAS SSD

ENDURANCE

- 1 DWPD high endurance and performance
- 5-year limited warranty protection plan
- 3-year Rescue Data Recovery Services plan

HARD AT WORK

- Ideal SSD solution for 24×7, multi-user NAS environments.
- IronWolf Health Management

SCALABLE

- Wide Range of Capacity Options: 240GB - 3.84TB
- NAS-optimized SSDs for NAS AFA or cache tiering
- workload support capable of 1 DWPD

Thank you!

Flexible and economic HDD + SSD hybrid configuration

- **Hybrid Configuration: 24 x HDDs + 6 x SSDs**

  24 x Seagate EXOS 7E2000 **2TB HDDs**
  + 6 x Seagate Nytro 1351 **1.92TB SSDs**
  = US$ 6,098.52

- **All Flash Configuration: 30 x SSDs**

  30 x Seagate Nytro 1351 **1.92TB SSDs**
  = US$ 12,492.6

For budget-limited enterprises, adopt a hybrid configuration to cut IT costs in half with same storage capacity.

Source:
1. https: //www.amazon.com/
2. https: //www.newegg.com/

QNAP

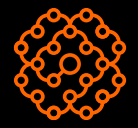
QuTS hero operating system

ZFS file system: Optimized operating system for AFA

TS-h3088XU-RP is shipped with the QuTS hero operating system which is based on the ZFS file system. It can provide the data integrity, safety, and efficiency required for all flash storage.

Data Efficiency

- Inline Compression & Inline deduplication
- Improve the SSD lifespan
- Easily expanded to PB-level storage



Data Integrity

- Data self-healing
- COW mechanism can avoid data loss that occurred on power outage.

Data Protection

- A nearly unlimited number of 65,536 snapshots (supports folder/LUN)
- New RAID Protection
- WORM (write once read many)

Disaster Recovery

- SnapSync real-time data mirror
- Snapshot Replica
- HBS3

QNAP

Data Efficiency

How to determine the SSD endurance

- SSD life is ended when the total data written has reached the defined capacity.
- How can the server prolong the SSD lifespan?

Example: 3.84TB SSD with 1DW/D for 7x24 5-year warranty
Lifespan = 3840(GB) * 1 (DW/D) * 365 (days) * 5 (years) = 7008 TBW

Endurance/Reliability				
Lifetime Endurance (Drive Writes per Day)	1	1	1	
Total Bytes Written to Flash (TB)	12,300	6,140	3,070	
Non-recoverable Read Errors per Bits Read	1 per 10E17	1 per 10E17	1 per 10E17	
Mean Time Between Failures (MTBF, hours)	2,000,000	2,000,000	2,000,000	
Warranty, Limited (years)[5]	5	5	5	

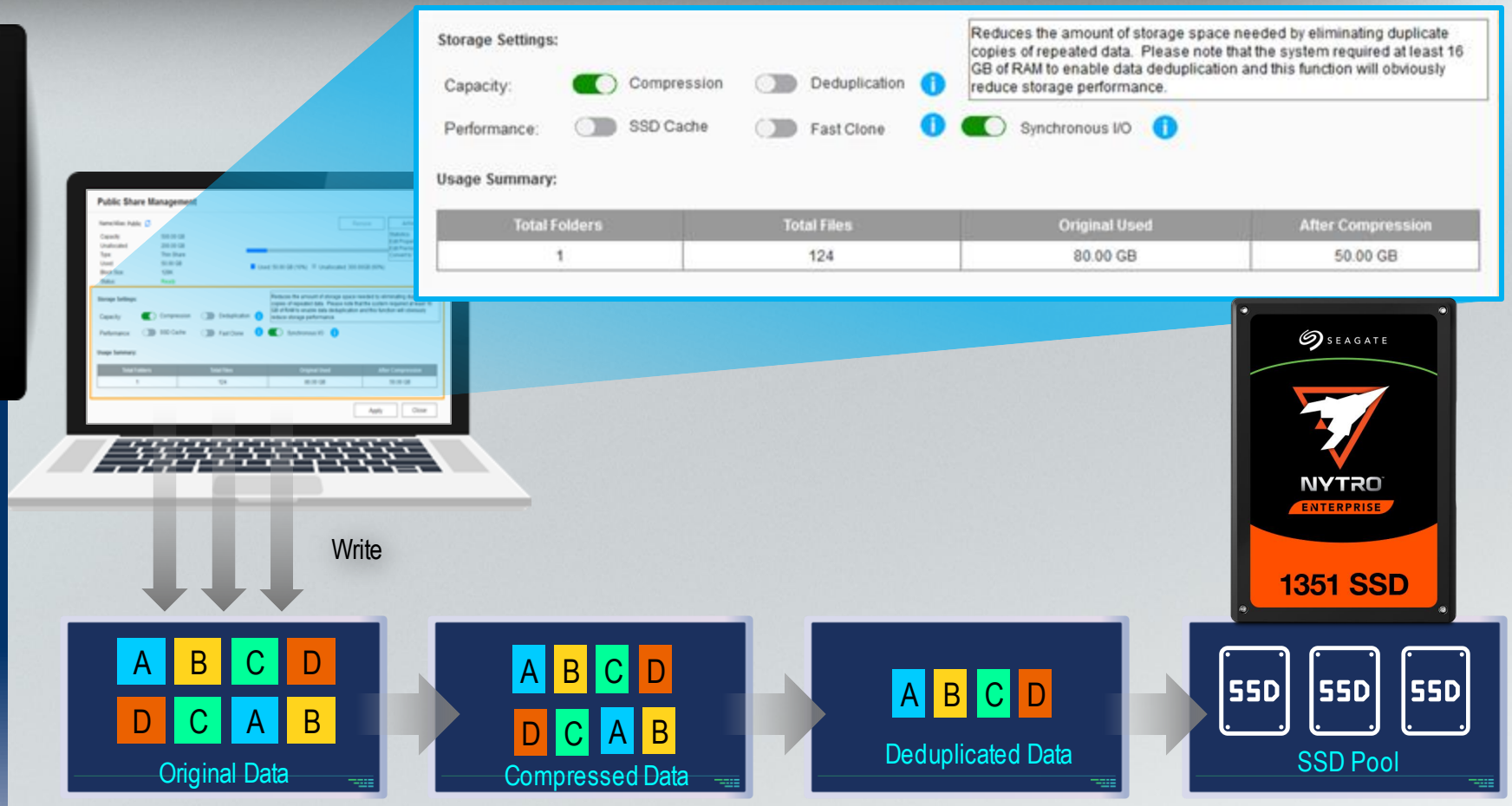
Data source: www.seagate.com

Powerful data reduction –
Extend the SSD endurance

It only works with inline processing before writing

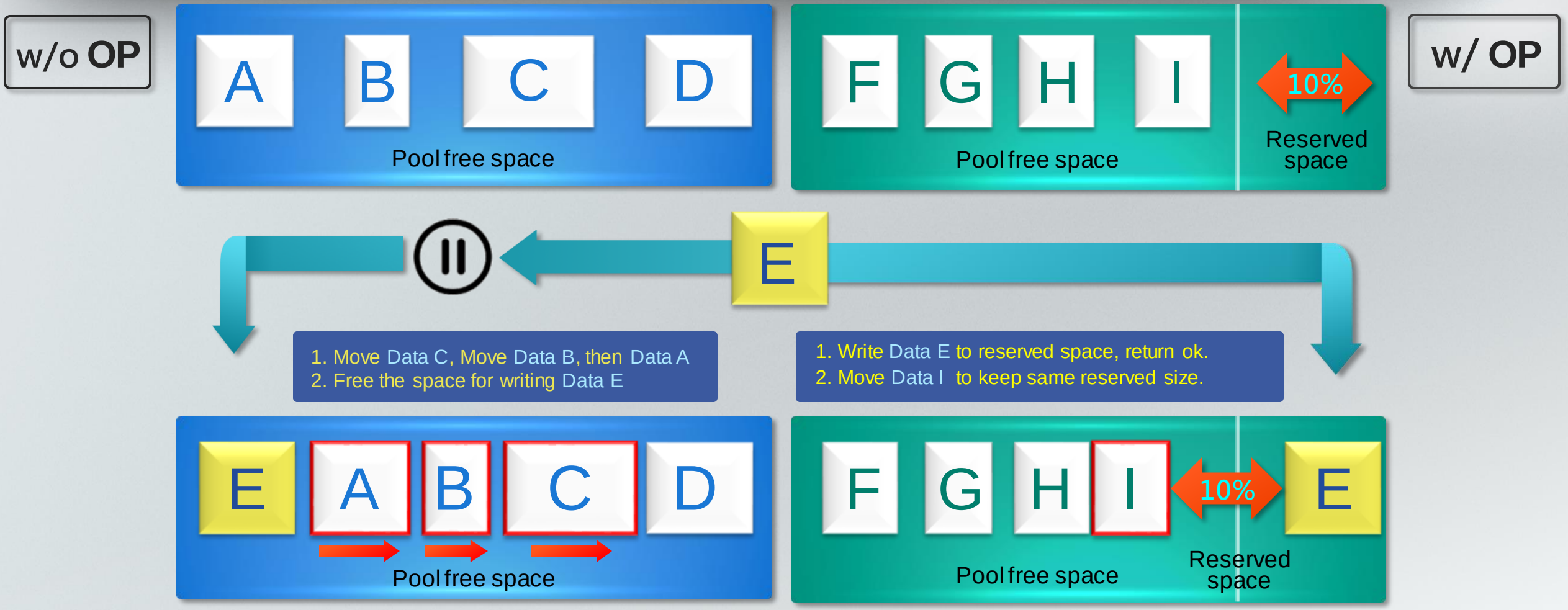
ZFS file system with inline deduplication compression feature

It's the best choice to pair with the all-flash and SSD storage because it reduces the data size and pattern that need to be written to the SSD directly.

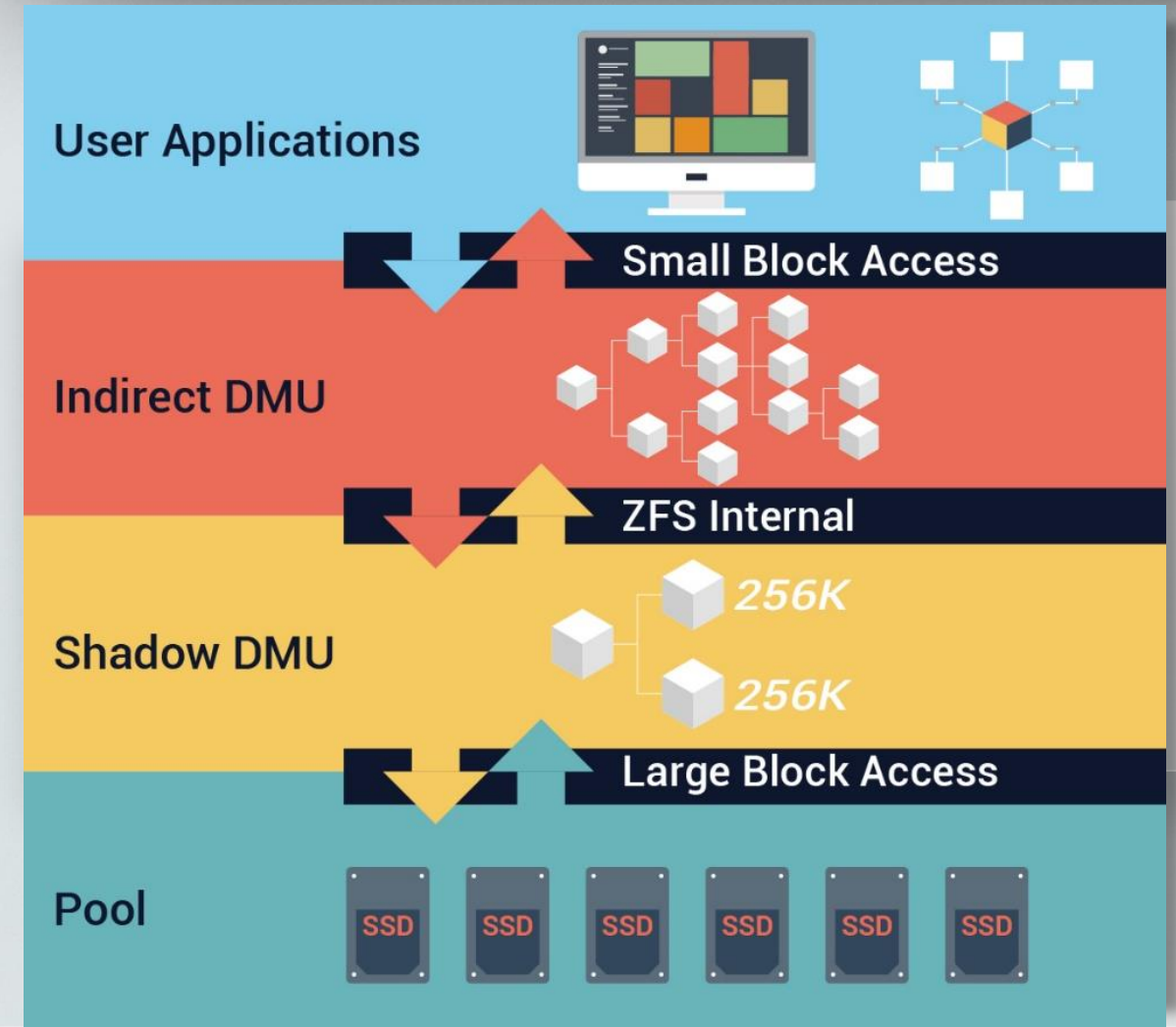


Storage Pool Over Provisioning

Improve the performance for fragmented pool (The scenario for small block)



Write Coalescing



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

QNAP

Data Protection

Snapshot Protection (65,536)

Shared Folder Snapshot

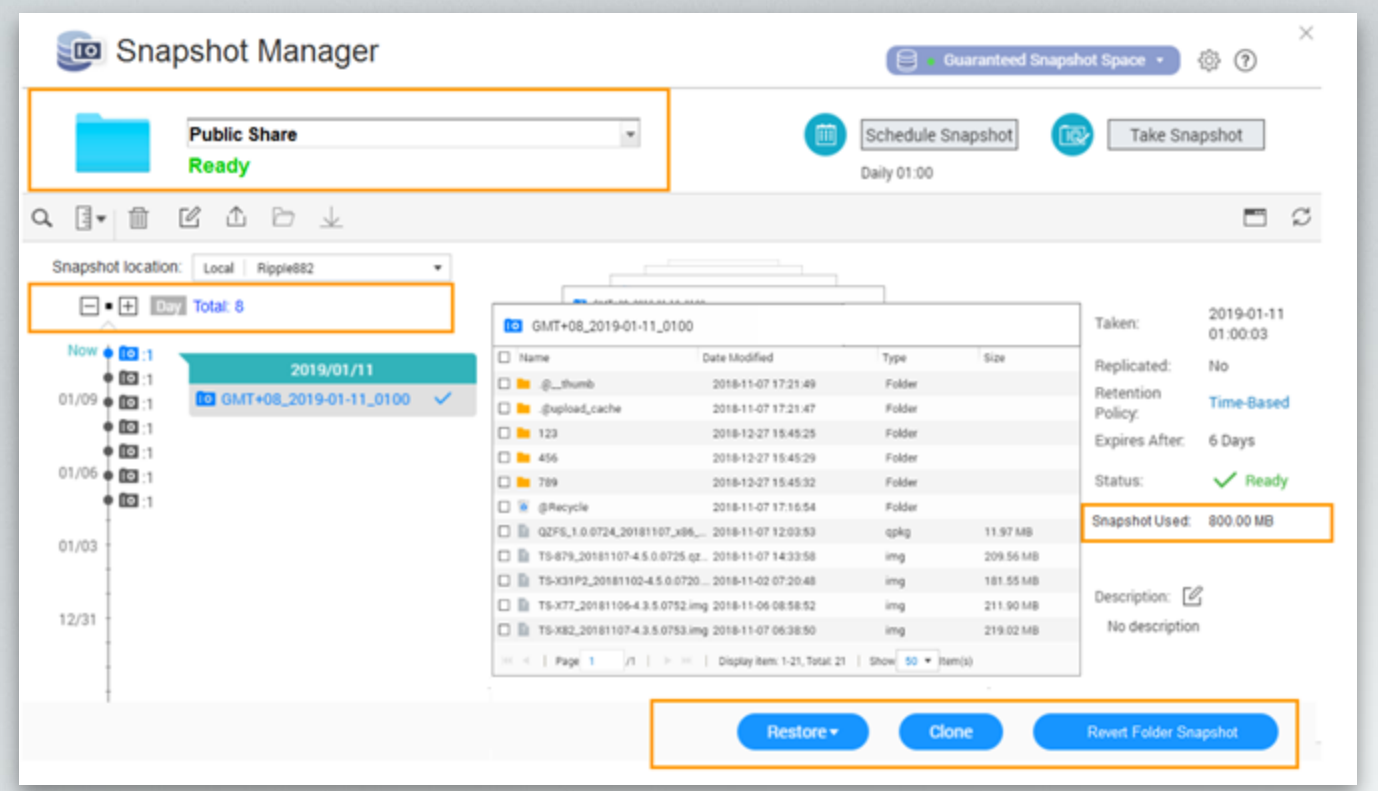
LUN Snapshot

NAS maximum **65,536**

Shared Folder

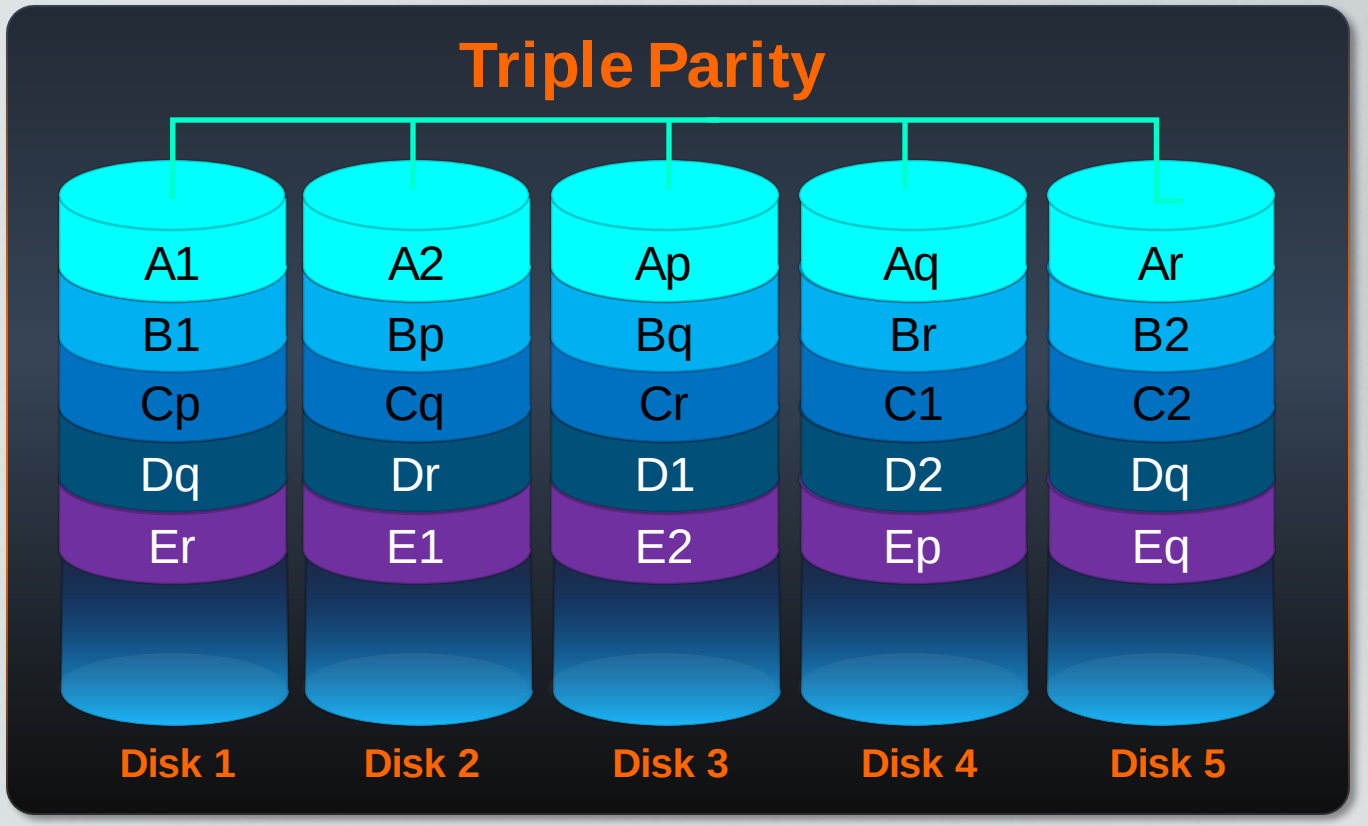
iSCSI / FC LUN

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

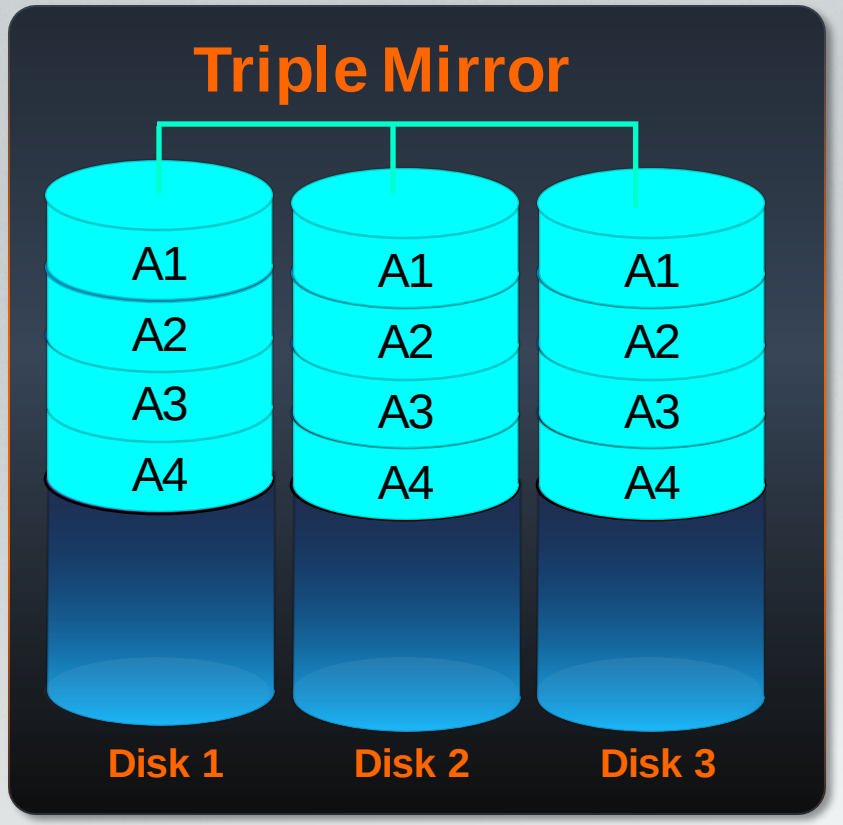


RAID types with even higher security: Triple Parity & Triple Mirror

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)

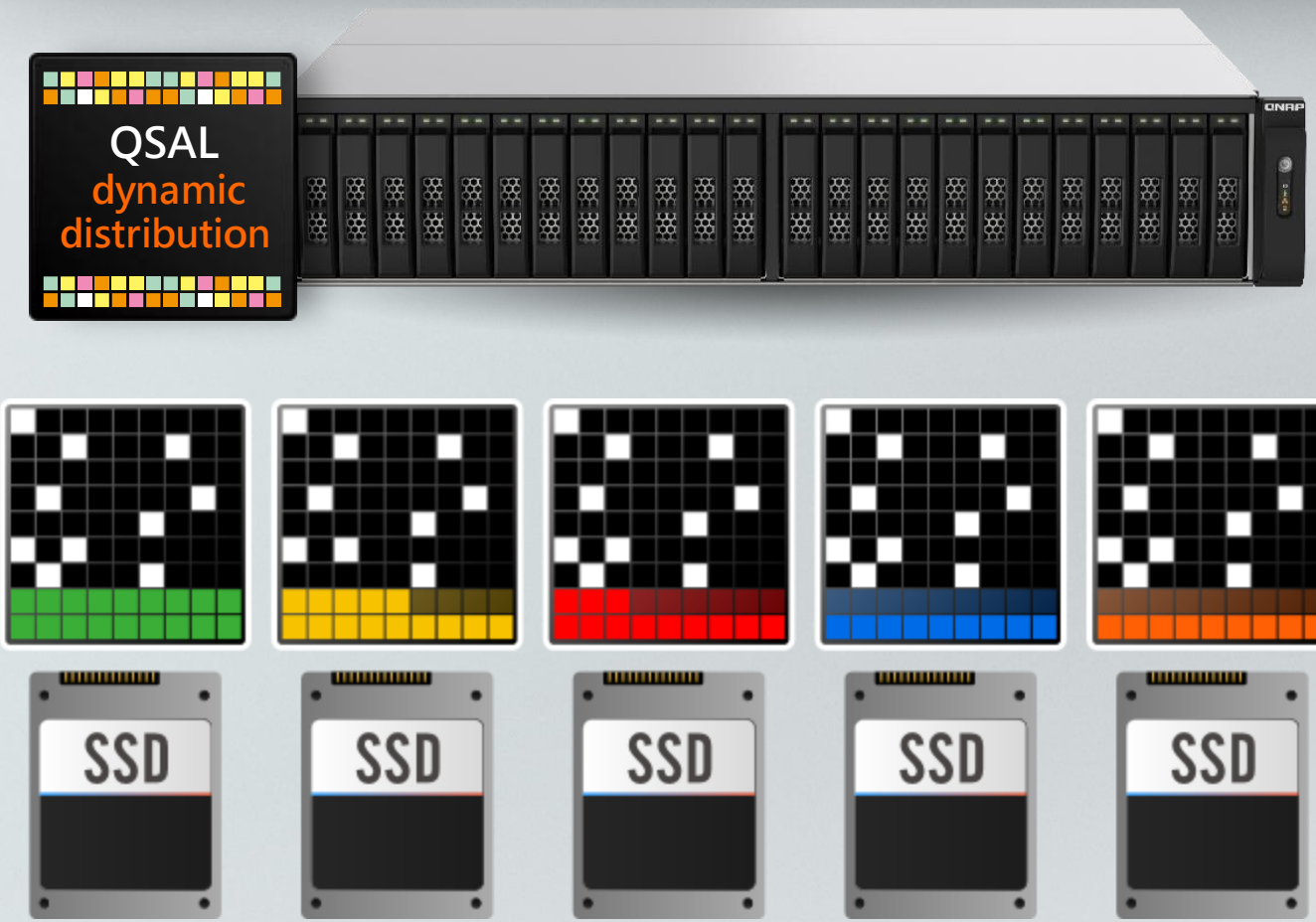


3 sets of identical data for redundant tolerances, will give you 3 times the protection.

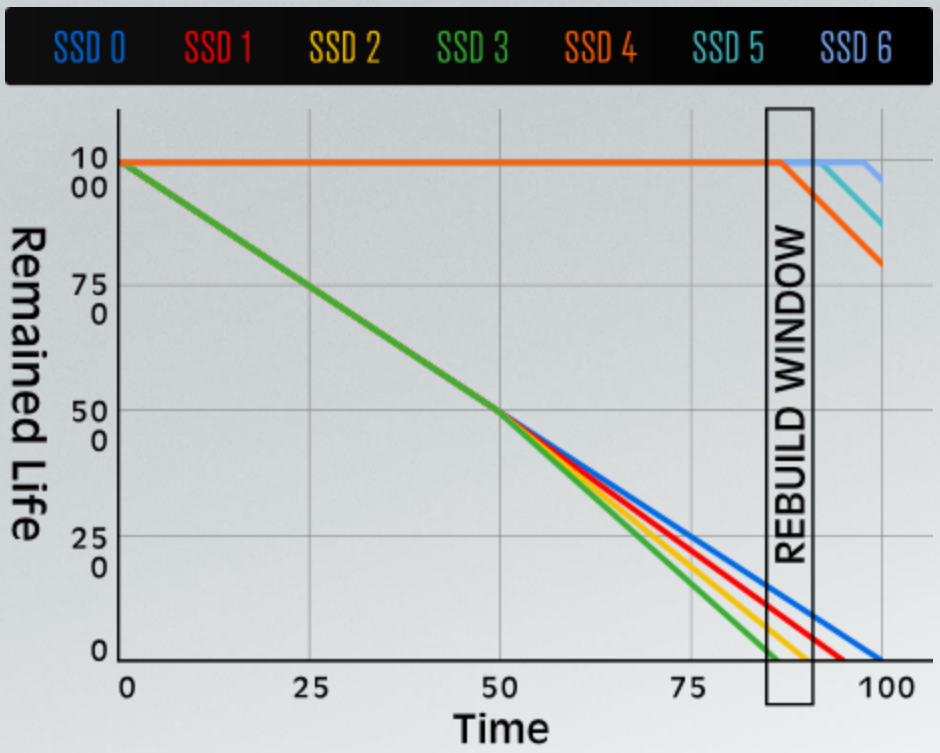


Patented QSAL technology: preventing multiple SSD malfunctioning at the same time

(QSAL will be available from Q4 2020)



Corresponding to SSD RAID 5 / 6 / 50 / 60 / TP(Triple Parity) will be enabled by default automatically.

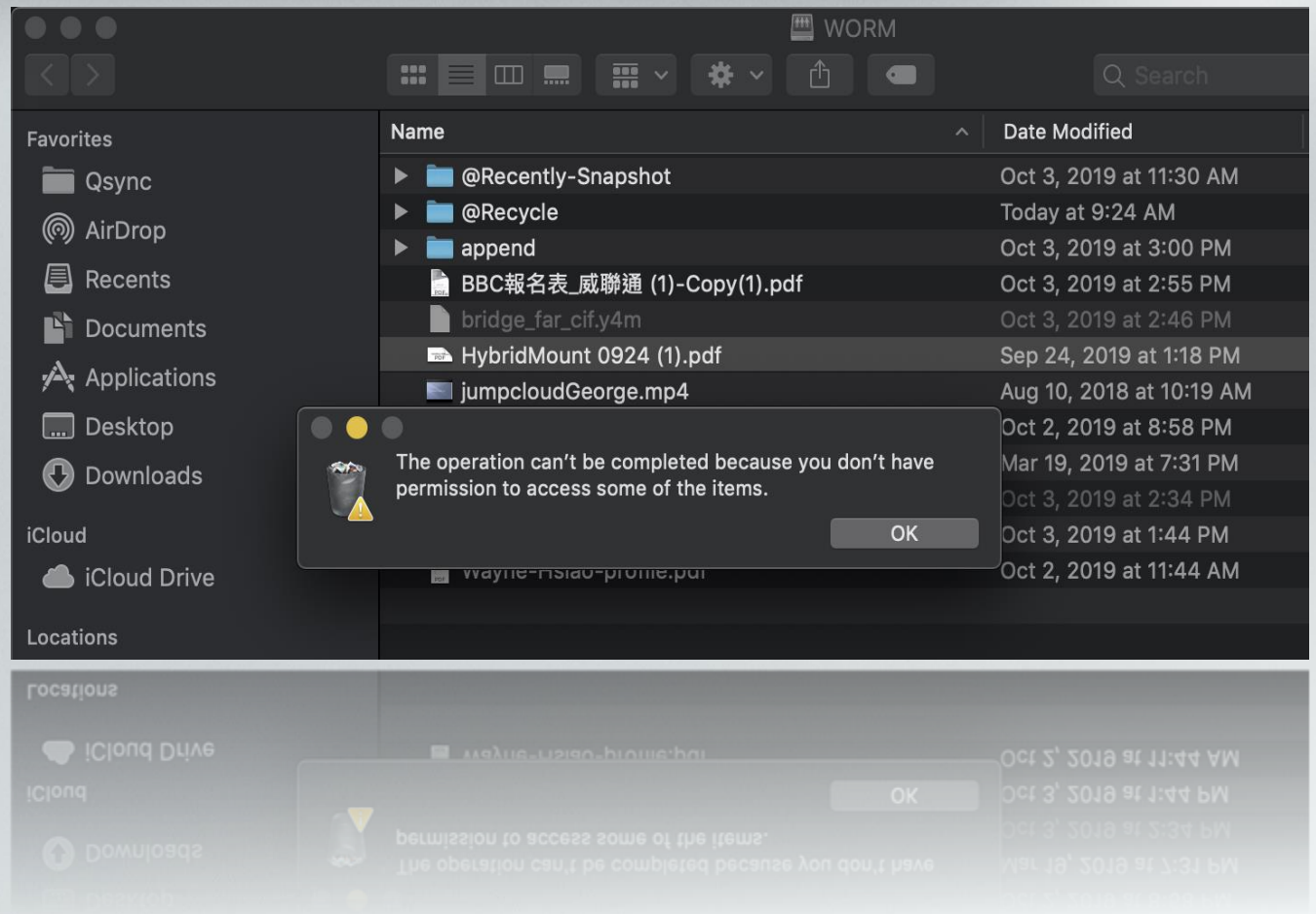


WORM (Write Once Read Many times)

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 QTS hero UI or SSH commands (QCLI).

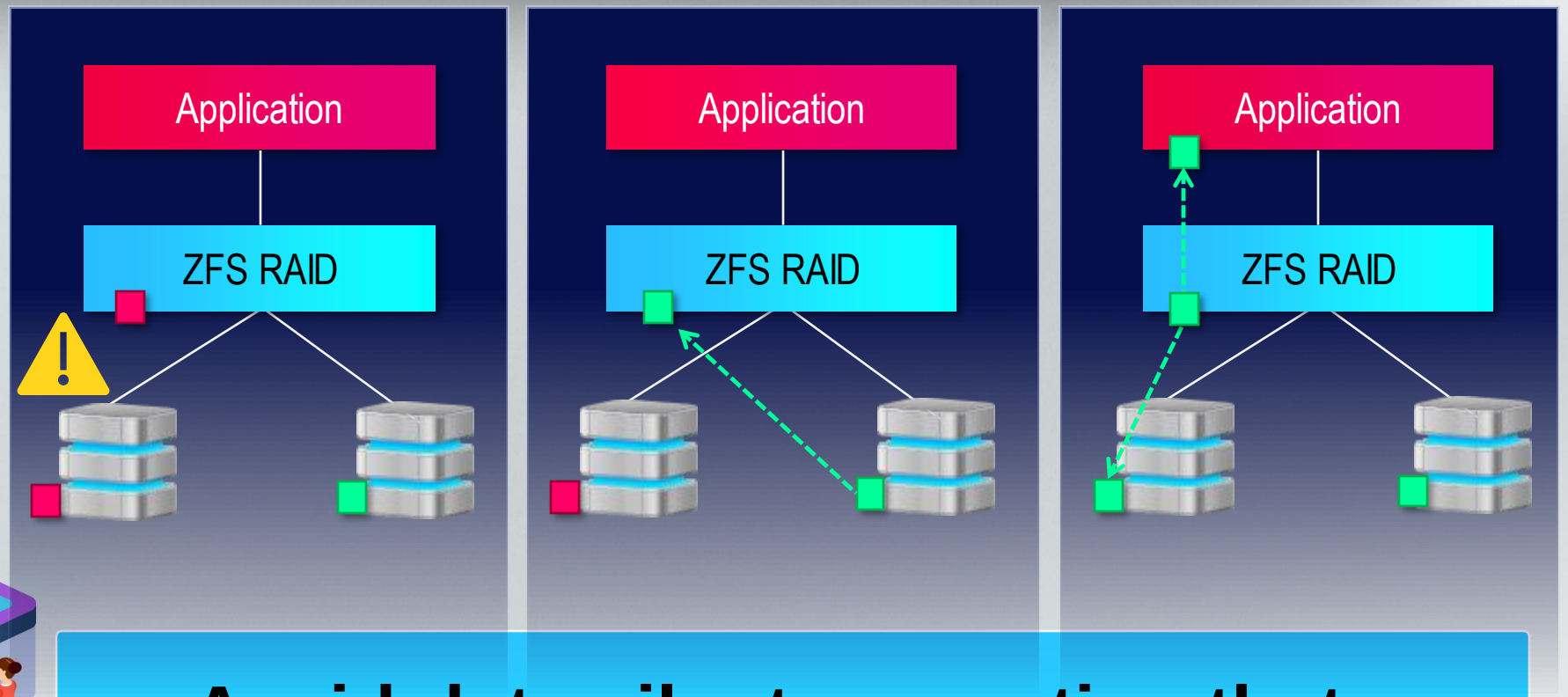
Compliance Mode : Have to take the Storage Pool offline and remove the Pool if want to destroy data.



QNAP

Data Integrity

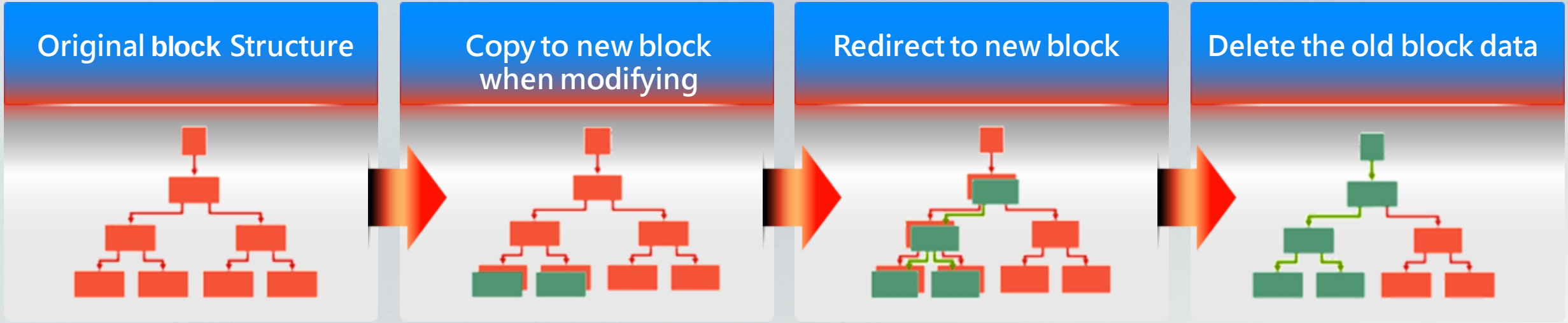
Silent data corruption & self-healing



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.

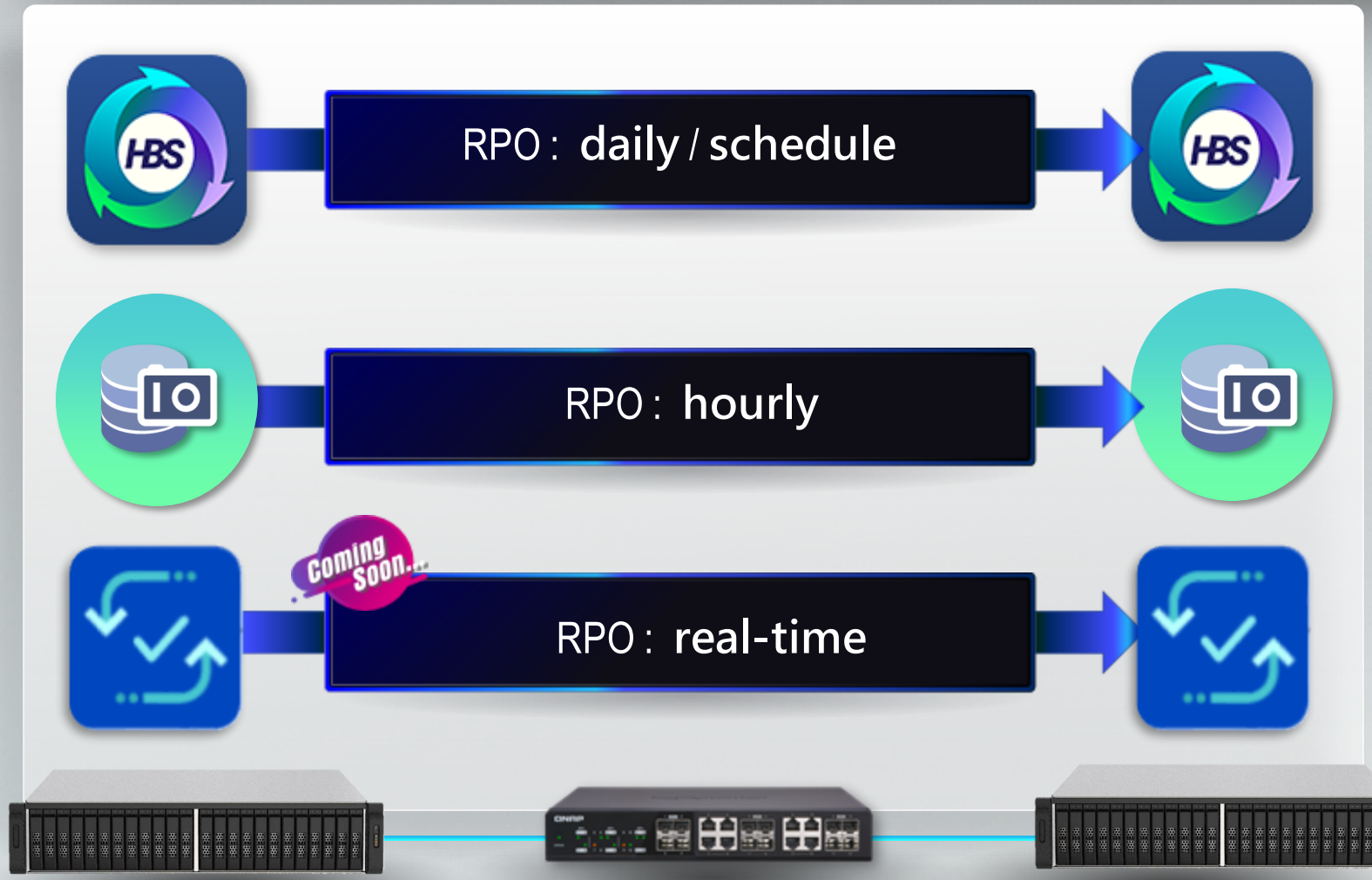


QNAP

Disaster Recovery

Three-layer backup solution

Builds the most complete data backup protection



HBS 3 :
File level, multi-version management

Snapshot & Replica:
File level, multi-version management. The most lightweight snapshot without affecting storage performance.

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

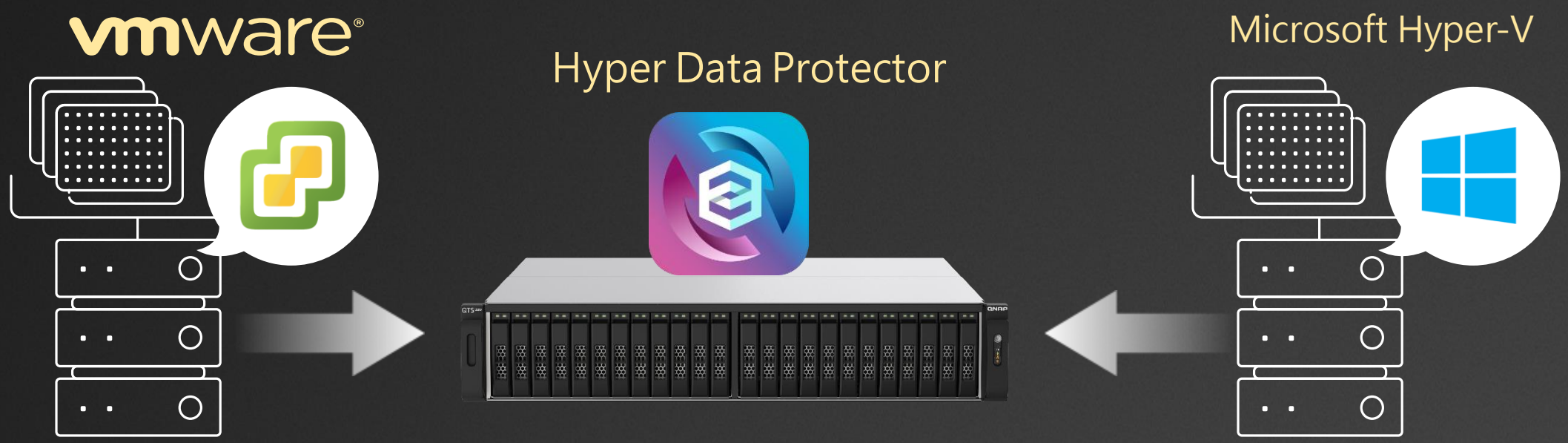
QNAP

Best Accompanying Apps

Hyper Data Protector: All-in-one active backup solution for virtual machines

For AFA that is most suitable for virtualized applications, it is particularly important to has a solution be able to back up virtual machines.

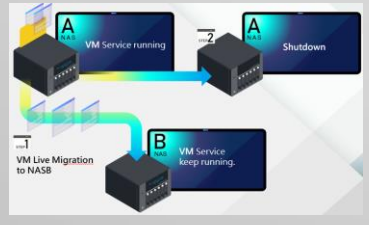
- Supports VMware, Microsoft Hyper-V
- Unlimited VM backups and license-free
- Active backup solution
- Restore at any time point



Virtualization Station and Container station for using NAS as an all-in-one appliance

Virtualization Station

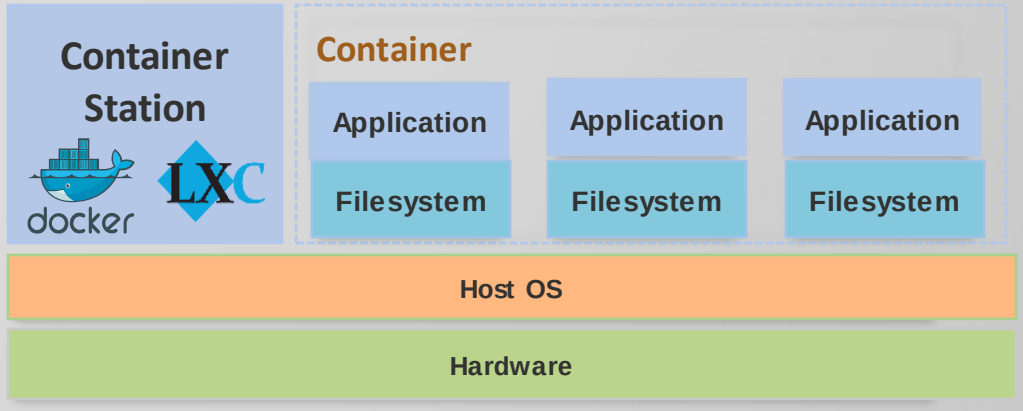
Virtualization Station allows you to create virtual machines on Turbo NAS to install Windows, Linux®, UNIX® and Android operating systems.



Supports Live Migration

Container Station

Supports two light virtualization technologies, LXC and Docker®. You can run a complete Linux® virtual machine on the QNAP NAS, and download thousands of applications from the Docker® Hub online collection



Establish and run dual systems - Ubuntu & QuTS hero

Ubuntu Linux Station

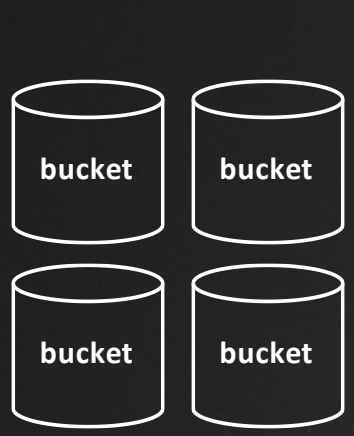
- Run QuTS hero and Ubuntu dual system, dual system application to enjoy.
- One-click installation of multiple versions Ubunutu: 16.04 / 18.04 / 20.04
- Ubuntu Software Center enjoy a variety of application downloads
- Remotely access the Ubuntu Linux desktop through a browser / Directly use the HDMI output screen in the server-room for maintenance.

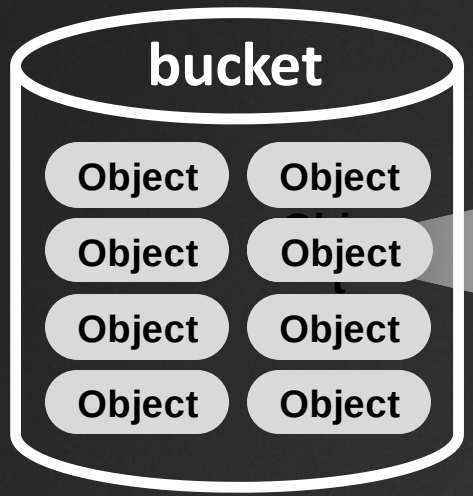
QuObject for simulating a S3 storage with NAS

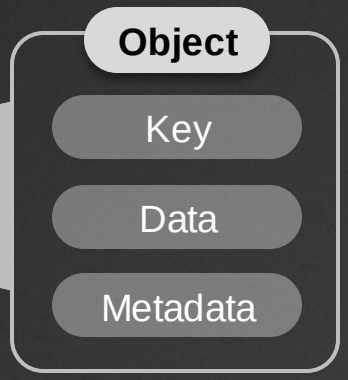
Storage Space=Shared Folder
Buckets=Folder

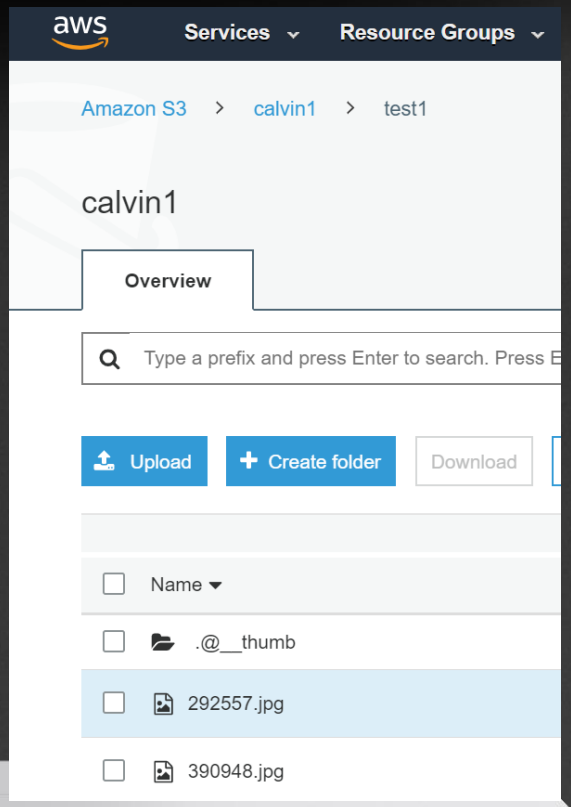
https://calvin1.s3.ap-east-1.amazonaws.com/test1/292557.jpg

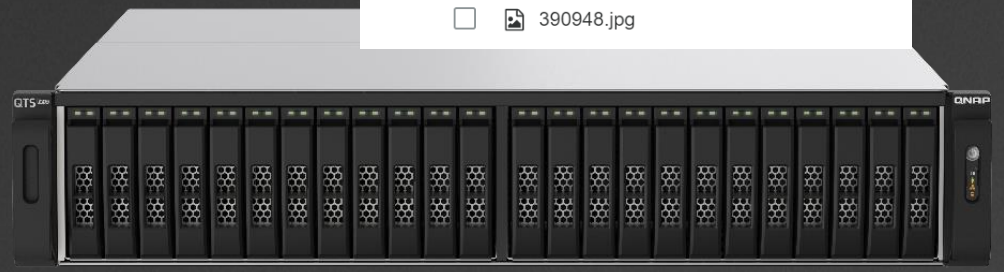
- calvin1 — bucket
- s3.ap-east-1.amazonaws.com — Cloud service provider
- test1 — Folder
- 292557.jpg — File name







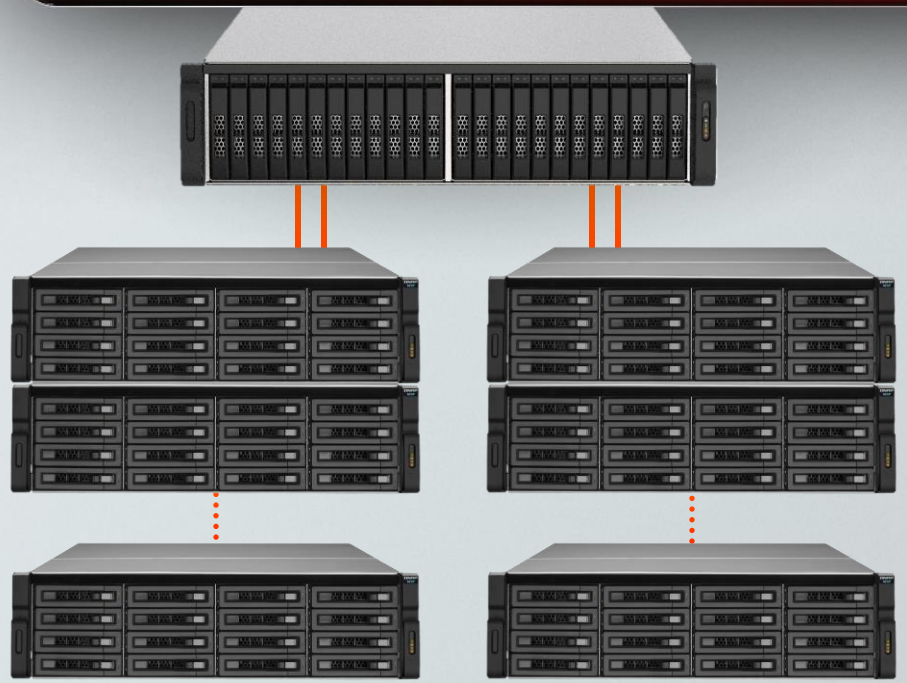




QNAP

Storage Capacity Expansion

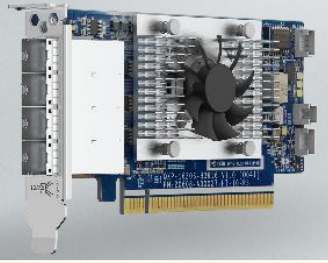
Expand capacity massively with SAS 12Gb/s JBOD expansion units



TL-R1620Sep-RP TL-R1620Sep-RP

- Connect up to **16 QNAP SAS JBOD** per host
  - REXP-1620U-RP, REXP-1220U-RP
  - TL-R1220Sep-RP, TL-R1620Sep-RP
- Each NAS host support up to **286 drives, 4~5PB of raw** capacity

SAS HBA (optional purchase)



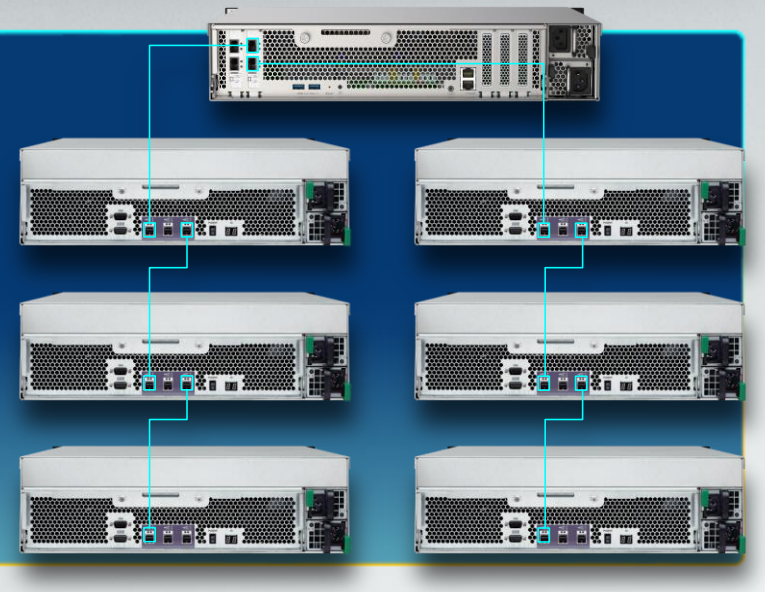
	SAS-12G2E	QXP-1620S-B3616W
SAS controller	Broadcom SAS3008	Broadcom SAS3616W
PCI bus	PCIe Gen3 x8	PCIe Gen3 x16
IOPS	1X	1.8X
Bandwidth	6,000 MBps	13,700 MBps
Port	External 8 port	External 16 port
Connector	2 x SFF8644	4 x SFF8644

Note: The above data is for reference only based on IC vendor's datasheets.
Actual performance could be different due to host, expansion unit or drives.

Amazing massive storage:

The best data carrier of big data analysis/edge computing/AI inference

Only PB-level shared folder is enough to store the huge data matrix.



Deep Learning

QNAP

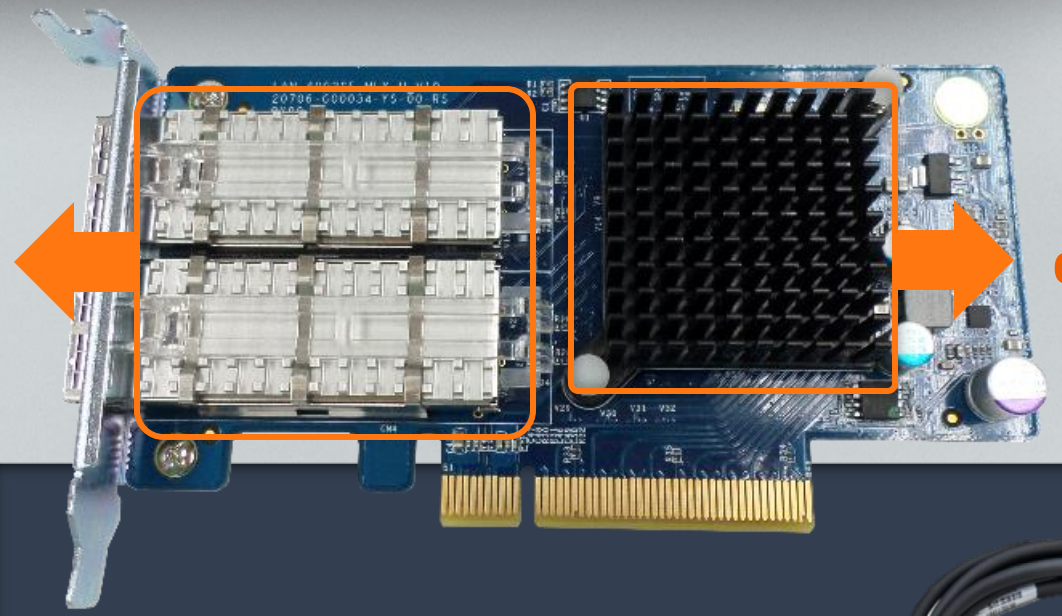
Business-class accessories

QNAP dual-port 40GbE SmartNIC cards

LAN-40G2SF-MLX

- Based on **Mellanox ConnectX®-3 Pro** network IC
- 2 x 40GbE QSFP+ ports
- Supports iSER/RoCE offload

QNAP® × Mellanox® TECHNOLOGIES



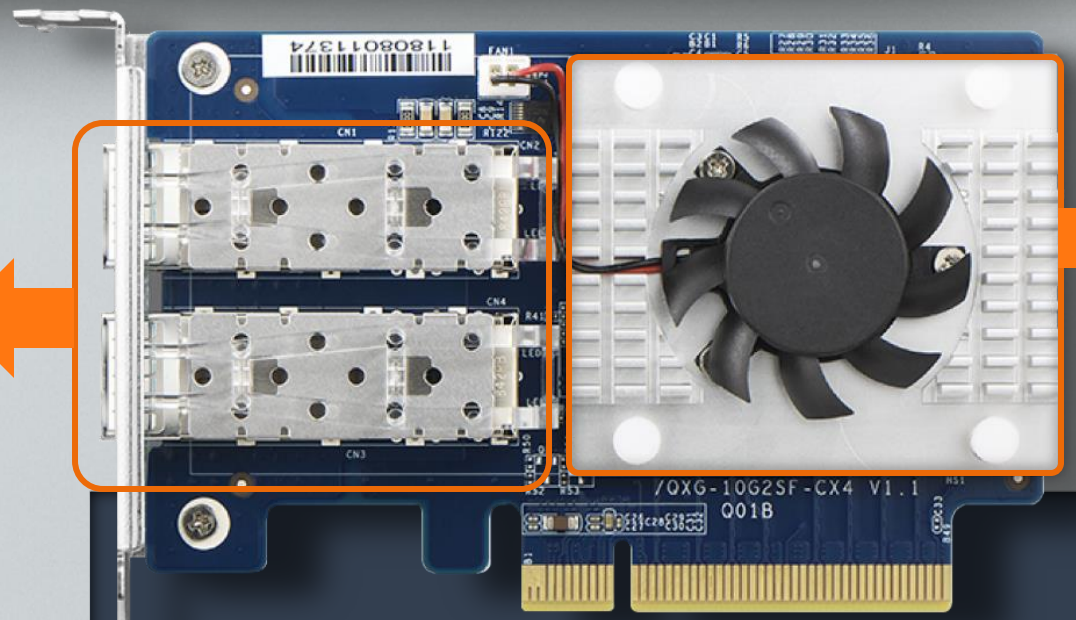
Thermal dissipation

Optional
QSFP+ 40GbE
transceivers
and cables

QNAP dual-port 25GbE SmartNIC cards

QXG-25G2SF-CX4

- Based on **Mellanox ConnectX®-4 Lx** network IC
- 2 x 25GbE SFP28 ports (compatible with 10GbE/1Gb)
- Supports iSER/RoCE offload

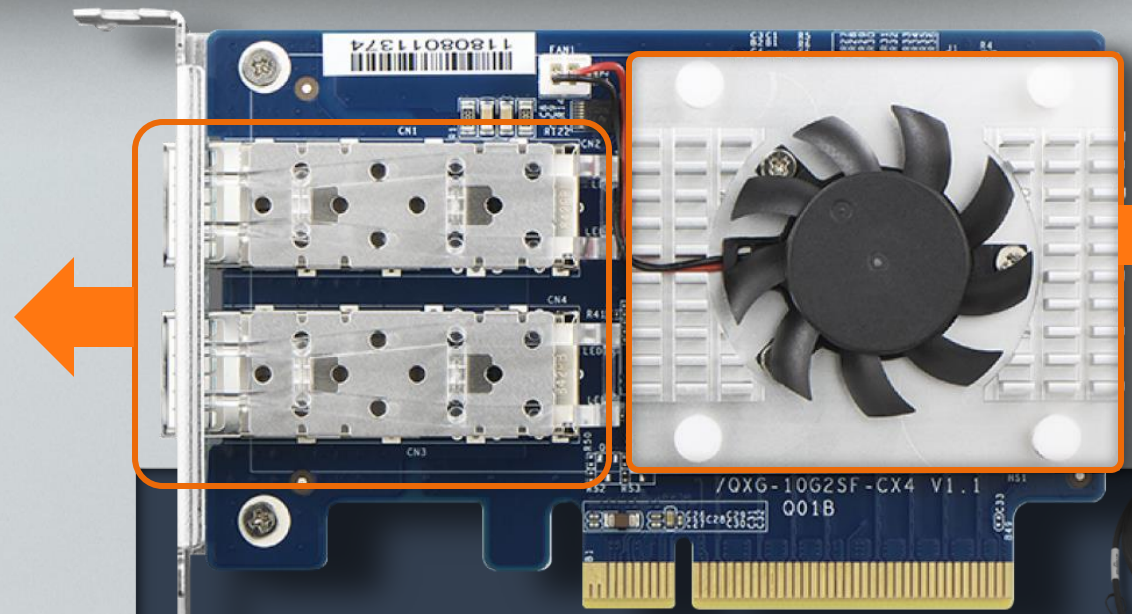


Optional **SFP28 25GbE** transceivers and cables

QNAP dual-port 10GbE SmartNIC cards

QXG-10G2SF-CX4

- Based on **Mellanox ConnectX®-4 Lx** network IC
- 2 x 10GbE SFP+ ports
- Supports iSER/RoCE offload



Thermal dissipation

Optional
SFP+ 10GbE cable or
TRX-10GSFP-SR-MLX
transceiver

Fibre Channel SAN
32Gb & 16Gb storage solutions

QXP-32G2FC

2-port 32Gbps FC card

QXP-16G2FC

2-port 16Gbps FC card

Designed for NAS, high-performance and efficient QNAP FC expansion cards*

* Installation on Windows are Linux hosts is not supported

Includes optical FC transceivers

- TRX-32GFCSFP-SR
  32Gb/16Gb/8Gb
- TRX-16GFCSFP-SR
  16Gb/8Gb/4Gb

Note: cables are not included.