

**QNAP**



**QNAP NAS**

**Expand storage space with  
security & performance in mind**



Your Challenges, Our Solutions:

**Storage budget is limited,  
but data growth is not!**

**How to expand storage capacity?**

# Why NAS Expansion Important

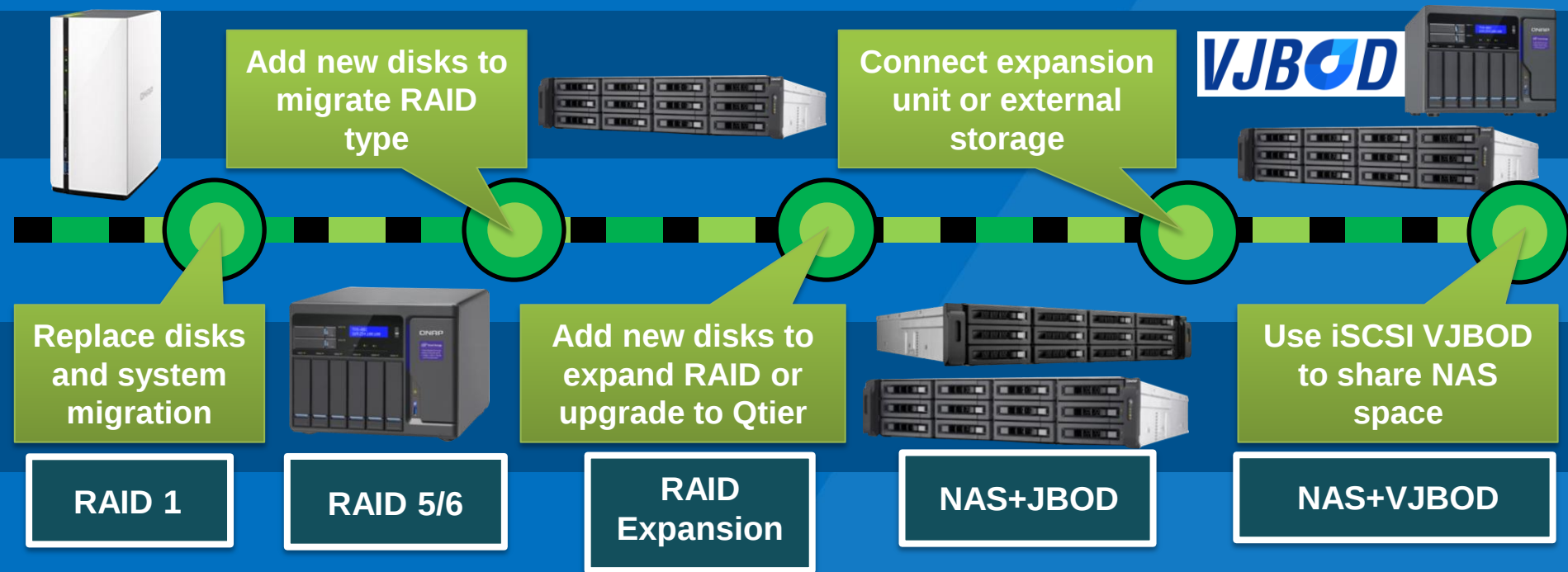
When purchasing NAS with 8+ bays, about 50% of SMBs choose not to fill all bays initially

Primary considerations are budget and flexibility

As your company grows, IT managers will need a solid plan to ensure continued operation



# QNAP NAS Road to Expansion



# NAS grows as your applications expand

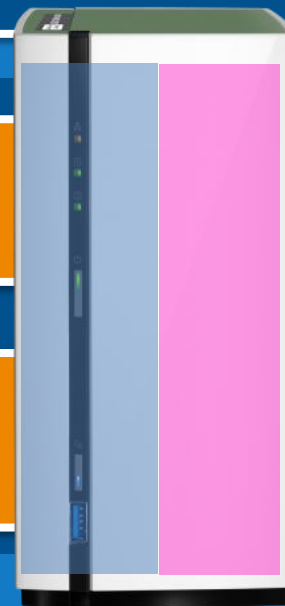
**Scenario :** Mike is a YouTuber and he always stores his materials in the TS-228A. With his followers increasing, he now needs a NAS with more storage to keep more video...

## Challenge:

How to expand a 2-bay NAS?

## Solution:

Replace Disks One by One, System Migration



# Replace Disk One By One

Disk capacity/price ratio drops year over year

Mainstream size from 2 TB in 2010 to 8 TB now

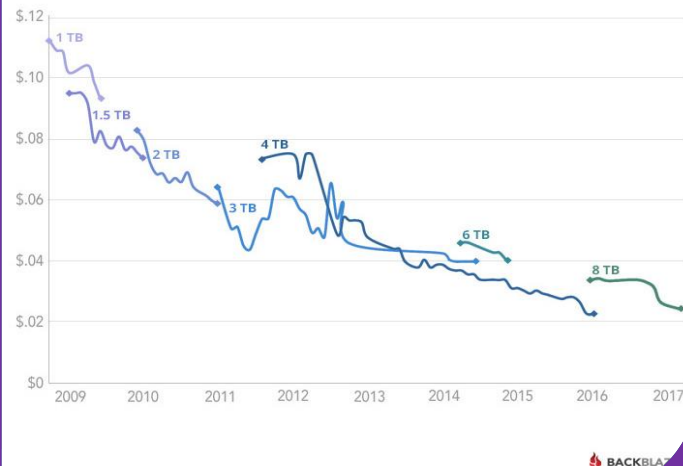
QNAP NAS RAID 1/5/6/10 support replacing disk on line

Plan B

When planning for expansion, technology advancements need to be evaluated.

Backblaze Average Cost per Drive Size

By Quarter: Q1 2009 - Q2 2017



Source: <https://www.backblaze.com/blog/hard-drive-cost-per-gigabyte/>

# 3 Steps to Replace Disks

1

Prepare new disks with the same number as the NAS's RAID group

2

Storage & Snapshot > Storage/Snapshot > Manage Storage Pool > Select a RAID Group > Manage > Select "Replace disk one by one"

3

Following wizard guide to unplug, plug in and sync disk one by one

Use "Priority" to increase disk re-sync speed

## Replace Disks One by One

Change

Please select at least one disk.

| Disk   | Model                     | Type | Capacity | Status | Description                |
|--------|---------------------------|------|----------|--------|----------------------------|
| Disk 5 | Seagate ST2000NM0053-1... | HDD  | 1.82 TB  | Good   | You can replace this disk. |
| Disk 6 | Seagate ST2000NM0053-1... | HDD  | 1.82 TB  | Good   | You can replace this disk. |

Source Disk RAID Group: Group 2 (RAID 1 Disk Group)

Disks <NAS Host: Disk 5 Disk 6>

You can expand the RAID group capacity to approximately: 1.811 TB

Expand Capacity

Cancel

"Replace disk one by one" only supports replacing smaller disk with larger disk

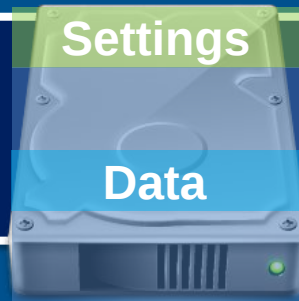


# System Migration With RAID Auto Re-Ordering

On QNAP NAS, system configurations will be backed up to disks

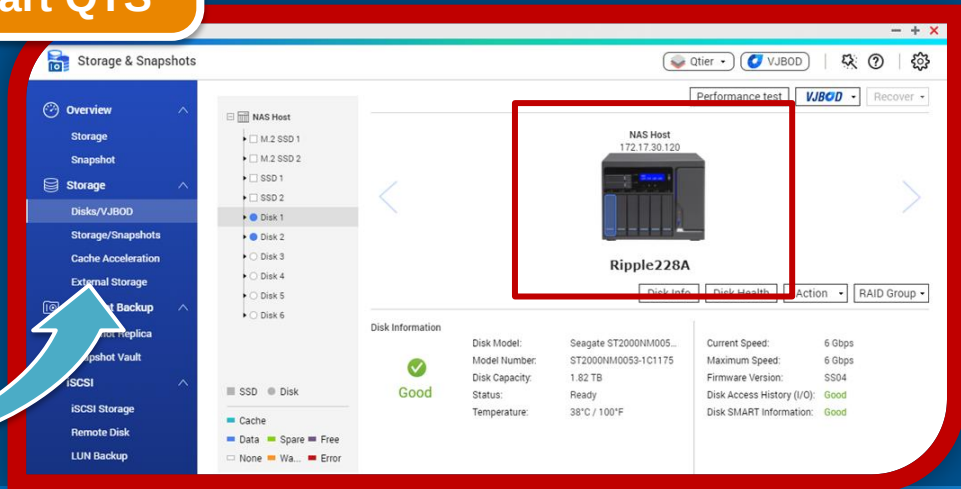
When purchasing new NAS, the system settings can be migrated with disk directly

RAID order can be auto detected :  
No need to worry if plug in the  
disk with a wrong order



# 3 Steps to Migrate System

- 1 Initialize new NAS and upgrade to the latest QTS version
- 2 Shutdown both NAS and plug original disks into new NAS
- 3 Power on new NAS and start QTS



System migration may not support migrating NAS from an enterprise model back to an entry one. For details please visit:  
[http://docs.qnap.com/nas/4.3/cat2/en/index.html?system\\_migration.htm](http://docs.qnap.com/nas/4.3/cat2/en/index.html?system_migration.htm)

# Advanced Tip: Safety Detach Storage Pool

For non-system volume and storage pool, the space & disk can be safely detached and roaming between NAS

1

Storage/Snapshot> Storage Pool manage  
> Remove > Safely Detach

2

Remove and plug in disks to new NAS

3

Storage & Snapshot > Disk/VJBOD  
> Recover > Scan all free drives

## Storage Pool 2 Management

Name/Alias: Storage Pool 2

Capacity: 214.07 GB  
Allocated: 68.62 GB  
Unallocated: 145.46 GB  
Status: Ready

Remove

Remove Pool

Safely Detach Pool

Snapshot used: 0.00 % (-)

Alert: Disabled

RAID Group of Storage Pool 2

| Name/Alias       | Capacity  | RAID Type | B... | Bitmap   | Status | Resync Speed | Priority             |
|------------------|-----------|-----------|------|----------|--------|--------------|----------------------|
| RAID Group 2     | 214.07... | RAID 1    | No   | Disabled | Ready  | --           | Default (Medium ...) |
| NAS Host: Disk 7 | 223.57... | Good      |      |          |        |              |                      |
| NAS Host: Disk 8 | 223.57... | Good      |      |          |        |              |                      |

Close

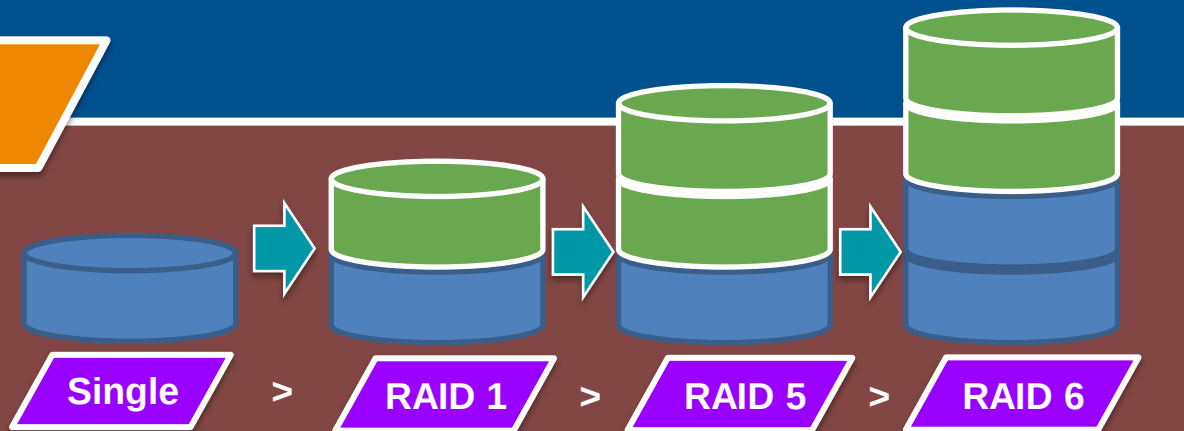
# Start expanding from only 1 disk

Challenge: How to expand a single disk to benefit from RAID protection?

Solution:

RAID Migration

With method  
based on "Reshape"

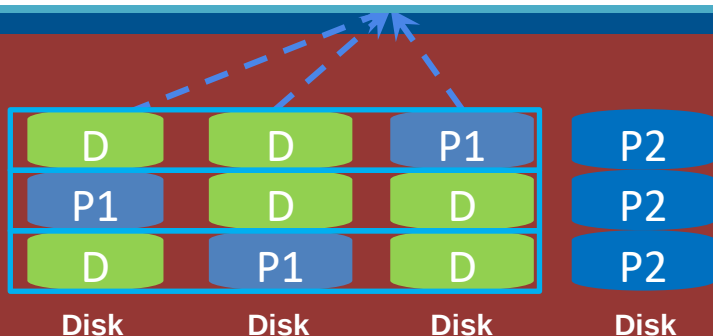


# RAID Migration

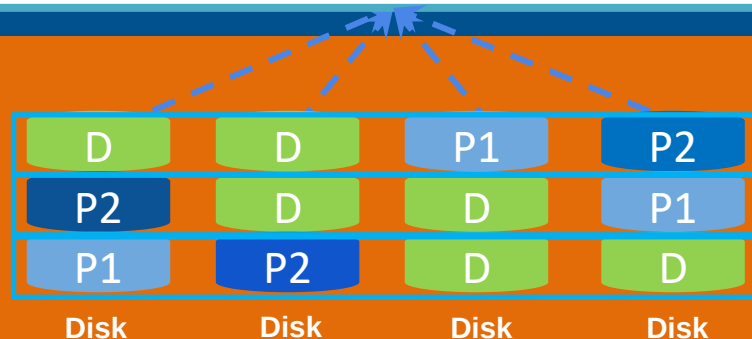
Supports migrating Single > RAID 1 > RAID 5 > RAID 6

Using Linux RAID Reshape: Requiring longer time to re-sync every disk to ensure post-migration performance

DSM 6.2: Using RAID Recover for faster migration but the newly added disk will not be used when reading data



QTS 4.3.4: Using RAID Reshape to ensure 4 disks can all be used when read data



# 3 Steps to Migrate a RAID

1 Plug in new disks into the NAS

2 Storage/Snapshot> Pool Management> RAID Manage> Migrate

3 Follow the wizard to select new disk for migration

**Storage & Snapshots**

**Storage Pool 1 Management**

Storage Pool

Name/Alias: Storage Pool 1

Capacity: 457.95 GB

Allocated: 71.14 GB

Unallocated: 386.81 GB

Status: Ready

RAID Group of Storage Pool 1

| Name/Alias      | Capacity  | RAID Type | B... | Bitmap   | Status | Resync Speed |
|-----------------|-----------|-----------|------|----------|--------|--------------|
| RAID Group 1    | 457.95... | RAID 5    | Yes  | Disabled | Ready  | --           |
| NAS Host Disk 1 | 238.47... | Good      |      |          |        |              |
| NAS Host Disk 2 | 238.47... | Good      |      |          |        |              |
| NAS Host Disk 3 | 238.47... | Good      |      |          |        |              |

**Migrate**

Select Disk(s)

Enclosure Unit: NAS Host [available disk(s): 4/30]

Please select at least one disk

| <input checked="" type="checkbox"/> | Disk    | Model               | Type | Bus Type | Capacity  | Status |
|-------------------------------------|---------|---------------------|------|----------|-----------|--------|
| <input checked="" type="checkbox"/> | Disk 17 | Samsung SSD 850 ... | SSD  | SATA     | 238.47 GB | Good   |
| <input checked="" type="checkbox"/> | Disk 18 | Samsung SSD 850 ... | SSD  | SATA     | 238.47 GB | Good   |
| <input checked="" type="checkbox"/> | Disk 19 | Samsung SSD 850 ... | SSD  | SATA     | 238.47 GB | Good   |
| <input checked="" type="checkbox"/> | Disk 20 | Samsung SSD 850 ... | SSD  | SATA     | 238.47 GB | Good   |

RAID Type: RAID 5 -> RAID 6      Estimated Capacity: 1.34 TB

Apply      Cancel



Demo:

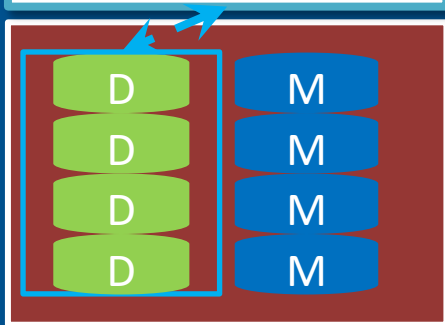
Use QNAP NAS to perform  
**RAID migration**

# Advanced Tip: RAID 1 Parallel Read

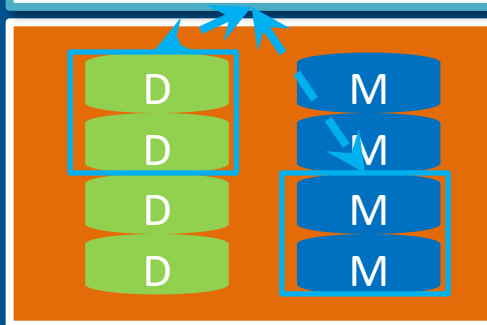
QNAP RAID 1 support read data from both disks at the same time

Apart from normal RAID 1, performance can be boosted even when migrate from Single to RAID 1

Normal  
RAID 1



QNAP RAID1 with  
Parallel Read



SSD RAID 1  
Sequential  
Read Increase  
50%

HDD RAID 1  
Sequential  
Read Increase  
10%



The actual performance may differ based on NAS models

# Advanced Tip: move to RAID 50/60 from 5/6

- ✓ QNAP RAID 50/60 sub-array can only be set up when creating storage pool
- ✓ To move to RAID 50/60 from 5/6, purchase NAS with doubled bays
- ✓ Create RAID 50/60 with minimum disks (6/8) and copy data to it
- ✓ Finally, add old disks to new sub-arrays

## RAID 50 Storage Pool

A1 A2 B1 B2 C1 C2

### RAID 5 #1

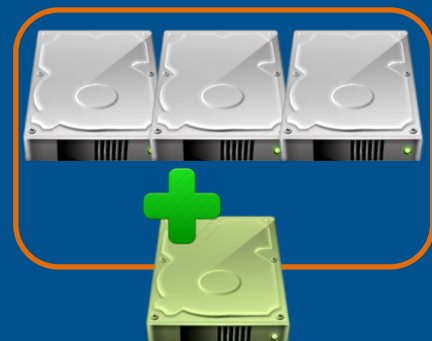
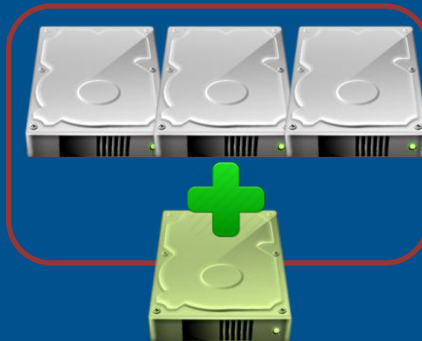


Disk Disk Disk

### RAID 5 #2



Disk Disk Disk





# Bigger Capacity Comes Greater Responsibility

**Scenario:** Mike has finished system and RAID migration, but the requirement of capacity, performance and protection also increase as his channel grows

## Challenges:

How to increase capacity, performance and protection with the same RAID configuration?

## Solutions:

Add new disks to the RAID group

Upgrade to Qtier Pool (With optional QM2 expansion card)

Setup hot spare disk

# RAID 5/6/50/60 Add Disk

RAID 5/6/50/60 support online RAID expansion

RAID 50/60 has dedicated UI to add disks to all sub-arrays at once

Expanding Storage Pool

Select an Expansion Method

☐ Create and add a new RAID group

Adds a new RAID group to the storage pool to expand the available capacity. Please note that the new RAID group will use Linear to append to the storage pool. To avoid data loss in the event of the RAID group failing, please ensure you have a proper backup plan.

☒ Add new disk(s) to an existing RAID group

Add one or more disks to an existing RAID group to expand the available capacity of a storage pool.

RAID Group 1, RAID Group 2

For RAID 50/60, the selected disks will be divided up equally between the sub-arrays.

Next Cancel

Step 1/3



Best-practice under limited budget: load half # of bays first for future 50/60 expansion

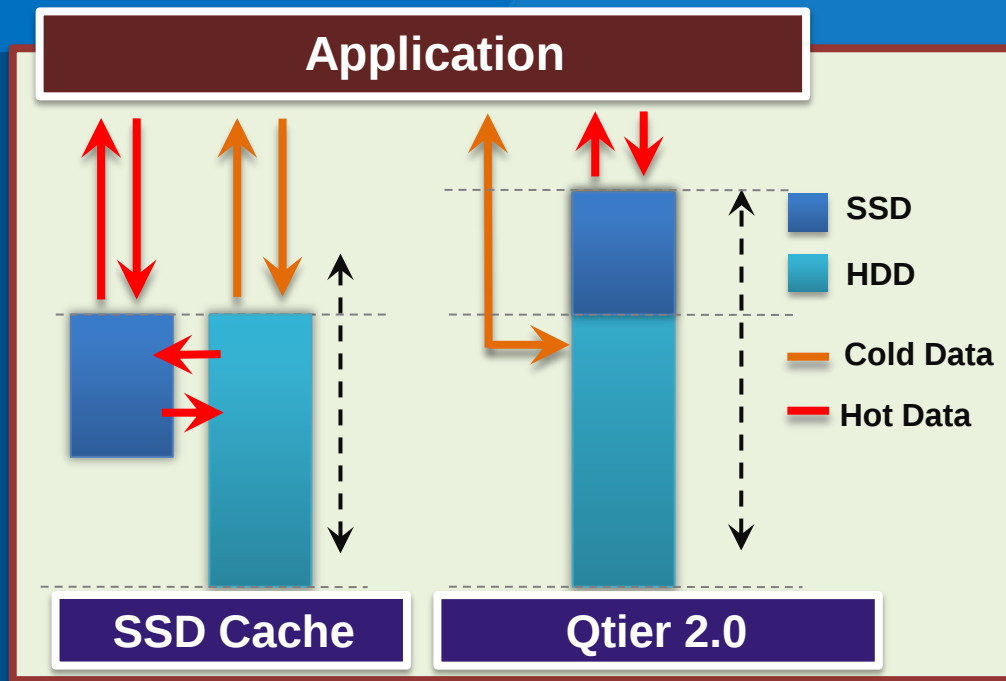
# Replace SSD Cache with Qtier 2.0

## SSD Cache

- The cache space cannot be used as data storage

## Qtier 2.0 Auto Tiering

- The SSD can be used to store hot data directly, **resulting to higher ROI from purchased SSD**

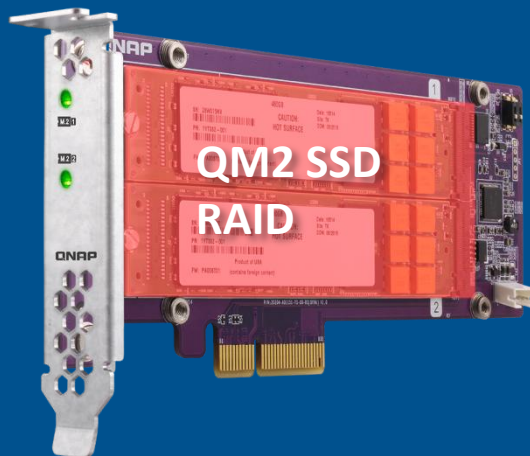
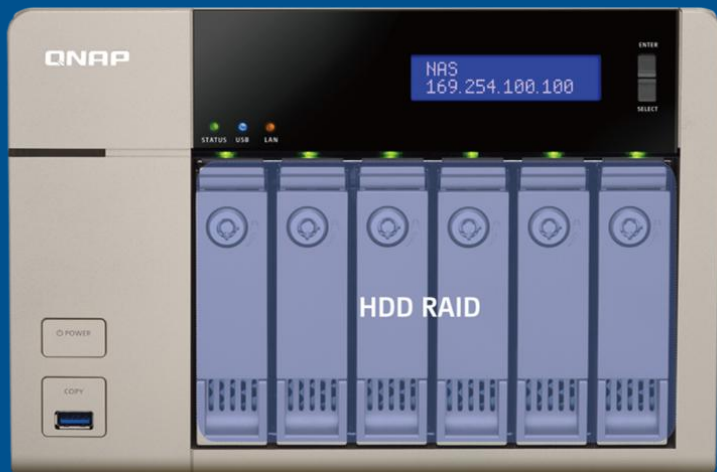


# Use QM2 to upgrade to Qtier

QM2 Support TS-x31X, 53B and above (with PCIe expansion slots)

QM2 also has T sensor and heat sink to ensure disk health

NAS can be expanded with 2 additional M.2 SSD slots



# 3 Steps to expand RAID group

1

Insert new disks into NAS

2

Storage/Snapshot > Storage Pool Management >  
Expand Storage Pool > Expand or Upgrade to Qtier

3

Follow the wizard to select new disks

**Storage Pool 1 Management**

Storage Pool

Name/Alias: Storage Pool 1

Capacity: 577.19 GB

Allocated: 72.33 GB

Unallocated: 504.86 GB

Status: Ready(Synchronizing)

RAID Group of Storage Pool 1

| Name/Alias      | Capacity  | RAID Type | B... | Bitmap   | Status          | Resync Speed           | Priority            |
|-----------------|-----------|-----------|------|----------|-----------------|------------------------|---------------------|
| RAID Group 1    | 577.19... | RAID 6    | Yes  | Disabled | ✓ Synchroniz... | 86.48 MB / s (00h 48m) | Default (Medium ... |
| NAS Host Disk 1 | 298.09... | ✓ Good    |      |          |                 |                        |                     |
| NAS Host Disk 2 | 298.09... | ✓ Good    |      |          |                 |                        |                     |
| NAS Host Disk 3 | 298.09... | ✓ Good    |      |          |                 |                        |                     |

Expand Pool

Expand Pool

Upgrade with Qtier

Close

**Upgrade To Qtier Wizard**

Add Tiers Summary

Select Disk and Configuration:

Tier: Ultra-high Speed (SSD)

Enclosure Unit: NAS Host [available disk(s): 2/10]

| Disk    | Model                     | Type | Bus Type | Capacity  | Status |
|---------|---------------------------|------|----------|-----------|--------|
| ✓ SSD 1 | KINGSTON SE50S3480G (S... | SSD  | SATA     | 447.13 GB | Good   |
| ✓ SSD 2 | KINGSTON SE50S3480G (S... | SSD  | SATA     | 447.13 GB | Good   |

RAID Type: RAID 1

Hot Spare Disk: None

Selected Disk: 2

Estimated Capacity: 437.63 GB

Cancel Back Next

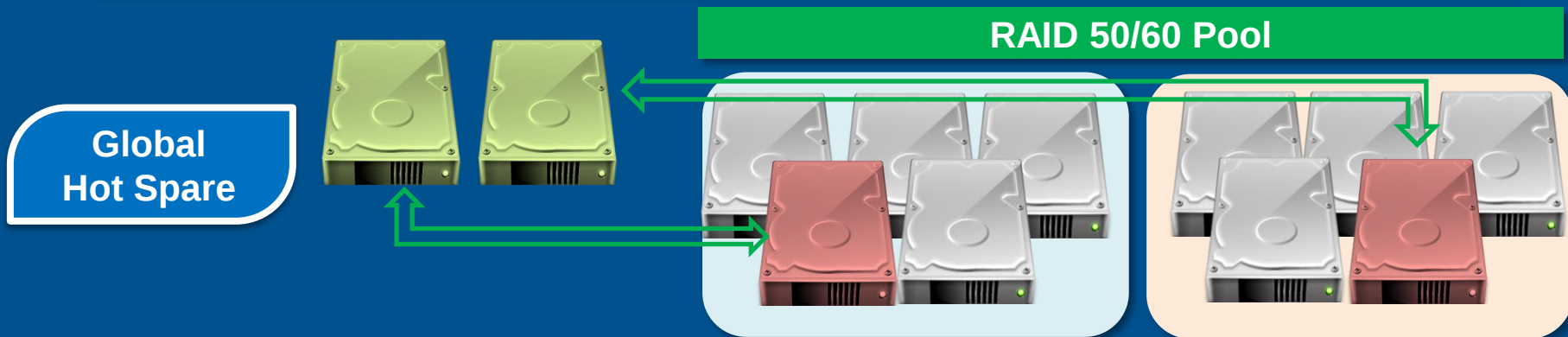
RAID expansion can be conducted online, while upgrading to Qtier temporarily suspends services to move metadata to SSD

# Add hot spare disks for additional protection

**Hot Spare:** When a disk in the RAID becomes unavailable, system will auto use hot spare disk to replace the faulty disk

RAID 1/5/6/10 support local hot spare

With multiple RAID or RAID 50/60, global hot spare is also supported



# 3 steps to configure hot spare

1

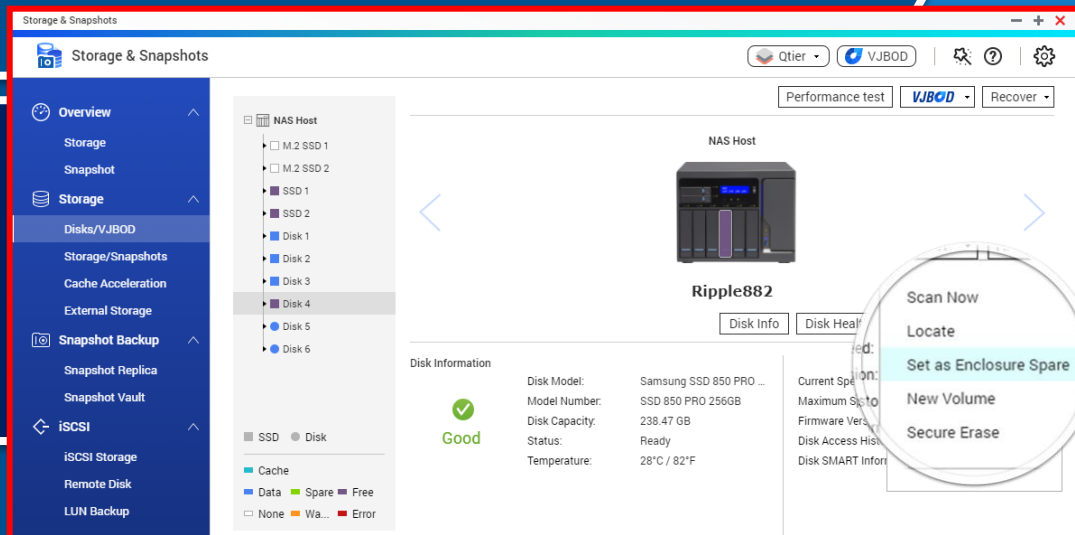
Insert new disks into NAS

2

Storage/Snapshot > Storage Pool Management > RAID Group  
> Manage > Set Hot Spare

3

Disk/VJBOD  
> Select a free disk  
> Action  
> Set as Spare



# Add JBOD if one NAS is not enough

**Scenario:** As Mike's YouTuber career soars, he now needs a storage to back up and archive data.

## Challenge:

When RAID cannot be expanded further, how to expand?



## Solutions:

Use USB/SAS/Thunderbolt JBOD

Use USB 3.1/Thunderbolt External Storage

# QNAP Expansion Units

| Interface         | USB 3.0 (UX)                               | SAS (REXP)                                  | Thunderbolt 2 (TX)                        |
|-------------------|--------------------------------------------|---------------------------------------------|-------------------------------------------|
| Major Use for     | Tower NAS                                  | Rackmount NAS                               | Thunderbolt NAS                           |
| Maximum Slots     | 12 (UX-1200U-RP)                           | 16 (REXP-1620U-RP)                          | 8 (TX-800P)                               |
| Theory Speed      | 5Gb/s                                      | 12Gb/s or 6Gb/s                             | 20Gb/s                                    |
| Connection Method | Direct Connect                             | Direct Connect/Daisy Chain                  | Direct Connect/Daisy Chain                |
| Scenario          | File server expansion or archiving storage | Deploy high capacity storage from the start | Deploy high capacity video editing server |

**Daisy Chain: Connect a JBOD to another JBOD that is already connected to host, so the maximum connection count will not limited to # of physical interfaces of host**

# Linear expansion or new storage pool

Liner: Combine New RAID with existing RAID

Drawback > Any failed RAID will affect entire storage

New Storage Pool: Independent expansion units can roam between NAS

When using expansion unit as backup or archiving server, new storage pool is recommended



# 3 Tips to manage expansion units

- 1 When expanding, use SAS expansion cards for higher performance
- 2 Use multiple daisy chains and add new expansion units in turns
- 3 Expand as a new storage pool

Multiple daisy chains decrease the chance of storage being affected by abnormal connection.

Chain 1

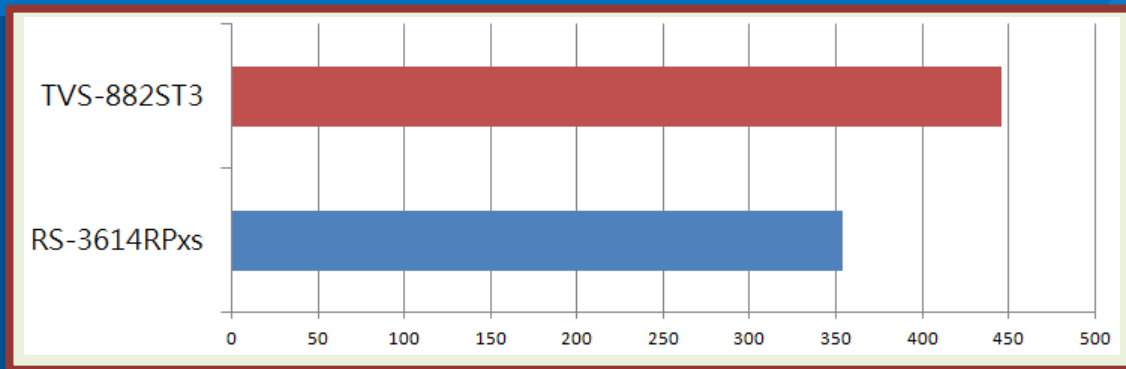
Chain 2



# Advanced Tip: USB 3.1 external storage

QNAP NAS support USB 3.1 Gen 2 Type A dual port  
USB-U31A2P01 expansion card

QTS4.3.4 TVS-882ST3 with USB 3.1 Gen 2 Sequential  
Write is faster than RS-3614RPxs USB 3.0 for 25%

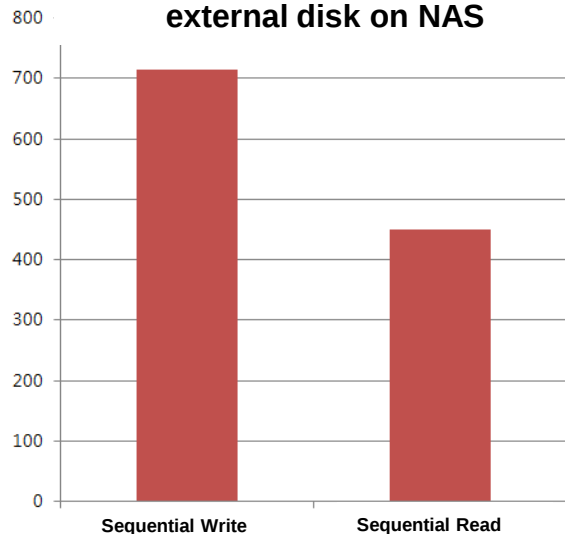




# Advanced Tip: Thunderbolt 3 is compatible with USB 3.1 Gen 2

Thunderbolt 3 port on supported models support both Thunderbolt & USB 3.1 Type C external storage device, with speed of USB 3.1 Gen2

From windows write data to external disk on NAS



Mount TVS-882ST3's SanDisk Extreme 900 from Windows can reach **700MB/s** (with NAS cache)

Thunderbolt3 and USB 3.1 Type C port are the same, with lighting mark as Thunderbolt supported

MB/s



More Protocols



THUNDERBOLT™



To use QNAP Thunderbolt™ 3 NAS with Thunderbolt™ 2 expansion device, Thunderbolt 3 (USB-C) to Thunderbolt 2 converter is required

# Multiple NAS can work together

Scenario: Mike is now a famous YouTuber and works with others in a studio. He finds not all space on every NAS is fully utilized

## Challenge

How to share space on multiple NAS?

## Solution

iSCSI Initiator  
QNAP Virtual JBOD





# Use iSCSI initiator to mount different storage devices

iSCSI initiator and target are industry standards

QNAP iSCSI initiator can be used with EMC, NetApp, Synology, QSAN and iSCSI target with special configuration

Utilize different storages space while enjoying QNAP software features

 DELL EMC

 NetApp™



 Synology®

 QSAN

The trademarks belong to respective companies.

# 3 Steps to use remote disk space

- 1 Configure iSCSI LUN and iSCSI target at the storage device with free space
- 2 Storage & Snapshot > Remote Disk > Create Virtual Disk
- 3 Follow the wizard's instructions to connect to disk

The screenshot displays the QNAP Storage & Snapshots interface. On the left, a sidebar menu shows 'Storage & Snapshots' expanded, with 'Remote Disk' selected. The main area shows the 'Add Virtual Disk' wizard, which is at Step 1/3. The wizard fields are filled with the following information:

- Target Server IP/Name: 172.17.20.102
- Port: 3260
- Get Remote Disk (button)
- Target Name: iqn.2004-04.com.qnap.tvs-1282t.iscsi.demo.0d3d5b
- Initiator IQN: iqn.2004-04.com.qnap.ts-x82.ripple882
- Authentication: ☐ (Username and Password fields are empty)
- CRC/Checksum (optional): ☐ Data Digest, ☐ Header Digest

Below the wizard, a 'Remote Disk (Configure iSCSI initiator)' window is open, showing a table of remote disks:

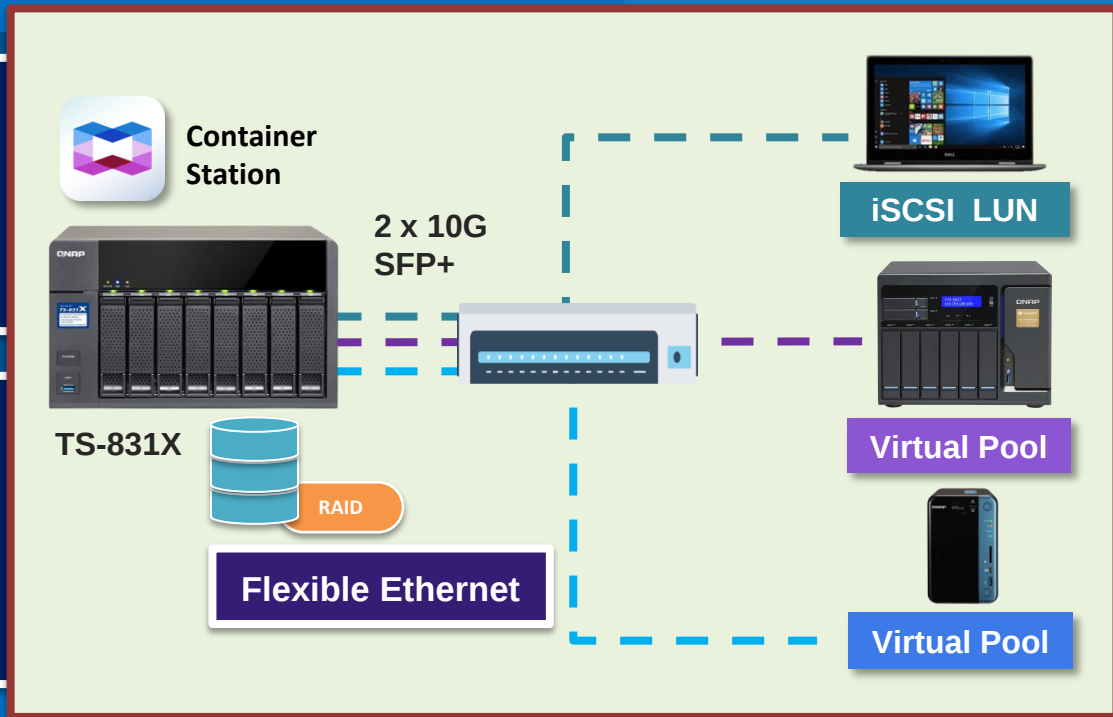
| Target Name/Virtual Disk Name                                    | File System | Total Size | Free Size | Status    |
|------------------------------------------------------------------|-------------|------------|-----------|-----------|
| 172.17.20.102 (iqn.2004-04.com.qnap.tvs-1282t.iscsi.demo.0d3d5b) |             |            |           | Connected |
| VirtualDisk1                                                     | EXT4        | 5.00 TB    | 4.98 TB   | Ready     |

Below the table, a 'File Station' window is open, showing a file browser view of the 'VirtualDisk1' mount. The left sidebar shows a tree view with 'Ripple882' as the root, containing folders like 'Backup\_Vol', 'DataVol', 'plex\_Vol', 'VirtualDisk1', 'Snapshot', 'Share link management', 'Shared with me', and 'Recycle Bin'. The main area shows a grid of files and folders, including 'ARM Use Snap...', 'ISER correctio...', 'ARM Use Snap...', and '1050196\_xl.jpg'.

# Use iSCSI VJBOD to replace JBOD

Use VJBOD to mount  
other NAS's LUN as  
local disk

Create Storage Pool;  
use snapshot, media  
indexing, Qsirch and  
other features



# Build a super storage With JBOD and VJBOD

Connect with 8 NAS as  
VJBOD disks

Connect 4 UX-800P  
expansion enclosures

Total Raw Storage Space  
can exceed 1 PB

Over 1 PB



8TB x 8 = 64TB

USB 3.0



iSCSI



JBOD 8TB x 8 x 6 = 384TB



8TB x 12 x 8 = 768TB

# 3 steps to use QNAP iSCSI VJBOD

1

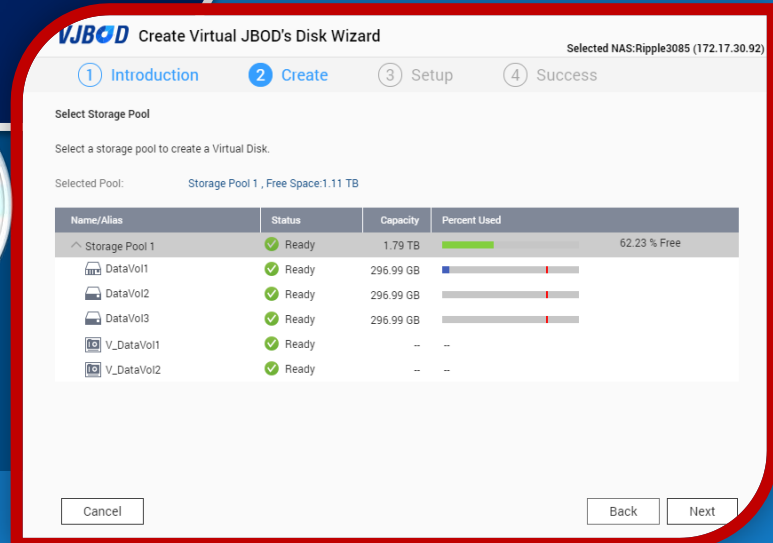
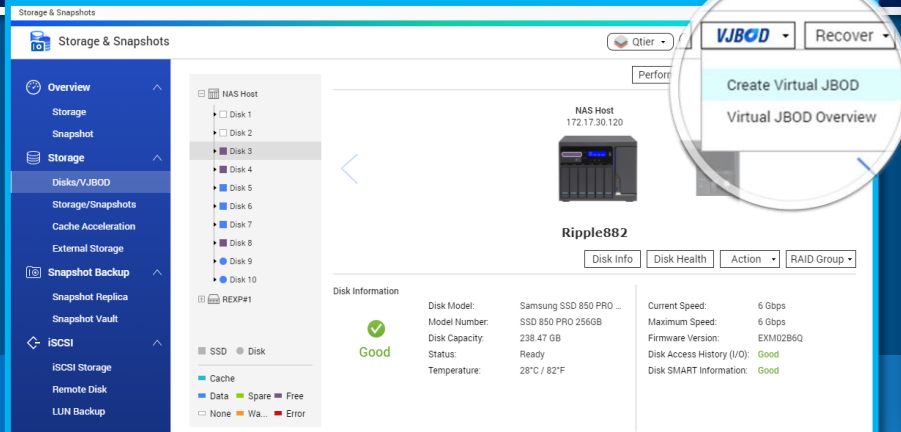
Storage & Snapshot > Disk/VJBOD > VJBOD > Create VJBOD

2

Input remote QNAP NAS address and allocate space

3

After creation, create new Storage Pool with the VJBOD disk





Demo:  
Use QNAP NAS with  
**iSCSI VJBOD**



# Summary

| Scenario       | Expand on original NAS      |                           |                                               |                                 | Additional Devices                                   |                                  |                      |                            |                            |
|----------------|-----------------------------|---------------------------|-----------------------------------------------|---------------------------------|------------------------------------------------------|----------------------------------|----------------------|----------------------------|----------------------------|
| Method         | RAID Migration              | RAID Expansion            | Upgrade to Qtier                              | Replace Disk                    | System Migration                                     | JBOD                             | VJBOD                | Remote Disk                | External Disk              |
| Empty Bays     | Needed                      | Needed                    | Needed                                        | -                               | -                                                    | -                                | -                    | -                          | -                          |
| Other Benefits | Improve Protection          | Improve Performance       | Greatly Improve Performance                   | -                               | Increase # of Available Bays                         | Support Storage Pool             | Support Storage Pool | Connect and Go             | Plug and Go                |
| Notes          | Support Single→ RAID 1→5→ 6 | Support RAID 5, 6, 50, 60 | Storage Service Will be paused when upgrading | Replace every disk need re-sync | Advance models may not migrate to entry-level models | Maximum number depends on models | Maximum 8 NAS        | Storage Pool Not Supported | Storage Pool Not Supported |

# QNAP NAS Road to Expansion

QNAP Storage & Snapshot allow the NAS to grow with the user!



Add new disks to  
migrate RAID  
type



Connect expansion  
unit or external  
storage



VJBOD



Replace disks  
and system  
migration



Add new disks to  
expand RAID or  
upgrade to Qtier



Use iSCSI VJBOD  
to share NAS  
space



RAID 1

RAID 5/6

RAID  
Expansion

NAS+JBOD

NAS+VJBOD



**QNAP NAS ,Your best choice!**