



Design Concepts & Capacity Expansions of QNAP RAID 50/60





Your challenges, our solutions:

**Insufficient protection of RAID 5?
Will performance be degraded when
using RAID 50/60?**

Why You Should Use RAID 5/6



- Number of disks and their capacities will affect RAID protection level

- With ServeTheHome RAID Calculator:

The failing rate of RAID 5/6 in 5 years:

Disk NO.	RAID Type	Disk Capacity	RAID Failing Rate
4	RAID 5	8 TB	0.07%
8	RAID 5	8 TB	0.77%
8	RAID 6	8 TB	0.001%
12	RAID 6	8 TB	0.01%
24	RAID 6	8 TB	0.64%

**RAID 5/6 protection
can be degraded
when NAS capacity
increases.**

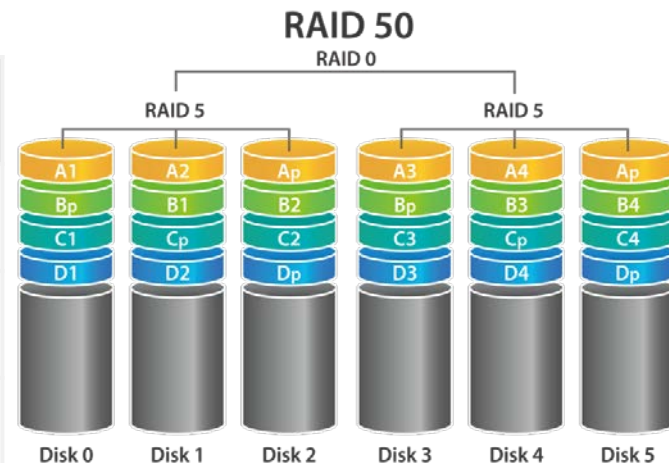


Better Protection with RAID 50/60



- **Protect** your data with **Lower** space redundancy
 - On NAS with 8 bays, QNAP no longer recommends using RAID5
- For enterprise models, RAID 6/RAID 10/RAID 60 is recommended:
Take 8TB disks as example:

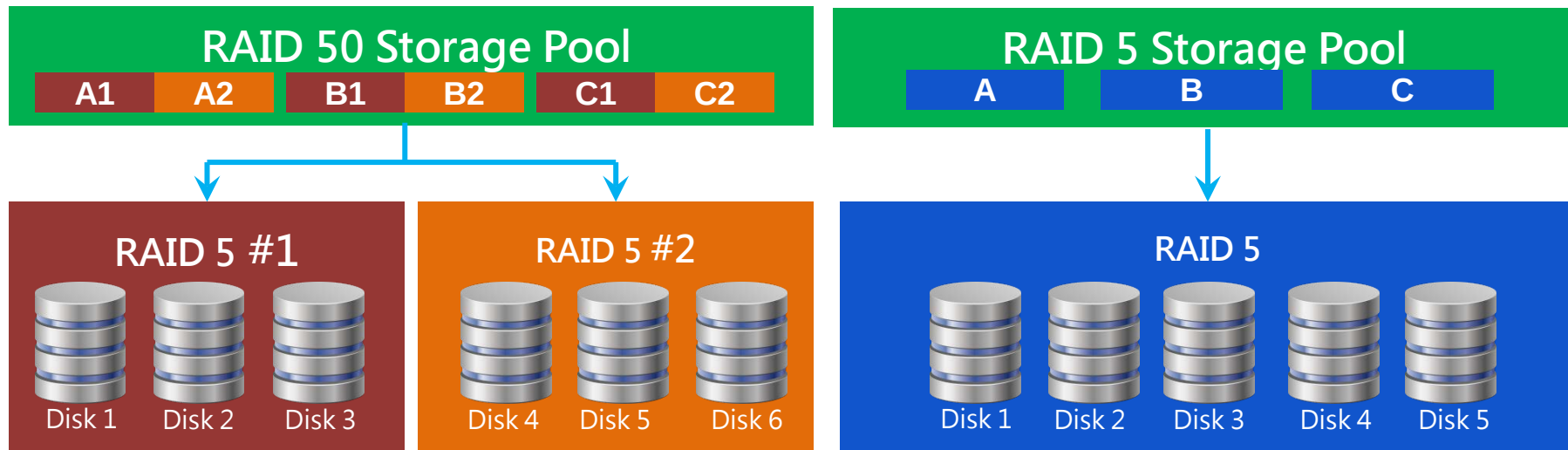
RAID type	No. of disks	Disk failure tolerance	Raw capacity	RAID failing rate
RAID 6	24	2	176 TB	0.64%
QNAP RAID 60	24	4 or more	160 TB	0.03%
RAID 10	24	12	96 TB	0.02%



QNAP RAID 50/60 Design Concepts



- Supported by NAS with 6 or more bays
- Supports Storage Pool, Static Volume and Qtier Pool
- Stripping Data Block to create RAID 50/60

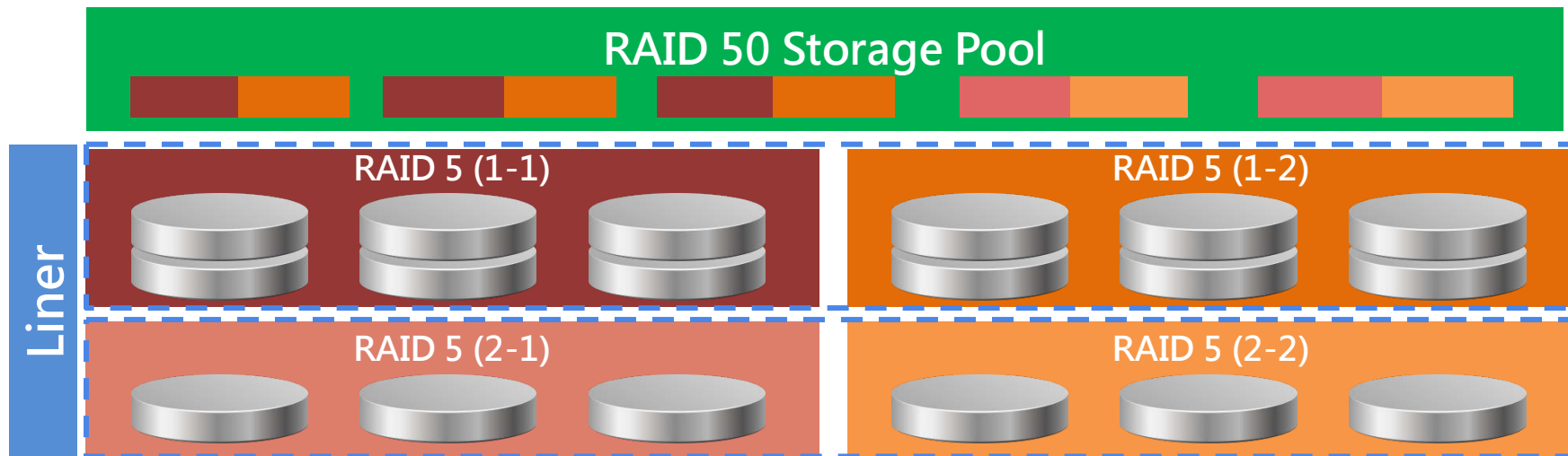


When expanding, new sub-arrays are not allowed



Number of RAID 50/60 Sub-arrays cannot be changed after creation

- No. of disks in Sub-arrays must be equal to avoid space waste
- Capacity can be expanded through new RAID 50/60 and JBOD (Liner)



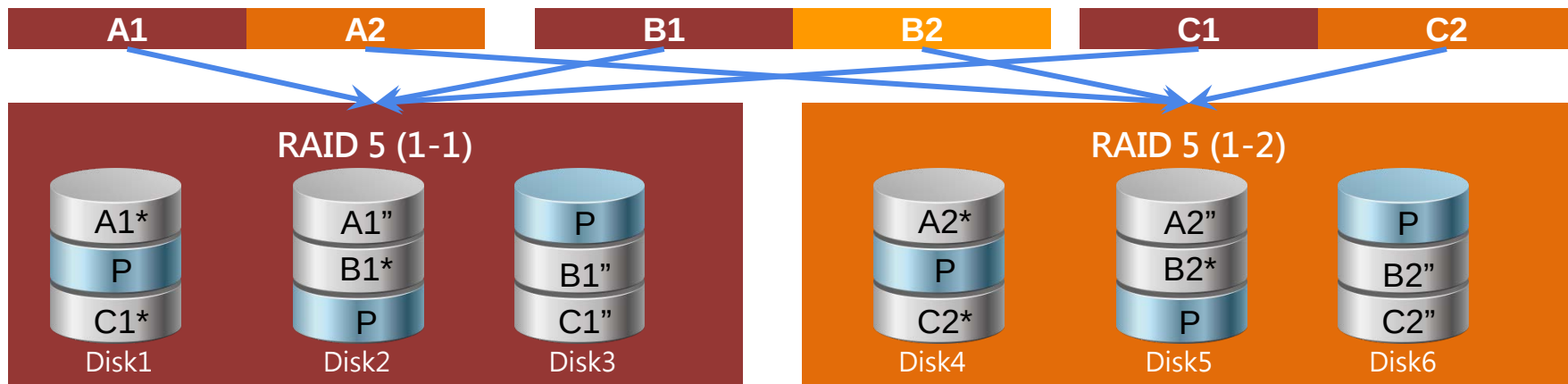
Concept of RAID 50 "Write" Operation



1. Data Block A is striped into A1/A2 for writing operation
2. A1/A2 then are striped again within each sub-array

RAID 5 RMW (Read Modify Write) 1 Write =

Read Parity+ Read Data + Calculate Parity+ Write Parity+ Write Data



Performance Comparison For RAID 50/60



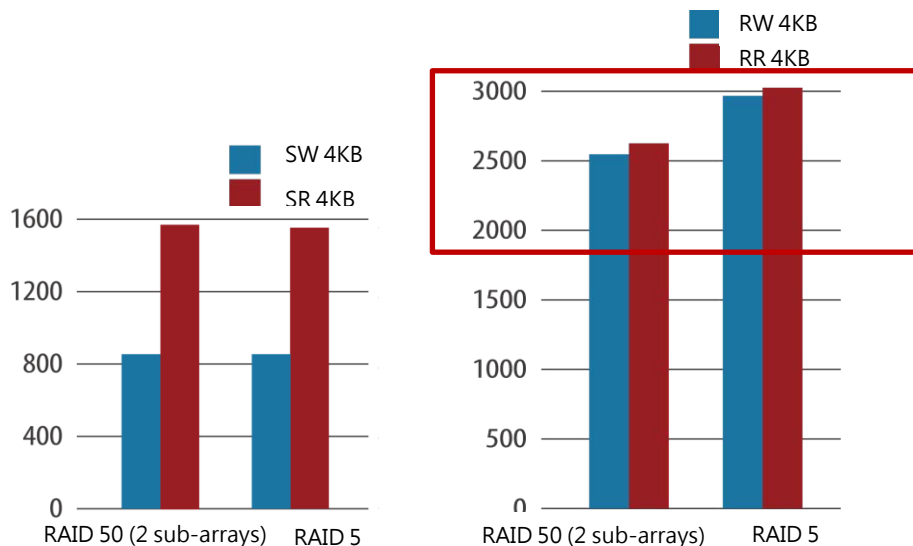
- Single RAID 0 = Performance can be N (No. of disks) * P (Disk performance)
- Single RAID 5 = $(N * P) / \text{RMW or RCW operations}$
- Compare RAID 50/60 to RAID 5/6 on HDD, performance can be reduced

No. of disks (HDD)	RAID type	Sequential read	Sequential write	No. of disks (SSD)	RAID type	Sequential read	Sequential write
6	RAID 5	687	370	12	RAID 5	3098	1904
6	RAID 50 (2)	566	305	12	RAID 50(2)	3092	1859
12	RAID 5	1563	853	24	RAID 6	4606	4481
12	RAID 50 (2)	1536	858	24	RAID 60 (2)	4607	4422

Performance With RAID 50/60 (HDD)



- The random read/write performance for RAID 50/60 can reduce 10% when the RAID is consisted of HDD with more read head operations
- **RAID 50/60 on HDD is priority for data protection**



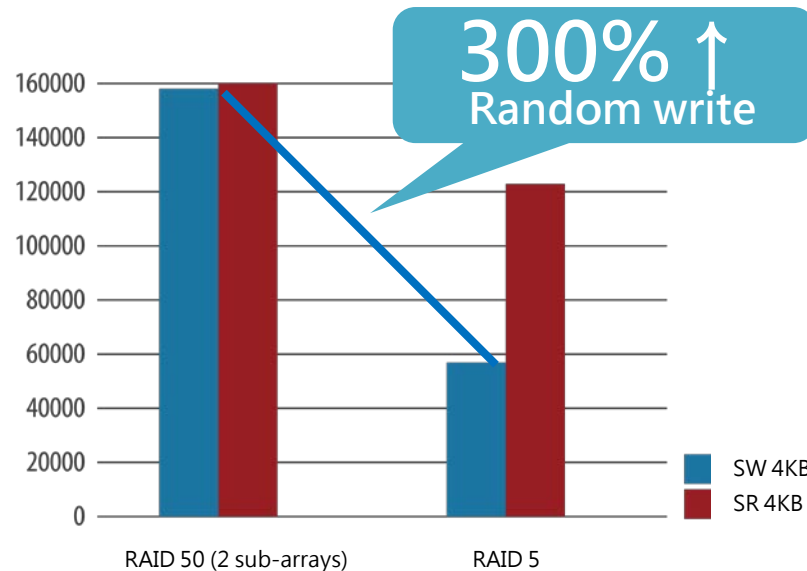
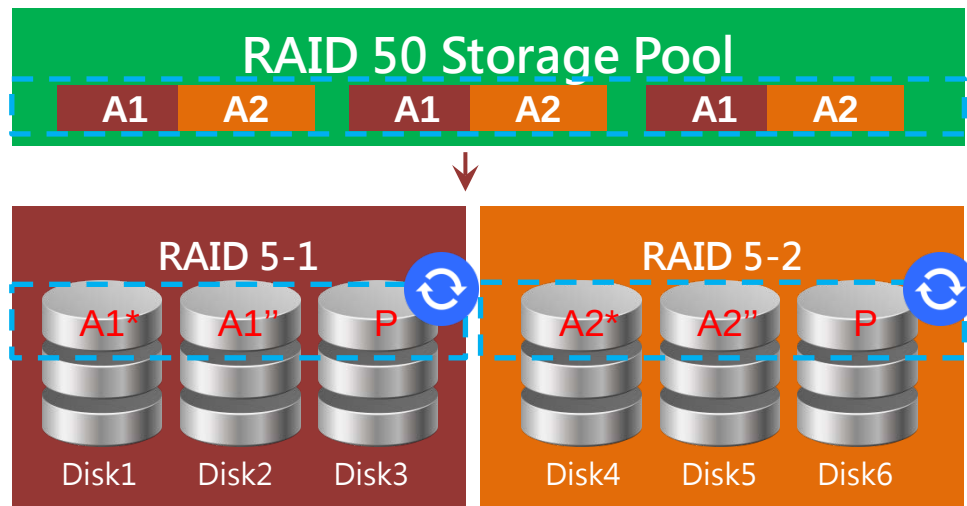
A RAID 50 can greatly increase RAID protection with little performance impact

No. of disks	RAID type	Disk capacity	RAID failing rate
12	RAID 5	8TB	2.82%
12	RAID 50	8TB	0.29%

Why random RW performance is increased with RAID 50/60 (SSD)



- RAID 50/60 with SSD will not suffer from read head operations penalty
- With SSD RAID 50, Random Read and Write has increased
- Suitable for all flash applications



QNAP RAID 50/60 Use Case Suggestion



■ RAID 50/60 Value: **Ensure Protection Level for High Capacity NAS**

General Application: RAID 5 is not recommended, 6-14 Bays: RAID 6/10,
Beyond 16 Bays: RAID 60 With SSD Cache

Backup Destination: RAID 50 for NAS higher than 8 bays

RAID Type	RAID 5	RAID 6	RAID 10	RAID 50	RAID 60
Disk No. Requirement	> 3	> 4	> 4	> 6	> 8
Disk Fail Tolerance	1	2	half	2~5	4~10
Capacity	★★★★★	★★★★	★	★★★	★★
Scenario	Backup	General Usage	VDI or Database	High-Frequency Backup	VDI and Video Editing



How to expand QNAP RAID 50/60?

Add Disks to All Sub-arrays



- In Storage Management select "Expand"
- Using dedicated UI to add disk on 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

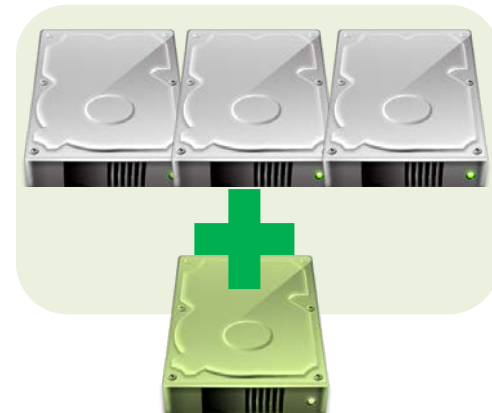
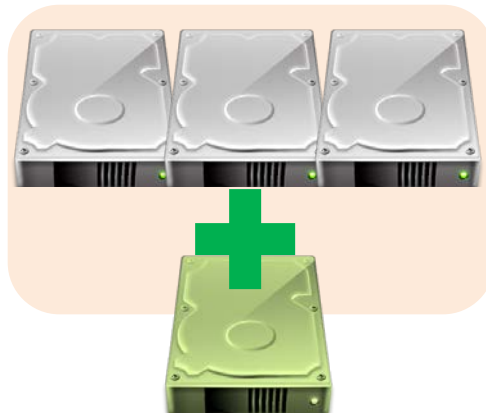
Add one or more disks to an existing RAID group to expand the available capacity of a storage pool.

RAID Group 1, RAID Group 2

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

Step 1/3

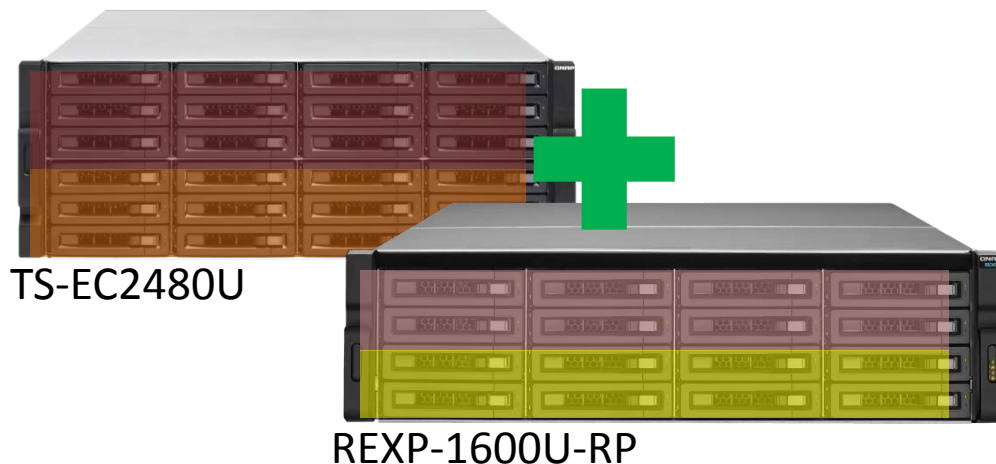
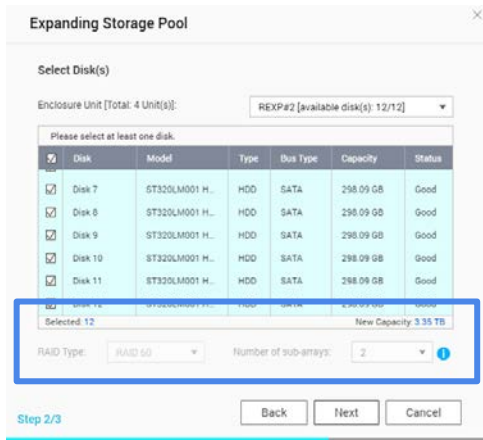
Next Cancel



Add new RAID Group for Expansion



- Add a new RAID 50/60 with same sub-array count for expansion
- Using Expansion Enclosure if Host NAS has no free slots
- The new RAID 50/60 must use same RAID type and sub-arrays count (Disk number can be different)





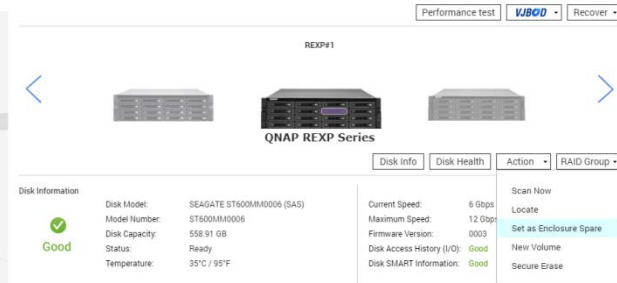
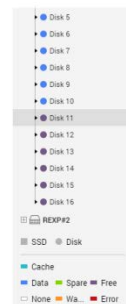
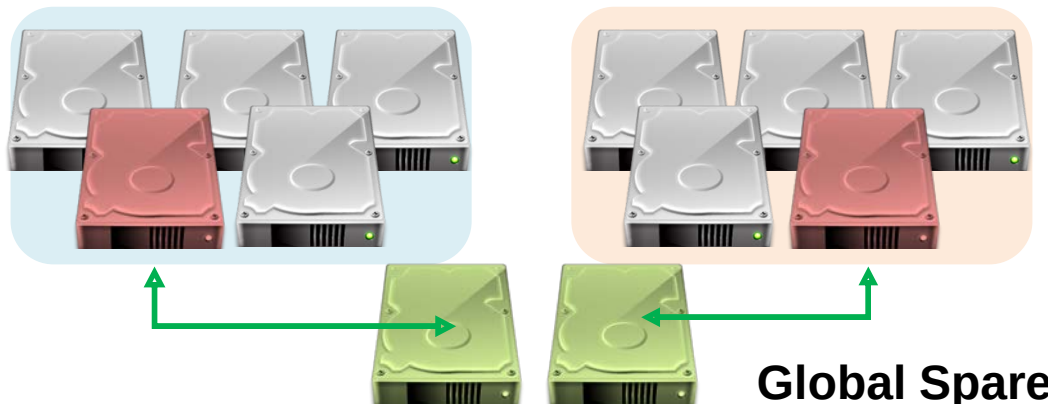
Demo : Expand RAID 50/60 By Adding Disks

Use RAID 50/60 With Hot Spare



- Local and Global Hot Spare can be used for each or all sub-arrays
- It is recommended to reserve Global Hot Spare
- Create RAID > go to "Disks/VJBOD" and set free disk as spare

RAID 50/60 Pool



Using Qtier/SSD Cache with RAID50/60



SSD RAID 60 = High capacity/performance video editing server

SSD Cache RAID 10 + HDD RAID 60 = High capacity/performance file server

Qtier SSD RAID 50 + HDD RAID 60 = High capacity/performance VDI server

Qtier SSD RAID 10 + HDD RAID 60 = High capacity/performance Database



QNAP IOAware Qtier + RAID 50 pool

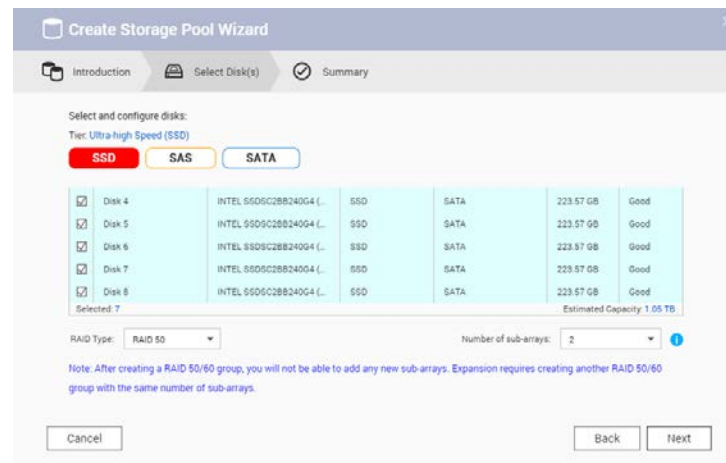


**RAID 5
(1-1)**

**RAID 5
(1-2)**

**RAID 6
(2-1)**

**RAID 6
(2-2)**





Thanks for listening