

QNAP

QNAP NAS Snapshot & Storage Management

**Best
Practice Reveal**





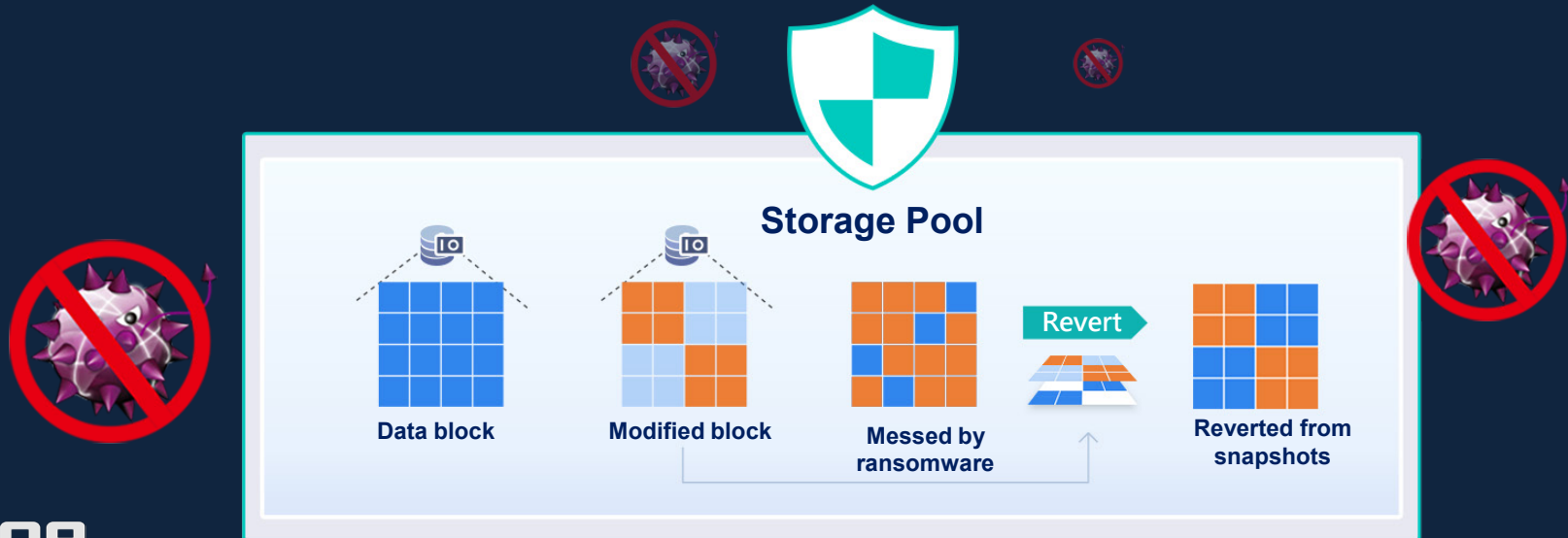
Your Challenges, Our Solution

How Much Space Will Snapshots Take?
Will Snapshots Cause Service Interruptions?



Snapshots are important to everyone

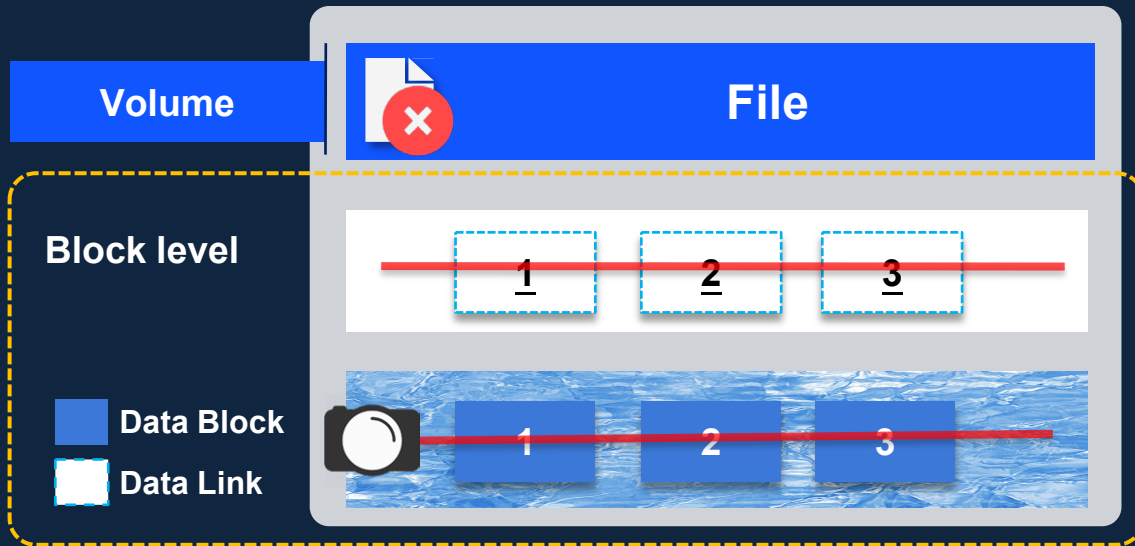
- Both enterprises and individuals could be targets of ransomware
- Data needs to be backed up, while backups also need to be protected
- **QNAP block-based snapshots protect your data from being damaged by ransomware**





Ideas behind QNAP snapshots: conservative but complete

- With snapshots enabled, delete files still take up storage space
- **Space will only be released when associated snapshots are deleted**
- Is a healthy snapshot retention recycle mechanism necessary?



Observation:

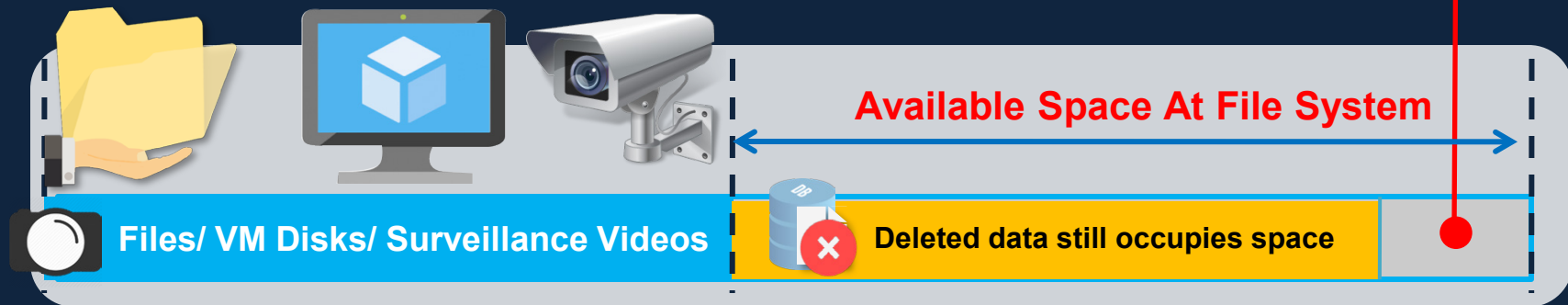
**QNAP snapshots
default retention:
1 Week**

S snapshots
default retention:
Forever**



When the storage is full of snapshots, programs requesting to write new data will fail immediately

- "Space used by snapshots" is actually modified data
- When there is no more free block, new data cannot be written
- If not specifically designed, the file system will be unaware of this





Disasters caused by data write failures

- File servers: **Interruptions of daily operations**
- Surveillance/ IOT Log servers: **Key data loss**
- Web/database servers: **Complaints from customers and partners**



Space issues associated with snapshots may occur with all storage vendors that provide the snapshot feature. Below is an UI screenshot from one of the other brands:

Storage Manager

Healthy
System is healthy.

All Storage Pools

Volume Status

Volume 1 (Normal)
位於 儲存集區 1, Basic
Storage Pool 1
144 GB / 144 GB

Storage Pool

Storage Pool ID

Storage Pool 1 (Normal)

Disk Information

File Station

Test

Upload **Create** **Action** **Tools** **Settings**

Name	Size	File Type	Modified Date
._@__thumb		Folder	2017-11-29 1...
#recycle		Folder	2017-12-06 1...
Test		Folder	2017-12-05 2...
40GB	40.52 GB	File	2017-12-05 1...

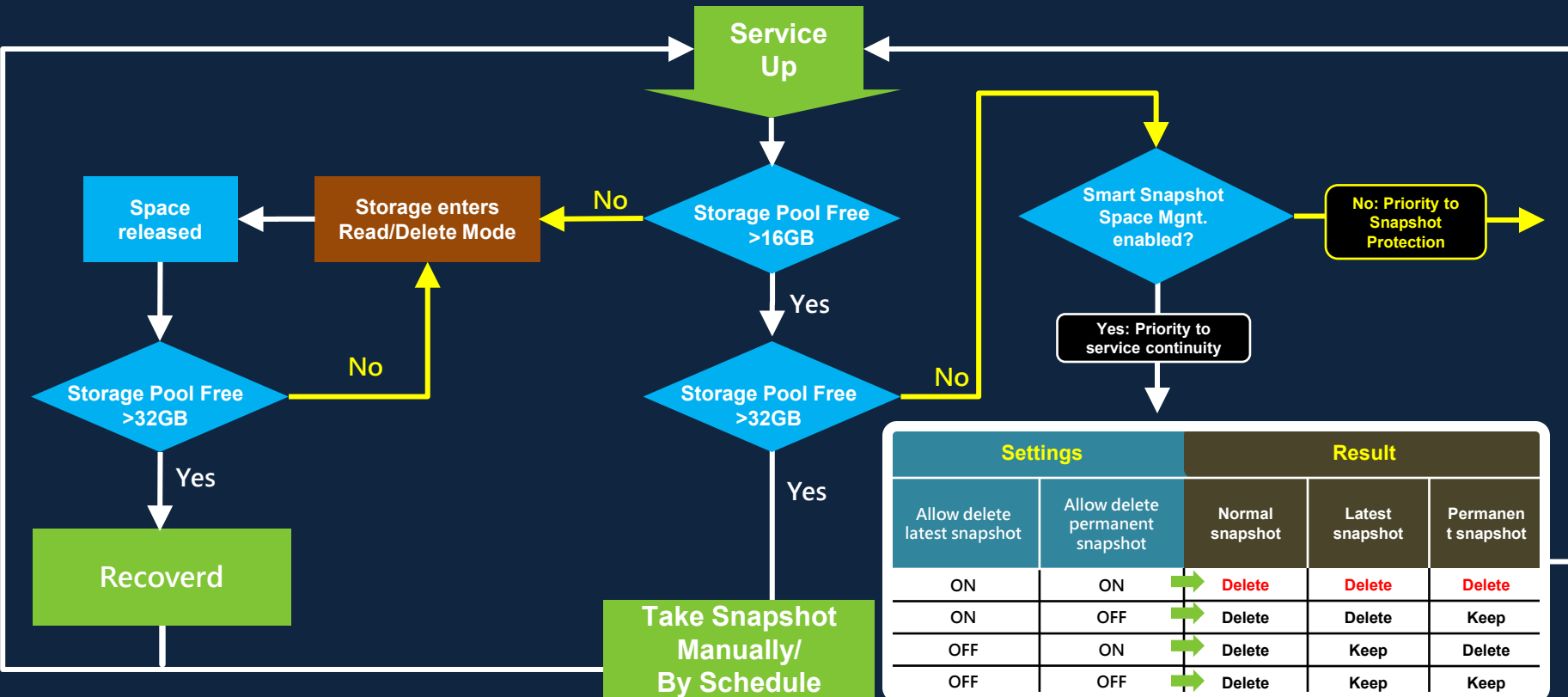
Snapshot List - Test

Name	Time	Description
GMT+08-2017.12.05-16.05.06	2017/12/05 16:05:06	Scheduled snapshot take...
GMT+08-2017.12.05-16.03.06	2017/12/05 16:03:06	
GMT+08-2017.12.05-16.01.43	2017/12/05 16:01:43	
GMT+08-2017.12.05-16.00.03	2017/12/05 16:00:03	Scheduled snapshot take...
GMT+08-2017.12.05-15.59.30	2017/12/05 15:59:30	
GMT+08-2017.12.05-14.55.09	2017/12/05 14:55:09	Scheduled snapshot take...
GMT+08-2017.12.05-14.50.02	2017/12/05 14:50:02	Scheduled snapshot take...





Space is limited, so you need snapshot space management



Settings		Result		
Allow delete latest snapshot	Allow delete permanent snapshot	Normal snapshot	Latest snapshot	Permanent snapshot
ON	ON	Delete	Delete	Delete
ON	OFF	Delete	Delete	Keep
OFF	ON	Delete	Keep	Delete
OFF	OFF	Delete	Keep	Keep



Tip 1

QNAP snapshots:

Stored outside of the thick volume

Changed data will be stored outside of the volume (unallocated space of the pool) :

Allows planning & reserving free space for snapshots

Allows monitoring space used by snapshots

Allows delete data without recycle snapshots if pool has space

Allows multiple volumes/LUNs to share space for snapshots

Easily monitor snapshot space usage





(1)

The "outside of the volume" snapshots operation

- Snapshot (**Copy On Write**) Technology
- When taking snapshots, blocks inside of the volume are frozen

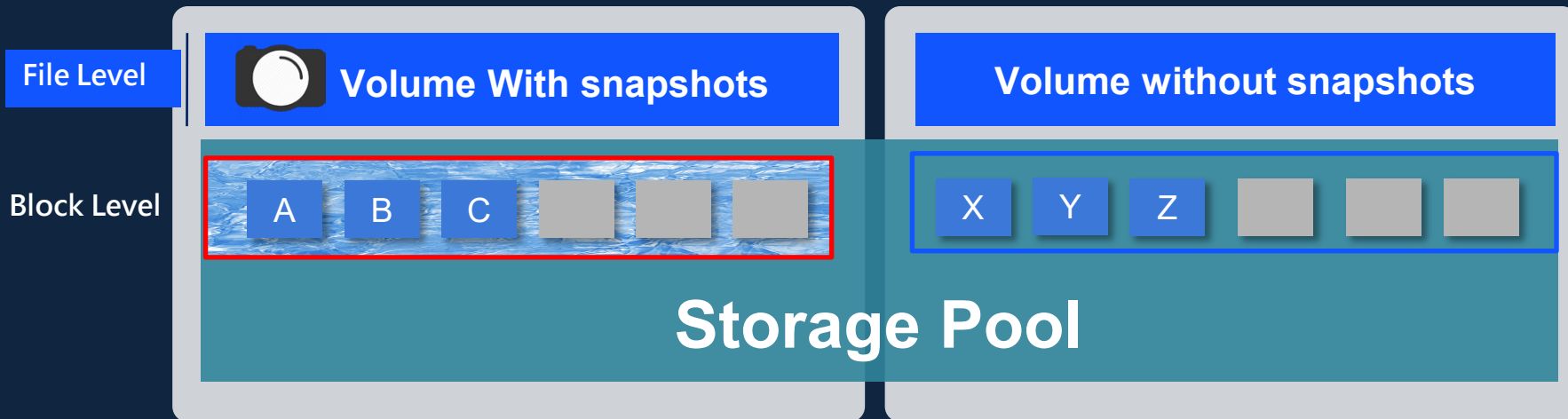
Snapshot Frozen Zone



Original Block



Storage Pool Space





(2)

The "outside of the volume" snapshots operation

- When frozen data blocks is to be modified, new data (A', B' and C') will be stored in data blocks outside of the volume
- For volumes without snapshots, data blocks will be overwritten directly with guaranteed space usage

Snapshot Frozen Zone

Original Block

Modified Block

Storage Pool Space

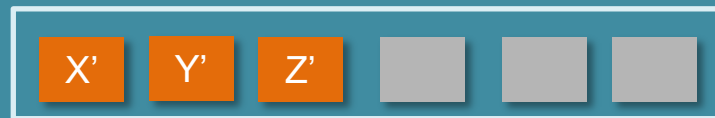
File Level



Volume With snapshots

Volume without snapshots

Block Level



Storage Pool



Tip 2

Priority snapshots:

Freeze the volume when space is insufficient

- The volume/LUN can actively detect snapshot space usage and enter Read/Delete Mode when space for snapshots is not enough
- **This is to prevent data from being changed and to ensure snapshots can be reverted**
- User can further assign Snapshot Guaranteed Space to ensure snapshot can be stored



The thick volume with no snapshots will not be affected

The system can actively detect remaining space for snapshots and provide notifications for admins



Total - Storage Pool: 1, Volume: 2, LUN: 0						Snapshot	Manage
Name/Alias	Status	Type			Capacity	Percent Used	
Storage Pool 1	Warning (Space Low)				437.64 GB		
DataVol1 (System)	Read/Delete	Thick volume	io	:9	197.78 GB		
DataVol2	Read/Delete	Thin volume	io	:2	197.78 GB		



How to recover from read/delete mode

- When storage pool space is released, volumes will be auto-recovered
- Recovers by manually or **automatically deleting snapshots**



Other methods: Expand Storage Pool, Change Guaranteed Snapshot Space or Convert a thick volume to a thin volume to release unused space

Status List

Snapshot Mgnt	(Free) Pool + Guaranteed Snapshot Space	Volume Status	Pool Free Space
Start Recycling Snapshot	<= 32GB	Enter Read/Delete	<= 16GB
Stop Recycling Snapshot	>= 32GB	Auto Recovery	>=32GB

Increase Pool Free Space

Free space in storage pool 1: [30.46 GB](#)
Perform one or more of the below actions to increase free storage pool space.

Release unused guaranteed snapshot space:[20.34 GB](#)

Edit

Run a space reclaim to release used space on thin volumes.
Reclaim: --

Execute

Convert a thick volume to a thin volume to release unallocated space.

DataVol11 (Unused 156.00 GB)

Execute

Expand current storage pool by adding disks or a new RAID group.

Expand

After performing the above actions, click "Refresh" to see whether storage pool space has increased

Close



Tip 3 Priority services: Active smart snapshot space management

- Same as Time Machine for Mac, enable this option to let the system automatically delete snapshots until enough space is recovered
- **Delete some or all snapshots for service continuity**





Snapshot "Space" & "Quality" Management

Smart Snapshot Space Management options:

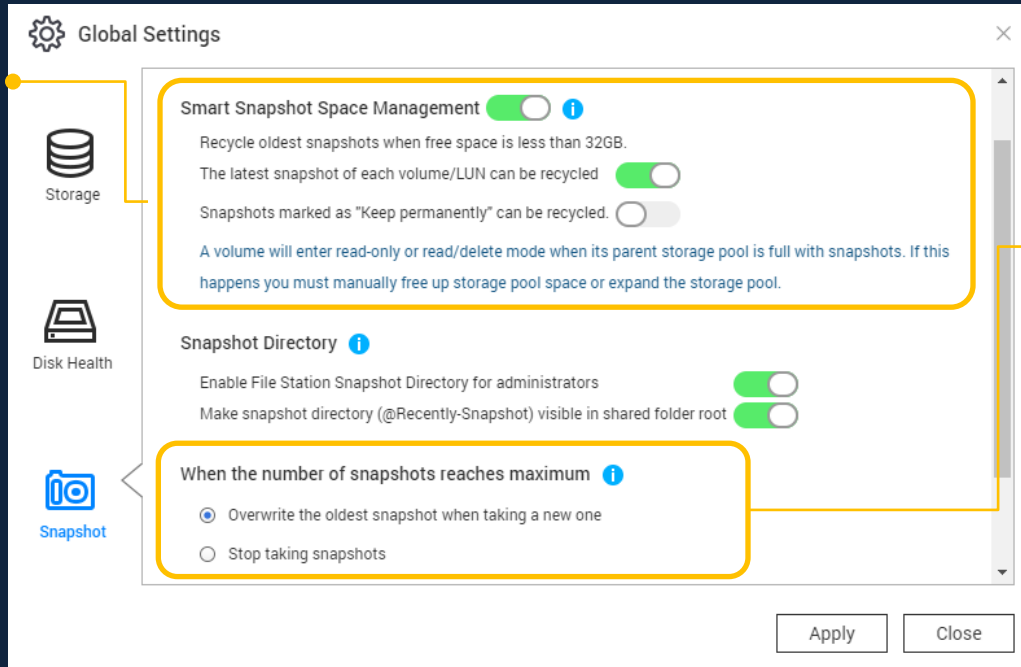
Recycle latest snapshot:

When disabled, last snapshot will not be recycled.

Recycle permanent snapshot:

When disabled, the snapshot that is set as permanently will not be recycled.

Disable those options can lead to Read/Delete mode



When number of snapshots Reaches System Max.:

- Replace oldest snapshot with new snapshot
- Stop taking new snapshot



**Demo : Snapshot space that can be
monitored and auto recycled**



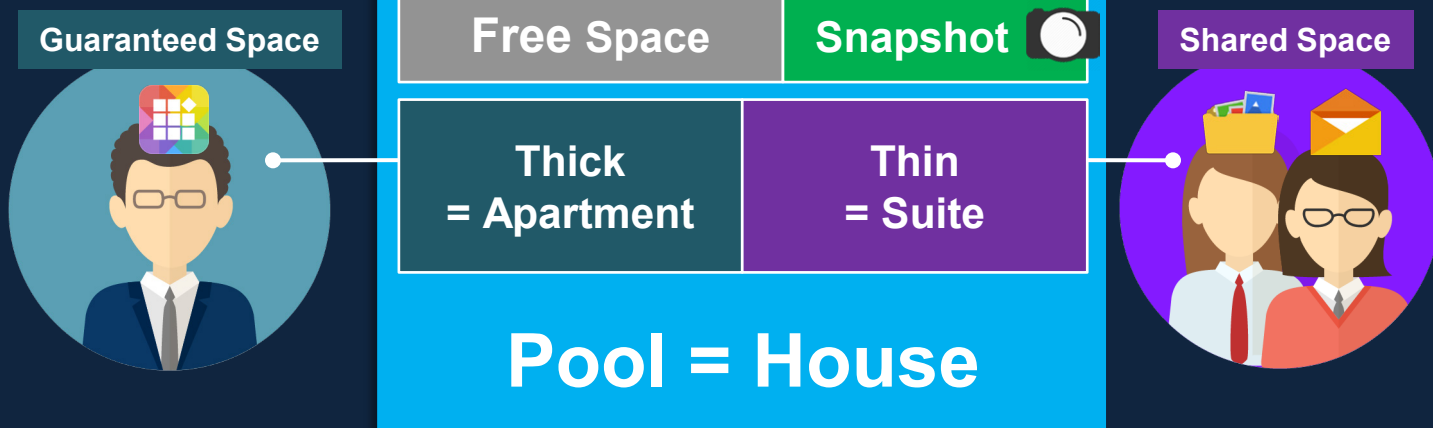
Your Challenges, Our Solutions:

**How can I optimize storage space for
both services & snapshot protections?**

QNAP NAS

Tips For Space Allocation

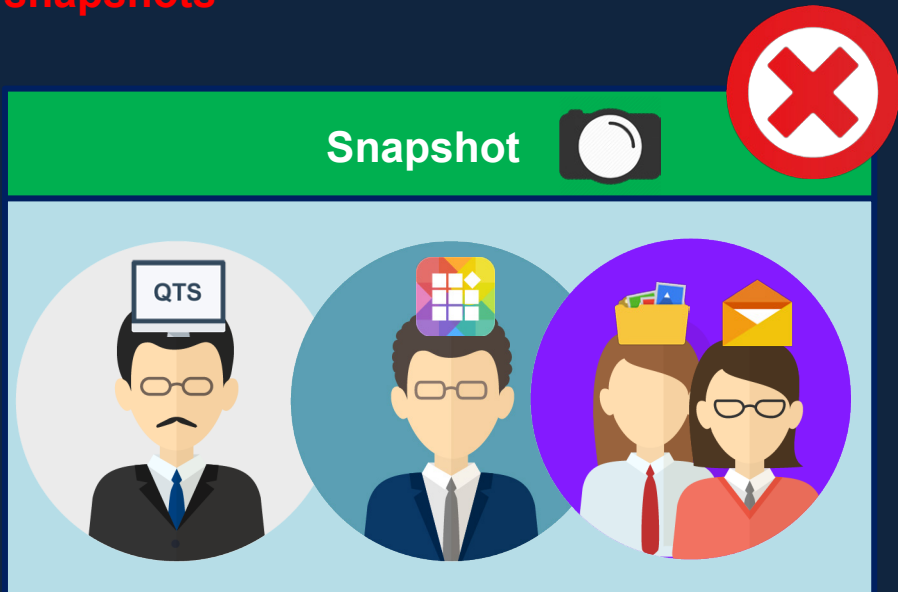
Just like renting a house



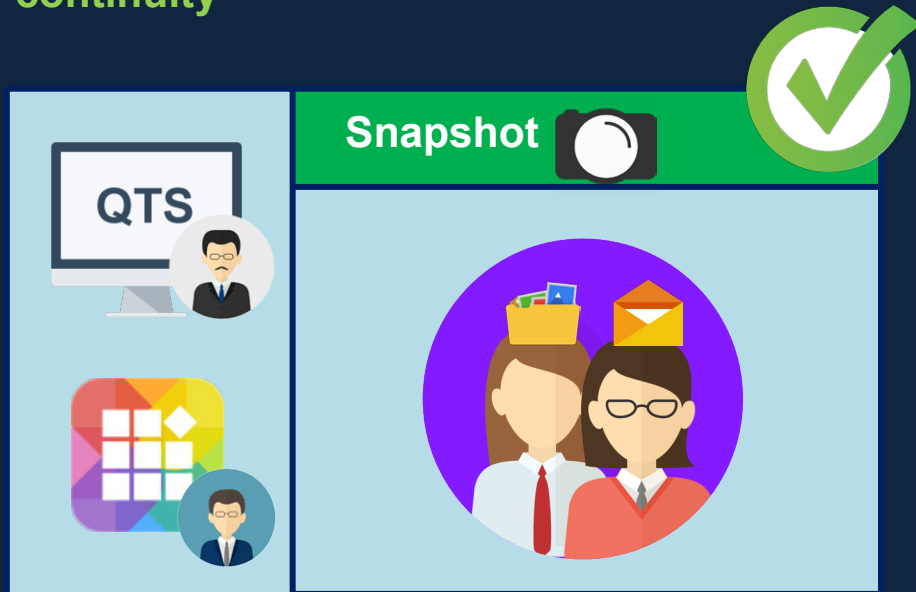


Separating system volume from snapshots

When system & files share the same volume, **application can be affected by snapshots**



Set a dedicated thick volume with no snapshots to **guarantee application continuity**





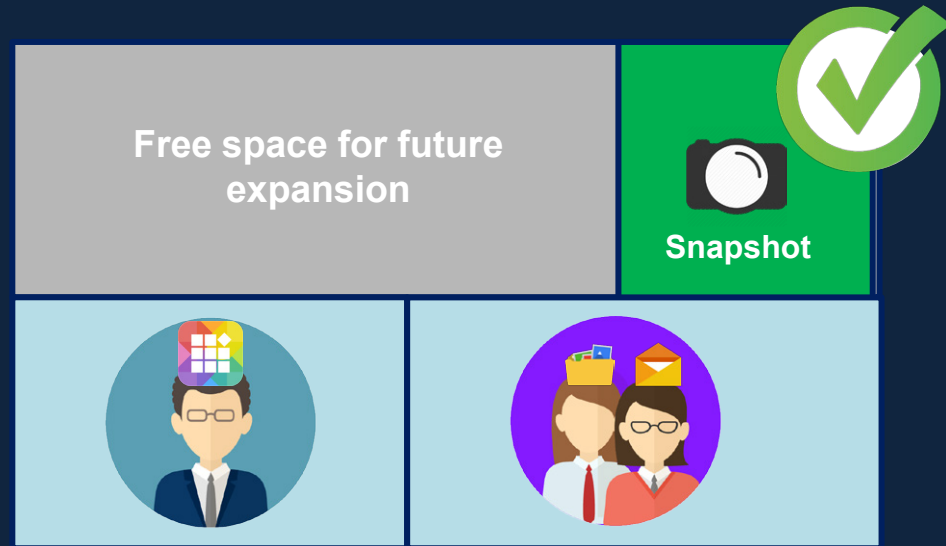
Reserve space for snapshots

When all space is allocated

Snapshot (take/revert) functions will be disabled



When using thick volumes, allocate less space initially **for future expansions and snapshots**





Convert to thin for more free space

- When the pool cannot be expanded , you can convert the thick volume to thin for releasing unused space to "share" this space with snapshots
- **Thin volumes should used with thresholds for monitoring usage**



Converting a thick volume to thin will require all existing snapshots be deleted.

Snapshot



Free Space



Snapshot

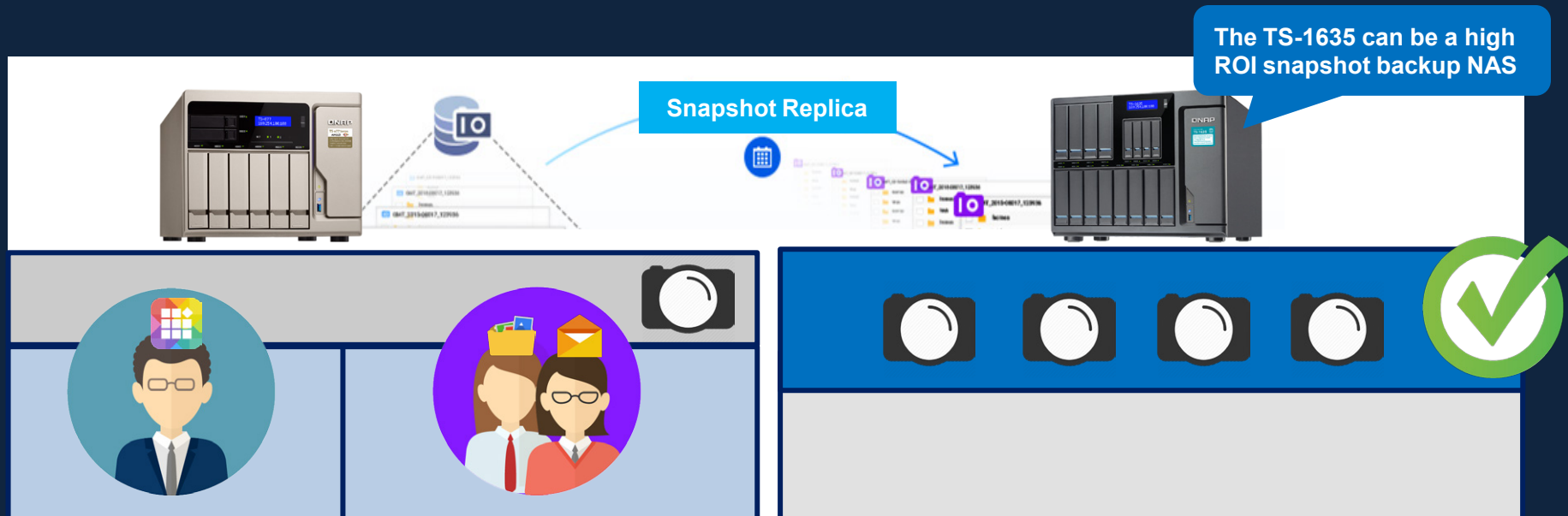




Use snapshot replica to store more snapshots

Keeping too many snapshots at the local NAS can take up all usable space

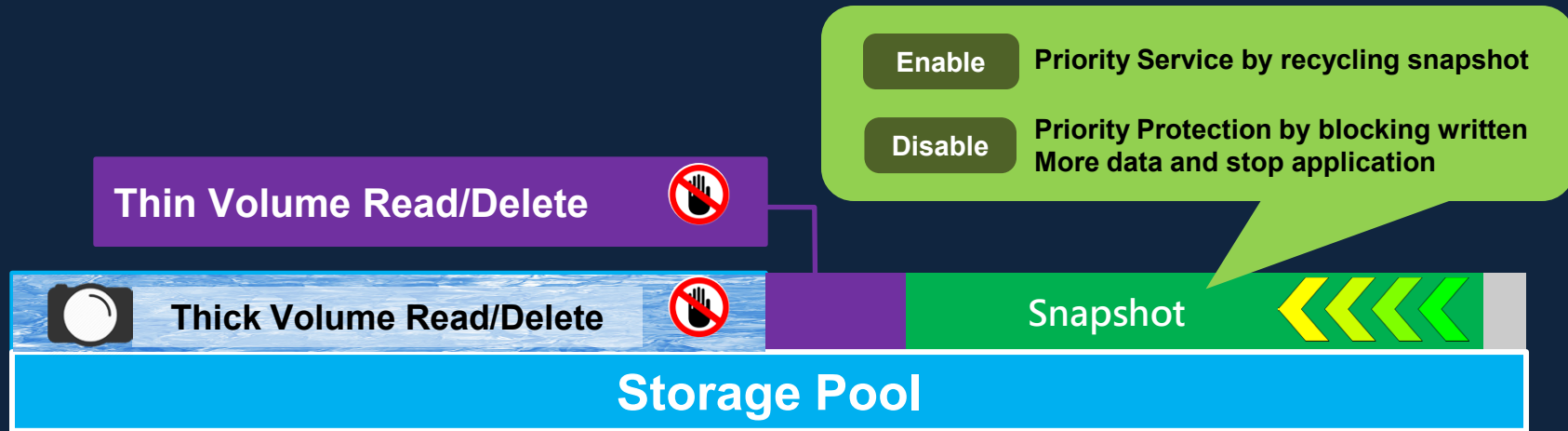
Choose a NAS with higher capacity or deploy snapshot replica to store snapshots: Advanced NAS for services, Entry-level NAS for backup





Recap: Using snapshots has its own risks

- Snapshot can take up space, a healthy retention cycle is required
- QNAP "outside of the volume" snapshot for manageable space monitoring
- Volume/LUN Read/Delete Mode to detect space issues
- Using Smart Snapshot Space Management to ensure application Continuity





Best practice for space allocation

1. Separate system volume from files, and disable snapshots on system volume
2. When using thick volumes, reserve space in advance for snapshots
3. When space is insufficient, convert a thick volume into a thin one
4. Using Snapshot Replica to store more snapshot versions

Total - Storage Pool: 1, Volume: 2, LUN: 1

Create New ▾

Snapshot ▾

Manage

Name/Alias	Status	Type	Snapshot	Snapshot Re...	Capacity	Percent Used
Storage Pool 1	✓ Ready				1.34 TB	
3 Backup	✓ Ready	Thin volume	:23	4 Started	495.42 GB	
1 System (System)	✓ Ready	Thick volume	--	--	197.78 GB	
LUN_0	✓ Ready	Block-based Thick LUN	:13	--	2 300.00 GB	



Thanks You!

