QM2 Expansion Card

feat. Qtier
SSD caching & auto-tiering volume to boost NAS performance
01 M.2 SSD + 10GbE revealed

02 NAS/PC supported, experience super speed NVMe SSD

03 QTS 4.4.1 fully utilize SSD’s performance
M.2 SSD + 10GbE cache card
Revealed
Select the QM2 card you need

- **M.2 SATA**
  - QM2-2S-220A
  - QM2-4P-240

- **M.2 PCIe Gen 2**
  - QM2-2P-244A
  - QM2-4P-284

- **M.2 PCIe Gen 3**
  - QM2-2P-344
  - QM2-2P-384
  - QM2-4P-342
  - QM2-4P-384

**Support 10GBASE-T port**

**Expand four M.2 ports**

NEW

- QM2-2S10G1TA
- QM2-2P10G1TA
Clear naming rule – featured 10GbE

QNAP M.2 PCIe cache/10GbE card

M.2 SSD + 10GbE

QM2-2P10G1TA

Number of supported M.2 SSD

Supported M.2 SSD connector type

P: PCIe NVMe SSD

S: SATA SSD

10GbE port

Single port BASE-T RJ45 throughput

revision
Clear naming rule - M.2 cache only

QNAP M.2 PCIe cache card

QM2-2P344

Number of supported M.2 SSD:
- 2: 2 x SSD
- 4: 4 x SSD

Supported M.2 SSD connector type:
- P: PCIe NVMe SSD
- S: SATA SSD

PCIe interface:
- 34 = Gen3 x4
- 28 = Gen2 x8

NVMe SSD slot bandwidth:
- 4 = Gen3 x4
- 2 = Gen3 x2
SSD cache and 10GbE in one card

**QM2-2P10G1TA**
Supports maximum 2 x PCIe NVMe SSD (M-key), provides Gen2 x2 on each slot

**QM2-2S10G1TA**
Supports maximum 2 x SATA M.2 SSD, provides 6Gb/s on each slot
Expand cache capacity or 10GbE redundant

Expand cache capacity by installing QM2 in idle PCIe slots

Provide redundant 10GbE for fail-over

Built-in 10GbE
3rd party operating system support

Active cooling module
Self-monitored with thermal sensors to control the speed of smart fan modules.

Compliant with PCIe standards
Low-profile PCIe add-on cards, bundled with full-height bracket.

AQC-107S
Linux & Windows Dual platform supported

QNAP NAS don’t need to install Driver, Windows/Linux platforms please visit QNAP website to download the driver
Note: M.2 SSD compatibility and function supported depends on the hardware design and platform. Please check with your motherboard manufacturer for details.
Support Multi-Gigabit NBASE-T standard.

<table>
<thead>
<tr>
<th>Model</th>
<th>Ports</th>
<th>Transfer Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>QSW-1208-8C</td>
<td>12</td>
<td>10Gbps</td>
</tr>
<tr>
<td>QSW-804-4C</td>
<td>8</td>
<td>10Gbps</td>
</tr>
</tbody>
</table>

- **QSW-1208-8C** provides 12 ports of 10Gbps transfer.
- **QSW-804-4C** provides 8 ports of 10Gbps transfer.

<table>
<thead>
<tr>
<th>Category</th>
<th>100 M</th>
<th>1G</th>
<th>2.5G</th>
<th>5G</th>
<th>10G</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT 5e</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CAT 6</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>CAT 6 A &amp; CAT 7</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓ (55M)</td>
</tr>
</tbody>
</table>
Efficient cooling dissipation

- 10GbE 10GBASE-T port
- M.2 slots
- M.2 thermal pad is bundled, provides more efficient heat transfer
- Active cooling fan
- Fin array heatsink
QM2-2P10G1TA performance up

Random read enhanced nearly 25%

<table>
<thead>
<tr>
<th></th>
<th>RR-4K</th>
<th>RW-4K</th>
</tr>
</thead>
<tbody>
<tr>
<td>QM2-2P10G1TA</td>
<td>272808</td>
<td>203626</td>
</tr>
<tr>
<td>QM2-2P10G1T</td>
<td>205057</td>
<td>200760</td>
</tr>
</tbody>
</table>

Iometer on PC, tested in QNAP Lab,
PC Environment
1. CPU: Intel (R) Core(TM) i7-6700 CPU@ 3.40GHz.
2. OS: Windows 10.
3. Memory: 64 GB.
4. SSD: Samsung SSD 860 EVO 1TB M.2 SATA *2, Software-RAID 1.
NAS/PC supported, experience super speed
NVMe SSD
Ideal choice to boost performance: M.2 PCIe NVMe SSDs

You don’t need to change motherboards or HW configurations, just simply install the QM2-2P10G1TA on your PC’s Gen2 x4 slot then you can enjoy the high speed of NVMe SSD.

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>Theoretical Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.2 SATA III</td>
<td>6Gb/s</td>
</tr>
<tr>
<td>M.2 PCIe Gen 3 x2</td>
<td>16G/s</td>
</tr>
<tr>
<td>M.2 PCIe Gen 2 x4</td>
<td>20G/s</td>
</tr>
<tr>
<td>M.2 PCIe Gen 3 x4</td>
<td>32G/s</td>
</tr>
</tbody>
</table>

M.2 PCIe NVMe SSDs have more than 2Xa performance enhancement.
Leave the 3.5” slots for huge capacity HDDs

Without changing existing configurations

Freely upgrade a normal pool to a Qtier pool without starting over

Install NVMe for cache

Huge capacity storage

NAS

PC
High performance NVMe in PC

Upgrade your PC to NVMe!

**PC Environment**
1. CPU: Intel (R) Core(TM) i7-6700 CPU@ 3.40GHz.
2. OS: Windows 10.
3. Memory: 64 GB.
4. PC SSD: ADATA Prod_SP550 120GB
5. QM2 SSD: Samsung SSD 970 EVO 256GB M.2 NVMe *2, RAID1;
   Samsung SSD 860 EVO 1TB M.2 SATA *2, Software-RAID 1.

**QM2-2P10G1TA**
- RR-4K: 272808
- RW-4K: 200760
- (IOPS)

- SSD: 55972
- QM2-2P10G1TA: 13893

**QM2-2S10G1TA**
- RR-4K: 156973
- RW-4K: 70823
- (IOPS)

- SSD: 55972
- QM2-2S10G1TA: 13893
QM2 series on Windows PC

1. Catch the NVMe SSD information from device manager
2. Disk partition
3. Set RAID1 protection
QTS Supports M.2 SSD Cache Acceleration

- Reduce I/O latency
- Global read-write cache

Accelerates IOPS performance
Applies SSD cache to all volumes and LUNs with a single setup process, or specified volumes only

Read caching
Read/Write caching

- Read
- Write

Application layer
HDD storage
SSD storage

Storage & Snapshots

- Overview
- Cache Acceleration
  - Usage
    - Allocated
    - Raw
  - Service
    - Enabled
  - Capacity
    - 1/8-64 GB
  - Cache Type
    - Read-Write
  - Cache RAID
    - RAID-1
  - Read Hit Rate
    - 50%
  - Write Hit Rate
    - 50%
  - Cache flushing
    - Status

Hit Rate History

Name/Size
- Name
- Capacity
- Status

DataVol1 246.44 GB  Ready
DataVol2 608.37 GB  Ready
DataVol3 608.37 GB  Ready
DataVol4 610.04 GB  Ready
DataVol5 608.37 GB  Ready
DataVol6 329.27 GB  Ready
Expand high-speed M.2 SSD tier with Qtier

**Storage space and SSD caching**

Keep flexibility to accelerate performance of key data and increase cost/performance ratio.

**Qtier 2.0**

- Total capacity = hard drives + SSD

**Read/Write caching**

- Sequential
- Random

- Application layer
- HDD storage
- SSD storage

**I/O aware**

**Tiering on**

- Hot data & reserved block
- Cold and archived data
Live Demo
Install QM2 on PC to enhance performance
QTS 4.4.1
Fully utilize SSD’s performance
QNAP QM2 in QNAP NAS is ideal on sharing data, applications and virtualized server applications for multi users. Install the QM2 on the NAS which has no other HDD slots available then combine with the 10GbE port and QTS 4.4.1’s remove and re-create Qtier solution, keep improving the random access speed (IOPS) to experience dramatic performance improvements.

<table>
<thead>
<tr>
<th>Disk Type</th>
<th>SW (MB/s)</th>
<th>RW (IOPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDD</td>
<td>100</td>
<td>350</td>
</tr>
<tr>
<td>SSD</td>
<td>300</td>
<td>60000</td>
</tr>
</tbody>
</table>

Sequential access vs Random access
QNAP SSD Cache can be applied to all volumes and LUNs once set with 3 modes:

- **Read-Only** ➔ Copy frequently used data to SSD
- **Read-Write** ➔ Not only copy data, new data can also be temporarily stored in SSD
- **Write-Only** ➔ Only new data will be written into the cache

**How Read-write Cache works:**

- Data from clients and storage will be cached at the block-level in real time
- When SSD space is not enough, read or write operations will be redirected to the HDD.
The Write-only Cache Increase ROI of SSD Cache with high Writing Demand

- Write-only cache is promoted by Microsoft for endurance control.
- QNAP believes that Write-only Cache can increase the ROI of SSD in below scenario:
  1. File Server focusing on write operations
  2. Database with more write operation (Such as IoT monitoring server)
  3. Use high endurance SSD (Intel Optane™)

Reference: https://docs.microsoft.com/en-us/windows-server/storage/storage-spaces/understand-the-cache
The Advantage of Software-defined Over-provisioning

- SSD vendor will reserve 7% or more SSD space for internal operation usage.
- QNAP allow user to test and increase the over-provisioning ratio from the software to increase that consist performance and endurance of SSD.

FIO used with parameters: --direct=0 --bs=4k(random)1M(sequential), --io depth=1(random) 32(sequential), --file size= 90G
QNAP allows the combination of SSD and HDD RAID into the same pool and migrate data automatically based on accessing pattern.

Support SATA, SAS, M.2, QM2 and U.2 SSD with QNAP Over-provisioning.

Provide higher capacity as SSD can be used to store data.

On QTS, PCIe NVMe SSD can only work as SSD Cache currently.

Alternative for Cache: Qtier Tiering Storage

Before Tiering

Data Access Pattern Changed

Start Tiering

Qtier Engine

After Tiering

Hot Data
Warm Data
Cold Data
Challenge: Changing SSD Tier Interface

Challenge

While SSD Tier is already created with SATA Disk, how can I replace it with QM2 to expand the NAS while improving the SSD Tier performance?
QNAP QTS 4.4.1 supports remove Qtier SSD Tier, the users can remove then re-create SSD tier as required.

When removing the SSD tier, all the storage pool data will be retained as data on SSD only to be moved to HDD.
Test of recreating Qtier SSD Tier

- In QNAP Lab, 4 250 GB SSD need to be replaced with 500 GB SSD. The operation is conducted with both Replacing Disk & Remove SSD Tier.
- The time for removing and re-creating the SSD tier is almost 2 times faster than replacing disk. The replacing disk method also does not support changing SSD on different interface.

* Using TVS-1282T with 4 enterprise HDD for testing.
Choose Between SSD Cache & Qtier

The best SSD configuration may only be measurable once it is configured. The SSD Cache and Qtier have different advantages.

**Real Time Performance Boost**
1. For accessing with burst IO such as file syncing and video editing.
2. Can be changed to Read or Write only with bypass block size.

**Fully use SSD Capacity**
1. For boosting IO with fixed pattern such as mail or database server.
2. With IO Aware Qtier can also support database operations.

*TVS-871T-i7-16G with QM2 card and ADATA 512GB SSD cache and Qtie SX8000NP*
QM2 Highlight points with QTS

QTS 4.4.1 fully utilize SSD’s performance

- Improve random access performance when the NAS has no idle HDD slots and 10GbE ports
- Improve NAS performance by using read only, read-write and write-only 3 type of caches for the whole NAS storage space via QM2
- Software-defined Over-provisioning increase Performance and endurance of SSD
- QTS Qtier improves both performance and capacity, in QTS 4.4.1 users can easily change the SSD to QM2 in the SSD Tier.
- 4.4.1 Beta will be released at End of May!
QM2 Expansion Card

feat. Qtier

Your Best Choice!