

# ES1686dc

Enterprise-Class Storage



**High Efficiency**

Data reduction technology



**High Availability**

Active-active controller architecture



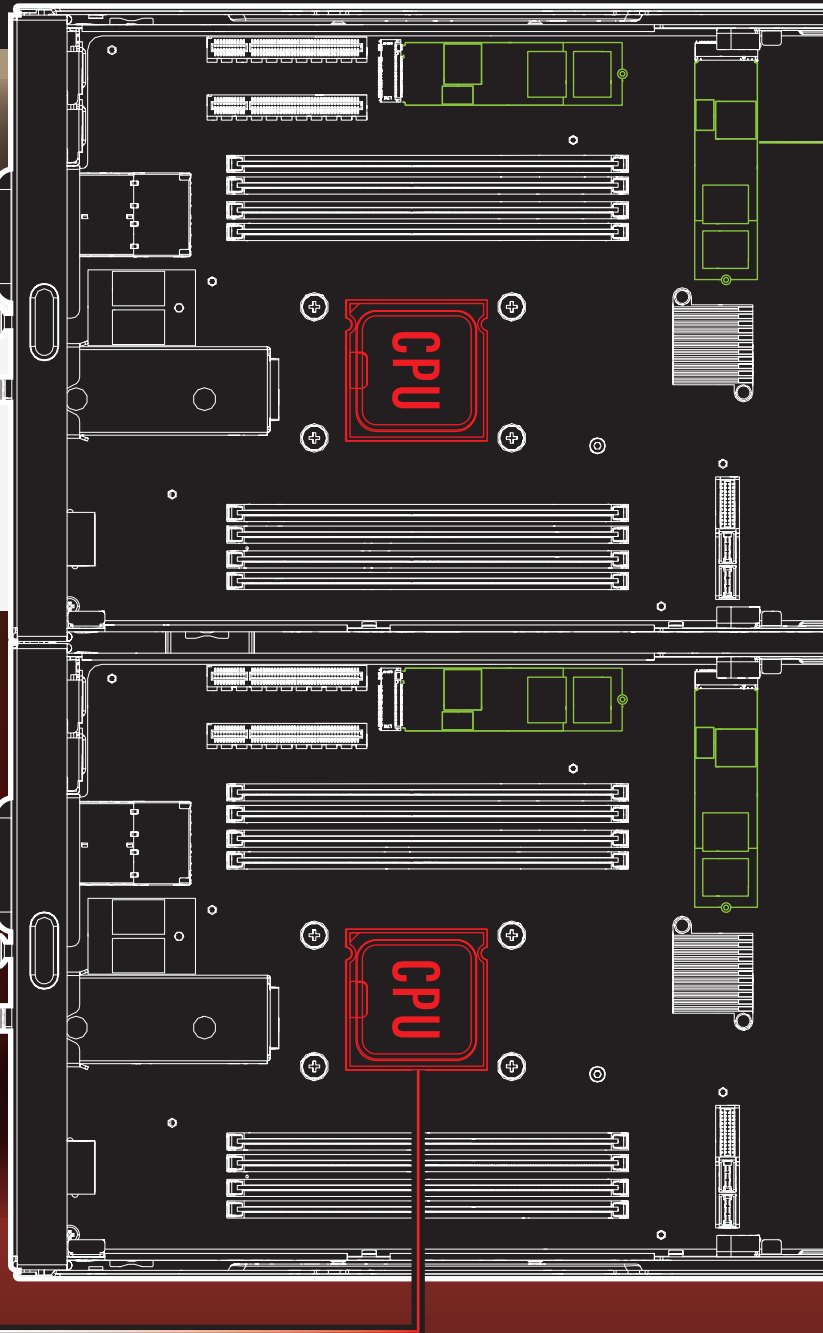
**Ensured Data Integrity**

ZFS file system

# Hardware Architecture

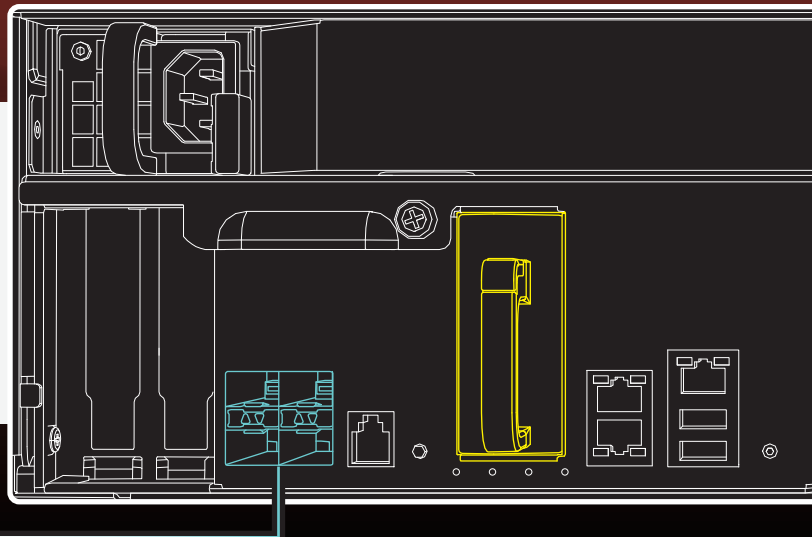
## Intel Xeon D-2100 series processor

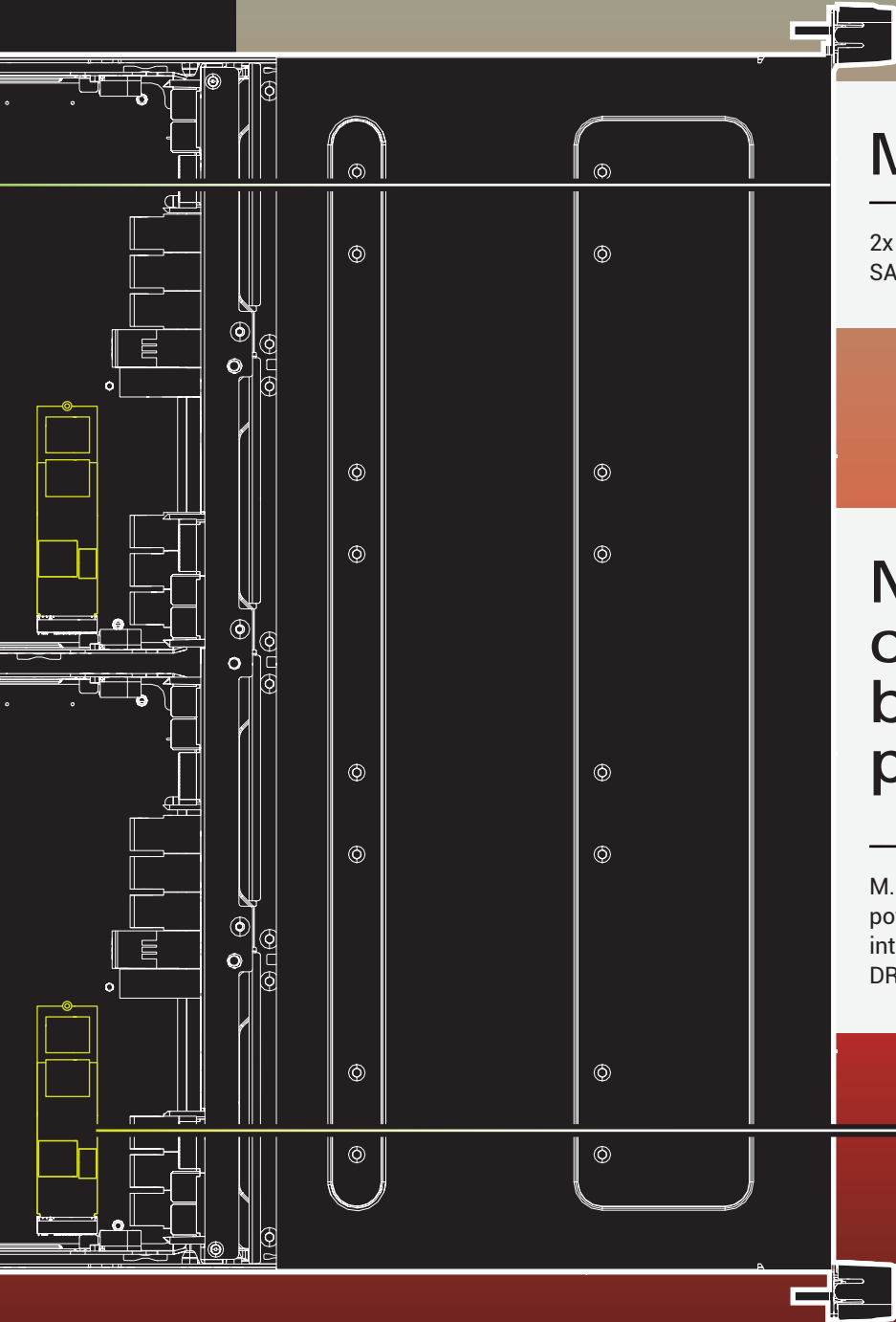
Provides the performance needed for enterprise-level storage and mission-critical applications.



## Built-in 10GbE SFP+ network interface

4x 10 GbE (SFP+) ports satisfy iSCSI, NFS, CIFS, and other data transmission needs.



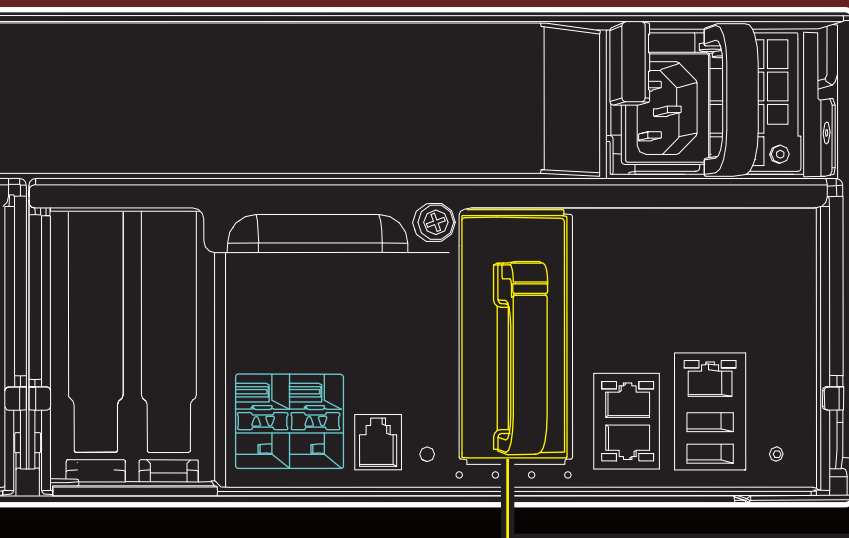


## M.2 SSD slot

2x M.2 SSD slots for read acceleration. Supports SATA 6Gb/s or NVMe Gen3 x4 2280 SSDs.

## NVRAM write cache with battery data protection

M.2 SSD for copy-to-flash (C2F) backup. If a power outage occurs, the system ensures data integrity by moving write cache data from DRAM to M.2 SSD using BBU power.



## Battery Backup Unit (BBU)

The hot-swappable battery provides sufficient power to maintain NVRAM during power outages.

# Software Architecture

## Excellent random read/write performance

SSD Cache allows the client to accelerate read performance on HDD-based storage pools. While write coalescing assists in transferring random writes to sequential writes to provide industry-leading performance.

### QES system

#### Controller A

##### File Service

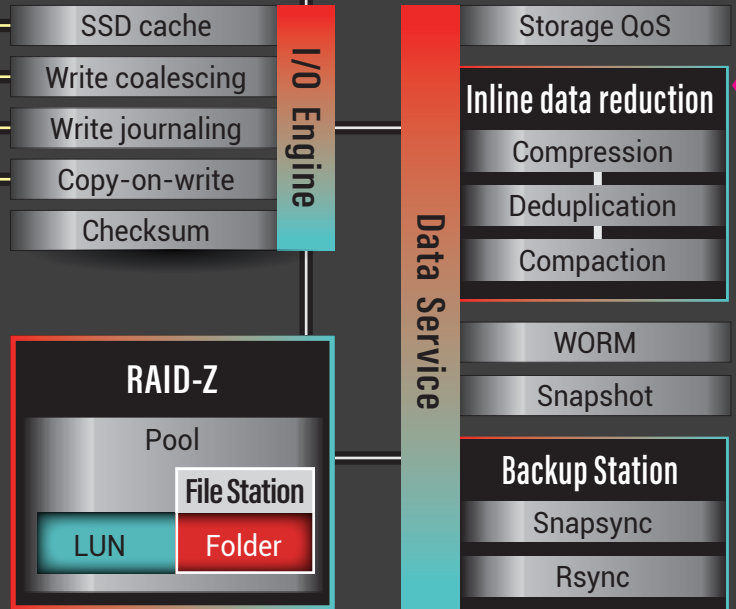
SMB  
NFS  
FTP

##### iSCSI Service

VSS  
ODX  
MPIO  
ALUA

- Immune to power failure
- No silent data corruption

See page 6

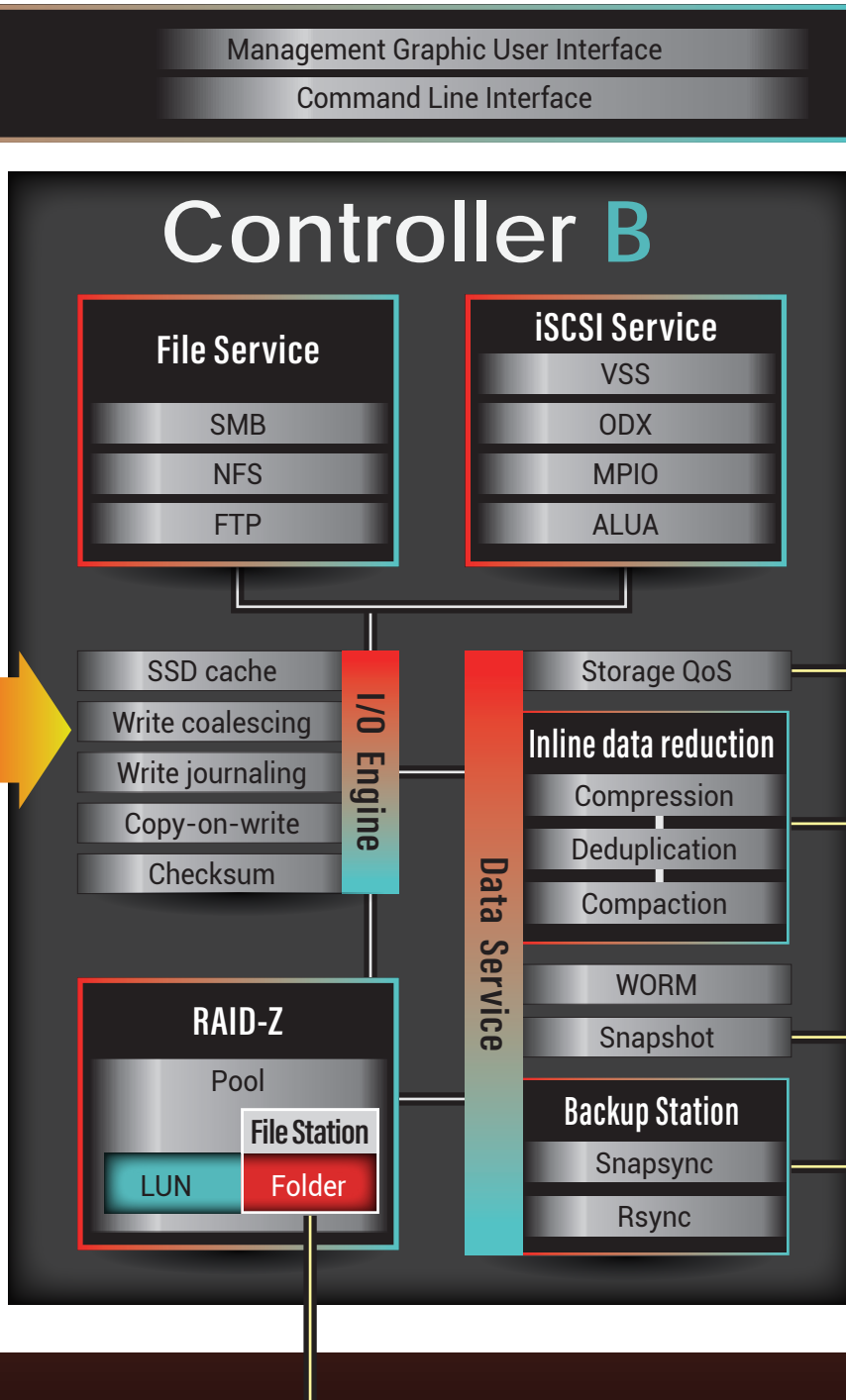
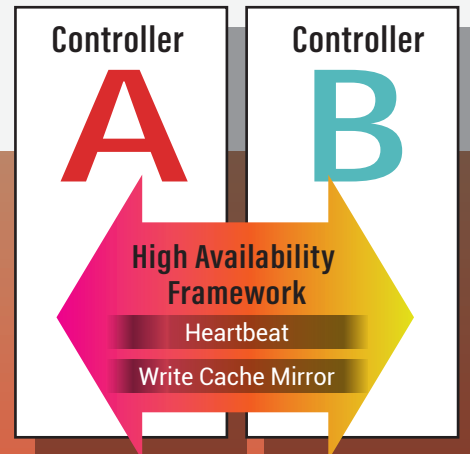


## RAID-Z supports triple-parity protection for large-capacity drives

Triple-parity RAID provides more protection for the system to finish rebuilding the array, which is especially useful for restoring high-capacity disks.

## High availability

The active-active controller architecture can withstand a single point of failure to ensure business continuity. The two controllers constantly synchronize write data and system status and are always ready to takeover in the event of controller failure.



- Solves the "Noisy Neighbor" effect
- Enhanced SSD lifespan
- Robust data protection

See pages 7 and 8

## File management with a visualized interface

Files are easily managed using the QES File Station.

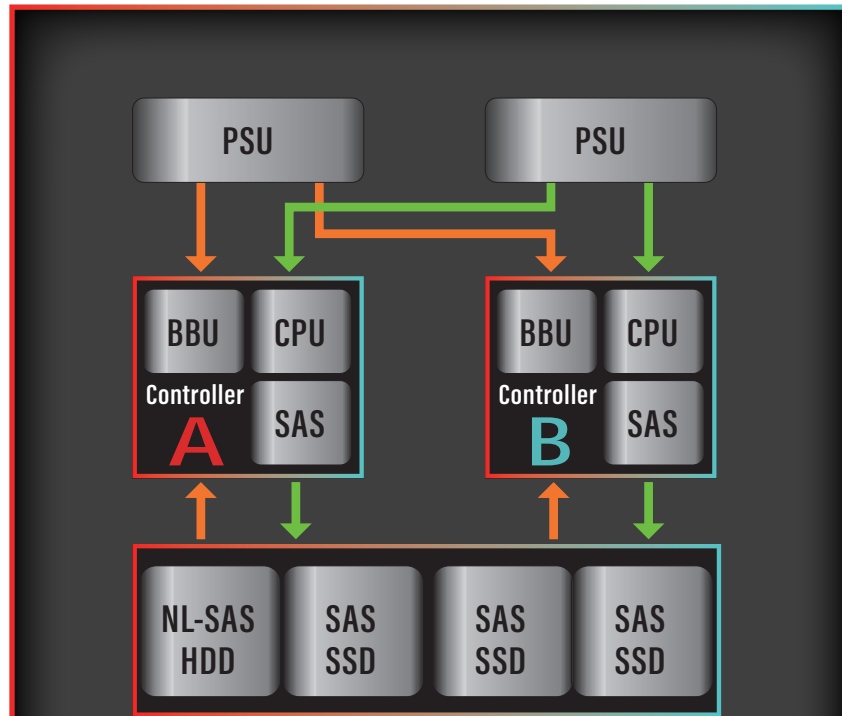
Built for mission-critical applications, the QNAP ES1686dc features ZFS, dual-active controllers, and a user-friendly GUI to provide users with ensured data integrity, high availability, and excellent performance.

## Redundant controllers ensure high availability

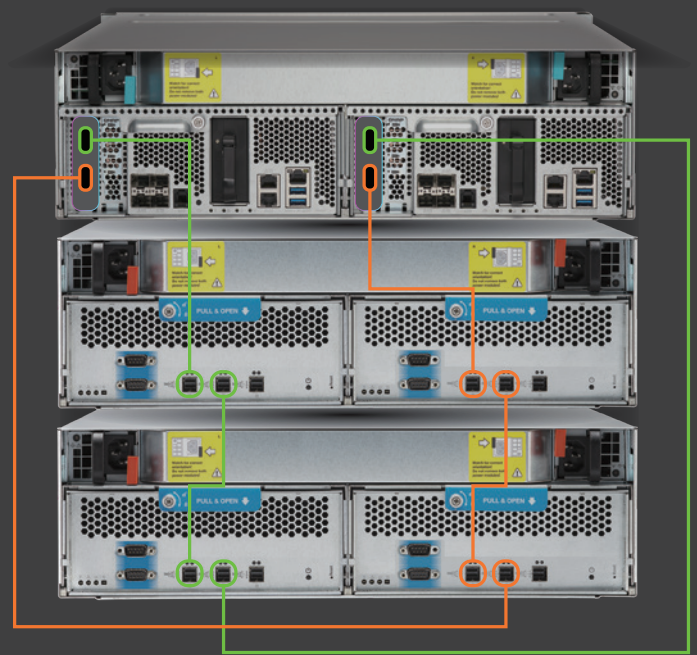
The redundant-controller design of the ES1686dc ensures uninterrupted operations. As the cache memory between the two controllers is continuously synchronizing with each other, if one of the controllers fails, the data written in cache memory can still be written to disks to ensure data integrity.

## Performance elasticity with active-active controller mechanisms

To ensure sufficient system resources during an unexpected controller failure, it is recommended to keep controller workloads at 50%. This configuration can then use the remaining system resources to reinforce performance-demanding applications during peak usage times.

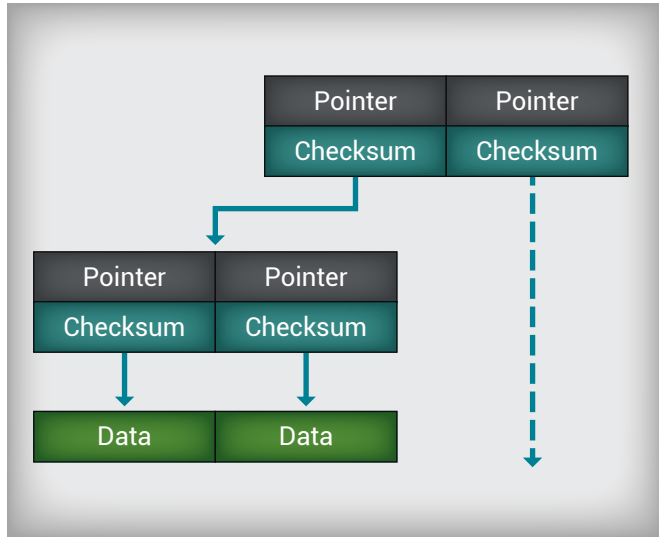


ES1686dc



## Robust data integrity with ZFS

ZFS is built to ensure data integrity, and features mechanisms suited for enterprise-level storage solutions.



### Protects against silent data corruption

Self-Healing

Within ZFS, each block of data is checksummed. When reading a RAID-Z block, ZFS compares it against its checksum, and if the data disks did not return the right answer, ZFS reads the parity and then figures out which disk returned bad data. Then, it repairs the damaged data and returns good data to the requestor, thus preventing silent data corruption.

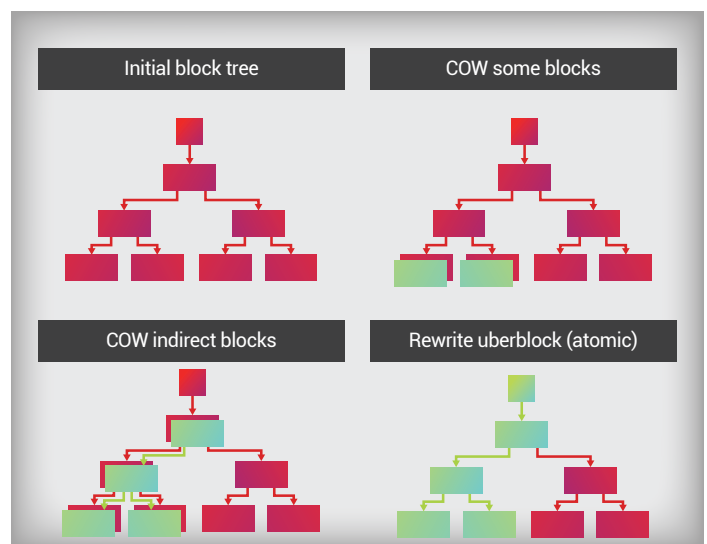
### Immune to power failure

Write Journaling

ZFS tracks file changes not-yet-committed to the file system by recording the intentions of such changes in its data structure. In the event of a system crash or power failure, ZFS checks the journal logs and then applies the scheduled changes, enabling the file system to be brought back online more quickly with a lower likelihood of becoming corrupted.

Copy-On-Write (COW)

ZFS uses a copy-on-write transactional object model. Blocks containing active data are never overwritten in place; instead, a new block is allocated, modified data is written to it, then any metadata blocks referencing it are similarly read, reallocated, and written. By operating with write journaling, the copy-on-write model ensures that users can still find the most-recent data before the latest write operation.

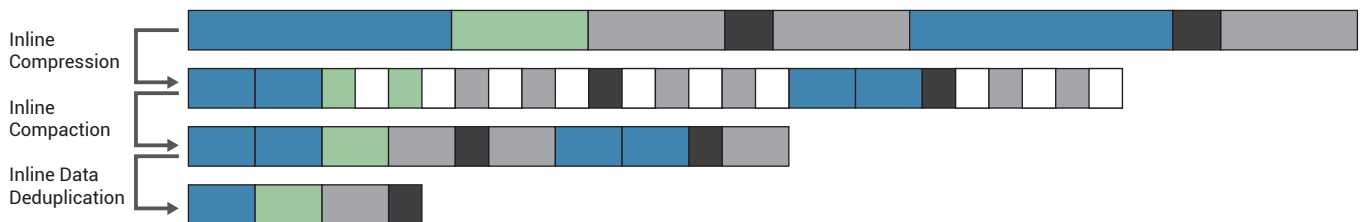


# Efficient data reduction with inline compression, deduplication, and compaction

The QNAP ES family features data reduction technology, making it especially useful for all-flash storage arrays.

## Reduce Storage Footprint

Every read-modify-write operation consumes the life of a flash cell. Inline data compression is being used to reduce the size of the data set to be stored. Data compaction stores multiple user data blocks and files within a single 4 KB block. Without data compaction, each file would get its own 4 KB block, consuming more 4KB blocks for the same amount of data. Inline deduplication then checks new data ready to be sent to storage against data that already exists in storage and doesn't store any of the redundant data it discovers. By minimizing the amount of physical blocks allocated for data storage, QNAP's data reduction technology helps to further extend the lifespan of users' SSDs - allowing the utilization of more cost-efficient SSDs without worrying about flash-cell wear-out.



## Robust Performance Optimization

### Performance optimization- Write coalescing

Write coalescing is a mechanism that transfers random writes (small blocks) into sequential writes (large blocks), which reduces the times of writes on drives. In an all-flash configuration, reduced write times result in minimized garbage collection, therefore minimizing the effect of write amplification.

### Supports NVMe SSD as system read cache

The ES1686dc has two M.2 NVMe slots on each controller, and supports the QM2 adapter (four M.2 SSDs on a single PCIe card). These SSDs can be configured as system read cache to improve total performance without occupying drive bays.

### Use cost-efficient QNAP Drive Adapters to boost system performance

The QNAP Drive Adapter (QDA) allows users to install SATA disks on dual controller models. This enables users to utilize cost-efficient SATA SSDs on the dual-controller ES1686dc system for all-flash configurations and SSD Cache.

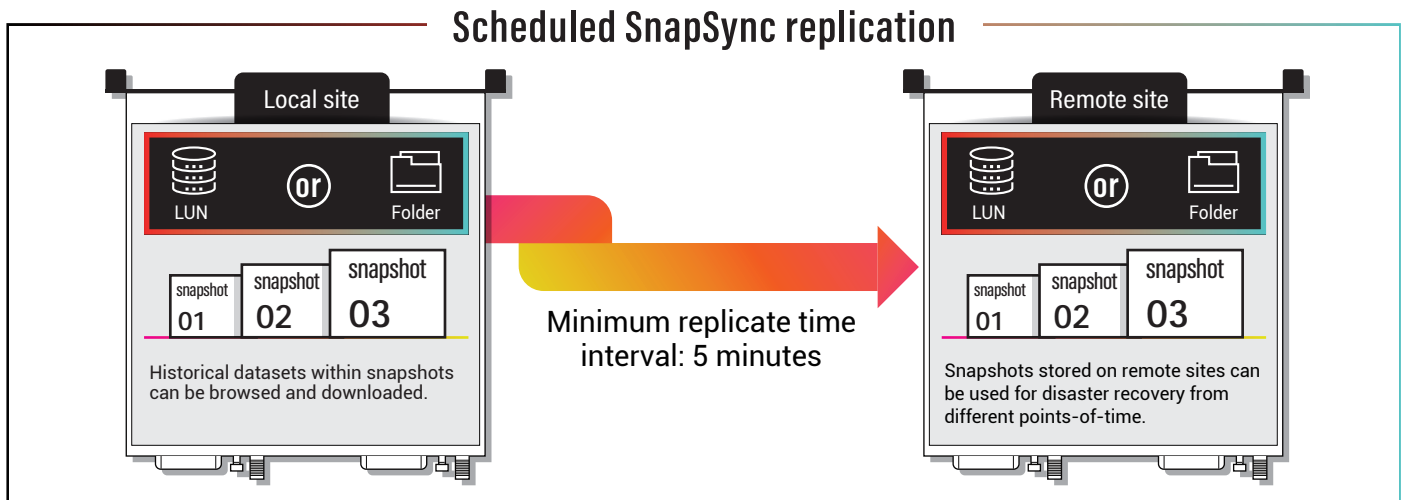
### Storage QoS

The ES1686dc is a powerful storage system that is capable of serving multiple applications in a single array. This raises the concern of the "Noisy Neighbor" effect where low-priority applications consume the resources necessary for more-important services. Storage QoS allows users to define the priority of every application running on the array by setting the system resources that should be allocated for LUNs and Shared Folders.



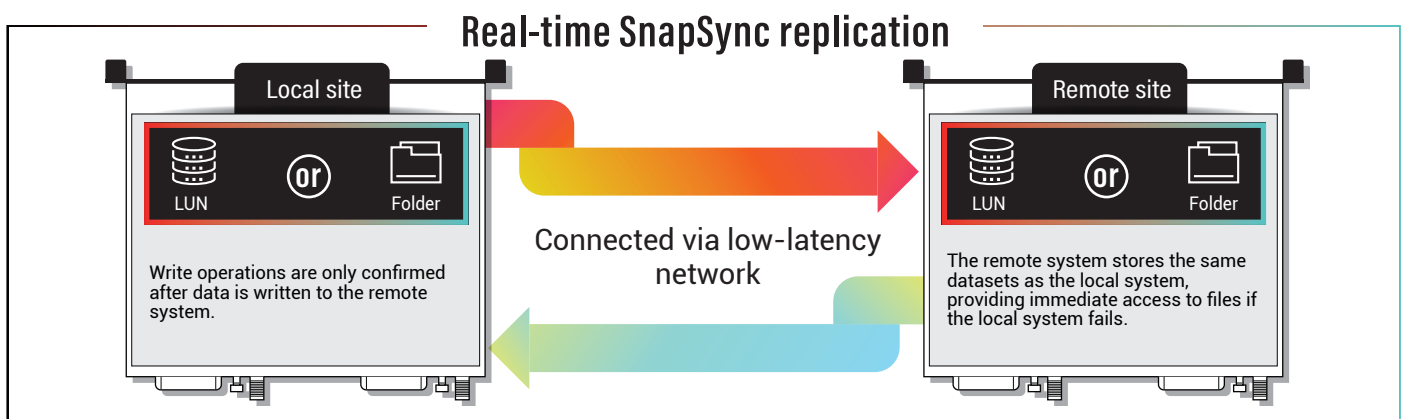
## Snapshot and SnapSync

QNAP NAS snapshots store differential datasets from folders and iSCSI LUNs with no performance impact. Snapshots can be further replicated to another QES system by using QNAP's SnapSync technology.



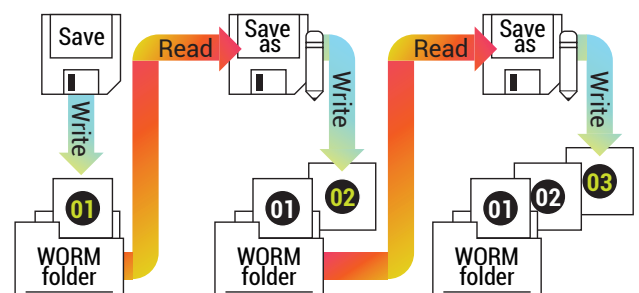
SnapSync creates either a real-time or a scheduled replication job between two QES systems. Disaster recovery can be performed through remote replication to minimize the impact from site failure, as data can be immediately retrieved from the remote backup site.

QES Backup Station allows browsing snapshot content, allowing users to download historical datasets without remounting the entire shared folder.



## WORM folder

With increasingly stringent regulations on how information is stored, many countries require government agencies, financial institutions, and healthcare providers to comply with strict data archiving regulations. To meet the security requirements of enterprise storage, the QNAP ES Series NAS has WORM functionality to help users protect important organizational information. WORM (Write Once, Read Many) is used to avoid modification of saved data. After this feature is enabled, data in shared folders can only be written, and cannot be deleted or modified to ensure data integrity. WORM folders can be deployed on thin-provisioning pools for future expansion flexibility as well as being configured with folder quotas for capacity management. Data reduction technology can also be applied to optimize storage utilization.



- Data cannot be deleted from the file system.
- Supports data retention periods and indefinite data retention.

# Hardware Specification

|                        | ES1686dc-2123IT-64G                          | ES1686dc-2145NT-96G        | ES1686dc-2145NT-128G       |
|------------------------|--|----------------------------|----------------------------|
| Form Factor            | 3U   |                            |                            |
| Processor              | Intel Xeon D 4-core 2.2GHz                   | Intel Xeon D 8-core 1.9GHz | Intel Xeon D 8-core 1.9GHz |
| Memory                 | 64GB   | 96GB                       | 128GB                      |
| Max. Memory            | 1TB  |                            |                            |
| Memory slots           | 16 (DDR4, RDIMM/LRDIMM)                      |                            |                            |
| Drive bays             | 16 x 3.5-inch SAS/SATA                       |                            |                            |
| M.2 SSD slots          | 4 (supports SATA 6Gb/s or NVMe Gen3 x4 2280) |                            |                            |
| SSD cache              | Yes  |                            |                            |
| Copy to Flash battery  | 12v, 2200mAh                                 |                            |                            |
| Management ports       | 1 per controller                             |                            |                            |
| On-board network ports | 4x 1GbE (RJ45)<br>8x 10GbE (SFP+)            |                            |                            |
| PCIe slots             | 4 (Gen3x8)                                   |                            |                            |
| USB ports              | 4 (USB3.0)                                   |                            |                            |
| Dimensions (mm)        | 132 x 483.05 x 630.62 mm                     |                            |                            |
| Weight (kg)            | 32.69 kg (Gross) ; 25.83 kg (Net)            |                            |                            |
| Temperature            | 0 - 40 °C (32°F - 104°F)                     |                            |                            |
| Relative humidity      | 5% - 95%                                     |                            |                            |
| Power supply           | 90~264VAC; 770W                              |                            |                            |
| Power consumption      | Normal 500.87W                               |                            |                            |
| Noise                  | 55.8 db                                      |                            |                            |

## Expansion Enclosure Specifications

|                   | EJ1600v2                                 | EJ1600    |
|-------------------|--|-----------|
| Form Factor       | 3U rackmount                             |           |
| Host Interface    | SAS 12Gbps                               | SAS 6Gbps |
| Dimensions        | 132 × 446.2 × 618 mm                     |           |
| Weight (Net)      | 33.76 kg (Gross), 24.11 kg (Net)         |           |
| Drive slots       | 16 x 3.5-inch SAS/SATA                   |           |
| Temperature       | 0 - 40 °C (32°F - 104°F)                 |           |
| Relative Humidity | 5~95% RH non-condensing, wet bulb: 27°C. |           |
| Power Supply      | 2x 450W, 90-240Vac~, 50-60Hz             |           |
| Power Consumption | Normal: 344.19 W                         |           |
| Sound Level       | 53.5 db(A)                               |           |

## Network Expansion Cards

| Brand    | Model          | Description  |
|----------|----------------|--|
| QNAP     | LAN-10G2T-X550 | Dual-port (10GBASE-T) 10GbE network expansion card |
| Mellanox | MCX312B-XCCT   | Dual-port (SFP+) 10GbE network expansion card      |
| Mellanox | MCX314A-BCCT   | Dual-port (QSFP) 40/56GbE network expansion card   |
| Mellanox | MCX313A-BCCT   | Single-port (QSFP) 40/56GbE network expansion card |
| Mellanox | MCX311A-XCCT   | Single-port (SFP+) 10GbE network expansion card    |
| QNAP     | LAN-40G2SF-MLX | Dual-port (QSFP+) 40GbE network expansion card     |
| QNAP     | LAN-10G2SF-MLX | Dual-port (SFP+) 10GbE network expansion card      |

## Software Specification

|   |   |  |
|---|---|--|
| <b>High Availability</b>  | <b>Security</b>   | <b>Thirty Party Plug-ins</b>   |
| Active-active dual controller for NAS   | Network access protection with auto-blocking: SSH, HTTP(S), FTP, CIFS/SMB       | SMI-S Provider   |
| Active-active dual controller for JBOD expander   | CIFS/SMB host access control for shared folders                                 | vSphere Web Client Plugin  |
| MPIO for iSCSI high availability  | FIPS 140-2 validated AES 256-bit volume-based and shared folder data encryption | VAAI Plug-in: NFS, iSCSI   |
| Firmware update without interrupting service  | Importable SSL certificates   | VMware Storage Replication Adapter (SRA)                                 |
| Link aggregation for network high availability  | Instant alert via E-mail, SMS, beep   | QNAP Cinder Driver for Openstack block storage                           |
| <b>Supported Client OS</b>  | <b>Storage Management</b>   | QNAP Manila Driver for Openstack shared file storage                     |
| Windows 7 (32/64-bit), Windows 8 (32/64-bit), Windows 10 (32/64-bit), Windows Server 2008 R2/2012/2012R2/2016   | Storage space utilization monitoring  | <b>Power Management</b>  |
| Apple Mac OS X  | Storage pool with RAID 0, 1, 5, 6, 10, 50, 60, RAID TP, triple mirror           | Wake on LAN  |
| Linux and UNIX  | Global hot spare  | Automatic power on after power recovery                                  |
| <b>Supported Browsers</b>   | SSD read cache  | Network UPS support with SNMP management                                 |
| Google Chrome   | NVRAM write cache (BBU-protected)   | <b>Access Right Management</b>   |
| Microsoft Internet Explorer   | Scheduled Backup Battery Unit (BBU) learning                                    | Batch users creation   |
| Mozilla Firefox   | Share folder/LUN with thin provisioning   | Import/Export users  |
| Apple Safari  | Checksum for end-to-end data integrity  | User quota management  |
| <b>Multilingual Support</b>   | Silence error detection and self-healing  | Local user access control for CIFS/SMB and FTP                           |
| Chinese (Traditional & Simplified), Czech, Danish, Dutch, English, Finnish, French, German, Greek, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, Portuguese (Brazil), Romanian, Russian, Spanish, Swedish, Thai, Turkish | Pool scrub for data verification  | <b>Domain Authentication Integration</b>                                 |
| <b>File System</b>  | Share folder quota management   | Microsoft Active Directory support                                       |
| ZFS   | Inline deduplication for shared folder/LUN                                      | LDAP client  |
| <b>Networking</b>   | Inline compression for shared folder/LUN  | Domain users login via CIFS/SMB, FTP                                     |
| TCP/IP (IPv4 & IPv6)  | Inline encryption for shared folder/LUN   | <b>Administration</b>  |
| 10 Gigabit NICs with jumbo frame (LACP, Load Balance, Failover, Round Robin)  | WORM (Write Once Read Many) for shared folder                                   | Multi-window, multi-tasking based system management                      |
| Service binding based on network interfaces   | Storage QoS (Quality of Service) for shared folder/LUN                          | Movable Icons and personalized desktop                                   |
| Proxy server  | Shared Folder/LUN snapshot  | Smart toolbar and dashboard for neat system status display               |
| Protocols: CIFS/SMB2/SMB3, NFS v3/NFS v4, FTP, FTPS, TFTP, HTTP, HTTPS, SSH, iSCSI, SNMP, SMTP, and SMSC  | Online pool, share folder, and LUN expansion                                    | Smart Fan control  |
| iSER (iSCSI Extensions for RDMA)  | S.M.A.R.T. Information for drives and Predictive S.M.A.R.T. Migration           | SNMP (V1/V2 & V3)  |
| Bonjour Discovery   | SSD Life monitors the remaining lifespan of solid-state drives                  | Resource monitor   |
| <b>File Server</b>  | Time-Limited Error Recovery (TLER)  | Network recycle bin for file deletion via CIFS/SMB, File Station and FTP |
| Shared folder for CIFS/SMB, NFS and FTP   | JBOD ID Reinitialized   | Smart file filter  |
| File sharing across Windows, Mac, and Linux/UNIX  |   | Comprehensive logs (events & connection)                                 |
| Windows ACL   |   | Syslog client management   |
|   |   | System settings backup and restore                                       |
|   |   | Command Line Interface (CLI)   |

# ES1686dc

Enterprise ZFS ES1686dc



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