NEC D-Series Storage Line
Spans Midrange *through* High End

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Management Summary

You probably know of NEC as a global manufacturer of electronics goods, semiconductors and information technology. It is a Japan-based corporation with a well-known history in these areas. We would like to bring your attention to an area of growing focus for NEC – enterprise storage. NEC has been in the storage business for over four decades. **In particular, it has launched a new storage family called the *D-Series*. It consists of six models based on the same architecture that span the midrange through the high end.**

D-Series features include the following.

- High-bandwidth, internal crossbar switched architecture
- SAS and SATA drive support for tiered storage
- Upgradeable without "forklift upgrade", in some cases online and non-disruptive
- Scalable from 72-drive array to 1,536-drive array
- Enhanced RAID schemes for high availability, such as RAID Triple Mirror
- Proactive drive failure diagnostics and reduced number of drive rebuilds
- Double redundant cache and power for high availability
- Reduced power consumption by shutting off inactive drives
- Several management and data protection software features

As you can see, this list adds up to an impressive set of capabilities for enterprise environments, especially for a new family of storage arrays. Read on for an overview of the NEC D-Series.

NEC D-Series Storage Line

The NEC D-Series is a capable and robust storage line that spans the midrange through the high end. As you can see in *Exhibit 1* on the next page, there are six storage models in the series. The *D1-10* is sized as an entry to the midrange with a capacity of 54 TB, 4 Fibre Channel host connections, and 2 GB cache. At the other end of the spectrum is the *D8-1040*, which is a high-end array with a capacity of 1.152 petabytes, 64 Fibre Channel 4 Gbit/s host connections, and 128 GB cache. In between are the *D3-10*, *D8-1010*, *D8-1020*, and *D8-1030*. All models are based on the same crossbar-switch architecture and are upgradeable within the family.
The D-Series has a number of salient features.

SAS and SATA Drives

The D-series supports both SAS and SATA drives in the array.

- *SAS* – 73, 147, and 300 GB at 15,000 RPM
- *SATA* – 500 and 750 GB at 7,200 RPM

Exhibit 1 — NEC D-Series Storage Line – Technical Specifications

Product	D1-10	D3-10	D8-1010	D8-1020	D8-1030	D8-1040
# Host Ports FC	4	12	16	32	48	64
Drive Types	SAS, SATA	SAS, SATA	SAS, SATA	SAS, SATA	SAS, SATA	SAS, SATA
Max # Drives	72	144	384	768	1,152	1,536
Max Capacity TB	54	108	288	576	864	1,152
Cache GB	2	4	32	64	96	128
Upgrade path	Yes, offline	Yes, offline	Yes, online	Yes, online	Yes, online	N/A

Source: NEC

These two drive types are designed for different purposes. SAS is the successor to parallel SCSI, which has a long history in enterprise storage. These drives are designed for high performance and robustness. They have dual, active-active ports and robust verification and error-correction capabilities. SAS can be used for critical applications – with the added benefit that current market prices are significantly less than Fibre Channel drives. SATA is the successor to parallel ATA and is designed for high capacity and low cost. SATA drives are suitable for online storage of secondary or archived data that does not need the performance and robustness of enterprise drives. These differences aside, SAS and SATA drives share a common serial interface that basically makes them interoperable, though some additional intelligence is needed to coexist behind one array controller.

With SAS to store primary data and SATA for secondary, the D-Series provides a single platform for tiered storage. It allows enterprises to balance and optimize storage performance, availability and cost – without the management overhead of different makes and models. Tiered storage is also a key component of information lifecycle management (ILM), a broader strategy for managing data actively, thoughtfully and according to the long-term interests of an enterprise. Its objective is to deliver the right service levels to the right data at the lowest cost.[1]

Upgradeability

The D-Series is upgradeable within the family, without a proverbial "forklift upgrade". The D1-10 and D3-10 can upgrade via a procedure that takes the unit offline, while the D8-1010, D8-1020, and D8-1030 can upgrade online and without disrupting host access.

Upgradeability protects a storage investment. Depending on how quickly data grows, an enterprise will eventually need a larger array. The ability to carry forward existing drives and controllers saves on equipment purchases.

Scalability

The scalability of the D-Series spans the midrange through the high end, from a 72-drive array to a 1,536-drive array. This is an unusually wide range, since most storage manufacturers have separate product lines for the midrange and high end. The D-Series' combination of scalability and upgradeability can effect a higher degree of consolidation in an enterprise environment. It eliminates the need for deploying different storage models to cover midrange and high-end requirements, which is easier to manage and increases utilization by creating fewer storage "islands".

Enhanced RAID

Several enhanced RAID schemes are available for protecting data and minimizing the impact of drive rebuilds. RAID-1 is commonly used to protect data by mirroring disk drives, but in the unlikely event that both drives in a pair fail simultaneously, data could be lost. Therefore, NEC offers a new technology called RAID Triple Mirror or RAID-TM that protects against this potentiality by mirroring drives twice. In other words, it writes data three times for redundancy. RAID-TM delivers fast random access performance and continuous operation in the event of two drive failures in a mirror group. It also offers RAID-6, a parity RAID scheme that can withstand two drive failures, and a double parity version of RAID-3.

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[1] See **The Clipper Group Explorer** dated November 17, 2006, entitled *Practical Steps Toward Information Lifecycle Management* and available at http://www.clipper.com/research/TCG2006100.pdf.

"Phoenix" Hard Drive Diagnostics

NEC's Phoenix technology continuously monitors hard drives for abnormal behavior patterns that suggest imminent faults. When a drive is flagged, Phoenix performs a special background diagnosis, without disrupting host access to data. The result determines whether the drive is repairable (perhaps with a bad sector sectioned off) or needs to be designated as a failed drive. According to NEC's field data, the net effect of Phoenix technology has been to reduce the number of drive rebuilds.

Performance

Each D-Series controller has an aggregate bandwidth of 12 Gbit/s to the attached disk drives, which connects through an internal cross-bar switch to cache and host ports. Depending on the model, an array has up to four controllers for redundancy and incremental performance.

Double Redundant Cache and Power

NEC also raises the ante for redundancy in cache and power. Instead of just mirrored cache, which is subject to performance degradation if one of the mirrors fails, the D-Series employs two instances of mirrored cache that are written in parallel, creating four copies of write data in cache before it is written to disk. While this approach doubles the amount of cache consumed for writes, it also eliminates slowdowns caused by a failed mirror.

Instead of just one redundant power supply for failover, the D-Series employs two instances of redundant power supplies, each with failover, so the unit can continue operating even with two supply failures.

Reduced Power Consumption

In the spirit of greening data centers, the D-Series can reduce power consumption by temporarily shutting down inactive disk drives. This is also known as *MAID (Massive Array of Inactive Disks)* technology. In the initial release, administrators manually establish times to spin down and spin up disks. In future releases, array firmware and eventually applications will stop drives based on access patterns.

Management and Data Protection Software

NEC offers several software management and data protection features for the D-Series.

- *StorageManager* – Configures devices and monitors health of components.

- *PerformanceMonitor* – Monitors array performance in real time and collects statistical data.
- *PerformanceNavigator* – Reporting and analysis tool using data gathered by Performance-Monitor.
- *ReallocationControl* – Leveraging a flexible pool of resources in a storage array, it allocates host adapters, disk adapters, cache, and logical disks to hosts based on application loads.
- *ReplicationSuite* (*DDR* and *DSV*) – Replicates data internally, asynchronously or synchronously, and establishes point-in-time copies.
- *RemoteDataReplication* (*RDR*) – Replicates data between storage arrays asynchronously or synchronously.
- *AccessControl* – Manages host access privileges to prevent overwriting or data loss in a shared SAN environment.
- *CachePartitioning* – Partitions cache and I/O resources per application.
- *RDR*/*DR* – Replicates data between storage arrays for disaster recovery purposes, asynchronously or synchronously, and supports consistency groups for applications.
- *PathManager* – Provides load balancing and failover for host SAN connections.

Conclusion

When you add it up, the D-series demonstrates a surprising breadth of scalability, performance, availability, and software functionality for a new storage line. NEC is clearly leveraging a long history of product development, while adding new innovations like SAS/SATA support for tiered storage, *RAID-TM*, and double-redundant cache and power. With so much going for it, we expect this product line will make an impact on the storage market.

If you are in the market for a midrange or high-end enterprise storage array, be sure to consider the new NEC D-series.

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