Performance Benefits of NVMe™ over Fibre Channel – A New, Parallel, Efficient Protocol
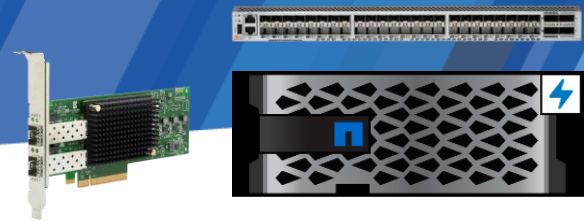
NVMe™ over Fibre Channel delivered 58% higher IOPS and 34% lower latency than SCSI FCP. (What's not to like?)

Executive Summary

NetApp's ONTAP 9.4 is the first generally available enterprise storage offering enabling a complete **NVMe™ over Fibre Channel (NVMe/FC)** solution. NVMe/FC solutions are based on the recent T11/INCITS committee **FC-NVMe** block storage standard, which specifies how to extend the NVMe command set over Fibre Channel in accordance with the NVMe over Fabrics™ (NVMe-oF™) guidelines produced by the NVM Express™ organization.

Why Move to NVMe over Fibre Channel?

The vast majority of enterprise datacenters use Fibre Channel SANs to store mission-critical data. Many of the customers running these datacenters already have the hardware necessary to run NVMe/FC, including Fibre Channel switches, adapters and storage. With this solution from NetApp and Broadcom, moving to NVMe/FC with this existing hardware requires only a software upgrade on the host initiators and the storage targets.

For this test report, Demartek worked with NetApp and Broadcom (Brocade and Emulex divisions) to demonstrate the benefits of NVMe over Fibre Channel on the NetApp AFF A700s, Emulex Gen 6 Fibre Channel Adapters, and Brocade Gen 6 Fibre Channel SAN switches.

Key Findings and Conclusions

> *NVMe/FC accelerates existing workloads:* Enterprise applications such as Oracle, SAP, Microsoft SQL Server and others can immediately take advantage of NVMe/FC performance benefits.

> *Test results:* in our tests, we observed up to **58% higher IOPS** for NVMe/FC compared to SCSI FCP *on the same hardware*. We also observed minimum differences, depending on the tests, of **11% to 34% lower latency** with NVMe/FC.

> *NVMe/FC is easy to adopt:* All of the performance gains we observed were made possible by a software upgrade.

> *NVMe/FC protects your investment:* The benefits we observed were with existing hardware that supports 32GFC.

> *NVMe/FC enables new SAN workloads:* Big data analytics, Internet of Things (IoT) and A.I. / deep learning will all benefit from the faster performance and lower latency of NVMe/FC.
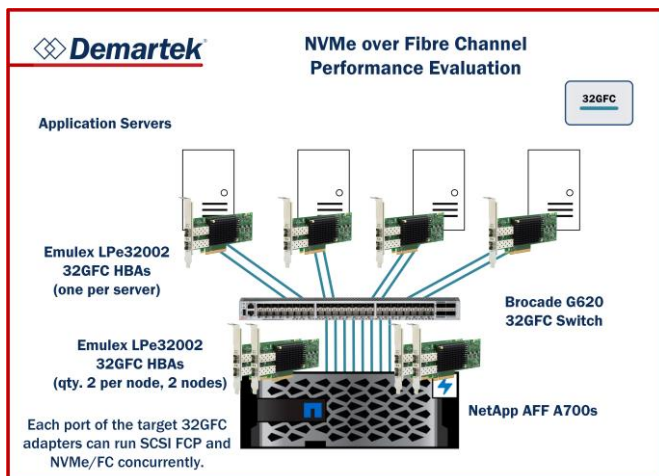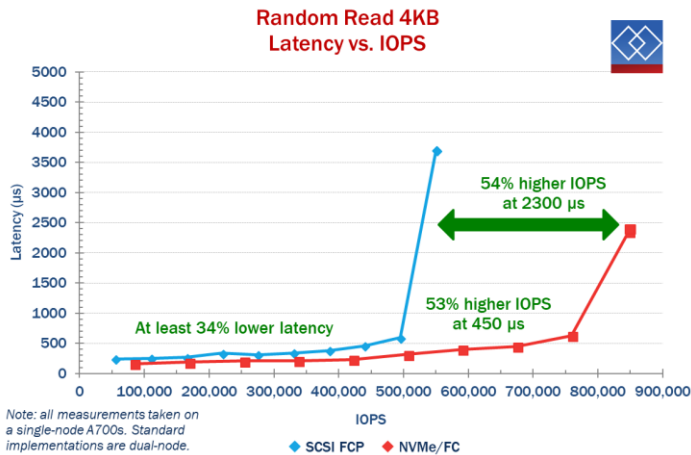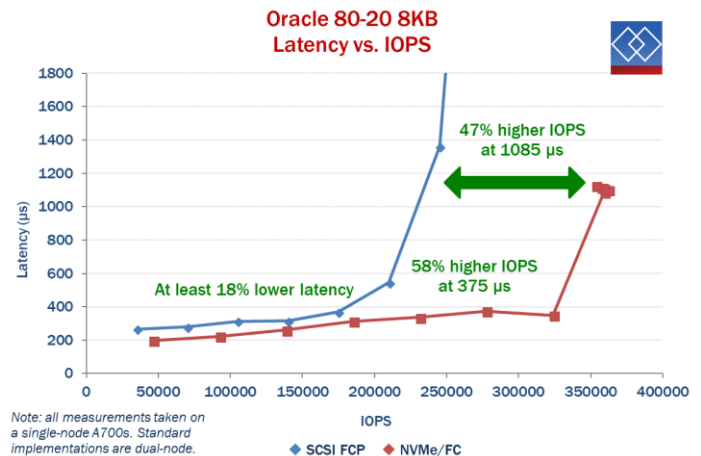
Performance Results

Random Read 4KB

For 4KB random reads, NVMe/FC achieved **53% higher IOPS** at 450 μs latency. **Latency was at least 34% lower** (better) for NVMe/FC.

**Random Read 4KB
Latency vs. IOPS**

54% higher IOPS at 2300 μs

At least 34% lower latency

53% higher IOPS at 450 μs

Note: all measurements taken on a single-node A700s. Standard implementations are dual-node.

Simulated Oracle 80-20 8KB Workloads

For the simulated Oracle workload with an 80/20 read/write mix at 8KB (typical OLTP database I/O)), NVMe/FC achieved **58% higher IOPS** at 375 μs latency. **Latency was at least 18% lower** for NVMe/FC.

**Oracle 80-20 8KB
Latency vs. IOPS**

47% higher IOPS at 1085 μs

At least 18% lower latency

58% higher IOPS at 375 μs

Note: all measurements taken on a single-node A700s. Standard implementations are dual-node.

Summary and Conclusion

NVMe/FC leverages the parallelism and performance benefits of NVMe with the robust, reliable enterprise-grade storage area network technology of Fibre Channel.

For the configuration tested, only a software upgrade was required in the host initiators and storage targets. This means that investments already made in Fibre Channel technology can be adopted easily without requiring the purchase of new hardware.

Demartek believes that NVMe/FC is an excellent (and perhaps obvious) technology to adopt, especially for those who already have Fibre Channel infrastructure, and is a good reason to consider Fibre Channel technology for those examining NVMe over Fabrics.

Additional test results are available in the full report.

The most current version of this report is available at
http://www.demartek.com/Demartek_NetApp_Broadcom_NVMe_over_Fibre_Channel_Evaluation_2018-05.html on the Demartek website.

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