NetApp EF-Series and Oracle Database

Confidently deploy high-performance databases on end-to-end NVMe EF-Series plus Broadcom Emulex HBAs and Brocade switches

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The challenge

Many organizations depend on high-performance analytics databases such as Oracle to run their business. These applications must operate at the highest levels with maximum efficiency, requiring latencies of only microseconds. Maximizing the number of business transactions and getting key insights quickly and reliably from your databases can differentiate your organization and accelerate efficiency and effectiveness.

The solution

With leading-edge NVMe technology, you can unlock the value of your data and use real-time analytics to rapidly develop insights that were previously impossible for performance-sensitive database workloads. The end-to-end NVMe midrange NetApp EF600 and entry-level NetApp EF300 all-flash arrays can accelerate access to your data to help you derive results faster. Get the most powerful performance, smart value, and trusted simplicity in a dense (2U) enterprise package. Future-proof your environment with NVMe technology from the NVMe industry leader.

The NetApp EF300 storage array supports the addition of NL-SAS HDDs to an EF-Series system with SAS expansion shelves. You can deploy both NL-SAS HDDs and SAS SSDs, supporting extra use cases such as an Oracle database backup location or, by using Oracle tiering capabilities, moving cold data to HDDs. With 24 NVMe SSDs and 240 NL-SAS HDDs, the maximum raw system capacity is 4687TB.

By combining Oracle ASM and NetApp EF-Series, you get a powerful set of tools to easily scale out storage to your meet performance needs. The midrange NetApp EF600 all-flash array is an end-to-end NVMe storage system that can turbocharge access to your data and increase its value, which makes it an optimal target for high-performance databases. Requiring just 2U of rack space, the EF600 all-flash array combines extreme IOPS, sub-100-microsecond response times, and up to 44GBps of bandwidth with leading, enterprise-proven availability features, including:

Key benefits

Enhance performance

- End-to-end NVMe NetApp® EF-Series systems can deliver up to 1 million OLTP IOPS with less than 300 microseconds of latency.

- Brocade NVMe over Fibre Channel (NVMe/FC)–capable Gen 6 and Gen 7 FC switches are the purpose-built network infrastructure for mission-critical storage, delivering superior performance, increased scalability, and operational stability.

Increase flexibility

- An EF300 system with SAS expansion shelves increases usability to meet your needs.

- Easy scalability helps meet your capacity and computational needs with Oracle Automatic Storage Management (ASM).

Control costs

- Industry-leading NetApp EF-Series all-flash arrays are proven to deliver optimal price/performance.

- Support for SCSI-based FC Protocol (FCP) and iSCSI makes it easy to migrate workloads.

Simplify deployment

- EF-Series systems are simple to deploy and manage.

- By using Dynamic Disk Pools, Oracle databases are easy to deploy on EF-Series systems.

- Redundant components with automated failover
- Intuitive storage management with comprehensive tuning functions
- Advanced monitoring and diagnostics with proactive repairs
- NVMe over Fabrics (NVMe-oF) support, including NVMe/FC, NVMe over RoCE (NVMe/RoCE), and NVMe over InfiniBand (NVMe/IB)
- SCSI-based 32Gb FCP and iSCSI support

With the joint Broadcom and NetApp solution, you can efficiently enable and accelerate a digital transformation for your enterprise. NetApp delivered the industry's first end-to-end enterprise NVMe/FC storage solution over a 32Gb FC fabric, and Broadcom's Brocade and Emulex divisions are leaders in the SAN fabric space. Brocade has been the leading provider of storage networking solutions worldwide for more than 20 years, supporting mission-critical systems and business-critical applications in the most demanding environments. Brocade networking solutions help organizations achieve their critical business initiatives as they transition to a world where applications and information can reside anywhere. Today, Brocade is extending its proven data center expertise across the entire network with open, application-optimized, and efficient solutions that are built for consolidation and unmatched mission-critical application performance.

The sixth generation of FC is aimed at satisfying the needs of growing deployments of flash storage, hyperscale virtualization, and new high-speed data center architectures such as NVMe. Brocade G620 Gen 6 FC switches shatter application performance barriers with up to 100 million IOPS and 32Gb/128Gb FC performance to meet the demands of flash-based storage workloads, with pay-as-you-grow scalability.

Because little change is required in the standards to implement NVMe/FC, adding NVMe/FC to your existing storage is easy, seamless, and noninvasive. And because NVMe/FC can use the same infrastructure components concurrently with other FC traffic, it's easy to migrate workloads at the pace that works for your organization. NVMe/FC also enables the efficient transfer of NVMe commands and structures end to end with no translations.

EF-Series OLTP performance comparison
Figure 1 shows EF-Series performance results for the entry-level EF280 (FC), the midrange EF570, and the end-to-end NVMe EF300 and EF600 arrays configured for a typical OLTP workload. For testing, each array was configured to use 24 SSDs in a pool, the FC or NVMe/FC host protocol, and a workload of 75% reads and 25% writes. The graph shows that at approximately 300-microsecond latency, the EF280 produces 100,000 IOPS, the EF300 produces 250,000 IOPS, and the EF570 produces 400,000 IOPS. The EF600 delivers up to 1 million IOPS with less than 300 microseconds of latency.
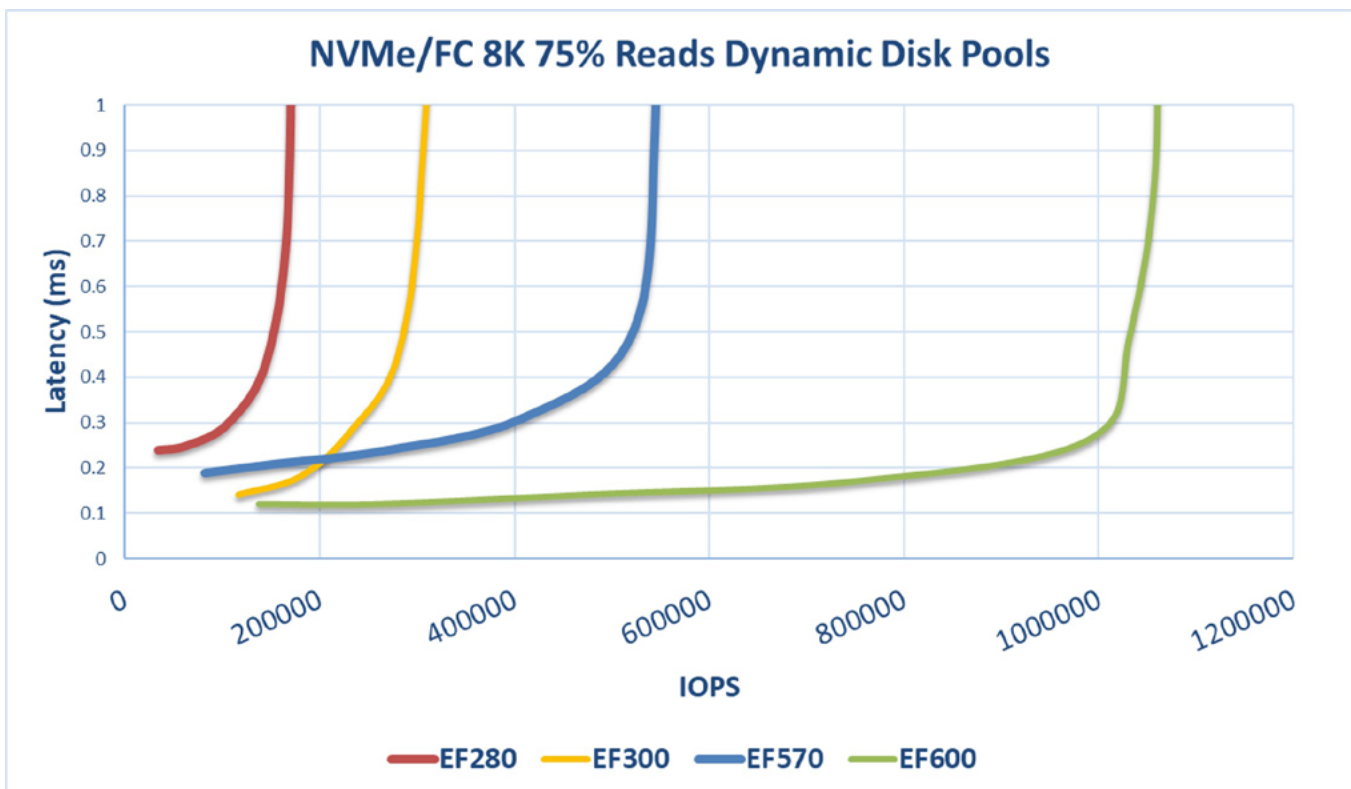

Figure 1) OLTP performance comparison.

Scale with Oracle ASM

NetApp EF-Series storage systems automatically load-balance I/O among all the SSDs for the underlying volume group. All LUNs that are placed in the single volume group can use all the volume group's SSDs in a balanced manner. Oracle ASM provides further load balancing of I/O across all LUNs or files in an Oracle ASM disk group. ASM distributes the contents of each data file evenly across the entire pool of storage in the disk group based on a 64MB stripe size. This distribution provides even performance through the available SCSI devices at the host and network layers.

When used with Oracle ASM, NetApp load balancing enables multiple LUNs and file system data to share common drives. This sharing reduces the number of LUNs that are required for each Oracle ASM disk group, which improves manageability without compromising performance. This reduction means optimal read and write performance in high-transaction database environments.

Figure 2 illustrates how you can configure an Oracle Real Application Clusters (RAC) database with multiple EF-Series all-flash arrays for a multinode RAC database. You can create a single pool by using all available drives on each EF-Series array; the data and log volumes are created from it. The ORADATA and ORALOG LUNs are provisioned on the EF-Series arrays by using the NetApp SANtricity® OS and are then presented to the Oracle RAC nodes. You can create a single ASM disk group to span all the LUNs and to present a single file system from a database and host perspective.

With this configuration, your workload is evenly distributed across all the storage LUNs and volumes on all your arrays. Oracle ASM offers the flexibility to scale performance and capacity by simply adding another EF-Series array.
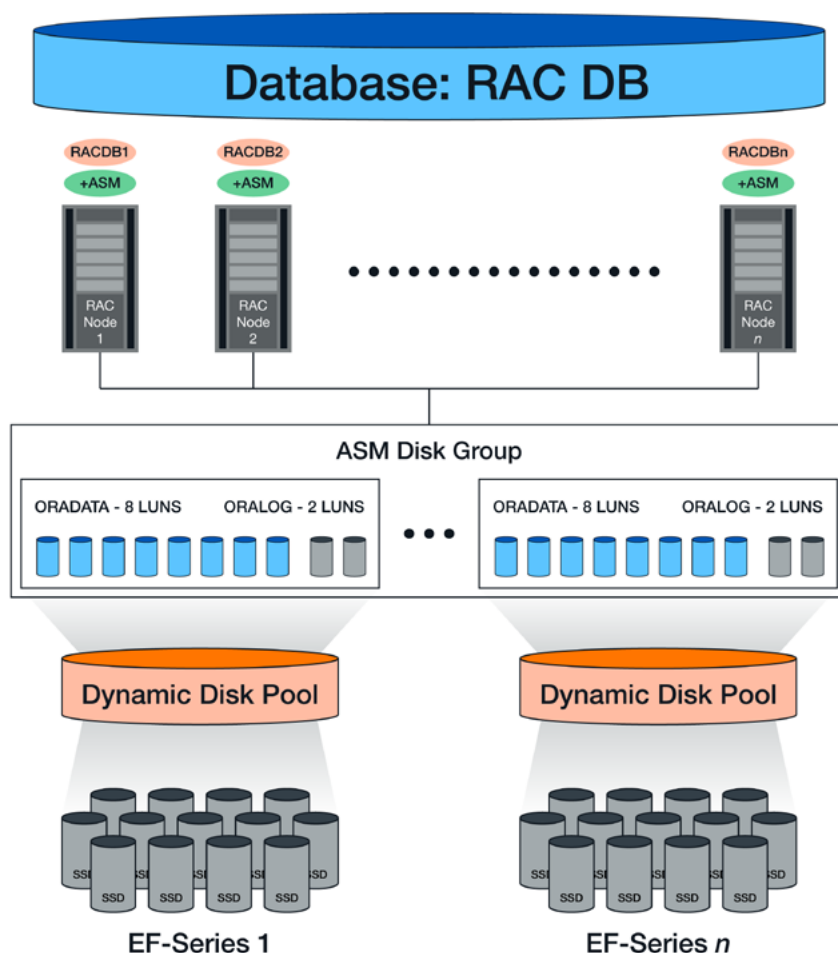

Figure 2) Oracle ASM disk group layout per database.

Brocade FC switches

To realize the full benefits of flash, your organization should transition your high-performance, latency-sensitive workloads to the end-to-end NVMe EF-Series storage. The Brocade G620 is NVMe-ready, so your organization can seamlessly integrate Brocade Gen 6 FC networks with the next generation of flash storage, without a disruptive rip and replace. The simplicity and efficiency of NVMe/FC enable significant performance gains for flash storage. Also, with NVMe, you can achieve faster application response times and harness the performance of SSDs for better scalability across virtual data centers with flash. By combining the efficiency of NVMe/FC with the high performance and low latency of Brocade Gen 6 FC switches, your organization can accelerate IOPS to deliver the performance, application response time, and scalability that you need for your next-generation data center.

Conclusion

The NetApp EF-Series solution for high-performance Oracle databases enables you to use best-in-class, end-to-end, modern SAN and NVMe technologies to deliver business-critical IT services today while preparing for the future. With the EF-Series, NetApp has created a SAN array that is both future-ready and usable today—and it is easy to implement with your current operational processes and procedures. NetApp EF-Series flash arrays plus Broadcom Emulex host bus adapters (HBAs) and Brocade switches are market leaders in delivering high performance, consistent low latency, and advanced high-availability features for your NVMe-oF environment. See Figure 3.

About NetApp

In a world full of generalists, NetApp is a specialist. We're focused on one thing, helping your business get the most out of your data. NetApp brings the enterprise-grade data services you rely on into the cloud, and the simple flexibility of cloud into the data center. Our industry-leading solutions work across diverse customer environments and the world's biggest public clouds.

As a cloud-led, data-centric software company, only NetApp can help build your unique data fabric, simplify and connect your cloud, and securely deliver the right data, services and applications to the right people—anytime, anywhere. www.netapp.com

About Broadcom

Broadcom is an enterprise storage company with a wide portfolio of storage technologies including PCIe switching, SAS/SATA controllers, and PCIe switching, as well as Fibre Channel HBAs for servers, to industry leading Fibre Channel Fabrics, and HBAs optimized for storage arrays. Broadcom is a $20B company with 16,000 employees (mostly engineers), decades of R&D in Fibre Channel and storage, and partnerships across server, storage, and networking companies.

NetApp EF-600   Emulex Gen6 FC HBAs   Brocade G620" Gen6 FC, 1U 64-Port

Figure 3) NetApp EF-Series + Emulex HBAs + Brocade switches.

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