

## Challenge of Deploying Oracle Applications

Businesses rely on Oracle database and Oracle Real Application Cluster (RAC) as the core of their customer, enterprise and operational systems of record and engagement. As the workload on these systems grow and new business opportunities are identified, organizational leaders need their Oracle infrastructure to seamlessly scale performance to support these new application workloads.

Faced with these new opportunities, IT architects are challenged to deliver more performance without re-platforming their Oracle RAC environments. The default strategy of simply adding more compute cores, storage capacity and Oracle licenses becomes cost prohibitive, especially when the existing all-flash array is only utilizing a fraction of the existing processing cycles caused by high latency. The preferred strategy is to eliminate any excess latency in order to deliver the IOPS and throughput required to support the new applications. In most cases, the source of I/O bottlenecks is the storage array controller, which causes the server compute cores to operate at much lower efficiency.

## Vexata & FUJITSU Building Powerful Oracle Solutions

Vexata and FUJITSU architected an Oracle RAC configuration within the FUJITSU solutions lab, the objective was to test and benchmark the performance which clearly demonstrates the advantages of the proposed architecture. This system architecture was based on the Vexata VX-100F NVMe Flash Array and the FUJITSU Server PRIMERGY 2540-M4 platform. The results of these benchmark tests follow, but they illustrate a greater than 10X performance advantage over benchmarks published by a legacy all-flash array vendor \*.

FUJITSU and Vexata collaborated to conduct a battery of Oracle benchmarks using a Oracle RAC configuration on a cluster of four (4) FUJITSU PRIMERGY RX2540-M4 servers and one Vexata VX-100F NVMe Flash Array using the following configuration:

### Oracle RAC Configuration:

#### Host Servers

FUJITSU PRIMERGY RX2540 M4

- Intel(R) Xeon(R) Gold 6154 CPU @ 3.00GHz
- 2 Sockets, 18 cores per socket
- 192 GB Memory
- 4x32Gb Fibre Channel ports
- Oracle 12c + RHEL 7.4



VX-Manager & Analytics

#### Storage

Vexata VX100-F All Flash Scalable Array

- 16 Enterprise Storage Modules
- 16x32Gb Fibre Channel ports
- RAID 5 (N+1+1) - Max Performance mode

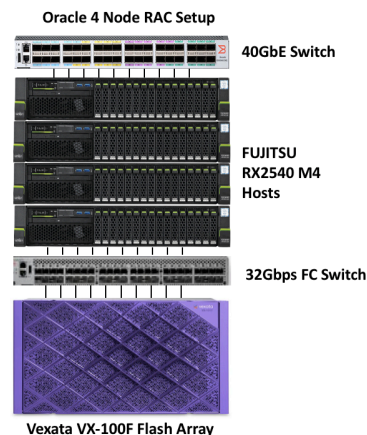


Figure 2: Oracle RAC Test Configuration featuring Vexata VX-100F with FUJITSU PRIMERGY RX2540-M4 Hosts.

### ORACLE OLTP



Figure 1: Vexata OLTP Performance vs. Leading All-Flash Array \*

Four sets of performance tests were run, using a combination of industry standard benchmark test suites (VDBench, Oracle SLOB and Hammer DB) to test the Oracle RAC performance to deliver the results highlighted on the next page.

\* Based on Dell/EMC White Paper VMAX All Flash Storage for Mission Critical Databases , May 2017

### **Vdbench - IOPS and Throughput**

Vdbench is an industry standard tool used to measure the performance across a range of I/O traffic patterns. This step provides a calibration/reference for subsequent Oracle based tests.

The 100% random read tests show that the system delivered 4.2 million IOPS (8k block size) and 50 GB/s (64k block size) of system throughput. It should be noted that throughout this test, the system maintained less than 300 uS of read latency at the array.

The 100% random write test shows that the system delivers 3.0 million IOPS and 24GB/s of throughput while maintaining sustained write latencies less than 100uS.

When subjected to a 80/20 read/write profile, the total performance maintained 4.2 million IOPS and 40GB/s of total system throughput.

The following table highlights what the reference design could deliver with 4 servers for different I/O patterns using Vdbench.

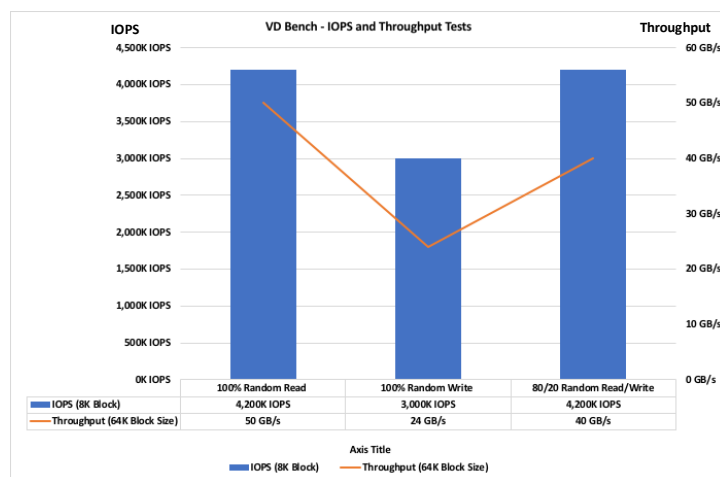


Figure 3: Vdbench test results for IOPS & Throughput under different traffic profiles

### **Oracle SLOB (Silly Little Oracle Benchmark)**

SLOB is used to measure performance with various application I/O patterns in Oracle database environment (100% Read, 50% Read/50%).

The chart in figure 4 provides the summarized result of the reference design for the 4 node Oracle RAC configuration. For the 100% read profile, the FUJITSU RX2540 server nodes achieved 4.2 million SQL IOPS (8K block size) at a read latency of less than 300µs at an array.

With a 50/50 read/write profile, the SLOB results measured 3 million IOPS at 225uS of sustained latency.

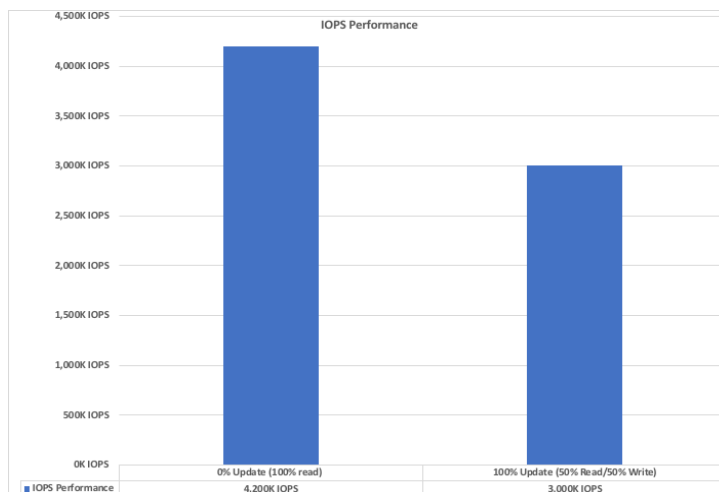


Figure 4: SLOB test results for IOPS under different traffic profiles

### **HammerDB / TPC-H Oracle Analytical Test**

The analytics test for this reference design utilized the TPC-H benchmark, which utilizes the query tests with a high degree of flexibility to provide faster loads and timely, accurate responses. The Vexata Fujitsu reference design for Oracle RAC delivered over 40GB/s of sustained throughput during the HammerDB/TPC-H analytics test.

### **Summary:**

The purpose of this reference design was to illustrate that when you deliver a low-latency high performance solution that eliminates bottlenecks for the I/O stack, you realize the following results:

- 10X better performance than traditional all-flash array architectures for Oracle RAC database
- Improved utilization of compute cores, faster transaction processing with faster analytic loads and queries, resulting in lower TCO, realized by requiring fewer server cores and associated Oracle database licenses.
- The superior performance density of the Vexata NVMe Flash Array is a perfect complement to the FUJITSU PRIMERGY family of high-performance servers.

To learn more and schedule a demo, please visit <https://fujitsusolutionslab.com/> or email [info@FujitsuSolutionsLab.com](mailto:info@FujitsuSolutionsLab.com)