



MySQL Database Acceleration over Mangstor Low Latency Storage and Mellanox Low Latency Networking

Overview

Every business has the goal to improve TCO. In MySQL database applications, the objective is to increase business efficiency. This can be done by supporting Online Transaction Processing (OLTP) services that deliver the maximum number of transactions per second, reduce user response times, and perform faster database queries and analytics. In addition, the solution must be scalable since the volume, variety and velocity of big data is causing traditional database applications to slow down. This consequently reduces overall organizational competitiveness and increases user frustration.

Ultra-low Latency MySQL Acceleration

The demand for flexibility and real-time data access is driving businesses to require much higher performance from their MySQL cluster environments. Performance can be significantly increased, and VM performance density improved in virtualized environments by adding Mangstor NX6325 solid-state arrays to supply Tier 0 block storage volumes, supporting more and larger scale-out MySQL instances for OLTP and OnLine Analytical Processing (OLAP) workloads.

Combining Mellanox's end-to-end 100Gb/s low latency Ethernet solution, which includes the Spectrum switch, the ConnectX-4 100Gb/s RoCE (RDMA over Converged Ethernet) NICs and LinkX cables with Mangstor's NX6325 scalable, NVMe solid state storage arrays; accelerates real-time data access for faster time-to-insight and increased business productivity. In testing performed by StorageReview labs, the MySQL data files, tempDB

files, and log files were all located on thirty-two NX6325 volumes and generated more than 38K transactions per second (TPS). This enabled lower Total Cost of Ownership (TCO) and higher business Intelligence (BI) efficiency.

Low Latency Solutions

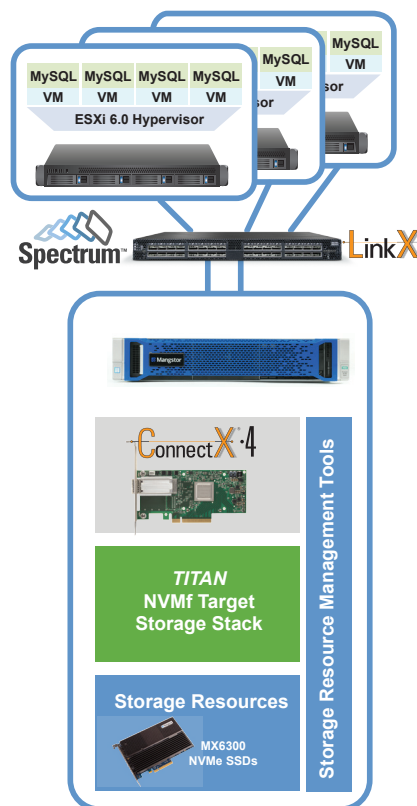
Low latency data requests from storage or other servers are the key to enabling more MYSQL OLTP TPS without increasing user response times. Mangstor Inc., and Mellanox Technologies are leaders in low latency storage and networking solutions and have combined Mangstor storage solutions with Mellanox high-performance networking to provide an NVMe over Fabric Storage Array solution. Mangstor's MX6300 NVMe Solid-State

drives provide high-bandwidth low latency flash storage connectivity using the server's PCIe slots. Mellanox's 100GbE, with Remote Direct Memory Access (RDMA) technology, provides low-latency network access and enables the fastest and most reliable data transfers with minimal server compute resources.

NVMe over Fabric Storage

NVMe over Fabric storage enables a host server with a Network Interface Card to connect with a remote flash storage subsystem to achieve faster application response times and better scalability across physical and virtual datacenters. Though SSD remote access over Fibre Channel (FC) and iSCSI network fabrics exists today, the capability had been based on legacy SCSI protocols designed for HDDs that deliver limited performance and latency.

Using RDMA over Converged Ethernet (RoCE) to transfer data from application servers to storage servers in high-speed RDMA scale-out applications, the lower level SCSI transport layer is bypassed resulting in faster data throughput and accelerated data access latencies. Unlike Direct Attached Storage



(DAS), NVMe over RDMA technology enables shared pools of flash storage to be scaled independently of compute resources, and vice versa, so that servers can access flash anywhere within the datacenter without paying an additional latency tax.

RoCE utilizes advances in Ethernet that enable efficient implementations of RDMA over Ethernet enabling widespread deployment of RDMA technologies in mainstream data center applications. RoCE-based network management is also the same as that for any Ethernet network management, eliminating the need for IT managers to learn new technologies.

The business advantages of NVMe over RoCE for a data center are:

- No Changes to data center infrastructure
- I/O unification on a single wire over 10/25/40/50/100 GbE networks
- Continue with existing data center management infrastructure
- Reduction in power and cost savings
- Maintain existing and future application compatibility
- Significant CapEx and OpEx savings with a single chip solution for I/O unification

High Performance Can Be Economical

To evaluate MySQL OLTP performance using the Mangstor's Storage Arrays and Mellanox's end-to-end RoCE solution, an HP DL380 G9 server with dual Xeon E5-2630v3 processors was used running Mangstor's TITAN NVMe over Fabric (NVMe over Fabric) Target Software Storage Stack. TITAN Software delivers leading performance and ultra-low latencies by tightly integrating NVMe SSDs with RDMA Network Interface Cards.

Mellanox's SN2700 32-port 100GbE switch in a 1U form factor allows multiple ESXi servers using RoCE to communicate with the NX6325 Storage array.

Mellanox ConnectX®-4 adapter supports 10/25/40/56/100Gb/s RoCE storage connectivity between the servers, all connected by Mellanox's LinkX cables.

Evaluating MYSQL OLTP Performance

MYSQL OLTP performance was measured using StorageReview.com Sysbench Infrastructure MYSQL OLTP load generator to create the actual workload of a typical DB user using Percona MySQL applications. The chart below shows 4 to 32 virtual machines running in parallel over 8 Dell R720 servers with each client experiencing 27 msec response time.

These results represent a significant efficiency boost versus competitive solutions utilizing the same setup.

• Highest Transaction Processing Per VM

In the Sysbench OLTP workload tests conducted by Storage Review, the NX6325 aggregate score for 32 VMs scaled to more than 38K transactions per seconds (TPS) delivering three times greater processing over the nearest solid state arrays tested.

• Lowest, Consistent Latency and Response Time

In the Sysbench scaled average latency tests conducted by Storage Review, the NX6325 delivered less than 27ms latency across all VMs and the aggregate score delivered two and three times faster response times over the nearest solid state arrays tested.

• Scalable, Cost Effective Solid State Storage Solution

Available in a 2U rack package, with 10.8TB or 21.6TB usable flash storage, the NX6325 storage array is scalable to hundreds of TBs capacity by simply adding more arrays. The Mangstor NX6325 is a storage solution that supports the database size existing today as well as where the customer needs to be in the future. Mangstor's advanced NVMe over RDMA technology provides three times the performance gains over direct attached in-server flash while still providing native MySQL OLTP functionality.

- » **Application Acceleration** - Better customer experience via faster response times

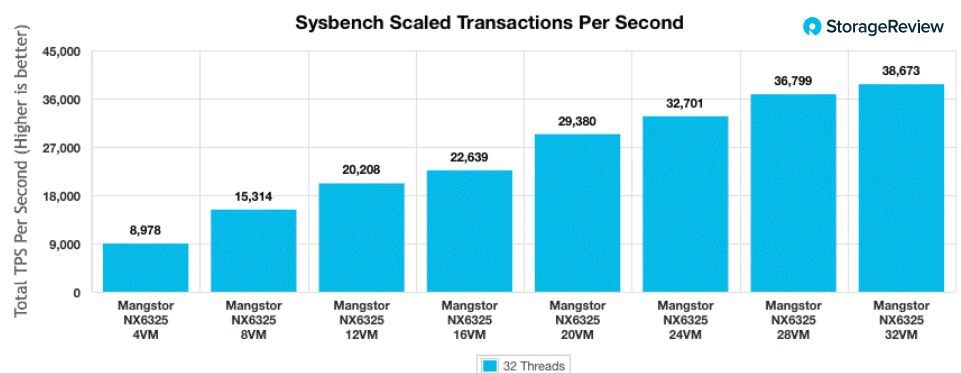


Figure 1. Storagereview.com performance running Percona MySQL applications over Mangstor NX6325 storage and Mellanox's end-to-end 100Gb/s RoCE solution

- » **Increased Business Productivity** - Quick decision making through enhanced analytics
- » **Virtual Machine Cluster Scalability** - Higher application performance at scale
- » **Solid State Storage Scalability** - Scale-up capacity to 100TB with four NX6325

Solution Summary

A high performance storage subsystem using Mangstor's NX6325 arrays and Mellanox end-to-end RoCE solutions with includes the Spectrum Ethernet switch, the ConnectX-4 NICs and LinkX cables boosts storage system efficiency; maximizing the return on the investment (ROI) and providing an economical alternative to the old Fibre Channel based storage subsystems.

About Mellanox

Mellanox Technologies (NASDAQ: MLNX) is a leading supplier of end-to-end Ethernet and InfiniBand intelligent interconnect solutions and services for servers, storage, and hyper-converged infrastructure. Mellanox intelligent interconnect solutions increase data center efficiency by providing the highest throughput and lowest latency, delivering data faster to applications and unlocking system performance. Mellanox offers a choice of high performance solutions: network and multi-core processors, network adapters, switches, cables, software and silicon, that accelerate application runtime and maximize business results for a wide range of markets including high performance computing, enterprise data centers, Web 2.0, cloud, storage, network security, telecom and financial services. More information is available at www.mellanox.com.



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