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WHITE PAPER

SUPERMICRO ULTRA ALL-FLASH NVME SUPERSERVERS FOR REAL-TIME DATA PROCESSING

EXECUTIVE OVERVIEW

In order to stay ahead of the competition in the market place, and accepting the construct that "knowledge is power", the most successful organizations will be those that are dedicated to fine-tuning their offering to precisely fit the needs of their customers.

Highly progressive data analysis is enabling online retailers, for example, to set adaptive pricing based on inventory levels, manufacturing forecasts and even prevailing weather conditions to be presented to the customer in real-time.

An infinite number of commercial opportunities are being unearthed by using statistically relevant indicators about how buyers and sellers are engaging, and the nature and volume of exchange. The next step, when it comes to big data, is being able to apply up-to-the-minute intelligence as soon as it enters the system.

This paper discusses what to consider when optimizing your IT infrastructure for database applications and features benchmark testing with noteworthy results.

Supermicro Ultra All-Flash SuperServers for Databases

- Highest performance per U (density optimized)
- Workload flexibility
- Scalability
- Hot-swap accessibility
- Low latency
- Lower total cost of ownership
- Ease of qualification

SERVER DESIGN MATTERS

The hardware you choose needs to be able to facilitate extreme data throughput at hyper speed while optimizing your chosen storage in order to guarantee instantaneous access to/utilization of volumes of structured and unstructured data.

Previously, the kind of infrastructure able to process real-time data en masse was only accessible to establishments having IT budgets generous enough to cover the prohibitive price of custom-built equipment. With this in mind, and an understanding of just how crucial it has become to a growing number of vertical markets to rapidly extract and apply business intelligence, Supermicro has developed a range of commercial off-the-shelf SuperServers able to provide the levels of speed, availability, concurrency and recoverability that a complex database schema requires.

Supermicro's Ultra SuperServer® range includes a 10-drive All-Flash NVMe system in a 1U form factor (Figure 3), and 24- and 48-drive All-Flash NVMe systems in a 2U form factor (Figures 1 & 4 and Figures 2 & 5) architected to offer unrivaled performance, flexibility, scalability and serviceability and therefore ideally suited to demanding enterprise-sized data processing workloads.
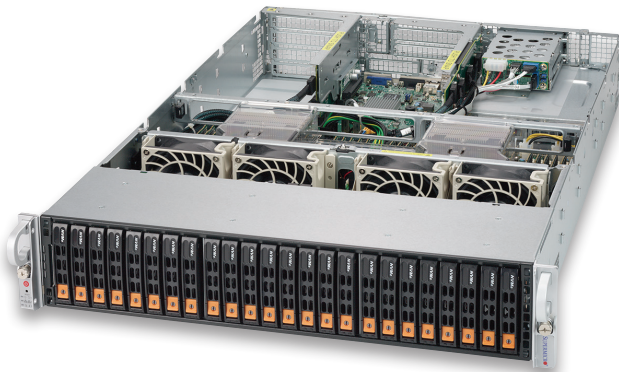

Figure 1. Supermicro 2U Ultra SuperServer® 2028U-TN24R4T+ featuring 24 hot-swap NVMe/SAS3 hybrid drive bays.

Figure 2. Supermicro Simply Double 2U SuperStorage 48 NVMe 2028R-NR48N featuring additional hot-swap NVMe SSDs arrayed in a patented Riser Bay for easy access and servicing.

With up to 165W TDP (Thermal Design Power) supported, the Ultra SuperServer® range heightens processing speed while extending the life span of one of the most vital components of the infrastructure. The frequency and performance optimized CPU SKUs are able to effectively dissipate the increased heat generated from high workload CPUs owing to an advanced cooling design.

Ultra SuperServers can be easily configured and reconfigured for a wide variety of workloads due to a number of Ultra Riser alternatives, including built-in 1G, 10GBASE-T, 10G SFP+, 40G, and InfiniBand; plus support for add-on SAS 3 HW/SW RAID controllers; and additional PCI-E 3.0 slots.

Figure 3. Supermicro 1U Ultra SuperServer®
1028U-TN10RT+

Figure 4. Supermicro 2U Ultra SuperServer®
2028U-TN24R4T+

FACTORS TO CONSIDER

An IT infrastructure that is able to respond immediately to simultaneous user requests or answer multi-dimensional analytical queries in real-time requires a combination of one or more online transaction processing (OLTP) or online analytical processing (OLAP) applications running in what is usually a highly specialized environment. The specific use case will determine the compilation of elements to some extent, but the factors to consider will include:

CPU

Choosing the right CPU is vital to ensure optimal performance. The latest generation CPUs, designed for real-time analytics, are able to query many terabytes of data and provide results in seconds.

Features to consider include responsiveness, reliability and scalability to insure fast, zero down-time processing, especially for mission critical workloads that need to be able to scale up seamlessly.

MEMORY

The list of advantages of using in-memory databases is growing as demand for gathering business intelligence increases and supporting technologies develop. The need for intelligence based on the analysis of data, at speed, in order to predict market mood and perceptions, and react to that market, is becoming the norm.

For example, in order to make sound business decisions to maximize gains on a given trading day, a financial institution could use financial modeling to build a predictive model that takes a number of pertinent variables into consideration, thus creating a theoretical representation of future, 'real world' financial situations. And of course, market conditions are ever changing, which means the predictive model will need constant fine tuning to remain relevant.

In-memory processing involves placing data in the system's RAM (Random Access Memory) in order to provide lightning-fast response times to queries, from multiple, concurrent users, and produce instantaneous results.

DDR4 (Double Data Rate 4th generation) RAM chips support transfer rates of up to 2.4 billion transfers per second: a significant memory boost at a lower voltage than their DDR3 predecessors. Still, big workloads devour RAM. This can mean large bites are taken out of your IT budget for a system that can deliver the DRAM capacities needed.

Figure 5. Supermicro Simply Double
2U SuperStorage 48 NVMe
SSG-2028R-NR48N

STORAGE

Datacenter Managers will tell you that storage I/O performance is invariably what causes bottlenecks when it comes to data extraction and analysis because the storage is required to perform in intense bursts. This is where flashed-based storage comes into its own.

NVMe, an interface specification for accessing non-volatile storage media via PCI Express (PCI-E) bus, is able to provide up to 70% lower latency and up to six times the throughput/IOPs when compared with standard SATA drives. And, as the technology is more widely adopted, it's becoming more affordable. In some instances, the 600% boost in performance that NVMe delivers will only cost 6-7% more than a traditional SATA SSD.

Flash can be introduced as capacity stores or as caching devices to improve performance, reduce latency and increase IOPs.

NVME PERFORMANCE

Figure 6 below compares Supermicro SYS-1028U-TN10RT+ with 10 NVMe SSDs to the industry standard 1U 10 bay server with 10 SAS3 SSDs.

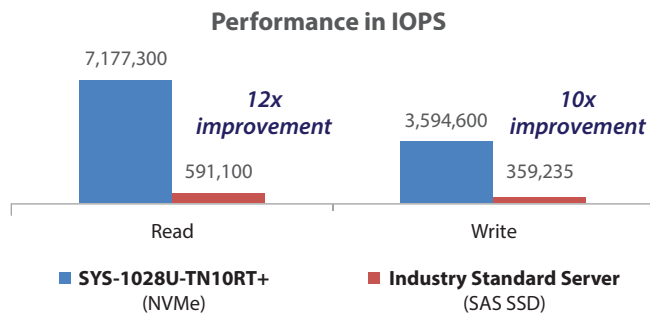The result: a noteworthy12x performance gain in read IOPS and 10x performance gain in write IOPS.

Performance in IOPS

7,177,300

12x improvement

591,100

3,594,600

10x improvement

359,235

Read

Write

■ **SYS-1028U-TN10RT+** (NVMe)   ■ **Industry Standard Server** (SAS SSD)

Figure 6. Performance in IOPs - Supermicro 1U Ultra SuperServer®
1028U-TN10RT+ vs. industry standard 1U server.

SuperServer® 1028U-TN10RT+ System Configuration for Benchmark Test

- **CPU**
  2x Intel® Xeon® processor E5-2680 v4 (35M Cache, 2.00 GHz)

- **Memory**
  288 GB RAM

- **Storage**
  10x HGST SN100 3.2TB NVMe (Database); 1x Intel S3700

- **Operating System**
  Microsoft Windows Server 2012

- **Database Server**
  Microsoft SQL Server 2014

TESTING NVME PERFORMANCE

To test just how well the All-Flash Ultra range performs when it comes to databases, the SYS-1028U-TN10RT+ system with10 U.2 NVMe SSD drives was chosen to process a database schema based on a SQL server 2014 and Windows Server 2012 R2 implementation, and was set up to mimic the workload created by 56 users monitoring stock moving through 5000 warehouses.

As shown in Figure 7 below, nine of the drives were assigned a database file each, using the HammerDB load testing tool designed to simulate heavy transaction processing and business intelligence workloads.
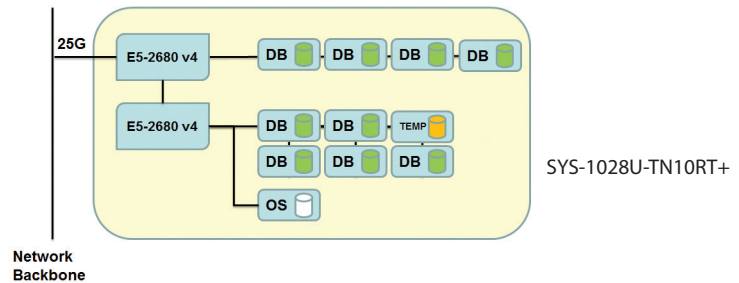
Figure 7. Graphical representation of nine of the SSD drives mapped to one database each.

THE RESULT

With 90% of the most highly available storage dedicated to database hosting, the 1028U-TN10RT+ produced an industry-first result of 4.9 million Transactions Per Minute (TPM). An exceptional feat for a 1U off-the-shelf server requiring minimal configuration.
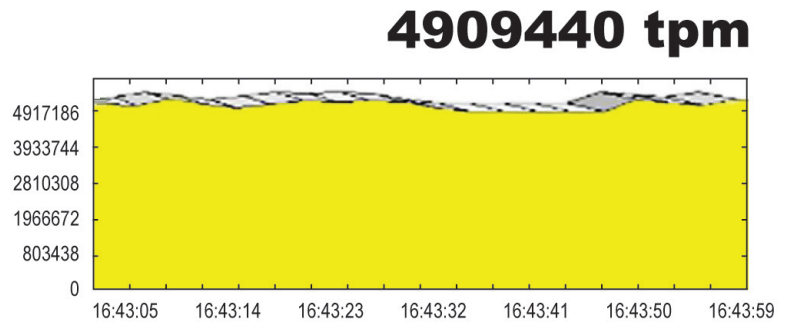

Figure 8. Performance results achieved in the HammerDB test.

TEST SYSTEM: SUPERMICRO SYS-1028U-TN10RT+

The only 1U server on the market able to accommodate up to 10 U.2 NVMe SSD drives and using a total of 40 PCI-E 3.0 lanes from two CPUs to provide full bandwidth (PCI-E x4) to each NVMe SSD, the 1028U-TN10RT (Figures 9 and 10) provides enterprise-class performance right where it's needed.
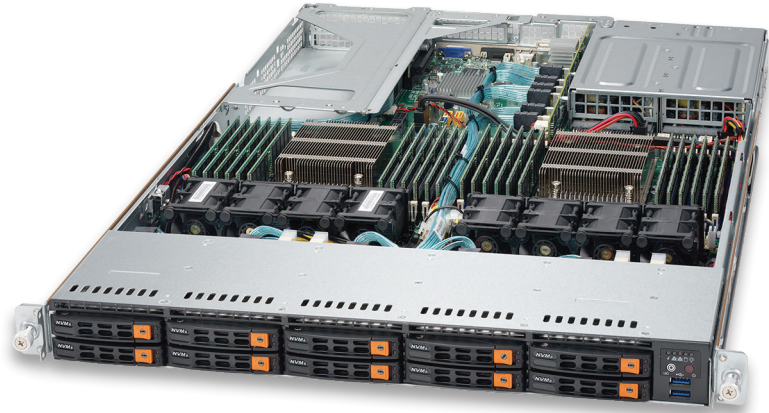

Figure 9. Performance and accessibility: 10 2.5" Hot-swappable Drive Bays: 6 NVMe ports and 4 NVMe/SAS3 hybrid ports for optional SAS3/SATA3.

Figure 10. Low power consumption: 1000W Titanium Level (96%) Redundant Power Supplies.

FOR MORE INFORMATION

Supermicro® SuperServer®
1028U-TN10RT+ Datasheet
**www.supermicro.com/products/
system/1u/1028/sys-1028u-tn10rt.cfm**

Supermicro® SuperServer®
2028U-TN24R4T+ Datasheet
**www.supermicro.com/products/
system/2u/2028/SYS-2028U-TN24R4T.cfm**

Intel® Xeon® Processor E5-2600 v4 Product
Family
**www.intel.com/content/www/us/en/
processors/xeon/xeon-e5-solutions.html**

Intel® NVMe SSDs
**www.intel.com/content/www/us/en/solid-
state-drives/solid-state-drives-ssd.html**

CONCLUSION

The server design you choose to house the components required for enterprise data processing workloads is as important as the components themselves.

Only Supermicro offers a powerful range of All-Flash solutions to allow you run more workloads, in less time, and using fewer resources in order to really optimize the performance of each element of the system.

Contact your Supermicro sales representatives today to find out more about how our new generation X10 All-Flash Ultra SuperSever® range can help your business turn the wealth of data at your fingertips into the tangible profits that come from predicting and responding to the changing needs of your customers, in real-time.

About Super Micro Computer, Inc.

Supermicro® (NASDAQ: SMCI), the leading innovator in high-performance, high-efficiency server technology is a premier provider of advanced server Building Block Solutions® for Data Center, Cloud Computing, Enterprise IT, Hadoop/Big Data, HPC and Embedded Systems worldwide. Supermicro is committed to protecting the environment through its "We Keep IT Green®" initiative and provides customers with the most energy-efficient, environmentally-friendly solutions available on the market.

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About HammerDB

HammerDB is a graphical open source database load testing and benchmarking tool built for Linux and Windows and used to test databases running on any operating system.

The tool, which utilizes built-in workloads based on industry standard TPC-C and TPC-H online transaction processing benchmarks to mimic 'real-life' conditions is automated, multi-threaded and extensible. HammerDB features dynamic scripting support, transaction and CPU monitors, and capture and replay for Oracle databases while supporting Oracle, SQL Server, DB2, TimesTen, MySQL, MariaDB, PostgreSQL, Greenplum, Postgres Plus Advanced Server, Redis and Trafodion SQL on Hadoop.

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