

RAID data protection reveals 100% of NVMe SSD performance with Intel I/O acceleration technology on Dell R750

The emergence of NVMe SSDs allows data to be stored in a performance we never imagined a decade ago. Now a single PCIe Gen4 SSD can achieve 7GB/s of throughput and easily over 1 million IOPS. To take full advantage of that, data center managers must consider a method to efficiently deliver that I/O performance to the system while maintaining its data protection SLA. With GRAID SupremeRAID, an Intel 3rd gen Xeon processor-based server platform takes advantage of Intel I/O acceleration technology to move data in/out of SSDs more efficiently. IT managers could enjoy the same data protection level while still enjoying the performance boost from NVMe SSDs.

Introduction

Business success is becoming increasingly dependent on the rapid transfer, processing and storage of data. To improve the data transfer to and from applications, IT managers are investing in new storage infrastructure like NVMe SSDs to achieve higher performance. However, the I/O bottlenecks associated with traditional RAID solutions have emerged as the key IT challenge for realizing full value of server investment.

Only recently, NVMe SSDs have replaced HDDs as the major storage media. The adoption of NVMe SSDs and the performance improvement in every generation are due to the confluence of various market trends, including:

- AI training and Big Data analysis
- 5G, IoT
- 4k/8k video capturing and processing
- Server consolidation and virtualization
- Database requires low latency and high performance
- High frequency trading

The increasing reliance on SSD performance results in a challenge to the data protection mechanism, a.k.a. RAID. Currently, RAID solutions are unable to match the

performance of NVMe SSD. As a result, IT managers are now asking “After investing in NVMe SSD, why aren’t we seeing comparable performance improvement?”

To answer this question, GRAID Technology Inc. released the next generation of the RAID solution – SupremeRAID – with its innovative technology to solve the bottleneck on both IOPS and throughput. Together with Intel 3rd Gen Xeon processors on Dell PowerEdge servers, GRAID delivers world record performance. This white paper discusses the RAID system bottleneck and how GRAID SupremeRAID solves those issues for accelerating RAID performance on NVMe SSD.

Finding the Bottleneck

Before SSDs, spinning disc drives allowed users to store a lot of information but were prone to damage and slow to respond to user queries. SSDs provided a huge leap in loading speeds via flash-based memory, instantly transferring data from memory blocks.

However, SSD’s reliance on the SATA data connector standard limited the speed with which users could transfer information. Moving to PCIe slots brought NVMe into existence, providing more lanes, more queues, and more commands in those queues, resulting in significantly faster SSD speeds..

When a data center’s processing capabilities cannot keep pace with operations, a bottleneck occurs. A limitation in any part of the system slows down the entire system as a result. If the CPU or the GPU is underpowered, they both slow down. A slow CPU means the GPU cannot realize its full potential. Conversely, an insufficient GPU will hamper the full capacity and capability of a high-end CPU.

The main bottleneck of a CPU is its ability to pull data from the storage medium. NVMe, given that it connects directly to the CPU, theoretically provides a staggering increase in efficiency. However, as many data centers have invested in NVME storage solutions to improve network bandwidth, they are not seeing comparable improvements in application response and reliability.

DMA I/O (direct memory access) and CPU latency between cores play an important role in speed. DMA allows users to perform processes independent of their CPU, but like the CPU, relies on the speed of the storage solution to perform these tasks. Core multithreading is a staple of modern CPUs, and standards like UPI rely on transfer

speeds to complete their operations. The fastest NVMe SSD facilitates the transfer speeds between these processes.

Remember, the speed of a user's storage determines how quickly they can load files. It also determines how long it takes their storage solution to wake up and begin retrieving that information. Every process on a computer can benefit from faster storage speed, whereas increased processing only provides marginal benefits on an older system.

Businesses benefit from these increased retrieval speeds. A user's server is reading and writing hundreds of megabytes every second during a normal workload. If that throughput increases, their storage solution needs to be able to keep up.

The idea is that we can achieve greater performance for large-scale data applications, but the reality is that customers will only get 10% of the available performance of SSDs due to the bottleneck introduced by RAID and software defined storage. Traditional RAID simply can't provide enough computing power and bandwidth to process all the data.

An NVMe RAID setup provides all the benefits of an NVMe connected to the PCIe Express slot scale up. Users get faster read and write times, less power consumption, and a better form factor.

The main benefit of RAID is that it allows multiple hard drives to function in tandem. As such, changing these to NVMe means they're working on the same pool. The limitation of four lanes used to be the factor that prevented RAID setups from achieving more, but now that's not the case.

The performance advantages on Dell R750 Powered by Intel Xeon

Increasingly demanding workloads require faster throughput from your storage solution. GRAID SupremeRAID™ delivers the speed you need to power high performance applications - a single GRAID SupremeRAID™ card is capable of delivering 16 million IOPS and 110 GB/s of throughput. This world-record performance is accompanied by scalable features like compression, encryption or thin provisioning.

By leveraging AI and parallel computing power to increase throughput to multiple applications, GRAID SupremeRAID™ delivers up to 100% SSD performance - without consuming your CPU resources.

GRAID has teamed with Intel to develop solutions that adapt to enterprise data centers' increasing bandwidth requirements. High-traffic volume has begun to outpace server resources, and significant system overhead, excessive memory accesses and inefficient TCP/IP processing are emerging as key IT challenges in realizing the full value of server investments.

Reliance on the rapid transfer, processing, compilation and storage of data only stands to grow, and a system-wide solution is needed that can fit anywhere in the enterprise computing hierarchy without requiring modification of application software and provides acceleration benefits for network bottlenecks.

Enter Intel I/O acceleration technology on Dell R750 powered by GRAID SupremeRAID™. The Intel platform frees up CPU resources by offloading computational storage to an AI-powered GPU, while also increasing system throughput to meet demanding workloads.

Performance Testing

Extensive testing has verified the performance of the Intel platform powered by GRAID for both Linux and Microsoft operating systems.

Two Intel platforms underwent performance testing - one with, and one without GRAID SupremeRAID™. As the graphs in Figure 1 illustrate, the GRAID-powered Intel platform achieved a CPU utilization improvement of over 40 percent, while also almost doubling network throughput.

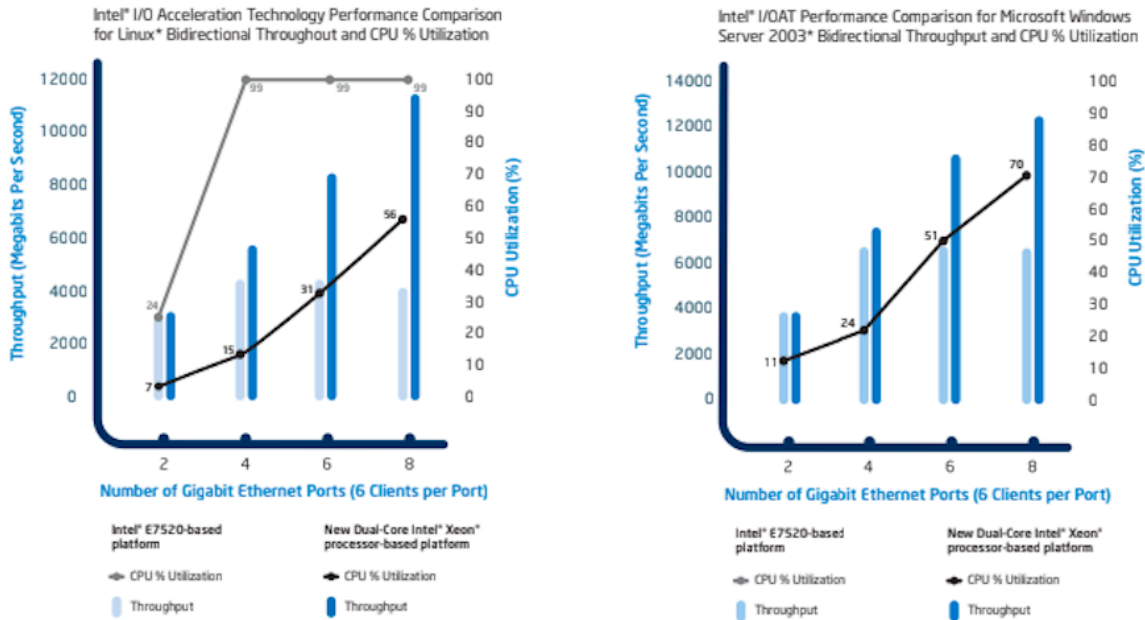


Figure 1. Network comparisons for platforms with and without Intel Xeon powered by GRAID.

Increased bandwidth, reduced latency, and reduced power consumption

Installation is plug-and-play, slotting in an open PCIe slot just like a graphics card and entering a few lines of code, similar to setting up a normal software RAID array. GRAID SupremeRAID™ directs reads/writes while avoiding PCIe speed bottlenecks and performs RAID calculations, freeing up CPU resources.

Everything is done directly from memory to storage, clean and simple: one slot, no cables, no additional pass-throughs - no fuss. The GRAID SupremeRAID™ solution delivers power, flexibility, scalability, and user-friendliness in a single PCIe card.

GRAID Technology's storage solutions require ZERO peripheral purchases - no switches, cabling, or additional power - an 80% cost savings. And unlike traditional systems, GRAID SupremeRAID™ doesn't rely on memory caching technology to improve performance, eliminating the need for battery backup modules.

Current existing solutions, whether software RAID or hardware RAID, are incapable of driving more than 4 NVMe SSDs. Conversely, GRAID SupremeRAID can easily manage up to 32 direct attached NVMe SSDs, delivering unmatched scalability and flexibility in addition to its industry-leading performance benchmark.

Conclusion

While traditional RAID technology has become the bottleneck of SSDs, GRAID Technology has developed a disruptive software plus hardware solution to unlock the performance bottleneck of RAID protection for SSDs. Graid SupremeRAID™ provides performance commensurate with your investment and it happens best on the Intel platform.

GRAID SupremeRAID™ works by installing a virtual NVMe controller onto the operating system and integrating a PCIe device into the system equipped with a high-performance AI processor to handle all RAID operations of the virtual NVMe controller. By leveraging multiple hard drives to facilitate data retrieval, GRAID SupremeRAID™ avoids bandwidth limitations while reducing latency.

GRAID SupremeRAID™ is the most powerful, high-speed data transfer and protection solution available for NVMe SSDs. GRAID SupremeRAID™ with NVMe-oF support delivers tremendous performance with comprehensive data protection and flexibility, not only resolving the performance bottleneck but also significantly reducing TCO.

GRAID SupremeRAID™ represents an evolution in data storage and performance, bringing traditional RAID systems into the modern age by unleashing 100% of their SSD potential. It doesn't get any faster - GRAID delivers lightning-fast NVMe performance without sacrificing scalability, ease of use, or protection for your mission critical data.

Sidebar Callout: Applications

- Large Scale Data Centers
- Online Transaction Processing
- Content Delivery Networks
- Big Data Applications
- High-Frequency Trading
- Video Streaming / Editing
- HPC and Technical Computing