BIOS IT

JUNE 2015

ERADICATE YOUR STORAGE BOTTLENECK
Bringing data closer to the CPU with Memory Channel Storage™

www.bios-it.com

INTRODUCTION

Due to the constant and dramatic increase in virtualisation, big data and low latency applications within the enterprise space; storage performance is more and more often becoming the bottleneck within today's datacentre infrastructure. Such applications continue to challenge existing technology and re-affirm the need for innovation in the enterprise storage space. IT leaders are currently faced with the challenge of optimising storage performance for a rapidly escalating range of applications, each with their own unique characteristics and requirements.

THE CHALLENGES WE FACE

VIRTUALISATION
- Requires high performance storage
- Needs scalable storage infrastructure
- Lots of random reads / writes
- Predictable performance essential

DATABASE APPLICATIONS
- Requires low response time / low read and write latency
- High transactional data
- High performing storage with QoS

LOW LATENCY APPLICATIONS
- Requires predictable, low response times
- Measured in nanoseconds
- Pushing the boundaries of storage technology

BIG DATA / ANALYTICS
- Needs to be scalable
- Works in parallel
- Requires high random workload performance

VIRTUALISATION
Virtualisation has become the 'go-to' for organisations around the globe, with approximately 75% of all enterprise applications now deployed on a virtualised environment. Virtualisation has provided enterprise with the ability to consolidate a vast number of physical machines down to just a few,

however as a result the burden on computational and storage resources has significantly increased. Virtualisation requires high performing, low latency storage due to the large amount of random reads and writes it generates through workload consolidation. Administrators of virtualised systems need storage solutions to have predictable performance in order to serve virtual machines consistently and without fail. Predictable performance translates into greater application performance and an enhanced user experience – something which is expected of virtualisation; but often isn't delivered.

DATABASE
Database applications have evolved dramatically since their inception, taking advantage of faster networking, compute and in particular high performance storage. Database applications put huge demands on storage infrastructure due to their high transactional characteristics. In order to serve database applications, storage arrays need to deliver dependable low latency and high performance in order to maintain quality of service goals such as high throughput or low mean response time.

LOW LATENCY APPLICATIONS
For many companies, predictable, low response times are not desired – they are essential. The difference between success and failure can be measured in nanoseconds when low latency applications are involved. These applications require the very fastest in network and compute performance, and the storage component must be designed to keep up. In most low latency applications and architectures, the slightest performance increase is a significant competitive advantage, and hence push the boundaries of storage technologies and beyond.

BIG DATA
No matter which vertical you are in, Big Data is the buzz-word of the industry. More and more organisations are turning to Big Data Analytics to assist with key business decisions. In Big Data workloads the data sets are much larger than that of database applications, hence requiring more robust and higher performing storage solutions. The large data streams must be analysed quickly, requiring fast read capability from the storage infrastructure.

THE PROBLEM: APPLICATIONS OUTGROWING STORAGE TECHNOLOGY

Modern day applications quickly outgrew traditional storage technologies such as SATA/SAS spinning disks, as such IT leaders made the move to faster storage technologies such as flash SSDs and PCIE-based storage technologies.

With the advent of enterprise PCIe-based SSDs, interface speed moved to the forefront of most performance-related conversations. When compared to SATA and SAS SSDs, the bandwidth available to PCIe drives was clearly superior, in most cases offering around 23 times faster IO than traditional SAS SSDs. As a result, PCIe SSD vendors have been vocal in promoting PCIe bandwidth as a key technology differentiator.

In practice, however, there is a world of difference between what an interface can support and what a solution using that interface can deliver. The focus on theoretical PCIe bandwidth, while compelling, has served to obscure a critical shortcoming, a pervasive bottleneck that limits both the performance and scalability of PCIe-based storage devices. Those SSDs represented the highest-performing storage available, so customers had no alternative options to consider.

PCIe-based SSD technology, although innovative and high performing, is now failing to keep up with the demands of today's enterprise applications and infrastructure architects are finding once again that storage is the bottleneck to many applications.

THE SOLUTION: MEMORY CHANNEL STORAGE™

To leverage the full potential of flash in the enterprise, Diablo Technologies™ has pioneered Memory Channel Storage (MCS)™, a technology that bypasses the architectural bottlenecks faced by pre-existing solutions by presenting flash storage directly to the memory bus, thereby bringing incredibly fast, persistent storage closer to the CPU and applications. This results in highly predictable ultra-low latency, all while scaling at a near linear performance.
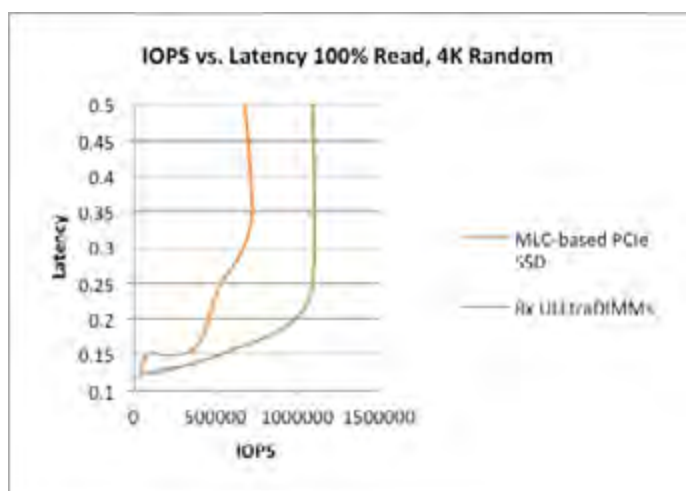
MCS™ is capable of servicing enterprise applications with remarkably fast response times, even under heavy I/O workloads, and achieves end-to-end parallelism (i.e. no bottleneck) by leveraging the server's natively parallel memory subsystem.

Memory Channel Storage™ solutions fit directly into existing IT infrastructures. The unique architecture of MCS™-based products allows for the seamless deployment of persistent flash memory directly into memory DIMM slots, without any changes to existing software or system architecture, unlike many new storage technologies. It is also supported on all major operating systems including Linux, Windows and VMware and is installed easily via downloadable drivers.

MCS™ BYPASSES THE ARCHITECTURAL BOTTLENECKS FACED BY PRE-EXISTING SOLUTIONS BY PRESENTING FLASH STORAGE DIRECTLY TO THE MEMORY BUS
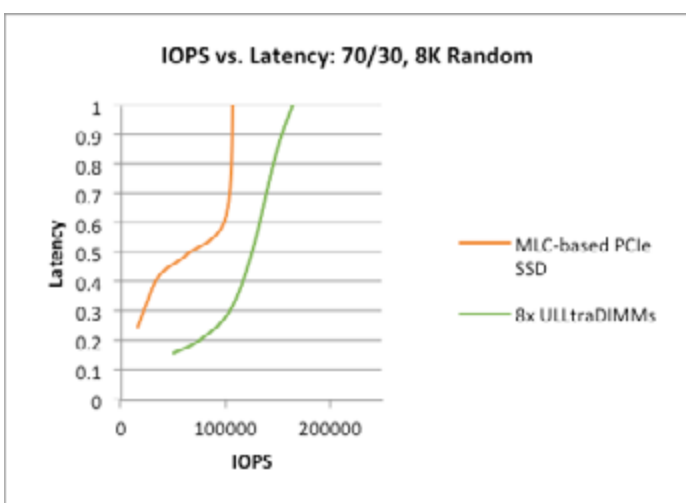
THE MCS™ PERFORMANCE IMPROVEMENT

When compared to flash storage connected via the PCIe bus, Memory Channel Storage™ shows significant improvements in both latency and IOPS. BIOS IT Labs conducted several benchmark tests, the results of which are shown below.

- FIGURE 1

FIGURE 1

The read performance of an MCS™ solution offers a dramatic improvement over a PCIe-based SSD. Compared to PCIe based SSD, the increase in latency with a rise in IOPS proves to be far more predictable using MCS™.
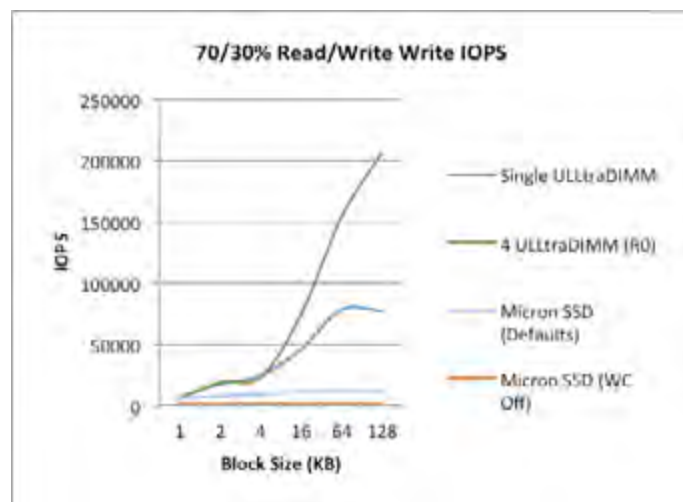

- FIGURE 2

FIGURE 2

The predictable nature of the MCS™-based solution is also evident in a mixed-workload comparison. This "70% read/30% write" mix is highly com-
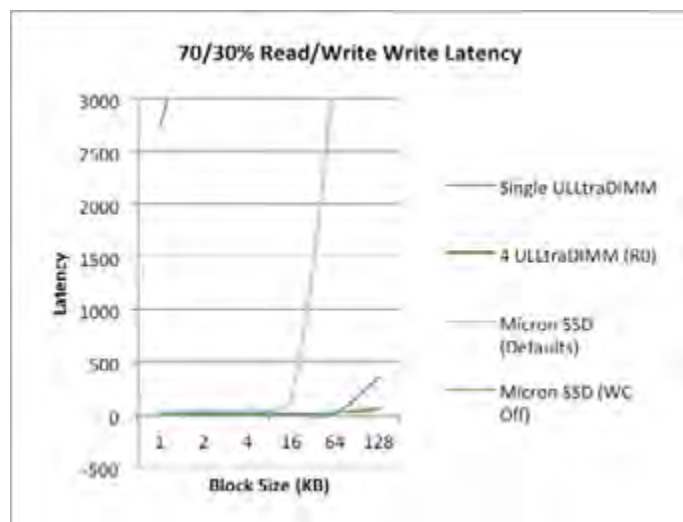
mon for popular applications like virtualisation and database transaction processing.
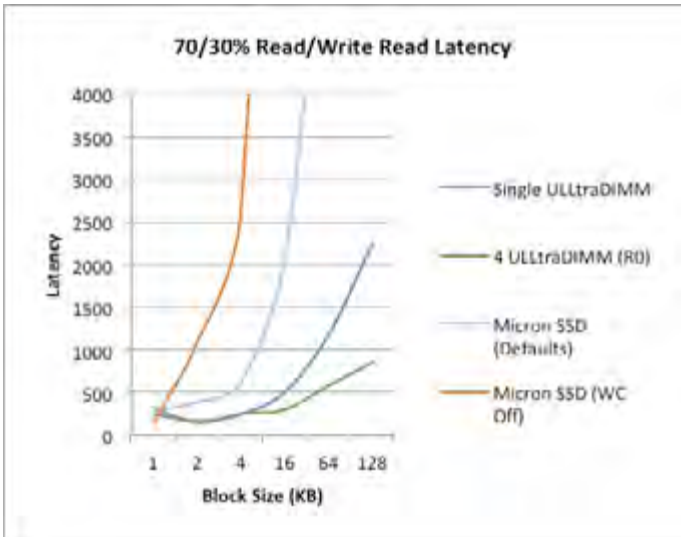

- FIGURE 3

FIGURE 3

BIOS IT's testing further confirms that an MCS™ solution also dominates write speeds in a mixed workload. Figure 3 shows a significant increase in IOPS against traditional PCIe SSD products. We can also see that performance scales in a linear fashion with the addition of multiple ULLtraDIMMs™.

- FIGURE 4

FIGURE 4

Similar to IOPS, the MCS™ solution significantly outperforms PCIe rivals in mixed workload write latency. As shown in Figure 4, the MCS™ solution's latency is significantly lower than the likes of SSD competitors. Once again we can see the linear scaling presented through using multiple ULLtraD-IMMs™.
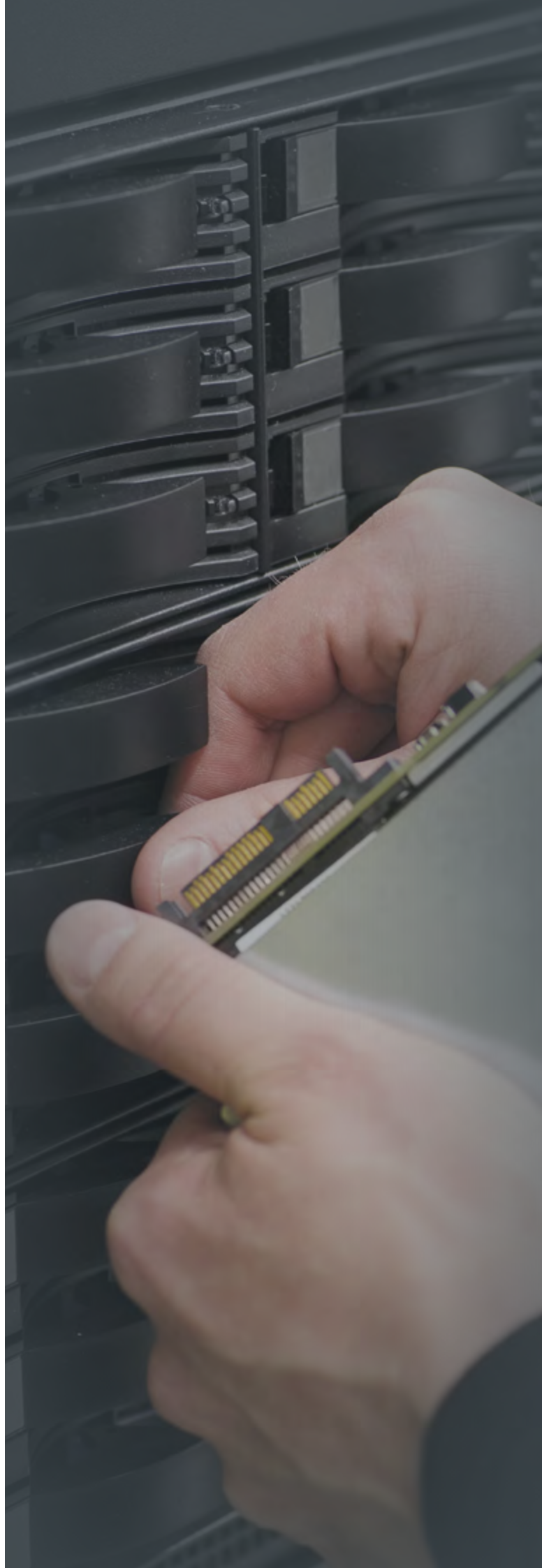
70/30% Read/Write Read Latency

- Single ULLtraDIMM
- 4 ULLtraDIMM (R0)
- Micron SSD (Defaults)
- Micron SSD (WC Off)

■ FIGURE 5

FIGURE 5

The MCS™ solution also displays very low read latency figures during mixed workloads when compared to PCIe SSDs. Where latency significantly increases around the 4KB block size with SSD, the MCS™ solution retains lower latency to much larger block sizes.

WHEN COMPARED TO FLASH STORAGE CONNECTED VIA THE PCIE BUS, MEMORY CHANNEL STORAGE™ SHOWS SIGNIFICANT IMPROVEMENTS IN BOTH LATENCY AND IOPS

WORKLOAD BENEFITS OF USING MEMORY CHANNEL STORAGE™

VIRTUALISATION

- Virtual Machine Acceleration: Ultra low response times and high performance per VM
- Reduced TCO: Enable more VM's per host compared to PCIe-based flash
- Superior Caching: Primary cache ideally suited for random, mixed virtualised workloads
- VMware vSAN Support: Improved scalability and efficient VM consolidations

DATABASE APPLICATIONS

- Improved Response Times: Process more transactions with lower response times
- Support High Transaction Density: Maintain high QoS even with many simultaneous transactions
- Optimised Database-Centric Workloads: Lowest write latency and acceleration for common DB workloads

LOW LATENCY APPLICATIONS

- Fast Response Times: Lowest latency, even under heavy I/O load
- Deterministic Response Times: Smallest latency variance
- Unlocks Application-Level Performance: Completes more transactions per second

BIG DATA / ANALYTICS

- Real-Time Analytics: Analyse streams of large volume data in considerably reduced time
- Optimised for Big Data: Significantly increase random workload performance of MongoDB, Casandra and other NoSQL databases
- Reduced TCO: Perform more work with fewer nodes

A CLOSER LOOK AT THE ULLTRADIMM™

The ULLtraDIMM™ from Sandisk™ is a revolutionary combination of MCS™ and enterprise-ready NAND flash subsystems. The ULLtraDIMM™ is available in 200 GB and 400GB modules, allowing for tens of terabytes of flash capacity in a single server. These modules come complete with backup technology to ensure data protection in the case of unexpected power interruptions.

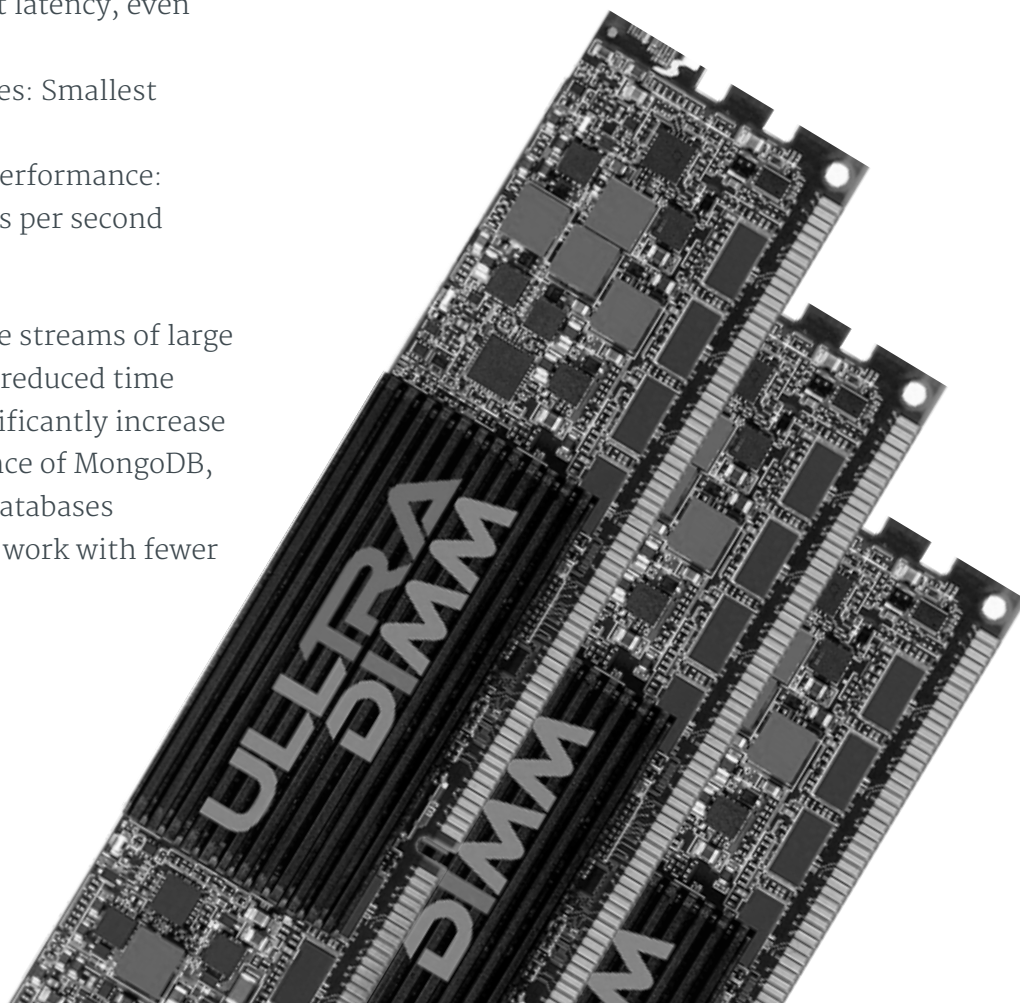### ENTERPRISE CLASS ENDURANCE & RELIABILITY

- 10 DWD for 5 years
- Backup power circuitry
- Full data path protection

SCALABLE AND COST EFFECTIVE MEDIA

- 200, 400GB Capacities
- Scalable architecture
- 19nm MLC NAND

ADDITIONAL FEATURES

- S.M.A.R.T Monitoring
- Supports TRIM
- Maintenance Tools

BIOS IT'S MEMORY CHANNEL STORAGE™ APPLIANCES

BIOS IT's range of MCS™ appliances are specifical-
ly developed for low latency and mixed workloads.
Combining the reliability and power efficiency of
Supermicro based products and the benefits of
Memory Channel Storage™, these appliances de-
liver unparalleled performance over a wide range of
applications.

2U HYPER-SPEED

- Suited for ultra low latency applications
- Manufacturer backed overclocking
- World Record x86 performance
- 16x DIMM Slots

2U TWIN 4 NODE

- Suited to Virtualisation
- High Density Solution − 4 Nodes in a 2U
- 8 DIMMs per node

1U DATA CENTRE OPTIMISED

- Well suited for all applications
- Small form factor
- 16x DIMM slots

CONCLUSION

The complexity and scale of modern day applications means that they are demanding faster and faster performance from the infrastructure upon which they run. The challenge facing many technical managers is that although compute performance and interconnect speeds continue to increase dramatically, existing storage technologies are failing to cope with this increase and the requirements put upon them, storage continues to be the bottleneck. Memory Channel Storage™ brings the data closer to the CPU, therefore delivering a huge and predictable increase in read/write speeds and a reduction in latency, giving today's IT managers and users a solution to the bottlenecks that inhibit many of their everyday applications.

MEMORY CHANNEL STORAGE™ GIVES TODAY'S IT MANAGERS AND USERS A SOLUTION TO THE BOTTLENECKS THAT INHIBIT MANY OF THEIR EVERYDAY APPLICATIONS.

ABOUT BIOS IT

BIOS IT delivers global first-to-market technology together with High Performance Computing products and techniques, previously exclusive to academia and scientific research, into the real world. With a number of key hardware and software partners, BIOS IT are able to design and develop unique and manageable compute and storage clusters with industry leading value/performance ratios.

Privately held since inception, we have grown from humble beginnings to become a global leader in enterprise information technology with over 20 years' experience. Although during this period technology architectures have evolved, our mantra for delivering high quality, first to market products and services has always been the same. This set of core values has allowed us to grow organically to a turnover of over $60million with a foot hold in the world's leading economies.

As a dedicated division, BIOS IT has then taken this innovation a step further to enable constant investment in new technologies and subsequently allowed us to design and manufacture our own HPC systems, the first of which was the micro-server Viridis platform, the world's first ARM server for the enterprise. This revolutionary architecture has enabled us to deliver supercomputing performance from as little as 5W per server, paving the way to exascale computing.

CONTACT US

www.bios-it.com | sales@bios-it.com
AMERICAS: 1-800-654-BIOS
EMEA: +44 (0) 203 178 6467
APAC:: +61(0) 2 9959 1010

BIOS IT