How Memory and Storage Technologies
Are Transforming Enterprise Computing

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Nothing is more important to an enterprise than its data. The ability to successfully manipulate, analyze, utilize and protect data is the key competitive differentiator of today's business era. Organizations that are able to leverage data with speed and accuracy are driving innovation and building a foundation for their future. Those that fail to invest properly in maximizing and safeguarding their data are putting themselves at risk.

Because of the growing reliance on data, storage and memory technologies have become the foundation of the modern enterprise. In today's data centers, a large portion of an enterprise's infrastructure is devoted to memory and storage. In fact, advances in solid-state storage and memory—such as enterprise-grade NAND flash storage and next-generation DRAM—are behind almost every critical enterprise IT initiative, from cloud computing to big data analytics to the Internet of Things.

Decisions around which storage and memory technologies to deploy have never been more strategic. IT leaders can drive their enterprises forward by paying close attention to what is happening in storage and memory—not only to run their businesses better, but to also ensure that their most critical assets are being properly protected. In fact, a "storage strategy" is critical to optimizing business processes that are tied to revenue and ensuring that data centers are able to handle data performance and volume requirements.

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This white paper examines the transformation taking place in enterprise IT and the strategic role that storage and memory technologies are playing in facilitating and driving that transformation. We also look at the trends and innovations in storage and memory technologies that address today's enterprise IT challenges while building a bridge to the next-generation data center.

Trends in Enterprise Computing

Enterprise computing is undergoing a major transformation. At the heart of that transformation is data. The amount of data being created and stored is projected to grow by a factor of 10 over the period from 2013 to 2020, from 4.4 trillion gigabytes to 44 trillion gigabytes.[1]

Data growth presents a range of challenges. First off, the data has to be stored, accessed and backed up: Simply buying more storage devices and disks to address the capacity challenge is cost-prohibitive. In addition, today's data centers need to access, move and analyze data at speeds that are beyond the capabilities of legacy storage and memory technologies. At the same time, most enterprise IT leaders are also under the gun to reduce costs and improve efficiencies.

The need for improved performance at lower cost is giving rise to agile new models for enterprise computing, such as hybrid and private clouds and software-defined data centers. These models enable far greater agility through enhanced resource sharing and pooling, but because of that they also require greater speed in accessing and processing data. This is creating a need for innovation and cost-efficiencies in the underlying infrastructure, particularly in the storage and memory technologies.

Leveraging Innovation in Storage and Memory Technologies

Whereas a technology such as spinning disk storage has remained relatively stagnant for many years, innovation in solid-state technology is accelerating rapidly—giving enterprises the ability to access, move and store data faster and more reliably than ever before. In fact, one of the challenges for IT and business leaders is to keep up with the pace of innovation taking place in memory and storage.

For example, just a few years ago there were hardly any all-flash solutions in a typical enterprise data center. Flash-forward to today: flash technology has advanced to the point that it is widely used in data centers and is displacing spinning disks in a broad range of use cases.

Similar innovation is taking place in memory technologies, such as DRAM. This is creating a paradigm shift for IT leaders. At one time, IT viewed storage and memory as problems that needed to be solved—for example, how to keep up with data growth without breaking the budget. Now, however, forward-thinking IT leaders view storage and memory as strategic solutions to their most important challenges, including:

- **Reducing data center costs** at a time when data is doubling in size every two years and IT

1 "The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things," IDC, April 2014

departments are under extreme pressure to reduce the physical space and energy footprints of their facilities.[2]

- **Delivering high performance** to support modern applications and emerging opportunities in cloud computing, big data, the Internet of Things, and virtual desktop infrastructure (VDI).
- **Supporting highly resilient data centers** that reduce downtime and provide maximum availability for today's 24/7/365 global business requirements.
- **Driving value and profitability** out of infrastructure investments by using flash storage and advanced memory solutions to optimize business processes.

Trends in Memory and Storage

The availability of cost-efficient, enterprise-grade solid-state storage continues to be one of the most important factors in transforming the data center. While most organizations initially turned to SSDs for performance, they are now discovering that, with the right solutions in place, they can also use SSDs to reduce overall costs and improve reliability.

One of the important trends, therefore, is to replace spinning disk drives with SSDs for all applications, not just Tier One production environments. As IT leaders are digging deeper into the cost of storage, they are seeing major benefits of SSDs. These benefits include:

- **Reduced power/space requirements:** For most enterprises, power is one of the biggest cost challenges. If you look at metrics such as operations per dollar per watt, or number of terabytes per dollar per watt, you will see that SSDs use up a fraction of the power of spinning disks, delivering significant savings over time. They also take up considerably less physical space. In some enterprises, the expanded use of SSDs has facilitated a consolidation in the number of data centers, which has brought dramatic cost savings.
- **Better performance and efficiencies:** The traditional view of looking at storage on a cost-per-gigabyte metric is outdated in today's era. What you really should be looking at is cost-per-IOPS because performance—and not capacity—is the driving factor in storage. In highly virtualized and cloud environments, the impact of this is significant. For example, with spinning disks you may be able to get 10-15 virtual machines on a single drive; however, if you use SSDs you can get many more SSDs, depending upon the capacity. This allows you to shrink the footprint of your data center, meaning you can buy fewer components, fewer servers and eliminate the need to house, power and maintain vast racks of spinning disks.
- **Improved time to value:** The increased speed and responsiveness of SSDs can drive significant productivity gains among workers, leading to optimized business operations and improved profitability. These productivity gains are obvious in applications where performance is critical, such as computer graphics rendering or seismic analysis. But, in reality, all workers are more productive when they get access to information faster. In addition, SSDs have lower failure rates than spinning disks, so the uptime of applications improves as well.[3]

2 "The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things," IDC, April 2014

3 "Debunking SSD Myths," Network World, Jan. 22, 2015

Data growth is also a major challenge in memory technology, particularly with the need to process larger data sets. With the emergence of big data and other data-intensive applications, moving data over long distances can be time consuming and expensive, particularly when you look at metrics such as power consumption. Therefore, an important trend in memory is to move the memory closer to the compute resource and to drive increased data rates, higher bandwidths and faster burst accesses.

What to Look for in Memory and Storage Solutions

One of the common misconceptions, particularly in solid-state storage, is that all flash is created equal. Not only is this not the case, it shouldn't be the case. Each application and workload is different, so you want to make sure your vendor focuses on designing application- and workload-specific solutions. You also want a vendor with a comprehensive portfolio so you have the flexibility to address specific workloads. In thinking about enterprise applications and workloads, typical examples/scenarios include:

- **Big data and analytics:** Flash storage provides superior high-performance IOPS and ultra-low latency to eliminate performance bottlenecks and offer a scalable, cost-effective solution.
- **Virtualized environments:** Flash storage consolidates the hardware environment with high virtual machine density and ultra-low latency for maximum application responsiveness.
- **Databases:** Flash storage brings high value and acceleration to demanding applications, with better cost-per-IOPS, superior IOPS/watt efficiency, easy scale-up and design-in endurance.[4]
- **Online transaction processing (OLTP):** Flash storage improves business efficiencies by enabling the organization to process more transactions in comparable time frames, enabling potential gains in sales and customer satisfaction.[5]

In addition, as the paradigm continues to shift away from spinning disks and towards solid state, enterprise customers will find that there is a major advantage in working with a vendor that is vertically integrated. A vertically integrated supplier can assemble flash components in conjunction with end-user solutions, while also leveraging its own manufacturing expertise to drive down costs and accelerate innovation.

Finally, it is important to work with a vendor that specializes in solid-state technology and is constantly developing new solutions with an eye towards the future. Your vendor should take a collaborative approach in helping you deploy the right storage and memory solutions for your needs so you can successfully navigate the major transformation that is taking place in IT.

Conclusion

This is an exciting, and challenging, time for enterprise IT leaders. On the one hand, their role in driving the business forward has never been more important or compelling. On the other hand, there is tremendous pressure to do more with less and to potentially bring significant and disruptive changes to their organizations.

4 "Hybrid Storage Arrays vs. All-Flash Arrays: A Little Flash or a Lot?" SearchSolidStateStorage

5 "IOPS Per What," SearchStorage

By creating an IT architecture strategy that leverages innovations in storage and memory technologies, data center IT decision-makers can drive cost efficiencies. They can also use their technology infrastructures to improve business operations substantially while avoiding the costs associated with expensive data center expansion. The result will be the ability to directly impact business processes that are tied to revenue. A major challenge is in choosing the right solutions at the right time for the right workloads.

Micron can help. Micron is one of the world's leading suppliers of memory and storage solutions, with a broad portfolio stretching from NAND and DRAM to fully integrated flash storage solutions. As a vertically integrated provider, Micron is able to drive innovation and tailor solutions. In addition, the company works with closely with enterprises as an expert partner to help define needs and pinpoint the right solution for each workload. **Here's how Micron can help you get started.**