DATA CENTER MODERNIZATION STARTS WITH INFRASTRUCTURE

DELL EMC BOLSTERS ITS POWEREDGE PORTFOLIO WITH 2ND GENERATION EPYC PROCESSORS FROM AMD

EXECUTIVE SUMMARY

Technology drives the business. This statement has always been true but is more relevant than ever. As mature trends take root and new trends emerge, the direct impact on businesses in the digital economy can be significant. Cloud computing and the "cloud model" can increase business agility by enabling faster adoption of new technologies. Businesses may also gain greater insights more quickly from edge computing, which processes and analyzes data nearer the source of that data.

Although the needs of an IT organization – increased responsiveness to the business while reducing costs and protecting security – are almost ironically consistent, it must transform as the business adopts and consumes new technology. No longer does the IT organization simply install and maintain technology, but it must be the first-choice service provider to business units that now have options. IT must deliver value.

Value begins with infrastructure, which is the cornerstone of IT transformation. This paper will explore how the Dell EMC server portfolio's embrace of AMD's 2nd Generation EPYC processor line-up is enabling organizations of all sizes to do more with less, quickly and securely.

THE MODERN ORGANIZATION HAS MODERN NEEDS

The workloads and applications that drive today's business bear little resemblance to those used just a few short years ago. Cloud-native (enabled by microservices architecture) and cloud-based applications are replacing traditional three-tiered architectures to enable better responsiveness and faster data insights.

While the cloud has already impacted both the business and the IT organization, the promise of edge computing is big yet unknown. The needs of edge computing, however,

are coming into focus and include real-time secure data ingestion, transformation and analysis.

Finally, the broad adoption of data analytics platforms such as Apache Spark is demonstrating value both internally and externally. Organizations of all sizes can gain operational efficiencies through real-time analysis of performance data. Businesses can also better serve the needs of an ever-demanding customer base through targeted messaging and fast, personalized responsiveness.

For the digitally transformed organization to operate efficiently, the underlying infrastructure must be able to respond to the diverse needs of these different workloads and applications. Additionally, the servers that power the modern workloads must be equally effective at supporting the legacy data and applications that often sit in the back office.

In some use cases, high core-count CPU accompanied by large memory footprints are critical to the movement and real-time processing of large amounts of raw data or the maximization of virtual machine (VM) consolidation. Other cases require a lot of high-speed I/O to enable application accelerators necessary for high-performance computing. And in yet other cases, efficiency is about achieving the right performance for the traditional relational (SQL) database that is licensed per core.

AMD's 2nd Generation EPYC Processor is a compelling compute platform as its performance profile can scale to meet this wide range of needs. AMD's CPU portfolio, bolstered by its latest "F" Series processors, can range in terms of cores without sacrificing other factors that impact performance. For IT this means consistency of price-performance across the range of CPUs – in other words, value.

However, a CPU is only as strong as its instantiation in the marketplace. And in the case of server infrastructure, one size does not fit all. For IT organizations looking to deploy a single architecture and server portfolio to support their broad range of needs, look for the company that demonstrates breadth and depth of portfolio. In the case of EPYC, Dell EMC is a company with a portfolio worthy of consideration.

A QUICK RECAP ON 2ND GENERATION EPYC

Before considering the advantages of the Dell EMC PowerEdge portfolio, it is worthwhile to review the capabilities of AMD's 2nd Generation EPYC Processor, for the capabilities of the server are rooted in the CPU.

The second-generation EPYC processor excels in three areas: performance, security and total cost of ownership (TCO).

1. **Performance** – EPYC's performance is tied to its design. AMD designed EPYC as a multichip module, connected by a high-speed interconnect called Infinity Fabric. This enables EPYC to achieve extremely high core counts (64 per socket) and maintain feature parity across the family of products. By manufacturing on a 7nm process (the only x86 server CPU on this process), the company can maintain packaging size and gain power efficiencies. This means best-in-class performance, based on industry-standard benchmarks, and ultimately great value for IT professionals looking to support a range of workloads.
2. **Security** – It is fair to say that securing data is a top priority for every IT professional and that effective security must begin at the lowest levels of infrastructure – in the silicon. Regarding security, EPYC is unique, with three elements that make it compelling:

    - ***AMD Secure Processor –*** EPYC's Secure Boot capabilities ensure the silicon boots into a pristine environment with no altered or hijacked firmware, drivers or other malicious microcode. This capability can protect PowerEdge servers from rootkit attacks and other low-level exploits.
    - ***Secure Memory Encryption (SME) –*** By encrypting the physical memory (DRAM), EPYC neutralizes dangerous hacking techniques such as memory scraping (a technique used to read sensitive data resident in memory).
    - ***Secure Encrypted Virtualization (SEV) –*** The third leg of EPYC's security strategy encrypts and isolates VMs in a virtualized environment, ensuring only the owner of the VM may have access to it or the resident data. This is especially attractive in shared environments where VMs from a variety of customers can reside on the same server.

3. **TCO** – The result of the performance gains, power savings and security capabilities lead to TCO savings. While TCO is a term that has perhaps been watered down over time, it is important to note the real direct and indirect savings that can be achieved by deploying PowerEdge servers based on the 2nd Generation EPYC Processor. One example of this is the high core-count CPU connected to a large memory footprint across many memory channels. This combination takes VM consolidation from the realm of theoretical to practical,

leading to real physical server consolidation. And this, in turn, has CapEx (e.g., server, software) and OpEx (e.g., power, management) implications.

FIGURE 1: AMD EPYC 7002 SERIES PROCESSORS

Model	Cores	Threads	Base Freq (GHz)	Max Boost Freq (GHz)	TDP (W)	L3 Cache (MB)	Memory Channels	Memory Freq (MT/s)	Memory Throughput (GB/s)	PCIe Gen4 Lanes (I/O)
7H12	64	128	2.6	3.3	280	256	8	3200	204.8	128
7742	64	128	2.25	3.40	225	256	8	3200	204.8	128
7702	64	128	2.00	3.35	200	256	8	3200	204.8	128
7702P	64	128	2.00	3.35	200	256	8	3200	204.8	128
7662	64	128	2.00	3.30	225	256	8	3200	204.8	128
7642	48	96	2.30	3.30	225	256	8	3200	204.8	128
7552	32	64	2.20	3.30	200	192	8	3200	204.8	128
7542	32	64	2.90	3.40	225	128	8	3200	204.8	128
7532	32	64	2.40	3.30	200	256	8	3200	204.8	128
7502	32	64	2.50	3.35	180	128	8	3200	204.8	128
7502P	32	64	2.50	3.35	180	128	8	3200	204.8	128
7452	32	64	2.35	3.35	155	128	8	3200	204.8	128
7F72	**24**	**48**	**3.20**	**3.70**	**240**	**192**	**8**	**3200**	**204.8**	**128**
7402	24	48	2.80	3.35	180	128	8	3200	204.8	128
7402P	24	48	2.80	3.35	180	128	8	3200	204.8	128
7352	24	48	2.30	3.20	155	128	8	3200	204.8	128
7F52	**16**	**32**	**3.50**	**3.90**	**240**	**256**	**8**	**3200**	**204.8**	**128**
7302	16	32	3.00	3.30	155	128	8	3200	204.8	128
7302P	16	32	3.00	3.30	155	128	8	3200	204.8	128
7282	16	32	2.80	3.20	120	64	8	3200	85.3	128
7272	12	24	2.90	3.20	120	64	8	3200	85.3	128
7F32	**8**	**16**	**3.70**	**3.90**	**180**	**128**	**8**	**3200**	**204.8**	**128**
7262	8	16	3.20	3.40	155	128	8	3200	204.8	128
7252	8	16	3.10	3.20	120	64	8	3200	85.3	128
7232P	8	16	3.10	3.20	120	32	8	3200	85.3	128

Dark gray rows represent single socket "P" SKUs.

Source: Moor Insights & Strategy

The addition of the new "F" series processors (bolded red in the above table) enables AMD to deliver a compelling price-performance value proposition to the enterprise IT organization. A CPU speed bump, increased L3 cache and other architectural improvements make this ideal for a range of workloads, from virtualized infrastructure to big data analytics to compute-intense workloads such as electronic design automation (EDA).

One of the more compelling deployment models is structured data management such as Microsoft SQL Server. Based on database benchmarking results from the Transaction Processing Performance Council (TPC), organizations may find strong value (price/performance) in the 7F72 (24 cores) and 7F52 (16 cores) CPUs.

CONSIDER YOUR SINGLE-SOCKET OPTIONS

When deploying new servers in the data center, many IT organizations default to the practices of the past. They use the same basic specifications, updated for new CPU, memory and storage architectures. This can lead to server environments that are highly underutilized, resulting in diminished value.

Moor Insights & Strategy recommends IT organizations look at single-socket server offerings such as Dell EMC's PowerEdge R6515 and R7515. These servers can deliver the performance of many two-socket servers deployed in the data center at a lower cost. Deploying single-socket servers and dual-socket servers in a test environment and evaluating overall performance would be a worthy cost-savings exercise for any IT organization.

FIGURE 2: EVALUATING EPYC COST/PERFORMANCE

EPYC Model	Cores	Threads	TPC Score	TPC "Per Core" Score	Licensing Cost
7742	64	128	6,716.88	104.95	$439, 936
7642	48	96	5,149.61	107.28	$329.952
7542	32	64	4,328.66	135.37	$219,968
7402	24	48	3,134.54	130.61	$164,976
7302	16	32	2,238.96	139.94	$109,984
7272	12	24	1,632.25	135.27	$82,488

SOURCE: MOOR INSIGHTS & STRATEGY[1]

CAN'T ALL OF THOSE CORES NEGATIVELY IMPACT LICENSING COST?

It is important to discuss the impact of high core counts on software distributions that license on a per-core basis. There are two points important to consider when sizing and deploying infrastructure with software licensed in this model:

1. **Base license cost on what will be deployed**. Just because EPYC has a 64-core offering does not mean 64-core socket systems will be deployed. In fact, in the example of relational databases, lower core counts with higher frequencies have better per-core performance than higher core-count systems. The best solution is one that considers overall performance and cost.

   In Figure 2 we compare highest-performing EPYC processors per core-count offering (based on processor speed) and show the TPC-E scores (actual and estimates) at the system and per-core level. We then show the licensing cost for Microsoft SQL Server Enterprise Edition to give the entire price/performance comparison. While system needs will vary from application to application, this chart demonstrates best price-per-core performance in the lower end of the processor stack.

   When reviewing the above data, consider AMD's recent additions to the EPYC portfolio (bolded red in Figure 1). The increase in frequencies combined with improvements to L3 cache should further improve the TPC-E scores seen in Figure 2.

2. **Do your own math.** Vendors will show absolutes to demonstrate the value of their solution. In the case of VMware's recent licensing change, this is likely a common discussion for IT and solutions vendors. However, internal Dell EMC studies have shown that even when deploying ESX on a single-socket 64-core system from AMD, the math does not substantially change. The savings are still significant.

[1]Based on MI&S analysis of SQL Server price-performance study conducted by Glenn's SQL Server Performance, based on TPC-E results. Licensing cost based on Microsoft SQL Server Enterprise Edition list price of $13,748 per two-core pack.

MOOR INSIGHTS & STRATEGY

THE PRACTICAL RELEVANCE OF DELL EMC EPYC-BASED PORTFOLIO

Designing a deep server portfolio is only compelling if that portfolio has relevance in the market. The servers and solutions that make up the portfolio should align with the needs and wants of consumers. And this, portfolio management, is where Dell EMC is uniquely capable. The company has developed an EPYC portfolio that spans computational and deployment requirements of a wide range of customers, from richly configured single-socket servers (R6515) to cloud-optimized platforms (C6525).

FIGURE 3: DELL EMC EPYC-BASED POWEREDGE PORTFOLIO

	PowerEdge R6515	PowerEdge R7515	PowerEdge R6525	PowerEdge R7525	PowerEdge C6525
Processor	1 x 2nd Generation AMD EPYC processor *Up to 64 cores/128 threads*	1 x 2nd Generation AMD EPYC processor *Up to 64 cores/128 threads*	2 x 2nd Generation AMD EPYC processor *Up to 128 cores/256 threads*	2 x 2nd Generation AMD EPYC processor *Up to 128 cores/256 threads*	2 x 2nd Generation AMD EPYC processor *Up to 128 cores/256 threads*
Memory Capacity	Up to 2TB DDR4 RAM (LRDIMM) Up to 1TB DDR4 RAM (RDIMM) 16 DIMM slots	Up to 2TB DDR4 RAM (LRDIMM) Up to 1TB DDR4 RAM (RDIMM) 16 DIMM slots	Up to 4TB DDR4 RAM (LRDIMM) Up to 2TB DDR4 RAM (RDIMM) 32 DIMM slots	Up to 4TB DDR4 RAM (LRDIMM) Up to 2TB DDR4 RAM (RDIMM) 16 DIMM slots	Up to 2TB DDR4 RAM (LRDIMM) Up to 1TB DDR4 RAM (RDIMM) 16 DIMM slots
Memory Bandwidth	8 Memory Channels	8 Memory Channels	16 Memory Channels	16 Memory Channels	16 Memory Channels
PCIe Slots	Up to 2 PCIe slots 1 x Gen3 1 x Gen4	Up to 4 PCIe slots 2 x Gen3 (1 x 8, 1 x 16) 2 x Gen4 (2 x 16)	Up to 3 PCIe slots 3 x Gen4 (x16)	Up to 8 PCIe slots 8 x Gen4	Up to 4 PCIe slots 2 x Gen4 1 x OCP 3.0 Gen4 1 x Gen3 (M.2 riser)
Accelerators			Up to 2 single wide GPUs	Up to 3 double wide (300W) Up to 6 single wide (75W)	
Storage	Up to 4 x 3.5" SAS/SATA HDD Up to 10 x 2.5" SAS/SATA/NVMe Up to 8 x 2.5" SAS/SATA	Up to 8 x 3.5" SAS/SATA HDD Up to 24 x 2.5" SAS/SATA/NVMe Up to 12 x 2.5" SAS/SATA	Up to 4 x 3.5" SAS/SATA HDD Up to 12 x 2.5" SAS/SATA/NVMe Up to 8 x 2.5" SAS/SATA	Up to 24 x 2.5" NVMe Up to 12 x 3.5" SAS/SATA Up to 16 x 2.5" SAS/SATA and NVMe	Up to 8 x 3.5" SAS/SATA HDD Up to 24 x 2.5" SAS/SATA/NVMe Up to 12 x 2.5" SAS/SATA
Management	iDRAC9 OpenManage	iDRAC9 OpenManage	iDRAC9 OpenManage	iDRAC9 OpenManage	iDRAC9 OpenManage
Security	Secure Boot, Erase, Lockdown Silicon Root of Trust AMD Secure Memory Encryption AMD Secure Encrypted Virtualization	Secure Boot, Erase, Lockdown Silicon Root of Trust AMD Secure Memory Encryption AMD Secure Encrypted Virtualization	Secure Boot, Erase, Lockdown Silicon Root of Trust AMD Secure Memory Encryption AMD Secure Encrypted Virtualization	Secure Boot, Erase, Lockdown Silicon Root of Trust AMD Secure Memory Encryption AMD Secure Encrypted Virtualization	Secure Boot, Erase, Lockdown Silicon Root of Trust AMD Secure Memory Encryption AMD Secure Encrypted Virtualization
Use Cases and Target Workloads	Scale out virtualization Departmental database ROBO HCI Network Function Virtualization (NFV)	Scale out virtualization Big data analytics Container environments Software Defined Storage vSAN Ready Nodes	Dense, scale up virtualization High Performance Computing Virtual Desktop Interface	All Flash - Software Defined Storage - Virtual Desktop Interface - Data Analytics	High Performance Computing Digital Manufacturing Research Web Technologies

Source: Moor Insights & Strategy

As previously mentioned, Dell EMC appears to have designed a portfolio that can meet the needs of the modern organization, supporting both new, cloudified environments as well as traditional virtualized and even legacy environments. The ability to support these environments on the same physical platforms, the result of Dell EMC's PowerEdge system designs, makes this even more compelling. Although it is sometimes hard to quantify value, the performance and cost analysis shows that PowerEdge and EPYC should deliver benefits.

The trend in IT is to purchase and deploy solutions that are more easily provisioned and managed. A good example of this is hyperconverged infrastructure (HCI) solutions such as Dell EMC's VxRail and vSAN, as well as the company's Microsoft Azure Stack HCI solutions Dell EMC AX6515 and XC6515. Dell EMC has enabled these solutions (termed "ready bundles") to run on EPYC as well. MI&S sees this as an opportunity for Dell EMC to truly differentiate from its competitors given its close relationship with VMware.

It is worthwhile to discuss Dell EMC's single-socket and dual-socket offerings. As computational capacity has increased over time, server "socket counts" have decreased.

Those with more experience in IT can remember the days when 8 and 16 socket servers were common for database environments. Dual-socket servers were reserved for file and print services with the misguided understanding that the second socket could be used for resiliency sake (i.e., failover).

As virtualization became the mainstay, IT administrators expected to see server utilization rates increase dramatically as data center consolidation projects were completed. However, MI&S believes the utilization rate for the average server sitting in the data center is still in the 20% range.

Dell EMC's single-socket servers (PowerEdge R6515, R7515) can outperform many of the dual-socket servers that populate today's data center as they can be more richly configured. In many cases, these platforms will deliver greater TCO savings versus dual-socket alternatives.

There are many reasons to continue to deploy dual-socket platforms such as the R6525, R7525 and C6525, including VM density per RU (rack unit) maximization, workload architecture scale-up and massive consolidation. MI&S believes it may be a worthwhile exercise for IT organizations to consider refreshing four-socket servers with two-socket platforms such as the PowerEdge R6525 and R7525. Given the richness of capabilities and large memory footprint, these servers can deliver performance at a lower cost.

THE DELL EMC VALUE-ADD

Not all servers are the same. Even those that share the same components differ in the way those components are leveraged for use in supporting workloads and applications. One of the unique qualities of Dell EMC is its ability to design and deliver solutions that align the needs and wants of the customer, regardless of size or industry.

MI&S views Dell EMC's approach to systems management and security as simplifying the burden of IT management in several ways. The company's OpenManage Enterprise and iDRAC products automate the deployment and provisioning and orchestration of infrastructure. Through OpenManage Enterprise, automated monitoring and advanced telemetry coupled with advanced recovery capabilities enable PowerEdge servers' high degree of resiliency. Coupling these management capabilities with the silicon-based security previously discussed should result in the "always-on" data center environment required by IT.

PUTTING IT ALL TOGETHER – HOW DELL EMC'S EPYC STRATEGY BENEFITS ORGANIZATIONS OF ALL SIZES

Dell EMC brings a pragmatism to its product development and rollout strategy that serves its customers well. The rollout of PowerEdge based on AMD's 2nd Generation EPYC Processors is a particularly good example of this pragmatism. Five SKUs power a range of platforms and solutions that can meet virtually all the needs of the modern business, from legacy and traditional back office to big data analytics to cloud-native and high-performance computing.

Because of these deep portfolio and Dell EMC's OpenManage Enterprise capabilities, IT organizations considering EPYC as their compute platform should take a serious look at Dell EMC.

MI&S PERSPECTIVE

In the ever-evolving technology market, the needs of IT are quite static – do more with less in the most secure fashion. However, IT must transform the way it delivers services to the business. That transformation starts with infrastructure that is performant and pliable to support the past, present and future.

When considering infrastructure refresh projects and the server technology that supports the modernized data center, IT organizations should perform thorough internal testing to ensure the best value. The result of such testing should answer the following questions:

1. Which server platforms best support the applications deployed and data generated in your environment?
2. Which server platforms deliver the best price-performance?
3. Are two sockets required across the environment or do single-socket platforms help drive the best price-performance?
4. Which servers best support the wide range of performance needed by the workloads in your environment?
5. Does the server platform under consideration deliver on the security requirements of your organization?

AMD's 2nd Generation EPYC Processor appears to be optimally designed for the modern business due to its richness of features and advanced security capabilities. Likewise, Dell EMC has taken the EPYC architecture and designed server platforms optimized for the modern business, delivering a range of performance and other features to align with customer needs. The breadth and depth of its EPYC-based platforms are unmatched, enabling the company to service customers of all sizes and types.

For more information on the Dell EMC server portfolio, click here.

IMPORTANT INFORMATION ABOUT THIS PAPER

AUTHOR
Matthew Kimball, Senior Analyst at Moor Insights & Strategy

PUBLISHER
Patrick Moorhead, Founder, President, & Principal Analyst at Moor Insights & Strategy

INQUIRIES
Contact us if you would like to discuss this report, and Moor Insights & Strategy will respond promptly.

CITATIONS
This paper can be cited by accredited press and analysts but must be cited in-context, displaying author's name, author's title, and "Moor Insights & Strategy". Non-press and non-analysts must receive prior written permission by Moor Insights & Strategy for any citations.

LICENSING

DISCLOSURES
This paper was commissioned by Dell EMC. Moor Insights & Strategy provides research, analysis, advising, and consulting to many high-tech companies mentioned in this paper. No employees at the firm hold any equity positions with any companies cited in this document.

DISCLAIMER
The information presented in this document is for informational purposes only and may contain technical inaccuracies, omissions, and typographical errors. Moor Insights & Strategy disclaims all warranties as to the accuracy, completeness, or adequacy of such information and shall have no liability for errors, omissions, or inadequacies in such information. This document consists of the opinions of Moor Insights & Strategy and should not be construed as statements of fact. The opinions expressed herein are subject to change without notice.

Moor Insights & Strategy provides forecasts and forward-looking statements as directional indicators and not as precise predictions of future events. While our forecasts and forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could cause actual results to differ materially. You are cautioned not to place undue reliance on these forecasts and forward-looking statements, which reflect our opinions only as of the date of publication for this document. Please keep in mind that we are not obligating ourselves to revise or publicly release the results of any revision to these forecasts and forward-looking statements considering new information or future events.