Blade Servers: The Answer to 5 Critical Data Center Challenges

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Today, IT organizations face significant, business-critical challenges in the data center. The ability to control soaring IT costs while meeting the computing requirements and needs of the business is necessary for businesses to remain competitive. Increased efficiency, combined with the rapid evolution of virtualized, standards-based open architectures, requires changes in the way companies build and deploy enterprise technology — and blade servers can be a key part of your strategy. Blade servers provide the following advantages:

- ◆ **They use less energy, which helps lower IT costs and optimize server power.**
- ◆ **They simplify data center management, which improves IT responsiveness to business needs.**
- ◆ **They conserve data center space and resources, which provides flexibility in when and how to expand data centers.**

The latest generation of Dell PowerEdge blade servers brings unparalleled levels of efficiency and computing power to the data center. Customers can achieve significant financial and energy savings when migrating to blade servers. However, the latest generation of Dell PowerEdge rack-based servers also provides scalable high performance and power efficiency. How do you determine when a move to blade servers is right for you?

This paper identifies the top five IT reasons to move to blade servers in your data center. It also provides a best practices check list to help determine if the time is right for you to migrate to blade servers.

Blade Servers: The Efficient Choice

Your data center requires outstanding reliability. Large-scale databases and virtualized environments require cost-effective scalability, memory capacity and flexibility. And to rapidly respond to business needs without adding more staff, you need servers that are quick to deploy, simple to manage and easy to maintain.

Dell™ PowerEdge™ blade server solutions, with their smaller footprint, lower power consumption and ease of management, offer a profound opportunity to maximize each dollar of your IT investment, whether you are building new capacity or optimizing your current infrastructure. Data center costs are so significant that in information-intensive industries such as financial services, telecommunications, and technology, they divert capital from product and service development and materially affect margins. Without improvement in data center efficiency, companies in these industries face reduced profitability.[1] The pressure in other industries may not be quite so acute, but the growing demand by data centers for resources is still significant. In fact, as much as 80 percent of IT costs come from simply keeping the lights on. Growing energy and power costs also are causing organizations to look for more power efficient (or "green") solutions to data center power costs.

Savvy IT leaders realize that increasing data center efficiency while reducing power and cooling costs enables them to reclaim money, time, and human resources that can be refocused to support strategic needs. Companies are choosing blade servers as a key component of their IT strategy when building out new data centers, implementing server refresh, virtualizing more of their environment, or simply looking to simplify the management of their server farms. Blade servers bring greater computing power, energy- and cooling-efficiency, reduced cabling, and far denser computation per square foot of data center space than traditional rack-mount servers.

The genius of the blade form factor is the reduction of redundant facilities. Blade servers work within a shared enclosure that provides them with power, cooling, networking connections, and management. Because individual blades share power and cooling in an enclosure, they use less electricity than the equivalent number of rack-mounts. By eliminating redundant equipment, blade systems can fit more servers

[1] James M. Kaplan, William Forrest, and Noah Kindler; *Revolutionizing Data Center Energy Efficiency*; McKinsey & Company; July 2008.

into a square foot than is possible with traditional rack-mount servers, so they take up less room in data centers.

Blades also feature prominently in virtualization deployments as businesses continue to consolidate workloads.[2] By driving up utilization, blades drive down server bloat, maintenance and administration staffing, power and cooling costs, and data center space consumption.

So, why haven't all data centers moved to blades? Primarily because not all data centers can support blade servers easily; blade servers require higher voltage circuits for power delivery than many rack servers. For example, a facility in the U.S. must be wired for 208 volt electrical rather than 110 volt in order to effectively support the density of a wide-scale production blade-server deployment; older data centers may not be wired this way. Higher server density means more heat per square foot, so the data center needs the ability to deliver adequate cooling to the server racks. A blade server is also typically deployed with external storage, such as network attached storage (NAS) or a storage area network (SAN).

For those data centers that can support them, blade systems are an excellent choice for tackling the following business challenges:

The energy saving from just one fully populated Dell M1000e chassis is enough to power a home for one year.[6]

- Reducing power and cooling costs in the data center
- Minimizing server space requirements in the data center
- Controlling sprawl
- Simplifying manageability
- Simplifying network complexity

But not all blades are created equal. Here's a look at the advantages of Dell PowerEdge™ M1000e blade server performance in each category.

1. Power and Cooling Optimization

IT power and cooling costs are a significant expense to corporations, and servers and storage are responsible for half of data center energy costs.[3] Reducing power consumption by servers and cooling equipment can lead to significant energy and dollar savings.

The Dell M1000e achieves energy efficiency with power supplies that have earned the 80

Plus Platinum rating. The 80 Plus specification is an international industry standard, recognized by the Energy Star program of the U.S. Environmental Protection Agency and the U.S. Department of Energy, for energy efficiency of the devices that deliver power to electronic equipment. A more efficient power supply means a direct reduction in energy consumption costs and in produced heat. Less heat means lower cooling requirements and, because heat is one of the leading causes of semiconductor failure, a more reliable computer.[4]

In addition, granular power management features within the Dell chassis provide additional benefits. With Dell PowerEdge Blade servers, organizations can set separate power thresholds for each blade in the enclosure, and real-time reporting provides power consumption information for the enclosure as a whole and for each individual blade. An M1000e uses multiple power supply modules and can put lightly used power supplies into a standby mode, increasing utilization and efficiency of the other modules.

The M1000e also uses power-efficient fans with a unique optimized airflow design in the enclosure. Improving airflow is critical to efficient cooling. The more constricted the airflow, the harder the system must work to force air over the components to carry heat out of the enclosure and into the data center, where HVAC systems can remove it. Dell's airflow design allows the M1000e to cool itself and consume less power in the process.

The superior results are clear in a comparison of roughly equivalent blade systems: a Dell M1000e with 16 M610 blade servers, an HP C7000 with 16 BL460C G6 blade servers, and an IBM BladeCenter H with 14 HS22 blade servers. The comparison of fully populated blade servers used the industry standard SPECpower_ssj2008 benchmark to compare power draw and performance per watt. Here are some key findings:

- The Dell M1000e enclosure fully populated with 16 M610 blade servers used less power across all load levels than either the HP C7000 enclosure fully populated with 16 BL460C G6 blade servers or the IBM BladeCenter H enclosure fully populated with 14 HS22 blade servers.[5]
- In the CPU utilization midrange (40 – 60%), the HP C7000 enclosure fully populated with 16 BL460C G6 blade servers used 13 – 17% more power per server than Dell M1000e enclosure fully populated with 16 M610 blade servers and the IBM BladeCenter H

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[2] Doug Washburn; *Maximize Your Energy Savings From Server Virtualization With Three Process Improvements*; Forrester Research, Inc.; August 26, 2010.

[3] Environmental Protection Agency, *Report to Congress on Server Bnd Data Center Energy Efficiency"*, page 7, August 2007. http://www.energystar. gov/ia/partners/prod_development/downloads/EPA_Datacenter_Report_Congress_Final1.pdf.

[4] Heat & Reliability Fact Sheet, 80 Plus.

[5] John Beckett, Robert Bradfield, et. al.; *Power Efficiency Comparison of Enterprise-Class Blade Servers and Enclosures*; Dell; August 2010.

Through 2019, data center capacity will expand at a 10 percent compound annual growth rate, driving additional capital expense.[8]

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enclosure fully populated with 14 HS22 blade servers used 19 – 20% more power per server.[5]

- The IBM BladeCenter H enclosure fully populated with 14 HS22 blade servers used 63.6% more power at idle than the Dell M1000e enclosure fully populated with 16 M610 blade servers, despite having two fewer blade servers. [5]
- A HP C7000 enclosure fully populated with 16 BL460C G6 blade servers used 24% more power than the Dell M1000e enclosure fully populated with 16 M610 blade servers at idle and 13% more at 100% CPU utilization. [5]
- In head-to-head testing with fully populated chassis, IBM HS22 blades used 87% more power per blade at idle than Dell PowerEdge M610 blade servers. [5]
- In head-to-head testing with fully populated chassis, IBM HS22 blades used an average of 16.1% more power per blade at 100% CPU utilization than Dell PowerEdge M610 blade servers. [5]

These efficiencies translate into significant savings. In fact, the energy saving from just one fully populated Dell M1000e chassis is enough to power a home for one year.[6] An enterprise that deployed 10 fully populated Dell M1000e chassis with 160 PowerEdge M610 blade servers could expect to save up to $20,391.40 over five year compared with a 10-chassis IBM solution (140-blades). Compared to a 10- chassis, 160-blade solution from HP, the savings would be up to $60,902.80.[7]

In addition, organizations benefit from capital expense savings that can result from requiring fewer Power Distribution Units (PDUs), Uninterruptible Power Supplies (UPSs), and other cooling equipment.

2. Physical Space Reduction
Data centers, including facilities, servers, storage, and labor, already account for 25 percent of the average corporate IT budget. Through 2019, data center capacity will expand at a 10 percent compound annual growth rate,[8] driving additional capital expense.

With current trends, companies must undertake new data center construction every three to five years.[9] Today, construction expense can run as high as $3,000 per square foot.[10] That figure does not include the associated costs of personnel, maintenance, or data and telecommunications connections to the corporate infrastructure. Because construction can easily take 6 to 12 months, companies lose the ability to respond quickly to change, effectively paying an opportunity tax.

The high cost in time, money, and opportunity make data center space efficiency a prime concern for IT departments. The more computing power a company can deploy per square foot, the more easily it can add additional servers to existing data centers rather than building new facilities.

The Dell M1000e can fit up to 16 blades in the space required by 10 rack-optimized 1U servers, a 60 percent density increase. In addition, the latest Dell blades offer dramatic increases in memory capacity, memory bandwidth, CPU capabilities, and core density over previous offerings, providing enhanced performance that can even further reduce the number of servers required for the given workload.

In addition to taking up less space, the new Dell blades make the space work better. Integrated networking in the M1000e eliminates the need to run cables to each server (although that is still an option). Reduced cabling minimizes clutter around the server enclosure and increases airflow, improving cooling and physical maintainability.

3. Control of Server Sprawl
In many data centers, server utilization is under six percent, and facility utilization can be as little as 50 percent. Up to 30 percent of the servers in many data centers are functionally dead, operating at less than 3 percent daily utilization.[11] Without a way to tap this underused capacity, companies spend more than necessary on additional servers and data center space, to say nothing of the administrative head count needed to support the servers.

By separating the work done by servers from the physical machines themselves, virtualization provides a way to put underused resources to

[6] Bradfield, Robert; Dell Product Manager on Dell PowerEdge blade servers, September 2010.
[7] Beckett.
[8] Kaplan.
[9] Kaplan.
[10] Rick Cockrell; *Putting the Heat on Data Center Cooling Costs;* Cleantech Group; September 28, 2009.
[11] Kaplan.

work. The IT organization can determine where there is capacity to do the work, and then pull the necessary resources into a virtual server to run the process.

Virtualization can also reduce energy costs by up to 80 percent, according to VMware. The company also says that for every server virtualized, a company saves approximately $700 and 7,000 kilowatt-hours per year.[12]

A key to successfully implementing virtualization is increasing the number of virtual machines that a single physical machine can support.[13] For example, PowerEdge M610 and Dell EqualLogic storage supports 22.2 percent more virtual machines than the equivalent HP ProLiant BL465c server and HP StorageWorks EVA 4400 storage, and does so with a 32.5 percent performance-per-watt advantage over the HP solution.[14] Similarly, a Dell PowerEdge M710 server and Dell EqualLogic storage supported 22.2 percent more virtual machines than the HP ProLiant BL685c server and HP StorageWorks EVA 4400 storage, with a 41.9 percent performance-per-watt advantage[15]. By supporting more virtual machines, the Dell blades can better support reduction of server sprawl and required data center space. Furthermore, the Dell M1000e provides the best performance per watt and price per performance against HP and IBM for virtualization.[16]

4. Simplified Server Manageability

Server sprawl also contributes to inefficiency by creating more work — in more places — for administrators. After all, IT departments have to maintain all the servers, whether they're effectively used or not. Typical server maintenance and management costs — which include deploying servers and software, configuring servers, and more — can equate to more downtime as well. Legacy data centers can contain a mix of servers, software, and hardware from a mix of vendors, making them difficult and time consuming to manage. Simplified server manageability can help reduce the resource costs — time and labor associated with managing a data center. This in turn frees up resources to refocus on more strategic IT tasks.

Dell PowerEdge blade servers help improve server manageability. Adding or replacing a server is as easy as sliding a new unit into the blade chassis, and fewer cables are required.

The Dell M1000e provides system management capabilities that IBM and HP blade chassis lack. Sophisticated control mechanisms automate common server functions and help system managers work more efficiently, reducing the time and quantity of administrative tasks.

The M1000e is the only blade system that provides enhanced, embedded system management functions that do not require the purchase, licensing or installation of additional software. The M1000e's Chassis Management Controller enables IT administrators to configure, monitor, or manage multiple blades from a single interface without having to rely on a software agent or even have an operating system installed. This reduces downtime and also frees administrative time.

High availability features such as hot-swappable hard drives, passive-connectivity chassis design, and fully redundant I/O fabric make the M1000e extremely reliant. In turn, that reliability reduces administration by preventing problems that can disrupt operations.

The M1000e's FlexAddress Plus feature provides additional advantages. In a virtualized data center, rapid response to a server that has gone down is critical as greater efficiency has driven out the amount of spare capacity available. FlexAddress enables IT administrators to pull out one blade unit, replace it with another, and still use the original unit's network identifications (WWN and MAC address), which helps get a server back online faster with much less manual work required.

Dell also offers the Dell Advanced Infrastructure Manager (AIM), a flexible, open tool to manage networks, storage, all servers (not just blades), and server workloads as a single resource pool. Administrators can rack and cable servers once without having to physically reconfigure to meet changing business needs. They can reallocate resources and redeploy workloads on the fly, managing both virtual and physical workloads through a single toolset. For greater compatibility with a company's virtualization effort, AIM supports VMware, Hyper-V, and Xen.

5. Reducing Data Center Networking Complexity

Network connectivity can contribute to data center inefficiency. Traditional rack-mount servers do not easily and directly integrate into LANs

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[12] VMware, http://info.vmware.com/content/GreenIT_LP/?src=WWW_08Q3_VMW_CSGN_ENERGY_EFFICIENCY_SOLUTIONS_PAGE.

[13] Bailey.

[14] *Virtualized OLTP Workload Performance Comparison of End-to-End Solutions: Dell PowerEdge M610 with Dell EqualLogic storage vs. HP ProLiant BL465c Server and HP StorageWorks EVA 4400 Storage*; Principled Technologies; March 2009.

[15] *Virtualized OLTP Workload Performance Comparison of End-to-Bnd Solutions: Dell PowerEdge M710 with Dell EqualLogic storage vs. HP ProLiant BL685c Server and HP StorageWorks EVA 4400 Storage*; Principled Technologies; March 2009.

[16] Dell PowerEdge 11G Servers, based on internal testing.

Are Blades The Right Choice for Your Data Center?

Use the following checklist, based on Dell best practices, to help determine if you can benefit from moving to Dell PowerEdge Blade Servers in your environment:

1. Are you purchasing or planning to deploy six or more servers for a single location?
2. Do you have the infrastructure to support 208v power?
3. Are you standardized on external networked storage (FC/iSCSI/NAS) or do you have workloads that require only minimal levels of local storage?
4. Do you require Enterprise Class RAS and/or manageability for your servers?
5. Are you facing challenges with data center space?
6. Do you desire more automated, simplified server management?
7. Would you like to optimize your data center power and cooling or reduce your current data center energy consumption?
8. Are you in the process of consolidating workloads or virtualizing your environment?
9. Are you adopting or planning for 10GbE (LAN and/or SAN) or InfiniBand?

or SANs. Because each server is a physically distinct unit, networking also requires bulky cable connections to each box, which adds to the complexity of set-up, configuration, and maintenance.

The Dell PowerEdge blade chassis helps simplify network connectivity by reducing the amount of cabling needed. Dell blades ensure seamless connectivity into virtually all networked LAN or SAN environments through Dell's SimpleConnect feature. Administrators can replace hardware or reassign it to other tasks without rezoning or reconfiguring the network. Because the M1000e is 60 percent more dense than rack-mount servers, it needs no extra space for network switches, and it offers more than 90 percent cable reduction.[17]

Virtualization, although a smart strategy for data center management, can add to networking complexity. In a virtualized environment, a single physical location can house many times the computing capacity of traditional racks; therefore, more data must move to and from each enclosure. The M1000e supports 1 Gigabit and 10 Gigabit Ethernet, Converged Enhanced Ethernet, as well as InfiniBand for networking

and Fibre Channel for traditional SAN fabrics. Internal networking reduces external cabling and costs, because the network switch does not require its own power supply or enclosure.

Meeting the Efficiency Challenge

Although rack-mount servers solve many corporate data and computing challenges, and Dell rack-mounts, in particular, are highly efficient, blade servers are best suited to address five critical data center challenges: power and cooling optimization, physical space reduction, control of server sprawl, simplification of server manageability, and reduction of data center networking complexity.

Of the various possible choices for blade servers, Dell models offer unparalleled energy and cooling features, with the highest computing density available for blades, better support for virtualization, advanced management toolsets that surpass competitive offerings, and enhanced networking support.

The economic and competitive challenges companies face today are formidable. The current class of blade servers gives IT leaders a tool that's up to the task.

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[17] Dell Internal Testing, PowerEdge Blade Servers, 2010.

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