WHITE PAPER

Blade Servers for the Masses: Cost Advantages in Midsize and Enterprise Markets

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Executive Summary

Early in their adoption cycle, blade servers were designed to provide economies of scale for larger systems. However, only the largest IT organizations gained the capital and operating cost efficiencies to warrant the investment. Today, when third- and fourth-generation products are common, and the choice is between deploying rack-optimized servers and blade servers, cost analyses favor blade servers over a much wider range of deployment sizes and configurations. Both capital expenses and facilities expenses can prove lower for blade deployments with as few as three servers, and the blade advantage is clear in deployments of over eight servers. Cost savings are leading to increasing blade server adoption, which in turn encourages technology vendors to create product portfolios that meet the needs of small, midsize, and large organizations.

As HP strives to maintain a leadership position in the blade space, it recently introduced the HP BladeSystem c3000 enclosure to complement the HP BladeSystem c7000 enterprise blade enclosure in the HP BladeSystem product line. The HP BladeSystem c3000 is specifically designed to meet the needs of smaller server deployments, while the HP BladeSystem c7000 is aimed at larger installations. To investigate acquisition, deployment, and facilities cost differences between rack servers and blade servers across a range of deployment sizes and configurations, IDC analyzed data provided by HP. The major findings are as follows:

☑ From a capital expense perspective, blade servers are less expensive than rack servers because the server blades can share services provided by an enclosure. Network connections, in particular, are consolidated by the blade server enclosure, which reduces network interface, HBA, and cabling costs. As systems grow larger, they gain greater economies of scale.

☑ From a facilities expense point of view, further economies of scale emerge. Blade servers use less electrical power than rack servers due to the shared infrastructure. This helps reduce power consumption as well as associated cooling costs, neither of which is insignificant, especially as energy costs have risen dramatically over the past few years.

☑ From a deployment perspective, blade servers can also be less expensive to install, primarily because the enclosure is a wire-once infrastructure and additional blades can be added with a minimum of time and cost.

In this context, IDC believes that the HP BladeSystem c-Class products are important platforms for IT organizations to evaluate when weighing relative acquisition and operation price points. The HP BladeSystem c3000 and HP BladeSystem c7000 models provide cost-effective choices across a wide spectrum of computing requirements.

Situation Overview

In today's IT department, control and reduction of expenses are top of mind. Concern for cost transcends typical IT variations such as company size and industry, and both capital and operating cost efficiencies are fundamental to any discussion about running and growing a business. This extends to costs for all business processes within a company and especially to costs in the IT organization.

However, the IT organization may not be able to identify expenses as precisely as other business units. Primary expenses, such as the cost of hardware and software licenses, are relatively easy to identify. However, secondary expenses, such as hardware cabling costs, facilities charges, and the personnel hours needed to configure and manage systems, are often not accounted for with precision. Tertiary expenses, which include the cost for service, maintenance, and retirement of old servers, are rarely allocated when estimating the total cost of ownership (TCO) for a new IT investment.

Typically, IT organizations will track the costs of infrastructure acquisition and operation over time so that they can make important decisions about capacity planning and computer acquisitions going forward. IT planners primarily use one-year, three-year, and five-year time horizons when conducting capacity planning for their computing systems.

How Cost Analysis Is Useful for IT Buildout

A cost analysis can be highly useful in relation to IT buildout in several ways. First and foremost, it can help IT organizations identify the true cost of architectures for their small server rooms before they invest in infrastructure components. Second, and equally important, cost analysis can assist IT management in setting realistic expectations for how much investment the complete buildout of an IT solution will require, in terms of both hard costs (i.e., hardware, software, and services) and soft costs (i.e., personnel time, downtime, and maintenance).

However, it is incumbent upon IT personnel to gather the financial metrics associated with technology deployments. While members of finance or accounting departments can be helpful, only IT personnel can understand fully the total amount of time and materials that must be accounted for. As a result, IT personnel need to have a strong understanding of TCO and all that goes into its analysis.

Overall, IT organizations must pay attention to the technical and business implications of their deployment plans. From the business perspective, these implications include identifying and quantifying the system life cycle, costs of IT staffing, and the ever-decreasing supply of resources to pay for additional system administrators.

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Cost Analysis: Midsize Observations

Midsize companies may not support formal datacenters, but they do have an increasing number of servers, storage, and networks to manage. The special power and cooling features of a datacenter are lacking, which generates a different set of requirements for multiple server implementations and for buildouts when increasing IT capacity. IT organizations are smaller and fewer skill sets are available. Thus, simplicity is a valuable characteristic to this segment of the market.

Cost Analysis: Enterprise Observations

It is important to note that underutilization of computing resources is rampant today. Many systems are overprovisioned in order to meet peak workloads that demand more computing resources than ongoing workloads. Accompanying this underutilization is a less-than-optimal deployment of personnel supporting these systems. Improving the utilization rates of these systems can free up skilled administrator time and labor to be focused on high-value projects rather than simple server maintenance.

Compensating for Variation

Because IT management practices and IT efficiency vary widely by different organizations, a full-blown total cost of ownership (TCO) analysis can be undertaken only on a client-by-client basis. Recognizing that fact, one can still look at the financial benefits of different platforms while not accounting for variations in IT management efficiency. That is what we have done here. Specifically, IDC and HP have looked at the factors that don't change between IT organizations — namely acquisition and facilities costs — and tried to compensate for at least a portion of the operating costs normally included in a full-blown TCO study by comparing the deployment and support services fees that HP charges for both blade and rack-optimized x86 servers.

Capital Expenses

Capital expenses related to a system rollout encompass not just the computing hardware but all related infrastructure components, such as the servers themselves, which include microprocessors, memory, hard drives, network adapters, power supplies and fans, as well as the associated storage hardware. Associated management tools, Ethernet and Fibre Channel cabling, networking switches and hardware, and SAN switches also add up to significant costs.

No matter what x86 server form factor is deployed — whether blade or rack optimized — a similar number of servers will be required. However, when it comes to fans, cooling, power supplies, management tools, Ethernet and Fibre Channel networking solutions, as well as all the associated cabling, the blade architecture offers organizations a strong and compelling option for reduced capital expenses.

For points of comparison, HP provided IDC with estimated costs for purchasing and deploying two systems: an 8-server system without a SAN and a 320-server system with a SAN. Blade and rack servers were matched as closely as possible. The blade and rack systems were configured as follows:

☑ The midsize system compared a rack with an HP BladeSystem c3000 enclosure containing eight HP ProLiant BL460c server blades to a rack with eight HP ProLiant DL380 servers. The servers contain two dual-core Xeon processors; 2GB of memory; and two 72GB, 15K SAS drives. One HP GbE2 interconnect was provisioned for each enclosure.

☑ The enterprise system compared racks of HP BladeSystem c7000 enclosures containing 320 HP ProLiant BL460c server blades to a rack with 320 HP ProLiant DL360 servers. These servers also contain two dual-core Xeon processors; 2GB of memory; and two 72GB, 15K SAS drives. Two HP GbE2 interconnects were provisioned for each enclosure. In support of SAN connectivity, two Brocade 4/12 interconnections were provisioned as well.

Hardware costs are easily measured. The rack and blade alternatives provide a realistic comparison because both are powered by the same processor and equipped to serve the same purpose.

Operating Expenses

Operating expenses accrue over the life of the system. Some costs, such as the cost of floor space, can be computed with precision. Other costs, such as the cost of time spent maintaining the system, are harder to account for.

Operating expenses can be broadly broken down into costs associated with facilities — the space, power, and cooling associated with supplying the physical plant of the datacenter — and management services — the software and labor associated with IT professionals managing the environment.

Power, Cooling, and Space

Power and cooling are increasingly important factors. As energy costs increase, one way to save IT dollars is to choose more energy-efficient equipment. In a large-scale, dense server deployment, the power available in datacenters can be a limiting factor.

Estimating power consumption is more complex as processor manufacturers work to reduce power consumption and the creation of heat. In particular, power consumption is strongly related to CPU utilization. A server that is idle can consume less than half of the power of a server with high utilization. Moreover, utilization varies for most companies with seasonal trends and other business cycles.

The footprint is also a key factor for larger deployments. Using third-party cost studies, HP assumes that constructing a square foot of datacenter space costs $62.50.

The total cost of management services is more difficult to determine with precision because it includes just about everything an IT professional does with his or her time and will vary dramatically from company to company. HP has chosen to highlight the differences in fees the company charges for deployment and ongoing support services (i.e., three-year, six-hour onsite response time). This is intended to act as a proxy for operating costs of companies that would otherwise do the deployment and maintenance work themselves.

HP BladeSystem c-Class

HP BladeSystem c-Class enclosures are offered as two distinctively different models. While server and storage blades are interchangeable, the enclosures are engineered differently to match user requirements. The primary differences are in size and expansion:

☑ The HP BladeSystem c3000 enclosure includes four high-speed interconnect bays supporting Ethernet, Fibre Channel, and InfiniBand interconnect modules. Ethernet alone is a common solution for smaller midsize installations. The HP BladeSystem c7000 enclosure, in contrast, has eight high-speed interconnect bays and is ready to support high-performance I/O to networked storage.

☑ The HP BladeSystem c3000 enclosure accepts 100–120 alternating current (AC) volts, which allows it to be connected to ordinary electrical power in North America. Both models accept 200–240 AC volts, and the HP BladeSystem c7000 enclosure also accepts three-phase power sources meeting North American, Japanese, and international standards.

As part of this white paper, HP's rack and blade systems were provisioned to be as similar as possible from a system management perspective. In particular, both systems include HP Insight Control Environment system management software.

IDC encourages readers to focus on metrics that are clear and quantification of ownership costs that is demonstrable. Estimates of capital expenditures and facilities costs are more reliable. Soft cost savings can accrue, but they are not as critical when making a purchasing decision.

Tables 1 and 2 show the savings in capital expenses, facilities expenses (i.e., power, cooling, and space costs), and deployment costs of the two systems.

Results

Small/Midsize Systems

The cost analysis for two 8-server solutions is shown in Table 1. Costs are classified as capital expenses and operating costs associated with facilities and management services (i.e., software and services).

TABLE 1

8-Server System Costs: Rack-Optimized Versus HP BladeSystem c3000

Type of Cost	Rack-Optimized	BladeSystem	BladeSystem Savings
Capital Expenses			
Server system	8	8	$17,997
Ethernet cables	40	5	$875
Ethernet switch ports	40	5	$10,081
Racks	1	1	0
			Total capital expense savings: $28,953
			% savings: 38%
Operating Costs: Facilities			
Datacenter space	12 square feet	12 square feet	0
Power	344 watts/server	234 watts/server	$2,602
Cooling	344 watts/server	234 watts/server	$2,602
			Total operating cost savings: $5,204
			% savings: 37%
Operating Costs: Management Services			
Management software	$4,392	$2,784	$1,608
Hardware support	$7,352	$3,766	$3,586
Installation/start-up	$12,400	$4,240	$8,160
			Total software and services savings: $13,354
			% savings: 55%
			Total savings: $47,511
			% savings: 42%

Source: HP, 2008

Capital Expenses

☒ A comparison of capital expenses in a smaller deployment finds that an HP blade server is less expensive than comparable HP rack servers. As expected, the greatest savings are in the cost of the servers themselves. Reducing the number of Ethernet ports by a factor of eight contributes as well.

☒ To simplify the modeling process, HP distributed the cost of the blade enclosure across the eight blades. IT organizations pay for the entire enclosure when purchasing fewer than eight blades outright. Or, IT organizations can lease a blade system with terms that reduce the up-front cost of the enclosure. HP estimates that four servers mark the crossover point when the HP BladeSystem c3000 offering emerges as the better choice.

Operating Costs: Facilities

☒ Operating costs show an overall advantage to blade servers except for the cost of datacenter space, which is equal when a single rack is needed. The 37% reduction in operating expense is entirely attributed to lower power and cooling requirements for blade servers.

- ☑ When estimating power consumption, HP set the utilization rate to 60%, which is a high-end estimate. Generally, processor utilization is in the range of 20% to 40%. HP used the larger parameter for two reasons — to be conservative when estimating power and to suggest that with virtualization technologies, multiserver systems will place heavier loads on the processors.

Operating Costs: Management Services

- ☑ Nearly a third of the cost savings are found in software and services. Installation is the largest contributor. This reduction is driven by fewer cable pulls and by blade server technology that accelerates system configuration, which is performed server by server when rack servers are deployed. Therefore, HP personnel spend significantly less time and effort deploying blades than standalone racks, and those savings are passed along in the form of lower services fees.

Large-Scale Systems

The analysis of two 320-server solutions is shown in Table 2. Costs are classified as capital expenses and operating costs associated with facilities and management services (i.e., software and services).

TABLE 2

320-Server System Costs: Rack-Optimized Versus HP BladeSystem c7000

Type of Cost	Rack-Optimized	BladeSystem	BladeSystem Savings
Capital Expenses			
Server system	320	320	$165,040
Ethernet cables	1,200	180	$25,500
Ethernet switch ports	1,200	180	$255,560
SAN cables	747	80	$350,087
SAN ports	747	80	$271,976
Racks	16	10	$8,934
			Total capital expense savings: $1,077,097
			% savings: 31%
Operating Costs: Facilities			
Datacenter space	192 square feet	120 square feet	$4,500
Power	344 watts/server	239 watts/server	$109,726
Cooling	344 watts/server	239 watts/server	$109,726
			Total operating cost savings: $223,952
			% savings: 38%
Operating Costs: Management Services			
Management software	$175,680	$111,360	$64,320
Hardware support	$176,000	$136,620	$39,380
Installation/start-up	$448,000	$84,800	$363,200
			Total software and services savings: $466,900
			% savings: 58%
			Total savings: $1,767,949
			% savings: 36%

Source: HP, 2008

Capital Expenses

⊡ For every category of capital expenses, blade servers are less expensive than comparable rack servers. The percentage of cost savings remains approximate to findings for 8-server costs; in a system 40 times larger, the dollar cost savings have grown appreciably.

⊡ Larger multiserver systems ordinarily draw on networked storage resources. As Table 2 shows, the blade server architecture vastly reduces the cost of connecting to a SAN by consolidating SAN connectivity at the enclosure level. Savings for enabling SAN exceed savings for all other categories.

Operating Costs: Facilities

⊡ At this scale, datacenter space differences accrue in favor of blade servers. The power and cooling needed for three years of operation contributes further to the blade server advantage.

Operating Costs: Management Services

⊡ Due to reduced costs for cabling and system setup, blade server installation and setup services contribute $363,200, the largest single contribution.

Note: The data is directly from HP and refers only to HP products, but the dollar value in savings, as well as the total percentage of capital cost reduction, should serve as a guideline to where opportunities to decrease capital and operating expenses exist.

IDC Analysis

Opportunities

HP has increased the available market for its HP BladeSystem architecture by providing a blade storage and server solution to the midsize market with the arrival of the HP BladeSystem c3000 product. By extending the lower end of the HP BladeSystem product line, HP aims to meet the requirements for smaller systems and smaller companies. HP's cost benefit tool has demonstrated that financial benefits scale down and up.

The HP BladeSystem family of products aims to deliver simplicity in installation and efficiency in operations, especially when compared with rackmounted servers. Standard interfaces support customer choices for network and storage peripherals. In addition, HP is delivering on its promise to create storage blades to further extend configuration options for the product line.

The blade architecture offers IT organizations the opportunity to build out systems more rapidly. A half-filled enclosure can quickly accommodate additional server or storage blades when additional IT capacity is needed.

Challenges

The HP BladeSystem products challenge the conventional thinking of IT organizations that host a large installed base of discrete servers. The HP BladeSystem c3000 will compete with standalone servers, and the HP BladeSystem c7000 will compete with rack-optimized servers. These servers are entrenched products with which IT managers feel comfortable. Moving from one architecture to another is never a trivial task, and in cost-conscious times, IT planners avoid risk.

For the HP BladeSystem c7000, HP will be challenged by the mind-set that blade servers are building blocks for smaller applications. Proof points will be needed to establish that high-performance blade systems can support high-demand business computing requirements.

HP will need to develop partnerships to address the midsize market segment. Increasingly, IT buyers are offered software and hardware bundles with significant discounts. This packaging will appeal to budget-conscious IT planners and also to the midmarket customers who prefer a complete solution that is ready to put into use.

Conclusion

HP BladeSystems are now available for small and large configurations. The new BladeSystem c3000 enclosure provides the same benefits as the HP BladeSystem c7000 enclosure, including economies of scale due to the blade enclosure backplane that unifies networking and power supplies. In both scenarios, the move to blades can save customers over a third of the start-up costs of deploying standalone blades. These savings come via both acquisition costs and facilities costs and are enhanced when coupled with HP deployment and support services.

IDC, based on the acquisition, deployment, and facilities cost savings data, recommends that organizations expecting to grow their IT infrastructures by more than four server systems consider moving to blades as a means to streamline the datacenter and maximize their IT dollars.

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