

HP BladeSystem

The business case for adopting the HP BladeSystem in the data center



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Solutions for the adaptive enterprise.



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The HP BladeSystem represents the logical evolution of traditional rack-mounted infrastructures that can accelerate the transformation of your data center.

Introduction

Blades are widely viewed as compact and efficient servers that primarily save space and power. However, the full story behind blades goes far beyond considerations of the individual server. When making a purchase decision, blades should be considered as part of an integrated, consolidated infrastructure—or a complete system—that includes compute nodes such as servers or desktops, storage, networking, and power, all virtualized and automated through a common management framework. Based on experience gained across the award-winning HP portfolio, and built from the ground up for tomorrow's IT demands, HP BladeSystem represents the logical evolution of traditional rack-mounted infrastructures that can accelerate the integration and transformation of your data center.

This paper first examines how the unique design and integration of HP BladeSystem drives cost savings and efficiencies. Next, it highlights ideal adoption scenarios for a variety of data center environments and IT strategies—including BladeSystems as a desktop consolidation solution. Finally, the paper quantifies how IT organizations can dramatically reduce costs, increase efficiency, and enhance business agility immediately and throughout the life cycle of the infrastructure.

In addition, this paper will demonstrate that acquisition costs of HP BladeSystems are significantly lower than rack-mounted infrastructures in most adoption scenarios. In all cases, the total operational savings that result from increased efficiency of HP BladeSystem yield long-term business value that justifies their adoption.

With this paper, a compelling business case can be made for adopting HP BladeSystems as a fast-track toward building an infrastructure optimized to enable an HP Adaptive Enterprise—the HP strategy for building an organization in which business and IT are synchronized to capitalize on change. The fact is, when it comes to increased business agility, greater data center efficiency, and immediate return on investment, HP BladeSystems are the logical choice for most new application or service deployments in Microsoft® Windows® and Linux® environments.

The value of HP BladeSystem at a glance

Lower acquisition costs

With as few as eight blade servers, HP BladeSystems with a Fibre Channel connection are more than 15 percent less expensive than comparable rack-mounted infrastructures. Plus increased storage utilization can reduce the amount of storage capacity needed by as much as 50 percent. In non-Fibre Channel storage area network (SAN) environments, the up-front costs are approximately more than 10 percent less expensive, depending on networking choices.

Operational cost savings

Reduce initial setup time from 12 hours to 30 minutes per server, and implement changes, updates, and reconfigurations from 4 hours to 30 minutes. Assuming an average administration cost of \$43US per hour, the annual costs for 100 servers can be reduced from US\$68,800 to US\$8,600. With networked storage, manage up to 6 times more storage than with server-dedicated storage and transfer your resources savings from storage management to strategic innovation.

Reductions in cable complexity

Reduce cabling by 87 percent and save US\$100 to US\$350 per 10/100 network port. Also eliminate the need for KVM switches and cables through Advanced Integrated Lights-Out (iLO) management capability over IP, saving up to an additional US\$25,000 for each rack.

Data center space savings

Reduce the amount of space required in the data center by more than 50 percent, supporting as many as 96 blades in the same space as 42 1U rack-mounted servers. Greater density frees rack space for technologies such as SANs that can reduce needed storage capacity by as much as 50 percent and extend space savings.

More efficient power usage

Save over US\$6,000 per rack of 32 servers through reduced power consumption and lower power distribution costs.

Improved high availability at lower cost

The integrated infrastructure eliminates downtime that occurs due to various causes, such as cable, server, storage, and switch failures; human configuration errors; and software, power, and cooling problems. In addition, time to repair these problems can also be significantly reduced, cutting both planned and unplanned downtime annually by nearly 100 percent. N + 1 redundancy built in across the system eliminates the need for idle, duplicate spares and 1 + 1 redundancy schemes, reducing redundant hardware costs.

Building a better infrastructure

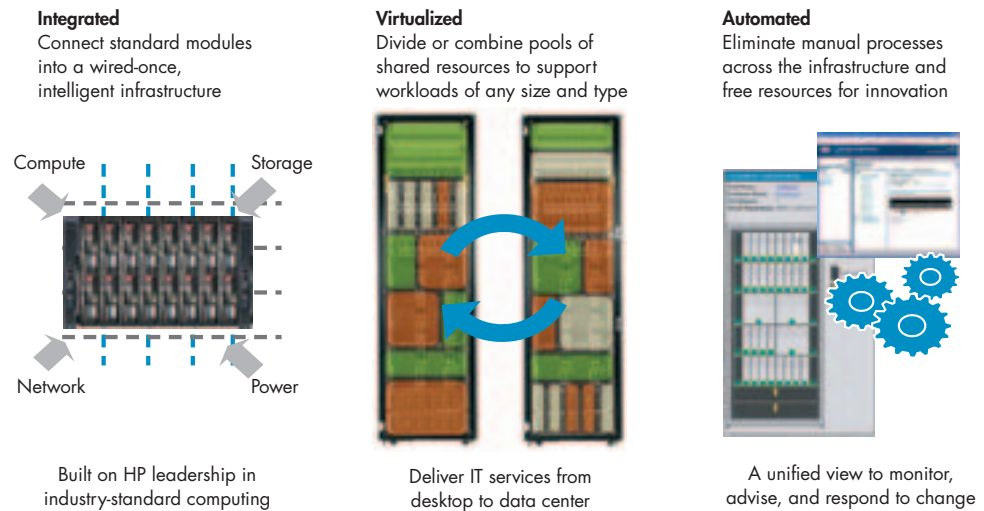
The HP Adaptive Enterprise is not a product you can buy; it is a state of enterprise fitness that must be built. To achieve this goal, HP BladeSystem employs an integrated, modular design that consolidates servers, storage, power, and networking controlled through a common management framework. Multiple resources are pooled, virtualized, and automated to scale for growth—to support more efficiently any workload or IT service the business demands. Distributed desktop environments can be centralized into a BladeSystem environment. Standard and advanced administrative and maintenance tasks can occur automatically and be achieved remotely.

A modular approach also makes it easy for businesses to repurpose and expand resources for new application and service deployments where the cost and efficiency improvements make the biggest impact on the bottom line. Modular resources can be mixed and combined to support nearly any enterprise or infrastructure application, deliver consolidation, migrate proprietary symmetric multiprocessing (SMP) systems, or construct Grid and High Performance Computing (HPC) environments. Finally, HP BladeSystems easily integrate with existing environments and introduce processes that are more effective and strategies for growth, management, and high availability across the entire environment.

To understand how the consolidated design of HP BladeSystems delivers better total cost of ownership (TCO) than traditional rack-mounted environments, this paper will examine the key features in three sections: the integrated infrastructure; the modular compute, storage and network components; and the management environment.

HP BladeSystem:

An integrated foundation for an efficient, agile infrastructure



BladeSystems are a consolidation of traditional rack-mounted components that simplifies the deployment, integration, and management of scale-out infrastructures. Combined with an adaptive management framework, multiple resources are virtualized to facilitate pooling and sharing of resources across any combination of workloads. Basic and advanced management tasks are then automated to improve efficiency and deliver dynamic agility.

Integrated HP BladeSystem infrastructure

The integrated infrastructure of the HP BladeSystem provides connectivity and shared redundancy, optimized for the management, reliability, and virtualization of servers, storage, power, and networking. HP BladeSystems are essentially traditional infrastructures repackaged and evolved for greater convenience. It's racked and wired once with very few cables, greatly simplifying cabling and reducing connectivity costs. With built-in redundancy, the intelligent infrastructure facilitates the sharing of resources such as power and networking for more cost-effective high-availability strategies and a better solution to meet future demands of power, cooling, and performance scalability.

Once in place, the HP BladeSystem becomes a foundation for simplified and efficient planning, growth, and administration. The intelligence provided by HP management software and built-in management processors enables the infrastructure to connect and identify the physical resource location and status within the rack. To protect current investments in HP rack-mounted infrastructure and to ensure compatibility with future blade components, the infrastructure leverages the same management tools used to manage your existing HP ProLiant server infrastructure. HP also delivers extensions to these tools that are specific to the BladeSystem environment.

The primary components of the physical infrastructure include the HP BladeSystem enclosure, network interconnections, and power distribution subsystem.

- **The BladeSystem enclosure** enables wire-once connectivity of server blades to virtual LANs (VLANs), shared storage, and power. Each enclosure can support up to 16 server blades, redundant network switches, and redundant Fibre Channel storage interconnects, and includes a built-in hot-pluggable management module that reports thermal, power, and protection fuse events and provides asset and inventory information. The management module and Ethernet network and Fibre Channel storage interconnects deliver connectivity beyond the enclosure to existing data and storage networks.

- **The BladeSystem network interconnections** enable all network signals from the enclosure's individual blade bays to be routed redundantly to the interconnect bays at both sides of the enclosure. Advanced network interconnect options from HP, Cisco Systems, and other industry partners allow VLANs that separate available network bandwidth into multiple independent and secure networks. Devices can be assigned network resources dynamically and transparently. HP also offers one of the broadest selections of network and Fibre Channel switch and patch panel options in the industry to support Ethernet and Fibre Channel connectivity. In addition, HP will deliver Brocade integrated Fibre Channel switches for efficient and consolidated uplinks to shared storage.
- **The BladeSystem power distribution subsystem** enables N + N AC and DC redundancy and eliminates the need for power supplies in each enclosure. This uniquely efficient design enables HP BladeSystem to reduce cost and heat. HP provides other technologies and services to plan for the power and cooling issues emerging due to increased power demands of next-generation processors and memory. To provide redundancy, power is distributed from the modular power enclosures to the server blade enclosures using redundant bus bars. In addition, a power management module determines if adequate power is available for new server blades and interconnect modules during the power-up sequence. HP's solution is superior to other choices based on its ability to expand to future power demands. Not limited to one enclosure of servers, the HP BladeSystem's power subsystem provides headroom without an overhaul of the power distribution scheme as the environment grows.

Modular system components

Server blades

Designed for flexibility, the HP ProLiant BL p-Class portfolio of server blades supports the widest range of application requirements in scale-out architectures. HP offers one-, two-, and four-processor server blades, delivering a range of performance and form factors that includes the most processing density of any blade portfolio. By pooling and virtualizing individual resources within the infrastructure—storage, server, network, and power—the system resources can be divided or combined to support a wide range of workloads. For example, BladeSystems enable the use of multiple servers and SANs to create a virtual 24-processor SMP machine image across 12 two-processor server blades, or consolidate multiple applications onto a single server sharing other resources.

Each HP ProLiant server blade is consistent with ProLiant rack-mounted server designs and therefore includes many of the same leading innovations and features found in ProLiant servers, repackaged for greater convenience within the BladeSystem infrastructure. Those familiar with renowned ProLiant server management, reliability, and performance will find the same consistency and ease of use with ProLiant BL server blades, extended to take advantage of the design of the HP BladeSystem intelligent infrastructure.

- **ProLiant BL20p Server Blade**—Designed with enterprise availability, this two-processor Intel® Xeon™ dual-processor blade has the performance needed for small- and mid-sized databases, mid-tier applications such as Web hosting or streaming media, and is ideal for server farms, or as a node in high-availability scale-out clusters.

- **ProLiant BL25p Server Blade**—Deliver enterprise availability and scalability and extend the performance advantages of AMD Opteron™ processors for a wide-variety of 32-bit infrastructure applications. The dual-processor AMD Opteron™ 200 Series processor-based blade is ideal for a wide variety of solutions requiring the highest price/performance and flexibility.
- **ProLiant BL30p Server Blade**—Ideal for high-performance computing environments, this dual-processor Intel Xeon dual-processor blade is optimized for maximum processor density and is ideal for a variety of mid-tier applications. These servers are also best suited for a SAN-centric (particularly those that boot from SAN), stateless computing environments.
- **ProLiant BL35p Server Blade**—Designed for ultra-dense deployments and networked storage environments, this dual-processor AMD Opteron™ processor-based blade (68 watt) delivers industry-leading price/performance. These servers are optimized for lower power consumption per unit while offering outstanding two-processor performance per watt.
- **ProLiant BL40p Server Blade**—For mission-critical applications, this four-processor Intel Xeon multiprocessor blade delivers the high performance needed for a database server, mail/messaging server, or enterprise application server.

Storage modules and interconnects

HP BladeSystems fully support boot-from-SAN capabilities to maximize storage consolidation and efficiency of overall system deployment. In addition, the server blades can integrate with “fused” NAS and SAN configurations, providing the ability to work in file and block environments seamlessly, and support multiple types of clustered configurations. In addition, they enable integration with HP backup, tape storage systems, and active archiving solutions to provide complete information lifecycle management.

- **MSA family**—Ideal for smaller deployments, including remote office locations, members of the MSA family can be deployed in a direct-attach or networked storage configuration. These servers offer the most affordable data protection and performance features in their class.
- **EVA family**—Ideal for moderate to large size data centers running key business applications, the EVA family offers scalability up to 70 TB of capacity, high-performance, many enterprise-class data protection features, a fully integrated suite of centralized management tools for greater administrative control, and supports storage virtualization and is one of the industry’s easiest arrays to manage in its class.
- **XP family**—Ideal for enterprise-wide deployment and mission-critical applications, the XP family offers the most extensible, resilient, and controllable storage solution available. It offers maximum scalability, industry-leading performance, a fully integrated suite of centralized management tools, and unmatched data protection and disaster tolerant features.
- **HP ProLiant Storage Servers (NAS)**—A comprehensive range of storage server solutions ideal for file serving and Exchange environments, for small businesses, branch offices, and enterprise data center customers. HP ProLiant Storage Server solutions are built on two industry-leading business platforms—HP ProLiant servers and the Microsoft Windows Storage Server 2003 operating system.

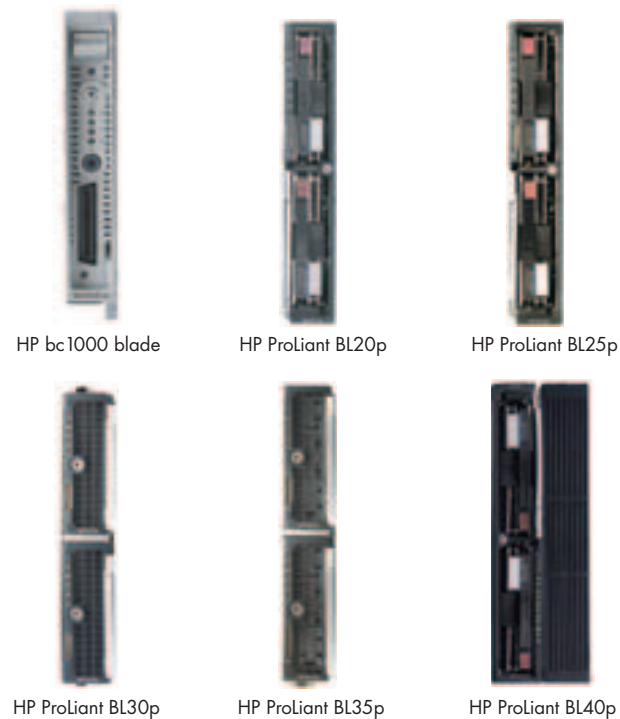
ProLiant server blades provide Fibre Channel interconnect options for redundant SAN interconnects. These server blades are optimized for HP StorageWorks arrays and NAS solutions and can attach to select third-party SAN solutions. With this choice of storage options, you can select the right storage solution for your needs—from high-performance direct-attached storage options to the simplicity of NAS or the scalability of SAN storage solutions.

Network interconnect modules

Two general categories of interconnect options are available. Patch-panel interconnects allow the collection of Ethernet or Fibre Channel signals to external LAN or SAN switch components and are very economical, completely passive, and require no software or management. The second option, interconnect switches, consolidate the Ethernet or Fibre Channel signals from the server blades to a smaller number of copper-based or fiber-based uplink ports. Fully VLAN-capable Ethernet switches provide up to 32-to-1 network cable reduction per server blade enclosure. Options include

- Cisco Gigabit Ethernet Switch Module for HP BladeSystem provides consolidated networking, 1000-Mb/s performance, consistent Cisco network management, and options for Fibre Channel pass-through.
- Integrated Brocade Fibre Channel switch (available in the second quarter of 2005); external HP B-Series, C-Series, and M-Series SAN switches are also supported.

Figure 2. Server portfolio: Wide portfolio of server blade choices to meet the unique needs for performance and density.



- HP RJ-45 Patch Panel Kit provides Ethernet signal pass-through only.
- HP RJ-45 Patch Panel 2 Kit provides both Ethernet and Fibre Channel signal pass-through.
- HP GbE Interconnect Kit consolidates 100-Mb/s Fast Ethernet NIC signals.
- HP GbE2 Interconnect Kit provides consolidation of 1000-Mb/s Gigabit Ethernet NIC signals, advanced network capabilities, and Fibre Channel signal pass-through, or Brocade Fibre Channel switch.

Power supply modules

The hot-pluggable, redundant power supplies for the HP BladeSystem are housed in a 3U power enclosure. The power supplies are front-accessible, hot-pluggable, and can be configured redundantly. Mounted at the bottom of the rack, the power enclosures are available in two models, depending on the number of server blades deployed:

- **Single-phase power enclosure**—holds a maximum of four hot-pluggable power supplies
- **Three-phase power enclosure**—holds a maximum of six hot-pluggable power supplies, supports more server blades and interconnect switches, and is recommended for scalability

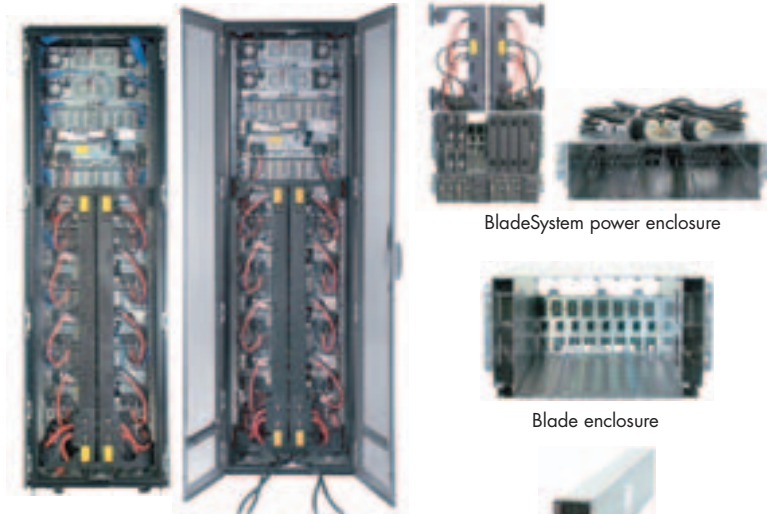
Blade PCs

Blade PCs are a key component in the HP Consolidated Client Infrastructure Solution that centralizes desktop compute and storage resources into easily managed, highly secure data centers. The solution provides end users with the convenience and familiarity of a traditional desktop environment. Blade PCs are part of a total solution that brings the advantages of centralized HP BladeSystem management to large PC deployments.

Figure 3. Simplified, consolidated infrastructure provides essential integration and connectivity across shared, pooled components.



Integrated Ethernet and Fibre Channel switches and patch panels from Cisco, Brocade, and HP



BladeSystem power enclosure

Blade enclosure

BladeSystem rack

Redundant power modules



Complete BladeSystem racked solution



EVA family



XP family



MSA family

HP BladeSystem management environment

HP's industry-leading portfolio of management capabilities is designed to maximize the potential of the HP BladeSystem while being consistent with the management of the rest of an HP infrastructure. The management environment includes HP Systems Insight Manager, ProLiant Essentials, and OpenView Software, as well as partner software. These management capabilities are flexible and cost-effective when used in a decentralized, project-based environment, but also scale to deliver significant power and control for a highly centralized management environment. The tools are designed to work together to remotely manage multiple components through a common user interface with consistent methodology and standards.

The HP management portfolio also includes tools for infrastructure discovery and monitoring, provisioning, and re-provisioning; change and patch management; dynamic recovery and scaling; and advanced remote management. A key function of the BladeSystem management environment is that it understands where all physical resources are located within the rack infrastructure. With this understanding of physical location, the HP toolset is capable of delivering advanced features such as auto-provisioning and re-provisioning and automated recovery and dynamic scaling. Add to this the ability to consolidate and virtualize resources using a combination of virtual machine technology and the ProLiant Essentials Virtual Machine Management Pack and management applications as well as business processes with tools from the OpenView portfolio and enterprises can significantly improve productivity and efficiency in managing a large scale-out environment.

Blade management begins with HP Systems Insight Manager Software and its plug-in ProLiant Essentials tools. These tools provide a consolidated view of all physical and virtual resources and deliver flexible deployment, performance management, remote management, vulnerability assessment and patch management, and virtual machine management of the environment. Systems administrators are able to fully manage traditional servers and other managed devices side by side with their BladeSystems, ensuring maximum leverage of existing management infrastructure and IT staff skill sets.

HP Systems Insight Manager and the ProLiant Essentials tools interact with the integrated HP BladeSystem infrastructure to present a single console view of all components, enabling dynamic control and even server role changes, regardless of physical location. This facilitates policy-based automation without the need to physically reconfigure or keep track of specific resource elements. Administrators can create or choose automated policies that, when triggered, will deploy or adjust application environments, assigning server, network, and storage resources based on the needs of the business.

System monitoring and control

To maximize control at a component level, each BladeSystem management module provides management information to other tools. The interconnection and system-wide management helps create a large resource pool that can allocate compute power and other resources to applications and services based on fluctuating demand.

Attached to the back of each server blade enclosure is a server blade management module that polls server blades in the enclosure for one-click access through the iLO management on each blade. It also reports thermal, power, and fuse events to all server blades in the server blade enclosure; provides asset and inventory information; and enables each enclosed server blade to communicate with other server blade enclosures. The HP BladeSystem also correlates events generated by shared infrastructure components, ensuring that administrators receive a single event from each affected enclosure, as opposed to a single event from each component.

Integrated Lights-Out Advanced management processors are built into each server blade, enabling out of band, graphical remote consoling and virtual floppy and CD (as well as ISO images) to ensure complete control from anywhere, anytime. Lights-out management processors also communicate with infrastructure management modules in the server blade and power enclosures to expose infrastructure and environmental alerts.

For greater power efficiency and availability, each power enclosure includes a self-contained and hot-pluggable power management module that monitors the power supplies and the power enclosure/backplane. The power management module determines if adequate power is available for new server blades and interconnect modules during the power-up sequence. The power management module must be connected to the server blade enclosure management modules to communicate management information, such as power supply budget and status, and to enable management tools such as Systems Insight Manager to determine an enclosure's location within the rack.

To better utilize storage resources, the StorageWorks management tools provide SAN and NAS provisioning and setup, SAN management, data replication and protection, backup, and other storage management capabilities.

The interconnect switches include a Web-based interface, a menu-driven console, and a scriptable command-line interface to configure, manage, and monitor the network. Cisco and Brocade customers can use the same tools within their current environment to manage the integrated Cisco and BladeSystem switches. Telnet, SNMP, and RMON are also supported. As a result, an administrator can monitor the interconnect switch remotely from an RMON-based network management console or an SNMP-based management tool such as HP Systems Insight Manager or OpenView Software. In addition, OpenView Network Node Manager Software provides network monitoring and alerting capabilities.

Advanced BladeSystem management

To extend and complement the control enabled by Systems Insight Manager, HP offers additional tools through its HP ProLiant Essentials Rapid Deployment Pack, OpenView Software, and ISV partners for virtualization, application management, automation, and change/patch management.

- **Initial server setup**—HP ProLiant Essentials Rapid Deployment Pack provides software deployment and bare-metal server provisioning. Unlike other imaging tools, the Rapid Deployment Pack enables unattended configuration of BladeSystem hardware, in addition to image deployment.

- **Auto-provisioning and workflow automation**—OpenView Automation Manager provides policy-based automation, including system activation, recovery, and dynamic scaling through configuration changes to servers, network, and storage devices.
- **Change and patch management**—HP Systems Insight Manager, along with its Version Control, provides system software baselining and deployment and control of ProLiant ML, DL, and BL Class servers. The HP ProLiant Essential Vulnerability and Patch Management Pack plugs into Systems Insight Manager and extends version control capabilities with operating system and application vulnerability scanning and patching. HP Radia provides policy-based change and configuration management and desired state management for operating system and application software in large enterprise environments.

HP partners with several leading ISVs to provide valuable middleware for HP BladeSystem, including

- **Virtual server technology**—VMware and Microsoft enabled IT server consolidation, VM-based availability, and dynamic migration and control capabilities that are well-suited to scale-out blades.
- **Load balancing and traffic management**—F5 Networks virtualizes and load balances IP traffic within and across the HP BladeSystem network. This is often used for Web-based applications.
- **Clustered file systems for scale-out, multinode application scaling**—PolyServe and Red Hat Sestina are ideal for creating complete virtualized SMP systems with a scale-out blade infrastructure. This technology is ideal for migrating large UNIX® SMP applications to Linux blade clusters.
- **Scale-out database clusters**—Oracle 9i Real Application Cluster and Oracle® 10g can be used to migrate large UNIX SMP database applications to scale-out Linux blade clusters.
- **Grid-enabling middleware**—Platform Computing, Data Synapse, Axceleon, Scali, and others can be used for high-performance computing applications.

HP BladeSystem adoption scenarios

There are many ideal scenarios for businesses to take advantage of BladeSystems for immediate return on investment.

BladeSystems should be the first platform considered for new deployments of many Linux and Microsoft Windows applications and services due to the underlying advantages of costs and efficiency that they can deliver to any workload in scale-out architectures. A conservative approach would be to introduce BladeSystems incrementally over time. In many cases, customers adopt BladeSystems for IT consolidation and multi-tier infrastructure application. Compared with traditional rack-mounted server infrastructures, the use of BladeSystems for these solutions provides valuable opportunities to reduce operational costs, improve service management, and increase IT agility. Additionally, HP's PC Blades can be utilized to replace traditional desktops while providing a more secure, consistent, and cost-effective environment. The main benefits to businesses using BladeSystems in these scenarios primarily include large gains in efficiency of personnel and improved processes.

The other key adoption scenarios include migrating from proprietary Sun Solaris SMP servers to Linux based BladeSystems plus SANs, or employing BladeSystems for HPC. These customers find that BladeSystems provide the advantages of centralized control, as well as decentralized flexibility and lower cost platforms due to the volume economics of industry standards; essentially, mainframe value with industry-standard economics. Both solutions can provide dramatic savings in acquisition costs over proprietary RISC systems and improve TCO and data center efficiency by an order of magnitude or greater. Often in these scenarios, the business decision of BladeSystems can be justified based on hardware and software acquisition costs alone.

Below, each adoption scenario is examined in more depth.

IT consolidation

Beyond lower platform costs, the key advantage to IT consolidation on any platform is primarily improved management efficiency. The integrated BladeSystem simply magnifies the management benefits of consolidation. By taking advantage of the pooling and virtualization capabilities of BladeSystems, enterprises can consolidate multiple under-utilized, special-purpose servers onto a compact and highly versatile BladeSystem—not only saving space, but also reducing long-term operational costs significantly. Working with a variety of software partners, HP enables an average consolidation onto virtual server partitions of at least 4:1. Using HP Blade PCs can reduce the need for individual desktop PCs by up to 30 percent. In addition, BladeSystems also consolidate storage, network, and power, reducing complexity of cabling and driving greater utilization of resources. A customer scenario for data center IT consolidation is shown in table 1.

Ideal candidates for IT consolidation include

- Web and e-commerce applications
- Mail and messaging applications
- Microsoft Windows applications
- Thin client/terminal services
- Infrastructure applications

Multi-tiered applications

With multiple data center resources networked together, BladeSystems are a natural fit for multi-tiered applications. In these environments, blades become a catalyst for change, driving integration and the adoption of next-generation tools and processes at lower costs. Access to virtual storage and networking, along with integrated management, provide a powerful solution for increasing efficiency and enhancing flexibility. Enterprises no longer have to dedicate a fixed set of Web, application, and database servers to multi-tiered applications.

Beyond greater management efficiency, a primary advantage of BladeSystems in this usage scenario is to improve utilization of multiple applications in the environment through virtualization and load balancing across the BladeSystem farms. Because BladeSystems provide higher availability through shared redundancy of all components, enterprises can also simplify planning and lower costs associated with business continuity strategies that today require duplicate, standby systems. A customer scenario for multi-tiered applications is shown in table 2.

Table 1. IT consolidation

Customer scenario: IT consolidation

A large cellular communications company needed an efficient and scalable IT infrastructure for its high-growth business. The company's goals were to conserve data center space and improve server utilization while reducing the administrative overhead associated with managing hundreds of servers.

Solution: ProLiant BL p-Class server farm running VMware ESX with an HP StorageWorks Enterprise Virtual Array SAN and HP blade management software

Results: improved server and storage utilization of 35–50% with average application consolidation of 13:1

Table 2. Multi-tiered applications

Customer scenario: Multi-tiered applications

A major commercial and retail banking and financial services company wanted to bring its Web hosting center in-house. The company's goals: reduce total cost of ownership over an external Web hosting service provider.

Solution: 800 ProLiant BL p-Class server farm running Windows 2000, with connectivity to HP StorageWorks SANs and HP BladeSystem management software

Results: reduced costs while gaining a flexible platform for increased performance and customer satisfaction

Ideal candidates for multi-tiered applications include

- Web and e-commerce applications
- Streaming media
- Small and medium databases
- Enterprise applications such as enterprise resource planning (ERP) and customer relationship management (CRM)

SMP to Linux migration

Migrating from large UNIX SMP systems to highly efficient Linux blade clusters can reduce platform costs 50 to 70 percent and result in significant long-term savings as a result of increased data center efficiency and simplified management. By leveraging virtual storage, cluster file systems, and scale-out multi-node database environments, along with the scale-out flexibility of the BladeSystem architecture, enterprises have the opportunity to improve storage utilization and increase performance and availability—all at lower cost than UNIX system-based SMP servers. BladeSystems can also deliver lower annual support costs, lower costs to achieve high availability, and provide more control and flexibility. A customer scenario for SMP to Linux migration is shown in table 3.

Ideal candidates for SMP to Linux migration include

- Custom (homegrown) applications (file based and relational database based)
- Enterprise applications such as large scale-out databases, ERP, and CRM requiring numerous CPUs

High Performance Computing

BladeSystems are well-suited for High Performance Computing (HPC) applications, primarily due to lower infrastructure and platform costs, as well as their ability to more easily take advantage of spare computing cycles. By capitalizing on the density, efficiency, and integrated technologies of HP BladeSystems, enterprises can build large compute clusters, in conjunction with Grid middleware, to handle the most intense HPC requirements. A customer scenario for HPC is shown in table 4.

Ideal candidates for HPC include

- Technical computation clusters for life sciences, CAE, and so on
- “Visualization” clusters for the entertainment or oil/gas industries
- Financial and portfolio analysis: computation clusters

Table 3. SMP migration to Linux

Customer scenario: SMP migration to Linux

A large North American bank sought to dramatically improve the price/performance of its server platform for a back-office banking application. The company saw migrating from a SMP UNIX platform to Linux as a cost-effective way to meet this objective.

Solution: ProLiant BL p-Class server farm running Linux, with an HP StorageWorks Enterprise Virtual Array SAN and HP blade management software

Results: 25% improvement in application performance, while reducing platform costs by 70%

Table 4. HPC

Customer scenario: HPC

A major biotechnology company needed a cost-effective, flexible IT environment for research and business applications. The company's goals were to manage its IT servers more efficiently and to gain the agility to provision and re-provision applications based on demand.

Solution: ProLiant BL p-Class server farm running Linux, with a 5-TB HP StorageWorks SAN and HP blade management software

Results: Increased performance over previous compute node cluster/Grid at lower platform cost, while gaining an adaptable infrastructure for its research community

Quantifying the benefits of HP BladeSystems

After understanding how HP BladeSystems are constructed and how they can be applied to a number of IT solutions, the final step is to build a solid business case for deploying blade solutions by translating the benefits into quantified savings. HP provides a TCO tool that is available from local HP sales representatives that walks through “what-if” scenarios, providing a compelling aid in the decision-making process. After this assessment, businesses will be armed with a powerful, compelling business case to justify BladeSystems for their next deployment.

This section of the paper provides an examination of how BladeSystems improve efficiency and reduce TCO in the data center using examples generated from the HP TCO tool. For each unique environment, any one of these dimensions of TCO savings could provide the justification for future BladeSystem deployments:

- Reducing system acquisition costs (in comparison to rack-mounted servers)
- Reducing data center management costs
- Reducing data center space utilization
- Improving power and cooling efficiency
- Simplifying cabling and reducing network connectivity costs
- Increasing system availability and redundancy

Reducing system acquisition costs

When looking at acquisition costs, it is natural to think in terms of server-to-server comparisons. In a multi-server environment, however, there is always much more to the true cost of acquisition than just the server. Storage, power, networking, KVM, cabling, and PDUs—all must be taken into consideration. While on a pure, server-to-server basis, ProLiant server blades may have a unit cost approximately equal to 1U rack servers, when all the associated components are calculated, a more accurate measure of true acquisition costs is revealed, where HP BladeSystem’s are up to 16 percent less expensive than 1U or 2U rack-mounted servers. The two acquisition profiles below illustrate this point (see tables 5 and 6).

Table 5 shows a small blade configuration (eight server blades) without SAN connectivity and Gigabit Ethernet networking.

Table 6 shows a small blade configuration (eight server blades) with SAN connectivity and Gigabit Ethernet networking.

Table 5. Small blade configuration without SAN connectivity and Gigabit Ethernet

	HP BladeSystem	1U rack-mounted servers	2U rack-mounted servers
Servers	\$48,760	\$49,320	\$51,640
Infrastructure	\$4,818	\$2,248	\$2,624
Switching (GE network)	\$3,896	\$6,720	\$6,720
Total US\$	\$57,472	\$58,288	\$60,984

Note: All monetary figures are in U.S. dollars.

Table 6. Small blade configuration with SAN connectivity and Gigabit Ethernet

	HP BladeSystem	1U rack-mounted servers	2U rack-mounted servers
Servers	\$56,750	\$67,952	\$70,032
Infrastructure	\$4,818	\$2,248	\$2,624
Switching (GE network plus Fibre Channel)	\$10,896	\$13,720	\$13,720
Total US\$	\$72,464	\$83,680	\$86,376

Note: All monetary figures are in U.S. dollars.

As the numbers in the tables indicate, when viewed as total systems, the up-front acquisition costs are generally lower than rack servers due to savings in network switching and SAN connectivity—especially when the server blades are connected with a SAN and when the environment requires Gigabit Ethernet networking.

Table 7 summarizes this comparison, based on a complete BladeSystem with eight or more servers.

In all of the above instances, BladeSystems are approximately equal to or less costly than 1U or 2U rack-mounted servers.

Clearly, customers can further reduce acquisition cost savings when a networked storage module is included as part of the BladeSystem. Also, networked storage can more than double storage utilization when compared to server-dedicated storage, which means it reduces required storage capacity in half compared to many server-dedicated storage environment. With HP SANs, many customers report utilizing 65 percent of capacity versus 30 percent with our previous storage environment.

Therefore, a strong business case can be made for BladeSystems purely based on acquisition costs. Even if a configuration of approximately equal acquisition costs are compared, the long-term operational savings in space, power and cooling, networking, and administrative costs, as described later in this paper, provide an even stronger justification for moving to BladeSystems from rack-mounted infrastructures. Server components from the previous estimates are compared in table 8.

Table 7. Acquisition cost summary

	SAN-connected	No SAN connectivity
1U Rack-mounted servers (ProLiant DL360 Servers)	HP BladeSystem are ~13% less expensive	HP BladeSystem are ~1% less expensive
2U rack-mounted servers (ProLiant DL380 Servers)	HP BladeSystem are ~16% less expensive	HP BladeSystem are ~6% less expensive

Table 8. Comparison components

Server components used for acquisition cost comparison	
<i>1U or 2U rack-mounted servers (2-processor Intel Xeon 3.20 GHz) vs. ProLiant server blades for HP BladeSystems</i>	
<ul style="list-style-type: none"> • 2 Internal drive disks • 1-GB memory • HP ProLiant Essentials iLO Advanced Pack license • HP ProLiant essentials Rapid Deployment Pack license • 3-yr. warranty 	
Fibre Channel interface cards (for SAN configurations)	
<i>Infrastructure components used for comparison</i>	
<ul style="list-style-type: none"> • HP BladeSystem (BL20p): <ul style="list-style-type: none"> – Blade enclosures – Power subsystems – Rack 	<ul style="list-style-type: none"> • 1U or 2U rack-mounted servers (DL360 or DL380): <ul style="list-style-type: none"> – Rack – PDUs – KVM systems
<i>Switching components used for comparison</i>	
<ul style="list-style-type: none"> • ProLiant BladeSystems: <ul style="list-style-type: none"> – Internal blade switch interconnects – Fibre Channel Interconnect kits – Cables – Fibre Channel switch (for SAN configurations) 	<ul style="list-style-type: none"> • 1U rack-mounted servers: <ul style="list-style-type: none"> – External GE VLAN switches – KVM infrastructure – Cables – Fibre Channel switch (for SAN configurations)

Reducing data center management costs

HP BladeSystems are a catalyst for improving efficiency at every point in the data center and for adopting next-generation tools to manage the data center. The positive impact on efficiency can be greater on people and processes than it is on technology. With management capabilities for the Adaptive Enterprise built in, HP BladeSystems facilitate adoption of advanced management tools that can automate and streamline numerous administrative tasks. By virtualizing the network, servers, and shared storage—and by using intelligent management technologies—BladeSystems reduce the need to physically touch every device in the data center with every change. More important, they improve management efficiency by merging separate management domains, such as servers, storage, and networking. This level of efficiency can also open opportunities to centralize management of multiple data centers to further simplify administration and reduce costs.

To achieve greater efficiency with people and processes, a key objective is to automate the processes that have to be repeated over and over in the initial provisioning or change management of data center infrastructure. Improving these processes can result in significant improvement and reduced costs of operations.

Table 9 illustrates the cost impact of the automation of server and infrastructure provisioning using HP BladeSystem and its associated tools.

To understand how these numbers were achieved, consider one example of how automation can cut management costs. An administrator can build a provisioning script/image (often called a server profile) assigned to a specific blade, and save the profile on a management server. When a server blade is installed into bay 4, the server blade seeks out the management server, downloads the pre-assigned script/image, configures the VLAN in the BladeSystem, configures/attaches the appropriate storage, and starts the application.

The application then begins working immediately, all without manual intervention. If that server blade requires replacement, the new server blade automatically seeks out the management server and downloads the pre-assigned script to configure itself identically. The same automated process can be used to dynamically scale the capacity of a BladeSystem application. This is just one example of how new automated provisioning, change management, and dynamic scaling tools can improve data center efficiency and operations.

With integrated modular storage, BladeSystem administrators can manage more storage capacity from hundreds of gigabytes to many terabytes—six-fold or more through consolidation of resources and virtualization and automation. This efficiency improvement can provide administrators additional time to focus on more strategic IT projects.

Table 9. Management efficiency of BladeSystems: A data center with 100 servers that need updates and changes 4 times per year, and a data center that adds 25 new servers per year

Common data center provisioning tasks	Rack-mounted servers	HP BladeSystem (using infrastructure automation)
Initial setup and provisioning (average person-hours per server)*	12 hours	30 minutes
Cost per hour of administrators**	\$43 per hour	\$43 per hour
Cost of initial provisioning per server	\$516	\$21.50
Annual costs for 25 servers (added or reconfigured)	\$12,900	\$538
Implementing changes, updates, and reconfigurations (average person hrs)*	4 hours	30 minutes
Costs for change management 4 times per year per server	\$688	\$86
Annual costs for 100 servers	\$68,800	\$8,600

Note: All monetary figures are in U.S. dollars.

* Once the blade infrastructure is in place, adding a new server significantly reduces the time to rack, cable, and provision the operating system, and configure VLAN and storage connections. Similarly, changes also take less time.

** Based on an annual cost of US\$125,000 per administrator.

Simplifying cabling and network connectivity

According to the Giga Group, up to 25 percent of a system administrator's time is spent on cable management. To make matters worse, cable failures are a prime cause of downtime.

HP BladeSystems greatly simplify cabling and reduce connectivity costs. Through the use of integrated blade VLAN switches, integrated Fiber Channel switches, multiple cables are consolidated down to a few uplink cables per enclosure. BladeSystems are also wired once and can be reconfigured through software, eliminating the need to reconfigure the physical cables.

HP BladeSystems also eliminate the need for KVM switches and cables by providing an Integrated Lights-Out Management (iLO) capability over IP. This feature can save as much as US\$25,000 for each rack of 1U rack-mounted servers.

BladeSystems often offer significant direct savings in network connectivity costs (cost per switch port), as illustrated in the table 10.

As table 10 shows, the use of integrated blade switches will save port costs over time within the network environment, and the reduced cabling and simplified cable installation of HP BladeSystems offer significantly more cost savings.

On average, a Fibre Channel SAN interconnect solution can be a very expensive and often complex network environment. By integrating familiar Brocade Fibre Channel switch standards within the HP BladeSystem, customers will be able to significantly reduce the cost and complexity of connecting servers to storage arrays, yet still enjoy all the benefits of today's SAN infrastructure (see table 11). A fully integrated blade switch solution reduces the installation time and accelerates the startup and architectural design considerations for SAN fabric deployments.

Table 10. Network connectivity cost savings

	8 rack-mounted servers	8 ProLiant server blades
Cabling	16–32 cables to the servers	2–4 from the switch blades
10/100 Ethernet downlinks	\$40–\$150 (copper) \$65–\$385 (fiber per port)	\$54 per switch port (copper or fiber)
Gigabit Ethernet downlinks	\$180–\$1,060 per switch port	\$92 per switch port (copper or fiber)

Note: All monetary figures are in U.S. dollars.

Table 11. Fibre Channel SAN infrastructure connectivity cost savings

	1U Rack infrastructure	BladeSystem infrastructure	BladeSystem savings
Dual-port FC adapters	\$19,600 ^a	\$ 8,840 ^b	\$10,760 (~55% less) Based on 8 servers
Servers to switch to SAN	\$ 2,760 ^c	\$ 552 ^d	\$2,208 (80% less) Based on 8 servers
Rack space savings	18U	9U "Zero footprint" SAN connectivity	50% savings in rack space Based on 16 servers

Note: All monetary figures are in U.S. dollars.

Cost savings are based on the assumptions below:

a: PCI-X card \$2,450 ILP (*8 = \$19,600)

b: BL Fibre Interface \$1,105 (*8 = \$8,840)

- Interface adapter \$999 ILP
- SAN pass-through port (add \$106)

c: 8 non-BL servers to SAN connect cost \$2,760

- Eight servers to switch connect costs \$2,208
- Two SFP uplinks to SAN connect cost \$552

d: 8 BL servers to SAN connect cost \$552

- 10 to 2 or 80% infrastructure reduction (cabling media plus transceiver)

With the new switch options available in the second quarter of 2005, Brocade customers can now take full advantage of the efficiency, low cost, and flexibility of HP BladeSystem without sacrificing the proven standards and familiarity of their Brocade Fibre Channel SAN infrastructure. The Brocade switch will integrate seamlessly into existing HP StorageWorks SANs and will run a common code stream as existing Brocade-based StorageWorks SAN switches.

Improving power and cooling efficiency

Today, many data centers are not equipped to supply adequate power to a large farm of servers. This is a reality of the future that every enterprise will face and must plan for, regardless of whether a blade or traditional rack-mounted architecture is employed. Power consumption in the data center is also increasing due to higher performance and speed of next-generation processors. Given these circumstances, HP BladeSystems were designed specifically to scale to meet future power demands, and offer the best short- and long-term power advantages over competitors.

New technologies like 68-watt AMD Opteron™ processors, Intel Xeon processors, and HP power management tools that can monitor and dynamically adjust the power consumption can significantly reduce the power required and heat generated. Based on processor utilization and application performance demands, customers can maximize power efficiency more effectively with these HP technologies.

Unlike standard rack-mounted servers or other blade server designs, which have dual power supplies in each server or blade enclosure, HP BladeSystems incorporate a centralized power subsystem at the bottom of the rack, which provides better monitoring and reliability. In addition, this design reduces the cooling requirements compared to rack-mounted servers, where individual server power supplies demand more cooling capacity from top to bottom of the rack. Instead, the bottom-based power subsystem (along with the reduction of cables throughout the rack) enables better airflow through the rack, and contains the heat of the power supplies at the bottom of the rack, where cooler air generally resides in a data center.

The consolidated power subsystem of BladeSystems reduces power distribution costs by eliminating the need for PDUs in the enclosure, and by minimizing the need for multiple power feeds in each enclosure, which alone can save up to an additional US\$3,000 per rack.

But the power advantages of BladeSystems go even further by addressing unknown power demands in the future. The power design of HP BladeSystems is unique and ensures that increased power demands from new, power-hungry processor technologies are met well into the future with the same modules and distribution system. HP BladeSystems also offer higher power availability through redundancy, reducing the number of power supplies per system. And with intelligent power management, BladeSystems ensure that the right amount of power is delivered where and when it is needed.

Reducing data center space utilization

As information demands grow, so does the physical data center. In a data center environment in which individual applications are tied to specialized architectures, data center and rack space can be filled very quickly. And when clusters are involved, space usage and cost can double to accommodate an idle spare.

BladeSystems reduce the amount of space required in the data center by up to 24 percent, supporting as many as 96 blades with switches in the same space as 30 or fewer rack-mounted servers with switches. The new ProLiant BL30p and BL35p Server Blades pack up to 192 processors per rack, building on HP leadership in processor density and space savings. By building in reliability across the system and by replacing duplicate spare systems, the floor space savings more than double. Additional savings can be realized by pooling storage capacity into HP StorageWorks storage array or ProLiant Storage Servers (NAS), the server blades are able to share the storage capacity instead of isolated storage pools found in server-dedicated storage. The result is you can more than double disk utilization—that means applications only need half the storage required in a server-dedicated storage environment. In areas where the price of real estate has soared in recent years, the impact can be significant. For example, in New York City, where floor space can be as high as US\$5,000 per square foot, a 24 percent reduction in data center space can translate to millions of dollars in savings. The use of BladeSystems can often be justified on the basis of space savings alone.

Realistically, few solutions require a rack fully deployed with only servers. Furthermore, few data centers are equipped to deliver the power necessary to a fully loaded rack of server blades. However, the point illustrated here is that the density of blades maximizes space within an individual rack and helps customers to integrate more components such as SANs, redundant power, and networking with less rack space.

Increasing system availability

In traditional rack-mounted server architectures, increasing availability requires additional hardware for redundancy, as well as for the connections and external networking components to support the duplicate systems—all of which amount to extra costs.

Within the HP BladeSystem, more redundancy—and therefore more availability—is built into the system. HP BladeSystems incorporate dual VLAN switches, redundant power subsystems, redundant backplane data paths, redundant storage and storage interconnects, redundant fans for cooling, and other redundant features. In addition, hot-swappable blade replacement provides high availability and simplifies maintenance.

The fact is, high availability is built in with BladeSystems, while in the case of rack-mounted servers, redundant components often must be planned for and purchased separately to achieve high availability. By virtualizing the server environment, large numbers of servers can be supported by a small backup pool. In the case of a failure, HP BladeSystem management tools can automatically failover to spares, assuming the same configuration within minutes.

When looking at a decision to purchase a blade solution in comparison to traditional rack-mounted servers, one could make the case that BladeSystems are inherently more reliable and reduce both planned and unplanned downtime commonly associated with traditional rack-mounted servers. Downtime occurs due to various causes, such as cable, server, storage, and switch failures; human configuration errors; and software, power, and cooling problems. In addition, time to repair these problems can also be significantly reduced when using the HP BladeSystem.

The potential savings can be significant, depending on a company's cost of downtime, and the business-critical nature of its applications. Table 12 provides a way to quantify the potential savings of reduced planned and unplanned downtime.

Table 12. Unplanned and planned downtime with BladeSystems and traditional rack-mounted servers

Unplanned downtime	Traditional rack-mounted servers	HP BladeSystem
Overall availability*	99.5%	99.75%
Average unplanned downtime per year	15 hrs	7.5 hrs
Average unplanned downtime cost per hour	\$42,000	\$42,000
Total annual unplanned downtime cost	\$630,000	\$315,000
Planned downtime	Traditional rack-mounted servers	HP BladeSystem
Overall availability**	99.5%	99.75%
Average planned downtime per year	17 hrs	8 hrs
Average planned downtime cost per hour	\$4,000	\$4,000
Total annual planned downtime cost	\$68,000	\$32,000

Note: All monetary figures are in U.S. dollars.

* Overall availability of blades is higher due to increased redundancy and reduced time to repair problems.

** Overall availability of blades is higher due to increased automation of setup and reduced time to make changes.

In addition, integrated networked storage allows additional capacity to be added “on the fly” without application downtime. Plus business continuity storage solutions like HP StorageWorks Fast Recovery Solutions quickly help restore popular industry applications back to their operational state. Customers can add capacity and servers on the fly and migrate applications without rebuilding the system.

Calculating the TCO savings

The numbers cited within this document only give an indication of where efficiencies are realized and the potential savings BladeSystems can deliver. To enable individual IT organizations to measure the TCO savings for their unique environments and against peer competitors, HP provides a TCO tool that is available from local HP sales representatives. This should be the first step toward a BladeSystem purchase to help your team uncover hidden project costs, identify benefits, and make a quick assessment of numerous scenarios and value propositions.

The HP BladeSystem TCO model creates a three-year total cost of ownership for two-processor server blades and a comparative value for 1U rack-mounted servers. It utilizes user-specific data (labor rates, pricing, power costs, and so on), combined with rack configuration rules, to produce results that are specific to each organization. Templates for dozens of the most popular and effective projects are included, in addition to hundreds of ROI worksheets to help create custom cases and plans. The TCO methodology weighs project costs versus tangible benefits, intangible benefits, and project risk-extending traditional ROI to better measure and manage IT value.

HP sales representatives and customers can walk through “what-if” scenarios, providing a compelling aid in the decision-making process. The tool is revised on a regular basis to reflect changes in variables and to incorporate new BladeSystem functionality as it becomes available. After this free assessment, businesses will be armed with a powerful, compelling business case to justify BladeSystems in their next deployment.

In addition to our HP TCO model, HP's IT Consolidation model is ideal for demonstrating financial justification for HP BladeSystem, including network, storage, and servers. The tool provides a series of outputs that can be readily used to present a formal business case to upper management and/or provide leverage for an “HP champion” within the customer. The software uses customer information, including HP servers, storage, industry applications, and management software, along with industry comparisons to demonstrate third-party analyst quantifiable business benefits of using advanced HP server and storage solutions.

Added value of HP Services

Maximizing the success of any data center implementation requires thorough planning, expert implementation, and committed support. HP offers a full portfolio of services to ensure the successful planning and implementation of HP BladeSystems—and HP is committed to providing responsive support to ensure the long-term value of customers' IT investments and ensure IT service-level agreements.

One of the most critical aspects of adopting BladeSystems is ensuring data center readiness. HP offers a complete data center assessment service, covering security issues, hardware and software support requirements, enterprise management, mission-critical support, and more.

As described above, power and cooling are central issues in the data center, regardless of the architecture being adopted. To ensure adequate power and cooling for the future, HP employs power calculator tools and offers a complete Smart Cooling Service. And HP provides the proven expertise to implement power and cooling solutions that meet specific requirements.

Also available, the ProLiant BL p-Class Sizing Utility tool provides valuable information necessary to help plan and prepare a site for delivery and installation. Site planning information, such as power distribution requirements and environmental specifications, is generated based on entered system configuration criteria. Simply configure each server blade with appropriate options, choose interconnects for each server blade enclosure, and enter data center power information. Once the valid information is entered, the tool calculates power specifications, overall equipment list, system weight, the number of power supplies and enclosures needed, and a summary table of blade components in the rack (server blades, memory, processor, and so on)

HP BladeSystems can also become a foundation for a utility computing model through the HP Instant Capacity solutions. The Instant Capacity program automates and streamlines acquisition, deployment, and billing. Server blades are delivered and activated only when needed. By placing preconfigured server blades and other components on-site, resources are available for deployment within minutes, versus days. When a server is activated, the business is invoiced for that server plus only a corresponding percentage of the infrastructure. Alternatively, the infrastructure can be purchased up front. Businesses can optionally bill user departments for the amount of capacity they use, aligning IT costs with business usage. HP Services will work with customers to determine computing needs, assessing the environment and helping to define the appropriate inventory levels.

To simplify the ordering, configuration, and deployment of complete HP BladeSystem solutions, customers may choose HP Factory Express services. HP's factory-direct capabilities speed project implementation, delivering plug-and-play blade solutions completely integrated and shipped in a fully configured rack. HP Factory Express provides customers with unique capabilities like fully integrated blade rack solutions built and configured to the customer's specifications that are preloaded, wired, racked, tested, and ready to deploy within 6 to 10 days of an order. To ensure reliability and protect the customer investment, each solution is fully tested and validated in an ISO 9002 environment prior to shipment.

To support individual business goals, HP provides a complete lifecycle services methodology for IT consolidation—from consolidation assessment and planning services to implementation and startup services, to availability assessment and support services. HP also offers optional services to provide an extra level of support beyond standard warranty coverage, including 24 x 7 technical support, high-availability services, and proactive remote services that alert administrators to faulty conditions before they affect customers.

In addition, for those customers migrating from proprietary RISC/SMP systems to Linux system-based BladeSystems, HP offers comprehensive porting and migration services, including needs analysis, application baselining, code analysis, and migration planning and implementation.

With 65,000 service professionals in 170 countries, HP provides the largest IT customer support organization in the world. Moreover, with our in-depth technology expertise, global strategic partnerships, and more than 60 years of IT experience, IT organizations are assured of getting a quality solution that delivers the highest levels of performance and flexibility at the lowest possible cost.

Conclusion

The HP BladeSystem provides a fast-track to building an integrated infrastructure optimized for the Adaptive Enterprise. These solutions offer a highly flexible and scalable environment that enables enterprises to embrace change, while dramatically reducing total cost of ownership. The automation and virtualization capabilities of BladeSystems are key, empowering IT organizations to respond to fluctuating business requirements in response to change. In addition, the consolidation and built-in intelligence of these solutions support advanced management tools that automate and simplify a wide range of administrative and enable advanced IT control.

With the evidence presented in this paper, it is also clear that acquisition costs of HP BladeSystem are significantly lower than rack-mounted servers in the majority of scenarios. The long-term operational savings that result from its increased efficiency yield long-term business value that justify adoption.

The combination of lower acquisition costs and dramatically improved data center efficiency make a strong business case for adopting the HP BladeSystem as the architectural foundation to transform the technologies, people, and processes behind your IT department. The fact is, when it comes to increased business agility, greater data center efficiency, and higher long-term IT value, HP BladeSystem is simply the best choice.

For more information, visit www.hp.com/go/bladefsystem

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