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WHITE PAPER

Making the Business Case for Blade Servers with Embedded Layer 2–7 Switches

Sponsored by: IBM Corporation

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EXECUTIVE SUMMARY

In the past decade, organizations have dramatically increased the number of network devices in their datacenters, adding critical functionality but complicating datacenter management. The Internet boom, in particular, fueled an explosion of single-function network appliances, creating a highly complex and inefficient datacenter topology that is difficult and expensive to manage and vulnerable to security threats.

In today's competitive business environment, CIOs are seeking to simplify their datacenter topology to cut costs and create a network infrastructure that is secure, easy to manage, always available, and capable of adjusting to unpredictable workloads and changing business needs.

In rearchitecting their infrastructure for greater efficiency and flexibility, many organizations are consolidating their rack-optimized, datacenter servers into a blade server chassis and then integrating the storage fabric and Layer 2 switches into the chassis. Blade servers were originally viewed as a means of conserving datacenter space and power, which were at a premium during the Internet boom. However, they are now valued more for their ability to increase availability and manageability and to lower acquisition and ownership costs. Integrating Layer 2 switches into the chassis further enhances the consolidation and manageability benefits of a blade server and provides the necessary backplane to support basic server workloads.

While this consolidation is an important first step, organizations can go further in simplifying their datacenter topology by integrating and embedding Layer 3–7 switching functionality within the blade server chassis. This LAN switch consolidation opens the door for tasks performed by function-specific appliances to be consolidated into the blade center chassis. In addition, adding switching intelligence to the blade server allows server capacity to be allocated dynamically to handle changing application loads.

One company that has acted early in combining the benefits of blade servers and intelligent switches is IBM, which has embedded and integrated a Layer 2–7 Gigabit Ethernet switch module designed by Nortel Networks into its eServer BladeCenter offering. With the inclusion of a Layer 2–7 switch, IBM expects to add new capabilities and benefits to its blade server offering, including increased application availability and performance, improved manageability and security protection, easier scalability, and greater flexibility to support on-demand computing.

To validate the benefits of embedding and integrating Layer 2–7 switches into a blade server chassis, IDC interviewed IT executives at nine major organizations that have deployed blade servers within their datacenters. IDC asked a number of questions about the cost savings and other benefits of server consolidation and embedding Layer 2–7 switching into the blade server.

IDC found that the combination of server and LAN switch consolidation delivers more benefits than just server consolidation or LAN switch consolidation alone. Enterprises in the IDC study that migrated from rack-optimized servers in the datacenter to blade server configurations will be able to reduce their average cost of ownership for server and network infrastructure by 48% over three years through server consolidation and reduced server acquisition and maintenance costs. Embedding Layer 2–7 switch functionality within the blade server chassis would reduce these costs by an additional 33%, for a total savings of 65%, by bringing similar consolidation and maintenance savings to the networking infrastructure and by further reducing acquisition costs.

CIO CHALLENGES IN THE DATACENTER

The challenges for the CIO today are numerous. End users increasingly demand the delivery of their IT resources with a variable rather than a fixed cost. Users also want the ability to consume IT services like any other utility, enabling them to readily compensate for the business "variability" they regularly encounter, due to such factors as the economy, globalization, mergers/acquisitions, and corporate restructuring.

Users are also demanding that the complexity of the IT environment be hidden from their view, and that the environment — whether computing, storage, or the network — be independently and dynamically scalable to meet the ever-changing operational demands on the business. Operational demands include an IT infrastructure that is highly available and that secures the end-to-end communications between users and the mission-critical applications running in the datacenter.

CIOs are also increasingly finding that to reduce complexity, they have to consolidate resources — either through the centralization of datacenters and/or through the physical infrastructure, data and application consolidation. Such consolidation is needed to effectively manage the vast amount of IT resources required to run all the facets of a complex business.

Additionally, CIOs are striving to make IT more cost-effective while seeking to increase IT staff productivity. Further, in addressing these challenges, CIOs must solve increasingly demanding budget issues through better utilization of hardware, software, network, and staff, and they must accommodate fluctuating business conditions that call for maximum flexibility in IT resources.

Simply put, CIOs and IT managers face a multitude of challenges and contradictions in planning, preparing, owning, and operating IT systems. These challenges include the following:

- The need to improve application availability and performance
- The ability to fluidly scale the infrastructure to support more users and new applications
- The capability to better align IT resources with the businesses priorities
- The need for easier, simpler, and more efficient infrastructure management
- The need for more effective ways of protecting against security threats
- The need to significantly reduce datacenter infrastructure cost of ownership

To meet these challenges, datacenter infrastructure and topologies will need to change. Applications will need to take advantage of real-time provisioning of server, storage, and network resources. IT staff, aided by supplier service offerings, will have to provide an infrastructure that is always available and that is capable of adjusting to rapidly shifting user demands and server resources. In effect, the IT infrastructure will need to provide much greater flexibility.

While the picture of a technology utility is a long-term, strategic vision, IDC believes that blade servers are a critical step in the progression toward that vision. The instantiation of blades in datacenters marks the beginning of greater flexibility in the IT infrastructure, and IDC encourages enterprises to begin considering how blade server solutions fit within their IT environments and help solve the challenges described above.

In addition to providing more flexibility, the network infrastructure needs to become more efficient. In the last decade, the number of network devices in the datacenter has increased dramatically, providing critical value-add functionality, such as firewalls, redirection, and bandwidth optimization to the underlying Ethernet network. In the process, however, this increase in devices has added to IT Infrastructure complexity.

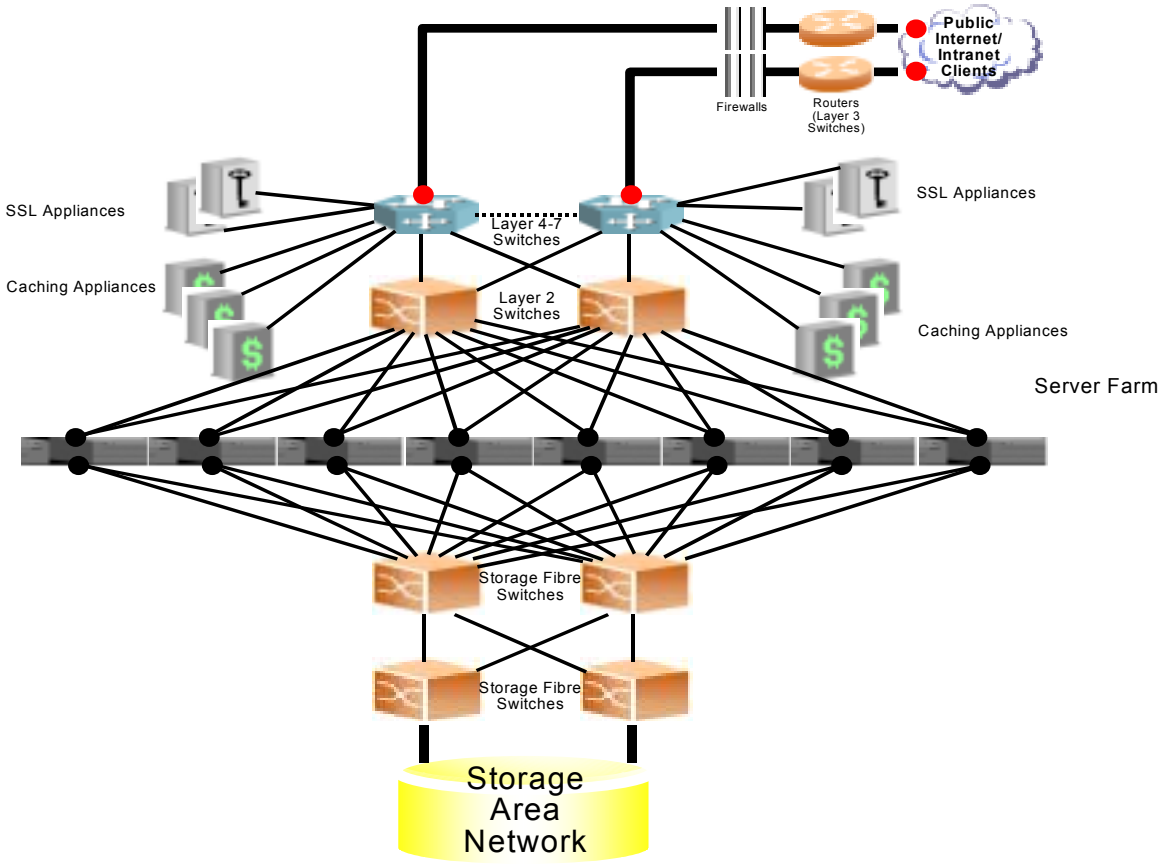
In particular, the Internet bubble created an explosion of single-function network appliances, which made the datacenter topology extremely complex, inefficient, and nearly impossible to manage. As a result, CIOs are increasingly demanding new products and solutions that can allow new functionality to be added to the network more efficiently and that simplify the datacenter topology without increasing IT infrastructure complexity or the number of discrete devices in the network.

Figure 1 shows a typical Web-enabled datacenter topology. In rearchitecting the infrastructure for greater efficiency, organizations can begin by consolidating the servers into a blade server chassis and integrating the storage fabric and Layer 2 switches into the chassis. Further consolidation is possible by integrating the Layer 3–7 switching functions within the blade server chassis (see Figure 2).

Integrating and embedding Layer 3–7 switching functionality within the blade server chassis opens the door for appliance consolidation. The tasks performed by function-specific appliances can then be consolidated into the blade center chassis, further simplifying the datacenter topology (see Figure 3). In addition, adding switching intelligence to the blade server allows server capacity to be allocated dynamically to handle changing application loads.

FIGURE 1

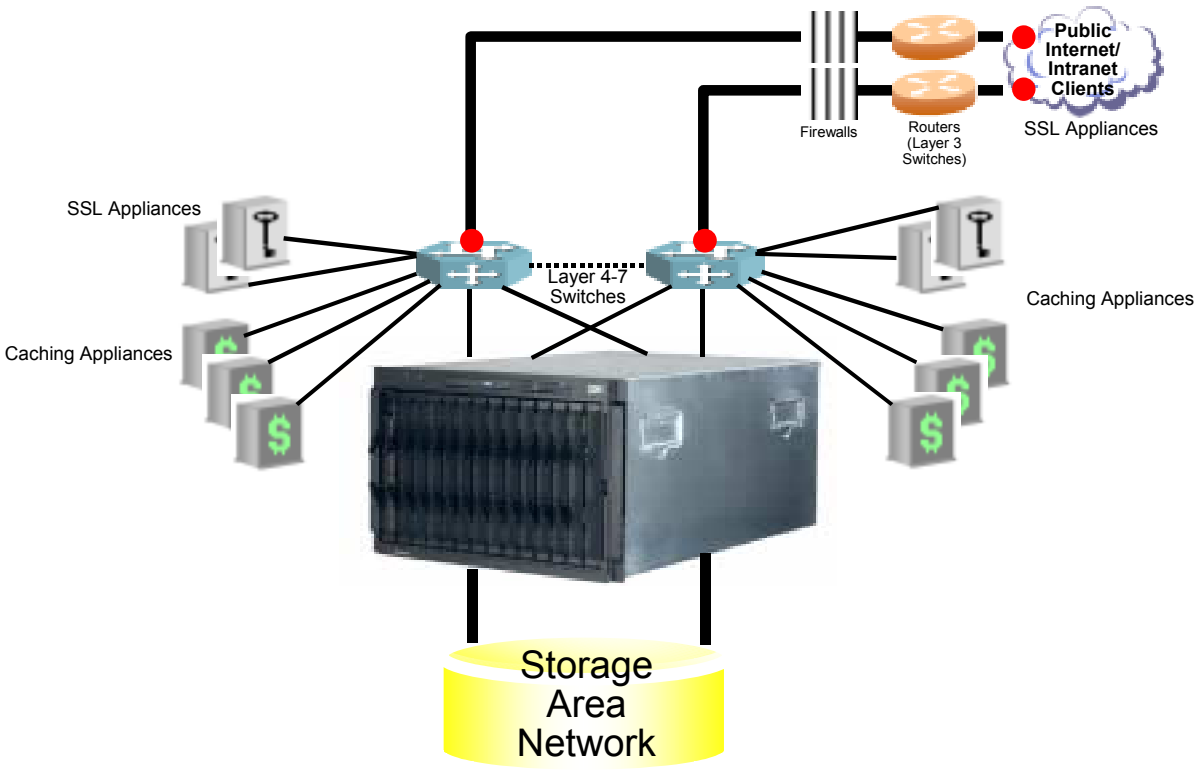
TYPICAL WEB-ENABLED DATACENTER TOPOLOGY



Source: IBM, 2003

FIGURE 2

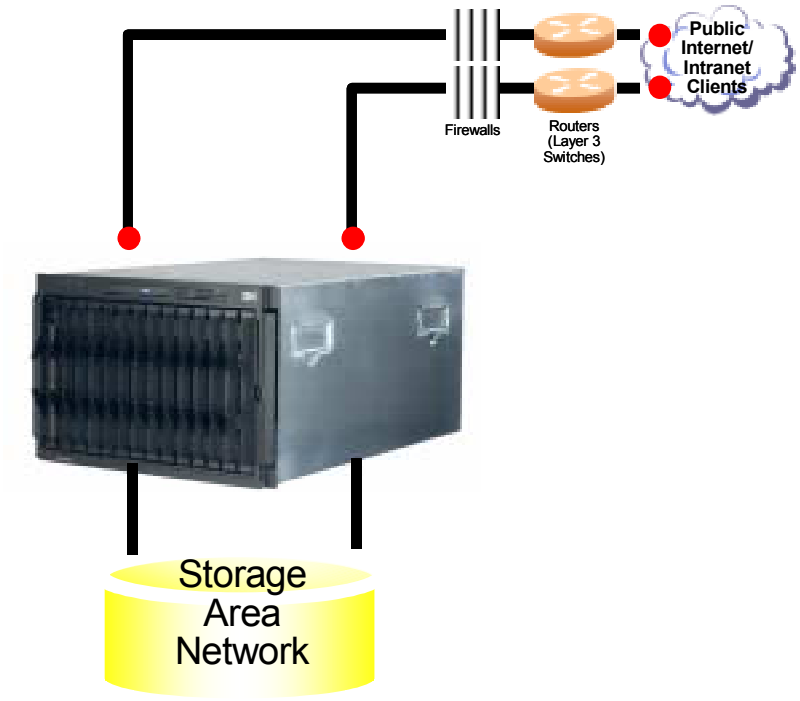
REARCHITECTING THE DATACENTER TOPOLOGY, STEP ONE



Source: IBM, 2003

FIGURE 3

REARCHITECTING THE DATACENTER TOPOLOGY, STEP TWO



Source: IBM, 2003

HOW CIO CHALLENGES ARE DRIVING THE EVOLUTION OF DATACENTERS

IDC believes the challenges facing CIOs have already begun to shape the evolution of datacenters and associated technologies. Enterprises are increasingly demanding more virtual and dynamic computing environments that are simple and cost effective to deploy and manage. Enterprises are also seeking to maximize provisioning and management automation while addressing datacenter floor space constraints and cabling issues associated with distributed computing environments.

Practices, now emerging in the datacenter, that help CIOs, IT managers, and their staff to cope with these pressures include the following:

- **Consolidation.** This includes datacenter centralization as well as the physical consolidation of hardware, data, and applications. The net effect of consolidation — especially with blade servers — is a flattening of the datacenter topology by eliminating layers of infrastructure (both servers and network switches). As a result, the infrastructure is easier to manage because the topology itself is less complex.

- **Integration.** This refers to the assimilation of disparate technologies in order to provide a simpler, yet more comprehensive, higher-performance, and easier-to-manage computing environment.

- **Process automation.** IT administrators need to "do more with less." They would like to offload the mundane, day-to-day tasks to software and hardware solutions that can "automate" certain tasks, allowing the administrative staff to focus on higher value-add activity, such as planning for new application and service rollouts. Process automation offers further improvements beyond freeing up staff. By offloading processes to the automation software, users are able to accomplish tasks more efficiently and deliver changes in near real time.

- **Network transformation.** This includes the changes in network architecture that result from a new generation of technologies, applications, and user requirements. Key network shifts include the following:

  - **The network is becoming smarter.** Enterprises are purchasing switches that are more intelligent (beyond Layer 2 and Layer 3) to enhance the performance and reliability of their growing Web-application deployments. These content/application aware switches allow enterprises to better manage, monitor, and secure the flow of data throughout the network at gigabit speeds. Today's intelligent switch products are designed to enable the mission-critical reliability and availability of enterprise applications. For example, Layer 4 and above intelligence enables the switch to monitor and health-check applications and servers and load-balance across multiple servers. Such functions provide the foundation of a highly available architecture.

  - **There is a growing migration to Gigabit Ethernet.** The need for increased network performance continues unabated. Enterprise customers are systematically upgrading their network connectivity from 10/100 Ethernet to Gigabit Ethernet to satisfy the increasing demand for bandwidth throughout the enterprise network. Organizations with high-availability requirements, such as the scientific community and service providers, have already begun 10-Gigabit installations. 10-Gigabit deployments commonly support clustering and grid computing.

  - **Network convergence is placing new demands on the enterprise network.** Network convergence plays an important role in the demand for network intelligence. For example, as voice and data networks converge, only Layer 4–7 intelligence can provide the functionality, availability, and reliability required to support the new converged applications. In addition, as enterprises allow their applications to be accessed using cell phones, personal digital assistants (PDAs), and other mobile devices, the network must have the intelligence to differentiate a PC user from a cell phone user so the data can be delivered to the user in a format readable by the user's access device. Layer 4–7 intelligence offloads from the server the task of distinguishing among the different types of devices. Utilizing intelligence in the network to serve different user types creates a more efficient IT infrastructure in the datacenter.

By following these four framing principles, enterprises will be able to build a more adaptive IT infrastructure that better positions their organization to tackle the challenges of a fluid, ever-changing business environment, expeditiously and with maximum efficiency and minimum disruption.

ROLE OF BLADE SERVERS AND INTELLIGENT LAN SWITCHES IN THE DATACENTER EVOLUTION

Server and networking companies have largely been working independently to address the datacenter challenges that CIOs face. However, with CIOs increasingly viewing and managing their datacenter as a single utility, there is an increasing need

for server and networking companies to work more closely to deliver integrated solutions. IDC believes that by combining blade servers with intelligent Layer 2–7 LAN switches, CIOs will realize benefits that exceed those of the individual products, and this realization will lead to a simpler, more reliable, and more efficient datacenter environment.

Blade servers originally came into existence as a means of offering enhanced density within a datacenter environment, as both space and power were the constraining issues (see the sidebar, "What Are Server Blades?"). As the concept began to evolve, vendors quickly realized that user concerns about space and power were matched, and often dwarfed, by the need to have a higher level of availability, performance, scalability, security and manageability as well as a lower cost of both acquisition and ownership.

What Are Server Blades?

IDC defines a blade server as an "inclusive chassis-based modular computing system that includes processors, memory, network interface cards, and local storage on a single board." Power, keyboard, video, mouse, external network connectivity, and, in some instances, even cooling are shared across multiple server blades. These common resources are packaged as compact modules and made available at a chassis level so they can be shared among a collection of server blades. The common resources interact with the individual server blades via a passive midplane/backplane. Blades and common resource modules are easily installed and removed.

Blades may be general-purpose servers, or they may be tailored and preconfigured for specific datacenter needs, such as security blades with firewall, virtual private network, and intrusion detection software preinstalled. One area of early traction for blades has been for server consolidation. Blades allow enterprises to physically consolidate multiple servers into a single managed entity. Relative to today's rack and pedestal servers, blade servers may require as little as half the datacenter floor space.

With most standalone devices, the simple act of cabling and installing the device into the rack can take several hours. With blades, once the chassis is installed, installation of new servers simply requires the user to slide in a new blade. The device automatically receives power and a network connection and is immediately ready for deployment. The ease of installation also makes servicing, replacing, and upgrading the blades an extremely quick process.

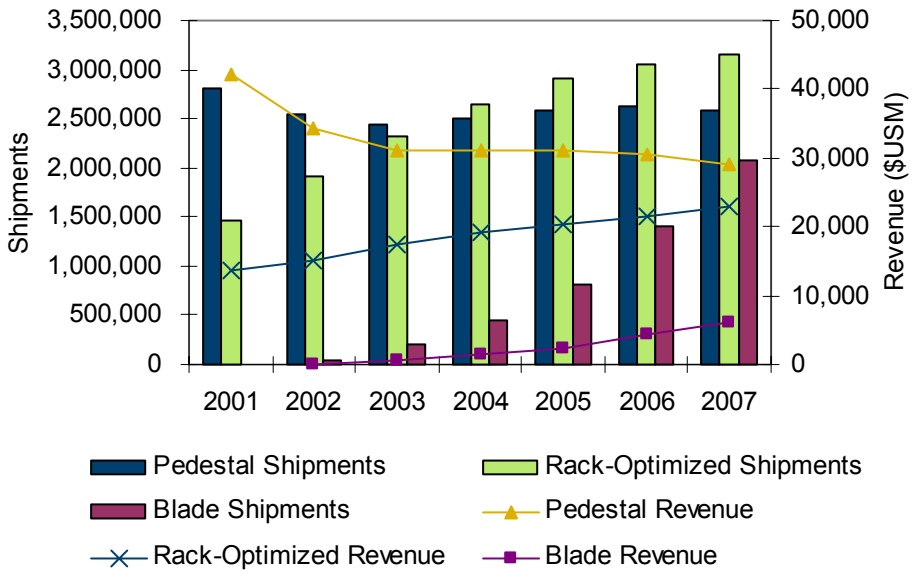
Blade hardware and software products are designed to deliver dramatically improved levels of automation and virtualization to today's datacenters. Additionally, IDC believes the combination of blade servers, management solutions, and services can significantly lower expenses — both on the capital acquisition and on the ongoing operation of the infrastructure.

While blades deliver users a means to lower power consumption, reduced floor space, and rack space requirements, they also provide forward/backward investment protection in managing capital costs. However, it is the operational cost reductions that ultimately have the largest impact on total cost of ownership (TCO) and return on investment.

Because of the benefits they bring to datacenter infrastructures, IDC believes the market share for blade servers will grow to 27% of all server units shipped in 2007. As Figure 4 shows, the blade architecture is on its way to becoming a major category within the server market.

FIGURE 4

OUTLOOK FOR MODULAR COMPUTING – ENTRY SERVER OUTLOOK BY FORM FACTOR



Source: IDC Quarterly Server Forecaster, 1Q03

Blade servers today are available with Layer 2 switches (see the sidebar, "What Are Embedded LAN Switches?"). While these switches enhance the consolidation and manageability benefits of a blade server and provide the necessary backplane to support basic server workloads, there is an emerging opportunity to leverage the added benefits of intelligent switching by consolidating Layer 2–7 switches within the blade server chassis.

What Are Embedded LAN Switches?

LAN switches are network devices that direct traffic within a LAN. They are the muscle that holds the datacenter together. Organizations may use a combination of Layer 2, 3, and/or Layer 4–7 LAN switches to ensure the high performance and availability required of a datacenter network.

- A Layer 2 switch forwards packets using Layer 2 information such as a MAC address.
- A Layer 3 switch uses Layer 3 address information such as IP headers. This enables the switch to prioritize different types of traffic based on the destination of each packet.
- A Layer 4–7 switch reads even further into the packet, beyond the TCP/IP header. This level of functionality enables the switch to make traffic management decisions based on the user, server, and application.

Most blade server offerings use one or more LAN switches as their backplane. Because these LAN switches reside physically inside the blade server chassis, they are commonly known as embedded LAN switches. These switches can provide Layer 2, Layer 3, and even Layer 4–7 traffic management for servers resident in a blade server chassis. Currently, most blade server vendors are shipping Layer 2 LAN switches in their blade server systems. IBM is first to market with an integrated Layer 2–7 switch module for its eServer BladeCenter brand of blade server systems. IDC's latest research and customer interviews show that, given the choice, organizations would prefer more sophisticated traffic management (beyond Layer 2) from the embedded LAN switches that control the flow of traffic to and from a blade server system.

The benefits of consolidating Layer 2–7 switching with blade servers include the following:

- **Greater application availability.** Layer 4 switching intelligence enables a higher level of application availability for servers.
- **Increased application performance.** The ability for multiple Layer 2–7 switches in a blade server chassis to share the workload while simultaneously acting as a backup to each other enables IT managers to optimize performance of applications running on the server blades.
- **Greater security protection.** Security is an overarching problem for CIOs that spans every inch of the network. As the types of corporate network users expand to include partners, suppliers, and an increasingly mobile, wireless-enabled workforce, security concerns are heightened and the need for application-level security becomes a top priority. Layer 2–7 switches in a blade server can allow traffic management decisions to be based on sophisticated security policies, making the enterprise's computing environment less vulnerable to security breaches.
- **Better scalability.** This scalability extends both within the blade server chassis and between multiple blade server chassis to rapidly provision servers to handle peak workloads.
- **Ability to add and remove server capacity on demand.** Intelligent switches can actively monitor the health and usage of a server blade or an application running on the server blade. With server load balancing, the switch can dynamically allocate and reallocate server capacity to handle changing application workloads. An example would be freeing up the resources of a lightly used server that is dedicated to quarterly reporting to provide just-in-time computing resources for an overloaded CRM application.

BENEFITS OF EMBEDDING INTELLIGENT LAYER 2–7 SWITCHES IN BLADE SERVERS

One company that has acted early in combining the benefits of blade servers and intelligent switches is IBM, which has embedded and integrated a Layer 2–7 Gigabit Ethernet switch module, designed by Nortel Networks, into its eServer BladeCenter offering.

Because bladed systems offer a standard platform that integrates multiple servers as well as a layer of network switching, there is an opportunity to leverage this integrated platform to enhance the automation of day-to-day tasks within the datacenter. Already, through its Director product, IBM is highlighting blade server automation features that include chassis discovery, event action planning, the capturing of configuration information, automated configuration of basic BladeCenter settings (both one-to-one and one-to-many), automatic configuration on new blade insertion, rapid image restoration and deployment, secure blade management, multicasting to an unlimited number of server deployments, the ability to create application software inventories, and remote management of the individual blades.

IDC expects that with the inclusion of a Layer 2–7 switch, IBM will be able to extend and enhance these automation features further while also offering new features and benefits, including increased application availability and performance, improved manageability and enhanced security protection, easier scalability, and greater flexibility to support on-demand computing.

By deploying an eServer BladeCenter with an integrated Layer 2–7 switch, enterprises will be able to support planned and unplanned server outages without disrupting application availability and achieve higher availability and performance for mission-critical workloads.

The integrated solution also provides better end-to-end security because encrypted SSL sessions can be terminated inside the blade chassis rather than outside. It also provides the ability to configure virtual IP addresses and better serve the device-dependant information needs of users. In addition, a blade server with integrated Layer 2–7 switching allows IT managers to build a massively scalable server farm that is capable of supporting thousands of users by grouping blades in a chassis and multiple blade server chassis into large, logical server groups/nodes.

SERVER ATTRIBUTES

In developing its BladeCenter product, IBM focused on a number of specific attributes, as follows:

- **Increased application availability.** High availability and ease of serviceability are mainly associated with hot-swappable blades, power supplies, and fans, but they also extend to blade failover capabilities and functions. Although these features are all available on traditional servers, IBM views the inclusion of these features as critical to the advancement of modular computing concepts.

- **Improved manageability.** IBM has recognized that by consolidating servers into a chassis, users have the ability to streamline the infrastructure management process to improve the operational efficiency of the datacenter and reduce the demand on the IT administrator. In total, blades allow customers to centralize and physically consolidate servers and provide a level of network resources, thereby lowering the cost of managing and operating the IT environment.

  The idea of better server management is especially critical for the development of a robust blade ecosystem. IBM is aggressively addressing this need with its Director product, which comes standard with the BladeCenter. Director allows users to manage the entire device holistically, while also delivering granular monitoring and management of the individual server, switch, or component on the device. IBM includes integrated systems management processors on all the blades as well as a chassis-based redundant management module that offers aggregated management and advanced features, such as streamlined blade software deployments.

  Specific features highlighted by IBM include chassis discovery, event action planning, capturing configuration information, automated configuration of basic BladeCenter settings (both one-to-one and one-to-many), automatic configuration on new blade insertion, rapid image restoration and deployment, secure blade management, multicasting to an unlimited number of server deployments, the ability to create application software inventories, and remote management of the individual blades. These features and functions extend directly into the concepts of IBM's Autonomic Computing initiative of self-optimization, self-configuration, self-protection, and self-healing and lay the foundation for building and delivering the business goals of Autonomic Computing.

- **Customization.** IBM delivers versatility through the ability to mix and match not only blades within the chassis but also switches, management modules, power supplies, and cooling units to configure a highly customized platform designed for a customer's particular needs. This also includes the ability to right-size blade performance by matching blade/processor to a specific workload. The intelligent Layer 2–7 Gigabit Ethernet Switching module enables simplicity in customization by directing traffic to the appropriate processor and workload.

- **Reduced cost of acquisition.** Blades offer a pay-as-you-go model of scaling resources. Adding blades is less expensive than adding rack-mounted servers since components such as switches, power supplies, cooling fans, and hardware interconnects are shared across all the blades. Because server blades share resources, users typically see a reduced cost of acquisition compared with individual standalone devices once the chassis is roughly half full. In the case of IBM BladeCenter, if the organization has a need for more than six or seven servers, a blade solution can offer lower upfront costs while still providing headroom for future growth.

- **Reduced cost of ownership.** The most significant opportunity to contain and lower the cost of business services at the end user's site lies in the effective management of a large datacenter. IDC estimates that, on average, approximately 60–70% of server life-cycle costs are associated with its management. By offering enhanced application availability, more comprehensive ecosystem manageability, easier scalability, and a lower cost of acquisition, IBM aims to offer a platform that can deliver a significant reduction in TCO relative to standalone, disparate, and patchwork approaches to building an IT environment.

SWITCH ATTRIBUTES

Adding the Layer 2–7 network switch to the eServer BladeCenter helps IBM strengthen and differentiate its blade server value proposition in the following ways:

- **Greater application availability.** Integrating Layer 2–7 switches into the BladeCenter chassis takes availability beyond the hardware hot-plug capability to an application level. The intelligent Layer 2–7 switches can redirect traffic to alternative server blades or chassis in the event of a server blade, application, switch, or chassis outages, whether planned or unplanned.

- **Back-to-the-future improvements in manageability.** Servers are always deployed with LAN switches. In the days of proprietary servers, the server operating system performed the functions that are performed by today's LAN switches, but with much lower performance because the functions were performed in software. Bringing the benefits of hardware-accelerated network intelligence into the blade chassis eliminates the complexity of managing multiple devices without sacrificing performance.

- **Easier scalability.** A Layer 2–7 switch module enables easier scalability and supports the vision of grid computing by allowing server blades and BladeCenter chassis to be grouped into "Logical Server Nodes." Multiple Logical Server Nodes can be further grouped together to create one "Massive Logical Server Node," or "Super Node." If any Logical Node fails, a designated Node will pick up the tasks of the failed Node. Such improvement in scalability enables customers to rapidly service demanding workloads using BladeCenter chassis as building blocks. Currently, with Layer 2 switches, blade servers are rapidly gaining share in some application niches. With a Layer 2–7 switch, IBM will be able to address a larger market and pursue the more demanding applications environments where session persistence and stateful failover are key requirements.

- **Increased flexibility to support on-demand computing.** The integrated Layer 2–7 switch enables customers to set thresholds based on server utilization. If a switch detects no activity, then it can redirect the resources of the underutilized server to service an overloaded application that is in higher demand, providing on-demand flexibility in the IT infrastructure.

- **Improved application performance.** The "Active-Active" operational mode of the integrated Layer 2–7 switch helps to boost the performance of the BladeCenter. Additional processor blades can be added on the fly to increase the performance of a particular application. Dynamic allocation of server blade resources based on real-time traffic patterns also enables more efficient utilization of server resources.

- **Greater security protection.** An integrated intelligent switch enables CIOs to enhance the security of their datacenter resources. Security benefits include having encrypted SSL traffic go directly into the chassis, IP address masking as a level of defense against attacks, and the ability to detect Denial-of-Service attacks and block suspicious traffic without disrupting legitimate traffic.

- **Additional savings in the cost of acquisition and ownership.** Consolidating Layer 2–7 switching functions into the blade server can significantly lower the cost of acquisition and ownership costs by reducing the number of discrete devices installed and managed in a datacenter.

THE TCO BENEFITS OF CONSOLIDATING LAYER 2–7 SWITCHING INTO THE BLADE SERVER

To validate and quantify the TCO benefits of embedding and integrating Layer 2–7 switches into a blade server chassis, IDC interviewed IT executives at nine major organizations that have deployed blade servers within their datacenters.

The companies represented a broad range of industries, from media and financial services to consumer goods, energy, and healthcare insurance. Six had annual revenues of more than $10 billion, one had revenues of $700 million, and two had revenues of approximately $150 million. The companies had an average IT staff of 403 full-time employees (FTEs), including 103 FTEs devoted to managing and supporting an average of 401 servers in three to four datacenter sites.

IDC asked the IT executives a number of questions about their datacenter environment and network infrastructure, including management practices and costs before and after server consolidation. IDC also inquired about the TCO and other benefits of server consolidation and the additional benefits the companies may realize by consolidating Layer 2–7 switching within the blade server chassis. From the interview results, IDC was able to calculate the average impact of server and LAN switch consolidation on datacenter TCO.

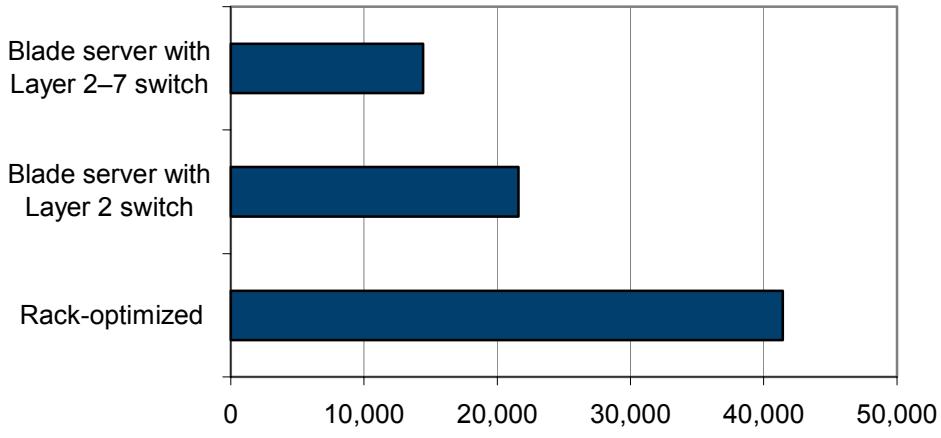
At a time when organizations remain cautious about IT spending, examining the TCO over the life span of a technology investment, including the cost of hardware, software, deployment, administration, support, and maintenance, provides a more useful measure of a solution's business value than, say, the initial purchase price or lease cost. Factors that contribute to lower TCO include greater efficiency and productivity, reduced cost of downtime, lower training costs, and longer life cycles. To account for the many factors, IDC calculates the TCO over a three-year period.

In the interviews, IDC found that the combination of server and LAN switch consolidation delivers more benefits than just server consolidation or LAN switch consolidation alone. Enterprises in the IDC study that migrated from rack-optimized servers in the datacenter to blade server configurations will be able to reduce their

average cost of ownership for server and network infrastructure by 48% over three years through server consolidation and reduced server acquisition and maintenance costs (see Figure 5). Embedding Layer 2–7 switch functionality within the blade server chassis would reduce these costs by an additional 33%, for a total savings of 65%, by bringing similar consolidation and maintenance savings to the networking infrastructure and by further reducing acquisition costs.

FIGURE 5

THREE-YEAR INFRASTRUCTURE COST OF OWNERSHIP PER SERVER



Source: IDC, 2003

CHALLENGES/OPPORTUNITIES

The challenges facing IBM and other server vendors as they attempt to transition their product lines to map to customer demands include developing a complete product portfolio, defining a succinct value proposition for the pragmatic market majority, easing concerns regarding blade standardization, and demonstrating that price competition will continue to drive down the cost of computing and networking.

The integrated Layer 2–7 switch brings a new level of security protection, performance, scalability**,** availability, on-demand capability, simplified management, and TCO benefits to each individual blade sever in the network. The challenge for IBM will be to articulate a strategy that emphasizes a coexistence with the existing networking infrastructure in the network (not just installed Layer 4–7 switch products). Enterprise customers have more than a billion dollars invested today in LAN switches, and they will want to be assured that the integrated Layer 2–7 switch module will interoperate with, and complement, their existing switch infrastructure.

As blade server vendors endeavor to penetrate beyond early adopters and technology enthusiasts, it is clear that demand will flow toward modular designs that do not forgo network intelligence, computing power, or availability over density. Dual-processor and even quad-processor blade designs are highly desired, and as such they have an opportunity to become central to tomorrow's datacenter infrastructure.

CONCLUSION

By interviewing IT executives at nine major organizations, IDC was able to validate the TCO and other business benefits of simplifying datacenter topology, first by consolidating rack-optimized servers into blade servers and second by embedding and integrating Layer 2–7 switching into the blade server chassis. IDC's research determined that the combination of server and LAN switch consolidation provides more benefits than just server consolidation or LAN switch consolidation alone. Enterprises in the IDC study that migrated from rack-optimized servers in the datacenter to blade server configurations will be able to reduce their average cost of ownership for server and network infrastructure by 48% over three years through server consolidation and reduced server acquisition and maintenance costs. Embedding Layer 2–7 switch functionality within the blade server chassis would reduce these costs by an additional 33%, for a total savings of 65%, by bringing similar consolidation and maintenance savings to the networking infrastructure and by further reducing acquisition costs.

Besides the TCO savings, the IT executives interviewed by IDC listed a number of other benefits from server and intelligent LAN switch consolidation, including improved application availability and performance, better scalability, and improved security protection. One executive said that the consolidation fits well with his datacenter strategy of "using resources wisely, with better overall management." Another executive cited reduction in the number of network attacks and security breaches "because users and applications traffic that didn't belong on a network would never be put there," while a third executive had a particular use for the integrated server-switch: easy configuration of an entire Web farm on a single chassis. Others listed such benefits as better utilization of power and space, improved load balancing, and better bandwidth management.

IBM is the first server vendor to combine the benefits of blade servers and intelligent switches. The IBM eServer BladeCenter offering now comes with an embedded and integrated Layer 2–7 Gigabit Ethernet switch module designed by Nortel Networks.

LAN switch functionality used to be part of the server operating system until server vendors decided to disaggregate the OS and take advantage of hardware to get better TCP/IP performance. It was this disaggregation of server technology, combined with a scramble to build out the network infrastructure during the Internet bubble, that left datacenters with a topology that is complex, expensive, and resource intensive to manage and operate and vulnerable to security threats. In today's tough economic environment, simplification of the datacenter topology is the name of the game, and consolidation is the winning strategy. Integrating Layer 2–7 LAN switches into the blade server has some aspects of a "back-to-the-future" solution, but, based on IDC's study, its value proposition appears to be compelling.