

WHITE PAPER

Making the Business Case for Blade Switches

Sponsored by: Blade Network Technologies

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Executive Summary

Blade servers have been widely adopted in datacenters because they cost less to deploy and less to operate (due to savings in power and cooling) than rack-optimized servers. Blade servers are also more easily scaled than fixed-capacity monolithic servers to meet workload growth and are easier to service with their field-replaceable blades.

Embedding switches into blade servers expands and enhances these benefits, providing further infrastructure integration, simplified management, greater scalability, improved power and cooling efficiency, and increased application availability. Additionally, blade server switches allow organizations to realize the full inherent benefits of blade servers.

As enterprises begin to migrate to next-generation datacenters, blade server switches are evolving to meet the new demands with advanced functions such as application-aware networking, low latency line-rate switching at 10 Gigabit (Gb) speeds, advanced quality of service (QoS), and support for iSCSI storage connectivity and virtualization.

In its simplest form, a Layer 2 blade server switch replaces the need for a standalone Layer 2 access switch in the datacenter. However, enterprises need the more advanced capabilities of an embedded blade server switch (Layer 3 switching, for example) to keep up with advanced workloads on the blade servers. Layer 3 switching reduces overall traffic on the datacenter network, conserves valuable bandwidth, and reduces the possibility of a security breach.

Enterprises can reap additional benefits by embedding application/content-aware (intelligent) networking into the blade chassis. With an embedded Layer 2–7 switch, enterprises can allocate server capacity dynamically to handle changing application workloads and accommodate planned and unplanned server outages without disrupting application availability. Intelligent networking also provides the functionality, availability, reliability, and security needed to support new converged voice and data applications. As enterprises bring mission-critical converged applications into the datacenter, the ability to distinguish among various types of user access devices will become increasingly critical, allowing data to be delivered in a device-appropriate format.

Bandwidth-intensive and latency-sensitive applications, in particular, benefit from the reduced latency inherent in an integrated blade server switch. Further, because blade server backplanes have been designed up front to handle 10Gb speeds, blade server switches are positioned to lead 10Gb Ethernet (10GbE) adoption in the datacenter. By deploying 10GbE, enterprises will be able to benefit from new applications and capabilities, such as IT consolidation, multimedia, high-performance computing, VoIP, and IPTV/video on demand. Furthermore, integrated 10GbE blade server switches help alleviate the cabling, power, space, and cooling challenges faced by most enterprise datacenters.

Blade servers provide an effective platform for virtualization. The blade server switch allows enterprises to bring network intelligence back into a virtual server deployment so that they no longer have to sacrifice Layer 3 functionality by virtualizing their server architecture within the blades.

One vendor focused on providing blade server switches is Blade Network Technologies, which was established as a fully independent company when it purchased certain assets of Nortel's Blade Server Switch Business Unit in February 2006. Blade Network Technologies introduced the first Layer 2–7 switch to be integrated into a blade server system. It was the first vendor to offer Layer 2–3 blade server switches and the first to bring 10Gb connectivity to blade server systems (10Gb uplinks). In 2007, the company became the first to offer an all 10GbE switch for blade server systems, with 10Gb uplink and 10Gb downlink capabilities.

The company is building its product strategy around a feature-rich operating system with the Layer 2-7 capability and is striving to achieve higher performance and functionality at a lower price than competitive solutions. Because of its singular focus on blade server networking, the company believes it can innovate faster than its competitors. Overall, the company's intention is not just to build products for its OEM clients but to proactively help them architect better rack-dense server solutions for their customers.

Situation Analysis: Evolving Datacenter Requirements

As IT managers evaluate technologies for their next-generation datacenters, they face growing demands for higher application availability and performance, improved security, and greater agility and flexibility in aligning IT with business priorities. With flat budgets and staffing levels, IT managers are also seeking to simplify infrastructure management, improve security, and reduce the cost of datacenter facilities and power.

- ☒ **Application availability.** Enhancing application uptime through intelligent provisioning of server, storage, and network resources increases critical business service levels.
- ☒ **Application performance.** Enterprises are deploying applications to a global constituency of employees, partners, and suppliers. The performance of these applications in the datacenter, and throughout the enterprise, is critical to enabling business benefits from the IT infrastructure.

- ☒ **Flat budgets and level staffing.** While IT organizations are under increasing pressure to deliver higher levels of service to end users, they are also faced with the need to reduce costs. Companies of all sizes and types are struggling as they try to balance increasing infrastructure demands and changing business practices with reduced IT budgets and staffing levels.
- ☒ **Power and cooling for faster, denser, and hotter components.** Enterprise CIOs are becoming increasingly concerned about power and cooling in the datacenter. New generations of processors generate much of the heat in the datacenter, and the deployment of more of this high-performance processing capacity per square foot of datacenter space will naturally increase both power consumption and heat output. To sustain the next generation of microprocessors, CIOs must manage heat effectively and use power as efficiently as possible. Embedded blade switches offer an improvement in power consumption over external switches. Blade server switches consume between 25 watts and 65 watts compared with external switches that typically begin consumption at 300 watts for access switches and escalate with increasing speed and size.
- ☒ **Real estate flexibility.** The availability of datacenter square footage varies significantly by organization. For some, the costs of datacenter floor space are minor compared with the costs of power and cooling. For others, leases, physical footprint of the datacenter, and other business-related real estate concerns all serve to heighten the need to reduce the footprint of the servers installed. For these customers, blade servers with integrated blade server switches have the added benefit of reducing the need to expand the datacenter footprint.
- ☒ **Simpler infrastructure management.** To reduce costs and minimize mistakes that cause downtime, enterprises must streamline their infrastructure management processes.
- ☒ **Business relevance.** Increasingly, users are looking to better align and tie their IT and business priorities. The ability to rapidly shift IT resources to meet changing business requirements is critical to unlocking the value of IT investments. To improve the cost of ownership, organizations must squeeze more flexibility from their infrastructure.
- ☒ **Agility and flexibility.** The next-generation datacenter infrastructure will need to provide much greater flexibility to meet changing requirements. Applications will need to take advantage of real-time provisioning of server and storage resources. IT staff will have to provide an infrastructure that is always available and that is capable of adjusting to rapidly shifting user demands and server resources.
- ☒ **Security.** Security is consistently one of the top concerns in any survey of leading IT architects. The rate of malicious attacks on an enterprise's IT infrastructure is increasing, and there are growing concerns around compliance and physical infrastructure security. Datacenter IT managers need to evaluate each architecture decision with security in mind. The network is in a position to enhance future security policies.

To meet these evolving requirements, datacenter infrastructure and topologies will need to change. Virtualization and blade servers are two examples of key technologies that are effecting change in the datacenter. The changes in server architecture are driving enterprises to adopt blade server switches and to evaluate new networking technologies, such as 10GbE.

Blade Servers on the Rise: Meeting IT Requirements

Blade servers are beginning a third cycle in their evolution. In the first cycle, IT organizations deployed blade servers in the edge tier to support workloads such as Web serving, data streaming, and file-and-print services. In the second cycle, triggered by more robust server blade platforms with greater processing capacity and improved reliability, availability, serviceability, and security, IT organizations began to host application-tier workloads. Blade servers were candidate platforms for mail and other collaborative applications, for example. IDC believes that the third cycle of evolution is marked by the deployment of mission-critical applications on blades.

Blade servers entered the market with a variety of promised benefits, particularly when compared with either rack-optimized servers or larger SMP servers. IDC believes, and our research confirms, that blades offer clear advantages over other architectures, including:

- ☒ **Lower cost of deployment.** Large numbers of servers can be deployed less expensively as blade servers than as rack-optimized servers. The costs of power and network cabling are significantly reduced because a blade chassis shares this cabling, whereas each rack-optimized server must be powered and wired individually.
- ☒ **Improved scalability.** Blade servers are more easily scaled than fixed-capacity monolithic servers to match workload growth, especially growth in the quantity of workloads (versus expansion of a single workload).
- ☒ **Better hardware serviceability.** Unlike both rack-optimized and monolithic servers, the blade architecture supports field-replaceable components, which require less skills and time to service or replace (e.g., a failed processor board, memory segment, or networking component).
- ☒ **Higher power and cooling efficiency.** Blade servers require less power and cooling than rack-optimized servers. Shared power supplies are the key. Whereas each rack-mounted server requires two power supplies, blade servers benefit from their use of efficient shared power infrastructures. This built-in redundancy contributes to high availability.

In summary, IDC views the blade server as an important new architecture that continues to attract enterprise-class workloads. The blade benefits are derived from a shared infrastructure model that includes processing, memory, power, cooling, and networking components.

Benefits of Blade Servers with Embedded Switches

The migration to blade servers enables customers to take the first step toward datacenter efficiency. The implementation of blade servers with embedded switches is the next logical step that expands and enhances the benefits of blade server adoption. A full portfolio of blade server switches is available, enabling enterprises to gain the benefits of deploying switches within the chassis without having to sacrifice data networking features. Regardless of the type of switch interconnect deployed, embedded switches are key to realizing the full benefits of blade server systems.

Infrastructure Integration

Integration of network devices and systems reduces the number of devices to be managed and increases operational efficiency. Embedded blade server switches enhance the consolidation and manageability benefits of a blade server. The integrated switch enables IT managers to reduce the complexity associated with multiple devices without sacrificing performance or functionality. By leveraging the physical management sensors and alerts in place within the chassis, enterprises simplify troubleshooting and optimize server and switch configurations in the datacenter.

Because blades have been designed with simplified connections between individual blades and the chassis into which they slide, cabling has become much less of an issue than it was with rack servers. Fewer cables result in faster installation and fewer potential points of failure, thus freeing up valuable system administrator time.

Integration brings the following benefits to blade server adoption:

- ☒ **Simplified infrastructure management.** Consolidating higher-level switching functions into the blade server lowers the acquisition and operational costs by reducing the complexity of the IT environment and the number of discrete devices installed and managed in a datacenter. Enterprises are finding that the deployment of blade server switches is reducing the reliance on patch panels. A patch panel is used for terminating or interconnecting voice, video, and data circuits. Server blades gained traction when users began to value the higher level of availability and manageability with blade servers, as well as the lower cost of both acquisition and ownership. With most standalone devices, the simple act of cabling and installing the device into the rack can take several hours. With blades and blade server switches, once the chassis and blade server switch are installed, addition of new servers simply requires locking in a new device. The device automatically receives power and a network connection and is immediately ready for use. The ease of installation also makes servicing, replacing, and upgrading blades a relatively quick process.

- ☒ **Improved power and cooling efficiency.** Also, because of the blade design and the centralization of its architecture, a large number of components are shared across all the blades in the chassis (such as power supplies, CD ROMs, switches, systems management modules). This means that a populated chassis requires less computing power than the rack-optimized form factor. In addition, the chassis power supplies are more efficient than those for standalone servers. Since the power consumption per system is reduced, performance per watt is increased and overall power consumption for equivalent computer power is reduced. As noted earlier, embedded blade server switches consume significantly less power and generate less heat than their standalone counterparts.
- ☒ **Greater scalability.** Blade server switch modules improve scalability by allowing server blades and the chassis to be grouped into "Logical Server Nodes." Multiple Logical Server Nodes can be further grouped together to create one "Massive Logical Server." If any Logical Node fails, a designated Node will pick up the tasks of the failed Node. This scalability enables enterprises to rapidly deploy capacity to meet demanding workloads. Bringing the benefits of hardware-accelerated network intelligence into the blade chassis eliminates the complexity of managing multiple devices without sacrificing performance.
- ☒ **Increased application availability.** Integrating a higher-level switch into a blade chassis improves system availability beyond simple hardware hot swap to application-level high availability since the switch seamlessly transforms and directs traffic to a new blade in the event of a failure. The switch can sense when a server blade is either not responding or overloaded and dynamically switch the user to an alternative server in the chassis that will perform as expected.
- ☒ **Increased security.** Blade server switch integration provides increased security benefits. Overall, by decreasing data traffic between the core network and the blade enclosure, customers can reduce the number of times the data is exposed to potential security breaches. Data traffic traversing server blades connected through an embedded blade server switch can't be intercepted, modified, or exploited as easily. Customers such as governments and financial services are particularly sensitive to this benefit of blade server switches.

The benefits of an embedded blade server switch are additive as enterprises look to migrate to next-generation datacenter technology. Some of the new initiatives and environments that benefit from embedded blade server switches are bandwidth-intensive applications, 10GbE, and iSCSI storage.

Advanced-Function Switches

Embedded Layer 2–3 Switches

The most common blade server switch is a Layer 2 switch, which replaces the need for a Layer 2 access switch in the datacenter. As enterprises move to the second and third cycles of blade server evolution, they need sophisticated switching functionality to keep up with advanced workloads on the blade servers. The IP forwarding capabilities of embedded Layer 3 switches provide multiple benefits. Embedded Layer 3 switching

reduces overall traffic on the datacenter network by eliminating the need for local traffic to leave the chassis if multiple subnets are configured on the same blade server chassis. Additionally, embedded Layer 3 switches do not send broadcast traffic out of the chassis, thus conserving valuable bandwidth. For enterprises with heightened security concerns, such as government agencies and financial services firms, containing traffic within the chassis reduces the possibility of a security breach. In short, embedded Layer 2–3 switches eliminate hops, thus reducing overall latency and conserving uplink bandwidth, and save CPU cycles while improving security.

For enterprises migrating a substantial portion of their server architecture to blade servers, a longer-term benefit of embedded Layer 3 switches will be the potential elimination of expensive power- and real estate-hungry aggregation switches and further simplification of the network topology in the datacenter.

Intelligent Networking Layer 2–7 Switches

Application networking is taking hold as enterprises recognize it as a key enabling technology for deriving business value from the corporate network. By securing and optimizing the application, the network can provide a flexible platform to address changing business requirements. Intelligent networking switches that provide Layer 4 and above intelligence help enterprises optimize their server infrastructure with advanced network services. By embedding the Layer 2–7 switch into the blade chassis, enterprises can allocate server capacity dynamically to handle changing application loads and accommodate planned and unplanned server outages without disrupting application availability. Intelligent networking also provides the functionality, availability, and reliability needed to support new converged (voice and data) applications. The ability to distinguish among various types of user access devices so that data can be delivered in the appropriate format will become increasingly critical as enterprises bring mission-critical converged voice applications into the datacenter.

Next-Generation Technologies

Bandwidth-Intensive Applications

One of the first areas of traction with blade servers has been with high-performance clusters, which require broad bandwidth, low latency, and high reliability. These bandwidth-intensive and latency-sensitive applications benefit from the reduced latency inherent in an integrated blade server switch. By eliminating the need to traverse from an access switch to an aggregation switch to the core datacenter switch, embedded blade server switches reduce the latency typically found in the datacenter network. Additionally, organizations are systematically upgrading network bandwidth to satisfy datacenter requirements. The blade server switches provide an environment that is ready to take advantage of 10GbE.

Use of 10 Gigabit Ethernet

Organizations are systematically upgrading network bandwidth to satisfy datacenter requirements. With 10GbE, CIOs can take advantage of the popular Ethernet standard to meet their current datacenter requirements while future proofing their network with higher-speed capability. Increasing server density and multicore processors are driving higher-bandwidth interconnections further into the datacenter. Adoption of 10GbE has been faster than expected, and prices are already dropping.

The price per port of 10Gb dropped 19% from \$5,900 in the third quarter of 2005 to \$4,780 in the third quarter of 2006. Also, 10GbE enables new applications, including IT consolidation, multimedia, high-performance computing, VoIP, and IPTV/video on demand. These applications require higher bandwidth, and in some cases, the QoS expectations are such that high performance (10GbE) is a prerequisite to meeting the QoS requirements. Additionally, the added overhead of security on the network encourages migration to 10GbE.

Blade server switches have a unique opportunity to lead 10GbE adoption in the datacenter because blade server backplanes have been designed up front to handle 10 Gigabit speeds. This built-in design capacity, coupled with the cost advantages from an embedded switch, creates an environment where IDC foresees potential pricing advantages for 10Gb switch ports for blade server switches over conventional access layer switches.

Use of iSCSI Technology

As Ethernet becomes the unifying technology in the datacenter for both storage and data networking, the iSCSI protocol running under TCP/IP on Ethernet further enhances this unification, reducing capital, operational, and staff training costs. The need for simpler and consolidated storage for IT is well established. Fibre Channel is fast and reliable, but complex to deploy and upgrade. Since it uses the well-known Ethernet technology, an iSCSI storage solution is easy to set up and manage and is less costly than Fibre Channel. With its 4Gb bandwidth, Fibre Channel used to have an edge over iSCSI using 1Gb Ethernet, but that advantage has disappeared with the availability of 10GbE capability. Also, with iSCSI, virtualization of disk shelf resources allows for efficient reprovisioning of disk resources. Other iSCSI benefits include low latency and low CPU utilization on the blade server and minimal bandwidth requirements. As the ecosystem of storage continues to encourage iSCSI adoption, blade server switches will be ready to support and encourage migration.

Virtualization

Blade servers provide an effective platform for virtualization. The adoption rate of blade servers for virtualization is almost four times that of other server form factors. As blade servers become the change agent that encourages server virtualization, the intelligent network switch will evolve to support this new datacenter architecture. An intelligent network switch will further the blade's ability to deliver a dynamic virtual environment. The blade server switch has the ability to bring network intelligence back into a server virtualization deployment. Enterprises will no longer have to sacrifice Layer 3 functionality by virtualizing their server architecture within the blades. Examples of switch functionality include resource pools, failover, and secure access.

Blade Network Technologies

One vendor focused on providing blade server switches is Blade Network Technologies. The company is a global supplier of Ethernet, IP, and application switches for blade server systems, with an installed base of more than 100,000 switches, 2 million ports, and over 500,000 connected blade servers.

Blade Network Technologies was established as a fully independent company when it purchased certain assets of Nortel's Blade Server Switch Business Unit. Its end users include a majority of the Fortune 500 companies across 26 different industry segments. The company employs over 90 employees in offices throughout the world.

Blade Network Technologies is the first networking vendor to focus exclusively on the networking needs of the blade and rack-dense server market. Its strategy is to take a multipronged approach to providing blade server switches with strong management, high availability, and advanced security features.

Blade Network Technologies provides custom blade server switches for the IBM BladeCenter that reduce the number of Ethernet cables attached to the rear of the blade enclosure by consolidating network intelligence into the blade chassis. Its recent release of the 10Gb Uplink Ethernet Switch Module was an industry first (see Table 1). The Layer 2–7 switch module provides extended functionality, supporting Layer 4–7 functionality. It was the industry's first Layer 2–7 switch to be integrated into a blade server system. The company achieved another milestone in January 2007 by becoming the industry's first vendor to offer an all-10GbE (10Gb uplink and 10Gb downlink) switch for blade server systems.

TABLE 1

Blade Network Technologies' Switch Modules

Modules for HP BladeSystem	Release date
HP GbE2 Interconnect Switch Module for HP BladeSystem p-Class	August 2003
HP GbE2c Ethernet Blade Switch for HP BladeSystem c-Class	June 2006
Modules for IBM BladeCenter	Release date
Nortel Layer 2–7 Gigabit Ethernet Switch Module	September 2003
Nortel Layer 2–3 Copper Gigabit Ethernet Switch Module	January 2005
Nortel Layer 2–3 Fiber Gigabit Ethernet Switch Module	January 2005
Nortel Layer 2–3 10Gb Uplink Ethernet Switch Module	June 2006
Nortel Layer 2–3 10Gb Ethernet Switch Module	January 2007
Blade Switch Management	Release date
BladeHarmony Manager	May 2006

Source: Blade Network Technologies, 2007

IDC interviewed a customer who has implemented a state-of-the-art new blade server-based datacenter architecture. This international law firm, which counsels some of the largest banks and pharmaceutical companies globally, has offices across the United States, Asia, Europe, and the Middle East. It reported that Blade Network Technologies' embedded switches are a core component of its new architecture. The embedded Blade Network Technologies switches lowered overall costs by reducing the cost of core switch ports as well as increasing the availability of the blade server architecture.

Blade Network Technologies also supplies the most popular blade server switches for the HP BladeSystem c-Class and p-Class, again reducing the number of Ethernet cables attached to the rear of the blade enclosure while adding network intelligence to the blade chassis. The commonality of Blade Network Technologies' switch features and functions across the c-Class and p-Class systems is seen by HP's customers as a major benefit.

The company's BladeHarmony Manager is a Java-based application that runs on Microsoft Windows, providing a graphical user interface for SNMP-based remote management of its blade switch modules. The tool is designed to help enterprises reduce the administrative burden of managing large numbers of blade server switches.

Blade Network Technologies is involved with a number of important industry alliances, including Blade.org and HP BladeSystem Solution Builder.

The company has also taken great pains to ensure that its blade server switch products can interoperate seamlessly in a Cisco backbone to take advantage of the large number of enterprises that run a Cisco-provided backbone.

In addition to providing seamless interoperability in a Cisco core, the company is building its product strategy around a rich operating system with Layer 2–7 capability and higher performance and functionality at a lower price than competitive solutions. Because of its singular focus on blade server networking, the company believes it can innovate faster than its competitors. It is also emphasizing customer support.

Overall, the company's intention is not just to build products for its OEM clients but to proactively help them architect better rack-dense compute solutions for their customers. Blade Network Technologies is well on its way to achieving this goal. IDC spoke with one customer who felt that Blade Network Technologies was very responsive and knowledgeable and that Blade Network Technologies was able to find root cause and provide a solution for the customer's network problem that originated from another vendor's product. This customer was impressed with Blade Network Technologies' ability to work beyond its product and solve problems at the solution level.

IDC Analysis: Opportunities and Challenges

It is clear that demand for blade servers is growing and that customers are increasingly purchasing integrated blade server switching solutions that maximize network intelligence, availability, and density. To stay on this growth trajectory, Blade Network Technologies must continue to develop a portfolio of products that leverage the benefits of blade servers desired by server IT staff while satisfying the bandwidth, management, and security features that network managers expect. By effectively bridging the gap between network and server staff, through functionality and role-based management, Blade Network Technologies will further the adoption of blade server switches.

Having established a leadership position in the market for blade server switches, Blade Network Technologies has a unique opportunity to further its lead by focusing some of its future development efforts to solve a growing customer problem — aggregating multiple blade server systems and multiple racks of blade server systems.

Conclusion

Customers are increasingly looking to blade servers as an architecture that is inherently suited to the requirements of the next-generation datacenter. With blade servers, customers realize lower cost of deployment, improved scalability, better hardware serviceability, and higher power and cooling efficiency. To fully realize the benefits of blade servers, customers must take the next step in adopting blade server switches. Collapsing network access and aggregation layers in blade network topologies can help reduce costs as well as space, power, and cooling requirements while simplifying the datacenter architecture and improving performance and security. When it comes to blade server switch infrastructure, customers have reasons to consider Blade Network Technologies' offerings over other solutions in the market.

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