

I D C V E N D O R S P O T L I G H T

Virtualization 2.0: Opportunities and Challenges for Next-Generation Datacenter Networks

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Adapted from *The Future of Virtualization: Leveraging Mobility to Move Beyond Consolidation* by John Humphreys, IDC # 211938

Sponsored by BLADE Network Technologies Inc.

Server virtualization is now widely accepted as a key method to consolidate computing resources. As companies take advantage of the cost savings of virtualization, they will begin to migrate to what IDC calls Virtualization 2.0 — using virtualization technology to improve business operations and mobility. This document describes enterprise virtualization today and the anticipated uses of this technology, particularly leveraging the capabilities provided by widespread adoption of 10 Gigabit Ethernet (10GbE) as a single, converged network fabric. In addition, challenges for organizations adopting the next generation of virtualization are discussed as is how network virtualization — another form of virtualization — can help meet these challenges. This paper also looks at the role BLADE Network Technologies has in next-generation datacenters with Virtualization 2.0 technologies.

Virtualization Today

Server virtualization now is a mainstream technology. Recent IDC surveys found that over 50% of all customers are employing server virtualization for production applications, including mission-critical applications such as supply chain management and enterprise resource planning. Within the next 12 months, these same users expect nearly half of their applications will be hosted on a virtualized server.

Server virtualization has enabled enterprises to harness the growing power of inexpensive computers and put a higher percentage of purchased capacity to use. An added benefit of virtualization is that organizations are also saving in terms of footprint and power and cooling costs within the datacenter. And server virtualization can also extend the life of datacenters.

This first phase of virtualization — which is primarily deployed for server consolidation — is dramatically changing the economics of IT, simply by addressing capital costs. This phenomenon has influenced the adoption of other IT-changing technologies. IDC sees the rapid adoption of blade servers, for example, as proof. Organizations are combining blades in a chassis, then running virtualization software on top of those blades, consolidating and encapsulating multiple applications to drive up system utilization.

The Next Phase: Virtualization 2.0

Initially, server virtualization technology has been used as a means to consolidate servers by encapsulating an operating system and application into an isolated virtual machine (VM) and then running multiple virtual machines on a physical server. For the most part, this technology has been applied to servers only, but more recently, the concept of consolidating desktops via the technology has been gaining momentum. Both of these applications leverage the encapsulation benefits of virtualization, but the technology also offers mobility benefits — the ability to move a virtual machine from location to location — as well. Such mobility occurs via either a cold migration — which simply copies the virtual machine and restarts a copy somewhere else — or a live migration, which moves a live running virtual machine, while maintaining state.

These attributes are kicking off the next phase of adoption, which IDC calls Virtualization 2.0, in which the mobility capabilities of advances in server and desktop virtualization leverage emerging network virtualization technologies and the high-performance, low-latency, and lossless capabilities provided by 10GbE network topologies to enable a host of new use cases such as business continuity, disaster recovery, and high availability.

In light of these new use cases, organizations are beginning to look at how virtualization can help them address the following datacenter issues:

- Reduce IT administrative costs
- Control IT management costs
- Improve productivity even as IT demands grow
- Reduce energy and cooling costs

Virtualization technology will increasingly play a role in corporate mobility and continuity to reduce downtime and increase the agility of IT. For example, enterprises are looking at virtualization as a way to minimize planned downtime and protect IT assets in case of disaster, ultimately helping them deliver on the concept of service-oriented computing. In addition, virtualization technology can be used as a tool for capacity planning in which users, for example, can treat multiple hosts as a single pool of resources and virtual machine loads can be balanced across the pool based on levels of utilization needs and policies.

Virtualization 2.0: Current Market Challenges

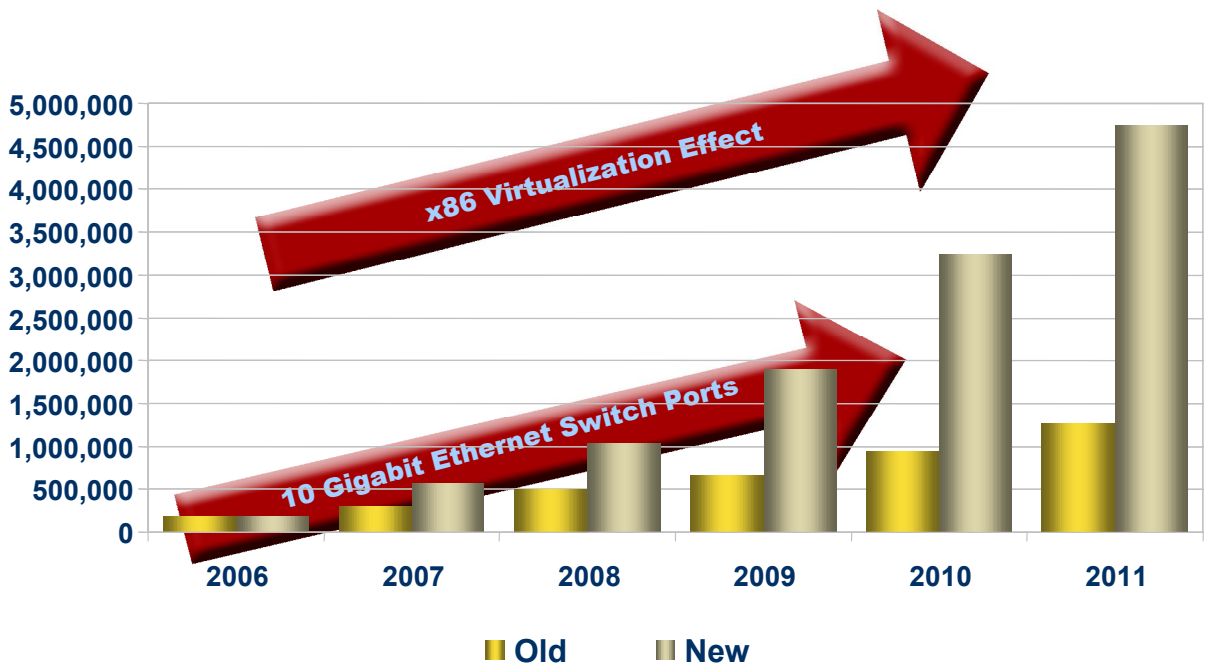
Virtualization 2.0 does have its challenges, however. First, while organizations are comfortable with the concept of virtualization to cut capital costs, there still are cultural barriers to overcome when applying virtualization to improving operations. Champions of Virtualization 2.0 must overcome cultural resistance to sharing systems across different groups within an organization and make sure that no one feels constrained by others using "their" resources. In addition, Virtualization 2.0 will require an updated set of IT management tools and techniques, especially as enterprises move to software-as-a-service models and need to monitor use for chargeback purposes.

The portability and reproducibility of virtual machines increase the complexity of keeping track of corporate resources; when changing corporate IT infrastructure becomes easier, it's logical to expect that change will occur more frequently. Similarly, virtualization will require more coordinated data replication to ensure business continuity and disaster recovery. Virtual machines, because they can be treated like data files, must also be added to an organization's backup program to ensure that nothing is lost in the event of an outage.

Perhaps the greatest challenges that organizations will face when moving to Virtualization 2.0 will be networking and related issues. As with the initial uses of virtualization technology in which multiple images are consolidated into a single server, Virtualization 2.0 will require the consolidation of network traffic and will also increase the need for more bandwidth to the server, both of which will be possible as enterprises make the move to converge and consolidate data, storage, and interprocess traffic on 10GbE networks. In fact, what IDC calls the "Virtualization Effect" is actually fueling the growth of 10GbE switch ports (see Figure 1). With virtual machines moving from host to host in Virtualization 2.0, it's critical that the network identity move as well. In addition, quality of service (QoS) and security policies associated with a virtual machine need to be maintained via a highly flexible 10GbE network topology.

FIGURE 1

Worldwide Datacenter 10 Gigabit Ethernet x86 Switch Port Shipments, 2006–2011



Note: The growth trajectory of 10 Gigabit Ethernet over the coming years is projected to be similar to the growth trajectory of x86 virtualization.

Source: IDC, 2008

In addition, to enable true mobility of virtual machines and allow for appropriate storage, backup, and recovery, physical resources must be connected in a unified fabric-based network rather than a linear-based network. Multiple servers — each running many virtual machines — must connect to others in multiple ways to ensure continuity. This again puts increased bandwidth pressure on the enterprise network. And finally, security is a challenge because it is easier to keep a standalone PC or application more secure through single network connections, password protection, firewalls, and physical devices. Due to its resource and file mobility, Virtualization 2.0 requires a more robust approach to keeping corporate information secure.

The Solution to Virtualization 2.0's Challenges: Network Virtualization

Ironically, the solution to Virtualization 2.0's limitations is virtualization itself. As virtualization technology matures, network technology is keeping pace. First, the cost of 10GbE networks has come down significantly, making it possible for enterprises to increase bandwidth for approximately the same price per port. This addresses the increased I/O demands of Virtualization 2.0.

Second, as enterprise computing continues to migrate to a more blade server/virtual machine-based paradigm, networking also is migrating to a logical view of resources instead of a physical view, which means that virtual networking is rising in the enterprise. Virtual network technology includes blade devices that reside in the same chassis as blade servers as well as virtual network infrastructure, such as VSANs, VLANs, VRFs, VPNs, and so forth.

While blade-based network devices minimize physical connectivity and resource use, virtual networking provides more efficient resource allocation for the network itself. As a result, network traffic is reduced, security is simplified, and control is increased.

When combined with the higher speed of 10GbE, network virtualization at the rack or container level can increase service levels, enable flexible deployment of resources, and improve management due to the fact that network devices can be treated as a service.

Considering BLADE Network Technologies

Privately held BLADE Network Technologies (www.bladenetwork.net), headquartered in Santa Clara, California, spun off from Nortel's Blade Server Switch Business Unit in 2006, with funding from Nortel and Garnett & Helfrich Capital. The company, with more than 150 employees worldwide, has reported a positive cash flow and strong growth from its inception. It is a supplier of Gigabit and 10 Gigabit Ethernet network infrastructure solutions that reside in blade servers and "scale-out" server and storage racks. BLADE's top-of-rack switches — which the company claims are "virtual, cooler, and easier" — demonstrate what it calls "rackonomics," an approach for scaling out datacenter networks to drive down total cost of ownership (TCO) and drive the adoption of Virtualization 2.0. Rackonomics refers to the design and provisioning of server-based network infrastructure and SANs on a rack-by-rack (or container) basis that can be efficiently and effectively replicated in a massive way (see Figure 2).

According to BLADE, the company's customers include over half of the Fortune 500 across 26 industry segments and an installed base of over 200,000 network switches representing more than 1,000,000 servers and over 4.6 million switch ports. BLADE has a leading 45% share of the blade switch market.

BLADE has been a pioneer in the development of intelligent Gigabit and 10 Gigabit Ethernet switches, along with integrated virtualization and switch management software, that address the issues involved in deploying Virtualization 2.0 in scaled out datacenters. These issues include cost, power, ease of use, space, performance, and management. BLADE says its RackSwitch products are the industry's first Ethernet switches for rack-level network virtualization and its 10GbE switches are less than \$500 per port.

BLADE's SmartConnect and VMReady virtualization software products illustrate the company's position in the market for network virtualization and support of emerging server virtualization technologies.

SmartConnect software, running on the BLADE Ethernet switches, decouples server provisioning and network configuration tasks. Server capacity can be scaled by server administrators without requiring configuration of VLANs, spanning tree, routing protocols, or other network details via an intuitive drag-and-drop GUI interface. This allows server administrators the flexibility to reconfigure servers without involving network administrators. On the other side of the Ethernet switch, virtual interfaces to applications within the servers are presented as single attachment points for whole groups of servers.

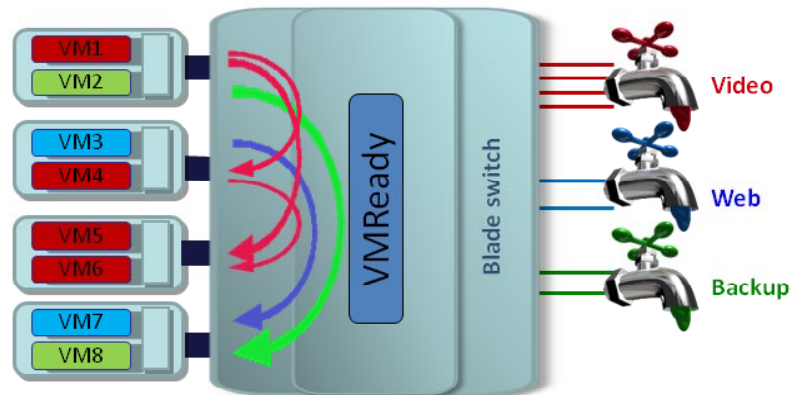
Network engineers can treat an entire rack of servers as a single large server with a common attachment point — greatly simplifying network designs. These principles should reduce the workload on both server and network professionals, speed implementation times, and apply to network-attached storage, blade servers, and rackmounted servers. BLADE's SmartConnect is designed to simplify administrative tasks, such as deployment, control, and policy administration, thus reducing the TCO associated with blade server systems.

FIGURE 2

Network Virtualization at the Rack Level

VMReady Virtualization

- Moves network and security policies with the virtual server
- Enables VM movement across a blade chassis or rack
- Runs on the switch, not on the server
- Works with VMware, Hyper-V and Xen



Note: BLADE's virtualization strategy moves network and security policies for all virtualization products.

Source: BLADE Network Technologies, 2008

VMReady is another software feature residing on BLADE's Ethernet switches that saves a huge amount of the IT administrator's time by automating the networking reconfiguration after a VM move. It enables configuration of network and security policies per virtual machine, allowing administrators to apply different network settings such as QoS, access control lists (ACLs), or IGMP snooping for each virtual machine. It monitors the creation and movement of virtual machines — whether they are moved for maintenance reasons or replicated to enable application scaling — and then takes action to ensure that network settings are migrated along with the virtual machine. This prevents the possibility of virtual machines being moved to servers with the wrong VLAN or other network settings. VMReady thus reduces the risk of an application outage due to a misconfigured network as well as the security risk of exposing a sensitive application to incorrect networks. VMReady removes a major obstacle to enabling VM movement — because it allows VMs to be moved without opening security vulnerabilities. Additionally, VMReady network policies are handled purely in switching hardware.

BLADE's VMReady provides policy-based configuration and automatic security policy migration during VMotion. However, VMReady is a more open approach since it works with all virtualization products, including VMware, Microsoft's Hyper-V, Xen, xVM, Virtual Iron, and so forth, without modification of Virtual Machine Hypervisors. It also works in multivendor networks and is available on BLADE's physical stackable switches.

The company's BLADEHarmony Manager allows datacenter administrators to manage thousands of its switches with a single mouse click. Working in combination with network management tools as well as server management tools, BLADEHarmony Manager adds an extra level of control to enable large and rapidly scaling datacenters.

The company has two routes to market for its solutions: Its embedded switches and software are sold through blade server industry leaders and OEM partners. BLADE's switches are an integral part of HP BladeSystems, IBM BladeCenters, NEC SIGMABlades, and Verari Systems' blade servers. Its newly introduced BLADE-branded top-of-rack Gigabit and 10 Gigabit Ethernet RackSwitch family is sold through some of the same OEM partners, plus direct and through VARs and resellers.

BLADE says that its advances in network virtualization, combined with the higher speeds, lower latency, and emerging standards-based lossless capabilities of 10GbE, enable organizations to create converged, single-fabric, multiconnection networks that offer the flexibility and speed required by service-oriented virtual computing while ensuring that expansion of datacenter virtualization demands can be met over time.

Challenges

The company does face challenges, however. First, BLADE Network Technologies is primarily known as an OEM supplier to very high-profile blade networking providers HP, IBM, NEC, and Verari Systems. While its rackonomics strategy is a major step, the company must work to highlight the performance and virtualization advantages of its blade networking and BLADE-branded hardware and software solutions. Perhaps more importantly, BLADE Network Technologies must continue its rapid innovation to stay ahead of its competitors.

While the company has garnered a leadership position in blade networking, especially in the area of network virtualization, it is only a matter of time before its competitors jump on the bandwagon. BLADE Network Technologies must be prepared for a tough battle for market leadership that goes beyond its technology advantages to include mindshare.

Furthermore, as the market grows, BLADE Network must come up with new innovations, competitive margins, and service and support options to motivate their OEM partners to continue to buy, instead of build.

Conclusion

Today's enterprises are increasing their use of virtual machines to consolidate resources and cut costs. This trend will continue with what IDC calls Virtualization 2.0, which will be used for administrative cost reduction, better resource allocation, more efficient management, and increased flexibility in a mobile world. In short, organizations will use virtualization to improve operations.

Companies are starting to take advantage of the fact that virtual machines are essentially files and the next wave of virtual applications is leveraging live migration capabilities. This will enable new virtualization models around disaster recovery, high availability, and — combined with SOA — an ability to deliver true service-oriented computing.

This next phase of virtualization is not without hurdles, however, particularly in the areas of cultural acceptance, new management tasks, and data replication and business continuity. In particular, Virtualization 2.0 presents key hurdles in networking and security, as increased computing efficiency and server/file mobility place more demands on the enterprise network. Ironically, one key to solving the challenges associated with Virtualization 2.0 is another form of virtualization — network virtualization.

By mirroring the paradigm of virtual machines and moving to a blade and top-of-rack datacenter network infrastructure where switches are housed in the same chassis or rack as servers, organizations can improve network performance and security. With the increased availability of affordable 10GbE, organizations also can make the move to a single, converged, multiconnection fabric for LANs and SANs, ensuring high availability and service-oriented computing.

IDC believes the market for Virtualization 2.0 networking technologies is an important one. To the extent that BLADE Network Technologies can overcome its challenges, IDC believes that the company should be on the short list of any organization looking to virtualization as a way not only to cut costs but also to improve operations in an increasingly mobile world.

A B O U T T H I S P U B L I C A T I O N

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Global Headquarters: 5 Speen Street Framingham, MA 01701 USA P.508.872.8200 F.508.935.4015 www.idc.com