

Analyst Viewpoint Article

Future Datacenter Management Strength - Network Convergence

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IDC Observation

Today, enterprises have been struggling to adapt to the agile growth of business applications and the needs for computing infrastructure. The frequent upgrading of the existing enterprise network infrastructures causes the higher pressure from total cost of ownership (TCO). The diverse networks among different business demands are largely threatening the infrastructure saturation and management operations. IDC believes that new technologies, such as server virtualization, blade, thin provisioning and network consolidation, will eventually change the IT industry, as well as the performance measurement at the business level. Considering emerging technologies and their relations, global IT market perspectives, and users' requirements, IDC has made the following estimates according to the data center market research:

- Energy efficiency and network compliance will require enterprise users' focus. Besides the business competitions, enterprise management realizes the importance of self-evaluation inside the computing infrastructure. The business value must be secured and effectively used within the enterprise, and it must also reduce the demands from the environmental cost, especially from the source materials.
- Data centers have rapidly adopted emerging technologies today. With the advent of highly virtualized data centers brought about by increased levels of server virtualization, it is a natural progression that networks will need to be integrated. and in the process, higher degrees of consolidation will be required to ensure IT budgets are kept within reasonable limits.
- The present economic fluctuation reflects the enterprise users' buying state-of-mind. In the meantime, power saving and business running efficiency are not the only points in a bad economic situation. With the macro economy recovering, IT managers need an efficient and sustainable method to improve their data centers. With increasing stresses from business network accessibility, most local enterprise users are looking forward to new ways of increasing network bandwidth, which must provide higher speed of I/O. InfiniBand, iSCSI and Fibre Channel over Ethernet (FCoE) are hot topics among data centers on the Ethernet network. Some aggressive IT owners have positioned themselves for the future by deploying high speed Ethernet in every possible enterprise data center.
- IDC projects that FCoE will take off around late 2010 and significantly offer a transformation opportunity to long-history Fibre Channel users. With the offering, many local Fibre Channel users could make the decision to step to high-speed network technology with no waste of existing hardware infrastructure.

Background

The economy downturn that affected the global market in 2009 led to a significant slowdown in IT spending across the world. In reality, IT, specifically enterprise, systems were mainly impacted by the lower turnover budget. The one particular area that most enterprise data center managers are considering is the existing complexity of network infrastructure. The challenge determines the necessity of IT managers to look forward to technology and infrastructure innovations.

The common acceptance from the majority is that business value today essentially relies on its computing infrastructure and its broad array of services. With the demand derived from business services, enterprise infrastructures inherently face an infrastructure sprawl fueled by the proliferation of servers, networks, and storage. Hence, the growth increased costs for cooling, space, and management complexity, and it reduced operational efficiency. To best solve the increase of the enterprise TCO, the industry tends to empower the network infrastructure with consolidation technologies such as server virtualization and blade, which both help transfer high-level physical server density to virtual density.

At present, the best way to consolidate the data center is using virtualization. Virtualization is essential to saving energy and improving management in data center systems. It can address data center inefficiencies by separating software from the complex hardware infrastructure. Furthermore, virtualization means deployment of fewer machines in data centers, which also means less electricity used for power and cooling. The association of high I/O bandwidth enables the network transformation and ensures the infrastructure mobility. After all, consolidation simplifies the infrastructure for savings across system connections, hardware installations, power, cabling, space, and management operations.

IDC's opinion is that the network consolidation includes the infrastructure re-designs using converged network adapters (CNAs) that allow multiple data transmission protocols accessed via a single and simple architecture. This innovation will significantly improve the data center network efficiency and management operational sufficiency at the critical business point.

Network Connection Demands

Ever since the late 1990s, data center runners have been forced to maintain multiple networks in order to meet diverse business applications using different connectivities. Traditionally, the data center includes separate networks for purposes of dealing with file servers, internal management wares, business applications, and storage connectivity. The clustering network typically requires a high-performance environment using high I/O InfiniBand protocols. However, the management and client-server connectivity is usually made up of IP network over the Ethernet. Also, the storage network is commonly between the Fibre Channel and the latest invention – iSCSI. All these networks are physically separated and established in isolated architecture.

Although the separate networks maintained for individual purposes of computing create lower business risks at the infrastructure level, many IT managers could not deny the fact that the growing cost of network complexity is unaffordable sooner or later in their organizations. The costs are messy due to the increasing numbers of servers, storage systems, switch ports, cables, and even cooling systems. Moreover, managers are facing challenges to operate effective maintenance and other system services in an adequate time frame. Apparently, the needs for system virtualization and network convergence have become vital, and IT managers are, more than ever, eager to incorporate these solutions into their data center infrastructure. At the same time, green perspectives drive the data center consolidations.

In fact, the converged network is broadly accepting transferring data via an enhanced IP network. No matter the upper level of networks based on Fibre Channel or InfiniBand, the data transferring protocols will apply IP network. However, the difficulty today is how the converged network transfers different data from different sources. It becomes the essence of the data center virtualization and systems consolidation. For example, storage data usually consists of a large number of packets. Usually, the smaller ones are typically latency sensitive. The converged network needs to provide classified priority groupings to allow for different resource allocation so that different data transferring types can get their fair share of the bandwidth. Saving data and allowing frequent access via single and simple converged networks are becoming critical in the future data center networks. Most IT developers believe the solution will rely on innovation at the hardware infrastructure level, particularly at the top point of the entire hardware architecture – the CNA.

IDC predicts that network convergence will be the key to solve the system virtualizations in the data center. This solution is simply propagated by the innovation of CNAs, which offer

multiple access ports, including high-speed Fibre Channel, iSCSI, InfiniBand, and even upcoming FCoE. This technology would enable the simplified data transactions among all different networks. Most importantly, it would reduce the current costs in hardware purchase, associated power, cooling, and cabling. This inevitably indicates significant optimization at management operations.

Advantages of Network Convergence

Network convergence would provide data access over Ethernet with several key advantages, including:

- Simplified network infrastructure and reduced TCO - A converged network with enhanced Ethernet reduces the number of adapters, switch ports, and cables compared to the conventional “dual-networks” option. The potential CNA should be capable of bundling traditional Fibre Channel Host Bust Adapters (HBAs), iSCSI adapters, and FCoE CNAs together in a single “chip” form, which unifies the management functions and provides strong data exchange connectivities. With the availability of network convergence over Ethernet, mid-tier and front-end servers will now be able to leverage the advantages of external storage by migrating from a direct attached storage (DAS) to an external storage infrastructure. In addition, network convergence also significantly reduces the power consumption across the data center by reducing the number of adapters and switches required.
- Improved data center operational efficiency - Through the use of “wire-once” architecture, an Ethernet converged network helps streamline and eliminate repeated administrative tasks such as server and network provisioning, enabling IT managers to efficiently handle Storage Area Network (SAN) growth with existing resources and personnel.
- Increasingly agile IT responsiveness - A converged network enables IT managers to rapidly respond to requests for new services and configurations with the capability to dynamically modify bandwidth allocations. When combined with server virtualization and virtual server mobility, the ability to dynamically modify network parameters lays the foundation for utility data centers.
- Reduced hardware inventory and extended upgrading cycle - Supported by the wire-once architecture, IT managers now can stock a lesser number of blade or virtualized configurations regardless of whether the server system is to be connected to external SAN storage or not. Beyond that, the converged network essentially reduced the need for switch ports and cables among these ports. By reducing a single switch, the data center may reduce up to 16 cables and associated nodes and an intangible cost of space and maintenance.

With the network convergence, virtualization could deliver the best result of power savings and a new way of deploying IT infrastructure with sufficient flexibility.

IDC findings for Data Center Virtualization and Network Convergence - A Real Case in Asia/Pacific

Before			After		
Type	Unit	Power	Type	Unit	Power
.1 CPU	-300	-475 W	.1 CPU	---	-.550 W
.2 CPU	-500	-550 W	.2 CPU	-.38	-.675 W
.4 CPU	-200	-950 W	.4 CPU	-.38	-.1150 W
.8 CPU	---	-1600 W	.8 CPU	-.4	-.1900 W
-200 Racks and 4700 Square Inches			-10 Racks and 235 Square Inches		
-Power Cost: \$289,878/Annual			-Power Cost: \$36,718/Annual		
-Cooling Cost: \$362,348/Annual			-Cooling Cost: \$45,897/Annual		

Source: IDC, 2008

Market Forecast

With the economic downturn hitting the IT industry, as a whole, IT managers would be well-advised to invest high-value return fields, such as virtualization and network convergence. Especially in the network connection frontier, IDC expects that a growing number of market-competitive companies will opt for FCoE as an alternative to Fibre Channel in their existing business environment. However, while broad adoption of FCoE or iSCSI (IP SAN) wouldn't start until late 2010 due to the technology maturity and current data center saturation, today, many users would still prefer to keep their enterprise infrastructure stabilized on Fibre Channel network.

"IDC expects accelerated deployment of FCoE CNAs (market revenue for these products will approach \$340 million in 2012) to be the more important long-term inhibitor of Fibre Channel HBA growth. As a consequence, the 2008–2013 CAGR for Fibre Channel HBA market revenue will be -6.4%. The expanded purchase of FCoE CNAs in 2011 and beyond, however, will mean that combined spending on these two solutions (Fibre Channel HBAs and FCoE CNAs) will begin rising again in 2011. The combined 2008–2013 CAGR for Fibre Channel HBA and FCoE CNA market revenue will be 1.4%," says Richard Villars, vice president of storage systems research, IDC.

Technology Transition

Network convergence will be introduced into the network in stages. By providing the initial transformation to Ethernet, Fibre Channel users will first establish the FCoE network via an FCoE CNA. This will lead the infrastructure transformation based on 1Gb at present to 10Gb Ethernet (10GbE).

The 10GbE transition is already starting. While network convergence merges into the user's market, the 10GbE will provide the following benefits:

- 10GbE for network interface card (NIC), iSCSI, and FCoE requires offload: 10Gb more than meets the bandwidth requirement in data center consolidation and as a switching fabric for cluster network communications. With dynamic TCP offload added to 10Gb adapters, users will see the benefits of removing TCP processing from the host computers.
- NIC section: 10Gb NIC would be used mostly on a server with lots of memory, which is also the trend of Nehalem (Intel new CPU). This configuration will be popular among servers.
- iSCSI Section: While prior implementation of iSCSI SANs typically employed NICs, an iSCSI software, and Ethernet switches in a segregated network, the emergence of 10Gb enables iSCSI traffic to be carried over a single Ethernet infrastructure.
- FCoE Section: FCoE is a standard being developed by INCITS T11 and will leverage the enhanced features of 10Gb Ethernet for I/O consolidation in the data center. It combines two leading technologies, the Fibre Channel protocol and Ethernet, to provide more options to end-users for SAN connectivity and networking.

And for those existing IP networks, users may have the option to move to 40Gb sooner rather than later in 2011. However, enterprise users may still remain with their Fibre Channel network and upgrade to higher I/O bandwidth, 8Gb or 16Gb in two years. The first stage for both traditional Fibre Channel users and IP users will offer the flexibility to transfer data among all different networks.

Network convergence will eventually enable the consolidation of the protocols to serve the system virtualization, and further provide the unified management operations in efficient environments. In reality, it will significantly reduce the switches, ports, connections, as well as cables among different networks.

Actions to Consider

IT managers have wisely accepted the trend that Ethernet will be placed in the data center together with Fibre Channel, combining for an integration of the enterprise infrastructure. The only question is which block protocol is best when both iSCSI and FCoE are offering significant value to entire enterprise networks and storage systems. The evaluation of the current enterprise circumstances and deciding which technology is best to adopt for network convergence is critical for all IT managers today in China:

□ Case I – Data centers with historical investments in Fibre Channel network

Most data centers at present, built to serve the core business values, have dedicated specialized resources and unique networks using Fibre Channel, such as telecom internal data centers, banking on highly consolidated data centers and government disaster recovery centers. During the migration, these data centers will need to address growing needs for data center bandwidth and data computing capability by either updating the Fibre Channel network into a higher speed level, shifting from 4Gb Fibre Channel to 8Gb or even higher 16Gb Fibre Channel, or transitioning from Fibre Channel to FCoE at 10Gb Ethernet or even higher at 40Gb. The transformation will pay for the extended investment to Fibre Channel architecture and disk storage components, while still remaining with the basic Fibre Channel infrastructure with historical investment. The new switch/adaptor will offer the flexibility among Ethernet, FCoE, and Fibre Channel ports, and will enable consolidations between the Ethernet and existing Fibre Channel networks.

Case II – Building new data centers

With new data center requirements, it is obvious that building the network based on 10Gb Ethernet can satisfy the needs of I/O streams for business. Both iSCSI and FCoE could be leveraged in the converged network. The fact is that the decision is based on the business size today and potential growth. Normally, IT managers and the majority of the data center runners have strong faith in the Fibre Channel fabric, so that the future will tend to leverage FCoE CNAs and Ethernet while the technology is ready for deployment. After all, standard-compliant products and network interoperability are essential to transition FCoE into a wide-scale network convergence in the enterprise data center.

Market Opportunity

Today, data center runners are looking forward to the consolidation of network infrastructures. This will be impacted by the business integration or migration between different applications, and it will also involve a mixture of storage networks: Fibre Channel, iSCSI, NAS, and even DAS. The converged network will provide key benefits to IT managers:

- Enable the server virtualization at hardware infrastructure level, while cutting off extra costs to switches, adapters/HBAs and possible systems
- Improve data accessibility across the diverse networks, via higher I/O bandwidth, and offer the path among different network infrastructures via a single and simple adaptor at the host side
- Provide the opportunity to re-tune the environmental costs, such as power, cooling, cabling, and floor
- Significantly focus on operational flexibility and comprehension while the converged network simply applies consolidated management on a virtualized platform.

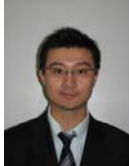
The fact is, most IT managers will have to make choices based on their own needs very soon, whether they choose iSCSI, FCoE or even Fibre Channel. They will always be served by the market inventors with the latest and the most powerful technologies. Moreover, there is the promise that the data center will be consolidated to ease the management practices among different networks and multiple business applications. Interoperation is going to trend toward breaking down the existing network blocks, reducing TCO, and improving energy efficiency.

In addition to considering the execution choices for better operations in enterprise infrastructure, IT managers have to identify the needs of the business diversity and possible solutions for future directions. Inevitably, energy savings and sustainable development have

become the focus for business firms today. Government not only insists on better IT efficiency and green compliance, but the telecom, finance and emerging sectors, and large enterprises put more resources toward developing more efficient and flexible business architectures. The enterprise users should consider the enterprise's useable resources and environmental protection responsibilities. They should also develop strategic objectives and processes to best fit with business growth.

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Reco Li is a Senior Research Analyst in storage research at IDC Asia/Pacific, based in Beijing. He is responsible for the disk storage and vertical industry markets research in the Asia/Pacific region. In his role, Reco analyzes market trends, new business models, product innovation deployment and channel selling strategies of disk storage in the region, and assesses how storage is implemented in diverse industrial IT infrastructures. He also conducts field consulting and on-demand research for storage research.

Reco's expertise includes IP networking, high-performance computing, blade storage, server and storage virtualization, cloud computing, and video surveillance systems and their market development strategies.

Reco was previously a Senior Research Analyst at IDC China's enterprise system group where he was responsible for the enterprise storage systems market and related customized and consulting projects. During his four years at IDC China, Reco led IDC's China Green IT research practice and greatly influenced the Green IT roadmap in the country. Reco has been quoted in a number of local publications including *CEO/CIO*, *Computer World*, *IT Manager*, *Storage & Server* and *The Office Automation*. He has also been a featured speaker at numerous industry conferences on the topics of "Green IT" and "Next Generation Data Centers", and appeared as a guest commentator on television networks.



Jason Chen is a research analyst for the Computing Systems Research team in IDC China. He is responsible for research on the x86 server market, and is involved in customized projects. Jason is in charge of project plans, desk research, client interviews, data processing, and analysis.

Jason has a solid IT analyzing and consulting background. In addition to the server market, he is also proficient in CRM solutions, data warehousing, and business intelligence systems. He led or was involved in many relevant projects for large enterprises.

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