

# White Paper

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## **The Converged Network**

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## Introduction

Rapidly changing business requirements present formidable challenges in heavily siloed legacy data centers. In order to achieve tighter alignment with the business, next generation data centers must be able to meet current business requirements while maintaining the flexibility needed to accommodate any unanticipated future needs. To accomplish this objective, many organizations embarked on data center and infrastructure consolidation initiatives. The goal is to eliminate monolithic legacy data centers and infrastructure and replace them with consolidated, highly virtualized, and flexible environments capable of rapidly adapting to ever-evolving business needs.

Numerous technologies are available to turn this concept into reality. Certainly, virtualization technologies in the server and storage domains are major catalysts driving this move, but other emerging technologies will help drive increased performance and flexibility. New processor technologies, like the new Nehalem EX, will ensure adequate processing power and, with server virtualization driving the adoption of networked storage environments, the network will play a more strategic role. Advances in network protocols will enable organizations to deploy a single converged network, instead of multiple purpose built environments, that can handle a broad range of uses. Based on 10 Gb Ethernet, the next generation converged network will need to be capable of running any type of traffic: block or file, storage and data, or server to server. These changes should be able to take place dynamically—and eventually even automatically—like VMware’s Dynamic Resource Scheduler. With a next generation converged network in place, organizations can derive the maximum value from virtualized computing and storage resources.

The biggest questions that many customers face are “when” and “how” to transition from today’s data center to that of the future. When should they replace the disparate networks that have created islands of inefficiently used compute and storage infrastructure with a converged network capable of creating a highly flexible, available, and converged data center? How should they go about this process? Is it a complete forklift upgrade or can it be done over time, leveraging existing assets? This paper will discuss the current state of data center networks and outline how and when organizations can best prepare themselves to adopt a converged network.

## Current State of Enterprise Networks

Enterprise applications have largely been built on highly segmented, purpose built network environments based on availability, cost, and performance requirements. There are separate networks for data and storage—and the storage network is even more segmented. Storage networks leverage protocols like Fibre Channel, iSCSI, and Ethernet—though this doesn’t include mainframe environments running ESCON and FICON or High Performance Computing (HPC) environments leveraging InfiniBand. Historically, Fibre Channel environments have been used for mission critical production environments and iSCSI or Ethernet have been relegated to Tier 2 applications, test and development, or file services.

Unfortunately, disparate infrastructures are costly to build and maintain. Fibre Channel networks require higher levels of both CAPEX and OPEX investments due to its performance (8Gb), smaller market size, and, operationally speaking, the fact that it requires specific skill sets and a dedicated team. Despite its higher cost, organizations selected it to ensure the highest levels of performance. The iSCSI protocol was the first attempt to drive storage over Ethernet, but TCP/IP offloads, dropped packets, congestion, and 1 Gb performance limited its adoption, especially in support of high performance applications. In many organizations, a separate team manages this environment.

Many organizations have significant investments in these highly specialized environments and are not likely to be motivated to make major changes—at least, not until the equipment has depreciated and there is a suitable replacement available. “Suitable” is the operative word here; for most organizations, a suitable solution must be fully tested and certified.

In addition to monetary investments in disparate technologies, IT organizations face a very real—and understandable—fear of change, impeding adoption of new approaches. Certainly, this fear does not apply to the minor changes that occur on a daily basis in every data center, but the kind of wholesale changes required for a transformation to a converged network can be scary. The general sentiment is, “if it isn’t broken, why fix it?” The

problem is that from the perspective of the business, the current model is broken; IT can't respond as quickly as it needs to. Fear of change comes from the fact that with a career on the line, IT needs to ensure that any new solution introduced will work as well as the old one or better—before widely deploying it.

## What's Needed

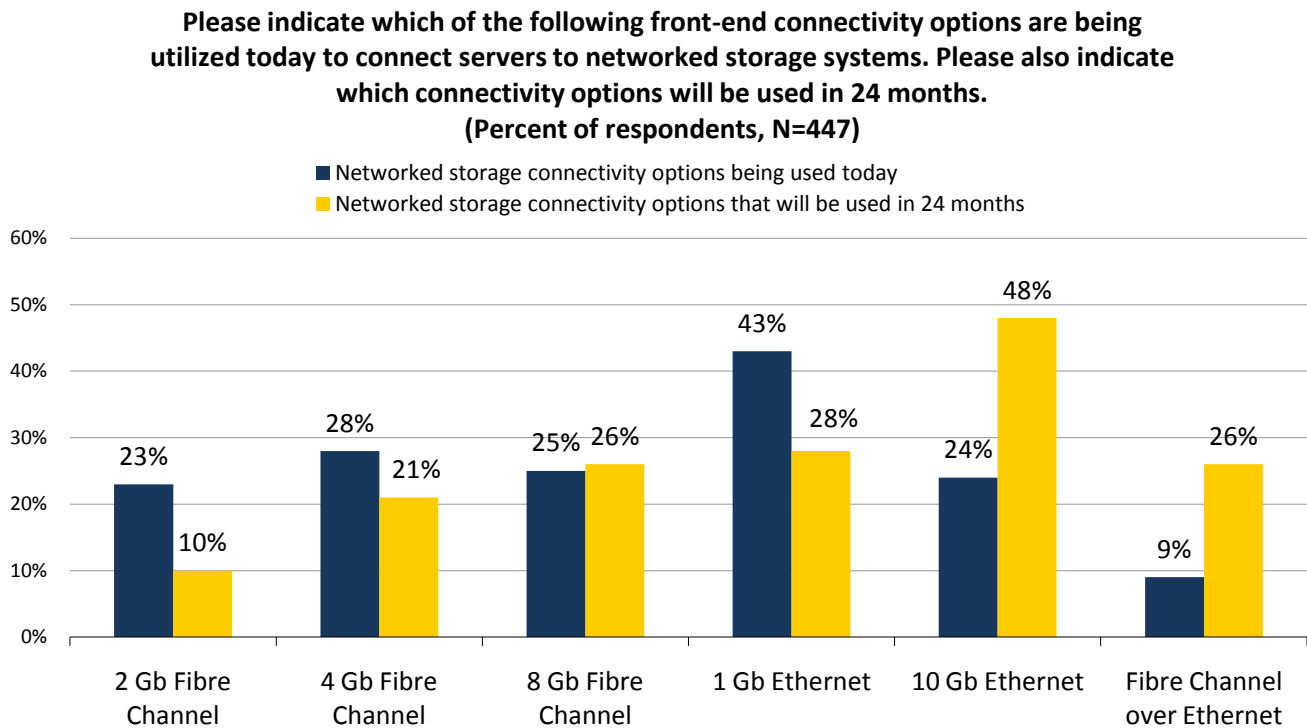
IT needs a converged network that can handle current business demands with a roadmap that ensures future needs will be met. Because we don't know what those requirements will be, the network needs to be prepared for any eventual service. It also means the ability to wire once to all devices and then dynamically reallocate resources via the network is a must. Ideally, this converged network would have the following characteristics:

- **High performance:** The network must be able to handle low latency, high transaction processing applications. The bar that must be met or passed is the one for set by 8Gb Fibre Channel and used in most production environments. Ideally, it would also be able to meet or exceed the requirements in the HPC market for InfiniBand.
- **Ubiquity:** If it is to be widely adopted, the converged network can't be another highly specialized environment requiring specific training and management tools. It needs to be simple to deploy and leverage existing skill sets and, if possible, management tools. This will not only keep costs down, it will also ensure minimal disruption to the business. All this points to an Ethernet network; as Bob Metcalf the founder of Ethernet once said, "I don't know what will come after Ethernet, but it will be called Ethernet."
- **High bandwidth:** Data growth continues unabated and the need to share that information is also expanding. As a result, more data will traverse internal and external networks than ever before. So it is imperative that the network will be able to accommodate not only current needs, but future ones as well. A roadmap that accommodates extreme growth would be required.
- **Flexibility:** Organizations will still need tiering in the network based on performance characteristics, so any converged network should include the ability to enable Quality of Service (QoS) and handle the widest range of protocols (FCoE, iSCSI, Ethernet). Also, because organizations have significant existing investments in current network protocols, like FC, a converged network needs to be able to seamlessly co-exist until a complete transformation can be made. Ideally, this would include the capability for a protocol to be introduced in one area and then grow organically. The reality is that several networks will co-exist over the next several years. In fact, as shown in Figure 1, ESG research indicates that over the next two years, 8Gb Fibre Channel will continue to grow slightly and 10 Gb Ethernet and Fibre Channel over Ethernet (FCoE) will post significant gains.<sup>1</sup>

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<sup>1</sup> Source: ESG Research Report, *ESG 2008 Enterprise Storage Survey*, November 2008.

Figure 1. Network Connectivity Options



Source: Enterprise Strategy Group, 2008.

## Convergence Will Work Now

In the past, there was always good reason for having different networks for different environments. So why is it different now? Let's take a look at some of the reasons why converged networking will now work and why Ethernet is the likely choice for the converged network:

- Performance issues have been solved for the storage environment:** In order to create a converged network based on Ethernet, some changes were required. Ethernet needed to support low latency, lossless storage protocols like Fibre Channel. In order to accomplish this, Converged Enhanced Ethernet was created to eliminate congestion and dropped packets. These advances in the Ethernet protocol have opened the door for Fibre Channel over Ethernet. It should also benefit iSCSI environments.
- Dynamic infrastructure requires any to any ubiquity:** Server virtualization is driving the need for networked storage environments. The dynamic nature of server virtualization means that virtual machines can be quickly and easily reallocated and the network needs to be able to respond with the appropriate levels of performance and still ensure connectivity to the appropriate storage, regardless of which physical server is hosting the VM.
- Available solutions preserve existing infrastructure:** The converged networking solutions available today allow organizations to leverage existing Fibre Channel infrastructure like storage arrays and FC switches, but using FCoE can effectively consolidate the network from the server through the top of the rack or end of the row. Essentially, FCoE provides existing FC users with a way to gracefully migrate away from FC at their own pace.
- It offers a more attractive roadmap:** An Ethernet-based network will yield additional benefits down the road in terms of performance and bandwidth. While currently at 10 Gb/s, the Ethernet roadmap extends to 40 Gb/s and then to 100 Gb/s. There is some thought that many vendors will bypass 40 Gb/s and go directly to 100 Gb/s. These speeds easily surpass Fibre Channel, which is currently at 8 Gb/s and is only slated to reach 16 Gb/s.

- **Price points for 10 GigE technology have dropped dramatically:** Like any new technology, when 10 Gb Ethernet was first introduced, it carried a pricing premium. As volume and the number of suppliers have increased, the price has decreased. When 10 GbE was first introduced more than four years ago, pricing exceeded \$40,000 per port. Today, however, it is under \$500 per port, making it far more attractive for widespread adoption. Users should expect that converged network adapters—which also allow storage traffic like FCoE—will carry a premium over standard 10 Gb Ethernet cards, but even those prices should decline as volume increases over the next year.
- **Management also converges in a converged network:** Joining the physical Fibre Channel and Ethernet networks means that the management of these domains is also converging. The storage and networking teams will need access to management tools for the same devices. Fortunately, vendors have recognized this and created unified management solutions that enable separate logon and management of each logical domain. This is important if organizations are to retain complete control over the converged network adaptor and continue to have insight from the applications through to the storage layer. Even more important is the fact that vendors have provided adequate security so changes made by one domain will not affect any other.

## Steps Organizations Should Take Now

With most, if not all, of the hurdles out the way, converged networks are poised to take off. But what is the best way to begin the convergence process? There are a couple of things that organizations should be thinking about now, including:

- **Deploying converged networking where and when it makes the most sense.**
  1. Between the end of 2009 and the beginning of 2010, organizations should be setting up test environments and piloting converged network technology.
  2. It doesn't make a great deal of sense to rip and replace existing FC and Ethernet cards, cabling and switches; however, for any new server environment, organizations should strongly consider a converged network.
  3. Start by converging networks at the top of the rack or the end of the row. Many organizations have large investments in core FC fabrics and arrays; converging over FCoE helps protect that existing storage investment while driving down complexity and, eventually, costs as well.
  4. Every server should be enabled with CNAs, especially in a highly virtualized server environment. While day one requirements may only need Ethernet and not FCoE, once in a highly dynamic environment, the workloads can shift and organizations need to be prepared. Look for solutions that offer flexible pricing based on usage.
- **Planning for the all Ethernet environment.**
  1. Organizations should closely follow standards and technology developments. If Ethernet continues to develop along its projected path, and the Converged Enhanced Ethernet standards develop with it, there could be implications for InfiniBand and perhaps even the mainframe.
  2. Think about preparing staff for convergence. Consider cross training and integrating the network and storage teams. Actually, forward looking organizations should leverage this opportunity to drive greater cohesiveness throughout all of IT so that IT is more closely aligned with the business, delivering a service that matches business priorities.

## The Bigger Truth

The need for tighter alignment between business and IT will become more pervasive as time passes. In order for IT to accomplish this objective, it needs to be able to respond quickly. Organizations are on a path to upgrade the infrastructure to better support a dynamic environment by virtualizing server and storage resources. Now, IT needs to focus on how a converged network can result in ever tighter alignment, providing greater agility and more efficient use of existing and future resources.

For those on the fence about deploying a converged network, take into consideration that the pricing has come down dramatically and the technology is now stable and ready to be deployed. With ratification around the corner in 2010 for both CEE and FCoE, organizations should be prepared to take advantage of converged networking. As 2009 draws to an end, it would appear that most of the major vendor qualifications have been or will be announced. 2010 will be the year to fully test and pilot converged network environments and by 2011 organizations should be prepared to deploy into production environments. So, given that the technology issues have been resolved, second generation technology is currently available and pricing for converged 10Gb ports are nearing commodity pricing, what are you waiting for?



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