

# White Paper

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## **Network Convergence in the Data Center Makes Sense**

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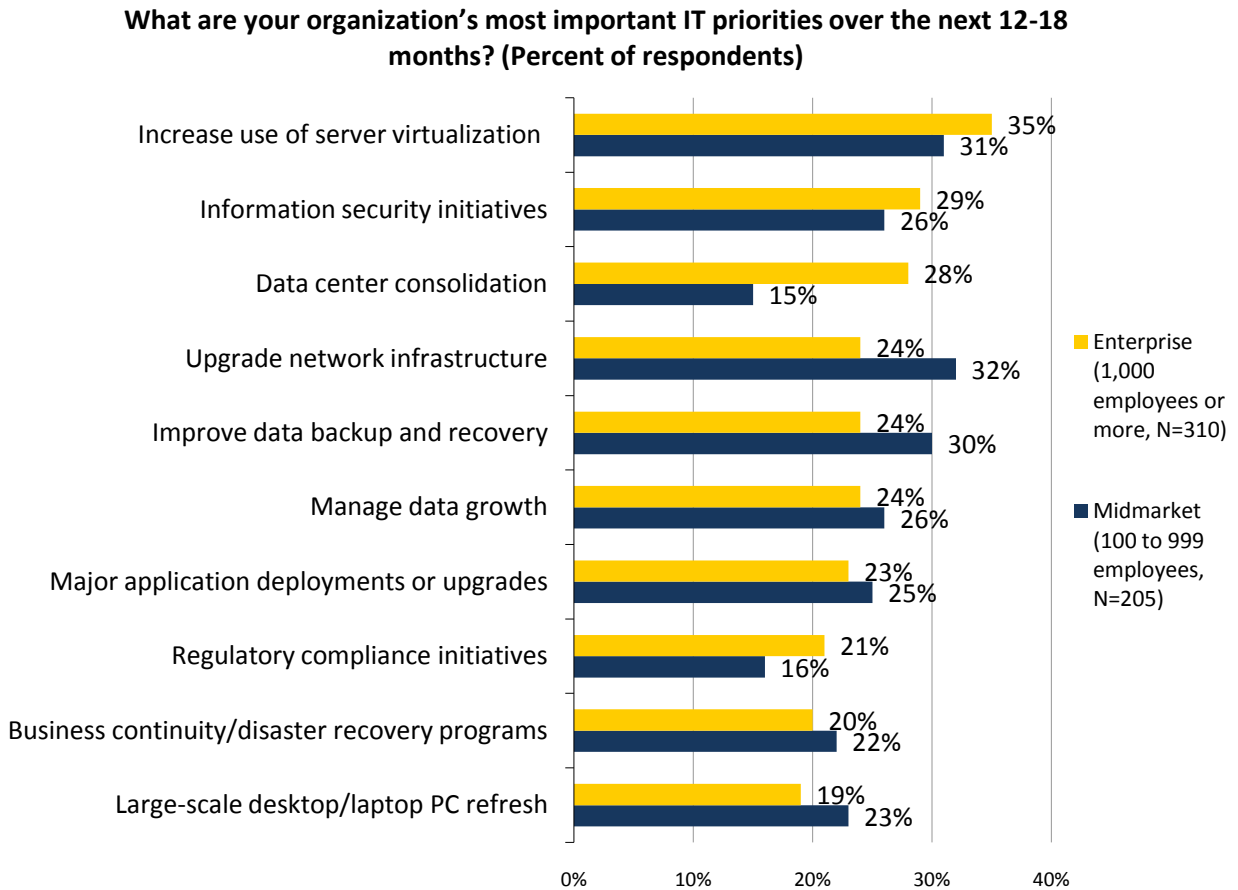
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## Networking Initiatives Gain Momentum

Organizations rely heavily on IT to run and grow the business. In order to maintain or gain a competitive advantage, investments must be made. But where are organizations placing their bets? According to ESG Research’s 2010 IT Spending Survey, top investments will vary based on the size of the company, but in general will focus on increased use of server virtualization, security, data center consolidation, upgrading networks, and protecting and managing data (see Figure 1).<sup>1</sup>

Figure 1. Top IT priorities, by Organization Size



Source: Enterprise Strategy Group, 2010.

### Why are Organizations Investing in the Network?

Many top IT initiatives are closely tied to an improved network to ensure success. In addition to those listed above, there are many other areas that need to be addressed, including:

- **Data center build outs driving network upgrades.**
  - Organizations continue to consolidate data centers to drive innovation and reduce costs. This is particularly important for enterprises with numerous data center locations; now that there is more data, organizations need to ensure there is adequate connectivity to move their data.
  - Increasingly prolific Web applications are highly dependent on network connectivity to ensure success.

<sup>1</sup> Source: ESG Research Report, [2010 IT Spending Intentions Survey](#), January 2010.

- Server virtualization requires networked storage to take advantage of advanced functionality. As organizations continue to expand use of server virtualization beyond test and development and into production environments, a network that will provide adequate performance and connectivity will be critical. In addition, having multiple applications or workloads sharing the physical resources of a single server make it more critical to have sufficient bandwidth to handle the output.
- **Limited number of IP addresses.** Organizations will need to migrate to IPv6 to accommodate the growing need for new IP addresses. As more users connect to the internet, mobile computing devices become widespread; as digitization gains momentum in health care and government, IPv6 will be required.
- **Ethernet is not only ubiquitous, but also has an attractive performance roadmap.** Ethernet networks are in the midst of transitioning from 1 GbE to 10 GbE. The roadmap includes moving to 40 GbE and then 100 GbE. This is far more aggressive than Fibre Channel (FC), which will double from 8 Gb to 16 Gb and, eventually, to 32 Gb.

## Where to Invest? Data Center Networks

Large organizations making it a priority to consolidate their data centers are presented with an opportunity to also consolidate the number of networks they support in those data center. As business has increasingly relied on IT to power it, organizations have typically deployed whatever technology best suits an application or workload. As a result, data centers typically end up supporting multiple technologies which, in some cases, require multiple networks. Some examples include mainframes, block storage (Storage Area Network, or SAN), file storage (Network Attached Storage, or NAS), and High Performance Computing (HPC) environments, to name a few.

While these technologies have solved specific problems for IT and the business, they have also brought complexity. Each new or different technology supported requires resources with specific skill sets, unique equipment, and management tools, all of which drive up costs. For example, take a data center with a mix of the above technologies. From a network perspective, mainframe environments started by leveraging proprietary Enterprise System Connectivity (ESCON) to create networked storage environments, open systems SAN would be supported with FC and iSCSI SANs, NAS would have a separate Ethernet network, and any HPC environments would leverage InfiniBand for low latency, high performance connectivity. Early attempts to consolidate data center networks include converting ESCON to Fiber Connectivity (FICON), which allowed mainframe storage networks to take advantage of both the Fibre Channel roadmap and the economies of scale that accompanied the proliferation of open systems (Unix, Linux and Windows) and FC SAN technology, which resulted in reduced equipment costs. It also meant that mainframes and open systems could share common FC directors—although most organizations still maintain separate FC and FICON networks. At the very least, the management tools and skill sets can be shared across multiple technology domains. Even more prevalent, though, is Ethernet, which is used for NAS, iSCSI, and general purpose local area networks (LANs) and wide area networks (WANs).

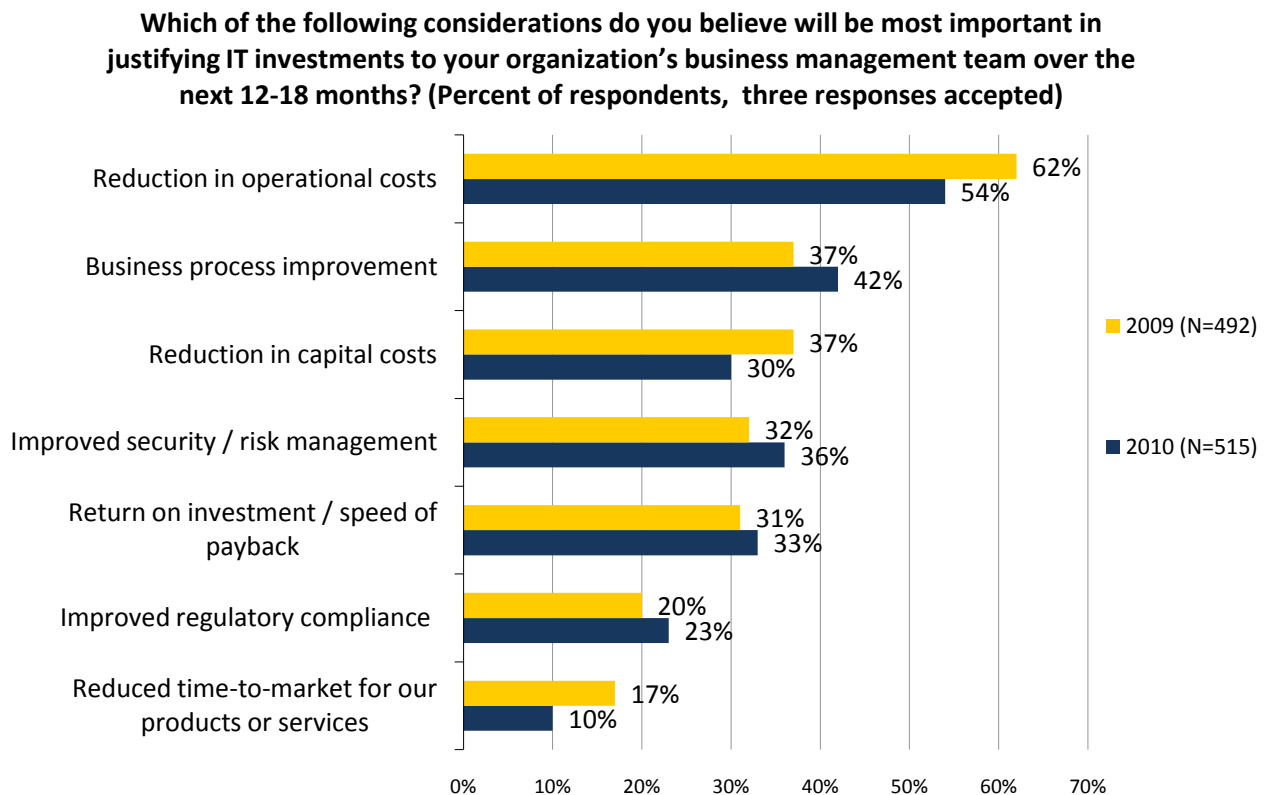
Another major reason to invest in a consolidated data center network is the widespread and increasing use of server virtualization technologies. Organizations of all sizes have benefited by consolidating open system servers (mostly windows-based) and increasing utilization. However, to take full advantage of the advanced mobility features (like HA, SRM, DRS, VMotion, etc.) server virtualization technologies offer, the consolidated servers need to be not only connected to the LAN, but also to networked storage. While this server consolidation effort has increased server utilization, it has also increased demands for greater throughput to both the LAN and SAN—mostly from the physical servers to the top of the rack. Additionally, consolidation is increasing the need to have greater throughput to both the Storage and the LAN. As organizations push for higher ratios of virtual machines to physical servers, the need for increased throughput will only increase.

It makes sense, then, that the biggest return on investment for network consolidation in the data center would come from converging FC and Ethernet. The challenge has always been to leverage the ubiquity and roadmap of Ethernet and the performance of FC. That means the converged network needs to be lossless, have low latency, and offer high performance. Fibre Channel over Ethernet (FCoE), leveraging Data Center Bridging (DCB) or

Convergence Enhanced Ethernet (CEE), addresses those concerns and enables high performance FC over an Ethernet transport. Organizations building out new data centers or transforming existing data centers should focus on how a converged network can provide significant benefits.

As businesses invest, it is worthwhile to look at the key criteria used to support these decisions. According to ESG’s research, the top requirements are that the new investment reduces operational costs, improves business process, and improves security and risk management (see Figure 2). It is interesting to note that this list varies from year to year. Last year in a down economy, reducing capital costs was tied for second most important. Now that business is picking back up, it has dropped to fifth place. Organizations will be willing to make one-time capital investments—if they will yield significant operational savings.

Figure 2. Important Considerations for Justifying IT Investments



Source: Enterprise Strategy Group, 2009.

## The All Ethernet Converged Network

Organizations have been working hard to consolidate their physical data centers, servers (with virtualization), and storage arrays (SANs)—now is the time to consider network consolidation. Specifically, the ability to consolidate Ethernet and Fibre Channel networks is very compelling. Advances have occurred that make this not only possible, but increasingly attractive. They include:

- **DCB or CEE** changes, as proposed by the DCB Task Group of the IEEE 802.1 Working Group committee, enable Ethernet to be viable for high performing data center applications and environments. Changes include lossless Ethernet (Priority Flow Control -802.1Qbb), priority/low latency transport (Enhanced Transmission Selection 802.1Qaz), and the ability to throttle traffic at the edge to avoid congestion (Congestion Notification (802.1Qau).
- **FCoE**, which was approved by the T11 committee in June of 2009 as a working standard (FC-BB-5), creates the model by which FC can be transported over a DCB or lossless Ethernet network. This ratification was important to help drive adoption and provide stability in next generation FCoE products.

- **FCoE will provide a graceful transition to Ethernet from FC.** The future of Ethernet looks pretty bright and, while FC will still be with us for a long time, implementing FCoE will allow organizations to begin converging the two technologies and meshing the appropriate skills sets and management tools. Vendors are facilitating this by keeping management screens very similar to existing Fibre Channel tools and Ethernet screens similar to existing Ethernet tools, essentially minimizing any impact of the transition to overcome the cultural issue in a timely and orderly manner.
- Future enhancements include FC-BB-6, which will enable end-to-end FCoE leveraging CEE or DCB switches. This is important as CEE or DCB switches will be less expensive—perhaps by more than half and will help to accelerate the adoption.
- **Major storage and server vendor support.** For those organizations with large data centers, it is even more important to have a critical vendor support a technology than to have it be a fully certified or ratified standard. In that regard, FCoE products from a number of suppliers have gained the seal of approval from just about all major vendors. This means that users can deploy technology knowing it will be fully supported by a trusted partner.
- **Cost advantages.** While most new technologies carry a significant premium, initial FCoE equipment capital expenditures should be offset by reductions in cable and wiring costs, making it even or less expensive overall. Over time, costs will continue to decline as volume increases and CEE or DCB switches can be leveraged. Operationally, FCoE should deliver significant advantages as well as reduced power, cooling, and maintenance expenses. Given that this is a top criterion for making IT investments, a converged network should be easy to justify. Also, wiring once and providing the capability to add other services—Ethernet, iSCSI, FCoE—without rewiring or adding cards will certainly help improve the time to provision new services.

## Where Converged Networks Fit

The next step is to determine if a converged network is feasible and, if so, where it should be deployed. Who should be interested? Organizations with:

- **Large existing FC environments.** With millions of dollars or more invested in FC infrastructure, skill sets, and management tools, most organizations are not in a hurry to rip and replace. Leveraging FCoE enables consolidation of the network infrastructure used to “fan in” any new servers or applications to the LAN and SAN. This would preserve the investment in core FC SANs and arrays and reduce costs.
- **Growing virtualized server environments.** With single physical servers hosting multiple applications or workloads, the ability to leverage a 10 GbE pipe that can be dynamically allocated to accommodate either storage or LAN traffic will become increasingly important. As greater densities are sought, reducing the number of cards, cables, and switches will create greater efficiencies.
- **A strong focus on adopting new technology to gain a competitive advantage.** The ability to dynamically throttle bandwidth or turn up new services without disruption (Ethernet, FCoE, or iSCSI) could be a competitive advantage for organizations looking to gain an edge. The ability to provision new services quickly should correlate to bringing new applications to market faster.
- **A strong focus on reducing operational expenses.** The consolidation of cards, cables, and switches will reduce power and cooling requirements, mitigate the need to invest and maintain separate management tools, and enable shared resources.

Where should a converged network be deployed? Initial deployments include:

- **Blade centers and unified computing environments.** These high density computing platforms are rapidly adopting the use of converged networking to minimize the network footprint and provide the requisite performance. Most blade center environments offer FCoE as an option and some organizations are leveraging it as a core technology packaged as part of a solution.

- **Top of the rack for new environments.** No one is suggesting ripping and replacing existing infrastructure to converge networks, but as new servers or racks are deployed, a converged network makes sense. This assumes that the servers are connecting to an existing FC infrastructure (switches and arrays).

## The Bigger Truth

Organizations have been spending huge sums of money to consolidate data centers, servers, and storage. Now is the time to begin consolidating the data center network. Mainframe shops understand the value of convergence—the move from ESCON to FICON allowed organizations to leverage existing FC devices and management tools. This simplified management and allowed cross-pollination of skills and resources between open systems and mainframes. It increased an organization's purchasing power by standardizing on common equipment which also reduced maintenance and spare parts costs. The technology now exists to drive data center network consolidation to the next level: converging FC onto an Ethernet network.

Keep in mind that this convergence will take time. FC and Ethernet will co-exist for many years to come, but the clear direction is towards Ethernet. Changes to the Ethernet protocol through FCoE make it feasible from a performance perspective, plus it has a much more attractive roadmap that goes to 40 and then 100 Gbps. Leveraging a converged network will not only provide the ability to gracefully migrate from Fibre Channel to Ethernet, it will also reduce costs, decrease complexity, and simplify management. So why keep deploying two separate networks when one network is all that's needed?



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