Field Audit
Report

Cisco Unified Fabric Technology

Multi-protocol Networking

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September 2013

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ESG Field Audits

The goal of Field Audit reports is to educate IT professionals about data center technology products for companies of all types and sizes. ESG Field Audits are not meant to replace the evaluation process that should be conducted before making purchasing decisions, but rather to provide insight into these emerging technologies as they are being applied in end-user environments. ESG's expert third-party perspective is based on interviews with customers who use these products in production environments. This ESG Field Audit was sponsored by Cisco.

Introduction

ESG recently completed interviews with several customers using Cisco networking solutions. This ESG Field Audit documents their successes in deploying Cisco Unified Fabric and Fibre Channel over Ethernet (FCoE) solutions.
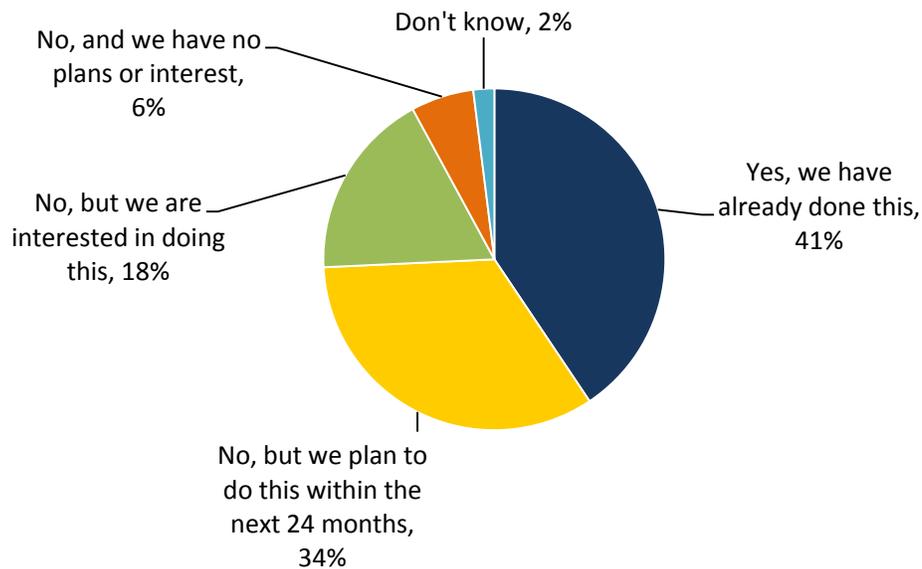
Background

Data centers are stretched to the limit by budget constraints, staffing restrictions, and the high costs of both equipment and energy. Many companies have discovered the benefits of consolidating servers using virtualization technology and are now able to put more data in a smaller footprint, reducing costs and simplifying management. However, different storage and data networking technologies have complicated their efforts.

It is not surprising that network convergence is gaining momentum; organizations are looking to consolidate network traffic to gain those same benefits. In recent ESG research conducted with North American networking professionals, 41% of survey respondents had already consolidated to a common Ethernet network, another 34% planned to do so in the next 24 months, and another 18% were interested in doing so (see Figure 1).[1]

Figure 1. Converged Data Center Networks

Has your organization implemented converged data center networks (i.e., common Ethernet network infrastructure for data communications and storage networking and/or server-to-server networking)? (Percent of respondents, N=280)

- Don't know, 2%
- No, and we have no plans or interest, 6%
- No, but we are interested in doing this, 18%
- No, but we plan to do this within the next 24 months, 34%
- Yes, we have already done this, 41%

Source: Enterprise Strategy Group, 2013.

Today's data centers demonstrate a strong interdependency between the virtual server, network, and storage environments. Networks must seamlessly connect all physical and virtual computing and storage resources. In order to properly support consolidated, highly virtualized environments, organizations need improved, easy-to-manage storage networks capable of cloud scale and performance, as well as support for on-demand access and around-the-clock availability. In addition, as virtualization and cloud computing expand, the list of requirements is likely to grow with increasing workload variation and deployment size. As a result, choosing the right networking and infrastructure components is a crucial decision.

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[1] Source: ESG Research Report, *Data Center Networking Trends*, January 2012.

Cisco Unified Data Center Solution

To change the economics of the data center and deliver simplicity and business agility takes a range of solutions designed to reduce complexity, speed provisioning, and automate configuration and management tasks. These capabilities enable an organization to be more agile in a dynamic environment, while improving visibility and control and keeping costs down. Cisco offers a wide range of solutions, including a few highlighted below.

Cisco Unified Fabric

Cisco Unified Fabric technologies help organizations build convergence with virtualization awareness, intelligence, and network scale using the Cisco NX-OS. Products in this category include the Nexus Series of switches and fabric extenders, the MDS family of multi-layer switches and directors, and management applications. These technologies help organizations to leverage Ethernet's economy of scale and continuing innovations. Of particular note are the Nexus 2000, Nexus 5000, Nexus 6000, Nexus 7000, and MDS 9000 platforms that combine reliable Fibre Channel (FC) and FCoE protocols.

Cisco Unified Computing

The Cisco Unified Computing System (UCS) is a next-generation data center computing platform designed for virtualized and cloud computing environments, integrating Cisco servers with network and I/O resources in a modular unit. Its model-based management, end-to-end provisioning, and migration support help organizations to simplify and accelerate reliable, secure application deployment and scale easily. Modular blade servers, chassis, racks, power units, and fabric interconnects work to create a flexible, scalable architecture while reducing the number of devices that require configuration, management, cabling, and energy resources.

Cisco Unified Management

Optimized for the UCS and Nexus architectures as well as heterogeneous data center and cloud environments, Cisco Unified Management solutions can simplify physical and virtual infrastructure management with task automation and process orchestration. Key features include management of virtual and physical resources for bare metal and multi-hypervisor environments, automated network provisioning to simplify deployment and minimize complexity, policy-based management, and simple scalability. Key products include Cisco UCS Manager and Cisco Prime Data Center Network Manager (DCNM). DCNM is designed to help you efficiently implement, visualize, and manage Cisco Unified Fabric. It includes a comprehensive feature set, along with a customizable dashboard that provides enhanced visibility and automated fabric provisioning of dynamic data centers.

Customer # 1: Regional Medical Center

ESG spoke with the IT Manager of a regional medical center consisting of a central hospital and 16 satellite facilities across three states.[2]

Situation

We were running out of space for additional servers and looking at a costly build out. Our key objectives were maintaining uptime, plus flexibility, consolidation and virtualization, and being on the leading edge of technology.

We now have 85% server virtualization, with about 400 servers in a physical footprint of 80, and within two years we will be as virtualized as we conceivably can be. Physical presence will remain in any healthcare organization because of FDA regulations. We were looking for ways to condense and consolidate the data center and when FCoE technology and unified fabric came along, we could collapse our networking and data infrastructure. Today, anything new is mandated to be FCoE connected—we won't allow any new FC connections.

There is an expectation of always up, always available—we don't have the luxury of maintenance windows, which is a fairly big challenge. We provide PC computing as well as server platforms, and provide virtual desktops in the hospital and satellite offices. We're a lot more high touch than many technical sites. We have 300+ applications; some of the key ones are Electronic Medical Records (EMR), the Admission, Discharge, Transfer system, and the financial application. We use Thin App for EMR and other applications that are convoluted to install, and distribute them via virtual desktops. A few applications are turnkey systems that vendors provide—we rack, stack, and power it, they do the rest—like cardiology and radiology PACS.

Cisco Environment

We use Cisco for networking for the main facility and all satellite offices, and we have Cisco IP telephony. At the main facility, we have a private cloud. We created a micro data center for high availability and are using it as hot standby, but also a stretch cluster so we can utilize the additional compute power that's sitting idle. We have EMC VNX and CX4 arrays, plus Centera for archiving of PACS images and EMR.

The two data centers are connected with 10GbE. We have one-for-one storage arrays and compute power [Cisco UCS] *so we can have a data center failure without any performance degradation; certain crucial applications, like Exchange, are pinned—so half is pinned in the primary data center and half in the micro data center. In the event of a room failure, we will keep e-mail up and running, which would be our principal form of communication with the outside world in a disaster. Replication goes both ways between the rooms. In terms of data, we have about 175TB and are growing 30TB to 40TB per year.*

In each data center, we use Cisco Nexus 2248s at the access layer. We use Fabric Manager, and will be installing DCNM soon.

We use EMC NetWorker for backup, and have a legacy VAX VMS system. A Windows Server 2008 emulator allowed us to move our entire legacy VMS financial system onto VMware and the 10GbE platform; that cut the backup time from 18 hours to 10, and now certain functions like Help Desk that couldn't function during backups before can be back in production within a couple of hours. It has definitely streamlined the workflow, and cut what was a $150,000/year maintenance cost down to about a $500 equivalent.

Our new VNX arrays (for tier-1) were connected to FCoE on day one, and we are transitioning our existing arrays to FCoE with absolutely no issue. Next we'll transition the CX4s (tiers 2 and 3). We should see an explosive move toward FCoE as we do lifecycle management and refreshes of other systems that are connected via traditional Fibre Channel.

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[2] Note: italicized paragraphs are used to indicate customer quotations.

Results

We selected Cisco because of its longstanding, proven reliability. I had long experience with Cisco LAN switching and the MDS line. The reliability was so great, and so we were very early adopters of the unified compute platform. We went into production within two weeks of racking, stacking, and powering it up, and we haven't looked back since. Reliability is excellent, support has been phenomenal, and what was promised was delivered absolutely on point. We were a huge Compaq/HP customer, and I have never regretted the decision to move to Cisco UCS. Also, we were already a VMware, Cisco, and EMC shop, so when they created the VCE company that just sealed our good decision. They've been good to us, and been there when we needed.

Our unified network with FCoE lets us wire once, collapsing and converging everything into one—it's easier to manage, maintain, cross train, and oversee, and as we always need more staff, it's a big help. We've cut our management topology by two-thirds. Another result is extremely fast throughput and significantly shortened backup windows—they take half the time.

With Cisco FCoE we have been able to reduce the total fiber infrastructure, and using 10GbE single wire twinax instead of 1GbE has provided a very cost-effective way of bringing 10GbE connectivity to servers in the data center. It's much simpler than two fiber runs and two copper runs, with ten times the throughput. A typical 10Gb optic runs about $70-$100 per end plus the fiber, so you can easily get to $2,000 per connection; twinax is about 1/10 of that cost. Extremely fast connectivity at a very cost-effective price point, and the CNA cost is negligible compared with the traditional HBA.

I think it's particularly phenomenal that once we implemented the Nexus switches, we did a migration from old EMC Centeras to new ones in five days; we had done this four or five years ago, and it took over a year to complete. Granted the old ones were 100Mb connected, but I think the biggest difference was having the 10GbE backbone. And we didn't see any performance degradation on other hosts during that migration.

Future

Our challenges have mostly been with being ahead of our vendors. I'm a champion for not being dictated to by healthcare ISVs; if you are using technologies from well thought-of companies like Cisco, there is little or no risk if you have your support contracts in place. As we have more FCoE connectivity, we can build the case that we're comfortable with it and pull vendors along with us.

Figure 2. Regional Medical Center Primary Data Center
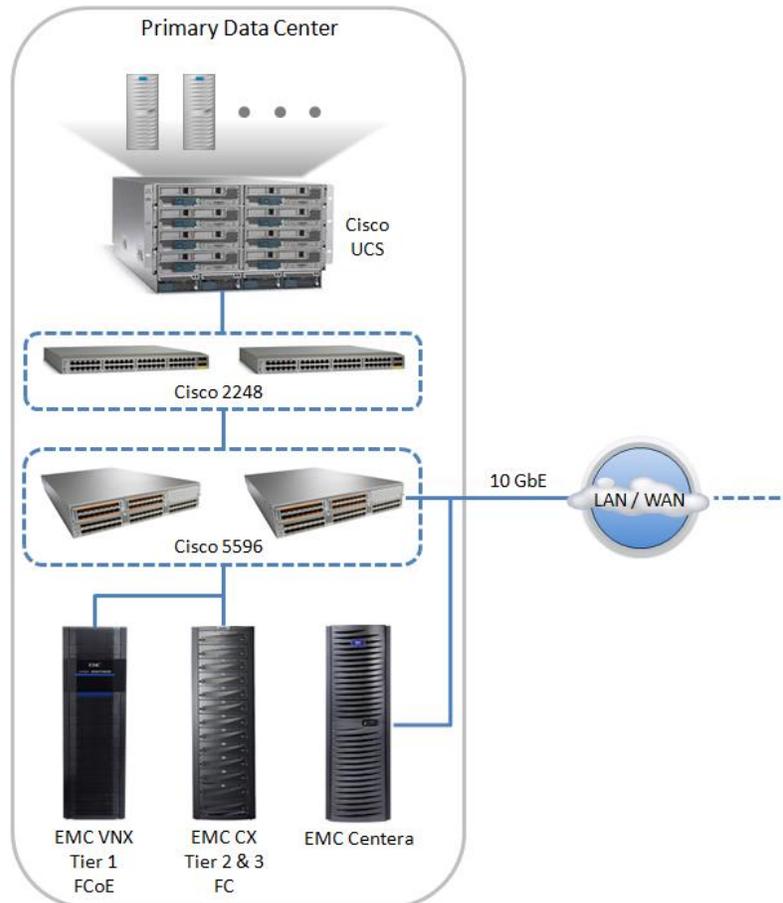
Why This Matters

Data growth and server sprawl are often the impetus for server consolidation efforts to minimize ongoing equipment, management, and energy costs. In addition, healthcare organizations like this regional medical center have stringent application and data availability requirements that are dictated by regulatory agencies.

After achieving 85% server virtualization, this long-standing Cisco customer turned its attention to leveraging Ethernet to condense and consolidate the network infrastructure, and today, all new connections are FCoE. The organization is able to support the main hospital and 16 satellite offices with Cisco data and storage networks as well as IP telephony. With the converged network, UCS, and Cisco management infrastructure, this customer has better performance, faster backup, simpler management, and lower costs. As this IT manager commented, "With our successes, both Cisco and other companies can use us as an example that [Unified Fabric] is successful, it works, it's a good decision, and there's no reason not to go ahead and do it."

Customer #2: U.S. Subsidiary of Global Financial Organization

ESG spoke with the Core Infrastructure Manager of a large European reinsurance company with a data center in the southeastern U.S. and three U.S. offices. He is responsible for the complete data center infrastructure, including compute, networking, storage, and applications.

Situation

We process a lot of data—more than the typical company. We have a unique data processing footprint—we have 300 employees in three US cities and close to 500 servers, so almost 1.5 servers per employee. We do a lot of actuarial modeling, data migration, and data extraction. So we need a very high-speed backbone network to handle it all. We have much more block storage than file; currently they are in a unified array but we plan to separate them.

We currently have 128TB of storage—we use deduplication, or it would be over 200TB. In terms of growth, since 2009, transactional data has grown 92%, reporting data 77%, analytics and modeling 80%, shared infrastructure like messaging, telephony, and collaboration 37%, and file shares 300%.

Cisco Environment

Cisco is our corporate and storage network standard, and we also use Cisco IP phones—bought them in 2002. In early 2010, we migrated our HP/Dell compute infrastructure to Cisco UCS. We are 90% Cisco UCS, and have done substantial consolidation and virtualization over the past three years, including virtualizing Exchange, SharePoint, and SQL Server. We brought two Nexus 7000s online for redundancy and then added two Nexus 5010s since that's what was out in 2010. We manage with a very small team—me, and one engineer—and use Cisco DCNM and UCS Manager. Instead of logging into each blade chassis to manage individually, we have a single pane of glass for the entire UCS pod with all the blades in it. Our server provisioning time has gone down from a few days to 30 minutes. And the learning curve was very, very short—things like building VLANs are very easy.

We have 10Gb FCoE in the UCS. We still have 8Gb Fibre Channel to our EMC NS-480 storage, but are planning to migrate to a multi-node VMAX. Our goal is to implement end-to-end Nexus-based 10Gb FCoE to EMC VMAX.

Results

We have seen the benefit of being powered end-to-end with Cisco. We've had five-nines uptime for the past two and a half years, so the business is very happy with us. We have never had to go get an outage from the business for any Cisco maintenance.

Moving to the Cisco Nexus 5000 and 7000 and UCS has allowed us to cut down on costs. We used our Cisco 6509 switch for ten years—retired it in June 2012. You can imagine it was running unsupported code for the past three years but still ran all those legacy servers fine. We don't see replacing the 7000 chassis for about eight years. We also still use our Cisco 3750 100b switches that we bought in 2004 for our IP telephony.

We consolidated seven racks full of servers down to three racks of Cisco UCS. We reduced close to 81 physical servers down to a single UCS blade. With our previous infrastructure, there were close to 50 settings; with UCS, there are only three or four settings for a code upgrade, with no downtime. If you do have to take an outage, you just vMotion the VMs off, reboot that blade, and vMotion them back and you're up and running. Also, in the past if a blade or HBA failed, you'd have to go and rezone it; now we just get a replacement blade and pop it in, and the profile server gets associated with that blade. It's 20 minutes instead of hours or days.

The level of support we get from Cisco, we don't see that from any other vendor. We had an issue back in 2002 when the engineers kept on switching and went around the globe and still continued to work on the issue. With any other vendor, we don't have that level of confidence in implementing a technology and walking away from it—that's why we're sticking with Cisco. Plus I can single-handedly run the infrastructure, as I have for more than ten years.

It boils down to a level of confidence. Some customers see Cisco as a networking company and wonder why they started making servers. Lift up the covers and take a look at what it brings you. We have neighboring companies that silo everything—they have a separate storage team, networking team, compute team, application team. Not

us—with our small team, we can do software upgrades without taking an outage, code upgrades in the middle of the day. I have upgraded firewalls in the middle of the day and never dropped a single VPN connection, with 60 people VPNed in.

Reliability is also key. When we put in the UCS pod, we ran a bunch of failover tests. We built VMs, and then yanked the power cord out—never lost even one ping. So we went upstream to the Nexus 5000 and did the same, and then rebooted the 7000, and lost nothing.

Future

Our goal is to put a data center in a hosted facility using Cisco and EMC technologies and leverage Cisco dark fiber and multiplex for disaster replication and active-active data centers. Hosted facilities rent per rack, so our consolidation helps that. We will run production in the primary data center and replicate to a recovery site for failover. It will be active-active, with the secondary site running dev and test environments except during a failover.

Figure 3. Global Financial Organization Current Environment
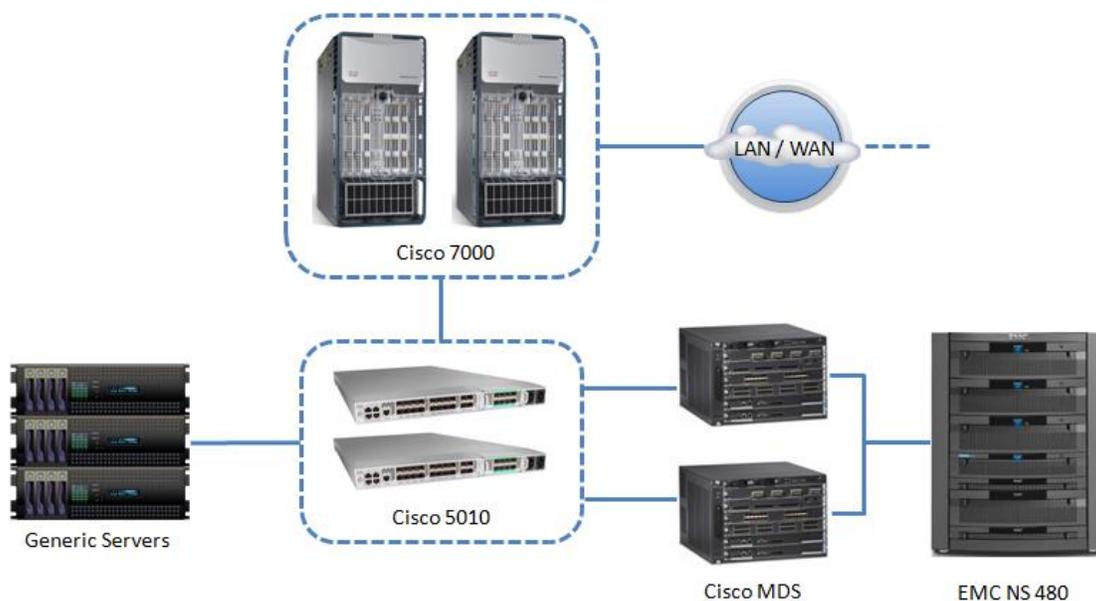
Why This Matters

Increasing complexity in the data center and the massive growth of all data types are key cost drivers. Organizations that must continually add equipment to process large amounts of data also suffer from long provisioning times and reliability problems that hinder productivity.

This customer has improved availability and cut costs by consolidating its server and network infrastructure with Cisco. Leveraging Cisco 10Gb FCoE, UCS, and network and server management applications, they have reduced provisioning time from days to minutes, cut costs, and retained the ability to manage with a small staff. In addition, they remain as confident of Cisco's reliability today as they did ten years ago. Said this infrastructure manager, "With a unified Cisco architecture, you just realize what value Cisco brings to you and how easy it is to run, with just a few people or just a couple of engineers, a very large infrastructure."

Customer # 3: Large Manufacturing Organization

ESG spoke with a tech fellow at a large equipment manufacturer. His role involves inserting advanced technology into the company's public and proprietary programs; recently, the focus has been on high-performance technical computing and high-performance SANs.

Situation

Our company is trying to reduce overall costs and staffing required for SANs, storage management, and networking for local and remote sites. The Cisco Nexus product with converged network adapters where you can run both Fibre Channel and IP data across the same interface made a cost-effective solution to our need. We have it deployed at multiple locations, but the big ones are our proprietary program environments that are 24x7x365 operations and require five-nines availability. Also, our customer and company communities need easy server upgrades, additions, and subtractions. Our shops are about 60% virtualized, 40% bare metal.

Cisco Environment

We went into production with FCoE near the end of 2010, and are multi-hop, end-to-end FCoE now. There was interest in InfiniBand and other systems early on, but the cost and performance models just didn't support what we needed, and InfiniBand only works in a homogenous environment.

I'd call our architecture a shared grid. The Cisco Nexus 7010 is our enterprise central plexus. The top-of-racks are generally the 5010s to route both the storage and servers up to the top of the rack, and then to the central switches. We use QLogic cards and drivers across all servers —we just picked one and use it everywhere because if you mix, you can introduce systemic errors that impact availability. We have a mix of Oracle, HP, and Dell servers, and SGI 4100 series storage.

All of our CNAs and internal networks are 10GB per channel and above; we also have 1GB NAS boxes for non-intensive applications, and that's completely supported. All of our legacy products work fine—NAS, NFS, IPv4. We still interface with [Cisco Catalyst] 6502s that are a decade or more old.

One reason we went to Nexus for the central core line is that our enterprise-class switches are generally there for a decade, and you can keep upgrading the supervisor and the cards. The edge switches change much faster, and we find it's better to invest in the central core switches and keep them for a very long time.

Results

The Cisco Unified Fabric solution has been a savings for us in cost, labor, and power/cooling. We have been able to reduce costs by using the virtual device context switching capability that allows us to share the same switch across different data types from a requirements-of-separation basis. This saves us significant amounts of money on the core switches. With the QLogic [cards] we run IP and Fibre Channel off the same port at the same time, so it reduces the number of servers I have to procure. You can only virtualize a server up to the I/O that you have available, so with servers that have ten cores per socket and four+ sockets, you need a lot of high-speed I/O to utilize those services effectively and be able to move them around. We wanted a solution that would support both the high-performance side and the lower performance virtualization side with minimum staffing and maximum hardware utilization.

We are utilizing the cores better, and keeping the I/O rates up with fewer cables, fewer switches, and using everything more effectively. This consolidation also means we use less floor space and a lot less power and cooling.

One nice feature we found during testing and configuration of the system is we're actually getting a 25%-30% performance bump on the IP side and a downgrade in the server overhead because when they redid the design to support FCoE, they optimized the IP part of the chip. So we were able to shrink down and get better performance using the same type of hardware.

We have a standard review process for every server deployed after the baseline. In the past, we had the networking group work on it, and the storage group work on it, and the server group. Now we have reduced staffing needs and

a unified environment that makes it much tighter, lower cost, and quicker deployment; it cut the personnel required for integration, test, and deployment by 25%.

We always oversubscribe our VMs, which are not as critical as the high-performance computing side. So they are 100% utilized, and when we start bringing on additional servers and procuring them, the wiring is so much simpler now.

There are some cultural ramifications to deploying FCoE. It seems like it was easy for the FC guys to get to know the IP side, but harder on the IP side to learn anything about storage.

Future

In the future, I plan to have a full cloud, with cloud management and pushing things from one side to the other, managing and orchestrating from one site, and with full reporting and chargeback. We are looking at adding FCoE for the WAN to the remote site as well, and using lossless Ethernet to maintain our performance rates.

Figure 4. Large Manufacturing Organization
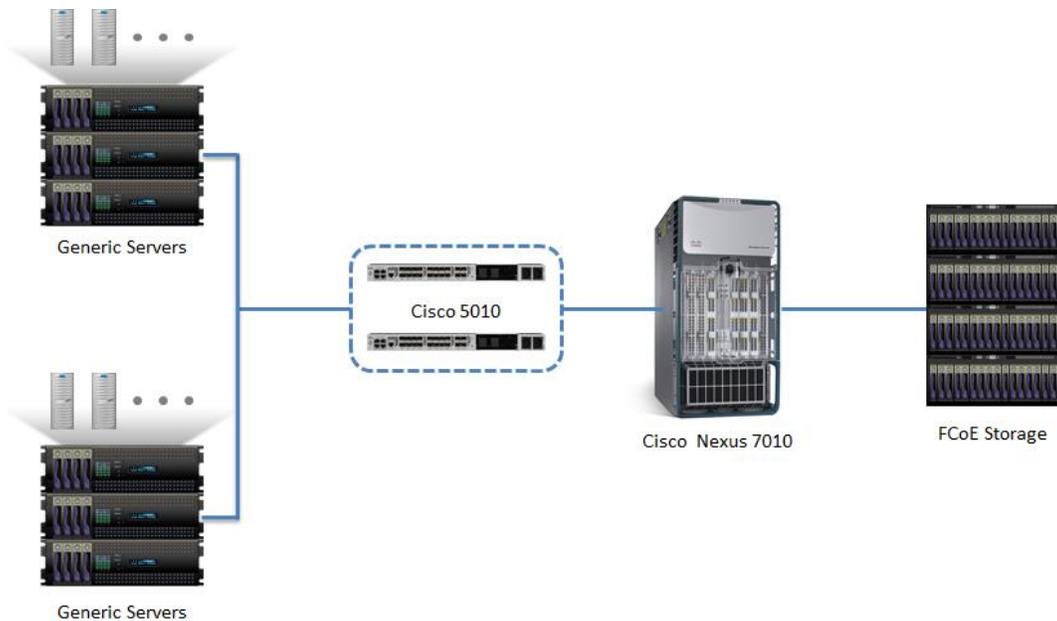
Why This Matters

High-performance computing and continuous availability place hefty demands on infrastructure. These efforts are made more difficult by budget constraints that pressure IT to reduce costs and staffing. Running multiple silos of infrastructure and separate networks contributes to complexity and cost.

This Cisco customer chose to integrate its IP and Fibre Channel networks with Cisco solutions, and has been able to support legacy and modern technologies equally well. They are saving in equipment, labor, and energy costs; are making more efficient use of infrastructure resources; and retain high I/O rates with fewer cables and switches. This tech fellow commented about the Cisco unified architecture, "I highly recommend it —it has done well by us. It has been a cost savings, labor savings, and power and cooling savings for us. And we were able to meet the timeline with our new deployments and new functionality with 25% fewer people —that shows you it worked really well, and we haven't missed in performance."

The Bigger Truth

Ask any IT professional, and you'll hear what trends are driving their activities today: web-focused applications, data center consolidation, increasing server virtualization, and IT-as-a-service. All of these demand levels of storage network scalability and complexity never before seen, and they render traditional processes and legacy infrastructure designs obsolete. In order to satisfy today's business demands, networks must be simple to provision, easy to scale, flexible, automated, and able to handle workload mobility to support dynamic server and storage domains. Added challenges are energy and equipment costs that strain budgets, and end-users with a low tolerance for poor performance and availability; as a result, networks must be highly reliable and designed for maximum uptime.

For many, storage network consolidation and convergence provide the levels of choice and flexibility needed to support today's requirements. IT cannot be constrained by having to choose a single network protocol, or to manage separate data and storage networks. As a result, multi-protocol networks, unified fabrics, and FCoE are gaining momentum. Cisco, long a recognized networking leader, retains its leadership role by delivering not only high-value converged network solutions, but also UCS server blades that take advantage of networking advancements.

The customers ESG spoke with were able to alter their network landscapes with these considerations in mind.

- A regional medical center implemented a converged Cisco network, compute, and management infrastructure, resulting in a much simpler and less expensive environment that is managed by only two IT staff members.
- A U.S. subsidiary of global financial organization has achieved five-nines availability, lower costs, no business outages, and provisioning times of 20 minutes (instead of days) since implementing its Cisco unified networking and UCS infrastructure.
- A large manufacturing organization uses Cisco converged networking for its high-performance computing environment, saving in energy, labor, and equipment costs, with higher availability and better performance, enabling a future full-cloud environment with consolidated management, reporting, and chargeback.

Cisco offers advanced networking solutions such as Unified Fabric to enable greater virtualization and cloud computing, providing IT with more flexibility, higher availability, and lower costs. Cisco is known for providing solutions for the long term, and these customers can attest to that —all of them were Cisco customers for a decade or more. In addition to the technology innovations they have come to expect from Cisco, these customers value the confidence they have in the reliability of Cisco solutions, the efficiency gains offered, and the ability to support legacy devices.