



## Advisory Report

# One Love, One Data Center, One Network



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### ■ Issue

As the data center continues to evolve and mature, business-oriented goals, such as IT agility and overall cost reductions for ongoing IT expenses, are emerging as priorities. These goals are currently being addressed in a number of ways including new green initiatives and virtualization. The overall theme behind most of these initiatives can be boiled down to simplification of IT infrastructure. Virtualization and highly dense blade servers are the most obvious examples of this drive for simplification. One of the most overlooked and elusive components of IT simplification is the need to consolidate onto a single network technology. Today, companies use Ethernet for general data traffic and Fibre Channel for storage traffic, and some large data centers that specialize in computational clusters even use technologies such as InfiniBand for server-to-server communication.

For there to be truly agile, cost-optimized, and efficient data centers, the network must be transitioned to a single technology. That technology is Ethernet. There is significant opportunity to break the old networking paradigms and advocate one network technology for the data center. Vendors that can see this vision, articulate it, and act upon it will be able to drive sales and brand recognition, all while serving their customers' best interests in the data center. The forces arrayed against the movement to one network for the data center are many and include entrenched storage vendors, vendors of specialty technologies such as InfiniBand, and even networking vendors in the Ethernet space itself. However, the way is clear and vendors with strong purpose and long-term vision can help drive and shape this evolution that, in hindsight, will be seen as unstoppable.

### ■ Current Perspective

One network in the form of Ethernet is coming to the data center. The reasons for it are simply too compelling to deny. However, customers need reassurance and leadership from networking vendors in order to ensure a smooth transition and avoid pointless technology holy wars that do not serve the needs of the customer. Vendors without a significant position

Report:

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One Data Center,  
One Network**

Data Center

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in Ethernet will resist, spreading fear, uncertainty, and doubt. Vendors need to unify behind Ethernet as the one network for the data center and, by doing so, they will not only better serve their customers, but will ultimately be able to compete better as well.

The mental leap required in order to fully understand the need for the data center transition to one network is much smaller than many vendors, customers, and analysts think. We have been taught over the last 15 years to approach data center technologies from an evolutionary standpoint rather than a revolutionary standpoint. Overly hyped technology that failed to live up to its promises and vicious vendor lock-in during the early days of the x86-oriented data center have taught a painful lesson that the data center runs smoother when technological change comes at a measured pace and with an evolutionary method that does not so quickly render investments obsolete.

When we discuss a single network in the data center, it is important to understand that what we are advocating is not topology, but rather the overall technology. The individual topology of a given corporate data center has more to do with the business and IT needs of that data center than it does with the transport technology. Data center managers will likely need to segregate some traffic on separate Ethernet networks due to bandwidth, security, and management constraints. Moving to a single technology for data center networks does not change the zero-sum game that is bandwidth calculation. It creates management and cost efficiencies that are simply not possible with multiple single-purpose networks.

Let's discuss the technology that is the natural selection for a single network in the data center. That technology is Ethernet. Ethernet has over the years shown a remarkable ability not only to adapt to the changing technological needs of customers, but also to adapt and overcome competing technologies that have challenged it for supremacy. The reasons for this are easy to see. First, Ethernet benefits from being one of the most widely deployed technologies both in the data center and in IT in general. This gives the technology the economy of scale that it needs to significantly reduce per-port costs for customers across the board. Second is the willingness of Ethernet's vendors to work together to ensure that the technology is compatible, regardless of brand or origin. Ethernet's compatibility wars were fought so long ago that most data center managers no longer even remember them. The result is an IT-friendly standard largely free of the single vendor lock-in that plagues many other technologies. Lastly, Ethernet enjoys some of the most consistent and constant technological advancement seen in the technology sector. This advancement is actually more than latency reduction and speed increases. Technologies such as Power over Ethernet as well as numerous other innovations have been adding value to Ethernet networks in a way no other networking technology can really claim. Even though Cisco is clearly the dominant vendor in the space, smaller and more nimble companies have always been nipping at its heels, driving new densities, speeds, and features into the market. There is even considerable development of technology for LAN on motherboard and NICs by companies such as Alacritech and Broadcom.

In addition to the obvious reasons for Ethernet as the one network for the data center such as cost, speed, and management, the Ethernet standards groups are working on new standards that address some of the more paranoid concerns posed in regards to the reliability and latency of an Ethernet network. This work is being carried out by IEEE 802.1 Data Center Bridging Task Group, which is calling the resulting standards Data Center Ethernet (DCE) or Converged Enhanced Ethernet (CEE). One of the best examples of this is the IEEE standard 802.11Qau with the tongue-twisting and mind-numbing title of “IEEE Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks

Report:

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One Data Center,  
One Network**

Data Center

**“Ethernet is used  
in mission-critical  
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- Amendment: 10: Congestion Notification.” What it essentially provides is a back-pressure mechanism similar to what Fibre Channel employs in order to prevent packet loss during periods of heavy congestion. Other standards such as 802.1Qbb – Priority-based Flow Control and 802.1Qaz – Enhanced Transmission Selection are also examples of changes being implemented that enhance Ethernet’s usefulness in the data center including SAN. The advantages of Ethernet make this change inevitable and vendors can take advantage of the trend in its early stages by providing leadership and showing customers the way forward with a single Ethernet network in the data center.

Now let’s examine some of the other technologies that are lingering in the data center, why they are there at all, and why they are no longer necessary. The first of these technologies is Fibre Channel. Fibre Channel itself allowed us to move our storage out of the server box and onto large, efficient storage arrays. Fibre Channel provided a reliable block-level transport that was simply not possible at the time on any other network technology. To give credit where credit is due, Fibre Channel gave us reliable, fast data center storage that served the business and IT need for speed while maintaining the reliability that is so critical in storage. However, the road was not completely smooth. Customers suffered because of incompatible switching technology between vendors, a problem that has not been entirely solved even today. This meant vendor lock-in for Fibre Channel switches and directors. Even more importantly, it created the environment of fear and obsessive certification that dominates the storage market today. Later, we will discuss how this fear is being used against Ethernet in the market today.

Since then, technologies have come to the forefront that posed a challenge to Fibre Channel, such as iSCSI. iSCSI suffered from a combination of early implementation issues as well as overly enthusiastic media hype. However, the real factor that held back iSCSI was the speed of the Ethernet network it ran on. Fibre Channel was twice the speed, at least on paper. That fact alone relegated iSCSI to small and medium business use only. In the interim, Fibre Channel grew and prospered, even in the face of market consolidation that left Brocade and Cisco as the only two Fibre Channel switch vendors of any real significance.

Today, all of Fibre Channel’s old advantages are gone. 10 Gigabit Ethernet has eclipsed Fibre Channel for speed as well as price both in hardware and personnel costs, iSCSI has matured, and vendors are now offering FCoE (Fibre Channel over Ethernet) as a way to preserve customers’ existing investments in Fibre Channel storage devices. It should be noted that some vendors are advocating FCoE as a permanent protocol on the network in order to preserve Fibre Channel margins. FCoE is a great technology for transition to iSCSI, but it should not be viewed as a permanent data center occupant. On top of that, Fibre Channel requires administrators to be trained in its arcane ways. Ethernet and IP are taught as a matter of course in every technology program at technical and four-year colleges. Yet, detractors of Ethernet storage networks claim that Ethernet is not reliable enough to handle the needs of storage traffic, even when that claim has been proven incorrect again and again by companies such as Dell’s EqualLogic storage division and others. Ethernet is used in mission-critical settings everywhere, from server-to-server communications and telecom company backbones to video streaming for cable and satellite companies. Ethernet and IP is everywhere, but only in the storage market is it not “good” enough.

Vendors that are claiming Fibre Channel must be maintained are not seeing the overall vision of the simplification of the data center environment. These vendors are simply protecting high-margin Fibre Channel sales and they come from both the switch side and the storage side. However, the truth is that, with some vision, these vendors could lead their

## Report:

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One Data Center,  
One Network**

Data Center

customers to the one-network nirvana on Ethernet and actually increase their sales in the process. The economy of scale, the speed, and the reduced administrative costs Ethernet brings make Fibre Channel an obsolete single-purpose technology. That being said, it is necessary to point out that Fibre Channel is not going to just suddenly go away. There will be a long and slow transition to Ethernet-based storage. This is not only practical, but necessary and evolutionary. And, it has happened before. The transition from token ring to Ethernet took about that long overall. It preserves customers' current investments in Fibre Channel-based storage equipment in the data center. Still, vendors with vision can continue to support Fibre Channel installations while pointing in a better direction. Vendors in the storage market that embrace this vision, rather than clouding the way with fear, will be able to manage this transition, give their customers exceptional value, and succeed in the long run.

One of the other technologies that has been getting some press and making some limited inroads over the last several years is InfiniBand. This interesting and innovative technology certainly showed promise, but innovations in Ethernet have rendered the market for InfiniBand largely limited to extremely specialized computational clusters. InfiniBand's claim to fame was not only its raw speed, but also extremely low latency. In large computational clusters, this equates to faster result times. However, in the enterprise data center, most companies simply do not need the latency offered by InfiniBand. Also, vendors such as Cisco, Foundry, and Force 10 Networks have created data center-centric switches that significantly lower the latency of Ethernet and this makes InfiniBand even less necessary. With the ongoing standards body work on higher-performance versions of Ethernet (100Gb), even the higher speeds of InfiniBand will succumb to Ethernet before long. InfiniBand suffers from the lack of economies of scale, the same way that Fibre Channel does, but even worse, keeping costs high. Overall, InfiniBand is an interesting technology, but one without a purpose. The administrative and equipment overhead necessary to keep a second or third network in the data center serves to diminish further the value that InfiniBand can offer customers. InfiniBand is likely to be of interest in the future only for extremely high-end applications involving research and it is unlikely to be a factor in the enterprise data center.

The science of biological evolution tells us that change is slow and constant. It also tells us that sometimes competition and more efficiency from one species can cause a formerly vital species to become extinct. In the vision of the one-network data center, we need to realize that some technologies have outlived their usefulness to everyone but the vendors selling them. It is easy to understand the trepidation this causes in data center managers, vendor product managers, and in the market as a whole. This could be viewed as an unwanted revolutionary change. In reality, it is a natural evolutionary change. For example, smaller companies that use iSCSI now will not change to Fibre Channel as they grow, but stick with Ethernet and iSCSI that has so ably served them.

**Recommended Actions****Recommended Vendor Actions**

- Cisco clearly has its eye on the Ethernet-only data center with its Data Center Ethernet initiatives and its Nexus line of data center switches. However, Cisco tends to take the position of selling the customers what they want. Cisco needs to take a strong position and become a stronger advocate for Ethernet-only data centers. Providing what customers ask for is noble, but in this case it should not be substituted for strong advocacy and leadership.

**Report:**

**One Love,  
One Data Center,  
One Network**

Data Center

- Brocade will have one of the most difficult tasks ahead in advocating an all-Ethernet data center. Brocade was built on Fibre Channel. However, with its pending acquisition of Foundry Networks, Brocade has the opportunity to embrace the new future that is coming and it should. When the Foundry acquisition completes, Brocade should begin emphasizing Ethernet as the future and helping its customers plan for a slow and measured transition.
- Storage OEMs such as HP, IBM, Sun, and EMC will all need to begin to implement their storage products for dual interfaces, Fibre Channel, and 10 Gigabit Ethernet. Some work has already been done along these lines, but in order for the data center to reach the one-network goal, storage OEMs will need to get onboard and begin to embrace Ethernet more completely.
- Companies such as Emulex and QLogic will simply need to continue to adapt and compete with Ethernet NIC and LAN on motherboard vendors. Any strategy that includes creating a special category of “storage NICs” is really contrary to the goal of a single network and is really a form of lock-in. A strategy that uses special storage products as its center is doomed to fail in the long run as other NIC vendors simply co-op features and remove the need for those products. TCP/IP offload engines do not need to be storage-specific.

**Recommended User Actions**

- Customers need to make inquiries with vendors regarding a one-network strategy. These talks should involve the storage OEM as well as the Ethernet switch vendor of choice. Careful planning and taking advantage of vendor services will ensure a smooth transition to an all-Ethernet data center.
- Customers should begin testing Ethernet-based storage solutions for suitability for use in their particular environment. For many customers, the time to switch will not be immediate. Familiarity with storage over Ethernet will aid in planning for an eventual switch as well as reassure typically conservative storage administrators that Ethernet is indeed up to the task of transporting storage data.
- Customers who are looking to install a SAN and do not have any Fibre Channel equipment now should move to Ethernet-based technologies and stay away from legacy Fibre Channel.

