IDC VENDOR SPOTLIGHT

Converging Infrastructure and the Impact of Romley on the Datacenter

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Economic pressures have created a growing desire among IT organizations to adopt a more converged approach to IT infrastructure design and deployment as a way to simplify the IT platform and underlying network environment. Because organizations also need to be more responsive to business requirements for greater bandwidth and performance, most of the expansion in IT asset deployment will leverage 10GbE for the underlying storage interconnections. IDC expects this transition will lead to rapid and sustained revenue growth for 10GbE storage interconnect solutions (converged network adapters [CNAs] and 10GbE switches). This Vendor Spotlight examines the challenges and requirements driving organizations to increase their datacenter efficiency, responsiveness, and reliability by moving to converged IT infrastructures. It describes the importance of 10GbE and FCoE solutions, especially in light of the recent release of Intel's Romley (Xeon E5) platform, and looks at the role of Broadcom as a solutions provider and an enabler of these strategically important market trends.

Challenges of Data and Network Growth as IT Spending Shifts

Enterprises are grappling with unprecedented growth in the amount of storage and network bandwidth needed to handle and retain increasing digital information for longer periods. Unstructured data, such as medical imaging results, video surveillance records, etc., is growing exponentially and consuming datacenter storage space at an alarming rate. Meanwhile, the megatrends of cloud computing and server virtualization are driving the need for greater network bandwidth.

Yet current economic difficulties, combined with reduced IT staff and budgets and escalating costs for hardware and software solutions, are constraining IT’s ability to respond effectively, thereby inadvertently doing more to exacerbate storage and network complexity than to resolve it. Often, the solutions put in place create performance problems.

Moreover, companies in data-intensive industries are struggling with a lack of available storage system floor space and with power limitations. The quickest way for them to obtain systems that can easily scale to meet unpredictable levels of data growth in the face of lowered IT budgets is to add more virtual machines (VMs) running on individual servers. IDC research has shown that many companies are increasing virtual machine counts by 25% to 100% as they seek to defer new server purchases. Regrettably, this approach adds considerable operational risk because hardware failures or network bottlenecks threaten many applications.

Intel has responded to these trends with the introduction of more powerful microprocessors — the Sandy Bridge series. A new generation of servers based on this technology, codenamed Romley by Intel, has a price/performance advantage over prior generations and is expected to drive a major server upgrade cycle. These servers, offered by major OEMs, will be able to handle more workloads, but they are also being designed with virtualization in mind and therefore will be able to host more virtual machines.
Transforming the Datacenter with Converged IT Infrastructure

A key to addressing the need for increased network bandwidth while reducing complexity is the use of converged network technologies such as lossless 10 Gigabit Ethernet (10GbE). This technology allows companies to dramatically simplify cabling and connectivity and also delivers the guaranteed performance necessary to ensure reliability as workloads grow. The use of 10GbE increases the mobility of virtual machines between pods, making virtualization across the datacenter for disaster recovery more practical.

2011 saw an accelerated adoption of 10GbE driven by increased deployment in datacenter and enterprise switching and routing equipment, compute clusters, and LAN on Motherboard (LOM) applications. A significant contributing factor for continued adoption will be the proliferation of 10GBaseT interface availability in addition to the already popular optical fiber and twinax copper interfaces. Most major equipment vendors now have at least one model of switching and routing equipment with a 10GBaseT interface. Intel's Romley platform will also drive the adoption of 10GbE LOMs as the I/O subsystem will need to catch up to the improved processors.

Although the industry has been working toward the 10GbE milestone since the beginning of 2000, a viable solution could not be achieved previously because of high power consumption and cost at the larger process nodes. However, today's 40 nanometer (nm) solutions not only can deliver on power consumption, but now the magic combination of no more than three times the price for ten times the speed (compared with 1Gbps) is within reach. This has been the "holy grail" for previous Ethernet technology migrations.

Another notable transition point will be the availability of integrated 10GbE PHY and controller chips on server motherboards in 2012, in contrast to the previous adapter-based 10Gb solutions. This will result in dramatic cost reduction. There is also an increasing need for network adapters that can support multiple protocols. Consequently, enterprises that are moving toward 10G networking infrastructures are considering multiprotocol adapters, especially as server virtualization continues to be deployed.

Enterprises adopting Intel's Romley platform will need to consider the underlying I/O systems that interact with this platform. After all, the I/O subsystem must not become a bottleneck to the faster processor speeds of Romley. Enterprises that are consolidating and converging their infrastructure will want to select a trusted provider of Ethernet connectivity independent of the protocol.

Considering Broadcom

Founded in 1991, Broadcom Corporation is a Fortune 500 company headquartered in Irvine, California, and a global leader in semiconductor solutions for wired and wireless communications. Broadcom has three major business units — Broadband Communications, Infrastructure and Networking, and Mobile and Wireless — with over 20 lines of business designed to facilitate growth in wired and wireless convergence. Its large portfolio of system-on-a-chip (SoC) and embedded software solutions enables organizations to connect and seamlessly deliver voice, video, data, and rich media connectivity across a wide range of digital products in home, office, and mobile environments.

The company is one of the largest fabless semiconductor suppliers and the owner of more than 15,000 U.S. and foreign patents and applications. As a market leader, Broadcom has a considerable portfolio of PHY, controller, and switch devices in all speed grades up to 10Gbps. Broadcom's Infrastructure and Networking group offers products supporting the latest technologies and features, such as the following:

- iSCSI, FCoE, and TCP offload for enterprise and datacenter applications
- Synchronous Ethernet, PTP, and Energy Efficient Ethernet (EEE)
Every year for over a decade, Broadcom has been systematically acquiring companies — often several in a year. In 2010 alone, the company made six acquisitions: Teknovus, Innovision, Beceem Communications, Percello, Gigle Networks, and Sightic Vista. The acquisition of Teknovus in March 2010 enabled Broadcom to enter the EPON market and to offer EPON SoC that integrates an Ethernet switch and voice DSP for VoIP. Broadcom’s purchase of NetLogic in 2011 is the company’s largest acquisition and enables it to enter the robust market of programmable processors in networking equipment, as well as emerging areas in telecom and storage.

However, Broadcom’s Infrastructure and Networking group is keeping its focus on products that address the demand from datacenters for 10GbE bandwidth and FCoE connectivity to support server virtualization, consolidation, and convergence. Its FCoE-based converged network solutions unite data and storage networks on a common 10GbE fabric while significantly reducing the cost of power, cooling, and cabling.

The following is a high-level overview summary of Broadcom’s latest 10G controller and storage product line capabilities:

- **Controller networking:**
  - 1Gb to 40Gb with 1000Base-T, 10GBase-KR, SFP+, and 10GBase-T native interfaces
  - Comprehensive family of controllers
  - Extensive OS support in the industry (many with in-box drivers)
  - Single chip, no external memory, low power, and smallest footprint (4x10Gb in 23mm2)
  - Full stateless and stateful offloads supported
  - RSS, NetQueue, MultiQueue, LSO, TSO, GSO, LRO/TPA, CSO, TOE, iSCSI, FCoE, etc.

- **Networking (L2) and storage (NAS, iSCSI, and FCoE) on common 10GbE fabric:**
  - Significantly reduces power, cooling, and cabling cost
  - iSCSI and FCoE support on robust, proven, time-tested converged platform
  - Industry-leading iSCSI and FCoE performance (1.5M iSCSI IOPS and 2.4M FCoE IOPS)
  - FCoE interoperability has been certified by partners (EMC, VMware, and NetApp) and customers

Broadcom’s latest generation of 10GbE converged controllers were designed for high-volume, converged LOM and converged network adapter applications. Its 40nm controller family includes quad-port converged controllers, which the company claims can deliver up to twice the port density, as well as numerous other features, in the industry’s smallest footprint with extremely low power per port.

These controllers reduce the overall cost of transitioning product lines to high-speed 10GbE connectivity while also increasing storage and networking performance via bidirectional line rate on all 10G ports simultaneously. Such functionality and speed can be achieved because the controllers utilize on-chip protocol processing. This capability offloads engines such as iSCSI, FCoE, TCP, and RDMA-ready hardware. Furthermore, these products reduce overall system power consumption because the offloads reduce overall system CPU utilization and allow CPU (and system) power-savings modes to be better utilized.
The newest 10GbE converged controller family includes the following:

- BCM57800S dual-port 10GbE/dual-port 1GbE
- BCM57810S dual-port 10GbE
- BCM57840S quad-port 10GbE

Broadcom's controllers provide a rich set of virtualization capabilities including PCI-SIG Single-Root I/O Virtualization (SR-IOV), NIC Partitioning, and Virtual Embedded Bridge (VEB). These VM traffic-switching modes support the PCIe 3.0 specification to provide an innovative architecture framework for improving throughput and latency of VM-to-VM switching.

Broadcom also has a fully interoperable FCoE offload solution on what it claims to be the world's fastest CNA platform with performance speeds of up to 2.4 million IOPS.

One of its latest converged controller and network adapters for FCoE storage includes the BCM57800S and BCM57810S for 10GbE. Broadcom’s 5719/5720 controllers offer support for 1G. Broadcom is leveraging the 19/20 (1G) and the 800/810 (10G) in the adapters for the new Romley servers.

As previously noted, when users begin adopting Intel's Romley platform, they will also need to reevaluate the underlying I/O systems that interact with this platform. As processor speeds and capabilities increase, so, too, must the I/O subsystem. Users looking to accelerate consolidation and convergence will need to look to a trusted vendor of Ethernet connectivity, of which Broadcom is a leading provider.

**Challenges**

All of this does not come without challenges for Broadcom. The company has been very successful on the LAN side with design wins among many of the leading server vendors. It has shown success on the storage side with FCoE wins at both Cisco and Dell, but it needs to continue to increase market share and show continued success with additional design wins.

Apart from the longevity and legacy of its competitors in the storage world, there is also the political aspect associated with a converged Ethernet interface. Network and storage administrators will now share a common cable. However, with the evolution of IT responsibilities associated with virtual server and desktop environments, IDC expects these political differences to be minimized quickly. Consolidation will happen first where common equipment (such as Ethernet switches) is being used but not actually sharing the wire. Running storage and networking concurrently will be the next step.

**Conclusion**

The transition to converged IT infrastructure will play a vital role in helping IT meet the fast-evolving business needs of today's global enterprises. This transition will be accelerated by the recent Romley server launch. It will also be a critical factor in efforts to reduce the capital and operational costs of running datacenters and the applications/information residing in them.

To meet these objectives, enterprises need to move from a static IT environment to a converged, virtualized, dynamic IT resource. They need solutions that more tightly integrate hardware elements, provide an open operating environment, and support full orchestration of resources across the entire datacenter.
As organizations consider how to take advantage of converged IT infrastructure, they are examining how all their assets — servers, storage, and especially networking — are being utilized and determining how consolidation and virtualization can be used to help them achieve their business goals within tightened budgets. Organizations looking to embrace 10GbE and create converged datacenter technologies will need solutions that enable them to increase their utilization of existing IT investments across servers, storage, and networks.

These solutions need to support new, dense computing platforms and reduce their total cost of ownership of existing and future products. Some organizations may also need help defining characteristics of hardware asset pools, integrating converged IT systems with existing IT environments and management systems, and retraining IT staff to support the more unified approach to provisioning and managing converged assets and services.

To the extent that Broadcom can successfully address the challenges described in this paper with solutions that enable organizations to meet their demand for 10GbE bandwidth, iSCSI, and FCoE connectivity, as well as support their migration to server virtualization, consolidation, and IT infrastructure and datacenter convergence, the company is well positioned for success in this market.