Romley/Sandy Bridge Server I/O Solutions
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March 2012

White Paper – sponsored by Broadcom Corporation

Impact of Romley/Sandy Bridge Servers:
As we discussed in our first whitepaper entitled Server I/O Considerations (January 2012), the arrival and subsequent ramp of Romley/Sandy Bridge-based servers, in association with recent network trends, will result in significant challenges and opportunities in the server I/O market.

The introduction of these more powerful servers, with a price/performance advantage over prior generations, will likely drive a major server upgrade cycle. This will result in much more pressure and demands on the network, as CPUs handle more workloads and process more data to be distributed via server I/O. These servers will help accelerate some of the trends driving unprecedented levels of network traffic including, ubiquitous and constant connectivity of billions of devices; more and richer traffic content, and manipulation and analysis of very large data sets and subsequent delivery of this information.

Furthermore, since these servers can handle more workloads and have been designed with virtualization in mind, they will be hosting even more virtual machines. Not only will the population of physical servers doing virtualization increase, but the number of virtual machines per server will also increase. This will put pressure on server I/O networking for a number of reasons. First, more virtual machines on a physical server will result in increased traffic burdens on the physical server network connection. Second, with virtual machine mobility, virtual machine workloads will move from one physical host to another via the network, with the expectation of continuous service availability and no downtime. There is also the expectation that identity, security and network profiles are preserved. Third, many of these virtual machines will often have a similar network storage profile on the various server hosts, putting more demands on the network as information is placed within networked based storage solutions.
All else being equal, more powerful servers with higher network demands, will result in more energy usage, both in terms of power consumption and cooling. Server I/O networking needs to address this in two ways. First, in terms of directly reducing the network’s energy consumption, and second, facilitating and managing the reduction in the server’s energy consumption. The former includes such things as Energy Efficient Ethernet, while the latter includes things like Wake-on-LAN, NIC Partitioning and protocol offload technologies (all of these are discussed in more detail, later in this paper).

As users upgrade to the new generation of Romley/Sandy Bridge servers, they will also be faced with many different server I/O networking choices:

- The option to use multiple Gigabit Ethernet (1GbE) connections or potentially less Ten Gigabit Ethernet (10GbE) connections.
- Deciding the best strategy to separate and manage different traffic classes.
- If implementing 10GbE, the decision to use 10GBASE-T or SFP+/DAC.
- Determining the best time to converge Storage Area Network (SAN) traffic on to Ethernet.
- When running SAN traffic on Ethernet, is it best to still run two physically separate networks or to combine on a common wire.

**Broadcom Romley/Sandy Bridge Server I/O Solutions:**

To address the above trends and impending Romley/Sandy Bridge launch, Broadcom has a number of full-featured, high-performance server-class silicon controllers – namely the NetXtreme II BCM57810S/BCM57800S and NetXtreme BCM5719/BCM5720 controllers. In combination, these products offer a very wide and diverse portfolio of solutions across rack/tower and blade servers including: Modular LAN-on-Motherboard (LOM)/Daughter Cards; Chip-down LOM, Stand-up PCIe Cards, and Mezzanine Cards. Furthermore, these are offered in network bandwidth speeds of both 1GbE and 10GbE, and even combinations of both speeds. Across these speeds the products are also offered in dual and quad-port configurations.

This is important because the market has become very diverse and a broad portfolio of products is needed to address this requirement. Developments such as virtualization, cloud computing, and network consolidation and convergence have all contributed to this diversity of server networking needs. For example, while we expect a very strong ramp of 10GbE – resulting in it becoming the eventual dominant server network connection – 1GbE will account for the majority of connections for some time. Figure 1 shows our forecast for this transition.
Although 10GbE network connectivity is often associated with virtualized server environments, virtualization is also a key driver of 1GbE connectivity. One popular deployment scenario is dedicated 1GbE ports in virtualized server environments. Here it is not uncommon to see six or more 1GbE ports on a single server. This allows different traffic classes within a single physical server to be separated in alignment with some virtualization best practices or end user network segmentation for reasons such as security, regulations, or bandwidth control. Broadcom’s BCM5719 controller enables a 1GbE quad-port LOM, giving four 1GbE ports natively integrated on the server and needing only one option card for additional ports (dual-port for a total of six or quad-port for a total of eight).

Besides such a broad offering of form-factors, speeds, and port configurations, Broadcom’s controllers offer important features that help address the needs and issues faced in server environments both large and small. One of those key issues is power consumption. This issue is getting increased scrutiny as we see more data center consolidation and the emergence of mega-datacenters centered around Cloud scale-out architecture patterns and Web 2.0 applications and service delivery. Broadcom’s products offer a number of complementary features enabling lower power consumption thus facilitating greener server environments and lower datacenter energy costs.

Power Efficiency

Broadcom has been a driving force behind the IEEE P802.3az Energy Efficient Ethernet (EEE) standard, and has integrated the technology as a key feature of its offerings, allowing for a lower energy consumption state that can be adopted during network idle time or low utilization. Furthermore, Broadcom has enhanced its EEE-enabled controllers with advanced policies to provide additional power savings. These controllers also support protocol offload capabilities, both stateful and stateless, which allow for lower CPU power consumption. Wake-on-LAN is another controller feature offered by Broadcom enabling power savings and energy efficiency. This feature allows a computer to be remotely booted or wakened from a hibernation or standby mode. In addition, Broadcom solutions feature NIC Partitioning, which enables a network adapter to be shared for multiple purposes, thereby reducing the number of devices required and lowering the overall server energy footprint.

End to End, In-house Controller, PHY, Switch Offerings

Broadcom has leveraged its own broad and diverse in-house PHY offerings and technology to enable and complement the above energy saving features. Another example of leveraging its PHY technology is Broadcom’s incorporation of the IEEE 1588 Precision Time Protocol. This is a packet-based timing synchronization which has a value proposition for time-sensitive applications where there is a need to know the precise timing of various events, such as financial trading, oil and gas, manufacturing, entertainment, and others.

Additionally, Broadcom’s PHY business gives it time to market capabilities for discrete solutions and a solid foundation when it comes to integrating PHY technologies into the controller – this is the case for 1GbE and 10GbE KR for SFP+ and Blade adapters and will be the case for 10GBASE-T once the time is right. Broadcom has a very broad and diverse set of PHY offering including 1000BASE-T, 1000BASE-X, 10GBASE-T, 10GBASE-KR, and 10GBASE-CX4. Moreover, since Broadcom has a diverse set of Ethernet networking offerings, including controllers, switches and PHYs, it can also leverage these for interoperability and greater predictability.
Expanded Capabilities for Server Virtualization

Addressing the trend that virtualization and convergence are putting multiple traffic classes in a single server network connection, Broadcom’s 10GbE controllers offer the ability to partition a single 10GbE port into multiple separate connections. NIC partitioning or NPAR enable server OEM partners to offer customers the capability to use a 10GbE connection much more efficiently and economically, allowing for the cost of the connection to be amortized over numerous different applications. Broadcom’s 10GbE controllers were a pioneer in enabling the carving up of a single 10GbE pipe into several connections with Hewlett Packard’s Flex-10 solutions, and they also claim the pioneering role for Switch Independent NIC Partitioning (NPAR) with Dell. These technologies enhance the 10GbE server networking value proposition, since there are few single applications yet that consume a full 10GbE connection.

Aside from NPAR, Broadcom’s 10GbE controllers have incorporated numerous other features to enable converged and virtualized datacenter networks. These include Fibre Channel-over-Ethernet (FCoE), PCI SIG Single Root IO Virtualization (SR-IOV), DCBX, along with iSCSI, on-chip TCP/IP offload (TOE), and Remote Direct Memory Access (RDMA). Although converged networking has garnered a lot of media attention in the last couple of years, Broadcom is on its sixth generation of convergence technology, with many of its prior generation controllers being deployed for storage-over-Ethernet applications. Furthermore, this upcoming Romley/Sandy Bridge cycle will, in total, mark the thirteenth generation of Ethernet controllers from Broadcom.

High Performance Solutions

Networking Performance

With the Romley/Sandy Bridge server refresh, it will be important to match processing power with networking I/O performance, and here Broadcom claims performance of full line rate across all ports on both its 1GbE and 10GbE controllers. More specifically, up to 8Gb/s for bi-directional 4 port 1GbE controllers and 40Gb/s for bi-directional 2 port 10GbE controllers. In addition, the 1GbE and 10GbE controllers deliver over one million packets per second for small packet performance (RFC2544).

Storage over Ethernet Performance

Broadcom has offered Ethernet storage offload capabilities since 2006 and has built on its storage offload capabilities to deliver the high levels of performance and reliability required for the Romley/Sandy Bridge platforms with its BCM57810S and BCM57800S 10GbE controllers. Broadcom has validated its performance claims through Demartek, a third-party, independent testing facility. Here it can point to 1.5 million iSCSI I/O per second with its iSCSI offload, and 2.7 Million FCoE I/O per second.

Long Standing Track Record in Ethernet

With such a technology legacy and execution track record comes a knowledge base that provides a very solid foundation for next generation datacenters. Broadcom can leverage everything it has learned over the past thirteen generations, and the associated solutions, to a plethora of corner cases that invariably occur in a technology as ubiquitous and dynamic as Ethernet. Broadcom was a key vendor helping to drive Ethernet from a best effort technology to the reliable technology it has become today. Over the course of these thirteen generations, Broadcom has also worked with its customers to provide seamless
integration between its controllers and their management tools. As a result, its server OEM partners have an ecosystem of hooks and APIs to manage the Broadcom controllers.

In association with such a long history of delivering Ethernet products, also comes a breadth and depth of interoperability testing. Broadcom has the ability to test current and legacy networking equipment and solutions. This gives its partners and customers solid confidence on the interoperability between Broadcom-based solutions and the other networking equipment that exists in the datacenter. As we move through the Romley/Sandy Bridge server upgrade cycle we will likely see server networking continue to move more and more toward Ethernet networking (Figure 2).

Broadcom has a strong heritage and proven track record in the Ethernet Networking market. As mentioned above, it has delivered many generations of Ethernet controllers, with the current products building on this knowledge base, track record and interoperability testing, in conjunction with offering a rich datacenter-class feature set. Broadcom’s controllers give its server OEM partners the ability to offer their customers both features and high performance, in any combination of network speed and form factor, whether it is the more mature and large installed base of 1GbE or the newer and fast growing 10GbE technology.

**Specific Server OEM Solutions based on Broadcom Controllers:** Broadcom’s complete portfolio of LOMs and Option Cards are available from tier-1 server OEMs including Dell and HP. These products are listed on the following pages. For an up-to-date list of solutions, please visit [http://www.broadcom.com](http://www.broadcom.com)
## Dell PowerEdge Select Network Adapters
**Powered By Broadcom NetXtreme™ Technology**

<table>
<thead>
<tr>
<th>Adapter Photo</th>
<th>Adapter Description</th>
<th>Product Details</th>
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| ![Broadcom 5720 Dual-Port 1GbE Network Interface Card](image1) | Broadcom 5720 Dual-Port 1GbE Network Interface Card | • 1 GbE / 2 Ports  
• L2 Networking  
• Dell P/N: 430-4423 (FH) or 430-4424 (LP) |
| ![Broadcom 5719 Quad-Port 1GbE Network Interface Card](image2) | Broadcom 5719 Quad-Port 1GbE Network Interface Card | • 1 GbE / 4 Ports  
• L2 Networking  
• Dell P/N: 430-4425 (FH) or 430-4426 (LP) |
| ![Broadcom 57810S Dual-Port 10GbE SFP+ Converged Network Adapter](image3) | Broadcom 57810S Dual-Port 10GbE SFP+ Converged Network Adapter | • 10 GbE / 2 Ports  
• L2 Networking, iSCSI HBA, FCoE  
• Dell P/N: 430-4421 (FH) or 430-4422 (LP) |
| ![Broadcom 57810S Dual-Port 10GBASE-T Converged Network Adapter](image4) | Broadcom 57810S Dual-Port 10GBASE-T Converged Network Adapter | • 10 GbE / 2 Ports  
• L2 Networking, iSCSI HBA, FCoE-ready  
• Dell P/N: 430-4419 (FH) or 430-4420 (LP) |
| ![Broadcom 5720 Quad-Port 1GbE Rack Network Daughter Card](image5) | Broadcom 5720 Quad-Port 1GbE Rack Network Daughter Card | • 1 GbE / 4 Ports  
• L2 Networking  
• Dell P/N: 430-4418 |
| ![Broadcom 57800S Quad-Port SFP+ Rack Converged Network Daughter Card](image6) | Broadcom 57800S Quad-Port SFP+ Rack Converged Network Daughter Card | • Two 10 GbE + two 1 GbE Ports  
• L2 Networking, iSCSI HBA, FCoE  
• Dell P/N: 430-4428 |
| ![Broadcom 57800S Quad-Port BASE-T Rack Converged Network Daughter Card](image7) | Broadcom 57800S Quad-Port BASE-T Rack Converged Network Daughter Card | • Two 10 GbE + two 1 GbE Ports  
• L2 Networking, iSCSI HBA, FCoE-ready  
• Dell P/N: 430-4427 |
| ![Broadcom 5719 Quad-Port 1GbE Blade Mezzanine Adapter Card](image8) | Broadcom 5719 Quad-Port 1GbE Blade Mezzanine Adapter Card | • 1 GbE / 4 Ports  
• L2 Networking  
• Dell P/N: 430-4730 |
| ![Broadcom 57810S Dual-Port 10GbE KR Blade Converged Network Daughter Card](image9) | Broadcom 57810S Dual-Port 10GbE KR Blade Converged Network Daughter Card | • 10 GbE / 2 Ports  
• L2 Networking, iSCSI HBA, FCoE  
• Dell P/N: 430-4398 |
| ![Broadcom 57810S Dual-Port 10GbE KR Blade Converged Mezzanine Card](image10) | Broadcom 57810S Dual-Port 10GbE KR Blade Converged Mezzanine Card | • 10 GbE / 2 Ports  
• L2 Networking, iSCSI HBA, FCoE  
• Dell P/N: 430-4401 |

*PCie Adapter Brackets: Full Height (FH) or Low Profile (LP)*

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**Best in Class 1Gb and 10Gb Ethernet Adapter Portfolio**

for Dell PowerEdge 12G Servers
## HP FlexibleNetwork Adapters
Powered By Broadcom NetXtreme™ Technology

<table>
<thead>
<tr>
<th>Adapter Photo</th>
<th>Adapter Description</th>
<th>Product Details</th>
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| ![Adapter Photo](image1) | **HP Ethernet 1Gb 4-port 331T Adapter** | • 1 GbE / 4 Ports  
• Form Factor: Stand-up Card (NIC)  
• Controller: Broadcom BCM5719  
• HP P/N: 647594-B21 |
| ![Adapter Photo](image2) | **HP Ethernet 1Gb 2-port 332T Adapter** | • 1 GbE / 2 Ports  
• Form Factor: Stand-up Card (NIC)  
• Controller: Broadcom BCM5720  
• HP P/N: 615732-B21 |
| ![Adapter Photo](image3) | **HP Ethernet 10Gb 2-port 530SFP+ Adapter** | • 10 GbE / 2 Ports  
• Form Factor: Stand-up Card (NIC)  
• Controller: Broadcom BCM57810S  
• HP P/N: 652503-B21 |
| ![Adapter Photo](image4) | **HP Ethernet 1Gb 4-port 331FLR Adapter** | • 1 GbE / 4 Ports  
• Form Factor: FlexibleLOM Rack  
• Controller: Broadcom BCM5719  
• HP P/N: 629135-B21 |
| ![Adapter Photo](image5) | **HP Ethernet 10Gb 2-port 530FLR-SFP+ Adapter** | • 10 GbE / 2 Ports  
• Form Factor: FlexibleLOM Rack  
• Controller: Broadcom BCM57810S  
• HP P/N: 647581-B21 |
| ![Adapter Photo](image6) | **HP Flex-10 10Gb 2-port 530FLB Adapter** | • 10 GbE / 2 Ports  
• Form Factor: FlexibleLOM Blade  
• Controller: Broadcom BCM57810S  
• HP P/N: 656590-B21 |
| ![Adapter Photo](image7) | **HP Flex-10 10Gb 2-port 530M Adapter** | • 10 GbE / 2 Ports  
• Form Factor: Mezzanine Adapter  
• Controller: Broadcom BCM57810S  
• HP P/N: 631884-B21 |

### Best in Class 1Gb and 10Gb Ethernet Adapter Portfolio for HP ProLiant Gen8 Servers