Executive Summary

Dell® and QLogic® have partnered to deliver their customers the highest performing, most reliable, and scalable solution for the twelfth-generation Dell PowerEdge™ server portfolio. To accomplish this, the platform uses a custom daughter card to house the complete LAN on Motherboard (LOM) subsystem. In these systems, the LOM is provided on the Network Daughter Card (NDC) as part of the Dell PowerEdge Select Network Adapters family. This technology brief will help you make an informed selection of the Dell PowerEdge Select Network Adapter for blade environments.

Benefits of Offloading I/O Processing to the Adapter

FCoE and iSCSI Protocol Offload Delivers Enterprise-Class Performance, Reliability, and Scalability
Enterprise-Class Data Center Requirements

<table>
<thead>
<tr>
<th>Enterprise Requirements for FCoE</th>
<th>Converged Network Adapter</th>
<th>Software Initiator</th>
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<tbody>
<tr>
<td>Performance</td>
<td></td>
<td></td>
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<tr>
<td>Support for I/O-Intense Applications</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Efficient CPU Utilization</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Reliability</td>
<td></td>
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<tr>
<td>Data Integrity Assurance</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Comprehensive Fail-over Support</td>
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<td>No</td>
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<tr>
<td>Enterprise Reliability</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Investment Protection</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Scalability</td>
<td></td>
<td></td>
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<tr>
<td>Scalability within Virtual Operating Environments</td>
<td>Yes</td>
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</tr>
<tr>
<td>IOPs Scalability</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Concurrent I/O Support for Consolidation</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Broad OS Support</td>
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<td>No</td>
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<tr>
<td>Proven Interoperability</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Boot from SAN Across Configurations and OSs</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Benefits of Hardware Offload

Consolidation driven by server virtualization is accelerating the move to 10GbE technology in data center networks. Virtualized environments require higher performance and greater bandwidth. IT administrators are looking to extend the benefits of virtualization by consolidating servers, lowering CPU utilization, accommodating multiple protocols (Ethernet, iSCSI, and FCoE), simplifying bandwidth, and reducing cable management complexity as they deploy 10GbE technology. FCoE provides a direct mapping of Fibre Channel onto Ethernet and enables the benefits of Fibre Channel protocol to be natively transported over the ubiquity of Ethernet networks. Performance, scalability, and reliability should be understood when specifying the interconnect for the FCoE-enabled data center.

Performance

Consolidation is being driven by virtualization. Yet, virtualization imposes additional overhead on the CPU, network, and I/O. With limited I/O bandwidth and CPU resources, it is not logical to further burden the CPU with processing I/O storage requests by using software FCoE initiators. In addition, mobility of virtual servers, load balancing, and failover will require high throughput, especially when it is being shared by multiple VMs. For enterprise-class applications, a software FCoE solution not only fails to...

End-User Benefits

Full Offload Capability
- Lowers CPU utilization for I/O processing
- Increases application performance
- Allows for more virtual machines (VMs) per server¹

Advanced Virtualization Techniques
Switch Independent Partitioning offers value, including the following:
- Enables hardware consolidation
- Reduces I/O emulation overhead
- Dedicates bandwidth (QoS) for improved scalability
- Lowers adapter, cabling, and management costs²

Simplified Management
- Provides concurrent support for Ethernet, FCoE, and iSCSI protocols
- Minimizes deployment disruptions
- Agnostic to network switches
- Proven and broadest interoperability with OSs, switches, storage, and ISV and IHV fail-over solutions
- Reduces operating overhead—single SKU across OSs/protocols

Higher Reliability
- Offers end-to-end data protection with T10 capability and Overlapping Protection Domains

¹ Allocates more CPU cycles for enterprise applications, resulting in faster response times and enhanced user experience
² The eSwitch capability on the adapter allows VM-to-VM traffic flow within the server without using expensive external switch ports
meet enterprise requirements but it also can be detrimental to data center virtualization goals. Deploying an I/O adapter with full hardware offload capability allows you to run more applications per server and extend the useful life of your infrastructure. Initial capital cost of software FCoE may be low, but it is important to consider the operational and intangible costs of a software initiator.

Reliability

The FCoE protocol adopts a data processing mechanism similar to Fibre Channel to maintain the same level of data integrity while sending storage data over Enhanced Ethernet. Data integrity checking is a compute-intensive process that is either performed by the CPU in solutions using a software initiator or by the offload engine of a Converged Network Adapter. Full hardware offload maintains the highest level of data integrity. Increasing traffic across an Ethernet network will produce dropped and out-of-order data frames. Using software FCoE initiators, recovering from both these issues can be a significant burden on the CPU and may cripple overall performance on a 10Gb Ethernet network. The Dell Select Network Adapter, powered by the QLogic offload engine, reassembles out-of-order frames and completes the process of resending those that are dropped while maintaining low CPU utilization, ensuring the highest levels of performance and reliability. Software FCoE initiators lack maturity for enterprise applications and it will take years of qualification testing to be ready for reliable enterprise data center deployments.

Enterprise data centers that run mission-critical applications require extensive, heterogeneous, and scalable deployments with high CPU efficiency and Reliability, Availability, and Serviceability (RAS) built into the design of the data center functions. The QLogic hardware offload technology and solutions provide key benefits to meet such demands. Hardware-based Boot from SAN offers several benefits for data center deployments. Boot images for the servers can be stored remotely with centralized management, leading to higher density and utilization of storage in each server, improved cooling with reduced storage requirement, and efficient management of host image deployments. This means lower operational costs while improving RAS by avoiding single point of failure on the local disk in the server. A stable, reliable, and extensively field-proven Boot from SAN hardware offload solution for the critical data center operations provides key advantages for the enterprise that a software FCoE solution may not adequately meet at this time.

Multipath I/O provides the critical high availability paths for SAN deployments in the data center. It enables the establishment of multiple paths between the I/O devices with redundant paths that can be leveraged when an I/O path fails. Multipath I/O allows enterprise critical applications to function, providing access to the critical data required for maintaining mission-critical functions. Increasing the number of virtualized deployments intensifies the importance of the multipath solution in the data center. When a path to a virtualized server fails, it is no longer a singular operating system (OS) that is impacted. The impact is exponential due to the high density of the VMs that are running with scaled-out applications. The QLogic full hardware offload solution provides the same level of RAS for multi-path I/O and fail-over solutions out-of-box, as seen with the Boot from SAN solutions.

Scalability

Software FCoE has lower scalability capacity. One adapter running a software initiator could easily consume up to one-third of the CPU processors’ capabilities. The addition of multiple adapters into a single system relying on the CPU to perform their multiple operations only compounds the problem, as does the addition of VMs. Using a software initiator on a NIC requires that every incoming TCP/IP, FCoE, and iSCSI packet be sent over the PCI bus in the server. Sending packets back and forth increases the PCI bus’ busy state, and can cause bottlenecks with other hardware on the PCI bus. Offload engines are a better alternative to software initiators in enterprise servers because organizations can address emerging and future scalability requirements within enterprise data centers. As enterprise application customers strive to achieve density and resource utilization objectives, high I/O performance will emerge as a requirement. Virtualization requires CPU processing capability to efficiently scale VMs. Furthermore, the addition of a virtualization layer can add overhead, which will degrade I/O performance.

With the Dell PowerEdge Select Network Adapters by QLogic, the Fibre Channel driver stack is processed by the adapter. Offloading Fibre Channel processing means that more CPU resources can be used to support more VMs. This provides greater cost savings and ROI for virtualized environments.

Switch Independent Partitioning offers value to an organization by enabling hardware consolidation of multiple 1GbE ports into a single 10GbE port. It also allows the creation of multiple partitions for flexible bandwidth provisioning on 10GbE adapters. Switch Independent Partitioning reduces I/O emulation overhead and assigns I/O hardware directly to VMs. It also provides dedicated bandwidth (QoS) for VMs and associated applications, which improves scalability.

In addition, QLogic is currently the only vendor to support NIC, FCoE, and iSCSI protocols concurrently. Along with performance, reliability, and scalability benefits, Dell PowerEdge Select Network Adapters by QLogic offer additional operational efficiencies, such as boot from SAN, multi-path I/O, the elimination of PCIe® bus bottlenecks, a mature, field-hardened driver, and the largest interoperability base in the industry.
Dell and QLogic Deliver Joint I/O Solution

Dell PowerEdge Select Network Adapters by QLogic offer a full-featured, high performance, and scalable solution that includes convergence and virtualization. Converged Networking Adapters provide the flexibility of built-in support for iSCSI and FCoE right off the motherboard without requiring any additional licensing costs. Virtualization enhancements such as Switch Independent Partitioning deliver exceptional value and future-proof data center investments in emerging virtualization technologies. Flexibility, converged functions, virtualized I/O, and effective system management all replace a single-function, fixed I/O LOM for blade servers. This powerful new approach to server I/O is a compelling reason to choose Dell and QLogic.