



By Sunil Ahluwalia

NEW TECHNOLOGIES SPEED THE MOVE TO 10 GIGABIT ETHERNET DATA CENTER CONNECTIVITY

To handle the demands of increasingly bandwidth-hungry applications, IT managers are turning to 10 Gigabit Ethernet technology for virtualized servers and networked storage platforms. New multi-core processor architecture and network interface card technologies are designed to meet rapidly evolving requirements for a truly dynamic data center.

Cost-conscious IT departments have adopted data center virtualization as a way to help increase efficiency and reduce total cost of ownership. As virtualized server and storage deployments increase, infrastructure components are evolving to keep pace. These collective enhancements promise unmatched data center efficiencies, but they pose new challenges too. Systems designed for virtualized environments, such as the Dell™ PowerEdge™ R710 server based on the multi-core Intel® Xeon® processor 5500 series architecture, can provide the compute power required to support a large number of virtual machines (VMs). At the same time, the aggregation of VMs and applications on a server raises the demand for I/O capacity.

Server consolidation can also intensify network storage requirements to support the data needs of VMs, including backup and live migration. By allowing cost-effective Ethernet infrastructure to be used as a storage area network (SAN) fabric, the Internet SCSI (iSCSI) standard has fueled rapid adoption of iSCSI SANs such as Dell EqualLogic™ PS Series arrays. Increasing demand for SAN connections can drive the need for increased I/O.

Escalating I/O demand is driving the data center framework toward 10 Gigabit Ethernet (10GbE) connectivity, with servers, network devices, and storage arrays designed to scale performance dynamically

in the face of constantly changing compute needs. The growth in 10GbE implementations is being fueled by increasingly cost-effective per-port capability. Meanwhile, the emergence of the Fibre Channel over Ethernet (FCoE) standard is expected to quicken the pace of 10GbE deployment by fostering a unified data center network.

Many elements of the dynamic 10GbE data center are already in place. The generation of servers based on the Intel Xeon processor 5500 series architecture enables the processing power and adaptability needed to support growing VM deployment without increasing power or space requirements. Intel 10GbE server adapters are designed to take advantage of the capabilities of these platforms and provide the necessary I/O bandwidth.

PROCESSOR ARCHITECTURE: ENHANCING I/O SCALABILITY

The Intel Xeon processor 5500 series combines multiple processors with architectural features that allow for a high level of 10GbE scalability—including specifications designed to enable faster memory, faster interconnect architecture, and a faster PCI Express (PCIe) bus than previous Intel processor architecture generations (see Figure 1).

An integrated memory controller with Double Data Rate 3 (DDR3) memory is designed to enable peak

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memory bandwidth of up to 32 GB/sec per socket, which is significantly higher than the memory bandwidth that was specified on previous platforms for the entire system. Another key difference is that the frontside bus has been replaced by an Intel QuickPath Interconnect (QPI) link that provides dedicated, high-speed communication between processors.

To support high-bandwidth I/O and the ability to scale across multi-port 10GbE, the new processor architecture also uses a second-generation PCIe 2.0 bus from the I/O hub to the network interface card (NIC). The PCIe 2.0 bus is designed to provide twice the transfer rate of first-generation PCIe.

**NETWORK CONTROLLER:
OPTIMIZING 10GbE FOR I/O
VIRTUALIZATION**

At the network interface, Intel 10GbE server adapters include Intel Virtualization Technology for Connectivity (VT-c) to enhance I/O performance in virtualized environments. Intel VT-c includes hardware optimizations that help reduce I/O bottlenecks and increase server performance. The Intel VT-c suite consists of Intel Virtual Machine Device Queues (VMDq) and Intel Virtual Machine Direct Connect (VMDc).

VMDq enhances data processing by offloading the network traffic sorting and queuing functionality from the VM monitor in the hypervisor to the Ethernet controller. VMDc is designed to provide direct connectivity to VMs that enables near-native performance and VM scalability.

Intel 10GbE server adapters support iSCSI and network attached storage. Intel 10GbE server adapters on Dell PowerEdge servers can accelerate iSCSI traffic by implementing key stateless offloads such as TCP segmentation offload (TSO). They also support iSCSI initiators from Microsoft®, Linux®, and VMware® platforms and provide a robust iSCSI remote boot implementation. In the next generation of Intel 10GbE Ethernet, planned performance-enhancing features

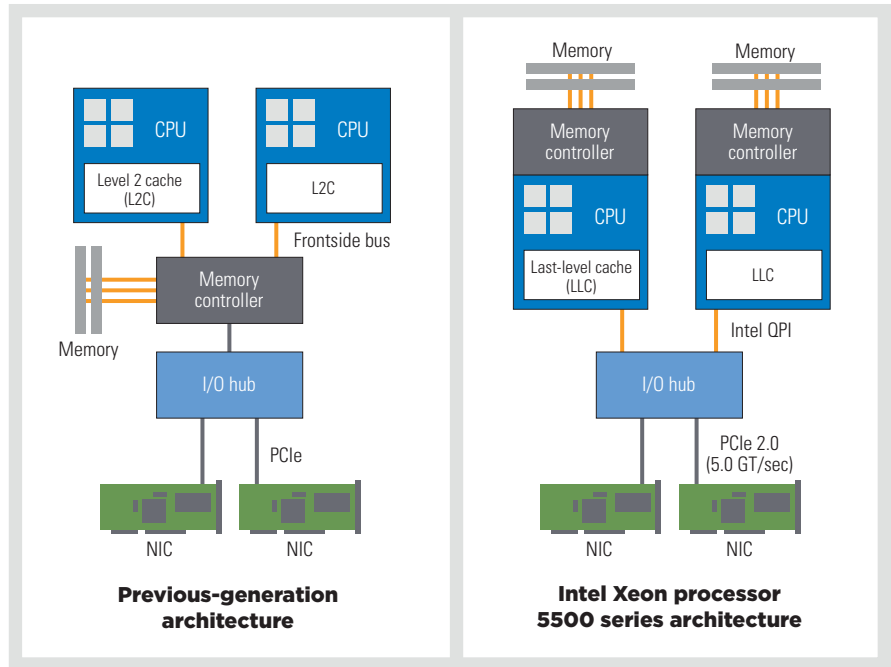


Figure 1. I/O enhancements of the previous-generation architecture in the Intel Xeon processor 5500 series architecture

include FCoE offloads and receive-side coalescing (RSC).

**CONSOLIDATION: TRANSFORMING
THE DATA CENTER**

A fundamental shift is taking place in enterprise data centers as IT managers leverage virtualization to consolidate applications and data onto fewer physical servers and storage devices compared with traditional non-virtualized environments. Dell PowerEdge servers with powerful multi-core processors and virtualized iSCSI SANs such as the Dell EqualLogic PS Series arrays help facilitate this transformation to a flexible and cost-effective data center. As enterprise growth requires these systems to continue aggregating VMs and storage, 10GbE connectivity enables the I/O capacity to support increased performance demands and bandwidth-hungry applications.

Together with an ecosystem of powerful applications and today’s cost-effective 10GbE networking hardware, innovations in the Intel Xeon processor 5500 series architecture and Intel 10GbE server adapters are helping drive the advance toward an emerging data center model

that dynamically adapts to changing business needs.

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