Dell and QLogic are Driving Next-Generation Server I/O Virtualization with Enhanced QoS Manageability

**Switch Independent Partitioning and VMware’s NetIOC**

Switch Independent Partitioning and NetIOC are complementary technologies that give IT administrators a method for best use of the 10Gb Ethernet network.

**SWITCH INDEPENDENT PARTITIONING**

Switch Independent Partitioning, also referred to as NIC Partitioning (NPAR), is a method of dividing a single physical 10GbE Ethernet port into multiple PCI physical functions or partitions with flexible bandwidth capacity allocation. This approach enables administrators to apply QoS to the virtual ports, which improves I/O performance while maintaining a low total cost of ownership (TCO). Dell’s implementation maps four PCI functions to each physical port on a dual-port 10GbE device. Switch Independent Partitioning presents the eight PCI functions per device using standard PCI configuration space. Each function or partition is assigned a unique MAC address. Each partition can support concurrent networking and storage protocols, enabling flexible bandwidth provisioning to applications.

The administrator can assign these partitions to run both networking and storage protocols, with an implementation that is agnostic to the external Ethernet switch. For certain configurations, the QLogic unique eSwitch implementation enables the switching of VM-to-VM traffic via the embedded switch located in the adapter, thereby reducing the traffic and latency of flow through an external switch port. This results in lower CPU utilization while preserving I/O performance, providing sufficient capacity to run additional applications. Switch Independent Partitioning with the unique eSwitch implementation ensures the highest levels of virtualization with assured interoperability in heterogeneous data centers.

**INDUSTRY CHALLENGES**

Moving to a 10GbE converged network overcomes the cost, cabling, and management complexities, as well as the bandwidth limitations, involved in network architectures based on multiple 1GbE NIC adapters. While 10GbE addresses these issues, consolidation of multiple traffic types presents new challenges for ensuring Quality of Service (QoS) policies meet the required SLAs for workloads of each traffic type. Network I/O Control (NetIOC), a feature introduced in VMware vSphere™ 4.1, is a software solution that allows separating physical network bandwidth among the different types of network traffic flows.

Dell™ and QLogic® are offering Switch Independent Partitioning as a standard way of addressing the market needs of today for NIC Partitioning functions across multiple protocols, speeds, and QoS for virtualized computing environments. Switch Independent Partitioning and NetIOC are complementary technologies that give IT administrators a method for best use of the 10Gb Ethernet network.

**SWITCH INDEPENDENT PARTITIONING – HARDWARE-BASED QoS**

Dell and QLogic are driving next-generation server I/O virtualization with Switch Independent Partitioning, which is based on QLogic’s VMflex™ technology. Switch Independent Partitioning, also referred to as NIC Partitioning (NPAR), is a method of dividing a single physical 10GbE Ethernet port into multiple PCI physical functions or partitions with flexible bandwidth capacity allocation. This approach enables the application of fine-grain QoS to the virtual ports, improving I/O performance while maintaining a low total cost of ownership (TCO).
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Dell’s implementation maps four PCI functions to each physical port on a dual-port 10GbE device. Switch Independent Partitioning presents the eight PCI functions per device using standard PCI configuration space. Each function or partition is assigned a unique MAC address. Each port can support concurrent networking and storage protocols (FCoE, iSCSI, and NIC), allowing flexible bandwidth provisioning to applications. Unlike competitive solutions, these partitions can be assigned to run both networking and storage protocols (FCoE, iSCSI, and NIC), allowing flexible personality (LAN or SAN) for the partitioned function that is agnostic to the external switch or operating system (OS). For certain configurations, this approach also enables the switching of VM-to-VM traffic via the embedded switch located in the adapter. This results in lower CPU utilization while preserving I/O performance, providing sufficient capacity to run additional applications. Switch Independent Partitioning provides a non-captive (switch and OS agnostic) solution to customers, ensuring the highest levels of interoperability in heterogeneous data centers.

VMWARE NETWORK I/O CONTROL – HYPERVERSOR-BASED QoS

NetIOC addresses the challenges of prioritizing traffic over the physical network by introducing a software approach to dividing physical network bandwidth among the different types of network traffic flows. It does so by providing appropriate traffic-shaping policies that enforce traffic isolation, predictability, and prioritization, avoiding potential over usage by a single virtual machine (VM) within server virtualization.

NetIOC’s functionality is within the hypervisor switch; it provides QoS capabilities in the software at the hypervisor level. NetIOC requires a vNetwork Distributed Switch (vDS) to be running. The VMware vNetwork Distributed Switch (vDS) is a virtual switch introduced in VMware vSphere 4. The vDS allows you to manage VM networking for a number of hosts as a single virtual switch. NetIOC uses predefined network resource pools associated with a fixed traffic type (for example, vMotion, VM, NFS, and software iSCSI traffic). Traffic shaping with shares are used for allocating the bandwidth for the predefined network flows. Workloads use the CPU cycles from the host processor to manage the network I/O control.

The NetIOC parameters, limits, and shares provide benefits by controlling the traffic flows to prevent one type of traffic from overtaking the bandwidth and thus starving another type. Limits define the upper or maximum bandwidth for specific traffic types, while shares provide relative importance for the identified traffic type. NetIOC is based in the hypervisor switch, and it provides QoS capabilities in software at the hypervisor level.

Using a software-based QoS implementation may lead to misconfigured management traffic schemes. Having dedicated and separate switch independent partition ports and a traditional vSwitch to manage traffic protects from this type of misconfiguration. This allows system architects to have separate interfaces for different application tiers and to segregate IP-based storage traffic.
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SUMMARY
Switch Independent Partitioning and NetIOC are complementary technologies that give IT administrators a method for best use of the 10Gb Ethernet network. Depending on the deployment needs, the hardware-based Switch Independent Partitioning can be leveraged for running QoS-enabled, concurrent LAN and SAN solutions without using the host CPU cycles or being tied to a specific OS—unlike a software-based solution. I/O-intensive traffic workloads are supported with full hardware offloads for high scalability. Flexible LAN and SAN personalities for the I/O function provide much needed flexibility for heterogeneous enterprise deployments, allowing the partitioned network port to change personality from LAN to SAN or vice versa. The dedicated hardware-supported QoS allows sustained fine-grain dynamic I/O allocations that are isolated from workload fluctuations and resource demands of the host CPU. Often overlooked when using a software-based solution is the ability to scale out with varying or unpredictable CPU and I/O bound workload spikes. Determining how much bandwidth can be used with unexpected demands, while ensuring enough host CPU cycles are preserved, creates a more complex solution deployment for avoiding I/O and host CPU bottlenecks.

The hardware-based Switch Independent Partitioning solution optimizes bandwidth utilization with oversubscription support; unused bandwidth is efficiently utilized when and where it is needed the most while supporting dynamic limits for isolation—all at zero cost to the host CPU. A hypervisor-based QoS solution provided in conjunction with Switch Independent Partitioning offers tangible benefits to maximize bandwidth utilization, simplify management, reduce capital costs, prioritize critical traffic flows, and provide the benefits of an integrated hardware- and software-based QoS network solution in virtualized environments.

KEY BENEFITS
Here are some of the ways Switch Independent Partitioning offers value to an organization:

Reduced Capital and Operational Expenditures
- Enables hardware consolidation of multiple 1GbE ports into a single 10GbE port
- Allows the creation of multiple partitions for flexible bandwidth provisioning on 10GbE adapters
- Provides lower adapter, cabling, switch port, and management costs

Eliminates Dependency on a Captive Switch
- Removes dependency on an external Ethernet switch to regulate and manage bandwidth
- Offers customers the freedom to choose an Ethernet switch of their choice

Simplified Deployment and Management
- Provides concurrent support for Ethernet, FCoE, and iSCSI protocols, which appear as discrete functions similar to native OS, minimizing deployment disruptions
- Eliminates the need for OS changes to implement flexible bandwidth provisioning

Improved Ability to Scale the Business
- Reduces I/O emulation overhead
- Assigns I/O hardware directly to VMs
- Allows the dedication of bandwidth (QoS) for VMs and associated applications
- Conserves PCIe slots in all server environments
- Enables high I/O performance in virtualized environments

Advantages of Switch Independent Partitioning
- Available today

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