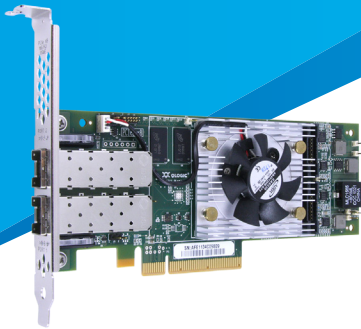


NIC Partitioning and VMware's NetIOC

Cavium is Driving Next-Generation Server I/O Virtualization with Enhanced QoS Manageability



Cavium offers NIC Partitioning (NPAR) as a standard way of addressing the market needs of today for NPAR functions across multiple protocols, speeds, and QoS for virtualized computing environments. NPAR with NetIOC give IT administrators the best use of the 10Gb Ethernet network.

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.

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

NPAR—HARDWARE-BASED QOS

Cavium is driving next-generation server I/O virtualization with NPAR, which is based on the QLogic® VMflex® technology. 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). Cavium's implementation maps four PCI functions to each physical port on a dual-port 10GbE device. NPAR 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, enabling flexible bandwidth provisioning to applications.

Unlike competitive solutions, these partitions can be assigned to run both networking or 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. NPAR provides a non-captive (switch and OS agnostic) solution to customers, ensuring the highest levels of interoperability in heterogeneous data centers. (See Figure 1.)

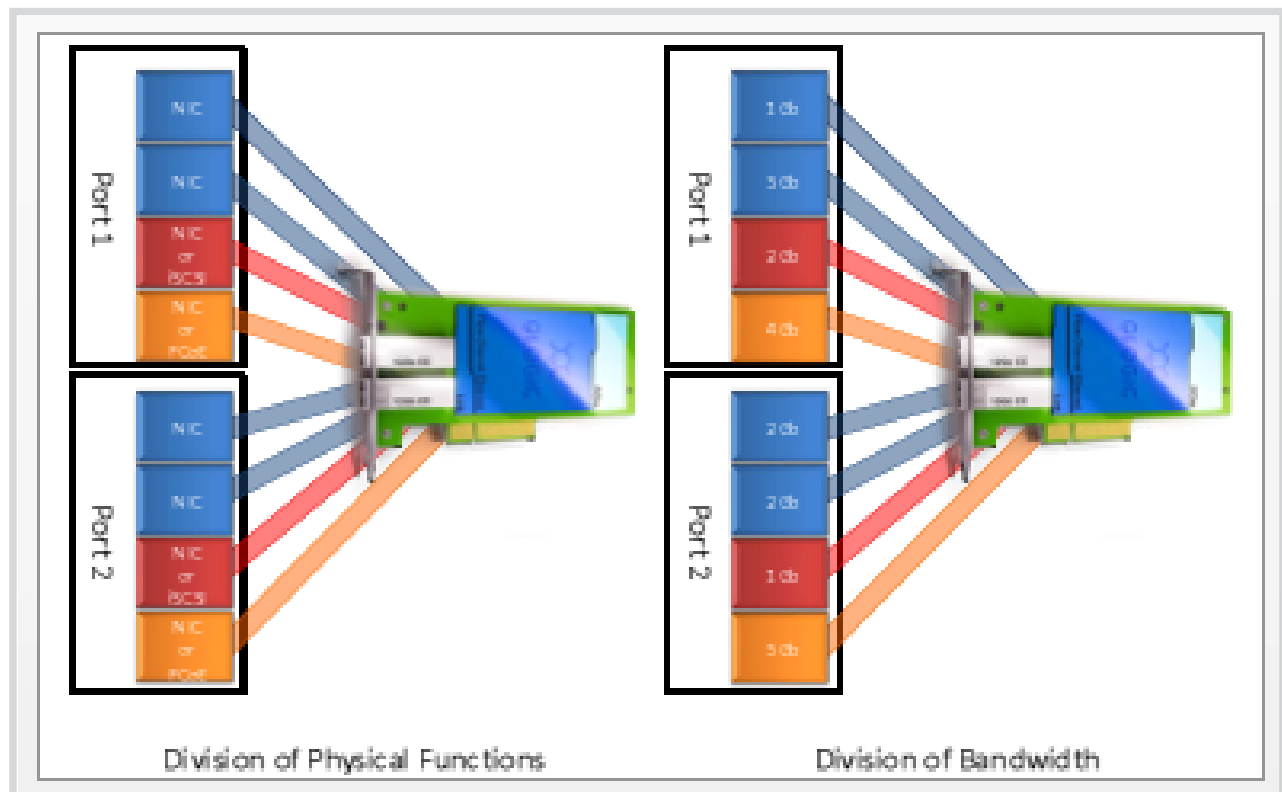


Figure 1. NPAR

VMWARE NETWORK I/O CONTROL—HYPERVISOR-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.

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. (See Figure 2.)

KEY BENEFITS

Here are some of the ways NPAR 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

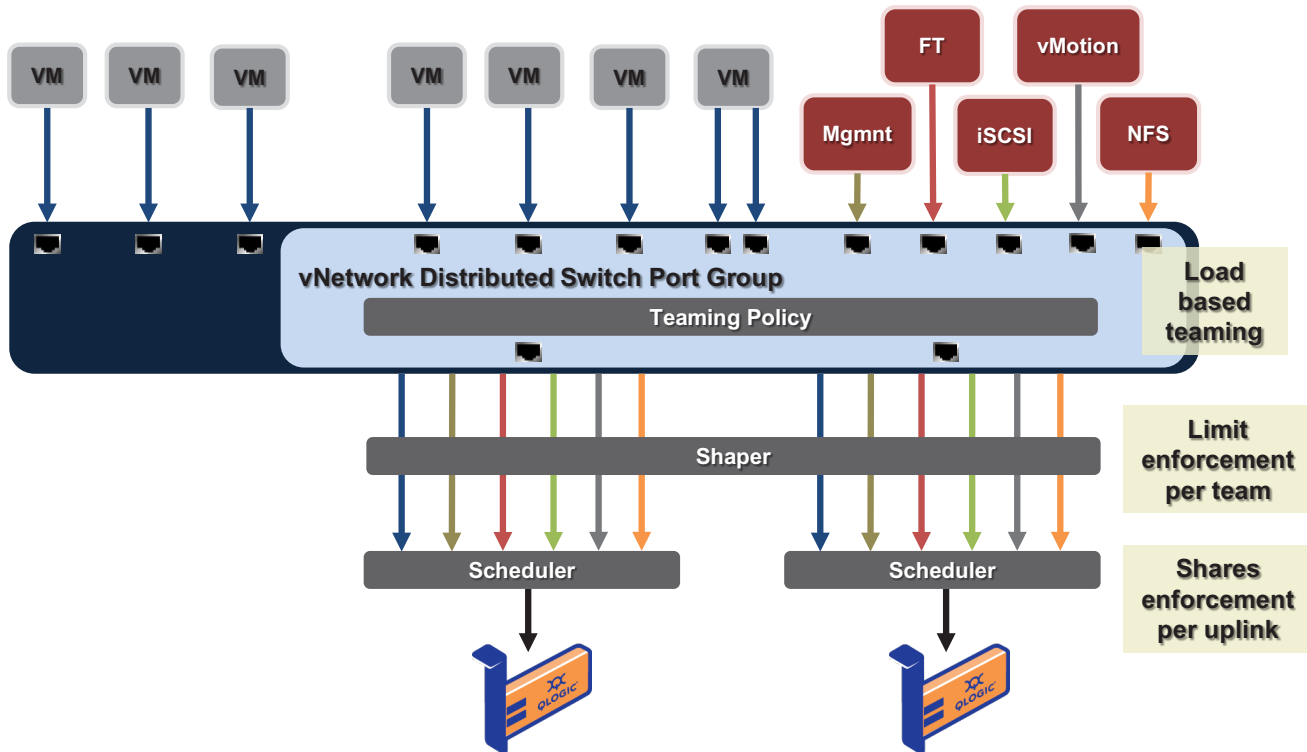


Figure 2. NetIOC Architecture

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 NPAR

Available today

SUMMARY

NPAR 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 NPAR 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 NPAR 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 NPAR 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.

ABOUT CAVIUM

Cavium, Inc. (NASDAQ: CAVM), offers a broad portfolio of infrastructure solutions for compute, security, storage, switching, connectivity and baseband processing. Cavium's highly integrated multi-core SoC products deliver software compatible solutions across low to high performance points enabling secure and intelligent functionality in Enterprise, Data Center and Service Provider Equipment. Cavium processors and solutions are supported by an extensive ecosystem of operating systems, tools, application stacks, hardware reference designs and other products. Cavium is headquartered in San Jose, CA with design centers in California, Massachusetts, India, Israel, China and Taiwan.



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