



## Enhancing I/O in a virtualized environment through NIC partitioning

By Michael Coon, Pankaj Gupta, and Rahul Deshmukh

With virtualization comes an increase in the amount and complexity of I/O traffic. NIC partitioning enhances I/O performance in a virtualized environment—advancing hardware consolidation and flexible bandwidth provisioning for heightened IT agility.

Envisioning the many potential benefits of virtualization—simplified IT management, optimized resource utilization, and reduced energy costs, among others—it's no wonder that organizations are stepping up their efforts to transform physical IT infrastructures into virtual ones. As they do so, the impact of virtualization on network I/O is a top-of-mind consideration. Namely, increases in platform performance, multi-core processing, hardware resource utilization, I/O speed, and the number and density of virtual machines (VMs) all contribute to a corresponding rise in the volume and complexity of I/O traffic.

I/O bottlenecks are particularly troublesome because they impair application performance and limit the number of VMs deployed. One method that helps reduce bottlenecks and improve system performance involves giving VMs direct access to hardware I/O devices. This approach avoids the overhead of embedded software switches.

Dell and QLogic are driving next-generation server I/O virtualization with network interface card (NIC) partitioning (NPAR) based on QLogic® VMflex™ technology. NPAR is a method of dividing a single physical Ethernet port into four partitions, or *virtual ports*, which enables administrators



to conserve PCI Express (PCIe) slots in the physical host server. In addition, NPAR allows administrators to dedicate bandwidth for VMs and associated applications and to apply quality of service (QoS) to the virtual ports, helping improve I/O performance. NPAR does not require special OS or hypervisor support, so it can be incorporated in existing IT infrastructures.

### Easing the transition to 10 Gigabit Ethernet

NPAR helps manage the transition to 10 Gigabit Ethernet (10GbE) networking, which is driven by increased performance and bandwidth requirements of virtualized environments and distributed applications. The move to 10GbE means that administrators no longer must deploy multiple dedicated Gigabit Ethernet (GbE) networking ports for different traffic types in a single physical server. Instead, they can replace multiple GbE ports with fewer 10GbE ports while still maintaining the high performance, bandwidth provisioning flexibility, and isolation attributes found in the physical server environments.

NPAR paves the way to a smooth 10GbE migration by enabling administrators to divide a single 10GbE adapter into multiple independent partitions. Each partition is designed to support concurrent storage and data networking protocols, including TCP/IP, Fibre Channel over Ethernet (FCoE), and Internet SCSI (iSCSI), as shown in Figure 1. As a result, this approach minimizes deployment disruptions and avoids OS changes to applications running in the VMs. In addition, flexible provisioning and multiple partitions help lower adapter, cabling, switch port, and management costs.

Because NPAR is agnostic to the external Ethernet switch, it avoids the related dependencies to regulate and manage bandwidth. Consequently, administrators are free to use an Ethernet switch of their choice.

For certain configurations, NPAR also enables the switching of VM-to-VM traffic within the physical server through a Layer 2 switch embedded in the adapter. By offloading VM I/O from the host server, NPAR helps free the processor to run additional applications.

### Implementing NPAR in a virtualized OS environment

Administrators can implement NPAR in either a native (bare metal) or a virtualized OS environment. Consider an example use case for a virtualized platform running on a Dell™ PowerEdge™ M610 blade server. Data centers today typically deploy multiple GbE NICs to isolate and regulate different traffic types being generated by the various applications residing on a single blade server: one NIC dedicated to OS kernel traffic, one NIC to management traffic, one NIC to backup traffic, and yet another NIC for the storage interface (see Figure 2, left). However, using multiple GbE NICs can lead to high management and infrastructure costs because each NIC adds to the management complexity and the amount of adapters, cables, switch ports, power, and cooling required. Moreover, the number of available I/O expansion slots limits the number of dedicated GbE ports in a blade server that an administrator can deploy. And finally, administrators cannot run applications that need more than GbE bandwidth because they are limited by the fixed GbE bandwidth.

As an alternative, administrators can install a QLogic QME8242-k 10GbE converged network adapter (CNA) mezzanine card in the PowerEdge blade server. This NPAR-enabled network adapter consolidates dedicated GbE ports into partitions of a single 10GbE port, thereby enabling cable consolidation (see Figure 2, right). From an OS perspective, no changes are required, which facilitates a smooth deployment. The eight partitions supported by the dual-port adapter appear as eight independent, discrete NICs to the OS.



### Next-generation I/O virtualization for blade servers

Discover the benefits of network interface card (NIC) partitioning (NPAR) as Sameer Shurpalekar from QLogic runs through a use case and provides tips on configuration.

[streaming.qlogic.com/NPAR.html](http://streaming.qlogic.com/NPAR.html)

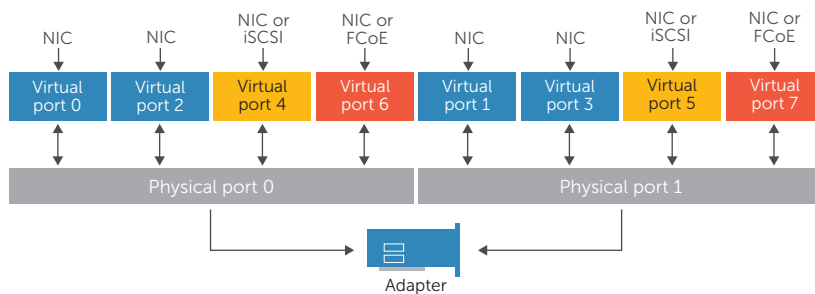


Figure 1. NIC partitioning divides each physical port into four virtual ports, each capable of concurrent storage and data networking protocols

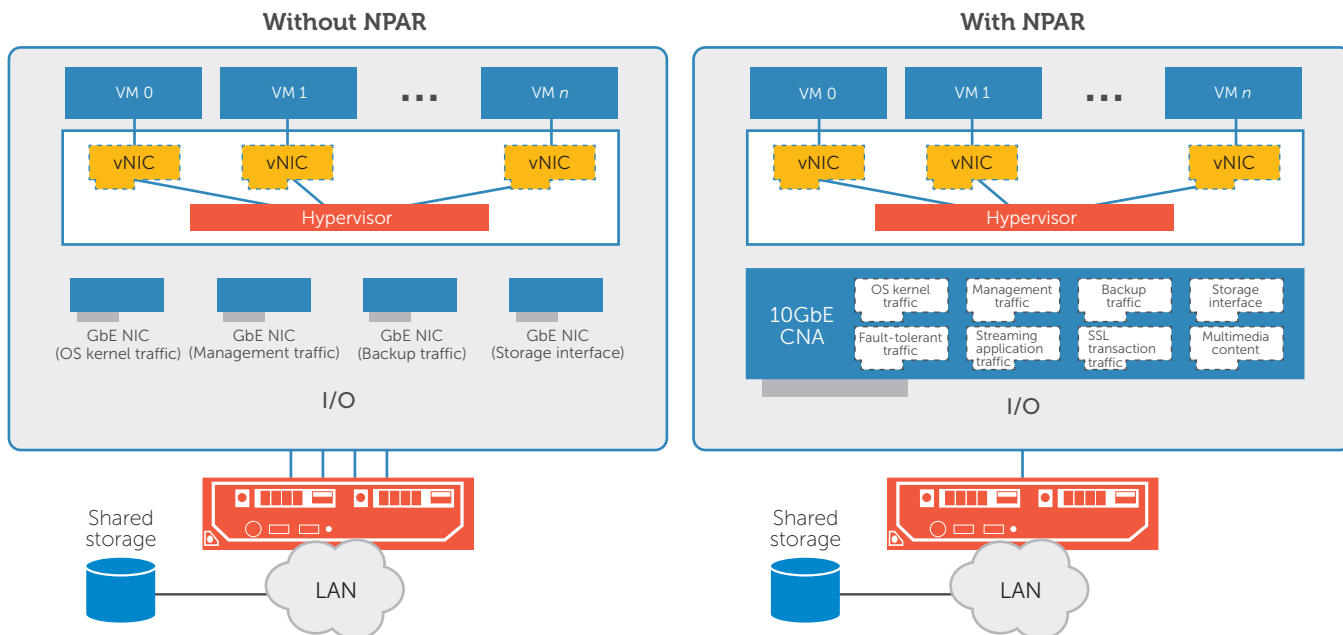


Figure 2. NPAR enables hardware consolidation over 10GbE

Administrators can set maximum and minimum bandwidth and implement dynamic bandwidth balancing for NPAR, which enables applications to get the appropriate bandwidth when they need it. This flexibility is available without installing a different external Ethernet switch infrastructure, because NPAR is switch-agnostic.

The CNA is managed through Dell system management tools such as Dell Unified Server Configurator, which is enabled by the Dell Lifecycle Controller. Embedded directly in PowerEdge blade servers, the Unified Server Configurator provides comprehensive access to systems management features that operate in a pre-OS environment. Using the Unified Server Configurator, administrators can configure, update, and manage the CNA through a single-pane-of-glass interface.

### Facilitating the deployment of consolidated I/O

NPAR technology helps administrators ease the migration path to 10GbE in virtualized environments by alleviating network I/O bottlenecks—boosting flexibility and performance through dedicated bandwidth

access to applications running on VMs.

Administrators can access NPAR functionality through the QLogic QME8242-k 10GbE CNA, which is available within Dell PowerEdge blade servers.

Because NPAR enables hardware consolidation and does not require a proprietary switch infrastructure, the technology, coupled with PowerEdge blade servers, helps organizations lower total cost of ownership for deploying cloud computing and virtualized environments. And by enabling organizations to transition from Fibre Channel to FCoE or iSCSI over 10GbE, NPAR facilitates the deployment of cost-efficient, flexible networks. **PS**

### Authors

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