

The Advantages of Multi-Port Network Adapters in an SWsoft Virtual Environment



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Introduction

Every enterprise can benefit from improving the utilization of IT resources. Improved utilization not only helps reduce costs but can also simplify IT infrastructure, leading to reduced operations costs. A virtual computing infrastructure can provide the features that enable these benefits. At the same time, a virtual infrastructure can heighten the availability of mission-critical applications and improve IT agility to respond to business needs. The SWsoft Virtuozzo server virtualization solution provides a high-performance, low-overhead environment for virtual computing infrastructures; the low overhead of Virtuozzo makes it ideal for I/O intensive applications such as databases. To maintain the reliability, flexibility and performance that a high I/O virtual infrastructure provides, physical servers hosting virtual environments need multiple high-throughput network connections. This is an ideal environment for the use of connection-dense HP ProLiant NC series network adapters based on Intel technology.

Virtualization addresses key challenges facing IT today

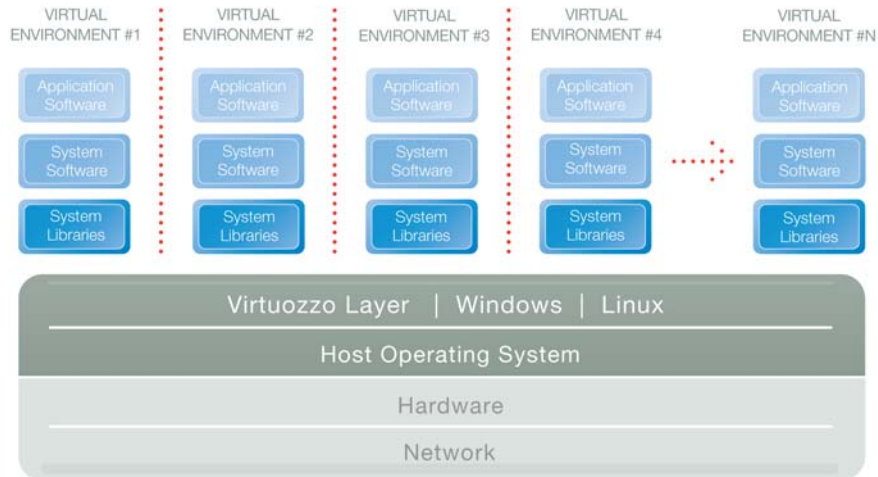
IT organizations everywhere face daily challenges: Do more with less. Respond to new initiatives faster. Reduce downtime. Sound familiar? A growing number of enterprises are finding that server virtualization:

- Is a proven way to better utilize equipment and improve return on investment. Virtualization enables the workload from multiple servers, likely all operating at low utilization levels, to run on the same physical server, taking advantage of that unused processing power while allowing 60 to 80 percent utilization.
- Keeps management, administrative and overhead costs in check, lowering total cost of ownership (TCO). Capital costs, administrative costs, IT infrastructure footprint, utility costs for power and cooling, and training costs can all be reduced with virtualization.
- Improves availability of resources. Virtualization helps improve availability by providing the ability to migrate a virtual machine to a different physical host with minimal service interruptions, eliminating hours of downtime.
- Provides a flexible infrastructure that accommodates rapid changes in business requirements. Virtualized servers can be modified or provisioned quickly—usually in minutes instead of days—to handle peaks in demand or address new opportunities.

Introducing Virtuozzo

Virtuozzo from SWsoft is operating system (OS)-level server virtualization software that virtualizes environments on top of a single operating system (Figure 1). The technology and tools provision, update, monitor, migrate and manage every task associated with a virtual server environment. Virtuozzo is available for Microsoft Windows Server 2003 and multiple Linux distributions, and operates on platforms based on Intel Xeon and Intel Itanium 2 processors, including HP ProLiant servers and HP Integrity servers. Virtuozzo supports multiprocessor configurations of up to 16 processors and 64 GB of memory on both the host and virtual environment (VE) levels.

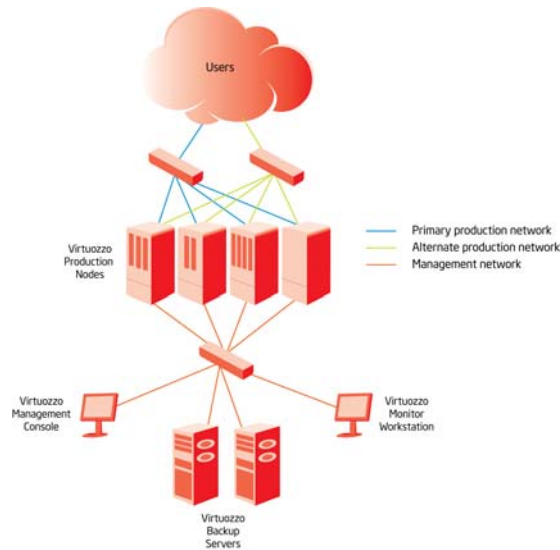
Figure 1. The SWsoft Virtuozzo environment



The virtualization technique employed by Virtuozzo uses a single, unmodified image of the OS to host all VE sessions. This approach offers several additional advantages when compared to other approaches to virtualization, including:

1. **Rapid provisioning:** Virtuozzo instantiates a VE session in several seconds because the underlying OS is already operating—the VE does not need an additional copy of the operating system. Therefore, the footprint for the VE consists only of the application, workload and data, and makes operations such as provisioning, backing up and migrating very fast.
2. **Cost-effective disaster recovery:** Several options are available for cost-effective disaster recovery and high availability, including: creating small footprint, passive-mode VEs stored on a single server; deploying VEs using a storage area network (SAN) to ensure high availability; employing scheduled and as-needed backups to maintain data integrity; and using live migration for any planned or unplanned outages to increase business flexibility.
3. **Comprehensive dynamic control:** Virtuozzo includes a full set of management tools that provide real-time capabilities, monitoring and control of any Virtuozzo VEs, all from a single console. These management capabilities enable administrators to rapidly respond to business needs or opportunities, shifting resources dynamically on a flexible infrastructure made possible by Virtuozzo (see Figure 2).

Figure 2. In a Virtuozzo environment, users connect to one or more VE nodes via a primary production network.



A virtualized environment requires a reliable, high-capacity network

To successfully consolidate server workloads onto a virtualized environment, it is essential that all server subsystems (processor, memory, disk and I/O) can accommodate the additional workload. In particular, careful attention should be paid to the planning of the Ethernet networking infrastructure of a Virtuozzo environment. While Virtuozzo only requires a single network connection to operate, best practices for virtualization initiatives recommend multiple Ethernet connections for optimal performance, availability, and reliability.

Multiple virtual workloads increase network traffic

With multiple workloads, the network capacity needs to scale to match the requirements of the combined workloads expected on the server. In general, as long as the server's processor is not fully utilized, the consolidated network traffic will be the sum of the traffic generated by each application. A cost effective way to deal with this demand is to boost bandwidth with additional Ethernet ports beyond the one or two embedded Ethernet ports provided on the server. This multi-port adapter approach provides additional capacity while conserving valuable PCI slots for other uses such as RAID controllers, Secure Sockets Layer (SSL) encryption cards, or other devices.

Migrations and restoration bandwidth requirements

While a VE can be created and started in minutes, any migration or restoration operation requires time to transfer all of the data from the source to the target. Network throughput is directly related to the time it takes to copy the data to a new VE on a different hardware server. VEs can have large amounts of data to transfer, and the faster this data can be copied over the network, the more rapidly the operation can be completed—especially in the case of a migration or a restoration. Adding more network capacity via multi-port network adapters can provide the enhanced availability needed for business-critical migrations or restorations.

Host node reliability is critical

With multiple virtual machines operating on a single server, the reliability of that server becomes much more important. Likewise, redundancy and fault tolerance are critically important for the network infrastructure. The failure of a connection supporting a server could affect every user of every VE operating on the server—a costly interruption that is time-consuming to fix. Providing alternate network paths through a meshed switch fabric and using multi-port adapters that support failover can mitigate that risk and improve overall reliability and availability.

Multiple network interfaces provide additional capacity and availability

All of the considerations listed above point to designing a virtualized infrastructure's networking subsystems with the capacity and availability features delivered by multiple high-capacity network connections. This can be challenging with servers that have a finite number of peripheral component interconnect (PCI) slots. This is especially true for density-optimized servers such as the HP ProLiant DL line. High-density servers acting as host servers have limited I/O expansion capability. Incorporating multiple network interfaces saves these valuable I/O slots for other purposes while helping to improve server reliability, availability and ability to handle the increased network traffic.

HP NC Series network adapters for VE deployments

The HP ProLiant NC Series Ethernet family of network adapters meets the performance, flexibility and reliability needs of host servers in connection-dense Virtuozzo environments. This adapter portfolio offers a wide range of network connection capabilities for small to medium-sized businesses and large enterprise organizations alike.

Performance

ProLiant NC Series Ethernet adapters offer exceptional throughput, increased processor utilization and some of the fastest Ethernet connectivity available. The family of adapters features jumbo frame support to reduce packet overhead for increased performance, interrupt coalescence, dual address cycles and 802.1p quality of service (QoS) tagging. To reduce processor involvement with the processing of network traffic, the adapters have mechanisms to delay and reduce transmit and receive frame interrupts, as well as TCP/IP segmentation and TCP checksum offload. HP ProLiant Ethernet adapters offer the throughput necessary for VE restorations or migrations—when time is of critical importance and very high throughput is a requirement.

To meet the virtualization needs for multi-gigabit traffic, HP multi-port adapters based on Intel Gigabit Ethernet technology are recommended. Intel is the leader in Gigabit connections, with over 20 years of Ethernet experience, so users can be confident of maximizing server uptime and performance. The Ethernet ports on the HP ProLiant family of multi-port adapters can be aggregated to deliver greater total bandwidth. Server performance can also be enhanced by teaming connections on adapters with connections on other NC Series Ethernet adapters to achieve the desired scalability. Throughput counts during a VE restore operation; the faster data can be transferred to the new VE, the sooner the VE can be placed into operation.

At very high data rates, network traffic can take a toll on server processor cycles. HP ProLiant Ethernet adapters feature interrupt moderation, which significantly reduces processor utilization and makes more processor resources available to applications. To increase performance in a multiprocessor environment, certain NC Series adapters can balance network loads across processor cores when used with Receive Side Scaling from Microsoft or Scalable I/O on Linux, environments both supported by Virtuozzo.

Flexibility

To support unpredictable network demands, such as heavy traffic on Web servers and intranets, IT departments are increasingly segmenting enterprise networks. Deploying multi-port HP NC Series network adapters can provide the platform flexibility to respond to evolving needs for network segmentation and enable the connection to multiple switches to segment traffic on a network. Segmentation can be employed effectively to optimize operation in a Virtuozzo-based network. A single segment can be used for production traffic. To remove single points of failure and thus increase network reliability, a second network segment with its own second, meshed network switch can provide an alternate path for normal production traffic. A third segment for VE management traffic, as well as backup/restore operations, keeps large traffic volumes from impacting production workloads.

Migration from legacy networks can also be achieved easily and cost-effectively using HP multi-port adapters. For additional platform flexibility, HP NC Series network adapters are available for both copper and fiber-optic networks. With a flexible design that fits almost any type of PCI bus, single-, dual- and quad-port HP adapters include standards-based management features and wide network OS support to help ensure extensive compatibility with the latest server and networking environments. HP Ethernet adapters are available for full-height and low-profile PCI slots.

Reliability

In a virtualized server environment, component redundancy is a key method for providing high availability. The HP NC Series network adapters include ProLiant Network Adapter Teaming to provide fault tolerance and load balancing across a team of two or more network adapters that function as though they were a single virtual adapter with a single IP address and single physical address. Several different types of teaming are included, giving the IT administrator a choice in the desired level of redundancy. Optional advanced teaming capabilities are further supported through the ProLiant Essentials Intelligent Networking Pack (INP). The INP enhances basic network adapter teaming by providing network-aware intelligence to the ProLiant servers. This allows the servers to adapt and change the network path to achieve maximum reliability and performance. Through the use of HP Network ProLiant Teaming, HP multi-port adapters can be configured to automatically switch to a secondary link when a server's primary link fails. HP NC Series network adapters also ensure server availability by helping avoid the cost of taking a server offline to install additional network connections when moving to a virtualized environment.

Manageability

HP network adapters can further enable business continuity efforts by allowing IT administrators to dedicate network ports for two key components of Virtuozzo—remote storage and management. While Virtuozzo provides comprehensive remote management capabilities for fine-grained VE control, multi-port HP NC Series network adapters support a full suite of Web-based enterprise management utilities and ProLiant Essentials software (including SmartStart and HP ProLiant Essentials Systems Insight Manager) that greatly simplify network management. The HP NC Series network adapters include drivers and agents that can be managed from all versions of HP ProLiant Essentials Systems Insight Manager and other SNMP-based management systems. HP Systems Insight Manager can recognize the adapter, individually or in teams, and can collect and report SNMP statistics on adapter events. Integrated Management Log support is provided by the adapters for critical event logging on HP ProLiant servers.

HP NC Series adapter family features and benefits

The HP NC-Series portfolio includes adapters with up to four networking ports on a single card, saving valuable ProLiant server I/O slots for other purposes. In particular, the HP ProLiant NC7170, NC360T and NC340T multi-port adapters based on Intel technology have the following product features ideal for virtualization initiatives:

NC7170 PCI-X Dual-Port Gigabit Server Adapter: The NC7170 server adapter features two 10/100/1000T ports on a single PCI-X card. The NC7170 server adapter is available in both full-height and low-profile form factors.

NC360T PCI Express Dual-Port Gigabit Server Adapter: Like the NC7170, the NC360T server adapter provides two 10/100/1000T ports on a single card. However, the NC360T is a four-lane (x4) PCI Express adapter supporting both full-height and half-height slots with the included brackets.

NC340T PCI-X Quad-Port Gigabit Server Adapter: The NC340T server adapter includes four 10/100/1000T Gigabit Ethernet ports on a single PCI-X card. It offers the greatest bandwidth and port density in a ProLiant Gigabit Ethernet adapter, ideal for SWsoft virtualization, server consolidation, network segmentation and other applications requiring maximum network throughput and port density.

HP also offers the single-port NC310F, a fourth ProLiant network adapter based on Intel technology. The NC310F is a 1000SX fiber-optic adapter with 133 MHz PCI-X bus technology providing greater cabling distances, improved security and enhanced electromagnetic interference protection over twisted-pair copper networks.

Make the connection to a virtualized environment

Virtuozzo software operating on HP ProLiant servers connected via HP NC Series network adapters provides a compelling virtualization platform. Together, these products offer a way to help IT managers help their businesses do more with less and respond to initiatives faster with a flexible, cost-effective, and efficient IT infrastructure.

Learn more about these virtualization products

For more information about the products described in this white paper, visit www.virtuozzo.com and www.hp.com/servers/networking.

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