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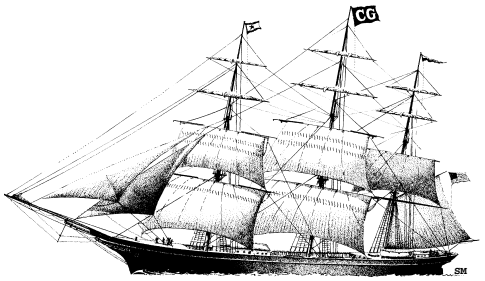

Navigating Information Technology Horizons℠

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HP Builds a Greener Environment Through a Virtualized Networking Infrastructure

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Management Summary

Municipal governments of all sizes are trying to reduce the costs of running their cities and towns, while at the same time improving the environment. Public transportation provides the perfect opportunity to accomplish both tasks. Every city is faced with the problem of reducing the number of cars in the core city: clogging the streets, burning gasoline at a precipitous rate, and polluting the air that we breathe. Implementing an effective public transportation system provides the city with an ideal means of getting employees to their jobs on time and shoppers into the stores, while reducing the number of cars, and traffic, in the city. However, how can they increase the number of people riding city buses without increasing municipal infrastructure? Well, to start, let's go back to the future, in fact, almost a century in the past, to the double-decker bus. A double-decker is a rigid single-decker bus but with an upper deck, with the decks joined by a staircase to consolidate passengers from two separate buses and to double capacity. Over 5 decades ago, in 1954, motorized double-decker buses, specially designed to navigate under city bridges, were introduced in London. However, you can go back another four decades, to August 14, 1912, when horse-drawn double-decker buses were introduced into New York City. Originally used to increase the number of passengers in a single bus, these vehicles have evolved and are now used to afford tourists a better view of city sights. Today, we also see commuter trains with a similar design being deployed to move passengers from point-to-point with more efficiency.

Putting these same concepts to work in the data center is one way that the CIO can reduce the total cost of ownership of the IT infrastructure and to reduce the energy consumption of the data center. Consolidation and virtualization of mission- and business-critical servers is a viable way to improve the efficiency of the IT infrastructure. The deployment of these strategies improves the utilization of systems resources and allows the IT staff to maximize the use of personnel with fewer servers to be managed and maintained. **Unfortunately, the virtualization of multiple applications on a single server requires the availability of more memory and I/O paths, or buses, in support of application execution. Server providers have taken care of the memory issue with the implementation of additional DIMM capacity and denser DIMMs with higher capacity; but what can be done to virtualize or "double-up" on the server I/O bus?**

Many new servers are being designed for virtualization. This means more CPU cores, memory and multiple 10Gb I/O controllers or expansion slots for 10GbE NICs. This bandwidth is great, but it needs to be shared by multiple applications, each with a different workload. HP has just announced the availability of *Flex-10* technology to facilitate virtual server environments. Virtual Connect Flex-10 creates multiple true hardware NIC channels out of a single port and provides the IT staff with the ability to fine-tune each channel to the needs of the associated workload. To learn more about Virtual ConnectFlex-10, please read on.

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Virtualizing the Data Center

When the CIO of any enterprise, large, medium, or small, takes a step back to see what hurdles need to be overcome in order to lower the total cost of ownership of the IT infrastructure, certain issues stick out as pain points as thorny as the spines on the arms of the Saguaro cactus. One of the most critical issues is the utilization rate of both mission- and business-critical legacy servers. Many enterprises have deployed applications on older, open system x86 servers, based upon single-core Intel *Xeon* or AMD *Opteron* processors, in a complex, scale-out architecture. The IT staff typically has deployed a single application on each of these servers and, unfortunately, achieves less than 20% utilization of the compute power of these platforms, in some cases, much less. As floor space and energy become scarce commodities, wasting 80% of server resources can no longer be tolerated.

In order to make better use of the data center and its resources, and to simplify the architecture, the typical IT staff is now consolidating multiple rack-mounted servers, and the storage arrays attached to them, into a single multi-socket, multi-core rack-mounted or bladed server, with SAN-attached storage. These servers can be virtualized using a hypervisor such as *ESX* from VMware, *Xen* from Citrix, or *Hyper-V* from Microsoft, among others. In this fashion, multiple applications can share both computing resources and floor space in order to make better utilization of the data center and to enable the IT staff to shift the alignment of resources as business priorities change. Consolidation and virtualization also enable the IT staff to make better use of the energy required to drive the platforms and cool the data center environment[1]. This requires the availability of applications that can precisely manage the amount of energy being consumed, not only by each processor, but by also each core within the processor architecture. If the IT staff can control, perhaps even reduce, the amount of energy being consumed, they then may avoid the acquisition of the $5M server – the one that forces the enterprise to build a new data center!

In many cases, however, the virtualization of the server environment requires the data center to dedicate *additional* physical resources to the server. This includes additional memory to support, efficiently, multiple applications on a single shared resource. It also includes the increased network capacity required for the server to allow multiple applications to communicate with shared storage and other servers in the network.

The 1Gb ports available on legacy servers are no longer sufficient to handle the throughput of a virtualized environment. Not only does the server require increased bandwidth, but each application also needs its own communication path, or data or storage network connection. In much the same fashion as a municipal bus being used as a shared transportation vehicle, **the server I/O bus needs to have multiple lanes so that each application can have its own dedicated bandwidth.** Furthermore, not all applications were created equal – some have a significantly-higher throughput requirement than others. **The I/O bus needs to be flexible enough to share its resources; with multiple 10Gb pipes available, there should be more than enough bandwidth for all to share.**

In order to resolve this data center issue, HP has begun to deploy 10Gb ports on its new blade servers and they have developed a new technology that will enable the IT staff with the capability to virtually allocate and fine-tune the 10Gb Ethernet bandwidth for virtual machine hosted applications at the server. They have named this technology *Flex-10*.

Flex-10 Technology

The *HP Virtual Connect Flex-10 10Gb Ethernet Module for BladeSystem c-Class* is an innovative way to simplify the deployment of data I/O resources, making the enterprise data center change-ready. The Virtual Connect Flex-10 module is a new class of blade interconnects with embedded software that enables the IT staff to allocate each 10Gb network connection into four independent physical *FlexNIC* server connections or channels. It provides high-performance connectivity to the data center, enabling a more efficient server environment. A Flex-10 NIC can be embedded on the motherboard or added to the blade via an optional mezzanine card for existing c-Class *ProLiant* blades. It is an ideal option for the enterprise data center that requires more than two NIC connections per server, an SMB with a need to bring up servers on the LAN or SAN, and for remote sites with no local IT staff.

Each FlexNIC can be adjusted from 100 Mb

[1] See the issue of Clipper Notes dated November 24, 2008, entitled *Capping Energy Demand in the Data Center – "It's Not Easy Being Green!"*, and available at http://www.clipper.com/research/TCG2008061.pdf.

up to 10Gb, allowing the *right* amount of bandwidth for each mission- or business-critical application, with the I/O connection automatically moving with the server if change is required. The Virtual Connect Flex-10 module separates the servers in the blade chassis from the network, simplifying I/O connections by reducing cable count without adding switches that require IT staff management. This enables transparent server change within a BladeSystem domain and allows the data center to set I/O throughput based on actual need, optimizing bandwidth utilization. (See Exhibit 1, to the right.) HP currently supports up to 24 FlexNICs per blade. This enables the enterprise to reduce total cost of ownership (TCO) and simplify both LAN and SAN connections in support of an overall enterprise consolidation plan.

HP provides a *Virtual Connect Manager* with every module. It contains a secure and easy-to-use HTTP interface, providing the systems administrator easy setup and management for the deployment, with SNMP v.1 and v.2, port mirroring, and a scriptable Command Line Interface. The Manager establishes security by role, enabling independent control of systems, LAN, and SAN administration of Virtual Connect domains.

In order to facilitate the deployment of their Virtual Connect Flex-10 technology, HP has embedded a dual-port Flex-10 NIC on the motherboard of the *BL495c* blade[2].

Deploying Flex-10 in the BL495c

With the embedded dual-port Flex-10 NIC on the motherboard, the HP *ProLiant BL495c Server Blade* can support up to eight FlexNICs with only two Virtual Connect modules and no mezzanine cards. This is significant, as blades from Dell (*M605*) or IBM (*HS21XM*) require 4 switches and 14 mezzanine cards to support a four-NIC per server configuration and IBM needs 6 switches and 28 mezzanine cards to support a six-NIC configuration[3]. An additional pair of dual-port Flex-10 NICs can be added via two mezzanine cards, for a total of six Flex-10 NICs per server, supporting up to 24 FlexNICs per BL495c with only six Virtual Connect modules. It should be noted that the majority of blades shipped to date have been deployed with only two NICs. However, as more enterprises virtualize their environments, the number of NICs required will rise to six, eight, or more.

Exhibit 1 – Flex-10 Performance

- (1) 10Gb Ethernet CX-4 uplink to connect to core switches or use to stack Virtual Connect modules;
- (8) 10Gb SFP+ Ethernet ports for additional high-performance uplink capabilities with optional Fibre and/or copper uplink capabilities;
- (16) 10Gb server downlinks to support a single 1Gb or 10Gb NIC port, or up to four FlexNics per 10Gb connection; and
- Wire speed, low latency hardware performance between server NIC and uplink ports.

Source: HP

Conclusion

With a goal to provide a bladed solution for every environment, HP continues to rollout innovative capabilities to achieve its goal. With existing solutions already deployed to consolidate and virtualize data center server, storage, and network resources, Virtual Connect Flex-10 seems to be the logical next step. By extending the benefits of virtualization beyond the server, to a consolidated network, HP has simplified data center architecture by virtualizing server-to-network connections.

Virtual Connect Flex-10, along with the ProLiant BL495c blade, creates an ideal virtual infrastructure to lower costs, consolidate network infrastructure, increase bandwidth, and add flexibility. If your enterprise is deploying a virtual environment to reduce IT TCO, the BL495c with Virtual Connect Flex-10 may be the answer that you seek.

[2] See **The Clipper Group Navigator** dated October 3, 2008, entitled *Adapting the Infrastructure for Virtualization – HP Virtualizes the Blade*, which is available at http://www.clipper.com/research/TCG2008052.pdf.

[3] Using cost figures provided by HP, a four-NIC configuration with two Fibre Channel connections costs $3,461 per port, which is 36% of Dell's list price and 41% of IBM's.

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