Adapting the Infrastructure for Virtualization —
HP Virtualizes the Blade

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Management Summary

With the football season in full swing, it has never been so obvious what coaches mean when they refer to football as a "team sport". The offense consists of the offensive line, rather large men, and the so-called "skilled positions", players who end up with all of the touchdowns, and the commercials. Similarly, the defense consists of a line composed of 300+ lb. behemoths, along with speedsters who can run 40 yards in 4.3 seconds. Teamwork involves the ability for players on each unit to work together *within* the units and *between* them, as each unit depends heavily on the other for success. If the offense breaks down, then the defense can be worn down by being on the field too long. If the defense is inept, however, and gives up too many points, then the offense suffers because the other team's defense knows what they will be forced to do. Further, if you have a breakdown *within* the offense, say in the offensive line, then one of the skilled players not only can end up on his back, he can end up in the hospital. (Hello, Tom Brady!) **The success or failure of a football team depends upon the integration of all of its pieces into a cohesive unit. Either the team wins together or they lose together.**

Teamwork, however, is not reserved for the sports arena. There is a necessity for it in the data center of every enterprise, large or small, as well. **The IT staff carefully must develop an integration *between* their servers, storage platforms, and I/O infrastructure, similar to a winning team**. They need to create a balanced environment where the architecture can eliminate bottlenecks before processing delays cause irreparable harm, and intolerable delays, to the data center computing capability, sending potential customers scurrying through the Internet seeking a more responsive solution. **Furthermore, there is a need for this same teamwork *within* the computing platform, itself**. Having the fastest processor in the world will not guarantee success. If the server platform does not have sufficient memory to execute the mission- or business-critical application set, or if there is not sufficient bandwidth to communicate *between* processors, or *between* the processors and storage, or *between* the processors and the various communications networks attached, then a breakdown in the application performance is assured. Technology is constantly evolving, providing the IT staff with multi-core CPUs, higher-capacity memory chips, and faster I/O controllers. Unfortunately, it becomes increasingly more difficult to package these together, especially when confronted with external barriers, such as limited energy.

HP has recognized these problems and has addressed them in a workman-like fashion. With a strategy in place to provide a blade option to every data center application environment, HP has introduced a new blade server, the *BL495c*, with a CPU-surround architecture to ensure enough memory and I/O to enable the IT staff to virtualize just about any application set. To learn more about the BL495c, please read on.

Server Infrastructure Pain Points

Server sprawl is running rampant throughout the enterprise. It exists in data centers of all sizes. For years, enterprises have been deploying new servers, or a new set of servers, for every new application required to satisfy a new business- or mission-critical need. **The majority, if not most, of these systems are running at a utilization rate of less than 20% of their compute capability. Unfortunately, they are also running at nearly 100% of their power envelope, wasting the electricity necessary to run, and cool the data center, without any means to throttle down the power consumed.**

The data center is also wasting another critical resource – the staff necessary to manage these servers. Time spent on trying to manage these issues takes resources away from what should be the primary focus of IT, addressing business priorities, enabling business innovation. In order to regain control of the IT infrastructure and reduce the complexity, the data center staff has initiated programs to *consolidate* the server environment, and to change the IT paradigm by *virtualizing* the resulting consolidated servers, thus reducing the total cost of ownership (TCO) of the data center. There are issues that must be addressed, however, with virtualizing a complex environment. Many systems may have enough processing power, but they often lack sufficient memory to adequately support the many applications deployed. Other environments may have enough memory, but lack the network connectivity to support the I/O requirements of the consolidated architecture. Still other platforms have enough CPU, memory, and I/O, but require so much energy that the data center cannot fully utilize these resources with their existing energy supply.

For the past few years, the focus of this effort has centered on the deployment and installation of blade servers in order to simplify the acquisition, deployment, and management of the data center infrastructure, reducing the consumption of energy, while at the same time improving IT productivity. Bladed environments provide a variety of benefits to the enterprise, based upon a shared infrastructure, their density, cable requirements (or lack of), and integration. (See Exhibit 1, in the next column, for a partial list of benefits derived from a bladed

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Exhibit 1 –
Benefits of Blade Servers

- **Density** – The physical orientation of blades within the chassis (vertical) enables a more efficient use of space, enabling the IT staff to deploy a server density greater than that of tower or rack-mounted platforms.
- **Cabling** – Because of a common, shared backplane, multiple servers can share the same physical resources, such as KVM, I/O, power, and management. This reduces the number of cables required by up to 93% resulting in higher reliability, less complexity, and reduced cost.
- **Deployment** – Fewer chassis translate to less time required to configure, deploy, and setup the infrastructure and fewer errors from a less expensive staff.
- **RAS** – Blades are configured to be hot swappable. They can be replaced by releasing a latching mechanism; no tools or cables are required. They also provide for simpler component access for maintenance and upgrade.
- **Component Integration** – A blade architecture embeds the I/O switches into the chassis allowing for a higher QoS with lower administrative and management costs.
- **Investment Protection** – Replaceable blades enable the data center to protect the investment made in the chassis, software, and staff whenever an update is required.

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architecture.) A common theme for each of these benefits is a reduction in cost for the deployment and/or maintenance of a multi-blade environment. There are, however, some inherent costs associated with the rollout of blades. These include the cost of the chassis, itself, and its rack. If less than five servers can satisfy your compute environment, then a more traditional rack or tower environment probably would suffice. This is where choice becomes critical. **Your enterprise cannot afford to deploy the best alternative that *your vendor* has to offer. You need to deploy an architecture best suited to the priorities of your enterprise**.

Virtualizing the Environment

Consolidation alone, however, will not provide the kind of improvements to server utilization that enterprises require in order to reduce the IT TCO. Due to the interaction between CPUs and memory, and CPUs and the I/O infrastructure, most applications, even mission-critical applications, cannot utilize 100% of the processing capability of today's multi-core microprocessors, or even the last generation of open systems CPUs. The processors must wait for information requested from the I/O subsystem to flow through memory before they can act upon it. Furthermore, with today's microprocessors, multiple cores wait to be utilized, with multi-core versions of both Intel's *Xeon* and AMD's *Opteron* CPU now available.

Unfortunately, many of the servers deployed in the data center cannot hold an adequate amount of memory, or deliver sufficient I/O paths, to keep these processors fully utilized. With the availability of applications such as *Hyper-V* from Microsoft, *ESX* from VMware, and *XenServer* from Citrix, however, the IT staff not only can virtualize each processor, but they can now also virtualize each core within the processor. By virtualizing the compute environment, the data center can more fully utilize all of the resources that the enterprise has deployed and, in fact, reduce the number of servers populating the data center. In turn, this will reduce the energy required to run and cool the data center environment, and reduce the administrative overhead required to monitor and maintain the IT infrastructure.

When the data center combines the consolidation of enterprise applications with the virtualization of the enterprise platform environment on the latest industry standard microprocessor architecture, the IT staff can achieve significant performance improvements while, at the same time reducing the TCO of the IT infrastructure. How the IT staff goes about changing their compute paradigm is another question. Recently, many enterprises have turned to a bladed environment to accomplish both their consolidation and virtualization needs, with many looking to Hewlett-Packard for a platform solution. HP has adopted a corporate policy of providing a blade option for every architectural solution, a "Blade Everything" strategy. This policy has led them to introduce a brand new blade especially de-signed to satisfy the requirements of a virtualized data center, the *HP BL495c G5*.

The HP BL495c G5 Blade

With a stated policy of providing an option to "blade everything", HP has offered a variety of blade chassis and blade server solutions to complement their tower and 1U, 2U, and 4U rack-mount configurations. HP's modular infrastructure is available in a variety of packages to enable deployment in enterprises of all sizes, with different budget requirements. As always, the choice is yours, as HP provides a variety of one-, two-, and four-socket blades with Intel Xeon or AMD Opteron microprocessors. Now, however, HP can also offer a next-generation blade solution that can compete with any other tier-1 vendor option, the HP BL495c, in either the HP *BladeSystem c7000* or *c3000 Blade Enclosure.*

The BL495c can be best characterized as a *virtualization blade* as it maximizes the number and performance of virtual machines that you can deploy on a single blade. It is optimized with the features and options required for an enterprise data center environment. It is a two-socket server utilizing AMD's latest 64-bit, quad-core *Opteron 2300* architecture with 512KB of L2 cache and 2MB of L3 cache at speeds up to 2.3GHz, including the Opteron *2347 HE,* a low-power model at 55W, to maximize energy-efficient performance. The BL-495c takes advantage of AMD's dual *Hyper-Transport* interconnection between processors, *Dual Dynamic Power Management* and *Advanced AMD-V* acceleration to improve performance in virtual environments. The BL495c also supports up to 128GB of memory distributed over 16 DIMM slots to eliminate memory bottlenecks and enhance the execution of mission-critical database applications. This means that a single BladeSystem chassis can support up to 2,048GB of RAM. **This represents twice the memory scalability of competitive systems**. The BL495c also comes with an integrated dual-channel 10Gb Ethernet adapter for improved throughput and scalability. The BL495c also has two mezzanine slots with optional Fibre Channel, Ethernet, and InfiniBand mezzanine cards, which allows for up to eight NICs per blade. Virtualized network connections enable the IT staff to add, replace, and recover servers immediately.

In addition, to improve disk I/O response, HP has enabled the BL495c with a pair of ultra-fast solid state drives (SSD), connected to an embedded SATA controller, replacing the mechanical drives traditionally used, improving response time and lowering power consumption to one watt per drive. This compares quite favorably to the nine watts of a 2.5" 15K SAS HDD. In fact, an SSD has 50 times the read performance of a traditional SATA HDD, even 15 times that of a SAS HDD. The value does not stop with performance and energy, however. Because there are no moving parts in an SSD, the data center achieves additional value from increased reliability and reduced noise. Currently, the BL495c supports 32GB and 64GB SSDs, or, optionally, up to six hot-plug SAS HDDs with an attached *SB40c Storage Blade*, up to 876GB. The BL495c also has an internal USB 2.0 connector for security key devices and USB drive keys. Simple, shared storage keeps the data center running, and protected, as your business grows

The HP BL495c supports multiple versions of Microsoft *Windows*, including *Windows Server 2008*, along with the enterprise version of both *Red Hat* and *SUSE Linux*. The BL495c also supports *Citrix XenServer* virtualization technology, with an optional integrated hypervisor. In terms of management, the BL495c supports HP's *Insight Control Environment for BladeSystem* to deliver foundation management for HP BladeSystem lifecycles, including hardware resource deployment, health monitoring, software version control, performance monitoring, vulnerability, scanning and patch management. Insight Control Environment for BladeSystem installs and licenses the following components by default using a wizard-based integrated installer.

- HP *Systems Insight Manager*
- HP *iLO Select Pack*
- HP *Insight Power Manager*
- HP *ProLiant Essentials Rapid Deployment Pack*
- HP *ProLiant Essentials Performance Management Pack*
- HP *ProLiant Essentials Vulnerability and Patch Management Pack*
- HP *ProLiant Essentials Virtual Machine Management Pack*

Conclusion

There are many factors involved in lowering the TCO of the enterprise data center. The virtualization and consolidation of the data center environment is a major component in the process to improve the utilization of valuable data center resources, making them available to deploy new projects. Reducing server sprawl and the implementation of ease-of-use productivity tools will free up IT staff. Reducing power consumption will enable the enterprise to go green and reduce energy costs. Reducing energy demands may also help defer the requirement to build a new data center in order to deploy new.

The deployment of new, high-performance, multi-core servers will provide the infrastructure necessary to change the enterprise IT processing paradigm. However, *surprise*, processing power is not the only gating element required to simplify and optimize essential business processes in a complex IT environment. A lack of memory and I/O can impede a virtual environment as quickly as insufficient processing power. **A balanced environment is required.** With HP's BladeSystem and the BL495c blade server, HP not only addresses these two concerns, it virtually eliminates them. The BL495c is an ideal solution for hosting virtual machines. With a compact form factor to promote higher density, more memory, more integrated I/O connections, flexible storage options, as well as lower acquisition cost, all help to simplify the implementation of a next-generation data center.

With a firm commitment to the deployment of bladed environments, HP continues to lead the way with blade innovation, with a blade specifically designed for a virtualized environment. If your data center is moving toward consolidation and virtualization to lower the TCO of your enterprise IT environment, HP's BladeSystem with the BL495c blade server may be the answer you are seeking.

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