

Virtualized architectures on HP BladeSystem

Concepts guide



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Introduction

Virtualization is commonly thought of in the industry as “virtual machines” within a physical server, but virtualization as a concept reaches beyond the bounds of breaking single host systems into multiple operating system containers. For the purposes of this paper, HP will refer to virtualization as a means to disaggregate hardware and software resources to promote simplified management and dynamic resource change which in turn creates an adaptive, agile IT that can better respond to business needs.

Virtualization as an emerging data center technology

When IT organizations had only a few dozen systems to manage, it was quite easy to keep track of all of them. IT organizations managed servers directly, with dedicated personnel assigned to each server. Maintaining high administrator-to-server ratios was common practice.

Now, as information technology has taken a strategic role in many organizations, just about every business decision has to be supported by some IT activity. Changing business conditions have increased the pressure on IT to reduce costs. This change has changed the economics of the data center, with more being expected with fewer resources, and a drive to efficiency in operations is required to realize this goal. To meet this need head-on, the very notion of what a server resource actually is is changing in many quarters. Rather than thinking about a discrete ‘server’ device with a maximum configuration internally connected to the outside world by network and storage cables, the server has evolved to become part of an integrated infrastructure, able to be managed at the rack level instead of an individual level, with aggregated support structures behind it. The very idea of a server booting a single operating system and not being able to share its resources has been challenged through the adoption of virtualization technologies.

These on-going trends are driving the need for an IT infrastructure that is more flexible and able to support many different business systems at significantly lower costs. There is a need for a system-wide approach to IT that impacts the cost of operations. The HP BladeSystem portfolio provides that infrastructure.

HP partner technology and virtualization

HP joins its own technology and knowledge with key partner offerings to meet the needs of customers in the deployment of virtualization as a solution. From virtual machine technology to server based computing, HP offers virtualization solutions to address the most pressing business needs.

Virtual machine technology

Virtual machine technology allows a single hardware platform to host multiple operating systems and applications, reducing the number of physical servers required while maximizing the utilization of each server. This results in fewer wasted cycles, and a reduction in processors brings power savings, management simplification, enhanced security and extreme agility to the data center. HP currently partners with the two leading providers of Virtual Machine technology, VMware and Microsoft®, to offer best in class solutions built on the HP BladeSystem platform. Combining these technologies with HP hardware and software delivers the ability to rapidly consolidate legacy applications, host applications in a high availability environment, improve system maintenance and manage virtual machines from a single console as if they were physical devices.

Server based computing

The benefits of virtualizing clients is to promote better management and control for the application environment, affording greater security for both applications and data. This approach also provides greater flexibility and security for remote access to applications, while affording an improved user experience, as access to application(s) and data is not dependent on location, client type, or access methodology. HP is working with the leading server based computing software vendors, Microsoft and Citrix, to create solutions that provide the best methods to virtualize traditional desktop applications and operating systems for the end user.

Storage clustering and virtualization

The ability to add additional compute resources that share the same data enables organizations to more easily scale-out their environment to meet changing needs. It also enables an organization to provide an opportunity to build a more cost-effective, highly available, application environment. Enhanced manageability, rolling upgrades and patches, scalability and high availability are tangible benefits. Storage clustering from HP and PolyServe enables the virtualization of storage and helps to create a utility computing platform for applications that can take advantage of a clustered file system.

Network virtualization

Network virtualization entails load balancing TCP and UDP traffic to and from applications to provide high availability, increased performance, and transparent failover. HP offers load balancing and layer 3-7 switching capability through BladeSystem and partnership with F5 Networks. F5's BIG-IP Blade Controller software runs on the HP ProLiant BL20p G2 server and can direct network load within the BladeSystem enclosure or across the enterprise. Combined with BladeSystem switching capabilities, this yields a powerful network virtualization solution that can take advantage of the interconnected nature of blade technology.

Virtualization on BladeSystem

What is available today?

HP offers a comprehensive line of servers to work with the BladeSystem infrastructure and fit any application workload. Table 1 lists current offerings, processors and server density.

Table 1. Current HP BladeSystem server offerings, processors, and server density (June 2005)

	BL20p	BL25p	BL30p	BL35p	BL40p	BL45p
Processor Type	DP Intel® Xeon™	AMD Opteron™ 200 Series	DP Intel Xeon	AMD Opteron 200 Series	MP Intel Xeon	AMD Opteron 800 Series
Processor Speed	3.6 GHz,	2.6 GHz/1M L2 Cache	3.2 GHz,	2.4 GHz/1M L2 Cache (lower power)	3.0 GHz,	2.2 GHz/1M dual core w/ L2 Cache
Max Processors	2	2	2	2	4	4
Std Memory	1GB or 2GB PC3200 DDR2	1GB or 2GB PC3200 DDR	1GB PC2100 DDR	1GB or 2GB PC3200 DDR	1 GB PC2100 DDR 266	1GB or 2GB PC3200 DDR
Max Processors per 42U Rack	96	96	192	192	48	96

Why is BladeSystem good for virtualization

BladeSystem is an ideal platform for virtualization. Throughout this guide, the following points will become evident:

- The nature of virtualization suggests rapid change. The pre-wired, location aware, infrastructure makes change simple.
 - Expand capacity by plugging in a system and walking away. With HP’s management utilities, the system can take advantage of pre-deployment scripting and, once plugged in, begin its role with little to no administrator involvement.
 - Change server roles via software. Underutilized systems in a virtual architecture can be repurposed via software rapidly and with little involvement.
 - Put your servers to work 24x7. Systems dedicated to end user programs during the day can also work all night. BladeSystem is ideal for rapid OS and software load changeover in a virtual environment.

- Resources should be maximized, not minimized. With BladeSystem, server organization is not tied to function. Run more applications on fewer devices to maximize the load on each system. Furthermore, balance the load, based not only on processor and memory usage, but also on SAN utilization, network load and power draw. With HP Power Regulator and BladeSystem, you can dial back power when the entire system is not working at peak load.
- Change requires management. BladeSystem presents a hierarchical and interrelated infrastructure to the management console. As such, patching, deploying, and altering BladeSystem servers is a simple process.
- Integrated SAN and networking can make BladeSystem less expensive to purchase than traditional rack mount systems with host bus adapters and external networking.

Solution starting point

Let's look at an example that is customized for an enterprise financial business. The customer is faced with solving the following problems. They are currently operating in a highly heterogeneous environment.

- Legacy applications have created a group of underutilized servers and the associated management issues that come with system proliferation. There are currently 30 servers running single applications. Average utilization per server is roughly 4-9% with peak utilization of up to 32% during peak usage periods. It takes two administrators to manage these systems and an extra support person to handle any break/fix issues.
- Application availability is becoming a serious issue in one department. A recent database server failure caused a key user application to be down for 2 hours. This application was used daily by 300 end users and resulted in 600 man hours of productivity loss, and a key deadline was missed in the process. The database server is three years old and covered under a separate maintenance agreement. There are 4 more database servers distributed in the department that are under light load that have the potential for consolidation to reduce cost and complexity.
- Desktop management costs have skyrocketed. Different and diverse application environments have caused the need for multiple desktops for many workers, which has increased support and management costs dramatically. The customer implemented Citrix Access Suite to begin controlling costs and to assist with Sarbanes-Oxley compliance, but the current expansion requirement of adding multiple servers per month is preoccupying IT staff that could be put to better use elsewhere.
- Three new web hosted applications are being added to support an internal purchasing group. Each application utilizes distributed web servers. There are currently 8 existing applications that are architecturally similar, each with its own form of load balancing. The customer wants to consolidate the number of load balancing applications and lower the number of servers required to serve up the applications.
- Systems used for report creation and generation are due to be replaced. Reporting systems currently in place are taking too long on existing hardware and the systems used sit idle after calculations are complete. The customer is interested in creating a cluster that will run a series of nightly reports, but can not commit the resources for as many servers as would be required to handle the processing.

Legacy environment

Management

HP Insight Manager 7, SP2

HP ProLiant Essentials Rapid Deployment Pack 1.3

Multiple third-party methods for patch management, vulnerability assessment, performance assessment, software monitoring and storage management.

Servers being replaced

Currently, the customer has 74 servers that will be replaced. These servers were acquired at different times, and much of this technology is based on earlier generations of processors that can no longer provide the performance or capacity required. There is a mix of systems including one quad-processor system serving as a database server, thirty single- and dual-processor servers acting as single application hosts, fourteen dual-processor systems serving as web servers hosting a variety of applications, nine dual-processor application servers tied to existing web applications, eleven dual-processor servers in a Citrix farm and five reporting servers separated into dual- and quad- processor systems. A desire to consolidate four separate database applications utilizing single server Microsoft SQL Server instances without purchasing new hardware also exists.

Considerations for the proposed solution

As with any change, there are issues to consider. The following considerations are also highlighted in Table 3 later in this guide. The purpose of listing them here is to emphasize decision points and what impact they may have on the solution as a whole. This is not a comprehensive list, but the items listed should be factored into the design and implementation process.

- For maximum availability on a virtualized network, load balancers should be run, at a minimum, in pairs. This example is on a small scale, but in a more complex environment, it is possible that maximum performance and availability could come from twelve blade servers acting as load balancers with nine active systems and three in passive mode. The decision point here is a matter of examining the priorities between availability and performance.
- Application state plays a vital role in deciding what form of virtualization is best suited for it. A stateless web application is excellent for network virtualization where a server failure can have zero impact on function. However, deploying an active state application server would be better suited to a storage clustering solution where the state data can be housed in a shared data set.
- Scheduled reprovisioning of servers is an excellent way to insure the highest utilization and greatest consolidation of systems. There are caveats to consider before designating systems for this role. In one of our instances, multi-purpose Linux servers become reporting clusters in the evening. In another, our Citrix servers join the same reporting cluster. In both examples, the time the server is used must be considered carefully. While an 8 to 5 workday is common, a computer's workday can be extended to 8 to 9 simply because of time zone differences. Know both when and how the systems are being utilized. In the Citrix example, remote access may require that some servers be available 24x7 to insure availability.
- Virtual machines carry overhead. While this overhead may be extremely small, it is important to plan for. In the solution described below, we have taken an approach to address capacity expansion and failure recovery with one extra system. We know that a few of the legacy applications see regular spikes in usage. We can schedule virtual machines (VMs) to be moved onto our spare system during these peak utilization periods to insure the systems can perform optimally. During these peak periods, our spare server becomes utilized, and warning of a hardware failure would allow us to move our VMs out of harms way but would affect application performance once moved. It is worthwhile to balance the demand for performance with the need for availability and recovery in any virtual machine deployment.
- The cluster scenario listed in our example provides higher availability than a single server instance would. When considering a larger scale SQL Server consolidation the size of the cluster may change drastically along with the number of nodes in an active or passive state. Take action to understand the utilization patterns of the hosted databases to insure the correct mix of performance and availability.

Creating the solution

The goal of the organization is to create an infrastructure that provides resources that can be managed by software at a high level and provide mainframe levels of flexibility while eliminating many hard costs and maximizing resource utilization. Despite this incredibly complex premise, with BladeSystem, this is an achievable goal.

HP proposes the use of HP BladeSystem as the foundation for this infrastructure.

The beginnings of change

The recommendation proposed involves more than simply purchasing new hardware. For the solution to work best in the long term, a number of changes are under way. It should be noted that, depending on numerous factors, there are many workable configurations that could be proposed. The following proposal is an example.

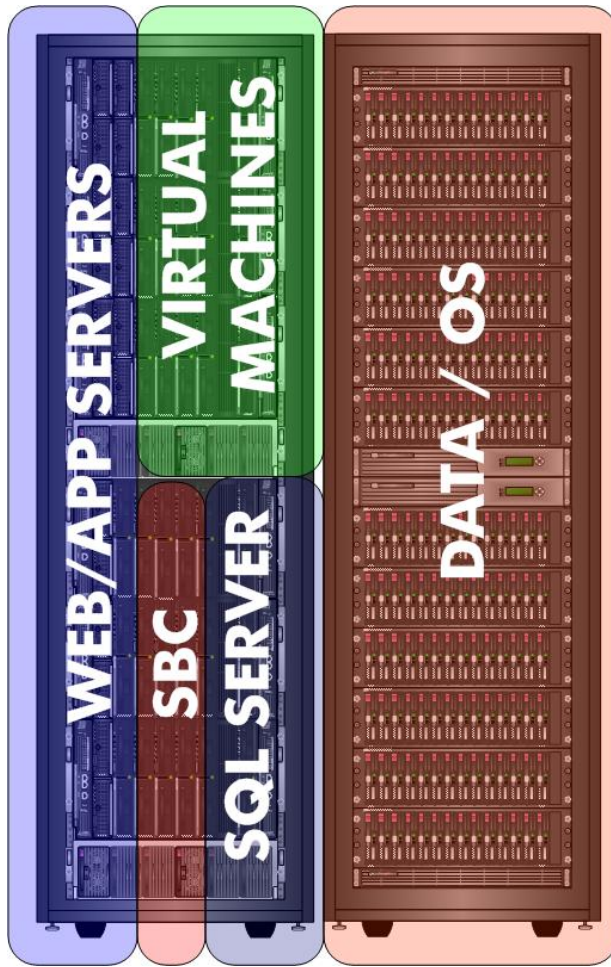
- The prior practice had been to name systems based on type and service. With BladeSystem, physical location is a known variable that can be retrieved via software. Since in many instances with BladeSystem, services are not always tied to servers, the IT staff is changing naming conventions to allow for the automated naming of systems during deployment. The system name is thus linked to location which assists in system recovery and deployment time, but system role can change based on need without confusing the naming schema.
- With a BladeSystem infrastructure, deployment will be standardized. All enclosures, when deployed, will have the same network infrastructure, SAN infrastructure, and will be fully cabled. This will reduce cable management, decrease time to server deployment, and insure that software can be used for all future system changes and maintenance without the need for cable changes.
- With BladeSystem, server management is being taken out-of-band on a private network with HP Integrated Lights-Out (iLO) Advanced. All BladeSystem servers will be headless and iLO will be integrated with the Active Directory schema. This allows for finer grained control of access permissions for management purposes and drastically reduces the amount of cabling and support infrastructure in the racks.

While not absolutely necessary for achieving the greatest return on investment, these incremental changes set up a new way of interacting with servers. This change is a starting point for achieving long term process change.

Hardware layout

The seventy-four original systems will be replaced by thirty-four new servers that will increase performance, agility and availability while decreasing downtime. It should be noted that the initial configuration outlined below is dynamic. The nature of virtualization allows for business and capacity drivers to create rapid change. If you were to lay out where the software and function resides on these same systems in a month, the diagram may change substantially based on these drivers.

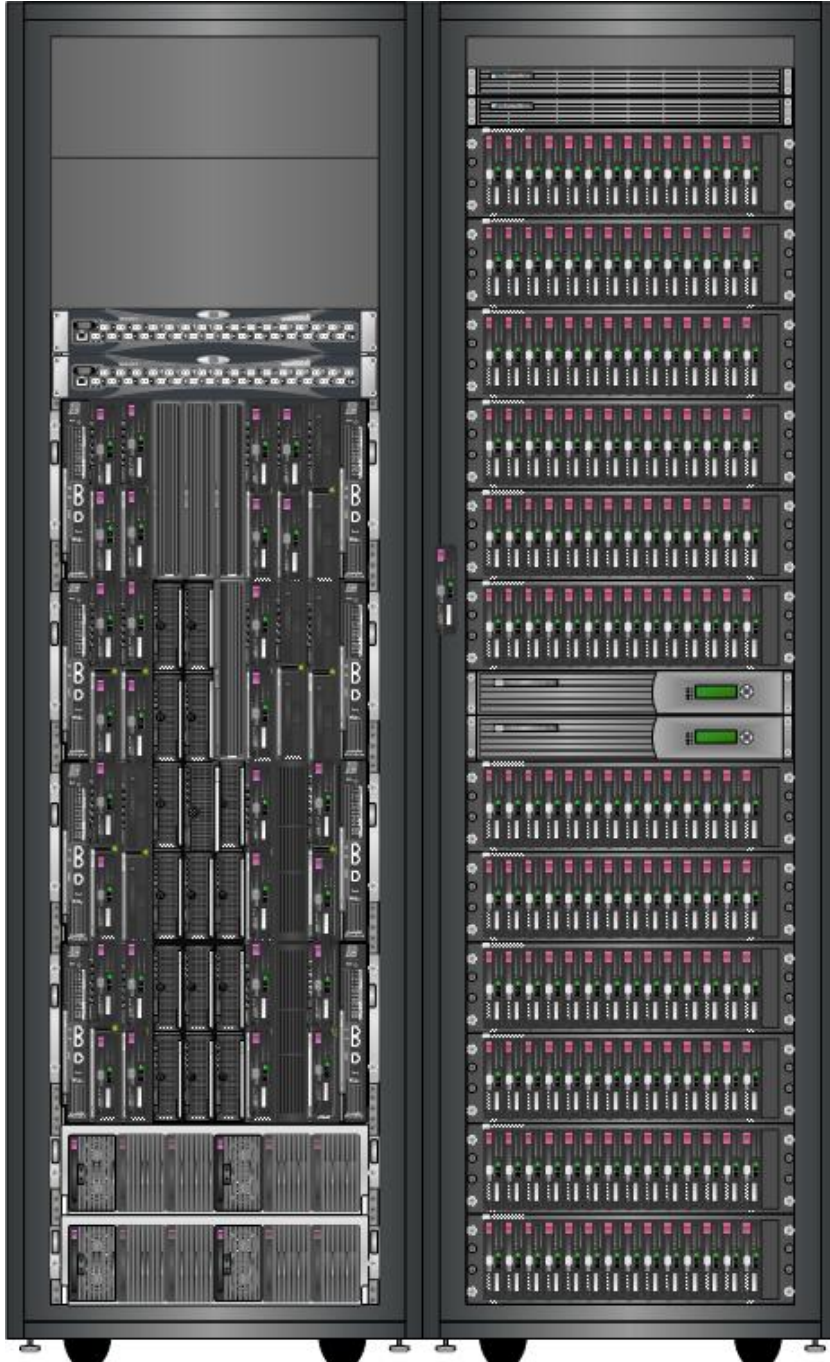
Figure 1. Virtualized architectures may be thought of as multiple systems combined to create a single pool of resources that can then be carved into smaller resource pools.



With BladeSystem, the interconnected nature of the components insures that the configuration shown in Figure 1 is flexible enough to change as resource and business demands change. This flexibility allows for an extremely agile IT infrastructure.

Figure 2 outlines the starting point for the solution. Within this diagram, one can see there is room for capacity expansion, system standardization, storage connectivity, and density. It should also be noted that this system integrates network and storage into the same umbrella as servers. Current infrastructures that break these systems up from both a technological and business structure standpoint can never achieve agility equivalent to what is offered here.

Figure 2. Starting point of the solution



There are now:

- 16 ProLiant BL30p servers
- 6 ProLiant BL20p G3 servers
- 2 ProLiant BL20p G2 servers
- 8 ProLiant BL25p single core servers
- 2 ProLiant BL45p servers

- 3 Blank enclosure slots
- 8 Cisco Gigabit Ethernet Switch Modules

Table 2 lists the configuration and operating system for each server organized into groups by function.

Table 2. Configuration and operating system for each server

Group	QTY	System	Local Drives	OS/Location	Fibre Connect
A	2	ProLiant BL20p G2, 2P, 1GB	2	F5 Networks BIG-IP Blade Controller on local disk	No
B	10	ProLiant BL30p G1, 2P, 2GB	None	Microsoft Windows® Server 2003 Web Edition on SAN	Yes
C	4	ProLiant BL30p G1, 2P, 4GB	None	Microsoft Windows Server 2003 Enterprise Edition on SAN	Yes
D	2	ProLiant BL30p G1, 2P, 2GB	None	Red Hat Linux ES, Standard on SAN, Red Hat Enterprise Linux AS on SAN	Yes
E	6	ProLiant BL20p G3, 2P, 4GB	None	Microsoft Windows Server 2003 Enterprise Edition on SAN / Red Hat Enterprise Linux AS on SAN	Yes
F	8	ProLiant BL25p G1, 2P (single core), 16GB	None	VMware ESX Server	Yes
G	2	ProLiant BL45p G1, 4P, 12GB	2	Microsoft Windows Server 2003 Enterprise Edition on local disk	Yes

Hardware deployment

HP Factory Express is recommended in this situation. With Factory Express, the rack arrives pre-configured, pre-wired, and can even be built with operating systems and software in place. Onsite deployment is an option that allows the process of adding new hardware and software to be as easy as placing the order itself. Servers can even be configured to hold specific firmware versions on all components.

These options are just the beginning. For more information on Factory Express integration, see <http://www.hp.com/go/factory-express> or contact your HP sales representative.

Software layout

The software for the solution is laid out as follows:

Table 3. Application loads by server group

Group	Systems	Software Load	Notes
A	ProLiant BL20p G2, 2P, 1GB	F5 Networks BIG-IP Blade Controller	Should be run in pairs. Offers enterprise load balancing across multiple geographies and networks.
B	ProLiant BL30p G1, 2P, 2GB	Microsoft Windows Server 2003 Web Edition on SAN, IIS, .NET Services	Application state considerations favor load balancing in this solution.
C	ProLiant BL30p G1, 2P, 4GB	Microsoft Windows Server 2003 Enterprise Edition on SAN	Applications in this solution can handle system failure. State is a factor in many circumstances and application clustering should be considered.
D	ProLiant BL30p G1, 2P, 2GB	Red Hat Linux ES, Standard on SAN, Apache, PHP / Red Hat Enterprise Linux AS on SAN	These stateless applications in a boot from SAN environment are ideal for scheduled reprovisioning.
E	ProLiant BL20p G3, 2P, 4GB	Microsoft Windows Server 2003 Enterprise Edition on SAN, Citrix Presentation Server, Microsoft Office 2003 / Red Hat Enterprise Linux AS on SAN	Scheduled reprovisioning with our Citrix servers means we must insure enough remaining capacity to compensate for unexpected loads.
F	ProLiant BL25p G1, 2P (single core), 16GB	VMware ESX Server, 35 virtual machines across 8 servers running 30 legacy applications plus 3 underutilized web servers and 2 application servers.	One server is setup as a "hot spare" virtual infrastructure component. It will be responsible for hosting VMs during peak periods and in the event of system failures or maintenance procedures.
G	ProLiant BL45p G1, 4P, 12GB	Microsoft Windows Server 2003 Enterprise Edition on local disk, Microsoft SQL Server	Databases are hosted on shared SAN resources with SQL Server running on local disks.

Software deployment

As the table in the previous section states, our first two systems will become dedicated network load balancers and Layer 3-7 switches. In our initial requirements, we stated that three new n-tiered applications would be joining the existing eight applications. All eleven applications require load balancing at the web layer. HP's partnership with F5 Networks brings the ability to consolidate the load balancing methods for each application into a single, centrally managed point. The load balancing blades can function across the enterprise, not just the enclosure. With this layout, our eight existing applications have had their load balancing source reduced to a single platform. Our new applications take advantage of this layout right out of the box.

The second group of servers consists of ten ProLiant BL30p servers which are booted from SAN with Windows Server 2003 Web Edition. These ten servers will be used as our web layer for our three new n-tiered applications. We should achieve maximum availability from the load balancing blades and rapid failure recovery from the boot from SAN environment. In the case where a system drops a network connection, all requests to the load balancer transparently shift to the other blades in the pool. This allows time for troubleshooting without stopping application access. In the event of a hard failure, blade enclosure slots in RDP are set to rebuild the servers upon replacement. Scripts tell the SAN to allow access to the storage at a particular logical unit number (LUN) by a new server and new replacement servers to boot from the LUN of the old system. This drastically reduces time to recovery and makes system replacement a simple matter of plugging in a new server.

The third group of servers is set up to host the application layer of our n-tiered applications. Three of the four servers host three applications each which distributes our load and failure risk across systems. The application software itself is designed to handle this scenario. All systems are configured for booting from SAN. The fourth server is kept as a spare. During system maintenance, systems can be shut down gracefully and the spare server booted to the existing LUN where it reads and writes data to the same location as the existing server. Similarly, in the event of system failure, the cold system can be booted as a replacement while the failed system is replaced with a new spare.

One of our new multi-tiered applications utilizes Linux, Apache and PHP. Two ProLiant BL30p BladeSystem servers will be used to host both the application and web servers. These applications are expected to see utilization between 8am to 10pm EST. At 10pm they will join a new reporting cluster outlined in the next section.

The ProLiant BL20p G3 servers will run the Citrix environment. To maximize utilization, we are making these systems multipurpose and booting them from SAN. The customer picks up the same flexibility as the previous groups in a boot from SAN configuration with rapid recovery and ease of maintenance, but in this instance, we are going to expand the boundaries. Citrix is an infrastructure application that serves end users directly. When employees leave at 5 PM, our system utilization drops down to a fraction of its daytime use. This creates underutilized systems that equate to little more than expensive decorations that continue to consume power while providing no return. In our setup, seven of the ten Citrix systems will be programmatically shut down at 7 PM. At 7:05, these systems will boot to a new LUN running Red Hat Enterprise Linux AS and will join a new reporting cluster. This is a small cluster that will serve as a replacement for the existing reporting systems and insure that the systems are utilized at far greater capacity than previously. At 6:05 AM these systems are returned to the pool of Citrix servers by rebooting to the original LUNs.

The ProLiant BL25p servers will run VMware ESX Server as the host operating system and will be managed with both the ProLiant Essentials Virtual Machine Manager (VMM) and VMware's Virtual Center. We began with 30 legacy applications hosted on single servers and discovered three additional web servers and three additional application servers that were severely underutilizing existing infrastructure. All of these systems will be migrated to virtual servers using the ProLiant Essentials Server Migration Pack (SMP). With SMP, you may take any physical system and use a wizard-based interface to migrate them to virtual machines. Three ProLiant BL25p servers will host 12 virtual machines each. The fourth server will serve as a spare and as excess capacity. It was mentioned earlier that some VMs had peak utilization periods. During these times, the virtual machines will be hot migrated to the spare server with no disruption to application operation. When utilization drops, they are migrated back. All servers boot from SAN and all of the virtual machines reside on SAN. The same benefits apply to these servers as the others listed as boot from SAN. Recovery is very rapid, maintenance capabilities are enhanced, and performance impacts can be anticipated and adjusted for.

We are now left with the consolidation of our failed SQL Server and underutilized systems. By default, SQL Server can not be distributed across multiple servers. In this configuration, six instances were running on six servers with low utilization and local files. As discussed, one application was temporarily crippled with serious consequences. The solution is to run two ProLiant BL45p servers with

SQL Server and use PolyServe to cluster the devices to a shared SAN. Data files for all six databases are placed on SAN and are configured in an Active-Active cluster state. The SQL Server instances are now in a highly available configuration with automated failover. The six original servers have now been consolidated down to two servers and database administration can now be handled from a central console by one administrator. Licensing costs have been removed for four instances and our remaining systems are running at much higher load than formerly possible.

Management suite

The original suite of management utilities consisted of a variety of non-related applications to manage different pieces of the infrastructure. The new software suite is as follows:

- Updated to HP Systems Insight Manager 4.2
- BladeSystem Management Suite, which consists of:
 - ProLiant Essentials Vulnerability and Patch Management plugin added, which will replace current software for vulnerability analysis and patch deployment. Since it functions in a multiple-operating-system environment, it can concurrently examine and patch our Windows and Linux servers and virtual machines from inside the HP Systems Insight Manager (HP SIM) console.
 - ProLiant Essentials Performance Management Pack (PMP) plugin to Systems Insight Manager – real time monitoring of Windows and Linux system performance to identify potential bottlenecks and inform administrators. In a BladeSystem environment, administrators can react rapidly to relieve potential problems before they occur.
 - Updated to Rapid Deployment Pack 2.1 – Server and application deployment
- Power Regulator – The blade infrastructure can now be configured to throttle power based on demand, yielding lower energy usage and better system utilization.
- Virtual Machine Manager 1.1 (VMM) and Server Migration Pack (SMP) – VMM controls both Microsoft- and VMware-based virtual machines from a web interface. With SMP, it also allows administrators to migrate physical machines to virtual machines and migrate one type of virtual machine to another.
- HP ProLiant Essentials Intelligent Networking Pack and Virus Throttle – Allows ProLiant servers to adapt to changing network conditions by detecting and adapting to network issues beyond the NIC. With the integration of Virus Throttle, Intelligent Networking also presents the ability to monitor for virus-like activity on the network and can slow the spread to new machines without effecting server performance.
- iLO Advanced Pack – Standard on every BladeSystem server, iLO Advanced Pack allows for the advanced monitoring and control of single systems when needed.
- HP OpenView Operations for Windows with SQL Server and Citrix SPLs and OpenView Internet Services and Probe for Citrix. This setup will allow for the real time monitoring of the end-user experience of applications hosted on Citrix and will also establish the creation of service maps for root cause analysis in mission-critical applications. This will also assist with planning and predicting issues which will minimize downtime.
- VMware Virtual Center

Infrastructure benefits

So far, this paper has concentrated on the application and management benefits. BladeSystem infrastructure provides additional benefits to manageability that are not easily expressed in the previous deployment example.

When deployed, the infrastructure outlined is completely pre-wired for 160 redundant gigabit network connections, 80 redundant fibre connections, and full power redundancy, even if there is not a single blade in an enclosure. This pre-built infrastructure offers several benefits:

1. With a pre-built infrastructure, capacity expansion can be planned and implemented before the server is ever ordered. Adding capacity never involves adding wires, trays, KVM switches, power cables or mounting rails. Simply plug and play. With a true sense of location and the proper data center conventions, BladeSystem enclosure slots can be preprovisioned, allowing you to plug in a server and walk away, a process that is far simpler than anything available to rack mount systems.
2. Reprovisioning and repurposing is a software based process. Do not log into the server. Manual processes for new network assignments, domain additions and subtractions, and even operating system deployment are a thing of the past. HP's suite of tools allows you to configure and reconfigure on the fly to make your IT work for you.
3. Power can be altered dynamically based on situation. With an intelligent power infrastructure and the HP Power Regulator software, power usage at the server level can be dialed back during low utilization periods saving money, cutting waste, and maximizing investment.
4. Interconnected components promote interconnected business. The nature of the HP BladeSystem infrastructure encourages the integration of servers, network, SAN, and NAS resource management. This promotes the cooperation of disparate IT management teams. Consolidation of IT management yields better communication, better security, and a more agile IT.
5. Manage at a new level. For years, servers have been managed as single devices. With BladeSystem, all components possess a relationship to the other components within the infrastructure. This hierarchical view allows for the deployment of patches, the aggregation of resources, and the management of "systems" in a better way.

All of these points add up to HP BladeSystem being an integrated, intelligent and agile infrastructure solution.

Solution benefit highlights

The server count has been reduced from seventy to thirty-four, reducing purchase price and creating long term savings during future refreshes. The initial savings is freeing budget for the SAN expansion and software consolidation.

For the long term, this reduction in server count leads to fewer systems to manage, less power usage and greater application density while maintaining availability and, in certain circumstances, substantially decreased licensing costs.

With regard to the reporting system, five servers were replaced with zero servers. By repurposing systems that otherwise see low utilization at known times, it is possible to maximize the utilization by changing the application load and system function based on time of day, day of the week, or even current utilization.

Legacy applications that were previously underutilizing servers are now in a highly available virtual configuration. They can be moved without shutting down, patched with the same software that is now patching all systems, and they are making greater use of computing capacity on both a per server and system wide basis.

From a management standpoint, we are now in an environment where the vast majority of management tasks for all devices can be accomplished from a single console. Administrators are assigned to roles and not tied to systems. This assists not only with management ease, but with business agility as well. Administrators can now prepare for change before they even order a system. They can also rapidly reprovision a system to meet business requirements and provision it back when it has served its purpose.

Capacity expansion in the future is greatly simplified. We have enclosure slots set aside for Citrix expansion, but this process can be repeated for many software vendors. Similarly, systems configured for use by one application may be rapidly commissioned to serve another application during low utilization periods.

What is now in place is a resource pool that is enabled by the BladeSystem architecture. The majority of the servers in this scenario have been freed from being bound to a particular application or process. This in turn has opened up a new level of flexibility that can not be attained with traditional rack mount devices. When combined with HP's approach to data center management, this results not only in increased flexibility and agility, but in much lower long term cost of ownership.

Conclusion

HP BladeSystem is an ideal infrastructure on which to create and grow an Adaptive Enterprise. Simplification of the design of the components, acceleration of the use of virtualization technology and the implementation of automated management allows IT staff to free itself from the day-to-day care of hardware and respond to business requirements faster than ever. It encourages companies to integrate business and IT in such a way as to enable strategic planning and competitive advantage for the future needs of the company.

For more information

For more information around BladeSystem and HP's virtualization partners, please go to the following links.

BladeSystem Solutions: <http://www.hp.com/go/bladesolutions>

BladeSystem Homepage: <http://www.hp.com/go/bladesystem>

HP ActiveAnswers: <http://h71019.www7.hp.com/ActiveAnswers/cache/71108-0-0-121.aspx>

Infrastructure Solutions: <http://h71028.www7.hp.com/enterprise/cache/9599-0-0-225-121.aspx>

Selected Partner Pages:

VMware: <http://www.hp.com/solutions/vmware>

Server Based Computing (Citrix and Microsoft): <http://www.hp.com/solutions/hpsbc>

PolyServe: <http://www.hp.com/solutions/polyserve>

F5 Networks: <http://www.hp.com/solutions/f5>

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