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WHITE PAPER

Business Value of Virtualization: Realizing the Benefits of Integrated Solutions

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EXECUTIVE SUMMARY

The use of static x86 server configurations is quickly becoming an outdated concept with the introduction of modern solutions based on blade architectures, which can offer both intelligent configuration and management and the ability to perform physical-to-virtual migration to promote uptime and efficient resource usage.

When combined with the quickly maturing x86 hypervisor technologies available from a variety of solution providers, the synergy of blade architectures and virtualization offers customers the ability to dramatically increase utilization of their server investments, boost uptime, provide a more resilient and available infrastructure, and roll out new infrastructure and services more quickly.

But equally important, these same technologies can also lower costs both directly, through an immediate reduction in power and cooling costs, and indirectly (but not with a lesser impact), through a reduction in IT administrative costs associated with server hardware and the layers of infrastructure software management.

IDC analysis of the potential to lower IT costs by moving to a virtualized infrastructure finds that the savings can be significant:

- Adopting a simple virtualized infrastructure can result in a reduction of up to 35% of total annual server costs per user compared with an unvirtualized static x86 server configuration (see the Appendix for included cost items). Described in this IDC White Paper as "basic virtualization," this starting point of virtualization refers to basic x86 server consolidation using virtualization software. It is commonly applied to test and development environments, along with at least some production use.

- Our research finds that the use of more advanced virtualization technology, along with increasingly sophisticated systems management tools that manage both the guest environments and the virtualization engines themselves, can further extend the benefits of virtualization significantly.

- An optimally managed or "advanced virtualization" infrastructure, described as an infrastructure that includes penetration of virtualized servers of more than 25%, storage virtualization, and the use of systems management tools, can deliver a total reduction of up to 52% per user per year.

- Integrated solutions from vendors such as HP, which offers the HP Insight Dynamics - VSE in conjunction with the company's HP c-Class BladeSystem products (using the HP Virtual Connect technology — a means of virtualizing Ethernet and Fibre Channel network connectivity for blades), provide essentially all of the same benefits of a basic virtualization scenario through a hardware-based solution. In addition, this solution can utilize a hypervisor to further extend customer benefits and, in that scenario, delivers some of the attributes IDC defines in an advanced virtualization scenario.

Table 1 compares the annual server cost per user for three types of deployment:

1. **Unvirtualized** — physical x86 server/physical OS usage/no virtualization and systems configured at less than 10% capacity

2. **Basic virtualization** — x86 server consolidation via virtualization without advanced functionality such as live migration and with limited automation and management applied selectively; systems achieve from 20% to 40% capacity utilization; common deployment for test and development scenarios, but limited production use

3. **Advanced virtualization** — widely virtualized infrastructure (>25%), including both server virtualization and at least some storage virtualization; use of management tools and automation tools such as workload redistribution and automatic workload migration — used both on live VMs and on cold OS images — for meeting service-level agreements and availability goals; systems achieve 40% to 60% or more capacity utilization

TABLE 1

Business Value of Virtualized Deployment: Total Costs

	Total Costs per User per Year ($)	Savings Versus Unvirtualized (%)
Unvirtualized	165	NA
Basic virtualization	107	Up to 35
Advanced virtualization	80	Up to 52

Source: IDC's Business Value of Virtualization Research, 2008

IDC believes that organizations using x86 solutions today should begin to adopt next-generation solutions as quickly as product adoption timelines permit. By so doing, organizations will gain better utilization of server resources and reductions in acquisition, deployment, and power and cooling costs.

Further, the reduction of staffing costs and increasing business agility translate into long-term benefits that for years to come will deliver ongoing returns on the investment required to put this in place initially.

SITUATION OVERVIEW

Value Proposition of Server Virtualization

Since its emergence in the early 2000s, virtual machine and hypervisor software technology aboard x86 servers has quickly become one of the most talked-about new technologies in IT infrastructure. The ability to virtualize servers and reclaim excess capacity has caught the interest of datacenter managers who are facing difficult power and cooling problems, the need for additional IT capacity to react to market changes, and a lack of significant capital resources.

The first phase of customer adoption of virtualization is really a continuation of a trend in the industry that began in 2000. Predominantly, this phase involved IT simplification. During the economic downturn that followed the dot-com boom, customers recognized the need for datacenter consolidation, physical server consolidation, and asset inventory controls. The problem of IT complexity was so severe in some cases that customers did not even know how many servers they were supporting.

Physical consolidation efforts and workload migration efforts started in the early 2000s and later began to merge with virtualization adoption plans, as x86-based solutions from VMware matured to the point of delivering good-enough scale and performance. As a result, customers began to rehost aging operating environments such as Windows NT 4.0 on newer hardware ("legacy rehosting") to get the cost and performance benefits of the new hardware.

By 2003 the market began to evolve toward a shift in the nature of the adoption of virtualization software on x86 servers. About 70% of all virtualization software deployments in 2003 were related to software development and testing — taking an emerging technology and applying it inside a sandbox of large organizations' test and development labs for consolidation purposes. But by the end of 2005, IDC saw the spending shift from consolidating software development and testing environments toward consolidating applications within the production part of the IT infrastructure. The focus was on securely encapsulating multiple applications to drive up utilization and drive down power and cooling expenses.

Since then, the industry has transitioned to focus more heavily on production-level consolidation, which continues today as a primary motivator for customers bringing virtualization within their organizations. In the interim, a variety of competitive solutions have entered the market, including multiple implementations of the open source Xen hypervisor technology, which has been integrated into both mainstream commercial Linux distributions and nonpaid Linux distributions and, in several cases, has been commercially packaged into a standalone product. Microsoft is the latest and arguably the most significant player to join the market. During 2008, Microsoft rolled out its Hyper-V hypervisor, which replaces its Virtual Server product that has been used primarily by customers for test and development purposes and low-scale, low-performance production deployments.

However, the industry has seen other related developments that offer similar value propositions that in some cases can reduce the need for a hypervisor. But more often, these solutions will work in concert with hypervisors to deliver a higher overall

value proposition. These solutions include sophisticated blade-based designs that deliver some of the same attributes associated with pure hypervisor technology, including the ability to move workloads from one blade to another, to proactively move a workload based on an impending failure, and to restart a failed workload aboard a healthy blade. These capabilities augment and extend the value proposition offered by software hypervisor technology.

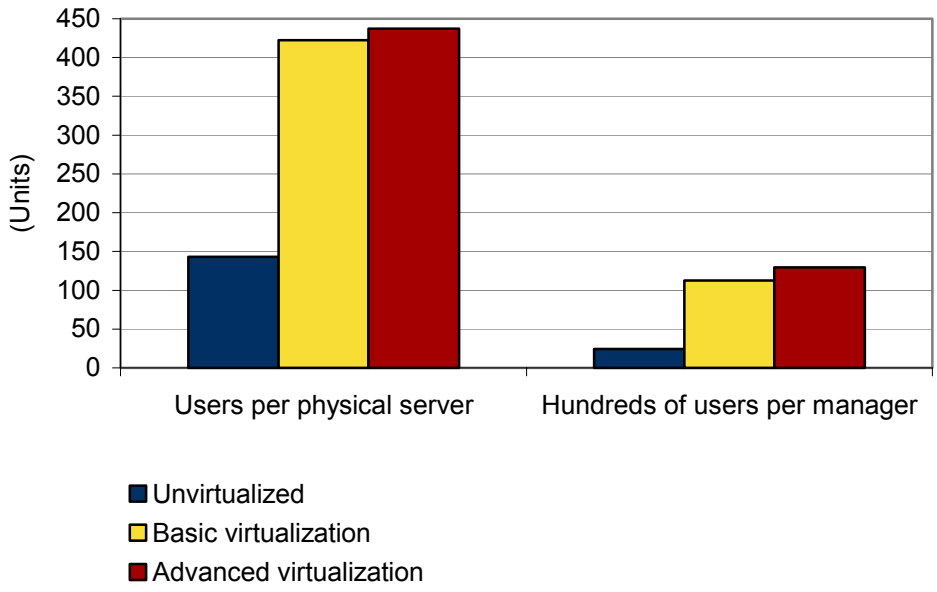
THE BUSINESS VALUE OF VIRTUALIZATION

This IDC White Paper presents a detailed analysis of the value proposition associated with moving across different virtualization adoption maturity levels. The following figures and tables compare business value accruing from the move from an unvirtualized environment to a virtualized environment or from a basic virtualization scenario to an advanced virtualization scenario.

Figure 1 shows that virtualization results in more (three times more) users per server and per server administrator. It depicts the direct impact of heavier provisioning — that is, increased number of operating systems — of servers using virtualization software. Merely moving from an unvirtualized infrastructure to a basic virtualization infrastructure boosts the number of users per server from 143 to 423. Likewise, the number of potential users per system administrator jumps from 2,400 to over 11,000, as might be expected, based on the increase in the number of physical servers managed by each system administrator.

FIGURE 1

Business Value of Virtualized Deployment: IT Benchmarks

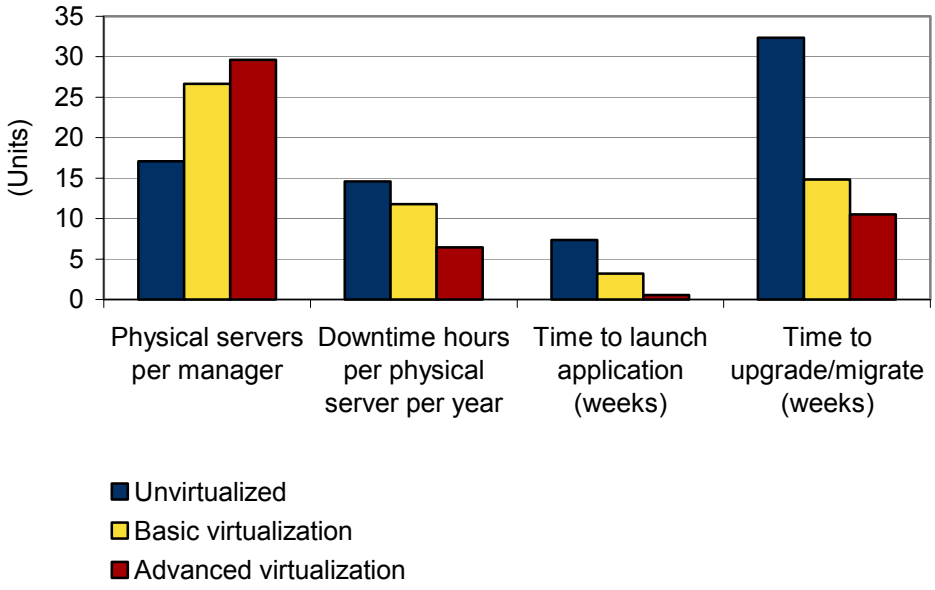


Source: IDC's Business Value of Virtualization Research, 2008

Figure 2 provides several additional metrics that illustrate the impact of moving to a virtualized infrastructure. As would be expected, the number of physical servers per manager nearly doubles, from 17 in an unmanaged, unvirtualized environment to 30 in an advanced virtualization infrastructure. This finding is a direct corollary to the data presented in Figure 1.

FIGURE 2

Business Value of Virtualized Deployment: IT Benchmarks



Source: IDC's Business Value of Virtualization Research, 2008

Figure 2 includes the first business value elements that go beyond hard total cost of ownership (TCO) data — the reduction of downtime hours on an annual basis and the significant reduction in time to launch applications. While there are multiple contributors to this downward shift, a few items stand out and deserve discussion:

- **More standardized configurations of servers.** Because a virtualized environment requires a level of standardization of the underlying operating system, it becomes easier to drive uptime through consistent configuration and patching of server operating system. No longer does each operating system require one or more unique drivers that are specific to a particular hardware configuration; instead, all operating systems map to the same portfolio of drivers provided by the virtualization software. This also helps ease the deployment of new applications because the underlying operating system is far more likely to be in a known and well-understood configuration.

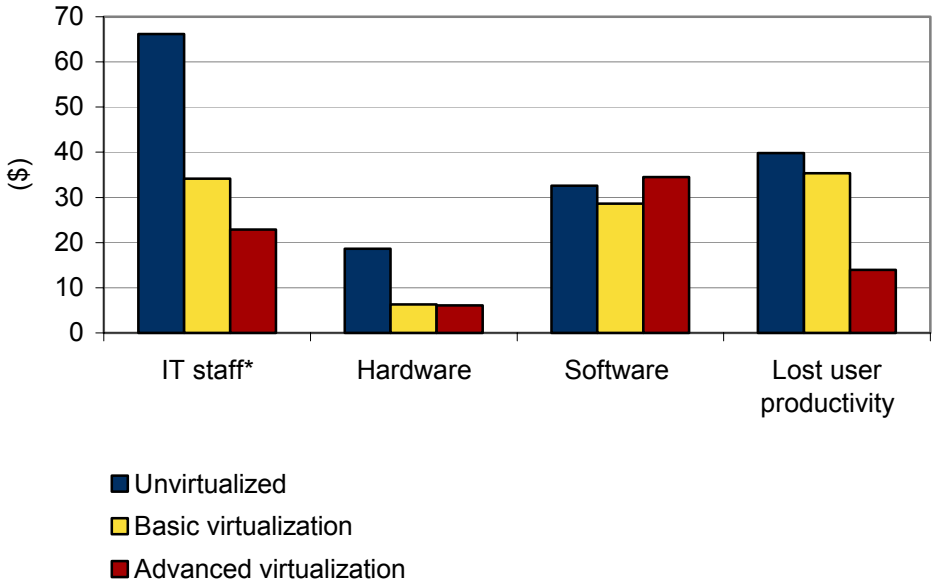
- **Ability to migrate workloads easily.** In the case of downtime reduction, operating systems can be moved from one server to another to facilitate repairs or maintenance, avoiding the lengthy downtime normally associated with that service. In the past, operating systems were tightly married to the underlying hardware, making it impossible to move the workload to an alternate server on a short-term basis. Even without live migration, it is possible to suspend an operating system and its workload, relocate it to another physical server, and bring it back up in only minutes.

- **Ability to snapshot and replicate operating systems** for test and configuration purposes. When IT deploys new applications, it now becomes possible, with little more than some mouse clicks, to replicate environments that can be used for testing and experimentation. "Trialing" a new application in a server operating system becomes easy and virtually risk free.

Figure 3 presents detailed elements depicting the measurable cost-saving metrics that come with a move to a virtualized infrastructure.

FIGURE 3

Business Value of Virtualized Deployment: Annual Costs per User



Note: IT staff costs include full life-cycle support and deployment for hardware, storage, operating system, and applications.

Source: IDC's Business Value of Virtualization Research, 2008

Not surprisingly, software costs remain consistent, or may even increase slightly, as one moves to a fully managed infrastructure, while hardware costs fall dramatically. Consistent with many previous IDC TCO studies, one of the most significant expense items is the staffing costs. However, unlike previous IDC studies, a substantial drop in staffing costs is realistic in a move to a basic virtualization scenario, with further gains possible with a move to an advanced virtualization scenario.

Our findings indicate that the use of increasingly standardized operating system images deployed on hypervisors (with increasingly common sets of drivers and devices) leads to more stable environments, a key contributor to the reduction in costs associated with supporting servers and the basic operating system configurations run on those servers. In parallel, lost user productivity, the cost of downtime, drops most significantly during a move from basic virtualization to the more tightly managed advanced virtualization deployment.

The Immediate Benefits of Virtualization

As detailed in Figures 1, 2, and 3, virtualization provides the following positive impacts:

- **User density increases dramatically.** The average user density grows by a factor of three on a per-server basis, while number of users per server manager goes up by a factor of between four and five times.
- **Availability improves.** System availability goes up even for basic virtualization. The real benefit comes from an advanced virtualization scenario in which downtime drops by 50%.
- **Scalability is a click away.** Once virtualized, an application that needs more scalability can be moved to a server that can fulfill that requirement with little more than a few clicks of the mouse.
- **Cost reductions occur.** Cost reductions occur across the board, but with future deployments, customers can move to server operating systems that offer unlimited virtualization rights, extending their savings dramatically in many cases.

System Management and Virtual Servers

General Benefits of System Management

The use of software tools to manage and optimize system resources has been a common practice in the IT industry for many years. As IT infrastructure has grown in complexity with the proliferation of distributed systems, networks, Web-based applications, and most recently, virtual servers, software for infrastructure management has become an essential requirement for smooth IT operations in the datacenter. Management software is also essential for delivering high-quality IT services to the business organization and to end users.

System management software is commonly used to support operational functions such as asset discovery and inventory, server provisioning, performance and availability monitoring and management, change and configuration management, and problem management. Across these functions, management software provides a number of key benefits that can result in cost savings and operational efficiencies.

These benefits include the following:

- **Automation of routine tasks.** Management software can be used to automate routine tasks, such as monitoring common infrastructure alerts and automating responses for known conditions, leading to an increase in IT staff efficiency.
- **Leveraging staff resources.** Use of management software helps increase the proportion of staff time used for productive work, increasing business value.
- **Higher availability.** System and network uptime plus application and database availability are key requirements for conducting business today. Downtime has direct costs to the business that come from loss of business opportunity and decreased end-user productivity.
- **Faster response to incidents.** This can occur in a number of ways, ranging from automated responses to simple alerts and alarms, to automatic creation of trouble and repair tickets for service desk functions, to problem determination and resolution aids such as event correlation, impact analysis, and root cause analysis.
- **Cost savings and improved return on investment (ROI).** As demonstrated repeatedly by numerous IDC studies, the overall effect of using automated software tools for IT infrastructure management typically results in cost savings and positive ROI. Areas for cost savings include reduced hardware and software costs, IT staff efficiency, end-user productivity, and enhanced operations for business applications, including reduced downtime and faster performance.

Virtualization: New System Management Challenges

While server virtualization brings many advantages in terms of cost savings and operating efficiencies, it also brings new and expanded requirements for system management. Server virtualization based on hypervisors introduces a new layer between the operating system and the hardware and creates new objects to manage. These objects include virtual server host systems, guest virtual machines stored in VHD libraries or deployed on host servers, as well as the need to manage "guest" operating systems and applications deployed in virtual machines.

Typically, server virtualization results in some level of operating system proliferation, or "virtual machine sprawl," which may substantially increase the overall number of server operating system images that need to be managed by system administrators. System management software is needed to perform the standard management functions required for physical systems, but now for virtual machine images as well.

Particular requirements exist for migrating physical server images to virtual images (P2V), as well as managing growing libraries of virtual images — many of which will be retained in cold storage but will still need to be inventoried and managed/maintained. Some functions, such as performance management, require extended capabilities to properly represent systems and applications running in guest environments.

System management functions can be well served by an approach that combines physical and virtual server management under a common umbrella that integrates functions and views — such as consolidated views that show all deployed physical and virtual servers with associated resources. In addition, management of the virtualized server environment needs to follow established IT processes or process standards for system management functions, such as ITIL best practices. In advanced virtualization cases, software for adaptive policy-based management and orchestration can be used to automate resource optimization and complex workflow scenarios to meet service-level requirements.

CONTINUING BENEFITS

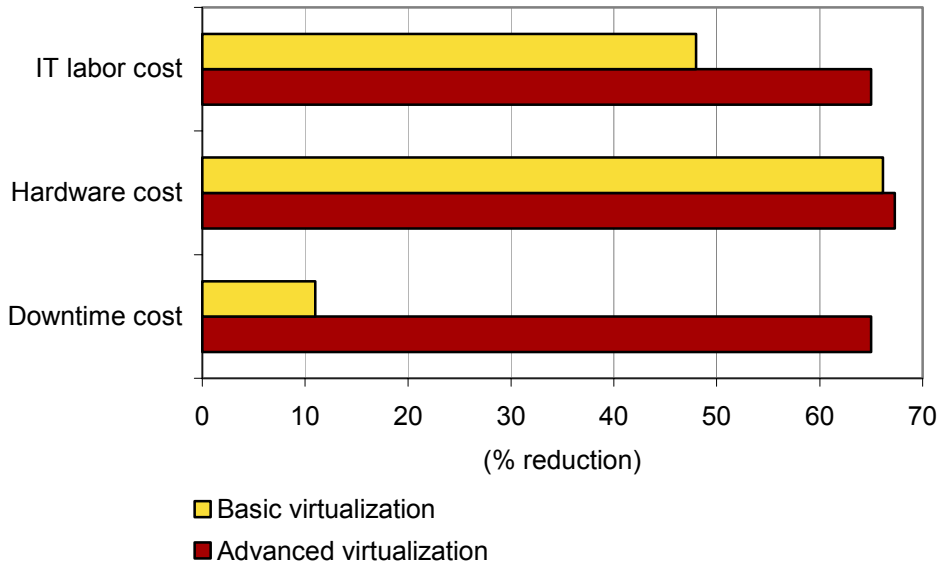
Moving forward, the business benefits articulated in Figures 1 though 3 accrue on an ongoing basis for customers leveraging a virtualized infrastructure. While the cost reductions are specifically measured using a software-based virtualized infrastructure, a hardware-based solution can achieve many of the same benefits.

Figure 4 compares cost reductions for a basic virtualization scenario and an advanced virtualization scenario against the baseline unvirtualized environment.

Hardware cost reductions for each scenario differ only slightly as these savings typically come form a one-time cost reduction that does not differ substantially for basic virtualization versus advanced virtualization infrastructures. As depicted in Figure 4, the move from basic virtualization to advanced virtualization has a major impact on the cost reductions associated with downtime reduction.

FIGURE 4

Business Value of Virtualized Deployment: Cost Reductions

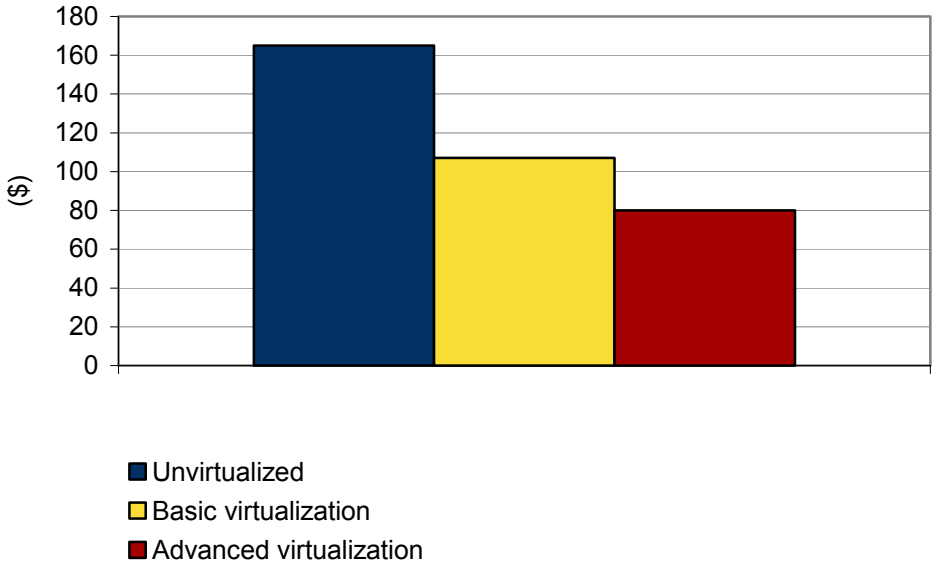


Source: IDC's Business Value of Virtualization Research, 2008

Figure 5 compares the annual cost of operations for a server configuration that is deployed in an unvirtualized mode with the annual cost of operations for basic virtualization and advanced virtualization scenarios. As noted, the TCO drops significantly from an unvirtualized scenario, when compared with either a basic or an advanced virtualization use case. The figure illustrates the benefits and payback that organizations gain by acquiring, and using, server management tools that work in concert with their underlying hypervisor, operating systems, and application workloads.

FIGURE 5

Business Value of Virtualized Deployment: Total Annual Costs



Source: IDC's Business Value of Virtualization Research, 2008

Return on Investment Calculations

Companies that have deployed basic virtualization are reducing their IT costs by $145 per user over three years with a total investment of $24 per user. Using IDC's standard discount rate of 12%, the average company deploying basic virtualization could see an ROI of 472% and payback in less than a year, including deployment time. This is a very significant ROI for a relatively low-cost, low-risk initiative.

In the advanced virtualization scenario, average benefits are increased by 49% (primarily through enhanced IT operations and user productivity cost reductions), while costs per user decline by 3% due to lower hardware costs. Table 2 presents the ROI story associated with a move to a basic or an advanced virtualization deployment.

TABLE 2

Business Value of Virtualization: Three-Year ROI Analysis (All Values per Server)

	Basic Virtualization	Advanced Virtualization
Total benefits	$144.9	$212.4
Total investment	$24.1	$23.3
Discounted benefits	$113.3	$166.1
Discounted investment	$19.8	$19.1
Net present value (NPV)	$93.5	$147.0
Return on investment (ROI)	472%	769%
Payback (months after deployment)	6.8	4.3
Discount rate	12.0%	12.0%

Source: IDC's Business Value of Virtualization Research, 2008

IDC uses a discounted cash flow methodology to conduct ROI analysis. The elements in Table 2 include the following items:

- **Total benefits** are the total cost savings per supported user over a three-year period.
- **Total investment** is the investment in hardware, software, services, and IT staff time to implement the virtualization solution per user over the same three-year period.
- **Discounted benefits** are the net benefits users realize after discounting for the cost of money.
- **Discounted investment** is the actual investment after accounting for the cost of money.
- **Net present value (NPV)** is the net discounted benefit (discounted benefits – discounted investment).
- **Return on investment (ROI)** is the ratio of the NPV to the discounted investment. It is used to compare investment opportunities.
- **Payback** is the time at which cash flow becomes positive. This is the period of time in months after the completion of deployment for the initial investment to be paid back. It is the best measurement of risk.
- **Discount rate** is the cost of money consisting of the average cost of capital plus a risk factor to allow for unforeseen costs or delayed realization of benefits.

HP AND x86 SERVER VIRTUALIZATION

As a leading vendor of industry-standard servers (ISS) based on x86 platform architectures, featuring HP ProLiant and HP BladeSystem servers, HP has placed heavy emphasis on delivering system management capabilities to support and add value to these platforms. Specifically, HP has incorporated hardware management facilities designed to simplify firmware updates and provide key targeted functionality, as delivered with HP Integrated Lights-Out (iLO) remote management or within a more holistic, integrated-by-design approach with its HP Insight Control Environment (ICE) management software suites based on HP Systems Insight Manager (HP SIM).

HP has taken a leadership role in the delivery and management of virtualization capabilities on x86 architecture servers. HP OEMs and supports software hypervisors from VMware, Citrix, and Microsoft to provide core server virtualization and virtual machine capabilities on HP ProLiant and HP BladeSystem servers.

iVirtualization

Recently, HP has introduced HP ProLiant iVirtualization — integrated virtualization capabilities that include preloaded hypervisors on HP ProLiant servers — to deliver "out of the box" virtualization with new product shipments. Integrated virtualization is designed to facilitate installation, configuration, and setup of host virtual servers and configuration and deployment of virtual machines. An important requirement for delivering these integrated virtualization capabilities is close cooperation between HP and key partners for development and support. HP ProLiant iVirtualization supports VMware ESXi and Citrix XenServer, with support also announced for Microsoft Hyper-V.

Facilities delivered through iVirtualization can be managed with HP SIM. HP's ProLiant Virtual Console (PVC), which currently supports XenServer environments, can be used to access and manage virtual machines from a local console or remotely via the embedded iLO 2 services processor found within the HP ProLiant servers and the iLO Advanced Pack license. With PVC as an option, the user has a variety of choices for managing virtual resources — through the local console, remotely with iLO Advanced, or by using a standard management tool.

HP Insight Dynamics - VSE

HP Insight Dynamics - VSE is a new class of software to visualize, plan, and change both physical and virtual servers using exactly the same approach. It provides a common integrated view of all physical and logical server resources on a single screen. HP Insight Dynamics - VSE is built on top of other HP server management software, including HP Insight Control and HP SIM, integrating these components as part of the management suite. This brings Virtual Server Environment capabilities, such as advanced capacity planning, that were previously available on HP Integrity servers to the HP ProLiant and HP ProLiant blade platforms.

HP Insight Dynamics - VSE also brings much of the flexibility of hypervisor-based virtualization to physical servers using a concept called "logical servers." A logical server can be a virtual machine, or it can be a physical HP BladeSystem blade configured with HP Virtual Connect technology, which virtualizes the network and storage network connections. HP Insight Dynamics - VSE not only works in conjunction with HP Virtual Connect technology but also requires HP Virtual Connect Enterprise Manager software.

A logical server carries a profile that identifies operating system and application configuration information so that the logical server can be deployed on any physical blade or virtual machine. HP Virtual Connect makes it possible to easily move server images across blades by automatically adjusting network and storage settings to reflect the new location of a server image. These capabilities can be used to support a number of use cases that require moving or deploying server images to optimize datacenter operations. Core use cases for HP Insight Dynamics include the following:

- Server migration and continuous consolidation
- Dynamic test and development scenarios
- Everyday high availability
- Energy-aware planning

HP Insight Dynamics - VSE incorporates the HP Labs–developed Smart Solver technology, which gathers more than 1,000 data points per day per server on resource utilization. This data is analyzed by HP Insight Dynamics - VSE and can be used to automatically generate recommendations for system consolidation to virtual machines. The tool can also be used to determine optimum placement of logical servers on target physical servers, based on a five-star rating system. The number of stars indicates how much additional capacity or "headroom" would be available if a workload was moved to a specific server.

CHALLENGES/OPPORTUNITIES

Any new technology faces challenges even as it opens doors to powerful new opportunities. Virtualization software and the associated systems management tools that enable an advanced virtualization deployment certainly face challenges such as the following:

- **Moving from distributed to consolidated infrastructure.** While the data presented in this IDC White Paper clearly illustrates the business justification for moving to a virtualized infrastructure, as with the introduction of any new technology, the return always comes only *after* the investment. IT organizations face the challenge of generating executive backing for that initial investment in moving from distributed to consolidated to save more money later.
- **Aligning and/or minimizing management tools in use.** Most organizations now support multiple management tools in their infrastructure. Proponents or departments invested in particular tools will resist consolidation down to a smaller number of tools.

- **Consolidating version inconsistencies.** Moving to an advanced virtualization infrastructure mandates ensuring a high degree of consistency in the virtual servers that run on the infrastructure. This goal, as attractive as it sounds, contrasts starkly with the typical deployments at most companies. The physical-to-virtual migration/consolidation activities will become more complex and involved than the simple, straightforward, and easily accomplished migrations that advertisements often suggest.

Once beyond these challenges, the customer realizes the following opportunities:

- **Cost reductions and business value.** As indicated by the data presented in this document, the cost reductions are potentially huge and can continue to accrue as additional servers are migrated from a distributed physical infrastructure to a virtualized consolidated infrastructure. Even the most virtualization-advanced organizations have integrated virtualization software into only approximately 20% of their systems. Only 10% of the prospective market has implemented virtualization at all. The potential upside for organizations remains huge.

- **Agility benefits that are real.** While agility benefits come first and foremost from having a solid management system in place, layering that solid management toolset on top of a virtual infrastructure multiplies those benefits.

- **Reduction of unscheduled downtime.** A virtual infrastructure is a two-pronged tool, which makes it easier both to reduce or totally eliminate unscheduled downtime and to minimize unscheduled downtime. The other prong is that by consolidating more operating systems aboard a smaller number of physical servers, those physical servers each become increasingly critical resources because of all the software loaded aboard those machines.

- **Green IT benefits.** Moving to a virtualized infrastructure that reduces the number of physical servers has a direct impact on power and cooling requirements and associated carbon emissions. Even better, moving to a virtualized x86 infrastructure may delay or eliminate the need for datacenter expansion. For some organizations, it may actually lead to datacenter consolidation.

CONCLUSION

Virtualization delivers compelling business value today, increasing by a factor of three the number of users supported per server, improving availability of servers, enabling application scalability, and reducing costs across the board.

The business case is clear and the options abound. In particular, the introduction of modern virtualization solutions based on blade architectures, which can offer both intelligent configuration and management and the ability to perform physical-to-physical migration, can help promote uptime and efficient resource usage, particularly when used in direct combination with the high-quality hypervisors available on the market today.

These same technologies can lower costs directly through an immediate reduction of power and cooling costs and subsequently deliver a long-term benefit through lower IT administrative costs that continue to benefit IT organizations and their parent companies year after year. IDC believes that these same benefits can accrue for integrated virtual and physical management solutions such as HP Insight Dynamics - VSE with its c-Class BladeSystem, which can offer customers hypervisorlike behavior when it's used with a workload running directly on a physical server.

IDC believes that organizations using x86 solutions today should move to adopt such a next-generation solution. In the process, they will gain better utilization of server resources and reductions in acquisition, deployment, and power and cooling costs. Further, the long-term benefit of reducing staff costs and increasing business agility leads to long-term benefits that will continue for years to deliver returns on the investment required to put this in place initially.

APPENDIX

Business Value Survey Sources and Methods

While cost-based metrics continue to be highly relevant and informative, IDC research goes a step further and also considers what we call the "business value" associated with new technology adoption. Business value not only considers quantitative, cost-based metrics but also describes nonquantifiable (or difficult-to-quantify) factors including adherence to standards, asset management, application availability, application deployment and deployment, performance considerations, as well as the ability of a company to respond to changing business conditions. This latter point, commonly called "business agility," is typically articulated in terms of the number of days to deploy an application to a given number of users or systems. Business value ultimately represents the best overall objective measure of total customer value — especially for the type of infrastructure workloads that IDC is analyzing in this study.

IDC analysts have been conducting TCO, ROI, and business value studies for the past 15 years. Through the years, IDC has developed a substantial database of information that paints a robust picture of operational costs and IT labor associated with supporting traditional servers.

Most often, the information in our database incorporates studies of specific platforms. In a typical study, IDC conducts interviews with a substantial number of end-user organizations — typically between 10 and 50 organizations — and, during that interview process, captures verbatim information about the staffing required to deploy, operate, support, respond to outages and problems, and manage and provision new applications through the life cycle of a given server or collection of servers. A given study generally focuses on a particular architecture or operating system. For the purpose of this business value analysis, we include only x86 platforms running operating systems such as Windows and Linux. Other operating systems aboard the x86 platform (Solaris, in particular) will likely exhibit behavioral characteristics similar to those of the operating systems measured in this view.

We combined this IT labor and operating cost data with primary research data on virtualization's effects. The IDC virtualization research project focused on virtualization adoption in the industry and provided us with consolidation measurements by types of workloads. We then complemented this base data with TCO/ROI study data that measured the effect of the use of systems management products on infrastructure costs. When these three sources of information are combined, the model produces a comparative evaluation of costs for a virtualized infrastructure versus the costs for managing the same infrastructure with highly capable enterprise systems management tools.

Scope of Measurement: Calculating Benefits

As described, the server virtualization business value model utilizes multiple data sets gathered from predominantly North American–headquartered enterprises during 2006 and 2007. Detailed usage data comes from interviews conducted directly with medium-sized and large companies.

Calculations for the server virtualization business value model of three major components are derived as follows:

- **The TCO model.** IDC's TCO model calculates and compares the total costs of delivering business applications to users. The server virtualization model normalizes the deployment environment to standard two-processor servers in virtualized and nonvirtualized configurations. Metrics calculated in this model include users per server, users per server administration IT staff, hours of downtime, and support hours of IT staff by server support activity type. These values feed the calculation of operations and user productivity costs. They also support the model's calculations of virtualized server configurations and costs, which we then compare with standard hardware, software, and datacenter infrastructure costs.
- **Cost comparisons.** The cost/benefit model also calculates the cost-saving benefits associated with the virtualized environment compared with the investment required to migrate from a nonvirtualized environment to a virtualized environment.
- **ROI analysis.** The ROI analysis model estimates discounted cash flows of the virtualized environment over three- and five-year time periods. This particular model presents the three-year ROI view.

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