

The Benefits of Using HP Integrity Servers to Consolidate HP 9000 Servers

A Detailed Analysis of the Potential Benefits of Using Consolidation and Server Virtualization when Upgrading HP-UX environments from HP 9000 servers to HP Integrity servers



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Using HP Integrity Servers to Consolidate HP 9000 Environments

Executive Summary

HP has been shipping HP 9000® servers with PA-RISC® microprocessors since about 1990. Since that time, nearly 100 different models of servers have been introduced ranging from single-CPU entry-level machines to enterprise-class Superdome® models that support 128 cores. Today, thousands of companies worldwide rely on HP 9000 servers and the HP-UX® operating system as key components of their IT infrastructure. Several years ago HP made a strategic decision to consolidate its high performance server product line by replacing servers based on PA-RISC and Alpha® chips with HP Integrity® servers (which are based on Intel's® Itanium® processor). HP's current plans are to continue selling HP 9000 systems until at least December 2008. Furthermore, HP has made a commitment to support these systems for at least five years after the last ship date if running HP-UX 11i V1 or V2. Support for V3 will continue for at least a further year. This extended support, combined with the reliability of HP 9000 servers, means customers can continue to rely on their systems through the year 2013 and beyond. Customers using HP 9000 servers, therefore, do not have to switch their systems out of necessity. However, one of HP's main reasons for moving to Integrity was to have the ability to offer higher performance servers at much lower prices (due to standardizing on the Itanium chip). Integrity's superior performance gives customers the opportunity to consolidate multiple HP 9000 servers into fewer HP Integrity servers.

There are several key benefits to server consolidation beyond the resulting obvious simplification of IT assets. Over the past few years many companies have turned to server consolidation to help control server crawl (i.e., rapidly growing number of servers in their organization) and to meet their growing IT processing needs. This paper provides a detailed Total Cost of Upgrade™, or TCU™, analysis for consolidating multiple HP 9000 servers running HP-UX into fewer HP Integrity servers. It is based on data collected from actual customers who have upgraded HP 9000 servers to HP Integrity servers, as well as current system and service pricing. This paper quantifies the costs and benefits from these consolidations and provides detailed cash flow analyses for four different scenarios. **The analyses shows that in 3 out of four scenarios studied, using HP Integrity servers to consolidate multiple HP 9000 servers running HP-UX pays for itself in 9 months or less.** In fact, it is possible to consolidate 8 high-end HP 9000 rp8420 servers into just 2 Integrity rx8640 servers with vPars and gWLM and have the consolidation pay for itself in just 9 months. **Due to the high performance and low cost of HP Integrity Blade servers, and the functionality of Integrity Virtual Machine, it is possible to consolidate 8 HP 9000 servers into 2 Integrity Blades and have the consolidation pay for itself in just 5 months.** The remaining consolidation scenario studied also had an attractive payback period of just 17 months.

TechWise® Research surveyed a total of 232 IT managers in the U.S. and in Europe who work with HP-UX environments running on HP 9000 and HP Integrity servers. These respondents manage a total of 6,123 HP 9000 servers and 1,384 HP Integrity servers. The surveys were designed to understand how the Integrity servers are performing compared to the HP 9000 servers on a variety of attributes. TechWise also utilized system pricing data from IDEAS International, and obtained performance data from HP for the analyses. **The analyses discovered multiple benefits to server consolidation with HP Integrity servers including reductions in service costs, management time, floor space**

requirements, energy use, and cooling costs. These consolidations also enable companies to utilize the latest technology and offer the opportunity for significant reductions in Oracle support costs.

HP offers several server virtualization technologies that enable companies to use their server resources more efficiently. These include HP's virtual partitions (vPars), Global Workload Manager (gWLM), and Integrity Virtual Machine (Integrity VM). By cutting the number of Integrity servers needed to implement a consolidation in half, vPars, gWLM, and Integrity VM make consolidations on Integrity even more financially attractive.

Each company that uses HP 9000 servers has a unique situation and decision criteria when it comes to consolidating multiple HP 9000 servers into fewer HP Integrity servers. This paper shows that the age-old adage of "*if it ain't broke, don't fix it*" will not apply in most cases. The payback periods are too short, and the financial savings too great, for most companies with multiple HP 9000 servers to ignore the consolidation opportunity. HP has taken steps to make the upgrade/consolidation decision easier for its customers by providing technical and financial assistance. Details of these programs may be found on HP's website at: <http://www.hp.com/products1/evolution/9000/faqs.html>. The results from 232 customer surveys show that **the majority of companies view Integrity servers to be as good, or better, than HP 9000 servers. This study also shows that HP-UX on Integrity is just as easy to manage and reliable as HP-UX on HP 9000.** Any company that has more than a couple of HP 9000 servers installed should seriously consider consolidating these servers into HP Integrity. **The consolidation has the potential to pay for itself quickly, lower annual support, operating, and energy costs significantly, and improve system performance dramatically.** Furthermore, the ongoing savings from the consolidation may be used to purchase additional hardware or invest in incremental application development.

Brief History of HP-UX and HP 9000

HP introduced the HP 9000® servers back in 1982.⁽¹⁾ In the ensuing twenty-five years HP introduced nearly 100 different models of servers ranging from single-CPU entry-level machines to enterprise-class Superdome® models that support 128 cores. After the acquisition of Compaq Computer (and the division that was formerly Digital Equipment) in 2001, HP offered many different hardware platforms including servers based on x86, PA-RISC®, and Alpha® chips. Shortly thereafter HP made a decision to consolidate its product line and to move towards standardizing future platforms on x86 and Itanium® processors. Just this year HP stopped shipping its AlphaServers®. HP's current plans are to continue selling HP 9000 systems until at least December 2008. Furthermore, HP has made a commitment to support these systems for at least five years after the last ship date if running HP-UX® 11i V1 or V2. Support for V3 will continue for at least a further year. This extended support, combined with the reliability of HP 9000 servers, means customers can continue to rely on their systems through the year 2013 and beyond.

The successor to the HP 9000 is the HP Integrity®, a family of servers based on the 64-bit Itanium 2 microprocessor. HP introduced the first Itanium 2 servers in 2002, which were re-branded as HP Integrity servers in 2003. HP Integrity servers have always supported the HP-UX operating system. HP's development team has focused on enhancing the reliability, security, partitioning, and virtualization abilities of HP-UX. Specifically, reliability has been improved through clustering technology and package failover on a system outage, as well as redundant hardware, increased quality testing, and error monitoring and correction. HP added kernel-based intrusion detection, strong random number generation, stack buffer overflow protection, security partitioning, role-based access management, and various open source security tools in HP-UX version 11i v2. All of this has improved the security of HP-UX. System partitioning options include hardware partitions, isolated OS virtual partitions, and Virtual Server Environments (VSE).

This past February HP introduced HP-UX 11i v3. Version 3 offers **enhanced** performance and **simplified management** that will make the decision to consolidate HP 9000 servers to HP Integrity servers even more attractive for companies. Although this new version is available for both HP 9000 and Integrity servers, it has been specially designed to take full advantage of the Intel® Itanium 2 processor family. Version 3 offers 30% faster operating system performance than Version 2. In addition, it is designed to take full advantage of the Dual-core Intel Itanium 2 processor with Hyper-Threading. This makes available a whole new level of server virtualization. Version 3 also offers improved security with a Native Encrypted Volume and File System (EVFS) for UNIX. Finally, Version 3 supports Dynamic Root Disk (DRD). This toolset allows users to clone an HP-UX system image onto an inactive disk for software maintenance and recovery. System downtime is reduced because new software or patches may be installed on the cloned system image.

In a separate paper entitled *Quantifying the Total Cost of Upgrading HP-UX Environments from HP 9000 servers to HP Integrity servers*, TechWise® Research shows the strategic and financial benefits of upgrading a single HP 9000 server to a single HP Integrity server. Companies that have many older HP 9000 servers running HP-UX will find server consolidations with HP Integrity servers even more attractive.

(1) Much of the historical data comes from Wikipedia, the free encyclopedia.

This paper provides in depth analyses into the decision to consolidate an HP-UX environment with many HP 9000 servers into fewer HP Integrity servers. Most customers can count on their current HP 9000 systems to continue to function reliably for many years into the future. Furthermore, HP will continue to support its HP 9000 servers through the year 2013 (or beyond). Why should customers incur the expense of consolidating functional HP 9000 servers into Integrity servers? Shouldn't the age-old adage of *"if it ain't broke, don't fix it"* apply? The answer is **in many cases companies with multiple older HP 9000 servers cannot afford not to consolidate these servers onto Integrity**. Most of the consolidations pay for themselves in less than 12 months. The subsequent annual savings can often be measured in hundreds of thousands of dollars.

In some cases consolidation does not make sense. HP 9000 servers that were purchased in the past year or so may not be good candidates to consolidate because these new servers would still be covered under HP's original manufacturer warranty. As a result, the payback period for consolidating these servers could extend beyond 36 months. In other scenarios, a customer specific application may not yet be available on HP-UX Integrity. Similarly, companies running older homegrown applications may no longer have resources qualified to port these applications over to Integrity. Despite the above reasons, this paper will show that the financial impact of the consolidation is so positive that many customers should initiate consolidation programs as soon as possible

The Math behind Server Consolidation

The amount of consolidation possible in an HP-UX HP 9000 environment will depend on a variety of factors including the number of HP 9000 servers, the applications they are running, the processing requirements of these applications, and the load and utilization factors of each server. HP Integrity servers provide two benefits that enable server consolidation. The first is through performance gains and the second is through server virtualization.

Configured with the same number of CPUs, an Integrity server offers approximately twice the performance of a comparable HP 9000 server. This is made possible by the Itanium 2 processor's speed advantage over PA-RISC, the improved architecture of Integrity servers over HP 9000, and the enhancements made to HP-UX previously mentioned. **Due to this performance advantage coupled with either nPars or application stacking, companies can achieve on average a 2:1 reduction in the number of servers** by consolidating HP 9000 environments to HP Integrity. This means that an environment with 8 high-end HP 9000 rp8420 servers could be consolidated into 4 HP Integrity rx8640s. Another example would be to consolidate 8 entry-level HP 9000 rp4410s into 4 HP Integrity BL860c blade servers. There is no reduction in performance in either of these consolidations.

HP also offers several technologies and products in the area of server virtualization that allow customers to use their servers in a more efficient manner. Traditionally, IT resources were designed such that a single server would be used to run a single application on a single operating system. This server would need to be sized to handle the application's peak loads. Most of the time the server will have excess processing capacity that goes unused. For example, a payroll application may require 8 CPUs two evenings a month when payroll is processed. The rest of the time it only requires 2 CPUs. The remaining 6 CPUs are idle and unused. Server virtualization enables companies to tap into this idle, or "over provisioned" capacity.

HP offers hardware and software options to implement server virtualization. The hardware partition, nPars, allows customers to partition a high end server as multiple servers (as small as one for each cell-board). Each partition has hardware isolation and a separate instance of the HP-UX Operating system and its file systems. Each hardware partition also has its own CPUs, memory and I/O hardware. The cell boards are hot swappable, meaning one cell board can be pulled out of a server while the remaining cell boards stay online and functional. The cell boards can be assigned to different applications. HP also offers Virtual Partition software, or vPars, that provides the ability to create soft partitions within a single server, each soft partition has its own Operating System. These separate partitions can then be allocated to different applications. Companies that have multiple servers in their environments can use nPars and/or vPars to "right-size" their servers. This greatly reduces or eliminates the need to over provision for peak loads. HP's tests have shown that eliminating over provisioning generally enables a 25% reduction in the required number of CPUs. HP's Global Workload Manager, gWLM, takes virtualization to another level by allowing server resource to be allocated dynamically across multiple applications. Based on rules set up by an IT Manager, CPUs can be automatically shifted from one application to another as processing needs vary because of peak times. This dynamic allocation of resources leads to an additional 25%-33% reduction in CPU requirements.

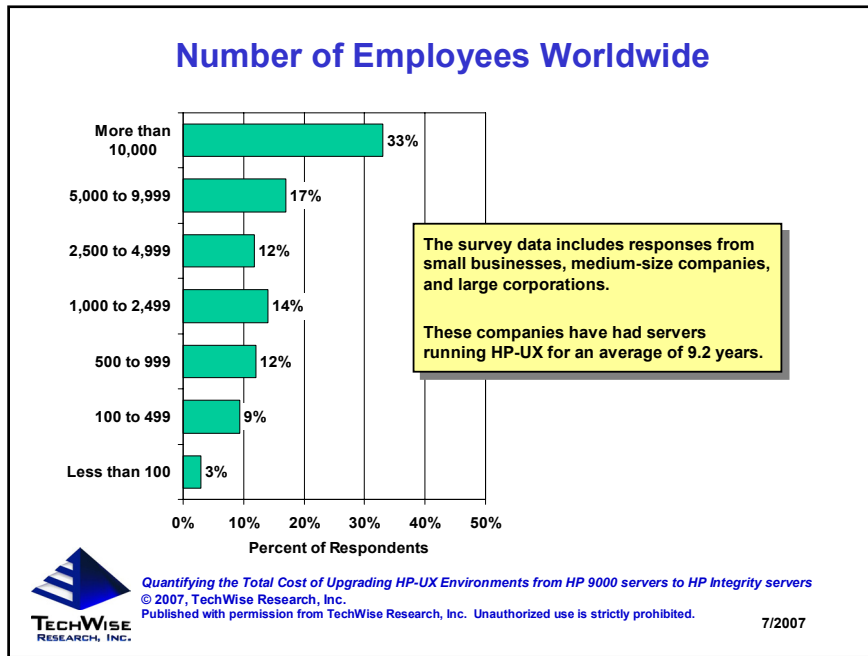
The combination of vPars and gWLM, therefore, can lead to a 50% reduction in CPU requirements. This 2:1 reduction in server requirements, for instance, means that it is possible to consolidate 4 Integrity rx8640s into 2 Integrity rx8640 with vPars and gWLM. HP's Integrity Virtual Machine effectively offers the same 2:1 server reduction as the combination of vPars and gWLM. The difference is that while vPars and gWLM make it possible to allocate individual CPUs to applications on an as needed basis, Integrity Virtual Machines makes it possible to dynamically allocate portions of a single CPU to different applications.

Combining the performance-related 2:1 server reduction with the virtualization-related 2:1 server reduction means it is possible to get as high as a 4:1 server reduction when consolidating multiple HP 9000 servers onto HP Integrity servers with vPars and gWLM or Integrity Virtual Machine. Virtualization makes consolidations on Integrity even more financially attractive, as will be shown later in this paper. In fact, 72% of respondents surveyed indicated that they will likely purchase one or more Integrity servers by December 2008 specifically to implement server virtualization.

Data Collection Strategy

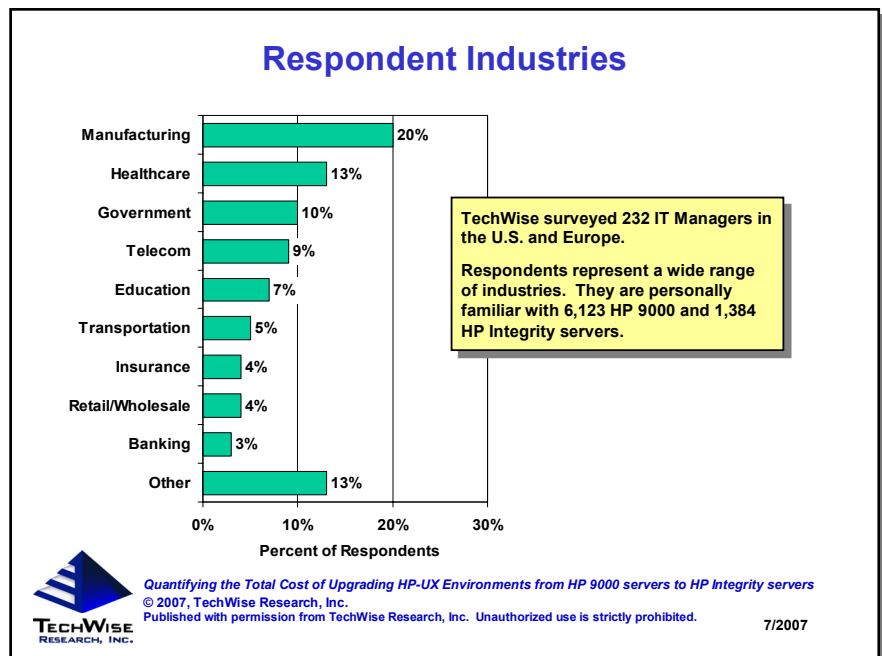
TechWise Research utilized current system and service pricing as well as customer data to perform robust Total Cost of Upgrade™ (TCU™) analyses on four different server consolidation scenarios. TechWise Research obtained current system and service pricing from IDEAS International. IDEAS International is recognized worldwide as a leading authority on systems technology, specializing in the research of comparative information on computer systems. Their current system and service pricing is updated daily with new product and price announcements. When buying servers, two customers can pay very different prices for two identical servers depending on when they buy them, and on the level of discount they can negotiate from their channel. In order to eliminate any timing or purchasing power bias from the analyses, TechWise used current list prices from IDEAS International. Few companies, however, pay list price for their servers. Our approach, therefore, is very conservative because it includes system pricing that is higher than what most companies would actually pay.

TechWise also designed and implemented an international research study to collect customer data relevant to the consolidation decision. The web survey targeted IT Managers who are using HP 9000 and Integrity servers in an HP-UX environment. The survey asked these IT Managers to compare Integrity to the HP 9000 on a variety of attributes. It also measured customer satisfaction with HP-UX Integrity servers. Respondents were recruited in the United States and Europe.



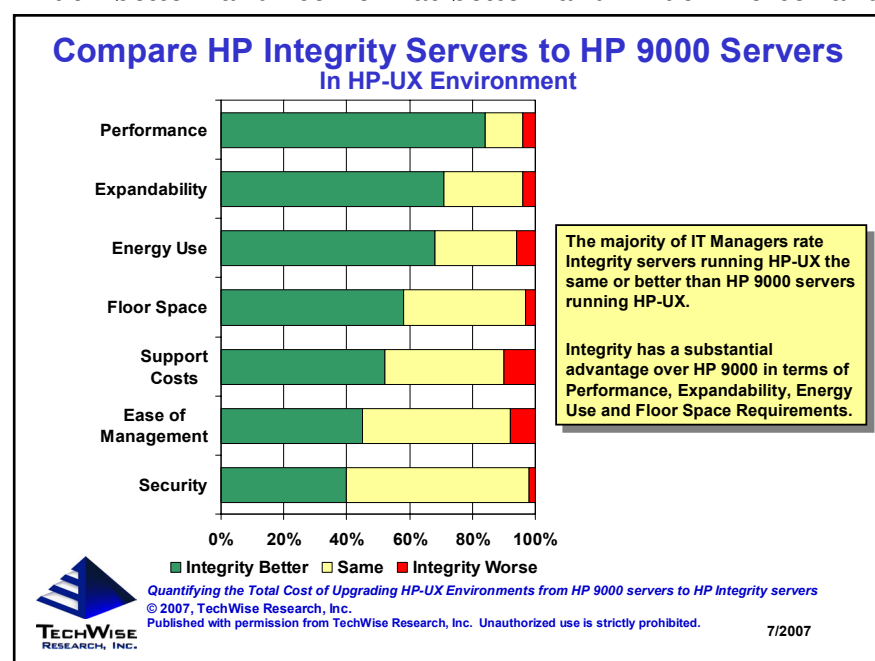
One of the design criteria for the study was to survey a random sample of companies that use HP-UX servers. The chart to the left, and the chart below, illustrate that this criteria was met. Respondents came from companies of all different sizes ranging from small businesses all the way to very large corporations. Regardless of company size, most respondents are very familiar with HP-UX. Respondents indicated that their companies have been using HP-UX, on average, for 9.2 years.

Respondents came from a wide variety of industries including Manufacturing, Healthcare, Government, and Education. The data set is robust not only in terms of the number of respondents, but also in terms of the number of servers managed by these respondents. Some of the respondents work with only a couple of HP-UX servers, while others work with 50 or more servers. This diversity enabled TechWise to identify how certain management costs are related to the number of servers managed. Overall, the 232 survey respondents were personally familiar with 6,123 HP 9000 and 1,384 HP Integrity servers, all running HP-UX.



Users Compare HP Integrity Servers to HP 9000 Servers

The 232 respondents were asked to compare their HP Integrity servers to their HP 9000 servers on 13 different attributes such as performance, ease of use, reliability, and application availability. All of the attributes are operational in nature and concern the use of the two types of servers. Respondents used a five point scale and indicated that the Integrity servers were either "much better", "somewhat better", "about the same", "somewhat worse", or "much worse" than the HP 9000 servers. To facilitate analysis, TechWise combined the "much better" and "somewhat better" and "much worse" and "somewhat worse" categories into "better" and "worse", respectively.

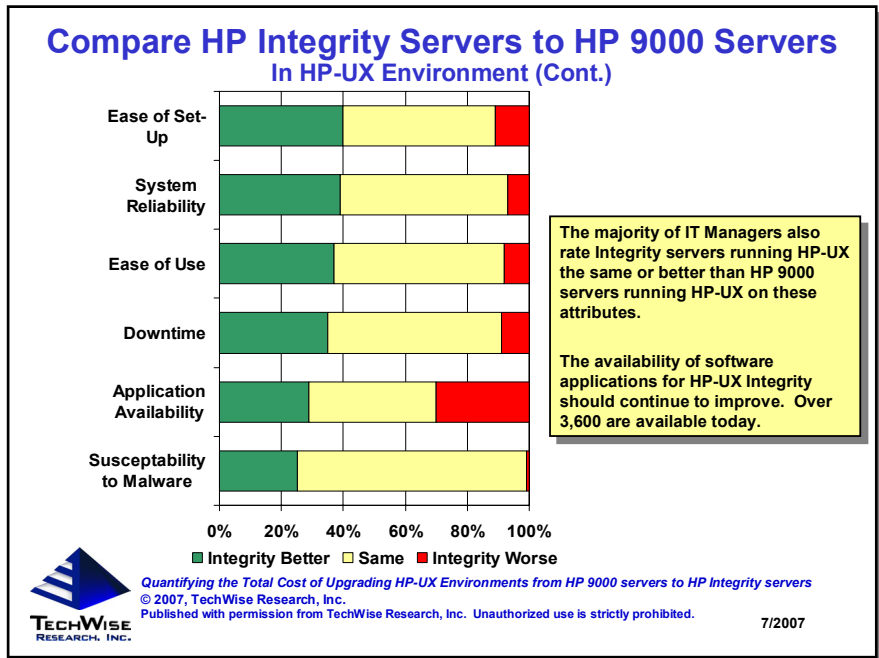


The chart to the left illustrates the findings for the first group of attributes. It shows that the majority of IT Managers rate the Integrity servers as the same or better than the HP 9000 servers. Integrity is seen as having a substantial advantage over HP 9000 in terms of performance and system expandability. This is not surprising given that Integrity is based on newer technology. In fact, two of the main reasons why companies should consider

consolidation are Integrity's superior performance and expandability. Customer perceptions regarding Integrity's performance advantage over HP 9000 will likely become even better as more companies adopt HP-UX 11i Version 3. This is because the new version offers a 30% boost in operating system performance over Version 2. Twenty-one percent of respondents indicated that they are running Version 3 (which was introduced earlier this year) on some of their Integrity servers.

It is interesting to note that only about half of the respondents view Integrity support costs to be better than HP 9000 support costs. This is surprising because, as will be shown later, Integrity support costs are substantially below HP 9000 out-of-warranty support costs. It is possible that some of the HP 9000 servers rated by respondents were purchased in the past two years and are still under HP's original support contract.

The chart to the right illustrates how Integrity servers compare to HP 9000 servers on the second set of attributes. Between 30% and 40% of respondents rate Integrity better than HP 9000 on attributes such as ease of set-up, system reliability, and ease of use. More respondents view the two server platforms as being the same on these attributes. This is not surprising because all of these attributes (as well as ease of management shown on the previous chart) are influenced by the operating system software. Since both systems are running the same HP-UX operating system, it is logical to expect the two systems will behave similarly on these operational attributes.




The one item of note concerns the availability of software applications for Integrity servers running HP-UX. Seventy percent (70%) of respondents rate application availability on Integrity as the same, or better, than HP 9000. However, 30% rate Integrity as worse than HP 9000 in terms of application availability. This is not surprising since HP 9000 servers have been available for decades compared to 5+ years for Integrity servers. In a separate question TechWise Research asked respondents how satisfied they are with the applications available for HP-UX Integrity. Eighty-five percent (85%) of respondents (not shown in graph) are satisfied with application availability on Integrity. This indicates that even though there are more applications available for HP 9000, most of the applications that are being used by respondents are also available on Integrity servers. According to HP, as of June 2007 there are 3,981 third-party applications available for HP-UX Integrity.

Consolidation Scenarios Analyzed

Every customer has a unique installation when it comes to the number and type of HP 9000 servers in their HP-UX environment. Furthermore, for every conceivable combination of HP 9000 servers, there are several potential consolidation paths. This paper focuses on the four different server consolidation scenarios that are described in the chart below. These scenarios were selected to illustrate some of the possible ways HP Integrity servers can be used to consolidate entry-level or enterprise-class HP 9000 servers. The first scenario involves consolidating 8 clustered HP 9000 rp8420s where each server has 16 chips with 32 cores. Due to Integrity's substantial performance advantage over the HP 9000, these 8 servers can be consolidated into 4 clustered HP Integrity rx8640s using nPars hardware partitions. The second scenario is a variation of the first plus virtualization. By using HP's vPars (Virtual Partitions) and gWLM (Global Workload Manager), it is possible to consolidate the same 8 clustered rp8420s into just 2 clustered 8640s. Consolidation #2, therefore, combines the performance gains of Consolidation #1 with the additive gains which virtualization provides. The third and fourth scenarios involve HP Integrity BL860c blade servers. Scenario #3 involves consolidating 8 entry-level rp4410-4 servers (each with four cores) into 4 BL860c

	Original HP 9000 Server Environment	Consolidated HP Integrity Server Environment
#1	<u>8 clustered HP 9000 rp8420s</u> 1.1 GHz CPU, 16 chips / 32 cores 64 GB RAM and 146 GB storage	<u>4 clustered HP Integrity rx8640s</u> 1.6 GHz CPU, 16 chips / 32 cores (using nPars hardware partitions) 64 GB RAM and 146 GB storage
#2	<u>8 clustered HP 9000 rp8420s</u> 1.1 GHz CPU, 16 chips / 32 cores 64 GB RAM and 146 GB storage	<u>2 clustered HP Integrity rx8640s</u> 1.6 GHz CPU, 16 chips / 32 cores (using vPars and GWLM) 64 GB RAM and 146 GB storage
#3	<u>8 HP 9000 rp4410-4 servers</u> 1.0 GHz CPU, 2 chips / 4 cores 16 GB RAM and 146 GB storage	<u>4 HP Integrity BL860c Blades</u> 1.6 GHz CPU, 2 chips / 4 cores 16 GB RAM and 146 GB storage
#4	<u>8 HP 9000 rp4410-4 servers</u> 1.0 GHz CPU, 2 chips / 4 cores 16 GB RAM and 146 GB storage	<u>2 HP Integrity BL860c Blades</u> 1.6 GHz CPU, 2 chips / 4 cores (using Integrity Virtual Machine) 16 GB RAM and 146 GB storage

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blades. Again, the 2:1 reduction in the number of servers in this consolidation is largely due to the performance benefits of the Integrity solution. The fourth scenario shows how Integrity Virtual Machine could be used to consolidate the same 8 rp4410-4s into just 2 BL860cs. Consolidation #4, therefore, combines the performance gains of Consolidation #3 with the additive gains which Integrity Virtual Machine provides. All of the Integrity servers use the dual-core Montecito processor, so that

every chip acts like two separate cores. Oracle treats the dual-core Itanium chips differently than the dual core PA-RISC chips when determining support costs. This will greatly impact the payback periods of any consolidations that involve Oracle, as will be shown later.

The next section of this white paper explains the approach TechWise Research used to develop its TCU model. It includes a discussion of the various factors involved in the consolidation decision and how TechWise addressed them in the analyses. The final part of the white paper includes the actual results of the TCU analyses for the four different consolidation scenarios just described.

The Two Sides of the TCU Equation

There are two sides to the equation TechWise Research developed to quantify the TCU for consolidating HP-UX environments from HP 9000 servers to HP Integrity servers. These are the upfront costs and ongoing savings associated with the consolidation.

Upfront Costs

- **Integrity Servers:** The cost to purchase the Integrity servers configured with the desired amount of memory and storage and three years of 24x7 support.
- **HP Software:** The licensing costs for HP-UX Integrity and any virtualization software.
- **Third-Party Software:** The cost to transfer licenses of any third-party application from the HP 9000 servers to the HP Integrity servers.
- **Installation:** The time and/or money spent installing the new Integrity servers, including any special management applications such as vPars, gWLM, or Integrity VM.
- **Training:** The time and/or money spent learning how to use the new Integrity server and any special management applications such as vPars, gWLM, or Integrity VM.

All of the preceding factors are one-time costs companies would pay at the beginning (or very early stages) of the consolidation process. In addition to these costs, the fully functional HP 9000 servers that would be replaced have a trade-in value that should be included in the TCU analyses. HP often offers programs to encourage companies to replace their servers. TechWise Research contacted HP directly to receive quotes on the "trade-in" value of the two different HP 9000 servers studied in the analyses.

In addition to the trade-in value of the HP 9000 servers, there are several potential sources of ongoing cost savings once the consolidation to HP-UX Integrity servers is in production.

Potential Ongoing Savings

- **Support Contracts:** This is the difference, if any, between the out-of-warranty costs of a support contract on the HP 9000 servers versus support on the Integrity servers.
- **Management Costs:** This is the difference in the time and costs spent managing the servers on an ongoing basis.
- **Energy Costs:** This is the difference in the ongoing power and cooling costs between the HP 9000 server and Integrity server.
- **Floor Space Savings:** The consolidations all result in a decrease in the amount of floor space used, freeing up space in the server room for other computing equipment. These savings were not included in the analyses because they vary by company.

The following sections explain our approach to quantifying all of the above costs and benefits.

Up-Front Costs Associated with an Consolidation

As previously stated, TechWise Research obtained current system and service pricing from IDEAS International. The cost to license the HP-UX operating system for an Integrity server can run in the tens of thousands of dollars, depending on the system configuration and type of license. However, for many customers consolidating HP 9000 servers into Integrity servers this cost will be zero. This is because of an HP program that allows a customer that has a support contract for its HP-UX license that entitles them to new versions to trade their HP-UX HP 9000 license in for an equivalent HP-UX Integrity license at no charge. Customers who do not have a support contract with HP for their HP-UX license may purchase an equivalent HP-UX Integrity license at a steep discount. Most HP server

customers that TechWise has interviewed in the past 8 years have had a support contract with HP. For this reason, TechWise assigned a zero cost for the HP-UX Integrity license in the TCU analysis. Companies that are not sure of their HP-UX support status should contact their reseller or HP to clarify their particular situation.

There are over 12,000 third-party applications available for HP Integrity. As previously stated, almost 4,000 of these applications are supported on HP Integrity servers that are running HP-UX 11i. Each software vendor will have their own policy regarding a customer switching from HP 9000 to Integrity. Since every company has a unique set of applications, the only way to get an exact measurement of these costs is for the company (or a third-party) to contact all of their software vendors and obtain the upgrade costs. For this paper, TechWise Research assumed that as long as a customer has a support contract with their respective software vendor, they can transfer their license to HP-UX Integrity at no cost.

Finally, the Integrity is a different platform than the HP 9000. Companies making this transition for the first time can expect to spend time installing the new Integrity and learning how to use it. One of the goals of the customer survey was to collect information on the time and money spent on Integrity server installation and training. From the 232 respondents, TechWise learned that the average company spent \$6,300 on training and installation (including staff time and external costs). These costs, which varied depending on the number of Integrity servers installed, were included in the TCU analyses. In addition, two of the consolidation scenarios studied involve specialized HP software (e.g., vPars with gWLM or Integrity Virtual Machine). TechWise Research assumed that customers making these consolidations would require training on these applications. An additional \$5,000 to \$7,000 in training costs, depending on the scenario, was included in these analyses.

Ongoing Savings Resulting from an Consolidation

There are two reasons why support contracts represent one area where companies can save a significant amount of money by consolidating HP 9000 servers into Integrity servers. First, consolidation by definition is a reduction in the number of servers (and hence fewer support contracts). Second, "next generation" computing equipment almost always have lower support costs. This is because service contract costs are typically directly proportional to system price and newer systems typically cost less than comparable older systems. How big an issue is this? The annual cost for a hardware and software service contract on an out-of-warranty HP 9000 rp8420 with 32 cores is approximately \$250,000. The one-time cost to purchase a new Integrity rx8640 with 32 cores, including all software licenses and three years of 24x7 support, is \$985,000. However, due to Integrity's performance advantage, in scenario #1 eight rp8420s are replaced by four rx8640s. **The \$2 million annual savings in service costs for the eight rp8420s alone would pay for the four rx8640s in just under 24 months.** This does not take into account savings from HP's software and hardware trade-in programs (which can easily exceed hundreds of thousands of dollars in this high-end scenario). TechWise Research contacted HP for the annual out-of-warranty support costs for the two HP 9000 servers analyzed in this paper.

One of the big unknowns going into this study was how Integrity servers running HP-UX compare to HP 9000 systems running HP-UX in terms of reliability and management costs. Although reliability is not factored into these TCU analyses, it is critically important in the consolidation decision. Few IT Managers would wish to consolidate servers to a less reliable platform. In terms of management, a complete TCU analysis should account for

any changes in the time required to manage the servers. Given that the number of servers is reduced after a consolidation, it stands to reason that management costs will decrease.

TechWise Research collected information about management costs and unplanned downtime hours from the 232 survey respondents. In terms of downtime, respondents indicated how many total hours of unplanned downtime, if any, they experienced in the past 12 months. **On a per server basis, there is no difference in reliability between HP 9000 and HP Integrity servers.** The HP 9000 servers averaged 1.3 hours of unplanned downtime while the HP Integrity servers averaged 1.1 hours. This works out to 99.985% or better availability. Companies that consolidate their HP 9000 servers into HP Integrity servers should, on average, see no decrease in system availability.

In terms of management costs, **comparing companies with similar numbers of HP 9000 and HP Integrity servers show that there is no difference in the amount of time spent managing these two types of servers on a per server basis.** This is not too surprising since both servers are running the same operating system. Scenarios #1 and #3 consolidate 8 HP 9000 servers into 4 HP Integrity servers. These scenarios will, therefore, result in a 50% reduction in ongoing management time and costs. Scenarios #2 and #4 consolidate 8 HP 9000 servers into just 2 HP Integrity servers due to vPars and gWLM or Integrity VM. These applications will require some extra amount of time to manage. Factoring in this additional time means these two scenarios result in a 70% reduction in ongoing management costs (as opposed to 75% if no additional software was involved).

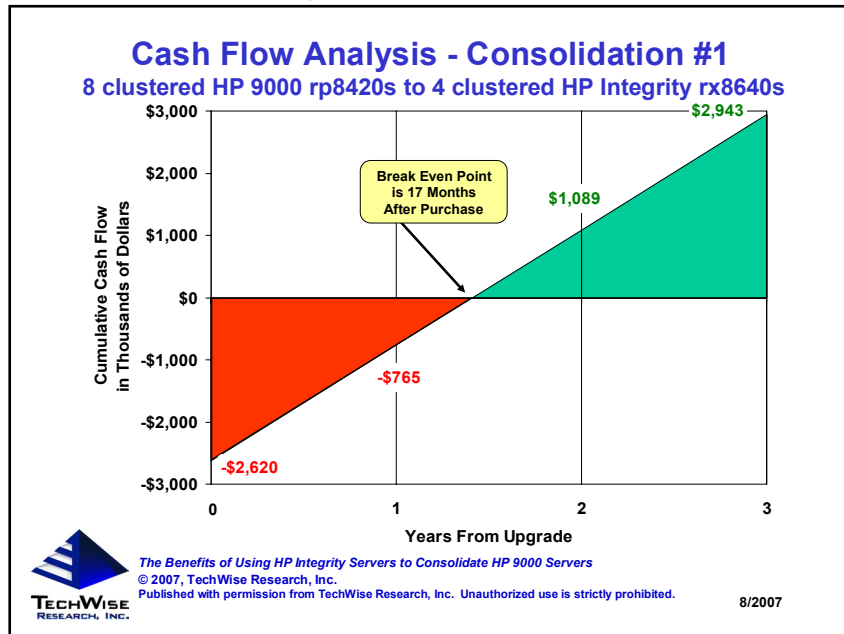
TechWise Research also included energy costs into its TCU analyses. Due to the ever increasing cost of energy, the cost to run a server and cool the server room can no longer be ignored. According to Bart Perkins of ComputerWorld, "in some markets, the electricity bill for a server facility can run four to six times the cost of renting the building space." These consolidations result in dramatic energy savings due to the reduction in the number of servers. The table to the right

Power and Cooling Requirements Comparison Expressed in Kilowatt Hours

Consolidation Scenario	HP 9000	Integrity	Percent Change
8 clustered rp8420s to 4 clustered rx8640s	55.52 kWh	30.89 kWh	-44%
8 clustered rp8420s to 2 clustered rx8640s	55.52	15.45	-72%
8 rp4410-4 servers to 4 BL860c Blades	16.87	4.13	-76%
8 rp4410-4 servers to 2 BL860c Blades	16.87	2.40	-86%

summarizes the energy and cooling requirements for the HP 9000 and Integrity servers studied in this paper and the resulting decrease in energy costs. **The analysis shows that these consolidations will result in a reduction of energy use of between 44% and 86%.** Depending on the scenario, this translates into annual savings of between \$10,000 and \$30,000. In addition, in this era of environmental awareness, companies that consolidate can say that they are doing their part to reduce their energy consumption.

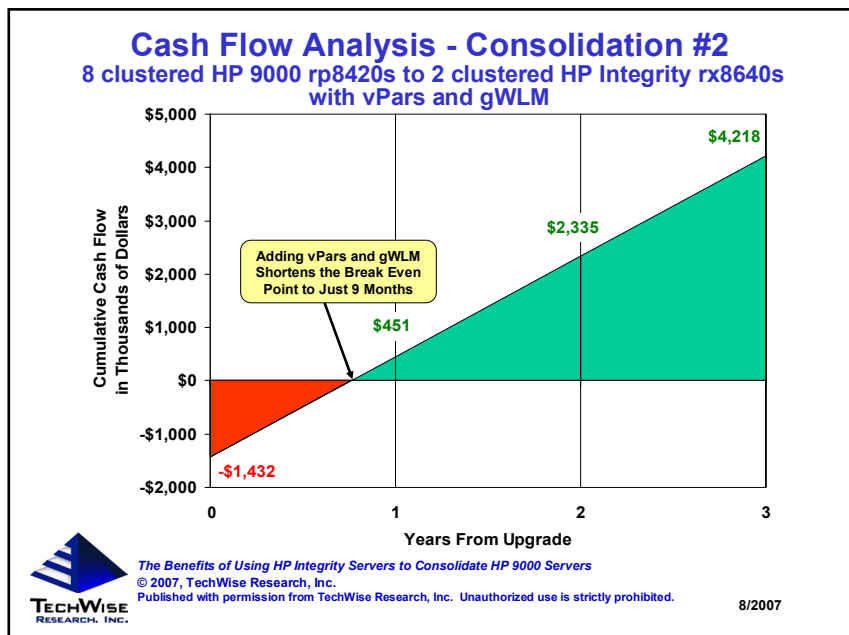
Cash Flow Analysis for Consolidations #1 and #2



In Consolidation #1, a cluster of eight HP 9000 rp8420 servers is consolidated into a cluster of four HP Integrity rx8640s. Due to the rx8640's performance advantages, the work of 8 rp8420 servers can be accomplished with just 4 partitioned rx8640 servers using nPARS. The initial cost for the Integrity cluster, including 3 years of service, installation, training, and the trade-in values of the HP 9000 servers and HP-UX licenses is about \$2.6 million. These costs are offset by annual savings in support,

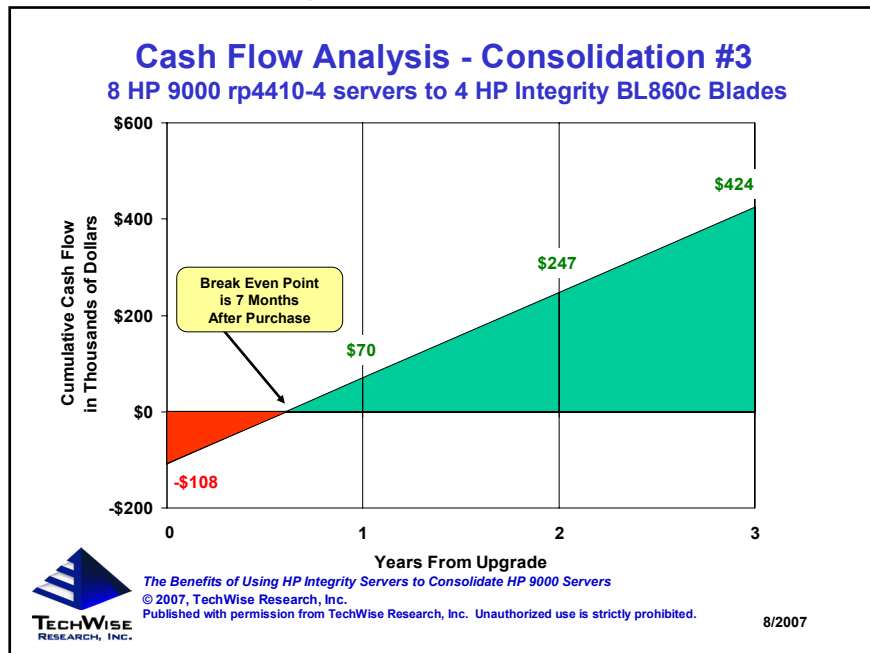
management, and energy. HP currently charges about \$250,000 per HP rp8420 server for an annual 24x7 support contract. Since there are 8 servers in the cluster, this translates into \$2 million dollars a year. The time it takes to manage the four Integrity servers is half the time needed to manage the eight HP 9000 servers. Finally, as previously shown, energy costs decrease by 44% as a result of the consolidation. **Due to reductions in service, management, and energy costs, this consolidation pays for itself in just 17 months.** The chart above shows that after 3 years, the **net savings** from this consolidation are \$2.9 million.

HP's Virtual Partitions and Global Workload Manager enable two rx8640s to do the work of four rx8640s. The chart to the right illustrates the impact of combining performance advantages of Integrity with the benefits of virtualization on the cash flow analysis. Even after adding the cost of vPars and gWLM licenses and training, the start-up cost drops to \$1.4 million due to the fewer number of Integrity servers. This cost is quickly offset by the annual savings in



support, management and energy. The net result is that **vPars and gWLM make it possible for this consolidation to pay for itself after just 9 months.** The cumulative net savings after 3 years is \$4.2 million (enough to purchase a second and third cluster).

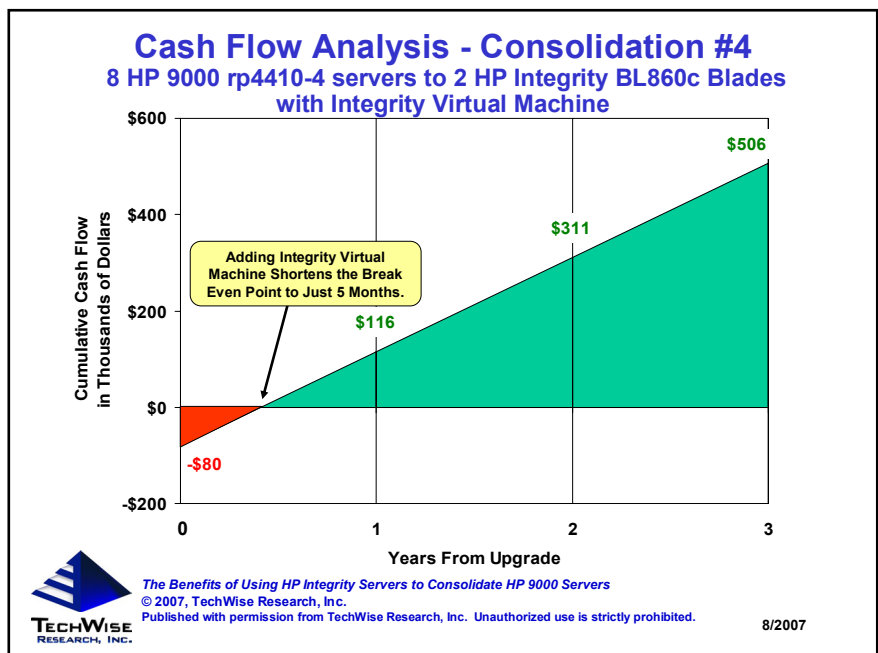
Cash Flow Analysis for Consolidations #3 and #4



The chart to the left summarizes the cash flow analysis for the third consolidation scenario. Due to BL860c performance advantages, 8 entry-level HP 9000 rp4410-4 servers are consolidated into 4 HP Integrity BL860c blades. The initial out-of-pocket cost for the 4 blades (including installation, training, three years of support, and HP 9000/HP-UX trade-in credits) is \$108,000. This expense is quickly paid for through savings in service, management, and energy. **The break-even point for**

this consolidation using 4 Integrity blade servers is only 7 months. It is not difficult to see why blades have been so popular with companies over the past few years. After three years, companies implementing this consolidation would save a total of \$424,000.

HP's Integrity Virtual Machine effectively enables two BL860c blade servers to do the work of four BL860c blades. The chart to the right illustrates the impact of combining the performance advantages with virtualization technology. In this final consolidation scenario, the same 8 rp4410-4 servers are consolidated into just 2 BL860c blades with Integrity VM. Even after adding the cost of Integrity VM training and licenses, the start-up cost drops to \$80,000 due to the fewer number of Integrity blades.



Consolidation #4 pays for itself in only 5 months. Any company that has three or more older HP 9000 servers would be wise to consider consolidating these servers on Integrity blades. **Over the first three years, this consolidation would result in total cumulative net savings of \$506,000.**

Oracle Users May Benefit Even More from Server Consolidation

As previously mentioned, upgrading to Integrity could also lead to savings on third-party software support contracts. Every software company has a different pricing policy for their support contracts. Oracle is one of the most widely used third-party applications. TechWise Research used Oracle's April 20, 2007 Global Price List (which is posted on its website and is subject to change at any time) to investigate the impact of Oracle support costs on these TCU analyses. Oracle currently charges \$8,800 *per processor* for an annual support contract that provides support and updates. For the purposes of license fees, however, Oracle treats each Integrity *core* as 0.5 of a processor and each PA-RISC *core* as 0.75 of a processor. Because of this, **every consolidation will substantially reduce Oracle's annual support costs.** How much can companies save in Oracle support costs? Consolidation #1 involves 8 HP 9000 rp8420s into 4 Integrity rx8640s. Both servers come with 16 chips and 32 cores. For Oracle licensing purposes, the HP 9000 environment requires 192 licenses (8 x 32 x 0.75) while the Integrity environment requires only 64 licenses (4 x 32 x 0.5). **Consolidation #1 reduces the number of Oracle licenses by 128, which translates into annual savings of \$1,126,400.** Consolidations #2, #3, and #4 reduce the Oracle licenses by 160, 16, and 20. These translate into additional annual savings of \$1,408,000 (Consolidation #2), \$140,800 (Consolidation #3), and \$176,000 (Consolidation #4).


Several assumptions went into the above calculations. First, TechWise applied Oracle's list price for service contracts. Some companies with a large number of Oracle licenses may have negotiated lower service costs. Second, TechWise assumed that the excess licenses from the consolidation would not be redeployed elsewhere in the company. Third, the calculations were based on Oracle's current technical support policies. This policy, dated July 10, 2007, states that "In the event that a subset of licenses on a single order is terminated or if the level of support is reduced, support for the remaining licenses on that license order will be priced at Oracle's list price for support in effect at the time of termination." The entire policy may be viewed here:

<http://www.oracle.com/support/collateral/oracle-technical-support-policies.pdf>.

Impact of Oracle Support Costs on Break-Even Point of Consolidation

	Consolidation	Original Break-Even	Break-Even After Oracle
#1	8 clustered rp8420s to 4 clustered rx8640s	17 months	11 months
#2	8 clustered rp8420s to 2 clustered rx8640s	9 months	5 months
#3	8 rp4410-4 servers to 4 BL860c Blades	7 months	4 months
#4	8 rp4410-4 servers to 2 BL860c Blades	5 months	3 months

As of July 2007, Oracle charges \$8,800 per year per CPU for support.
Oracle treats each Integrity core as 0.5 CPU and each PA-RISC core as 0.75 CPU.



The Benefits of Using HP Integrity Servers to Consolidate HP 9000 Servers
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The table to the left shows the potential impact of Oracle support costs on the break-even point for all of the consolidations. **In all cases the additional savings in annual Oracle support costs roughly cut the break-even time for the consolidation in half.** In all four scenarios the consolidation pays for itself in less than 12 months. Companies that run Oracle on HP 9000 servers can save hundreds of thousands of dollars a year by consolidating their HP 9000 servers onto HP Integrity.

Conclusion

This study focused on quantifying the costs and benefits associated with consolidating various HP-UX environments from HP 9000 servers to HP Integrity servers. Detailed cash flow analyses were performed on four different consolidation scenarios. A variety of factors were included in the TCU analyses including: the list price of the new Integrity systems, current service pricing for Integrity and out-of-warranty HP 9000 systems, trade-in value for the HP 9000 and its operating system licenses, installation and training costs, management savings, energy savings, and potential savings in Oracle support costs.

A total of 232 customers were surveyed to determine the feasibility of these consolidations. One key finding from the customer surveys is that **there is no significant difference in reliability or management costs between HP 9000 and HP Integrity servers.** The Integrity hardware platform has the same reliability as HP 9000 and did not require any additional time to manage on a per server basis.

Another major finding is that **consolidations involving Integrity servers can often pay for themselves in 9 months or less.** Companies whose IT budgets are stretched thin will find these consolidations extremely attractive. In all but one case, the consolidation paid for itself in less than 12 months. This is amazing given that two of the scenarios have out of pocket costs well in excess of \$1 million. The fact that the consolidations pay for themselves in less than a year means that when these consolidations are implemented at the start of a company's fiscal year, they will have no negative impact on that year's IT budget. Ongoing annual savings from these consolidations are substantial and can be re-deployed into other IT assets including hardware and software development.

One unexpected benefits was also found. **Companies that use Oracle Server can save hundreds of thousands of dollars a year in software support costs.** These additional savings in Oracle support costs nearly cut the break-even time in half.

There are some cases where consolidation is not advisable. Recently purchased HP 9000 servers that are still under HP's original warranty may not be good candidates for consolidation. Companies that run a considerable amount of custom code may find upgrading from HP 9000 to Integrity too expensive or labor intensive. Despite these potential drawbacks, consolidation on Integrity makes sense for most companies with 3+ older HP 9000 servers. The savings are so tremendous that companies that do not consolidate run the risk of having a competitive disadvantage over other companies that do consolidate. This is because consolidation with HP Integrity servers and blades enable companies that use HP-UX servers to run their IT department in a much more cost-effective manner.

TechWise Research is an independent primary market research firm that has conducted hundreds of market research studies in the computer industry. If you have any questions regarding this paper, please contact Chip Levinson at clevinson@TechWise-Research.com.

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