

IBM System p5: Lower TCO Through Server Consolidation

This paper examines trends in server virtualization and consolidation, and presents a detailed case study on the results that can be achieved through server consolidation on IBM System p5 servers.

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EXECUTIVE SUMMARY

Throughout the 1980s and 1990s, the emergence of distributed computing and the appeal of low-cost open systems servers lead to the proliferation of small and medium sized servers. Organizations often purchased new servers for each new business application. Now the rising costs of maintaining these heterogeneous infrastructures, and advances in more powerful servers with flexible partitioning and simplified virtualization technology, is swinging the pendulum back toward the consolidation of computing resources.

This paper examines the economic justification for server consolidation on the latest IBM System p5™ servers through the analysis of a detailed case study. This study is based on the infrastructure and operational costs for a representative insurance company, as well as savings projections based on research by Alinean. The results of this study revealed that consolidating computing resources on new IBM System p5 servers offered significant opportunity for IT cost reduction through lowered operations expenditures, projecting an impressive 56% lower Total Cost of Ownership (TCO) over three years for the IBM solution, versus maintaining the current inefficient infrastructure.

In this study our prospect could replace 47 servers from IBM, HP, and Sun Microsystems with just two System p5 590 servers. This consolidation resulted in a projected reduction in support contracts, systems administration labor, and facilities costs of nearly 75%.

Case Study Summary

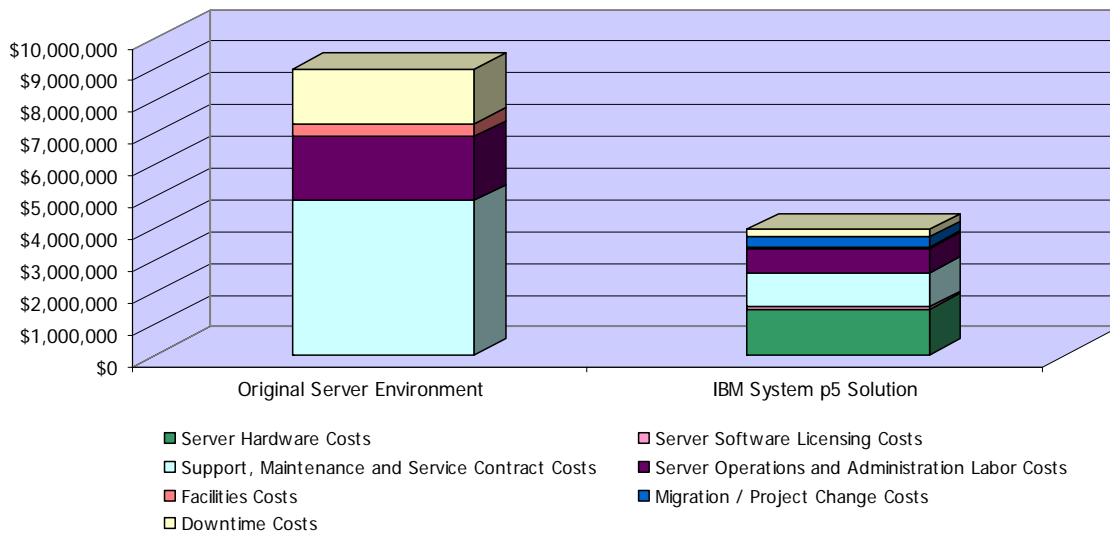
The results of this study revealed a tremendous opportunity for cost reduction in on-going server operational expenses as well as significant benefits from infrastructure simplification and improved service levels. Overall, we projected reducing on-going IT operational expenses for our study subject by 74%, resulting in an annual savings of \$2,000,000. In addition, system availability improvements were projected to result in over \$475,000 of annual benefits by decreasing planned and unplanned downtime for internal employees and externally focused revenue generating applications.

The majority of benefits came from three areas; a reduction in annual support and maintenance contracts for server hardware and software, decreased power and cooling load, and lower systems management and administration requirements.

TCO Comparison (cumulative 3-year)	Original Server Environment	IBM System p5 Solution	Total Savings	Difference
Server Hardware Costs	\$0	\$1,429,331	(\$1,429,331)	0.00%
Server Software Licensing Costs	\$0	\$76,546	(\$76,546)	0.00%
Support, Maintenance and Service Contract Costs	\$4,849,200	\$1,074,906	\$3,774,294	77.83%
Server Operations and Administration Labor Costs	\$2,004,367	\$759,154	\$1,245,213	62.13%
Facilities Costs	\$427,383	\$60,738	\$366,645	85.79%
Migration / Project Change Costs	\$0	\$294,413	(\$294,413)	0.00%
Downtime Costs	\$1,724,135	\$249,755	\$1,474,380	85.51%
Total	\$9,005,085	\$3,944,843	\$5,060,242	56.19%

Figure 1: 3-year TCO Comparison

Three Year Cumulative - TCO Comparison



SYSTEM P5 VIRTUALIZATION CAPABILITIES

Recent advances in partitioning and virtualization technologies have increased the flexibility and value of server consolidation. The IBM Hypervisor firmware available with the new System p5 servers virtualizes a physical system so that each application appears to run on its own logical system. These logical systems can in turn support different operating systems, including AIX 5L™, Linux® and i5/OS®, as well as different logical processing capacities. This ability to host heterogeneous system environments on a single server platform enables the consolidation of diverse applications.

In addition, IBM's support of shared processor pools enables processing capacity on a server to be shared amongst applications without compromising the performance of critical applications. IBM's Hardware Management Console (HMC) can be used to define micro-partitions, or shared partitions, which describe the minimum processing requirements for an application, as well as the opportunity for sharing available capacity. Applications are guaranteed this minimal processing capacity, to insure sufficient performance for agreed service levels, but they also may borrow available processing capacity from other applications to increase performance.

This combination of virtualization through partitioning, and dynamic workload balancing enables much higher average utilization of server resources than traditional single function servers, which are typically configured for maximum workloads, but generally operate at low utilization rates around 8% to 15%.

Although managing a multi-function virtualized server is more complex than single function servers, the consolidation of servers can actually significantly reduce overall systems administration and management requirements. Software tools such as IBM's Enterprise Workload Manager, and Resource Dependency Services allow systems administrators to manage and monitor virtualized resources in a simplified and consistent manner. Much of the savings in systems administration from server consolidation comes from reducing the sheer number of physical servers which must be monitored for availability, diagnosed when problems arise, and constantly updated for change management. Applying a software update to a single server with 100 virtual partitions is much faster and more reliable than applying that same update to 100 separate physical servers, even with automated software distribution or patch management packages.

Another major advantage of virtualization beyond higher asset utilization and more efficient operations comes from increased business agility. Traditional single function server deployments require considerable time for procurement and provisioning often ranging from two weeks to multiple months. These delays in system setup often correspond directly to lost opportunity costs. However, virtualized servers can be defined and provisioned in minutes, enabling the immediate execution of business initiatives.

STUDY METHODOLOGY AND GOALS

The case study described in this paper is based on a representative server consolidation proposal. The current costs for the original server environment are based on the operating expenses for the servers within the scope of this project. The projected costs for the IBM System p5 solution represent the costs for new server hardware, software licenses, estimated change and migration costs, and projections for ongoing operational expenses.

The proposed server configuration for consolidation was based on an examination of the current workload for the applications within the scope of this project.

Consolidation Scenario

Original Server Environment

The original server environment hosted a variety of applications including Claims Processing, Customer Relationship Management (CRM), e-Commerce, employee Web portal, Business Intelligence, and database servers. The following table describes the actual server configurations:

Primary Server Function	Server Type	Number of Servers	Processors per Server	Average Server Age
Web e-Commerce Portal	IBM pSeries® 660 Mod 6H1	16	4	6 years
Agent CRM Application	IBM pSeries 630 Mod 6C4	20	4	5 years
Database Servers	Sun Fire 12K	4	32	4 years
Claims Processing Application	HP Integrity Superdome	1	32	4 years
Departmental Servers	Sun Fire 6800	6	16	3 years
Total		47	400	5.1 years

Figure 2: Original Server Configuration

These servers support a user population of 2000 internal employees, and are responsible for supporting \$1.5 Billion in on-line transactions. The servers are managed by a staff of eight server operations and administration staff. The original average utilization for all servers combined was a mere 19%.

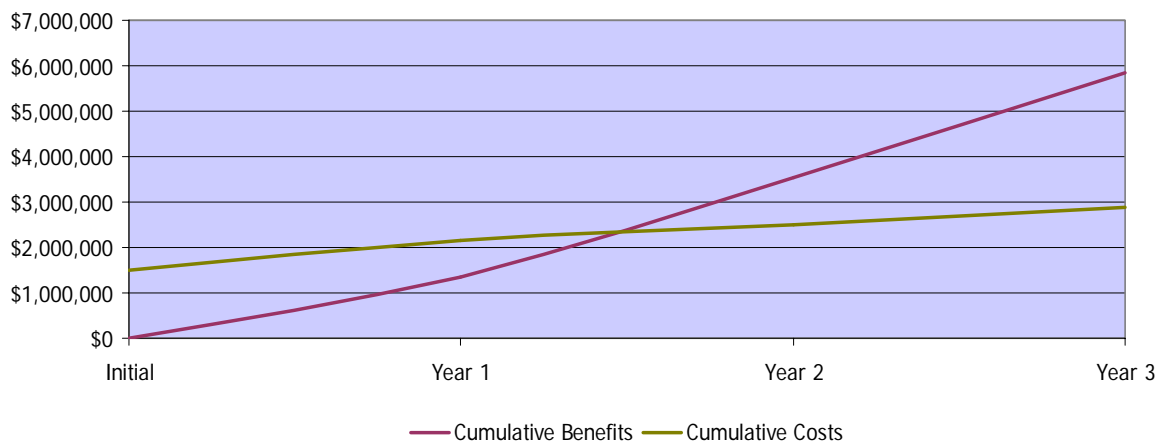
Proposed Server Environment

Based on an analysis of the current workload of the original servers IBM recommended the replacement of the current servers with two System p5 590 servers. One of the 590s will be configured with 32 processors and 128 gigabytes of memory, while the other 590 will have 16 processors and 64 gigabytes of memory. Based on the virtualization and workload balancing features of the 590 servers, similar or even higher levels of service could be assured, while raising average server utilization to nearly 60%.

Investment Summary and Payback

In addition to the new server equipment, the project also required expenditures for application migration, as well as new software licensing. The total initial investment was just shy of \$1.8 Million; \$1,429,331 for server hardware, \$76,546 for new AIX 5L software licenses, and \$294,000 for application migration charges. Based on this initial investment and projected cost savings, the project is expected to break even in 18 months with a return on investment (ROI) for the 3-year analysis period of 104%.

Break Even Analysis



CASE STUDY DETAILS – TCO COMPARISON

Hardware and Software Support and Maintenance Contract Savings

Since hardware support contracts are based on the size and number of servers, and software support contracts are generally based on processor counts, reducing the total number of servers from 47 to two, and the total number of processors from 400 to 48 provided tremendous opportunity for reduction in annual support costs. The biggest areas of savings came from eliminating maintenance contracts on server hardware, and operating systems, as well as reducing required support for database licenses, application server software and systems management software. In this case annual support costs could be reduced by over \$1,340,000, a 79% reduction. Figures 3 and 4 compare original support contract expenditures with support contracts for the new consolidated environment.

Original Annual Support Costs

Support Type	Product	Average Annual Price per Processor	Original Processor Count	Original Annual Support Cost
Hardware Warranty	Mixed	\$1,344	400	\$537,600
Operating System Support	Mixed	\$357	400	\$142,800
Database Support	Oracle	\$4,773	176	\$840,000
Application Server Support	WebSphere®	\$1,500	64	\$96,000
Systems Management Support	Tivoli®	\$200	400	\$80,000
Total				\$1,696,400

Figure 3: Original Annual Support Costs

IBM System p5 Consolidated Annual Support Costs

Support Type	Product	Average Annual Price per Processor	Consolidated Processor Count	Consolidated Annual Support Cost
Hardware Warranty	IBM p5-590	\$4,014	48	\$192,690
Operating System Support	AIX 5L	\$425	48	\$20,412
Database Support	Oracle	\$6,000	16	\$96,000
Application Server Support	WebSphere	\$2,000	16	\$32,000
Systems Management Support	Tivoli	\$200	48	\$9,600
Total				\$350,702

Figure 4: IBM System p5 Consolidated Annual Support Costs

Software License Reallocation Benefits

By reducing the number of software licenses required for the applications within the scope of this project, excess licenses become available for growth of new applications, thus avoiding the purchase of additional software licenses. Even factoring in license transfer fees, and a conservative license reuse rate of 50%, the value of excess software licenses yielded an impressive \$2,800,000 benefit in future license purchase avoidance. Figure 5 shows the savings by license category.

Note: In order to maintain a conservative approach of only including direct costs and benefits within the scope of the consolidation project, the value of this benefit was excluded from the overall financial analysis.

License Type	Product	Original Processor Count	Consolidated Processor Count	Available Licenses for Reallocation	Average Purchase Price per Processor	License Purchase Avoidance Value
Database	Oracle	176	16	160	\$30,000	\$4,800,000
Application Server	WebSphere	64	16	48	\$10,000	\$480,000
Systems Management	Tivoli	400	48	352	\$1,000	\$352,000
Total						\$5,632,000

Figure 5: Available Software Licenses for Reallocation

Facilities Expense Reductions

Server consolidation has tremendous implications for facilities management for two reasons. First, more powerful, compact and efficient servers can significantly reduce current expenditures on power and cooling. For every 100 Watts of server power consumption savings, there will be about a 42 Watt savings in cooling requirements. Secondly, and perhaps even more importantly in many datacenters, consolidation frees up capacity for needed growth in computing resources. Many datacenters are quickly reaching their limits of available power and cooling capacity. Without reducing current energy consumption companies don't have enough electrical capacity to power additional equipment, without building additional data centers. In our example we were able to reduce power consumption by over 85%, saving over \$115,000 per year in power and cooling costs.

Server virtualization plays a large role in the reduction of power consumption. In the current environment, servers have an average utilization of only 19%. So, nearly 80% of the power and cooling consumed by these servers is wasted on idle systems. On the other hand, with a projected average utilization of 60% for the p5-590s and advanced energy saving features, far less energy is wasted on idle systems.

Annual Facilities Costs	Total Annual kWatt Hours	Cost per kWatt Hour	Total Annual Costs
<i>Original Server Environment</i>			
Power Consumption	1,051,920	\$0.09	\$94,673
HVAC Costs	441,806	\$0.09	\$39,763
Total	1,493,726	\$0.09	\$134,435
<i>IBM System p5 Server Environment</i>			
Power Consumption	151,652	\$0.09	\$13,649
HVAC Costs	63,992	\$0.09	\$5,759
Total	215,644	\$0.09	\$19,408
Annual Savings	1,278,082		\$115,027

Figure 6: Annual Facilities Costs

Network Infrastructure Savings

In addition to reducing the space and power consumption of the actual servers, consolidation can also lead to considerable savings in required networking equipment. Because we are only examining the replacement of existing systems in this case study, we have not included cost avoidance of additional networking equipment in the financial analysis. However, networking costs can easily equal 10% - 20% of the server hardware costs, depending on the size of the server and network configuration.

Server Administration Labor Savings

Clearly the biggest cost factor for infrastructure expenditures is the labor cost associated with managing the equipment over its useful life. Monitoring system performance and availability, problem diagnosis, and change management activities are all directly proportional to the number of devices managed, and these expenses tend to increase with the age of the equipment. Reducing the server count by 96% from 47 to two significantly lowers the systems administration requirements.

In our case, we projected staffing requirements to go from eight full time server administrators (FTEs) to a conservative three administrators, resulting in an annual reduction of \$400,000 for basic server management. Organizations have often found that rather than strictly reducing head count, it is often more productive to shift these skilled resources from traditional infrastructure maintenance functions to more innovative technology projects for competitive advantage..

Migration / Change Costs

In addition to the capital costs for new server hardware, one of the biggest expenditures for server consolidation is in the effort required to migrate and validate applications for the new environment. The costs for this effort vary widely depending heavily on the percentage of commercial packaged applications which are available in both environments, the amount of customization performed on packaged applications, the volume of custom developed applications, and the similarity of the current and proposed server architectures.

In our case, a high percentage of the current servers were already IBM RISC-based systems running various versions of AIX® or AIX 5L. Migrating the applications on these servers required minimal porting and validation effort. In addition a significant percentage of the applications on the HP and Sun servers were commercial applications, which were also available on the new System p5 590 servers.

Overall the migration and change costs for this project were estimated at just under \$300,000. Half of these costs were allocated to the internal staff, while half of the expenses were for outside consulting resources. The migration was expected to be performed in a staged fashion, with the initial applications being ported to the new environment within six weeks, and all applications being migrated within 9 months.

Availability Impact

Although the current server environment was relatively stable, with minimal configuration changes impacting system availability, the age of the servers, sheer number of servers, and mix of architecture types created challenges in maintaining high levels of availability. Based on average systems availability, the combined availability for all of the servers in the original environment was estimated at 99.75%, while planned downtime for system maintenance was expected to exceed 200 hours per year. The combination of planned and unplanned downtime was estimated to cost over \$550,000 per year in lost employee productivity and disruption of critical revenue related systems.

The new simplified System p5 configuration is expected to provide an annual availability of 99.95% or higher, with only 16 hours of planned downtime per year for all systems combined. This improved availability is projected to save over \$475,000 per year in lost productivity and revenue opportunities. Figure 7 shows the cost breakdown for this case.

System Downtime Costs	Year 1	Year 2	Year 3	Total
<i>Original Server Environment</i>				
Employee Productivity Impact	\$415,736	\$432,365	\$449,659	\$1,297,760
Lost Revenue	\$142,125	\$142,125	\$142,125	\$426,375
Total Cost of Downtime	\$557,861	\$574,490	\$591,784	\$1,724,135
<i>IBM System p5 Server Environment</i>				
Employee Productivity Impact	\$59,538	\$61,920	\$64,397	\$185,855
Lost Revenue	\$21,300	\$21,300	\$21,300	\$63,900
Total Cost of Downtime	\$80,838	\$83,220	\$85,697	\$249,755
Total Savings	\$477,023	\$491,270	\$506,087	\$1,474,380

Figure 7: Annual Downtime Costs

Agility Impact

A final benefit worthy of mention, which has not been quantified in this case, is the added flexibility that the generalized System p5 server provides. When new applications need to be deployed, they can be added to the existing infrastructure in minutes without the need to acquire and provision additional hardware. While traditional single function server deployments often require several weeks for procurement and provisioning, resulting significant delays for business initiatives and lost opportunity.

CONCLUSION

With the latest advances in virtualization and workload management technologies enterprise class servers today offer far more than just increased processing power. The new System p5 servers from IBM provide a flexible platform for the consolidation of diverse applications. Consolidating server resources can yield significant savings in operational expenses by reducing on-going support and maintenance expenditures, cutting energy costs, and freeing up valuable data center floor space, and power capacity. Consolidation can also greatly reduce server administration requirements, while improving overall system availability and service levels.

When examining your current infrastructure and on-going operational costs, the results of this study clearly illustrate that the old adage, "If it isn't broke, don't fix it" may not apply to legacy server infrastructures. Replacing several older functional systems with a few faster more efficient and more flexible servers can easily pay for themselves in a couple of years, and lower your costs of operations for years to come.

ABOUT ALINEAN

Since 1994, the Alinean team has been the pioneering builder of tools to help quantify and improve the ROI and TCO of IT investments. Alinean was named for the Spanish word for "Align", matching the Alinean mission as the leading developer of analytical tools to help IT vendors, consultants and IT executives align IT investments with business strategies.

The Alinean team has over a decade of experience in the practical development and application of ROI and TCO methodologies, models and tools to optimizing IT investment decision making. In 1994, the Alinean team formed Interpose, the original pioneers of ROI tools, developing analytical software for over 50 major IT vendors and consulting companies worldwide, and creating the industry standard TCO Manager and TCO Analyst software. Interpose was sold to Gartner in 1998, where the team continued their developments and marketing of ROI and TCO software tools. The original team reunited to form Alinean in 2001, once again becoming the leading pioneers and developers of ROI sales and analytical tools. Current customers include leading IT solution providers such as HP, IBM, Dell, Intel, Symantec, NetIQ, EMC, SAP, Oracle, SBC, and Microsoft, as well as leading consultancies and Global 1000 companies.

Additional information about Alinean and helpful ROI educational resources can be found at <http://www.alinean.com>.