ALINEAN

Migrating to SUSE® Linux Enterprise Server from Novell® for SAP on IBM eX5 Enterprise Systems

Lowering Total Cost of Ownership

An Alinean White Paper

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EXECUTIVE SUMMARY

Historically, SAP has provided mission critical, bet-your-business, enterprise software. During the 1980s SAP R2 relied on the performance and reliability of powerful mainframe systems for its integrated ERP solution. In the 1990s RISC/UNIX-based server hardware vendors demonstrated that they could deliver sufficient levels of scalability and availability to support mission critical workloads, and SAP introduced R3 to leverage the greater economies and flexibility that these open systems offered. Now, servers with Intel x86-based processors running highly reliable Linux software are again reshaping the infrastructure choices for the most demanding enterprise applications. Over the past few years the performance of multi-core Intel Xeon processors has caught up with and even surpassed most RISC-based processors. During this same period Linux has matured from a special purpose operating system to a reliable standard for mission critical applications in the data center.

This paper examines the economic business case an international manufacturing company recently put together to select the most appropriate server hardware and software infrastructure for its SAP Applications suite. At the time of the analysis, the organization was supporting approximately 20,000 SAP users on a cluster of 10 Sun Enterprise SPARC servers. The organization had recently acquired two smaller competitors that would enable it to expand manufacturing and distribution operations into Latin America and Asia, and it needed to expand its SAP system to accommodate these new subsidiaries. Additionally, the organization had been planning on implementing the SAP Unicode support for international operations, which would also require increased processing capacity. Overall the organization was looking to double the processing capacity of its original servers.

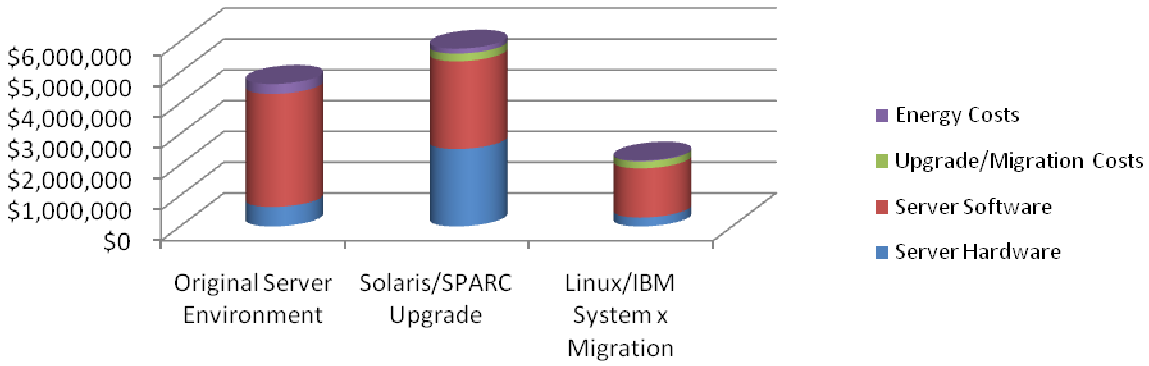
For its upgrade the organization considered two alternative approaches. It looked at replacing its current Sun Solaris/SPARC servers with the latest generation of Sun/Oracle SPARC servers, and it investigated migrating its SAP Applications suite to IBM System x eX5 servers with Intel® Xeon® 7500 series processors running SUSE Linux Enterprise Server from Novell. This paper presents the highlights of the comparison of these two options and discusses the benefits the organization hoped to achieve through the upgrade.

Financial Overview

Based on its financial assessment the organization determined that it could double its processing capacity and save nearly $2,500,000 or 54% in operational costs over three years by migrating its SAP Applications servers to SUSE Linux Enterprise Server / IBM Systems x servers compared to its current Solaris/SPARC Enterprise server environment. With superior price performance the Linux/IBM Systems x consolidation solution was also $3,632,717 less than a comparable Solaris/SPARC Enterprise server upgrade configuration. Significant advantages for the Linux/IBM System x configuration compared to the Solaris/SPARC upgrade option came from both server hardware and software costs. Overall the Linux/IBM System x migration option was 63%, or $3,632,717, less than the comparable Solaris/SPARC upgrade option. The IBM server migration would also reduce energy consumption by an impressive 92%, saving $100,000 per year, and extend the life of the current datacenter facility. Table 1 shows the expected costs for the original environment and the two upgrade proposals over a three year analysis period.

Three Year TCO Comparison	Original Server Environment	Solaris/SPARC Upgrade	Linux/IBM Migration	Linux/IBM Savings vs. Solaris/SPARC Upgrade	
Number of Servers	10	9	8	1	11%
Server Hardware Costs	$633,600	$2,512,240	$287,680	$2,224,560	89%
Server Software Costs	$3,666,960	$2,848,800	$1,594,105	$1,254,695	44%
Upgrade / Migration Costs	$0	$250,000	$230,000	$20,000	8%
Energy Costs	$325,438	$159,760	$26,298	$133,462	84%
Total Three Year Costs	**$4,625,998**	**$5,770,800**	**$2,138,083**	**$3,632,717**	**63%**

Table 1: Three Year TCO Comparison Chart



SERVER UPGRADE CASE STUDY

Original Server Environment

The original ten (10) server environment consisted of two (2) Sun Fire E6900 servers for the database tier and eight (8) Sun Fire V890 servers for the application tier. The Sun Fire E6900 servers were each configured with 24 dual-core UltraSPARC IV+ processors and 256 GB of memory. The Sun Fire V890 servers were each configured with eight dual-core UltraSPARC IV+ processors and 64 GB of memory. The original purchase price for all ten (10) of the Sun Fire servers totaled over $2.5 million, and annual hardware support was costing $211,200. Table 2 shows the original server configurations, original purchase prices and annual hardware maintenance costs for the servers.

Original Server Environment	SAP Database Tier	SAP Application Tier	Total All Servers
Server Type	Sun Fire E6900	Sun Fire V890	
Number of Servers	2	8	10
Processors per Server – (chips / cores)	(24 / 48)	(8 / 16)	(112 / 224)
Memory per Server (GBs)	256	64	1024
Purchase Price per Server	$800,000	$130,000	$2,640,000
Annual Hardware Maintenance per Server	$64,000	$10,400	$211,200
Total Three Year Server Hardware Costs*	**$384,000**	**$249,600**	**$633,600**

Table 2: Original server configurations

Sun Solaris/SPARC Upgrade Option

For the Solaris/SPARC upgrade option the organization would purchase two (2) Sun Enterprise M8000 servers for the SAP Applications database tier, and seven (7) Sun Enterprise M5000 servers for the application tier. The M8000 servers would both be configured with fourteen (14) quad-core SPARC64 VII+ processors and 512 gigabytes of memory. Each of the M5000 servers would be configured with eight (8) quad-core SPARC64 VII+ processors and 128 gigabytes of memory.

The Sun Enterprise M8000 servers were priced at $390,000 each, with annual hardware maintenance of $31,200 per server for 7x24 coverage. The Sun Enterprise M5000 servers were priced at $178,000 each with annual hardware maintenance of $14,240 per server. The total hardware cost including maintenance for all nine (9) servers was over $2.5 million for the three year analysis period. Table 3 shows the server configurations, purchase prices and annual hardware maintenance costs for the Sun SPARC upgrade option.

Solaris/SPARC Server Upgrade	SAP Database Tier	SAP Application Tier	Total All Servers
Server Type	Sun Enterprise M8000	Sun Enterprise M5000	
Number of Servers	2	7	9
Processors per Server – (chips / cores)	(14 / 56)	(8 / 32)	(84 / 336)
Memory per Server (GBs)	512	128	1920
Purchase Price per Server	$390,000	$178,000	$2,026,000
Annual Hardware Maintenance per Server	$31,200	$14,240	$162,080
Total Three Year Server Hardware Costs	**$967,200**	**$1,545,040**	**$2,512,240**

Table 3: Solaris/SPARC Upgrade Option

SUSE Linux Enterprise Server / IBM System x Migration Option

For the SUSE Linux Enterprise Server / IBM System x migration option the organization would replace the Sun Fire E6900 database servers with two (2) IBM System x3850 X5 servers configured in a high availability cluster. Each of the IBM System x3850 X5 servers would be configured with four (4) eight-core Intel Xeon X7560 processors and 512 gigabytes of memory. The SAP Application servers would be migrated to six (6) IBM System x3690 X5 servers, configured with two (2) eight-core Intel Xeon X7560 processors and 128 gigabytes of memory each.

The IBM System x configuration delivered similar performance compared to the Sun SPARC upgrade option, but at a fraction of the cost. The IBM System x3850 X5 servers were each priced at $65,000, and the IBM System x3690 X5 servers were priced at $17,000 a piece. The total purchase cost and hardware maintenance for the IBM System x solution would come to $287,680 the three year analysis period, 89% less than the Sun SPARC upgrade option. Table 4 shows the configurations, purchase prices and annual hardware support costs for the IBM System x migration option.

SUSE Linux Enterprise Server / IBM System x Server Migration	SAP Database Tier	SAP Application Tier	Total All Servers
Server Type	IBM System x3850 X5	IBM System x3690 X5	
Number of Servers	2	6	8
Processors per Server – (chips / cores)	(4 / 32)	(2 / 16)	(20 / 160)
Memory per Server (GBs)	512	128	1792
Purchase Price per Server	$65,000	$17,000	$232,000
Annual Hardware Maintenance per Server	$5,200	$1,360	$18,560
Total Three Year Server Hardware Costs	**$161,200**	**$126,480**	**$287,680**

Table 4: SUSE Linux Enterprise Server / IBM System x Migration Option

Server Hardware Cost Comparison	Original Sun SPARC Configuration	Solaris/SPARC Upgrade	Linux/ IBM System x Migration
Number of Servers	10	9	8
Total Processors – (chips / cores)	(112ch / 224co)	(84ch / 336co)	(20ch / 160co)
Total Memory (GBs)	1,024	1,920	1,792
Server Hardware Purchase Costs	N/A	$2,026,000	$232,000
Annual Hardware Maintenance Costs	$211,200	$162,080	$18,560
Total Three Year Server Hardware Costs	**$633,600**	**$2,512,240**	**$287,680**

Table 5: Server Hardware Cost Comparison

Price Performance Comparison

Based on benchmark results and the costs for the servers, the SUSE Linux Enterprise Server / IBM System x solution provided a clear price performance advantage over the Solaris/SPARC configurations. Chart 6 shows the relative price performance comparison for the three configurations.

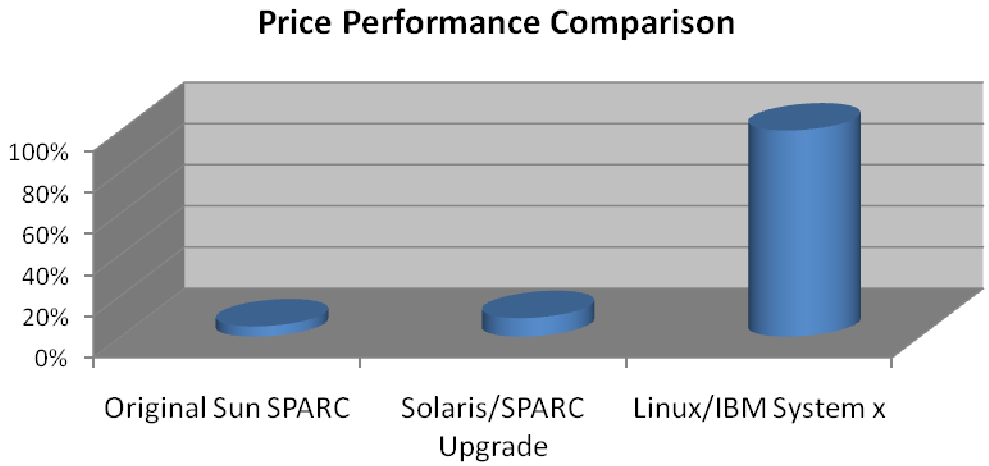


Chart 6: Relative price / performance comparison between server options

Software Licensing and Support Costs

Original Sun SPARC Software Configuration

The organization had licensed Sun Solaris for the Sun Fire E6900 and V890 servers. The annual support costs for the operating system software totaled $105,600 per year for all ten (10) servers. For the SAP database servers the organization licensed Oracle Database Enterprise Edition with the Oracle Real Application Clusters (RAC) option for high availability. The organization needed a total of 72 Oracle Database licenses for the 96 combined cores on both database servers, since Oracle uses a factor of 75% per core for UltraSPARC IV+ processors. The Oracle Database and Oracle RAC software cost $15,510 per license for annual support for a total cost of $1,116,720 per year. The total annual software support for the original server configuration came to $1,222,320 for the operating system and database software. Table 7 shows the license configurations and annual software support costs for the original server environment.

Original Server Environment	**SAP Database Tier**	**SAP Application Tier**	**Total All Servers**
Server Type	Sun Fire E6900	Sun Fire V890	
Number of Servers	2	8	10
Processors per Server – (chips / cores)	(24 / 48)	(8 / 16)	(112 / 224)
Operating System	Sun Solaris	Sun Solaris	Sun Solaris
OS Licenses	2	8	10
Annual OS Support per Server	$32,000	$5,200	$105,600
Database Software	Oracle EE & RAC	N/A	Oracle EE & RAC
Database Software Licenses	72		72
Annual DB Support per License	$15,510	$0	$1,116,720
Total Annual Software Support Costs	$1,180,720	$41,600	$1,222,320
Total Three Year Software Costs	**$3,542,160**	**$124,800**	**$3,666,960**

Table 7: Original Sun SPARC software requirements and annual support costs

Sun Solaris/SPARC Upgrade Software Configuration

For the Sun Solaris/SPARC upgrade option the organization would continue to license Sun Solaris on all of the Sun Enterprise servers. With Oracle's new bundled hardware and operating system support policy the annual software support cost per server is calculated at 4% of the purchase price for the server. The total operating system support for the nine (9) Sun Enterprise servers came to $81,040 per year.

For the SAP database the organization would continue to run Oracle Database with the Oracle RAC option for high availability. Although the total number of cores for the new M8000 servers (112) was greater than the number of cores on the original E6900 servers (96) the number of Oracle Database licenses required for the new servers would actually go down, since Oracle uses a lower factor of 50% per core for the new SPARC64 VII+ processors. The new configuration would only require a total of 56 Oracle Database and Oracle RAC licenses for a total annual support cost of $868,560. The total annual software support for the new Solaris/SPARC configuration came to $949,600, saving $272,720 per year compared to the original server environment. Table 8 shows the software configurations, and annual software support costs for the Sun Solaris/SPARC upgrade option.

Sun Solaris/SPARC Upgrade Option	**SAP Database Tier**	**SAP Application Tier**	**Total All Servers**
Server Type	Sun Enterprise M8000	Sun Enterprise M5000	
Number of Servers	2	7	9
Processors per Server – (chips / cores)	(14 / 56)	(8 / 32)	(84 / 336)
Operating System	Sun Solaris	Sun Solaris	Sun Solaris
Operating System Licenses	2	7	9
Annual OS Support per Server	$15,600	$7,120	$81,040
Database Software	Oracle EE & RAC	N/A	Oracle EE & RAC
Database Software Licenses	56		56
Annual DB Support per License	$15,510	$0	$868,560
Total Annual Software Support Costs	**$899,760**	**$49,840**	**$949,600**
Total Three Year Software Costs	**$2,699,280**	**$149,520**	**$2,848,800**

Table 8: Sun Solaris/SPARC Upgrade annual software support costs

SUSE Linux Enterprise Server / IBM System x Migration Software Configuration

SUSE Linux Enterprise Server has been one of only two reference platforms for SAP since 2006, and is the exclusive platform option for several SAP offerings including, SAP Business Warehouse Accelerator, SAP NetWeaver Enterprise Search, and SAP StreamWork Enterprise Agent. More recently, Novell has collaborated directly with SAP and IBM in the SAP LinuxLab in Waldorf to produce a version of SUSE Linux Enterprise Server specifically designed for SAP workloads. The new SUSE Linux Enterprise Server for SAP Application includes performance and availability enhancements to optimize the use of memory cache and ensure the coordination of multiple high availability components. SUSE Linux Enterprise Server for SAP Applications also includes several systems support features including coordinated packaging of service packs and updates with SAP and an installation wizard for the rapid migration and deployment of SAP applications.

The SUSE Linux Enterprise Server for SAP Applications software is licensed on a per server basis for $7,250 for Priority Support for three years. The total three year support for the SUSE Linux Enterprise Server for SAP Applications operating system came to $58,000 for all eight servers, 76% less than the Solaris support for the new Sun Enterprise servers. In addition to the Linux software, the organization would need to license VMware vSphere virtualization software to run multiple instances of the SAP application software on the IBM System x3690 X5 servers. The VMware vSphere software was priced at $2,245 per socket for a

total software license cost of $26,940 for the twelve sockets on the six servers that would be used for the SAP application servers.

The IBM System x configuration would also require fewer Oracle Database licenses than the original server configuration. The organization would only need 32 Oracle Database and Oracle RAC licenses for 64 cores in the two IBM System x3850 X5 servers. This would decrease annual support costs for these servers by 57%, saving $669,900 per year and free up 40 software licenses which could be used for other purposes. Overall the Linux / IBM configuration would decrease annual software support costs by $690,265 compared to the original Sun Solaris/SPARC configuration. Table 9 shows the software licensing requirements and software support costs for the Linux / IBM System x migration configuration.

SUSE Linux Enterprise Server / IBM System x Software Costs	SAP Database Tier	SAP Application Tier	Total All Servers
Server Type	IBM System x3850 X5	IBM System x3690 X5	
Number of Servers	2	6	8
Processors per Server – (chips / cores)	(4 / 32)	(2 / 16)	(20 / 160)
Operating System	SUSE Linux Enterprise Server for SAP	SUSE Linux Enterprise Server for SAP	SUSE Linux Enterprise Server for SAP
Operating System Licenses	2	6	8
Three Year OS Support per Server	$7,250	$7,250	$58,000
Virtualization Software		VMware vSphere	VMware vSphere
Virtualization Software Licenses		12	12
Cost per Virtualization License		$2,245	$26,940
Annual Support per Virtualization License		$561	$6,735
Database Software	Oracle EE & RAC	N/A	Oracle EE & RAC
Database Software Licenses	32		32
Annual DB Support per License	$15,510		$496,320
Software Purchase Costs		**$26,940**	**$26,940**
Total Annual Software Support Costs	**$501,153**	**$21,235**	**$522,388**
Total Three Year Software Costs	**$1,503,460**	**$90,645**	**$1,594,105**

Table 9: SUSE Linux Enterprise Server /IBM System x migration software requirements and annual support costs

Software Cost Comparison

Server Software Costs	Original Server Environment	Solaris/SPARC Upgrade	Linux/IBM System x Migration
Total Servers	10	9	8
Total Processors (chips / cores)	(112ch / 224co)	(84ch / 336co)	(20ch / 160co)
Annual Operating System Support Costs	$105,600	$81,040	$19,333
VMware vSphere License Costs	$0	$0	$26,940
Annual VMware vSphere Support Costs	$0	$0	$6,735
Annual Database Support Costs	$1,116,720	$868,560	$496,320
Total Software License Costs	$0	$0	$26,940
Annual Software Support Costs	$1,222,320	$949,600	$522,388
Total Three Year Software Costs	**$3,666,960**	**$2,848,800**	**$1,594,105**

Table 10: Three Year Software License and Support Cost Comparison

Systems Administration and Operations Labor Costs

Often, server upgrades or consolidation projects can reduce systems management requirements by increasing standardization and reducing the total number of servers being managed. In this case, the organization believed that some of the features in the SUSE Linux Enterprise Server for SAP Applications package, such as integrated HA support and page cache memory management, along with coordinated upgrades for the SAP application and SUSE Linux Enterprise Server OS would simplify systems management, but would not necessarily lead to reduced headcount or other measureable financial savings. Since these on-going operational costs were expected to be the same for the upgrade options they were not included in the financial analysis.

Datacenter and Environmental (Green) Impact

The organization was excited that the SUSE Linux Enterprise Server / IBM System x migration effort would ease space and power constraints on the current datacenter. Over the past several years new customer service and decision support applications had required additional storage devices which were pushing the capacity of the datacenter.

Each of the new IBM System x3850 X5 servers would only require 4Us of space in a standard rack and consume on average 800 Watts of power. The IBM System x3690 X5 servers had a 2U form factor and consumed on average 350 Watts of power. Replacing the current Sun Fire servers with the IBM System x servers would free up five and a half racks of space in the datacenter and reduce energy consumption for the SAP Application servers by 92%, saving nearly $100,000 per year. The Solaris/SPARC upgrade option, however, would require almost three full racks, and consume six times as much energy as the IBM System x servers. Table 11 shows the annual energy requirements for the original configuration and the two proposals.

Annual Energy Consumption	Original Server Environment	Sun SPARC Upgrade	Linux/IBM System x Migration
Number of Servers	10	9	8
Average Power Consumption per Server (Watts)	4,950	2,700	500
Total Power Consumption (Watts)	49,500	24,300	4,000
Annual Operating Hours	8766	8766	8766
Data Center PUE Factor*	2.5	2.5	2.5
Annual Power Consumption (kWatts)	**1,084,793**	**532,535**	**87,660**
Average Price per kWh	$0.1000	$0.1000	$0.1000
Annual Power and Cooling Costs	**$108,479**	**$53,253**	**$8,766**
Average CO2 Emissions (lbs/kWatt)	1.341	1.341	1.341
Annual CO2 Emissions (tons)	**727**	**357**	**59**

Table 11: Annual Energy Consumption and Cost Comparison

* PUE – Power Usage Effectiveness is the measure of energy required by the data center as a whole for each unit of energy delivered to servers. This measure includes cooling and other data center equipment.

From an environmental perspective, the reduction in energy consumption for power and cooling would result in a decrease of approximately 669 tons of CO2 per year, or the equivalent of eliminating the emissions of 111 cars per year. (On average cars produce 6 tons of CO2 per year.)

Upgrade / Migration Costs

One of the biggest concerns the organization had with moving off its Solaris/SPARC server infrastructure was that it did not want to introduce additional project risk by changing platforms. The SAP ERP system was the central life-blood for the organization's supply chain, manufacturing, and financial operations. Regardless of the potential savings it could quantify on paper, these benefits could easily be wiped out if the migration project ran into technical snares, or if the resulting system was not completely stable and suffered from periodic outages.

The fact that SUSE Linux Enterprise Server was a reference platform for SAP development, and that SUSE Linux Enterprise Server for SAP Applications had been specifically customized for SAP, and extensively tested in the SAP LinuxLab helped alleviate most of these concerns. The extensive experience that both Novell and the IBM Migration Factory teams had with successfully implementing mission critical SAP solutions on IBM System x platforms also gave the organization confidence to move forward with the migration effort. In fact, the organization believed that the new installation wizard packaged with SUSE Linux Enterprise Server for SAP Applications would even reduce the potential for configuration errors and accelerate the implementation of the SUSE Linux Enterprise Server / IBM System x solution compared to the traditional manual upgrade process required for the Solaris/SPARC option.

The organization expected that the Solaris/SPARC upgrade project would take approximately twelve weeks for planning, system installation, application migration and system validation. The organization budgeted $160,000 for external professional services, and an additional $90,000 for internal implementation labor for the Solaris/SPARC upgrade option. The organization expected that the installation wizard with SUSE Linux Enterprise Server for Applications would help them shave a week off the schedule by reducing configuration and system validation time, saving $20,000 compared to the $250,000 upgrade costs projected for the Solaris/SPARC option.

CONCLUSION

As a mission critical bet-your-business enterprise system, SAP Applications have always required high performance and the highest levels of reliability. Originally, SAP introduced its ERP suite on mainframe platforms, and later introduced SAP R3 for UNIX/RISC platforms when those servers proved their maturity for enterprise applications. Now the performance and reliability of servers featuring the latest generation of Intel Xeon processors and SUSE Linux Enterprise Server have caught up with and in many cases surpass traditional UNIX/RISC based servers at significantly lower costs. As illustrated in this customer case study, migrating to the latest IBM System x3850 X5 and IBM System x3690 X5 servers allowed this organization to double its processing capacity and lower annual operating costs by a significant 54%, saving over $825,000 per year. With the relatively low purchase costs for the IBM System x servers, the organization was able to recoup its initial investment in less than a year, and save nearly $2,500,000 over the three year analysis period.

The largest savings came from reduced software maintenance costs. By moving from the Solaris/SPARC servers to the SUSE Linux Enterprise Server / IBM System x servers, the organization was able to reduce its Oracle Database software licensing requirements by over one half, saving $690,000 per year in software support costs. The most impressive savings on a percentage basis came from reducing energy consumption. The new IBM System x servers were able to address an increased workload over the original server environment while cutting power consumption by 92%, helping to extend the useful life of the current datacenter.

While the results for this organization were impressive, many factors can influence individual savings. To better understand your potential for reducing costs we encourage you to perform your own economic assessment based on technology options that would be appropriate for your unique environment and requirements.

EXPLORE FOR YOURSELF

As illustrated in this case study, the latest IBM System x servers powered with the latest Intel Xeon processors offer tremendous opportunity for reducing energy consumption, shrinking your data center footprint and lowering operational costs. Alinean has developed an easy to use Server Consolidation TCO Calculator that will allow you to explore these potential savings for your unique environment. Learn how you can achieve similar benefits with a payback in a little as nine months. Get your customized report at: http://www-03.ibm.com/systems/migratetoibm/whyibm/campaigns/sconevaltool_intel.html

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.