



Sun's Investment Protection Strategy and How It Benefits Sun Customers

How Sun Has Continued This Strategy with UltraSPARC® IV+

December 2005

PREPARED FOR

Sun Microsystems

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Executive Summary

For the last several years, companies have focused intensely on the cost of their IT departments. Outsourcing and cutbacks have become routine, as costs have been slashed. Reducing Total Cost of Ownership (TCO) has become a mantra in the industry, with computer vendors responding to this pressure in different ways. This paper focuses on how Sun has helped its customers reduce TCO while protecting their IT infrastructure investments. As part of our research for this paper, Ideas International, Inc. (IDEAS) interviewed executives from a cross section of Sun customers. This paper presents their thoughts on how various Sun initiatives have benefited their organizations. Sun's recent announcement of the UltraSPARC® IV+ microprocessor adds a new chapter to this story. All of the benefits of Sun's investment protection strategy discussed in this paper carry forward to systems based on UltraSPARC® IV+.¹

A number of key Sun initiatives covered in this paper have delivered real benefits to existing customers, including a reduction in overall IT costs. These initiatives and their associated cost reductions (where quantifiable) are detailed across the following key areas:

Solaris – Key to Investment Protection and Lower TCO

- » The 64-bit Solaris Operating System (OS) runs on RISC-based, x86-based, and Opteron-based platforms, providing customers with a high-performance operating environment for running their applications, and enabling them to leverage their Solaris support staff and skills investments across a broad range of system platforms.
- » Solaris scales vertically for systems with more than 100 processors and horizontally for clustered systems.
- » Older releases of Solaris can run on the latest set of microprocessors, enabling customers to stage upgrades on their terms and timeframes.
- » Solaris features binary compatibility, which allows customers to install faster processors without modifying their applications. Binary compatibility allows customers to run their standard applications while they continue to work through subsequent upgrades of the Solaris OS.

¹ This is an updated version of a paper that was developed originally for US IV.

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- » Solaris 10 is now available as open source for both SPARC and industry-standard platforms.
- » Solaris 10 is also available as part of the Solaris Enterprise System.

Systems and System Components

- » Sun's Uniboard design facilitates system upgrades and maintenance for Sun's midrange and high-end systems. These modular components offer investment protection by enabling customers to reuse and recycle Uniboards to other systems in their computing infrastructures.
- » A single Sun box can run a "mix" of UltraSPARC® III, IV, and IV+ processors, each running at their rated speed. This capability affords customers with enhanced flexibility for their workload and staffing requirements, which translates into cost savings.

System Reliability and Scalability

- » The customers we spoke with highly valued the reliability they received from their Sun systems. Several customers stated it had been years since they experienced unplanned downtime from their systems.
- » UltraSPARC® IV+ incorporates new features that enhance system reliability even further through earlier and more comprehensive error detection.
- » Scalability was another property of Sun platforms that customers prized. Sun systems can scale from one microprocessor to more than 100 microprocessors and maintain binary compatibility.

Lower TCO and Greater Investment Protection

- » The Solaris Enterprise System provides a unique range of software at no charge. Developer tools, Solaris, and Sun's Java Enterprise software are all included. Customers can experiment with the software and deploy it in production for free, thus achieving a significant reduction in TCO for their IT operation. Customers need not incur any software costs until they decide to procure support from Sun.
- » Sun's Java Enterprise System (JES) integrated software packaging, testing, and release process enables customers to more easily maintain their current systems environment by taking advantage of new software features (as well as reducing the effect or likelihood of software bugs through enhanced integrated testing procedures).
- » We show how Sun's approach across these various initiatives differs from IBM's and HP's, and how it translates into value and reduced TCO for customers.

Sun Customer Comments

- » We present four situations that show how customers have benefited from Sun's investment protection strategy.

Customers that we talked to were very enthusiastic about Solaris support for Opteron. They believed that the ability to easily move applications to a new platform would save them significant development dollars.

Background

There are many ways to assess a vendor's product and services. This paper focuses on the investment protection afforded by Sun technologies. Our findings represent the experiences of about a dozen different customers. We gathered some of these opinions by talking directly to Sun customers; we collected the others by speaking with independent consultants who had worked with them. In general, the people that we spoke with had "Director" level titles, were knowledgeable about Sun technology, and knew how their organizations were implementing it.

In this paper, IDEAS presents comparisons between Sun and other vendors that we believe to be fair and factual. We also report on comparisons made by the customers we interviewed as they were communicated to us. In these cases, we do not try to present justifications for any other vendor. However, within these caveats, we believe our study provides insight into how Sun tries to deliver value to its customers as well as insight into how some Sun customers have reacted to Sun's efforts. We encourage readers to assess how these findings may apply to their own environments.

Solaris – Key to Investment Protection and Lower TCO

Solaris is a key part of Sun's strategy to both lower TCO and protect customer investments. Customers have huge investments centered on the operating systems they have installed. Their applications depend on the operating system. In most organizations, moving applications to a different operating system would require a massive investment. Moreover, the skills of the system administrators are often critically dependent on the characteristics of the operating system. Sun has recognized both of these factors and has taken steps to help customers leverage their operating system investments and reduce the TCO of the operating system.

Expanded Solaris Support for SPARC, IA-32, EM64T, and Opteron Platforms

To help customers leverage their operating system investments to other processor technologies, Solaris now supports AMD Opteron and x86 microprocessors, in addition to SPARC. Hence, customers who have investments in programs written for these systems can move their applications to newer Sun platforms if they see a benefit.

Solaris 64-bit support is very mature, whereas such support in other operating systems on industry-standard platforms is far less mature. Solaris supports both 64-bit and 32-bit applications running natively – no emulation. Thus, customers that have 64-bit applications can take advantage of Sun's 64-bit technologies, but those with 32-bit applications can also use the latest Sun OS and hardware technologies without any negative effects.

While Sun's competitors support a variety of platforms, in terms of UNIX offerings, they do not support the range that Sun does with Solaris. IBM only supports POWER, while HP only supports PA-RISC and Itanium platforms. Conversely, Solaris supports SPARC, IA-32, EM64T,² and Opteron platforms, enabling Solaris customers to move their applications to the platform that makes the most business

² EM64T is the name for the 64-bit version of IA-32 systems. These systems carry 64-bit support but are also compatible with IA-32 systems (unlike Itanium, IA-64, which is not compatible with IA-32 systems).

One customer said that Sun has made the operating system upgrade process “almost transparent.”

or technical sense for them. If customers want maximum scalability for an application, they can place it on the SPARC platform. On the other hand, if a given application makes the most sense on industry-standard hardware, then Solaris customers can move their applications to that platform. Finally, if an application needs the floating-point performance that a Galaxy Opteron provides, then Solaris customers can move to that platform and retain the same operating system. The Galaxy Opteron platform provides investment protection for Solaris x86 applications. Note that an application will need to be recompiled when it is moved to a different processor type (e.g. moving from SPARC to Opteron). However, once a binary version of the application exists, the customer will be able to carry it forward to new versions of Solaris on the chosen platform without making changes.

To best highlight the value of Solaris support, we present the steps that an IBM or HP customer would need to take in order to run a UNIX application on an IA-32 or Opteron system. In the example below we assume that the customer will use Linux as the OS – although, it would also be possible for the customer to convert the application to Windows.

Figure 1. Steps to Run a UNIX Application on an IA-32 or Opteron System

Step 1	Get source code for existing UNIX program on POWER or PA-RISC
Step 2	Select version of Linux
Step 3	Evaluate differences between UNIX and Linux
Step 4	Rework program for Linux
Step 5	Compile for Linux version
Step 6	Test in Linux environment
Step 7	Tune program for Linux

In contrast, Sun customers moving to a different Solaris-supported hardware platform will normally only have to recompile the program. The key advantage for Sun customers is that with Solaris, they now have a choice of platforms (while at the same time they can preserve the investment that they have already made in Solaris). Sun's competitors require that customers switch to another operating system when they wish to use x86 or EM64T platforms to run UNIX applications.

Easy Operating System Upgrades

Sun carefully studied the problems that customers have typically had with costs relating to large computer systems. One issue it looked at was the cost to change from one release of the operating system to another. The problem was that just as customers were getting their datacenters to run smoothly, their vendor would come along with a new release of the operating system. Some vendors also require an operating system upgrade in conjunction with a new hardware purchase.

Historically, IT departments used new operating system releases as a basis to upgrade their hardware technology due to the perceived added functionality of the new operating system. However, the process of installing the new release was very time consuming and in many cases dragged on for months (and required skilled systems administrators). IT shops often dreaded the process because it was almost

One consultant told us that DTrace reduced the elapsed time required to analyze a program from thirty days to two days. In just two days, the consultant was able to reduce the runtime of a million-line application by 60%.

as laborious as the first time they installed the operating system. Sun, which has always had a reputation for being technically innovative, approached the onerous task of upgrading a new operating system release by examining the process in order to devise a better method. In doing so, Sun was able to change its own internal process and implement binary compatibility, which enables clients to upgrade easily and quickly between older and newer versions of operating systems. Sun's customers report that now operating system upgrades take only a few days and involve a smaller number of systems administrators, effectively replacing a process that required an army of technicians working for weeks or months. One Sun customer commented that Sun has made the upgrade process "almost transparent."

Reduced Staffing Requirements

One independent consultant told us that in his customer base it typically took five times as many administrators (or more) to support Windows or Linux systems than it took to support Solaris systems. Several other customers seemed to confirm this statement, commenting that only a few administrators were required to maintain and upgrade a Solaris system.³ Note that we are not referring to the effort needed to convert to Solaris from some other system. We were also not able to get any data comparing Solaris to other UNIX systems in this respect; hence, we cannot say whether Sun has any advantage here over its UNIX competitors. However, IDEAS believes that this characteristic of Solaris will contribute to a lower TCO when compared with Windows or Linux.

DTrace – Enhancing Application Asset Protection and Optimization

DTrace is a new feature of Solaris 10 for optimizing applications. It is a facility that allows programmers to instrument programs by placing probes in the Solaris kernel. DTrace includes its own language called "D," which it uses to control these probes. The DTrace information can be displayed to help programmers understand the behavior of the program that is being traced, find bottlenecks, and identify possible areas for improvement.

DTrace enables application optimization, and as such, enhances application asset protection. An independent consultant spoke to us about one of his customers who had a performance problem with an application containing over one million lines of code. The customer asked the consultant to find and fix the problems in this application. Normally, in an application of this size, the consultant would plan to spend about 30 days on the assignment. However, the consultant used a beta version of Solaris 10 with the DTrace offering. In just two days, DTrace helped the consultant find the problems and reduce the runtime of the application by over 60% – saving the customer both time and money, while successfully resolving the problem.

When one considers the investment that a customer would have in an application of this size, it is easy to understand how DTrace protected that investment. Neither IBM UNIX nor HP UNIX has any equivalent to DTrace, although IBM's zOS (MVS) does have a limited trace facility. DTrace is just another example of how Sun's continuing innovative approaches to solving technology problems deliver real cost savings to customers.

³ We did not do a statistically valid survey so we do not claim that this result is established; nevertheless, it is intriguing.

Customers could not say enough about the value of the binary compatibility that Sun has maintained in Solaris.

The Importance of Binary Compatibility

Sun has implemented a "binary compatibility" policy with Solaris that will help most customers when they replace a system. Sun generally supports two or three older releases of Solaris on any new hardware that it delivers. In addition, Sun guarantees that an application meeting certain requirements and running on an earlier version of Solaris will run on a later version as well. In practice, this means that well-behaved applications⁴ that run on an earlier version of Solaris will execute properly on Solaris 10. Customers who are not totally up to date with the latest release of Solaris (or who do not have the staff trained to support it) can install the new hardware and keep their existing version of Solaris. Sun's approach enables customers to postpone the operating system update until it is convenient for them. The new UltraSPARC[®] IV+ processor supports both Solaris 9 and Solaris 10, thus customers can get the benefits of the UltraSPARC[®] IV+ processor without having to upgrade to a new operating system.

To better understand Sun's investment protection strategy, it is necessary to cover some technical details of binary compatibility. Applications that run on a computer exist in several forms. They are written by programmers in higher-level languages such as C, C++, and Java. The program statements in these languages are called the source code for the program. Modern computers only understand binary data; therefore, these source code statements must be translated into a binary format in order for the computer to execute its instructions. Simplifying matters somewhat, the binary version of the program, along with any libraries needed, constitutes the runtime version of the program.

Binary compatibility enables an installation to move the runtime version of a program and its libraries to another system and operating environment (where the program will still run and produce valid output). The new environment could be a different machine, a different operating system, or both. Normally, the new system needs to offer the same microprocessor architecture for the binaries to execute properly. Without special tools, it is generally not possible to run the binaries from one machine on another that has a different architecture.

What is desirable about binary compatibility or why should customers care? Most customers have many programs (some may have thousands or more). Whenever a datacenter needs to install new servers or change the operating system, the issue of binary compatibility comes up. If the new environment and the old environment are binary compatible, then moving the binaries of the programs and their associated libraries over to the new system is a relatively trivial task. On the other hand, if binary compatibility is not maintained, then the task of moving to the new environment becomes far more complex and expensive in terms of time, staff resources, and corporate productivity. In theory, the requirement to get the source code and the libraries for each of the programs retranslated for the new environment does not sound that difficult. However, the task quickly expands into the following steps:

1. The correct version of the source code must be identified. Because several versions of the source code may exist, identifying the correct one is rarely a trivial task. With very old programs, the source code may not even be available.

⁴ Sun provides tools that check application conformity to standards. See <http://www.sun.com/software/solaris/programs/guarantee.html>.

Many third-party applications can be taken from older versions of Solaris and run unchanged on the new version.

2. Once the correct version is identified, it needs to be retranslated and connected with the new version of the library.
3. The resulting binary created in the last task is in some respects a new program for the installation – so often, a test suite must be run against it to validate correct operation of the program.
4. After the test suite is run, the output must be checked. Any deviation from the expected output must be analyzed. Eliminating the discrepancy may require changes to the source code and a retranslation. Then, the test suite must be rerun.
5. Finally, the new version of the program and its libraries must be replicated across all the systems that need to execute the program.
6. This entire process repeats for the other programs – and there may be hundreds (or more).

There is another complicating factor involved – much of the process is manual and error prone. For many customers, breaking binary compatibility will stretch the process of migrating the environment into a project that may take more than a year and involve hundreds of people months in recompiling programs.

Sun understands this situation well. For modern Solaris/SPARC systems, Sun provides a strong guarantee of binary compatibility. If a program passes Sun's compatibility test, then Sun will guarantee that the binary of the program will run on another version of Solaris or on another machine with a different version of SPARC processors. Sun maintains upward compatibility with all modern versions of Solaris and all modern SPARC systems. Thus, customers can make changes without having to recompile all of their source code.

UltraSPARC® IV+ customers that we spoke with all endorsed the importance of binary compatibility. This factor allowed them to evaluate the new microprocessor with minimal turmoil. They advised other SPARC customers not to worry about binary compatibility as Sun has guaranteed it and they had experienced it with the new processor.

Binary compatibility, however, is only part of the story of protecting software development investments. Applications written for a multiprocessor system may be binary compatible with older multiprocessor systems but if the system architecture changes then the application may no longer be optimized for maximum performance. Over the last several years there have been two primary programming models, the shared memory model, which is found in SMP (symmetric multiprocessor) servers, and the distributed memory model.

The shared memory model is generally easier to write for and to optimize applications on. Basically, any processor can access any memory at the same time so it is not necessary to program around data location.

The distributed memory model, however, does require attention be paid to memory locations to achieve the best performance. In order to protect customer investments in software optimization, Sun has built all of its servers (since the early 90s) according to the shared-memory model. Therefore, ISV and customer applications

can maintain their performance optimization from one processor or server generation to the next and from one version of Solaris to the next. Clearly, maintaining the same programming model protects software development investments and adds to the benefits of binary compatibility.

How does Sun compare with its chief competitors HP and IBM in offering binary-compatible systems? No vendor frivolously makes changes that will break binary compatibility, as each knows the headaches that its customers will encounter when they are forced to fall back on the source code of their programs. However, it is fair to say that Sun's competitors have not made the same investments that Sun has made to avoid these problems. Because HP will drop support for MIPS, Alpha, and PA-RISC processors, all of HP's customers who are currently running systems with these microprocessors installed will have to migrate to systems that utilize different microprocessors. While HP has tried to mitigate the customer effort involved in this type of move, customers still have to fall back on the source code for many of their programs. In IBM's case, the situation is more complex. While IBM has tried to maintain compatibility, it has not always successfully done so. For example, IBM has stated that 64-bit applications written for AIX 4.3 will not run on AIX 5 (the latest level of the operating system). These applications will need to be recompiled.⁵

While Sun maintains binary compatibility across Solaris releases, the situation with third-party applications is more complex. Several customers told us that they were able to run their old binaries from third-party applications without any trouble. They were able to take a binary certified for Solaris 8 and run it unchanged on Solaris 9.

However, there is a limitation to this functionality, as not all binaries from certain applications and vendors (notably PeopleSoft and Oracle according to the customers we spoke with) are certified. Customers with systems running these products will have to wait until ISVs release versions of their applications that are certified for the new operating system. Of course, it is possible that Sun's binary compatibility would assist the ISV in this recertification. This situation is not unique to Sun, since both HP and IBM customers must wait for certified versions of these applications when they want to move to a new version of the operating system. In sum, Sun's binary compatibility guarantees that the customer's application investments are protected across many generations of hardware and software. Sun is unique in the industry in this protection.

Perceived Sun Quality

In many customers' minds, the quality of Sun's new releases of its operating system coupled with its binary compatibility capabilities make for a very smooth transition from one release of Solaris to another. Customers emphasized that since Solaris 7, the quality of Sun's new Solaris releases has been excellent; they encountered very few problems in the release-to-release transition. While there were still occasional issues, these problems were usually minor and quickly addressed.

Open Source Solaris

Sun has made Solaris 10 open source for both the x64 and SPARC platforms. Sun customers can access the source code for Solaris and modify it if they desire. This

⁵ See page 12 of IBM's "AIX 5L Differences Guide," SG24-5765-02.

version of Solaris is no-charge as well. IDEAS believes that modifying operating system code should not be a routine or common customer practice, as operating system modifications can lock customers into the modified operating system and prevent them from upgrading. On the other hand, a customer who has access to the operating system source code may find opportunities to save costs. For example, there may be some critical function that can be implemented as an addition to the operating system – in a way that saves the customer a great deal of time. Access to the operating system source code may assist in the debugging of complex problems that cannot be addressed in any other way. It is also possible that the open source community for Solaris will provide fixes for Solaris bugs more rapidly than Sun itself. The code-sharing enabled by open source can potentially provide additional benefits as well.

For all of the reasons stated above, we believe that open source Solaris, when used wisely, will contribute to lower costs for customers. Neither IBM nor HP has announced any plans to open source its version of UNIX.

Solaris 10 is also available as a part of the Solaris Enterprise Systems, which is described later in this paper.

Systems and System Components

In addition to its software developments, Sun has also evolved its hardware to reduce costs for customers. The longer a customer can use a given server, the lower the TCO for that system (i.e., obviously, if a system can be utilized for 40 months it will cost less per month in depreciation than if it can only be used for 20 months).⁶ One of the key reasons why customers replace systems is to upgrade their technology. Just as in the case of upgrading to newer versions of the operating system, new technology usually offers the possibility to do more work with the same cost – thus driving down TCO. Due to Sun's binary compatibility, upgrading hardware does not introduce added software, operating system, and training costs.

UltraSPARC® IV+

Sun's announcement of UltraSPARC® IV+ introduces a new chapter to its traditional investment protection story. The good news for customers is that all of the benefits that apply to UltraSPARC® IV carry over to systems based on the new microprocessor. The new UltraSPARC® IV+ processors will be supported on Sun Fire V490, V890, and V1280 systems up through Sun Fire E25K systems with a starting frequency of 1.5 GHz (with faster speeds planned for the future). As stated earlier, these processors will support both Solaris 9 and 10. In addition, the UltraSPARC® IV+ processors exhibit the following improvements over UltraSPARC® IV:

- » Improved performance (see next section)
- » Improved RAS
- » Enhanced security
 - Security toolkit

⁶ For the sake of simplicity, we are ignoring the complication of rising maintenance costs in older systems. Sun has addressed this question by holding these costs down and we expect it to bring some innovative technology to bear on this issue in the future.

One customer did not have time to install a new system, but was able to install a Uniboard in an existing system. This allowed the customer to evaluate new technology inexpensively.

UltraSPARC® IV+ Performance

The first version of this paper did not discuss performance, but we have corrected that omission in this update. Improved performance is a key element of investment protection. It does not make sense for customers to invest in a system that continually falls behind in performance; they would be better off moving on to a newer, faster system.

Early adopters of UltraSPARC® IV+ have reported a range of 1.5 to 1.8 times faster performance over comparable UltraSPARC® IV systems. In some cases, the performance improvement was as high as 2.5 times the UltraSPARC® IV performance. UltraSPARC® IV+ systems will experience even greater speedups in 2006, when faster versions of the processor are introduced.

Based on this information, one could generally expect a 50 to 80% performance improvement over UltraSPARC® IV systems. However, one must be cautious with such performance estimates. If a particular workload is heavily dependent on the speed of certain I/O devices such as disks and tapes, it is entirely possible that the performance improvement will be very little. Therefore, customers should consult with Sun if they must establish exact performance improvements. Sun has UltraSPARC® IV+ systems available for benchmarking at its iForce centers, so that customers can establish what the performance improvement will be for their critical workloads.⁷

To calculate the price/performance of UltraSPARC® IV+ systems, customers need to first establish the cost of upgrading and then determine the performance increase that will result. Then they can calculate the value of the upgrade. Early UltraSPARC® IV+ adopters strongly recommend that others consider the upgrade. Further, we must note that when Sun introduced the UltraSPARC® IV+ processor there was no increase in price. Thus, four UltraSPARC® IV+ processors will cost the same as four UltraSPARC® IV processors, but exhibit higher performance and better price/performance.

UltraSPARC® IV+ Compatibility

One early UltraSPARC® IV+ adopter made a very strong statement regarding UltraSPARC® IV+ compatibility. He said, "You can count on Sun. It's just like clock work – if Sun says that it's compatible, then it is. And if there are any problems they will be minor in nature and will be resolved quickly."

Sun's Uniboard Design

The Uniboard is a key component of Sun's midrange and high-end systems. Sun servers that use the Uniboard technology include the Sun Fire 4800 up through the Sun Fire E25K. The Sun Fire v1280 and Sun Fire E2900 use a board with four processors and memory, but it is not interchangeable with others servers. The Sun Fire v490 and Sun Fire v890 use boards that have two processors and memory and they are interchangeable between those two servers but not with other Sun servers.

⁷ We have to mention that such types of benchmarking are likely to be expensive and should be used only where the cost would be justified. In most cases, the general range of performance may be acceptable.

One customer told us that the reliability of its Sun Fire F15K approached that of a fault-tolerant system. This high reliability enabled the customer to function with only a single large system. The customer's confidence in Sun's high reliability enabled it to save on the associated expense of a backup system.

Each Uniboard contains a number of processors and associated memory. Customers can upgrade a Sun system merely by replacing the Uniboards and do so while the system is running; hence, the upgrade does not require the customer to bring the system down or to wait for some planned maintenance time. In addition, the Uniboards themselves can be removed for maintenance without bringing the system down. Uniboards can also be reused in another system. This ability to reuse Uniboards provides measurable cost savings (such as less downtime for upgrades and maintenance) and offers investment protection to customers. The net here is that the TCO of a system will be reduced over its lifetime by the Uniboard concept.

If customers want to replace a system because it has fully depreciated from an accounting standpoint, Sun's design innovations do not prevent them from doing so. However, the Uniboard approach does afford customers more choices by reducing the pressure to replace entire systems for technology upgrades. Based on our discussions with Sun customers, this approach has enabled customers to stretch out the productive life of their systems for an additional year or so (providing direct cost savings).

The Uniboard design also offers other customer values as well. One customer needed to assess the performance of Sun's latest technology with a key application. Sun offered to lend this customer a server with the new technology, but the customer did not have the resources to bring up the application on a new server. Sun then lent the customer a Uniboard with the new technology installed on it. The customer installed the new Uniboard in its production system without bringing the existing system down, and created a dynamic system domain (hardware partition) for the new Uniboard, which enabled the customer to run performance measurements on the new UltraSPARC® processors. When the tests were complete, the customer removed the Uniboard and returned it to Sun. We must note that this is not a scenario a Sun competitor could easily achieve.

Sun has a strong advantage over IBM and HP in this area. IBM does not employ a Uniboard-like philosophy. Therefore, maintenance and system upgrades require bringing down the entire IBM system. In HP's case, the situation is more complex, as HP designs its systems around cell boards, which carry some limitations. HP's cell boards are not compatible across HP's entire product line. In addition, HP promises that it will only support online addition and replacement of cell boards in future releases of HP-UX (after 11iV2).⁸ Hence, current HP customers may have to take down an entire nPar (or hard partition) whenever a cell board requires maintenance.

Early UltraSPARC® IV+ adopters emphasized the importance of the Uniboard design and dynamic system domains for testing applications with the new chip. One customer said, "It is really a huge benefit to be able to divide an existing server and not have to bring in a whole new platform, as some other vendors require."

⁸ See page 26 of "Meet the HP Integrity Superdome – A White Paper from HP," available at <http://h71028.www7.hp.com/ERC/downloads/5982-9836EN.pdf>.

Customers say that they would not be able to install a new system if they had to change the operating system at the same time.

Mixed Processor Support

A very important feature of Sun's UltraSPARC® processors is the ability to mix different generations and speeds of UltraSPARC® processors in the same system. Customers can mix any processor from the 900 MHz UltraSPARC® III processor up to the 1.5 GHz UltraSPARC® IV+.

Sun Availability/Reliability

The customers we spoke with highly prized the reliability of their Sun systems. Customers repeatedly told us their systems had been running for months or even years without any downtime. Several customers could not remember the last time they had experienced a system outage. It is also interesting to note that these customers did not believe Sun's Uniboard design really contributed to availability, as they were already accustomed to the high availability of Sun hardware. Because system problems are rare, the ability to address a problem without taking the system down (which is what the removable Uniboards offer) is not seen as that important in this context, but still needs to be pointed out as another benefit.

Customers associated this reliability with a high business value, but were generally unable to quantify it. This lack of quantification is not uncommon, as IT still continues to provide systems to business units without a clear understanding of the value and payback of those systems to the overall business bottom line.

Sun's design for the UltraSPARC® IV+ processors further enhances the availability and reliability of its systems. The UltraSPARC® IV+ architecture improves on the already strong RAS features of UltraSPARC® IV. Errors that do occur are more likely to be detected. UltraSPARC® IV+ contains about 170 more detection nodes than the prior processors. Sun paid attention to this topic in its design of UltraSPARC® IV+ and it will pay off for customers in production.

One early UltraSPARC® IV+ adopter very much appreciated the key RAS characteristics of Sun's low-end and midrange servers (such as the Sun Fire V490) – including remote management and redundant hot-plug components – which are usually found only on larger systems.

Making the Case for Fork Lift Upgrades When Necessary

What may surprise many are the customer reactions and opinions toward forklift upgrades. While some are vehemently against them, many others look at the replacement process as a standard way of upgrading both their hardware and software. We would not go so far as to say that the customers were like automobile buyers who are eager to try the new model, but there was some of that flavor in their attitudes. Many customers accept the necessity of a system replacement and just view it as a major technology upgrade. On the other hand, customers do acknowledge the work involved in a forklift upgrade. With the exception of one customer, all the customers strongly endorsed Sun's policy of supporting older releases of Solaris on the new hardware. Several customers said that they would not have been able to install the new system if they could not reuse the old operating system version. This policy of supporting older versions of Solaris on newer hardware clearly saves costs by enabling customers to avoid OS upgrades.

A university told us that its constrained budget made Sun's low-end systems especially attractive. The university could preserve the Solaris capabilities on a system that cost only a few thousand dollars.

Customers can deploy new hardware without having to upgrade the OS and applications at the same time.

Extending the Life between Technology Upgrades

The time line on the next page for UNIX and technology upgrades compares Sun, HP, and IBM over the 2004 to 2006 timeframe. Prior to 2004, only Sun was able to deliver upgrades to its technology without requiring customers to replace their existing systems. Sun customers are able to move from UltraSPARC[®] III systems to UltraSPARC[®] IV systems by only updating their hardware. As of 2005, these customers can now upgrade to UltraSPARC[®] IV+ (again via Uniboard or processor board upgrades). We should mention that upgrading from the earlier UltraSPARC[®] II technology to UltraSPARC[®] III did require a change of hardware platform. Generally, Sun customers can make upgrades without changing the version of Solaris that they use in production. So, where the system itself has the expansion capability, customers can add UltraSPARC[®] IV+ dynamic system domains (domains) to existing systems without disturbing the production domains. The new UltraSPARC[®] IV+ domains will need to run Solaris 9 or 10, but Solaris 8 can continue running in the existing domains that have no UltraSPARC[®] IV+ processors. New systems can be entirely UltraSPARC[®] IV+.

IBM customers were required to make a server change when they moved to POWER4+ and were required to do so again when they moved to POWER5. Customers who move to POWER5+ must change servers yet again. Additionally, POWER5 requires the customer to move to AIX 5.2 in order to support the new POWER5 technology. To get the maximum benefit from the new POWER5 or POWER5+ technology, customers must install AIX 5.3. All customers on any earlier AIX versions must upgrade to these versions of AIX.

IBM customers must also use the same processor generation and speed in a given system. Unlike with Sun and its UltraSPARC[®] III to UltraSPARC[®] IV+ processors, it is not possible to mix and match different-generation or different-speed processors in IBM systems.

HP customers face a somewhat more challenging set of migrations. Tru64 customers will have to install new hardware and move from Tru64 UNIX to HP-UX. HP has allotted these customers several years to complete this migration.⁹ Finally, HP-UX customers who are currently running on PA-RISC systems will need to upgrade to a version of HP-UX that will support both Itanium and PA-RISC. At some point, these customers will have to move to an Itanium platform, since HP is going to discontinue support for PA-RISC. HP will allow a mix of PA-RISC processors and Itanium processors in a system but not in the same cell. This is only possible with PA-8900 processors.

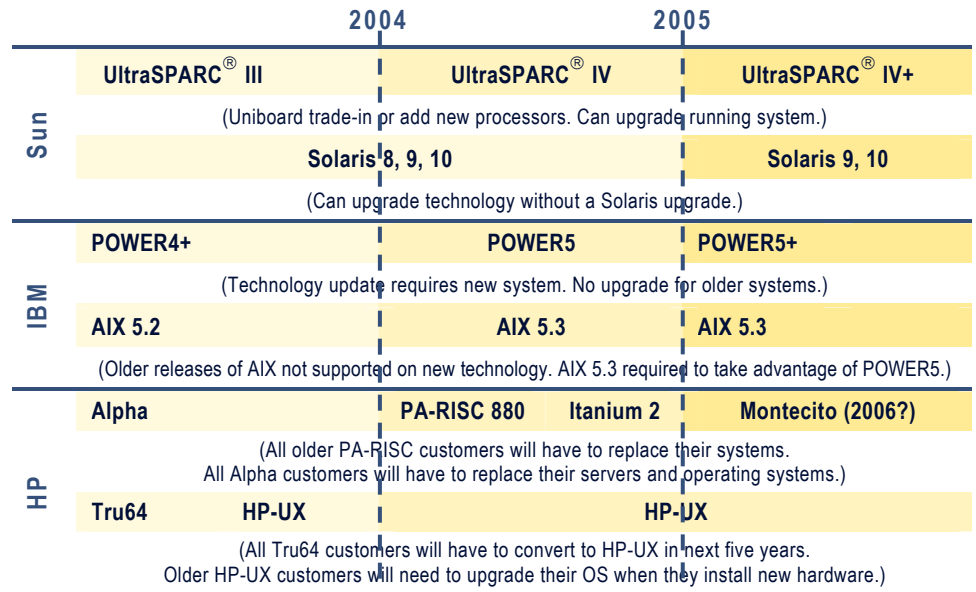
Migrating from HP-UX on PA-RISC processors to HP-UX on Itanium processors is non-trivial. At a minimum, a recompile is required. Because of the major differences between the Itanium and PA-RISC processors, in many cases the application being moved will need to be modified or rewritten in order to achieve solid performance.

⁹ HP had planned a version of HP-UX that would include the key Tru64 features. HP has dropped those plans and now offers VERITAS features that essentially provide these features.

One customer told us that it could not afford to be a systems integrator. This customer felt that the value of Sun's integrated solutions was in the range of several millions of dollars per year.

These added steps can complicate the migration process and add significant cost to both customers and ISVs.

Figure 2. Time Line for UNIX and Technology Upgrades



Scalability Perceptions

One customer that we interviewed emphasized the scalability that Sun provides as a contributor to lowering TCO. This customer explained that Sun offers systems that span a range from several thousands of dollars to millions of dollars. To him, this wide product range meant that he could move an application to the platform best suited for it. He did not believe that Sun's UNIX competitors offered the same flexibility.

Providing an End-to-End Solution versus Systems Integration

In many environments, customers are forced to become their own systems integrators (having to buy a server from one vendor and the various other components – like tapes – from other vendors). In these cases, marrying the server with the other hardware chosen becomes the customer's responsibility. The customer must install the software and the other components needed to support the system. If at some future point, for example, a malfunction occurs involving the tapes, the customer will have to mediate between the operating system supplier, the server supplier, and the tape supplier. Frequently, each of these vendors will point to the others as the source of the problem, leaving the customer frustrated and the system inoperable until the issues are resolved. Customers would like to have one vendor responsible for fixing problems.

Several Sun customers believed that they could buy an end-to-end business solution from Sun without creating any systems integration problems. These customers were very confident that the Sun solution would work. They did not believe that Sun's competitors were able to deliver such integrated solutions to the degree that Sun could.

Customers highly valued the support they received from Sun. Sun's openness helped customers plan. Sun's Systems Engineering field force received high marks as well.

Lower TCO and Greater Investment Protection

Sun Support – A Key Differentiator

Customers commented on the value of Sun support and the fact that in a Sun environment, they often did not need to pay for Sun support and consulting services, which in many cases they believed a Sun competitor would have charged them for.

The Sun customers that we spoke with believed that Sun support was valuable to them. Customers mentioned that Sun's hardware maintenance was outstandingly responsive. One customer noted that Sun would deliver spare parts to him in a couple of hours, whereas Sun competitors usually took a day or more. Sun's systems engineers were also praised, with customers stating that these technical resources provided high value when engaged.

Finally, customers believed that Sun was very open with them in discussing its future plans. These customers said that they were able to make business plans based on what Sun had disclosed to them. These customers commented that Sun delivered "tremendous business continuity," which they valued highly. Again, these customers did not believe that Sun's competitors were able to match Sun's openness. However, the customers did comment that the flip side of this openness was that Sun was not always able to deliver on the plans that it had announced. Customers seemed to accept that risk in light of the overall benefit.

Solaris Enterprise System

Sun recently announced the availability of a vast array of software with no charge. Solaris 10, development tools, N1 Software, and the Java Enterprise System are all included in this offering. This integrated package should save many customers significant time in installation. Since there is no charge, customers can take their time in evaluating which products to put into production. The no-charge version of the products is the same as the supported version.

Making software available this way enables customers to evaluate software without incurring an upfront fee. Customers can pick and choose which products will fit into their production environment. Once they are satisfied with their choices, they can evaluate whether or not they wish to purchase Sun support. Thus, the terms that Sun offers the Solaris Enterprise System under will allow customers to achieve a significant reduction in TCO for a great part of their software.

We describe the Java Enterprise System below in some detail. It is only a small part of the software available from Sun under this program. A complete description of the program can be found on the Sun website.¹⁰

The Power of the JES Integrated Middleware

Sun has also addressed the problem of updating the middleware that customers require. Middleware is a collection of software that runs on top of the operating system. It sits between the operating system and the real applications. It provides functions that applications need like security and web services. The problem is that

¹⁰ <http://www.sun.com/software>

middleware is not necessarily one product, but multiple products – getting this collection of products to work together can be difficult. In addition, updating the middleware can be as challenging as updating the operating system (as the total price of the collective middleware is expensive). Sun came up with an innovative approach that sharply reduces the time and effort needed to install and update middleware. Sun calls this package the Java Enterprise System, or JES. Sun packaged together all the middleware that an enterprise might need into one total offering. Customers can now install this pretested package in a fraction of the time that it would take to install the individual products. Moreover, when a client upgrades the operating system, JES easily upgrades with it.

JES pricing is also attractive. It is based on the number of employees in the company licensing it.¹¹ Remember that JES is free initially; customers only pay when they require support. This JES software price packaging provides customers with a powerful tool for reducing the costs of keeping their software up-to-date (as Sun provides a refresh every quarter). Additionally, depending on the number of employees in the organization and the price paid, Sun will include with this offering various levels of training credits, workshops, and custom consulting hours.

JES offers several benefits. It saves administrator time, as many customers spend months collecting the middleware products that they use (then they must maintain and apply patches to these products). Sometimes, the maintenance for one product will cause problems in another product, requiring more time and effort to make the entire stack work. The stack also requires testing. JES eliminates most of this work because all the required middleware components are pretested, installed, and updated on a regular basis by Sun. In addition, the pricing for JES should contribute to a lower TCO for the installation. JES's ease of installation will also enable IT departments to offer new features to users, and assist them in meeting service-level objectives.

Neither IBM nor HP offers any equivalent to JES in the UNIX space. Their middleware products are generally priced on a per-product basis, although they may have various discount plans available. Neither provides an integrated stack that matches JES.

A number of customers have substantiated the savings and the reduction in TCO that they obtained from the use of JES. One company documented a 90% reduction in software TCO. Another company achieved a 30% reduction in overall TCO. All companies studied showed strong Return on Investment (ROI) results. Thus, we conclude that JES has now proven its worth in production.¹²

The figure on the next page lists the content of the JES package. Customers can substitute their own preferred products for any of the products that Sun includes.

¹¹ For more details, see <http://www.sun.com/service/sunjavasystem/javaenterprisesystem.html>.

¹² For additional details on the value of JES see http://www.sun.com/software/javaenterprisesystem/case_studies.xml.

Figure 3. JES Components as of December 2005

Network Identity Services <ul style="list-style-type: none"> » Access Manager » Directory Server » Directory Proxy Server » Identity Manager Resource Adapters 	Web and Application Services <ul style="list-style-type: none"> » Application Server Platform, Standard and Enterprise Edition » Message Queue Enterprise Edition » Web Server » Web Proxy Server
Communication and Collaboration <ul style="list-style-type: none"> » Messaging Server » Calendar Server » Instant Messaging 	Availability Services <ul style="list-style-type: none"> » Sun Clustering » Sun Cluster Agents » Sun Cluster Geographic Edition
Portal Services <ul style="list-style-type: none"> » Portal Server » Portal Server Mobile Access » Portal Server Secure Remote Access 	Security Services <ul style="list-style-type: none"> » Security is not an add-on; security services are embedded in the individual products
Development Tools <ul style="list-style-type: none"> » Java Studio Enterprise » Java Studio Creator » Sun Studio 	Others <ul style="list-style-type: none"> » Service Registry » N1 Grid Service Provisioning System

Justifying and Quantifying Lowering TCO

While none of the customers that we interviewed had completed a formal TCO analysis of their Sun Solaris environment, a number did believe that if they were to do such an analysis, the results would be favorable to Sun. The factors that they believed enabled a lower TCO were:

- » Binary compatibility and the fact that Sun's new releases of Solaris have been trouble free (which is perceived as contributing to lower operational costs).
- » The reliability of Sun hardware systems, which makes many customers believe that high availability contributes strongly to achieving business goals.
- » Sun's support, which customers believed made a real contribution to their ability to make business plans and reduce costs.

Sun Customer Experience

We present four examples of Sun customers who are receiving major benefits from the various points discussed in this paper.

Customer 1

This research organization has about 100 Sun servers installed. It has been a Sun customer for about 20 years. All Sun servers are running Solaris 9. The organization typically has updated to a new Solaris release about 6 to 12 months after its initial release. The organization has many applications written in FORTRAN and C that it is able to move easily due to the binary compatibility that Sun offers. This customer found great value in receiving an end-to-end solution from Sun that would work (as the customer did not want to get involved in systems integration work with every upgrade cycle). The customer believed that its costs would go up by 30 to 40% or several million dollars if it were forced to do its own systems integration. Through Sun's solutions, this customer was able to avoid the integration pit. The customer was also installing Sun's Opteron-based servers and planning to run Solaris on them. It saw "tremendous value" in having Sun as its business partner. Further, the customer felt that it experienced excellent business continuity with Sun over the years.

Customer 2

This ISV sells an application that normally runs on very large Sun servers. Its development environment consists of a Sun Fire 15K and six smaller Sun servers. It has been using Solaris for four years starting with Solaris 7. The company consolidated recently from about 16 servers and thus far has received outstanding reliability from the Sun Fire 15K. Because this ISV promises a quick turnaround time (of hours) to customers who report a problem, it needs very high availability from its development systems to satisfy this requirement. The ISV developed its application several years ago on HP-UX, but discovered that most of its customers wanted Solaris. The ISV also found that when it ported to Solaris, the Sun C and C+ compiler was stricter than the HP compiler. Hence, the company decided to move the application to Solaris and make Sun its reference platform. The ISV also recently converted the application to 64-bit before moving it. Sun was extremely helpful to this ISV and contributed resources to the team making the transition.

This ISV also embeds other products like Oracle into its product. Its customers will not go to a new release unless all products are certified for the new release; hence, the ISV frequently has to wait until all the embedded products are certified for the new release of Solaris before it can upgrade (it will go to Solaris 10 as soon as it can). When the ISV needed to evaluate UltraSPARC® IV, Sun lent it some Uniboards, which the ISV was able to install in the Sun Fire 15K. The ISV then created a domain so that it could test the performance of its application using UltraSPARC® IV processors.

Customer 3

This large university has been a Sun customer since 1988. It has about 100 servers and all its major processing takes place on Sun equipment. The university employs many third-party applications. This customer stated, "It is almost transparent to go

from one release to another." It only takes the university a week or so of planning and then it can upgrade servers very quickly. The university continues to use the old binaries of third-party applications on the new releases. With the exception of PeopleSoft, which is not currently certified, this policy has always worked for the university.

Although this customer believes that in the past Sun had made a shambles out of Solaris on x86 platforms, it is now very interested in Solaris on Opteron (due to the enhancements that Sun has made). The university also believes that Solaris has far better multiprocessing support than Linux does.

The university also mentioned that it had found a flaw in the binary compatibility when it moved to Solaris 9. Apparently, a third-party library needed to be recompiled. However, this was the only problem of this type that the university ever encountered. "On the whole, Sun is right 99% of the time and they are far better than anyone else," was this customer's final comment.

Customer 4

This communications company has been a Sun customer for about 10 years. It has about 1,000 servers, of which 400 are Sun servers. The customer's key applications, Oracle and Siebel, run on Sun. The company has four- and eight-way systems that it regards as commodity building blocks. It has a somewhat unique strategy of writing its servers off after two or three years and then replacing them with new servers along with new operating systems. The company rarely performs operating system upgrades any other way. Consequently, this customer fully relies on Sun's binary compatibility to get the applications working on the new servers. To date, it has not experienced any trouble in this regard. In addition, this customer said that its Sun hardware never breaks. The customer also stated that compared to the Sun upgrades (which could be done very quickly), its Windows upgrades took many weeks. Additionally, this customer has done some TCO work and did say that Sun looked very good compared to others.

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