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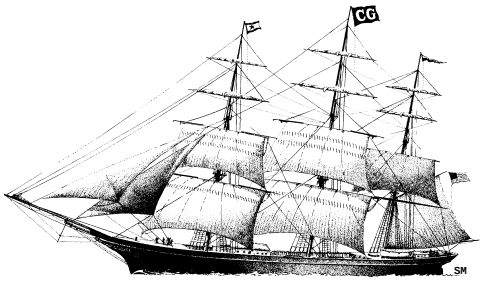

*Navigating Information Technology Horizons*℠

Published Since 1993 Report #TCG2005067 October 25, 2005

# Sun Reignites Its Heritage — Re-Energizing Sun Fire with a New SPARC

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## Management Summary

Success can be fleeting, especially when an organization forgets how that success was achieved. In sports, success is usually associated with a team that can build upon its strengths to reach a level where they can outperform their competition. In baseball, for example, a manager strives for balance between hitting and pitching, trying to ensure that his team can compete with other teams that may have a superior lineup or a superior pitching staff. In football, a coach may strive for balance between the running game and the passing attack, trying to ensure that he can keep his opponent off-balance. However, with limited financial resources, and in some cases a salary cap, a perfect balance is often unattainable. Therefore, the management will try to stress one or the other, emphasizing what the team does best, trying to ensure at least one area of superiority. When teams lose that focus, they become average and return to the middle of the pack.

A similar scenario holds true in the business world where product diversification has become a buzzword in the boardroom. We can clearly see the impact of diversification and focus within the soft drink industry with Coca-Cola, for example. Coca-Cola owns a mélange of beverage brands from soft drinks to designer water, from coffee to tea. They own competing labels such as *A&W*, *Barq*, and *Ramblin'* - all selling root beer; *Dasani*, *Evian*, and *Frutopia* – all selling water. However, what happened when Coca-Cola lost their focus about a decade ago and introduced *New Coke* in competition with *Pepsi*? They literally were forced to re-introduce the original formula as *Classic Coke* by angry drinkers, who were deserting to alternatives and told them, in no uncertain terms, not to mess with a good thing.

In the world of Information Technology (IT), we can see an example of a company that has diversified its product set *and* retained focus in its baseline technology. Sun Microsystems built their reputation throughout the 1990's with a server set based upon the *SPARC* microprocessor and the *Solaris* operating system. At the turn of the century (the 21st century!), Sun had lost its industry leadership status and SPARC had lost its *spark*. Sun has diversified in order to regain some of its lost shine with AMD's *Opteron* technology. However, they have not forgotten their roots or their legacy partners. Recently, Sun announced the newest member of the SPARC family, the *UltraSPARC IV+*, and an upgraded family of servers designed to run the latest versions of Solaris, and optimized for *Solaris 10*, and to lower the total cost of ownership of the IT data center. To see if UltraSPARC IV+ can bring your data center into 2005 and beyond, please read on.

**IN THIS ISSUE**

## The Legacy Data Center

Many data centers are faced with similar problems revolving around the issues of trying to optimize the throughput of their application set and increase reliability, availability, and serviceability (RAS) on a scalable platform, while at the same time, lowering the total cost of ownership (TCO) for the IT infrastructure. Unfortunately, while you may be able to find a plastic raincoat in a pouch with a one-size-fits-all label, the data center staff is unlikely to find a single architecture that is optimized for compute-intensive applications in high-performance computing environments, while at the same time, optimized for the I/O requirements of a mission-critical OLTP application. Nor in fact do they have to!

First of all, let's establish one fact – today, unless you are a start-up, very few enterprises are installing a *new* data center. All enterprises are upgrading legacy IT architectures with newer models in order to take advantage of the *higher performance* resulting from faster microprocessors, *better server utilization* that can be achieved through dual-core implementations or the *lower cost* available by replacing systems that are out of warranty and incurring high maintenance charges. These solutions can be implemented by upgrade from an existing vendor, by transitioning to the latest and greatest innovation from another vendor, or by implementing a different, i.e., open, operating environment that runs on multiple platforms within the same IT infrastructure. Obviously, the data center can lower its risk through an in-family upgrade, retaining the same operating environment, simply installing more servers (and *more complexity*), or adding a faster microprocessor to an existing server infrastructure, in order to do more of what they have been doing. This will protect the investment made by the enterprise in their current infrastructure and reinforce the wisdom of decisions made in the past. This would take advantage of a proven platform and lower the TCO by restarting the warranty clock with a new three-year window. However, there is always the concern about obsolescence – is my existing IT environment running out of steam and in danger of coming to end-of-life - as has occurred with the *HP-PA* architecture from Hewlett Packard (HP).

What about consolidation? What do you do if the best means of lowering cost, and floor space, is to increase the application density through moving various infrastructure applications, i.e., file or print services, to the same server that runs a high-performance computing application? This could result in increased costs if the infrastructure services were running in a *Windows* environment while the HPC applications were under the control of a *UNIX* server. The CIO could always succumb to the siren song of another vendor's sales force and replace the current server set with a new platform that is guaranteed to improve system utilization to as much as 80%.[1] These solutions may reduce the complexity of the network, but at what cost? Retraining an entire data center staff for a new operating environment can be a time consuming and expensive task, raising the TCO instead of lowering it.

What is the best way to reconfigure your IT infrastructure in order to take advantage of access to higher throughput and the latest developments in multi-core technology, while lowering the data center TCO? Many data centers have answered this question with the transition of their application set to an open systems framework, evolving to a cross-platform environment where the same applications can be run on different servers. Operating systems such as *Linux* or Windows can run on a wide variety of x86 platforms and, in the case of Linux, many proprietary platforms as well. Unfortunately, they do not provide binary compatibility between disparate platforms. Multiple copies of applications may need to be managed in order to create an enterprise-wide solution.

There is a third alternative: Sun's *Sun Fire* platforms running under the control of Sun's *Solaris* operating system. Sun Fire presents the data center with the best of both

[1] In many data centers, open systems servers are running at <30% CPU utilization. This obviously results in a less than satisfactory ROI.

worlds.

- A set of x64 platforms implemented using AMD's *Opteron* microprocessor[2] that empowers entry-level and mid-range scale-out environments with infrastructure solutions running under Windows and Linux, while at the same time enabling consolidation of mission-critical OLTP applications under Solaris with cross-platform source code compatibility; and
- A set of *SPARC* platforms designed to support both scale-out and scale-up architectures, enabling distributed processing in remote branches as well as enterprise consolidation services, via partitioning through *Dynamic System Domains* and *Solaris Containers*, in order to reduce data center complexity. With *UltraSPARC IV+*, the enterprise retains binary compatibility for all UltraSPARC III, IV, and IV+ platforms.

Sun has had SPARC and UltraSPARC platforms in their solution set for almost two decades. At times, these platforms were state of the art solutions and were the very foundation of the tremendous Internet business explosion of the 1990's, along with the introduction of multi-core microprocessors. More recently, they have not been viewed as kindly. SPARC performance lagged behind the advancements made in the open systems community by AMD's Opteron and Intel's Xeon, as well as IBM's *POWER* architecture. **Now, Sun is fighting back, and with a vengeance.** With the introduction of UltraSPARC IV+ Sun has re-established itself on the microprocessor firmament. The availability of this new, high-performance microprocessor within the Sun Fire family has restored Sun Fire as a viable competitor for data center attention.

## Sun UltraSPARC IV+

UltraSPARC IV+ is an enhanced version of the UltraSPARC IV processor with twice the performance, but no additional power requirements. Moreover, UltraSPARC IV+ has five times the performance capability of UltraSPARC III. This is extremely significant when you consider the vast number of data centers that are still populated with UltraSPARC III-based servers. How did Sun achieve such a significant improvement in throughput? It took more than a turn of the CPU clock – although the IV+ microprocessor does run at 1.5GHz, a modest improvement over the 1.35GHz rating of the version IV processor.

**Exhibit 1 – UltraSPARC IV Features**

- Chip Multithreading (CMT) technology to double compute densities;
- Improved L2 cache configurations with 8MB of 2-way, set-associative L2 cache per thread and address bus error protection to improve RAS;
- Enhanced Floating Point Unit higher performance and hardware assist for IEEE exception processing;
- Enhanced write cache to reduce write cache latency.

As the fifth generation of the 64-bit UltraSPARC family, IV+ takes advantage of all of the features of UltraSPARC IV (see Exhibit 1), and brings 90 nanometer technology to an open systems platform. UltraSPARC IV, at 130 nanometers, was implemented to improve throughput performance in commercial applications; IV+ carries the environment one giant step further. **With a significantly enhanced, second generation dual-core architecture running at 1.5GHz, 2MB of on-chip L2 cache and 32MB of external L3 cache, Sun Fire servers with UltraSPARC IV+ CPUs are ideal vehicles for mission-critical database applications, web infrastructure servers, and high-performance technical computing**.

## The New Sun Fire Servers

All of the SPARC models of the Sun Fire family, both rack-mounted and stand-alone, have been refreshed with the UltraSPARC IV+ microprocessor and re-announced at the same price and with the same footprint. Initially available at 1.5GHz, the new UltraSPARC IV+ extends the application and

[2] See **The Clipper Group Navigator** dated October 11, 2005, entitled *Sun Boosts Server Performance with Opteron – Adds More RAS for Commodity Sun Fire* at http://www.clipper.com/research/TCG2005065.pdf.

hardware lifecycle for all UltraSPARC III and IV platforms with in-chassis upgrades, binary compatibility, and support for *Solaris 9* and *Solaris 10*, and in some cases, *Solaris 8*[3]. Designed with Sun's *Uniboard* technology, each processor complex has up to 4 CPUs (8 threads) and 32GB of memory per board. The data center can hot-plug (on-the-fly) a new uniboard into an existing platform – incurring no downtime with dynamic reconfiguration (with Oracle). These upgrades protect the investment made by the enterprise in legacy Sun Fire platforms and application software and reduce the TCO by eliminating costly downtime, avoiding the problems incurred with "fork-lift" swap-outs, and packaging twice the performance of the UltraSPARC IV in an 80-watt power envelope, a 25% reduction from UltraSPARC IV.

The new models enable the data center to mix and match UltraSPARC IV and IV+ CPUs at native speeds[4] in the same server, protecting the investment that the enterprise has made in UltraSPARC IV. See Exhibit 2 for the scalability of the Sun Fire servers.

With growth to 36/72 CPUs and 72/144 threads, the E20K and E25K are ideal platforms for enterprise consolidation, with a significant reduction in the TCO of the IT infrastructure. In fact, all Sun Fire servers – even the Opteron-based servers running Solaris – can support thousands of partitions per server, via Containers, with virtually no overhead against partition performance. The E4900 to E25K also support Dynamic System Domains, which are electrically-isolated hard partitions. The E25K can support up to 18 Domains, with thousands of Containers running in each Domain. Small and medium sized enterprises can accomplish the same economies via platforms sized to their requirements. The high-end servers are optimized for high-volume database applications (OLTP), in addition to customer resource management (CRM) and decision support. The Sun Fire E25K also is designed for full enterprise RAS capability (see Exhibit 3, above) with mainframe-like reliability, availability, and serviceability. A sub-set of the E25K RAS functionality is available on all UltraSPARC IV+ platforms.

**Exhibit 2 – Server Scalability**

**Rack-Mount Servers**

- *Sun Fire V490* - 4 CPUs/32GB
- *Sun Fire V890* - 8 CPUs/64GB
- *Sun Fire E2900* -12 CPUs/96GB

**Stand-Alone Servers**

- *Sun Fire E4900* - 12 CPUs/96GB
- *Sun Fire E6900* - 24 CPUs/192GB
- *Sun Fire E20K* - 36 CPUs/288GB
- *Sun Fire E25K* – 72 CPUs/576GB

**Exhibit 3 – Sun Fire E25K RAS Features**

- Full Hardware Redundancy;
- Dynamic reconfiguration;
- Auto diagnosis and recovery;
- Proactive self diagnostics;
- Online upgrades;
- End-to-end data integrity including ECC;
- Redundant network connections;
- Redundant storage connections;
- Kernel hot patching;
- Hardened operating system kernel;
- Live operating system upgrades;
- Cluster support
- And more

In addition to optimizations for CMT and network throughput, Solaris 10 brings some unique features to the enterprise data center in terms of processor utilization (up to 80%) and high availability.

- Partitioning through thousands of Solaris Containers for each Dynamic System Domain (for E4900 and above);
- Consolidation support for thousands of applications;
- Complete fault and security isolation;
- Automatic reconfiguration based on enterprise requirements;
- Predictive Self-Healing;

[3] Solaris 8 can run in a separate domain on Sun Fire E4900 to E25K servers.

[4] UltraSPARC IV runs at 1.05, 1.2, and 1.35GHz.

- On-line debugging and tuning with Dynamic Tracing (Dtrace).

Buoyed by the outstanding improvement in performance over previous generations of the SPARC architecture, Sun initiated a family-wide series of benchmarks to determine the impact of UltraSPARC IV+ in mid-range configurations as well as enterprise-level, in compute intensive environments as well as transactional. As one would expect from Sun, the results were illuminating.

In order to determine real world performance and throughput, Sun ran both the Sun Fire E6900 and the E20K against the *Manugistics NetWORKS Fulfillment v7* benchmark. This test measures the performance of a complex retail supply chain management workload and batch processing capability, requiring a balance of I/O, memory, and CPU power. The E6900 with 24 dual-core processors outperformed a 32-way *Integrity Superdome* server from HP and a 32-way Fujitsu *PRIMEPOWER 1500*. The E6900 was measured at 50,660,623 SKUs/hour. In order to establish proof of scalability, Sun ran the same benchmark against the E20K, with a result of 66,744,558 SKUs/hour for a 36-way server. This is an improvement of almost 33% with an additional 12 CPUs. In order to demonstrate transactional performance within a *Lotus Domino* framework, Sun ran the *Lotus Domino R6iNotes* benchmark on a 12-way E2900. The result was the highest number of *NotesMark* transactions/minute: 28,268. A third transactional benchmark was run to measure performance in an industry-standard decision support environment designed to measure a system's capability to examine large volumes of data and execute complex queries. The V890 performed best in the 100GB category with 24,139 queries per hour.

In *SPECjbb2005*, a benchmark designed to measure the performance of a Java implemented application, a 12-way E4900 was rated at 184,418 business operations per second (bops), with a 24-way E6900 exhibiting excellent scalability, coming in at 241,560, the highest value reported so far. In the *SPECjbb2000* benchmark, based on order processing in a wholesale supplier application, a 24-way E6900 was measured at 747,791, over 75% faster than an UltraSPARC IV-based E6900. The IV+ E6900 was also 30% faster than a 32-way HP *Integrity Superdome*, rated at 574,912. In another SPEC benchmark, SPECweb99_SSL, designed to measure the performance of secure web serving transactions, a 16-way Sun Fire V490 cluster more than doubled the performance of a 16-way HP Integrity rp8400: 10,700 to 4,700.

## Conclusion

With a long-standing capability to support their customers through hardware, software and services, Sun has become more than just another vendor; they have become a trusted partner who can be counted on to deliver the performance, RAS, and cost reduction qualities that a modern enterprise demands. Sun has shown that they will not stand still in any area of data center IT infrastructure. Their innovations in SPARC technology, with the introduction of UltraSPARC IV+ servers, complement their introduction of industry-standard x64 Opteron servers within the Sun Fire family. Their recent acquisition of StorageTek indicates their intention to provide innovation in the area of disk and tape automation, too.

With over nine years of experience in delivering application-binary compatible platforms for its SPARC/Solaris customers, Sun has proven itself in the area of investment protection. With the introduction of x64 open systems Sun Fire platforms, they have proven that they now have an open mind as well. Sun seems determined not be eclipsed easily. Before you make a hasty migration decision, investigate these new Sun Fire systems. You too may see the light.

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