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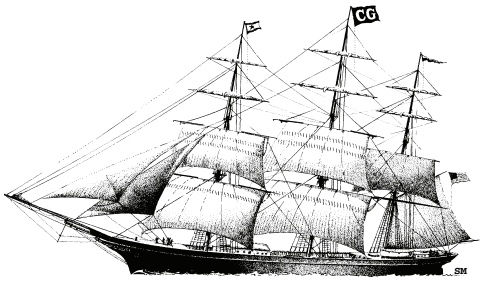

Navigating Information Technology Horizons℠

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Sun Adds Functionality to Performance with T2 — *It's in There!*

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Management Summary

When we go into the kitchen to prepare our dinner, we do not have the same luxury of time that our mothers or grandmothers enjoyed. With two working parents, we look for convenient, healthy foods that are easy to prepare. Pasta certainly qualifies in all respects: add spaghetti to a pot of boiling water, wait *ten minutes*, drain, and serve. However, there is the matter of the pasta sauce. Your grandmother would go shopping for ripe tomatoes, oil, garlic, vegetables, spices, perhaps some meat, and simmer these ingredients together for, say, *ten hours* and then serve it over the pasta. Unfortunately, no one has ten hours any more to devote to preparing a meal. Instead, we go to the cupboard and open a jar of pasta sauce, perhaps *Ragu*, because as the commercial says, ***It's in There!*** No matter what flavor you like, the good folks at Ragu have combined fresh, healthy ingredients for you to heat up and enjoy.

A similar story occurs in every data center around the globe. The IT staff looking to deploy an energy-efficient, mission-critical server network throughput the enterprise can go shopping for the finest microprocessor with the highest processing ratings, the fastest and most reliable memory controller chip set, communications controllers with the highest throughput, a network infrastructure to interconnect the enterprise, mathematical co-processors for specialty computations, and more. They can issue RFPs to a variety of vendors, wait 60 days, evaluate the responses, and award five or six contracts for different components. In another 30 days, they may even be able to take delivery of these individual elements and commence the integration process. This assumes of course that the enterprise is still in business while it waits for this *mission-critical* project to be completed.

There is an alternative, however. Sun Microsystems has just announced their much-anticipated, next generation *SPARC* microprocessor, the *UltraSPARC T2*. Not only does this general-purpose processor rank among the highest performing microprocessors in an energy-efficient package, but also, Sun has integrated it with the latest memory controller, multithreaded networking, encryption, and floating point technology available to the data center. Furthermore, Sun has announced this new integrated micro-architecture as an open source environment, making it available to hardware and system designers outside of Sun, enabling them to innovate their own designs, creating new applications for the OpenSPARC community, not to mention the thousands of Solaris applications already running on the SPARC platform. To learn more about UltraSPARC T2, and how it can help to reduce the total cost of ownership (TCO) of your IT environment, please read on.

IN THIS ISSUE

Today's Enterprise Data Center

The uncontrolled proliferation of under-utilized servers is spreading throughout the data center of every enterprise like an uncontrolled virus, in an attempt to meet the growing demand of a voracious Internet. If the IT staff finds a virus on just one mission-critical server consuming 85% of its compute cycles, they will employ a swat team to eliminate that virus and restore the server to full health. How do we explain, then, the situation existing in enterprise data centers today where the majority of enterprise servers are operating at only 15% efficiency, while the IT staff ignores the other 85% of the CPU's processing capability? The cost to power these crippled servers, and cool the data center, increases the TCO of the IT infrastructure and has a direct *negative* impact on the bottom-line of every enterprise. In addition, wasting energy limits its availability to add new applications to meet the needs of a growing enterprise.

Consolidating **multiple servers onto a single platform, while *virtualizing* the environment to enable heterogeneous applications to operate, is one method of removing much of the complexity out of the IT architecture and simplifying the infrastructure to enable the staff to restore order to the IT environment.** While it is painful to think about redesigning the IT infrastructure**, it is irresponsible to ignore the necessity**.

Two of the most urgent imperatives any CIO must face in changing the server paradigm of the data center are the need to **improve the utilization** of enterprise resources while also increasing the **energy-efficiency** of the data center, reducing demand on electricity, improving performance per watt. The data center acquired many of the open-systems servers installed throughout the enterprise in a pre-Y2K buying spree, or in the value-packed era immediately following the tech-bubble bursting five years ago. In either case, these commodity servers consist of single-core processors from companies such as Intel and AMD, designed for scale-out environments running *Windows*-based applications, not for the scalability implicit in SMP architectures used in UNIX platforms and designed to grow with the enterprise. While lacking many of the reliability, availability, and serviceability (RAS) characteristics found in UNIX and mainframe systems, these scale-out platforms were labeled "good-enough" for the infrastructure environments that they ran. This may be true for a single print server or file server, but **when a data center installs 300 platforms in a mission-critical environment, "good enough" is *never* good enough**. Consolidating these disparate systems requires the highest levels of consistent and reliable **performance**, **virtualization**, and high-performance **I/O**, not just "good enough". They also require the flexibility to access UNIX and Linux applications libraries, to avoid reinventing the wheel, with RAS characteristics necessary to ensure system availability

Multi-core processors, with multiple threads on each core, have taken over the mission-critical server landscape, not just from Intel or AMD, but also from legacy vendors who have been using UNIX servers for the past two decades, including Sun with their *SPARC* architecture and IBM with *POWER*. Multithreading enables the processor to consume less power while delivering higher throughput. Sun had already taken the lead in terms of the number of cores, and the number of threads per core, with their *UltraSPARC T1* (*T1*) microprocessor, employing eight cores, with four threads per core, at a typical energy level of 72W. *UltraSPARC T2* (*T2*) maintains the technology lead with eight cores, and extends the thread margin by doubling that count to eight per core, all within a nominal power envelope of less than 95 watts. **With 64 threads on a single T2 processor, Sun provides the data center with the basic building block necessary to virtualize multiple heterogeneous applications within a single server.** This is extremely significant in any transaction-heavy commercial application environment, such as the telecomm industry, as each of the 64 threads can interact with the database at the same time. This significantly reduces the IT infrastructure, reducing energy consumption, maintenance costs, and management personnel, lowering TCO for the entire IT environment.

Sun's UltraSPARC T2

With exceptional computational performance, paradigm-changing multithreading, integrated encryption for security, and fast, integrated I/O, the UltraSPARC T2 processor performs the functions of an entire server, *on a single chip*. With eight cores, the most by far on a single piece of silicon, each running at a CPU speed of 1.4 GHz, T2 doubles the throughput of its predecessor, T1, and with a nominal power rating of 95W, has the energy efficiency necessary to help control the power drain in the data center while supporting more users. This restores health to the enterprise in terms of increasing the bottom line, as well as reducing the data center's carbon footprint, helping to "green" the ecology. Moreover, T2 has the capability to manage each core, migrating application use during off-peak periods – consolidating workloads over fewer cores and temporarily disabling the unused cores to save even more energy.

Sun has made additional improvements in T2, beyond the capabilities of T1. For one, T2 has a floating-point unit (FPU) for each core, rather than the single FPU for the T1 processor. T2 also has 33% more L2 cache than its predecessor, along with four memory controllers that can reduce power to memory when not in use. For a complete list of T2 functions, see Exhibit 1, at the top of the next column.

Ten years ago, you needed a *Sun Fire E10K* to deploy 64 threads with a transactional performance of 150,000tpm. That system typically consumed **9620 watts** of energy in a rack weighing 1,800 lbs, almost one ton. Using the UltraSPARC T2 processor, you will soon be able to deploy a system with the same number of threads and the same performance but consume significantly fewer watts in a 1U drawer, lowering acquisition costs and TCO. Sun has tested T2 against the SPEC benchmark series, obtaining preliminary results with a *SPECint_rate2006* rating of 78.3 and a *SPECfp_rate2006* rating of 62.3[1]. **These would give T2 the highest single-chip ratings to date.** Sun will submit official results later this year when the first UltraSPARC T2 systems are ready for shipment.

Exhibit 1 – UltraSPARC T2 Functionality

- **High-throughput processing** – via 8 cores and 64 threads;
- **Networking** – Dual, virtual, multithreaded 10Gb/s Ethernet ports;
- **Security** – Eight cryptographic acceleration units, including NSA-approved algorithms, with no performance penalty;
- **Computation** – Eight FPUs enabling high-performance computations for scientific applications;
- **I/O** – Eight PCI Express lanes to provide acceleration for applications such as streaming media, database, and backup;
- **Memory controllers** – four integrated memory controllers to deliver more than 50GB/s of memory access;
- **Software support** – from the massively threaded Solaris O/S to take advantage of the multi-threaded processor.

Source: Sun Microsystems

Conclusion

Over the past three years, Sun has implemented a microprocessor roadmap that has seen a performance increase of 35X, from UltraSPARC IIIi through UltraSPARC T2. Moreover, that roadmap has already identified the next performance bump, *Victoria Falls*, with 128 threads of executable highway in a comparable energy envelope. Sun has made energy economy as simple as turning off the lights when you leave a room; in fact even easier, as T2 will turn off cores and memory not in use automatically.

T2 leads the field, consuming the fewest watts per core of any commodity CPU, less than IBM's *POWER 6*, less than AMD's Opteron, even less than Intel's *Xeon 5300*, and Sun has more functionality built-in. As you look to consolidate or upgrade, take a look at Sun's newest shining light, it may be what you've been seeking.

[1] UltraSPARC T2 at 1.4GHz (64 threads, 8 cores, 1 chip).

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