

The New *AlphaServer*[™] Series – “*Marvelous*”

Introduction

Compaq continues its decades-long leadership in offering customers the most advanced, most flexible, and most compatible IT solutions with the New *AlphaServer*[™] Series systems. Based on revolutionary engineering focused squarely on customer value, new systems from Compaq will carry our customers smoothly forward to the end of the decade with minimal effort, and prepare for an easy migration to the Intel[®] Itanium[™] Processor-Based Family when the customer is ready.

COMPAQ

Inspiration Technology

Notice

Compaq shall not be liable for technical or editorial errors or omissions contained herein. The information in this publication is subject to change without notice and is provided "AS IS" WITHOUT WARRANTY OF ANY KIND. THE ENTIRE RISK ARISING OUT OF THE USE OF THIS INFORMATION REMAINS WITH RECIPIENT. IN NO EVENT SHALL COMPAQ BE LIABLE FOR ANY DIRECT, CONSEQUENTIAL, INCIDENTAL, SPECIAL, PUNITIVE OR OTHER DAMAGES WHATSOEVER (INCLUDING WITHOUT LIMITATION, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION OR LOSS OF BUSINESS INFORMATION), EVEN IF COMPAQ HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

The limited warranties for Compaq products are exclusively set forth in the documentation accompanying such products. Nothing herein should be construed as constituting a further or additional warranty.

This publication does not constitute an endorsement of the product or products that were tested. The configuration or configurations tested or described may or may not be the only available solution. This test is not a determination of product quality or correctness, nor does it ensure compliance with any federal state or local requirements.

Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies.

NonStop, *Compaq*, AlphaServer, TruCluster, and the Compaq logo Registered in U.S. Patent and Trademark Office. OpenVMS and Tru64 are trademarks of Compaq Information Technologies Group, L.P. UNIX is a registered trademark of The Open Group in the United States and/or other countries. All other product names mentioned herein may be trademarks or registered trademarks of their respective companies.

Copyright ©2002 Compaq Computer Corporation. All rights reserved.
Printed in the U.S.A.

The Revolutionary Evolution of Compaq AlphaServer systems

In 2002, we will introduce the New *AlphaServer* Series systems, built on the revolutionary Alpha microprocessor, EV7 – the *system on a chip*. These systems continue a strong tradition. They represent our ongoing commitment to investment protection, long-term growth, growth without disruption, reduced TCO (Total Cost of Ownership), and increased Service Levels. They do so by delivering scalable application performance in a balanced system architecture, application availability, manageability, flexibility, and adaptability to changing requirements

Compaq *AlphaServer* systems were first introduced a decade ago with the revolutionary *AlphaServer* 2100 system. Built on an elegant and robust engineering heritage of technical excellence that reaches back through the VAX™ and PDP-11 system families, it provided the basis for the most flexible, scalable, adaptable, manageable, and powerful world-class enterprise systems.

The successful *AlphaServer* 2100 system, running both the *OpenVMS*™ and *Tru64*™ UNIX® operating systems, was followed by the equally successful *AlphaServer* 4100 and the revolutionary *AlphaServer* 8400 (Turbo

Laser) systems. This breakthrough system introduced Very-Large Memory to the market and the value of VLM to our customers. Through this revolutionary evolution, general-purpose servers became powerful business tools allowing enterprises unprecedented access to information, sophisticated analysis, and more. We followed that up with even faster and more advanced processors – the *AlphaServer* ES40 and *AlphaServer* GS140 systems – introducing further revolution in microprocessor performance and parallelism into leading-edge enterprise and technical computing systems. In 2000, Compaq introduced the next revolution in mission-critical computing with a new family of enterprise servers, the GS Series of Compaq *AlphaServer* systems. The evolution and revolution did not stop there. In 2001 we unleashed the powerful midrange *AlphaServer* ES45 machine.

AlphaServer systems were unique in their ability to handle diverse workloads extraordinarily well, even under the heaviest load conditions. Compaq *AlphaServer* systems continue to demonstrate exceptional facility in handling all kinds of applications – whether scientific or commercial, interactive or batch, single- or multi-stream – even as those applications have changed and evolved over the past decade.

Through this revolutionary evolution, general-purpose servers became powerful business tools allowing enterprises unprecedented access to information, sophisticated analysis, and more.

An Architectural Overview

What are the “revolution” and “evolution” in these remarkable systems?

Revolution at the Technology Level

The revolution is born of technology, research, and development focused on the customer. The project to build the New *AlphaServer* Series systems began with externally focused product research, focus groups, and one-on-one customer engagements. This research was focused on identifying clearly what customers required in the scalable servers they planned to buy in the next millennium. This work provided the core framework in specifying these New *AlphaServer* Series systems. Furthermore, we conducted technology analyses of systems in real life. We wanted to better understand exactly what worked well ... and what didn't. We wanted to understand where we could focus engineering skills and talent to make the most difference in real life.

Our analysis of current systems showed that application run time was dominated by the processors waiting – waiting for I/O, waiting for data. With process technologies moving ahead quickly, we determined that we had the unique opportunity to drive all of the symmetric multi-processing systems components

“on-chip.” So we took the industry-leading EV68 core and put the memory controller on-chip; put the L2 cache and cache controllers on-chip; put the inter-processor communications and synchronization on-chip; and put a connection to the I/O subsystem on-chip. The result of all of this is a processor implementation that supports highly scalable performance by driving bandwidths dramatically up and latencies stunningly down. It also increases the inherent reliability of the system by radically decreasing the number of components. We chose to use RAMBUS memory because of the performance it could give us for *real* applications and the density it provides to reach up to 1 TB of main memory.

With this remarkable new processor as the foundation, we then built scalable systems by connecting processors (systems on a chip) directly to one another. This “switch-less” mesh architecture lets us build very large-scale Compaq *AlphaServer* systems and easily transform that scalability into real application performance and real scalability. The mesh handles the entire cache coherency and interconnect requirements of a large-scale SMP system. We use a dynamic routing method so that interprocessor communications are never blocked. In addition to the system architecture, we build balanced systems – balancing processor power, the memory and I/O

subsystems – in order to deliver solid scalable application performance to diverse application types.

We also extensively “fault harden” the system, even more than we had with the previous generation of Compaq *AlphaServer* systems. A good example of this is the introduction of RAID memory to address memory protection for Very, Very Large Memories (up to 1 TB or more). And we electrically isolate one partition from another, providing for no single points of failure in a partitioned system. Indeed, these partitions are truly “Cluster-Worthy” in that they can be clustered together for management, operational, and TCO savings, yielding a more available environment than one with partitions running separately. (Of course, for customers requiring the highest levels of application availability or disaster-tolerant solutions, separate systems will always be highly recommended!)

Evolution at the Solution Level

Our focus in designing these new systems was to make sure that they represented a natural evolution – not a disruption – for our customers. We required that they be completely binary compatible with existing *AlphaServer* systems running the *Tru64* UNIX and *OpenVMS* operating systems. We required that they would cleanly integrate into existing *Tru64* UNIX and *OpenVMS* clusters. We required that they would in-

stantly work with the *Storage-Works™* by Compaq and other enterprise storage infrastructures that our customers might have. And we required that these systems integrate cleanly into the customers’ existing system management tools and procedures.

This concern for our customers’ applications extended into the engineering work we undertook for the *Tru64* UNIX and *OpenVMS* operating systems. The operating system updates required to support these systems are minor updates. They will not require ISVs to re-certify or re-qualify their applications. We implemented this architecture in a way that is transparent to applications.

Not only is the EV7 microprocessor built on the EV68 core that is available and running today, but also the integrated memory controller is transparent to applications. And the on-chip cache design is transparent to most applications. Only the rare customer-written application that tunes to the cache needs to pay attention. Otherwise, applications will benefit immediately and transparently from – *evolution at the solution level, revolution at the technology level.*

Applications will benefit immediately and transparently from – evolution at the solution level, revolution at the technology level

Building a Scalable Enterprise System

We've built a scalable enterprise system by constructing three basic reusable components:

- 2-processor EV7 CPU Module
- Standard I/O option
- High-performance I/O option

These I/O options support both PCI and PCI-X. This, along with dynamic multi-path I/O (which is still unique to Compaq) means that we provide a highly available, scalable storage and networking infrastructure today, as well as for the next generation of high-performance storage and network interconnects that will be coming out over the next several years.

From the CPU module, we build two system building blocks, a 2-CPU building block and an 8-CPU building block.

- From the 2-CPU building block we will build a family of workgroup and departmental servers in the 2- to 8-CPU range
- From the 8-CPU building block we will build a scalable enterprise server platform supporting 2 to 64 processors initially
- Both the 2-CPU and 8-CPU building blocks support N+1 power, RAID memory, and N+1 fans

We build these systems with the switch-less mesh architecture by simply connecting processors to one another, almost like LEGO® blocks, adding memory and I/O where desired. We also have a common server management system for managing all members of the server family, whether small or large. This server management system will integrate smoothly into the broader system management tools and infrastructure that our customers are now using.

Clusters – the Foundation for Solution Evolution

This evolution at the solutions level is made stronger with the use of Compaq clustering solutions. Both the *Tru64* UNIX and *OpenVMS* operating systems define clustering. Indeed, Compaq created clustering. Compaq clusters bring unique value to customers, value that covers economic and operational dimensions.

Operationally, Compaq clustered solutions are “built-in,” not “bolted-on,” as with clustered solutions from other vendors. To use them, you need only “turn them on.” Compaq clusters manage a collection of systems as a single system – for system management, data access, authentications, networking, and so on. This means that you update, change, or add things only once. They are then automatically available to all systems in the cluster. You can mix computing

technologies, different family members, and different system sizes in the same cluster without any challenge. You manage the whole cluster with no more resources than it took to manage a single system, a capability also unique to Compaq. You have a shared file system which not only affects the system operationally, but also affects it economically since you don't need to duplicate storage investments for each node. And since it is managed as a single system with a cluster-wide file system, it is much easier to manage and operate. This helps create a more available environment by not artificially introducing complexity and confusion.

Economically, we offer customers solutions requiring fewer system management resources. They require less storage. This means direct reductions in total IT costs and lower TCO. And since the system is managed as "one" rather than as a collection of systems, and since things are done once, this reduces the time it takes to administer system management changes or operations, because they don't need to be duplicated or replicated. This reduces TCO and operational costs since the system management resources are more efficient, effective, and productive, freeing them up for other assignments and projects.

The New *AlphaServer* Series systems will integrate cleanly and transparently into existing clustered environments. This means that they quickly move into test and qualification, and move even more quickly into production – without disruption or changes in applications or management procedures. The solution level simply evolves to embrace and exploit these new system capabilities.

Compaq AlphaServer Systems: A Solid Foundation for this Decade

In short, *AlphaServer* systems provide a solid foundation for this decade. *AlphaServer* systems are some of the best mission-critical, high-performance servers in the industry today. We have significant improvements planned for the middle of 2002 with the introduction of two new members of the *AlphaServer* DS Series family, an upgrade for the *AlphaServer* ES45 family, and an upgrade for the *AlphaServer* GS Series family. The path forward to the New *AlphaServer* Series systems is smooth and continues to evolve.

For customers running the largest Compaq *AlphaServer* systems available today, the 32-way *AlphaServer* GS320 system, this new generation represents a growth path forward – not just in single-processor performance

(EV68 enhancements to EV7 to EV79) – but also to 64 and more processors. Yet the new generation will co-exist elegantly and smoothly with the current one.

Customers running smaller configurations and smaller systems of 2 to 16 processors will be able to increase their performance even more substantially with the improvements offered by EV79 and the very dramatic increases in scalability that are realized with this new family of *AlphaServer* systems.

that they will move to Intel® Itanium™ Processor Family-Based systems over time. It provides for a *money-back satisfaction guarantee* for transitioning to these new systems, and it also provides for product continuity assurance. To further back up our commitment and confidence, we offer financial assistance and protection with attractive leasing and guaranteed trade-in values for hardware and software. And we provide transition support to our customers, including workshops, white papers, tools, training, and technical resources. In addition, we are making major investments in supporting our ISVs as they make this transition as well.

Compaq AlphaServer Systems: The Best Today and Tomorrow

Compaq *AlphaServer* systems have always been known for the quality, robust infrastructure they provide in highly available, high-performance mission-critical IT solution environments. This leadership in scalable performance *and* support for mission-critical environments has resulted in their #1 position in the high-performance technical computing market and a strong presence in telecommunications, large database, healthcare, and other markets world-wide. This foundation is based, not just on the *AlphaServer* technology itself, but on the ongoing engineering investments in the world-class

The Compaq AlphaServer Customer Assurance Program has been praised by industry analysts and customers alike for going far further than any vendor ever has in protecting customers and their investments.

AlphaServer Customer Assurance Program

This growth will clearly take the vast majority of our customers forward to the end of this decade. This means that they can manage the migration to Intel® Itanium™ Processor Family-Based systems on a schedule that meets their needs. Compaq is making significant investments in software, tools, and business practices to ensure that this migration path is smooth and guaranteed. The Compaq *AlphaServer* Customer Assurance Program has been praised by industry analysts and customers alike for going far further than any vendor ever has in protecting customers and their investments.

The Compaq *AlphaServer* Customer Assurance Program provides guarantees to all customers who purchase new Compaq *AlphaServer* systems (EV68 and EV7-based) with the expectation

Tru64 UNIX and *OpenVMS* operating systems, in clusters, in storage (with *StorageWorks* by *Compaq*), and in Compaq Global Services. We offer complete, integrated IT infrastructure for the most demanding environments.

We deliver IT infrastructure that helps customers improve the quality of their own Service Levels, and increase their confidence at being able to meet their Service Level Agreements while keeping infrastructure and staff costs down. Their Service Level needs are satisfied, not just by the application performance achievable with Compaq *AlphaServer* systems, but with the “Always-On” nature of our IT solutions which focus on never requiring customers to plan application down time.

We deliver IT solutions that help customers lower TCO and realize operational efficiencies as well. In addition to supporting a 99.999% uptime guarantee (in partnership with customers and Compaq Global Services), our clustered systems are designed to significantly lower TCO by substantially reducing storage and system management costs. Furthermore, our *AlphaServer* operating systems with clustering “built-in” require far fewer system management staff resources.

At Compaq, we continue to protect our customers’ investments. There are no application changes since these new systems are completely

binary compatible. Reusable components mean that customers who need to grow very small systems into very large ones, can do so by making use of what they already have installed. With unmatched flexibility and adaptability – with hard and soft partitions for workload management and isolation – customers have the ability to run all types of applications exceedingly well. This means we offer customers an IT environment that evolves to meet their needs, even as those needs change in unpredictable ways.

And, of course, we offer a secure foundation for long-term growth. Growth is “built-into” this system with the enhancements to EV7 and EV79; the growth of single systems to 64 processors and eventually more; support for next-generation storage and network interconnects; and the investments to handle the migration to the Intel® Itanium™ Processor-Based Family seamlessly. Few customers will outgrow this system. None will need to move beyond them before they are ready, or before they realize benefits by doing so.

The New *AlphaServer* Series systems are clearly a platform for the next decade.

They are “**Marvelous.**”