

TECHNOLOGY BRIEF

August 1999

Compaq Computer Corporation

Prepared by
ISSD Technology Communications

CONTENTS

Introduction	3
Architecture Overview	3
I/O Subsystem	4
Memory Architecture	4
Advanced Symmetric Multiprocessing.....	4
Conclusion	5

Highly Parallel System Architecture in Compaq Servers

As business-critical applications place growing demands on system resources, increasing system bandwidth becomes a vital issue. After evaluating available system architectures, Compaq determined that a new system architecture would provide the higher levels of performance, processor and I/O expandability, and bandwidth to satisfy the needs of increasingly complex transaction, database, internet/intranet, and file/print applications. The Highly Parallel System Architecture, introduced by Compaq in 1997, delivers the greatest system bandwidth available today for such demanding applications.

This technology brief describes the Highly Parallel System Architecture.

Please direct comments regarding this communication to the ISSD Technology Communications Group at this Internet address: TechCom@compaq.com

COMPAQ

NOTICE

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.

Compaq and ProLiant are registered with the United States Patent and Trademark Office.

Microsoft, Windows, and Windows NT are trademarks and/or registered trademarks of Microsoft Corporation.

Novell and NetWare are registered trademarks of Novell, Inc.

Pentium and Xeon are registered trademarks of Intel Corporation.

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

©1999 Compaq Computer Corporation. All rights reserved. Printed in the U.S.A.

Highly Parallel System Architecture in Compaq Servers

First Edition (August 1999)

0166-0899-A

INTRODUCTION

System bandwidth is critical to businesses running complex transaction, database, internet/intranet, and file/print applications. As an industry leader, Compaq anticipated the need for increased bandwidth to accommodate the growth of these business-critical tools and pursued possible solutions. In 1997, after cooperative development efforts with Reliance Computer Corporation, Compaq introduced the Highly Parallel System Architecture to deliver increased system throughput and performance when compared to traditional X86-based designs.

The Highly Parallel System Architecture is a high-performance, industry-standard architecture that addresses the need for greater system bandwidth. This design also delivers increased memory scalability and overall microprocessor performance for servers.

ARCHITECTURE OVERVIEW

Offering parallelism in multiple ways, the Highly Parallel System Architecture provides maximum bandwidth to ensure the highest levels of application performance. Under similar operating conditions, servers with this architecture significantly outperform those with traditional architectures. This balanced, high-performance system design incorporates:

- Multiple data paths in I/O subsystem
- Balanced system resources
- A new memory architecture
- Advanced symmetric multiprocessing support

These characteristics are discussed in detail in the sections that follow.

For one view of the enhanced performance of this architecture, see benchmark summary ECG052/1198, *Compaq ProLiant 3000 Continues to Provide Best Performance and Price:Performance in its Class* at www.compaq.com.

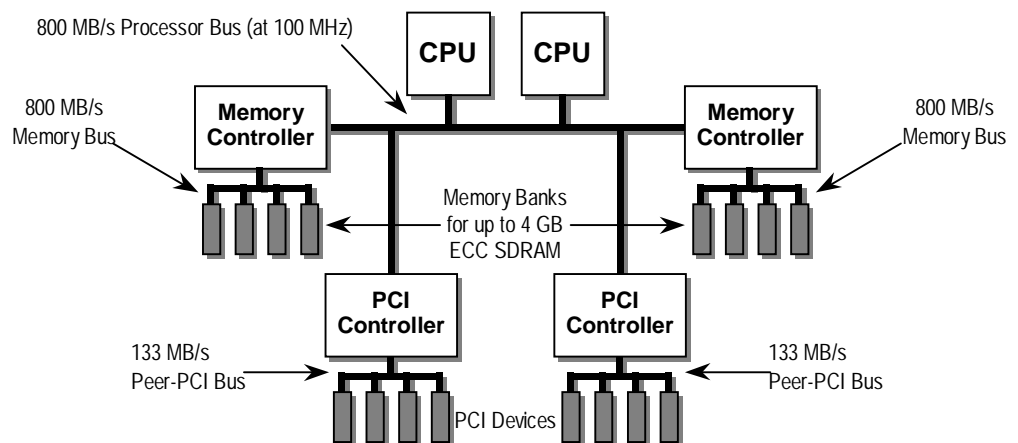


Figure 1: An example configuration of the Highly Parallel System Architecture

I/O SUBSYSTEM

Compaq servers with the Highly Parallel System Architecture have dual peer-PCI buses to increase system I/O bandwidth. A single PCI bus provides I/O bandwidth of up to 133 MB/s (or 533MB/s for a 64/66 PCI bus), which must be shared by peripherals such as the SCSI controllers, array controllers, and a network interface controller. With dual-peer PCI buses, multiple requests can be processed in parallel. Each bus can provide peak bandwidth in parallel with the other controller, allowing an aggregate I/O bandwidth of up to 267 MB/s. This implementation provides twice the bandwidth of single bus architectures and reduces overall system latency to decrease system bottlenecks.

The dual PCI buses also permit greater system I/O integration and expandability, supporting up to 12 PCI devices — twice the number supported on single bus implementations. This allows Compaq servers with the Highly Parallel System Architecture to integrate other PCI components, such as the SCSI and network controllers on the system board and still deliver up to eight available PCI-based I/O expansion slots.

The dual peer-PCI buses are wide high-speed buses that support 64-Bit, 66-MHz PCI, and PCI Hot Plug I/O technology. Future enhancements from Compaq will allow the Highly Parallel System Architecture to support PCI-X technology. For more information about PCI-X, see technology brief ECG070/0299, *PCI-X Technology: An Evolution of the PCI Bus*.

Another benefit of dual-peer PCI buses is the ability to balance system resources. Critical system resources reside on separate buses to help balance throughput and improve system efficiency: With peripherals divided between two PCI buses, there is less competition for access. This results in better performance.

MEMORY ARCHITECTURE

A new, standards-based memory architecture delivers significantly greater bandwidth and scalability by using dual memory controllers. While traditional memory architectures use a single memory controller to process all memory requests, the Highly Parallel System Architecture's dual memory controllers provide independently parallel, multipath access to memory from all processors and I/O devices. Each memory controller provides bandwidth of up to 800 MB/s. The aggregate peak bandwidth of up to 1.6 GB/s is two to four times that of other systems.

Dual memory controllers permit up to 4 GB of error checking and correcting (ECC) SDRAM. This is the highest system memory capacity available on the market in an Intel-based, dual processor capable server.

In addition, the 1-to-1 interleave memory scheme of the dual memory controllers allows customers the option of upgrading memory by one dual in-line memory module (DIMM) at a time, as opposed to the four DIMMs required in wider buses with 4-to-1 interleave schemes. Customers can purchase only as much memory as is required, making incremental upgrades to suit specific needs.

The Highly Parallel System Architecture is a standards-based design that permits the use of third-party memory. However, Compaq has not tested and does not support third-party memory in its servers.

ADVANCED SYMMETRIC MULTIPROCESSING

The Highly Parallel System Architecture also supports symmetric multiprocessing (SMP), although the system-level parallelism is independent of the number of processors.

SMP has been supported on RISC/UNIX servers for a number of years. Many people have not, however, associated Microsoft Windows NT and the applications that run on it with SMP. Windows NT does support SMP; and users can reap the benefits when running many demanding

multi-threaded: having the ability to process more than one transaction at a time.

business applications. Transactions and analyses performed in enterprise environments require tremendous numbers of calculations. Fortunately, many of these applications are *multi-threaded* or otherwise lend themselves well to multiprocessing.

The Highly Parallel System Architecture provides excellent scalability for increased system performance under Windows NT, as well as Novell NetWare and UNIX, supporting the use of multiple Intel Pentium II, Pentium III, Pentium II Xeon, or Pentium III Xeon processors to meet the widest possible range of customer needs. The processors share the processor bus, so instructions can be processed simultaneously. Configuration of the Highly Parallel System Architecture varies slightly between the Compaq servers that include this architecture. For precise information about specific servers with this architecture, please visit the Compaq website (www.compaq.com).

CONCLUSION

As the bandwidth requirements of business-critical applications continue to increase, Compaq has taken the lead in developing advanced solutions to meet the needs of enterprise customers. The Highly Parallel System Architecture implemented in Compaq servers improves overall system performance by delivering increased bandwidth to critical subsystems, including memory and I/O. Multiple data paths, large high-speed data buses, and balanced system resources make it the best, most cost-effective choice for uncompromising performance with today's demanding business applications.

Compaq servers with this architecture outperform comparably configured servers that do not use this architecture; however, there are several other factors, such as requirements for reliability, serviceability and expansion, to be considered when determining which product is best for a given application. For more information about specific product offerings, please visit the Compaq website at www.compaq.com.