

Extreme Availability with Compaq's UNIX Enterprise Server Consolidation Solution



Abstract:

This document addresses the high availability benefits of Compaq's UNIX® Enterprise server consolidation solution. Compaq offers unparalleled consolidation availability with the *AlphaServer™* GS Series, *Tru64™* UNIX V5.1A operating system, advanced *TruCluster™* Server V5.1A clustering technology and comprehensive high availability services.

Contents

- 1 The Value of Consolidation
- 2 The Importance of High Availability
- 3 Compaq Enterprise Server Consolidation Solution
- 3 High Availability Features of the *AlphaServer GS Series*
- 6 Enhancing Availability with Clustering
- 8 Services to Ensure High Availability
- 10 Summary

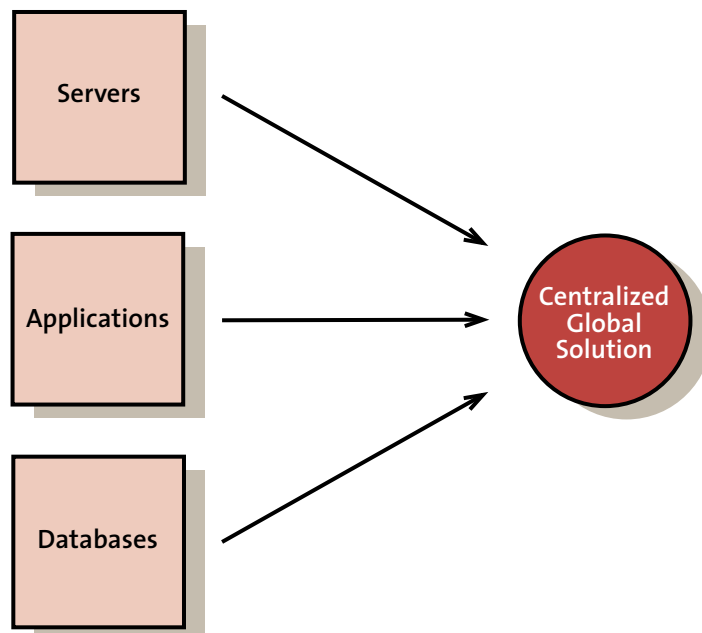
The Value of Consolidation

Server consolidation provides significant business benefits to organizations that are experiencing rapid growth and require continuous uptime. The right consolidation solution should be easy to manage and virtually unstoppable. The following are a sampling of the advantages of server consolidation using Compaq *AlphaServer* systems, software, and services:

- > Reduces or eliminates unscheduled downtime
- > Operates 24 hours a day, 365 days a year
- > Can be guaranteed 99.999 percent uptime with appropriate configuration, business processes and services
- > Provides performance to solve problems that were not previously addressable
- > Simplifies IT operations via faster recovery time for hardware and software errors, better recovery procedures, and fewer operator errors

- > Enables complete “lights-out” support
- > Accelerates time-to-application deployment
- > Enables external connections to customers and partners
- > Balances workloads across more servers
- > Operates multiple business-critical applications or operating systems on a single server or clustered set of servers
- > Enhances the ability to implement disaster tolerance.

Server consolidation is ideal for organizations that must operate around the clock with little or no downtime



Enterprise server consolidation is the movement from many distributed servers, applications and databases toward a centralized and global solution

If downtime impacts your profitability or your ability to do business, you need a high availability solution

The Importance of High Availability

Today, most systems at both the front and back ends of the business process require increasing levels of availability. If the downtime of any computing system adversely affects the financial performance or business process continuity of an organization, that system must be regarded as mission-critical and subject to high-availability requirements (Gartner Group). The cost of downtime negatively affects productivity and in turn can lead to lost revenue and customers. As IT departments are required to maintain strict quotas for downtime – often measured in minutes – the importance of availability is paramount.

Downtime can result from a variety of expected and unexpected occurrences. The causes of downtime, as identified by Gartner Group, include planned maintenance, software system failure, hardware system failure, human error, network transmission failure, and natural disasters.

Planned downtime is the most common form of downtime and can be curtailed with a high-availability server consolidation solution. If constant uptime for your computing environment is important, it makes good fiscal sense to consolidate your servers and put the proper support infrastructure behind them.

Availability %	Yearly Downtime
99	88 Hours
99.9	8.8 Hours
99.99	53 Minutes
99.999	5.3 Minutes

Increasing uptime from 99 to 99.999 percent availability means improving availability by nearly 10,000% and reducing downtime to less than 30 seconds per month

Compaq Enterprise Server Consolidation Solution

For organizations with large-scale distributed computing environments that encompass multiple UNIX servers from Compaq, HP, Sun, or IBM, Compaq offers an unparalleled server consolidation solution using the *AlphaServer GS Series* server. Designed to provide the highest levels of 64-bit performance and availability, the *AlphaServer GS Series* scales to clusters of 100s of CPUs, gigabytes of memory, and terabytes of storage.

Ideal for the consolidation of Oracle, SAP, PeopleSoft, BaaN, SAS, BEA, Lawson, Netscape, and custom applications, Compaq's consolidation offering improves competitiveness, streamlines operational costs, and creates new market opportunities.

Newest Generation of *AlphaServer GS Series* Delivers Enhanced Performance

The *AlphaServer GS Series* is now available with the new *Alpha EV68* processor rated at 1001 MHz with 8 MB on-board cache per processor and a central system clock speed increased by 7%.

The performance improvements of applications that have been tested vary over a range from 25% to 48%. Some examples are:

- > More than a 50% performance improvement for a single *Alpha* processor as measured by SPECint2000 and SPECfp2000.
- > The total system performance for on-line transaction processing applications increased by 48% as measured by the industry standard TPC-C benchmark.
- > The iBaan ERP applications suite performance increased by 25% as measured by the standard Baan benchmark.
- > The performance of a weather modeling application (MM5) increased by approximately 30%
- > The performance of the NAS Parallel benchmark increased by 24%.

And now, with the agreement with Intel to migrate Compaq's entire 64-bit family of servers to the Itanium processor architecture over the longer term, the consolidation availability benefits of Compaq's proven UNIX solutions will be available on the industry-standard 64-bit platform of the future.

High Availability Features of the *AlphaServer GS Series*

The extreme availability of the *AlphaServer GS Series* is a function of major advances in server technology that virtually eliminate many of the causes of scheduled and unscheduled downtime. From the beginning, the server was built with technically advanced availability features including:

- > On-line maintenance and upgrades
- > Complete hardware monitoring and environmental reporting
- > Fully redundant service processors with automatic fail-over capability
- > N+1 fault-tolerant power subsystems
- > High availability networking and storage subsystems
- > Easy serviceability and high availability

The AlphaServer GS Series provides the availability that is demanded in large distributed enterprise environments

The AlphaServer GS Series allows IT staff to replace or upgrade critical components without any disruption to users

On-line Maintenance and Upgrades:

Most components within the *AlphaServer* GS Series were designed for on-line maintenance and upgrades. Components may be hot swapped or warm swapped (removed and inserted while the system is running) depending on their function. To further enhance serviceability, this feature is also supported for on-line maintenance and upgrades of the operating system, database, or applications.

Complete Hardware Monitoring and Environmental Reporting:

The *AlphaServer* GS Series monitors all components and modules in the system as well as the operating environment. Any physical change in any component is reported automatically. The operating characteristics of the environment are also monitored, reporting changes in state as they occur so that appropriate action can be taken.

Fully Redundant Service Processors with Automatic Fail-over Capability:

Each module and component within the *AlphaServer* GS Series has a dedicated monitoring processor. The service-processing network of monitoring processors is available even in the absence of main power or if a component fails. All module or component information is tracked, including model variants, serial numbers and firmware levels.

Any change in component status, including loss of power or failure, is reported to the system console.

N+1 Fault-tolerant Power Subsystems:

The *AlphaServer* GS Series offers automatic and immediate fail-over with its N+1 fault-tolerant power capabilities. Should a power supply fail, application availability is not disrupted. Unique to this remain operational and applications continue to run. In addition, optional dual AC inputs are available to separate AC power grids for ultra-high availability in the face of external AC main power disruptions.

Highly Available Network and Storage Subsystems:

Many system failures can be caused by failures outside of the server. The *AlphaServer* GS Series can be connected to external subsystems in a way that promotes high availability for the system configuration and ensures the server itself does not fail in the event of an external hardware subsystem failure. Input/output multi-pathing is supported for storage and networks. By configuring redundant storage or network subsystems at your site, any component failure between the server and the external environment are tolerated, without loss of data or transactional integrity. Additionally, the GS Series console subsystem has no single points of failure. If multiple consoles are used, the failure of an

The AlphaServer GS system can tolerate failures external to the server

individual console results in automatic and transparent fail-over to another console – which becomes the control console for that partition or system.

Easy Serviceability and High Availability:

Compaq has performed extensive analysis on the root causes for component and system failures and designed the *AlphaServer GS Series* systems to improve serviceability and availability. Features include:

- > Fewer components and cables (which improves reliability)
- > Point-to-point links instead of busses
- > “Ready to Hot Swap” LED’s in CPUs for easy identification
- > Color coded building blocks, cables, and modules for “fool proof” identification by service personnel
- > Improved connectors with enhanced alignment to guarantee a perfect connection, without the risks of bent pins or off-center contacts which can slip due to vibration
- > Captive fasteners used throughout system on all serviceable hardware
- > Highest caliber components and modules used in critical subsystems

- > ECC on memory, cache, and all system data and instruction pathways to prevent data corruption and resulting system failures

- > Extensive factory “burn-in” to remove early failure modes

The result of Compaq's unparalleled innovation with the *AlphaServer GS Series* design, combined with Compaq *Tru64 UNIX* operating system and *TruCluster Server* software, has produced the industry's most available RISC/UNIX system

Compaq Tru64 UNIX Operating System:

The *Tru64 UNIX* operating system delivers industry leading UNIX system capabilities and leads the industry in customer satisfaction (DH Brown Report, March 2000¹). And the latest version of *Tru64 UNIX -- V5.1A --* brings new capabilities to the table for large-scale mission critical applications such as e-commerce, business intelligence, and business processing. The biggest advantage to *Tru64 UNIX --* and a unique capability on the market today -- is its single-system-image clustering and global systems-management technologies. This capability allows a cluster to be managed as a single system (discussed in more detail later in this document). Additional operating system availability features include:

- > **Workload management:** *Tru64 UNIX* workload management tools provide greater control of resources, improved application performance and availability, and simplified management. Partnering with Aurema, *Tru64 UNIX V5.1A* now includes the ARMTech technology bundled in the base operating system. This enables administrators to more easily control and reduce the impact of occasional runaway processes that would otherwise take over the whole system -- either accidentally or as a deliberate denial-of-service attack.

- > **Event management:** The *Tru64 UNIX* event management capability enables access to key event information for managing and tuning the system, resulting in faster diagnosis of problems.

- > **Online add and remove:** With *AlphaServer GS160* and *GS320*, online add and remove (OLAR) of CPUs lets you replace a faulty CPU or add a new CPU while the system is running.

“Analysts rate Tru64 UNIX V5 first in reliability, availability, and serviceability functions.”

¹DHBrown's 1999-2000 Operating System Function review, March 2000
[<http://tru64unix.compaq.com/dhbrown/osfr.pdf>]

- > **Operating system upgrades:** Upgrades to subsequent versions (V5.1 and later) of the operating system can be done without bringing the cluster down, increasing system availability.
- > **Dynamic tuning:** The *Tru64* UNIX operating system can be tuned while the system is running, maximizing uptime and availability.
- > **Alternative pathing:** The *Tru64* UNIX operating system allows multiple paths to any storage or networking device for elimination of single points of failure and increased availability.
- > **Multi-user path:** This feature allows on-line patch installation without bringing the system down, resulting in increased uptime and availability.
- > **Dynamic memory Isolation:** The *Tru64* UNIX operating system allows failing memory to be isolated to reduce unscheduled downtime.

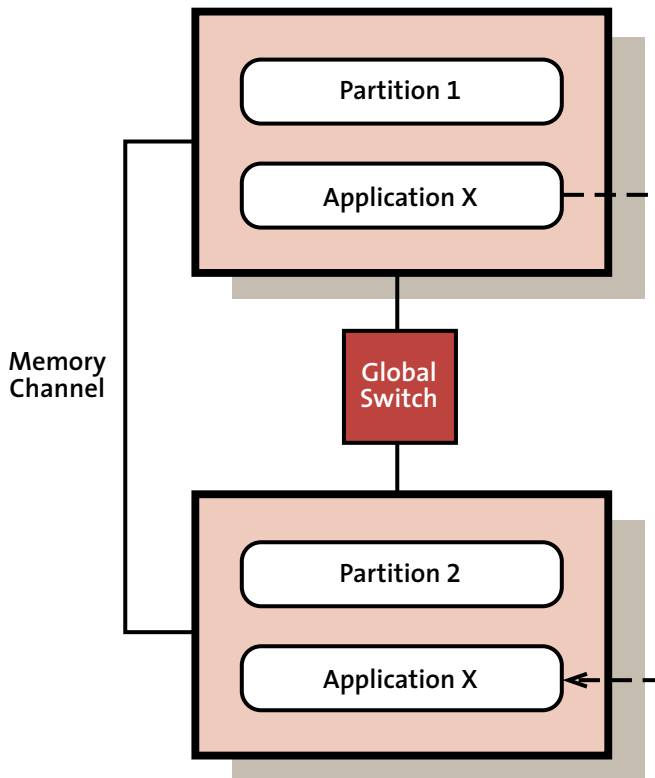
Enhancing Availability with Clustering

If you demand extreme availability, then you need clustering. The Compaq *TruCluster* Server V5 technology brought the ultimate in high availability to server consolidation environments. The *Tru64* UNIX V5.1A and *TruCluster* Server V5.1A releases extend those capabilities with increased levels of interoperability, high availability, scalability, manageability, and a robust *Tru64* UNIX Internet infrastructure.

A D.H. Brown study² found that the *TruCluster* Server on *AlphaServer* systems offer

the industries highest overall cluster functionality as well as the most comprehensive availability features.

TruCluster Server enables extreme availability for separate physical servers and high availability for system partitions within a single server. *TruCluster* Server V5 integrates tightly with servers operating *Tru64* UNIX V5 by providing automated load balancing, single system management, Cluster Application Availability framework, and scalability for the entire cluster-wide file system.



This *TruCluster* Server is operating within a single system and provides high availability via automated partition failover. In this scenario, partition 2 takes over the application running on partition 1 automatically and transparent to end-users

² DHBrown's Competitive Analysis of UNIX Cluster Functionality, March 2000
[\[http://tru64unix.compaq.com/dhba_ras.pdf\]](http://tru64unix.compaq.com/dhba_ras.pdf)

Automated Load Balancing: With automated load balancing, clients connecting to *TruCluster Server* are assigned to a cluster member with the lowest current load – whether a standalone server or a partition. By continuously rebalancing client connections, *TruCluster Server V5* ensures optimum performance and resource utilization. Even as workloads intensify, systems and partitions can be easily added or resized without affecting user performance.

Single System Image Management: *TruCluster Server V5* manages a cluster as a single system rather than a collection of multiple systems. This benefit substantially reduces management and operational costs. A cluster-wide file system also enhances storage management cluster-wide, providing improved data management, higher availability, and lower costs. In addition, application failover is faster and easier to implement with a cluster file system.

Cluster Application Availability (CAA): The CAA facility records the dependencies of, and transparently monitors the state of, registered applications. If a hardware or software failure prevents a system from running a service that supports an application, the fail-over mechanism automatically relocates the service to a viable system in the cluster, which maintains the availability of applications

and data. Administrators can manually relocate applications for load balancing or hardware maintenance.”

LAN-based Cluster Interconnect and Gigabit Ethernet Interconnect: With *TruCluster Server Version 5.1A*, clusters can be configured to use either the traditional Memory Channel interconnect or a LAN interconnect (Ethernet). The ability to configure LAN hardware as the cluster members’ interconnect media expands the range of cluster configurations possible. Especially for customers taking advantage of the *AlphaServer DS* series platform, *TruCluster Server* using 100 Mbps Ethernet LAN as the cluster interconnect provides a lower-cost cluster configuration. Gigabit Ethernet will be supported soon and allow the use of 1000 Mbps Ethernet adapter as the cluster interconnect.

Scalability: Should application requirements change, additional servers or system partitions can easily be added to a *TruCluster Server* environment. Combined with the system partitioning capability of the *AlphaServer GS Series*, Compaq provides an unprecedented level of flexibility to expand or reconfigure systems to meet your changing needs. Benefits include:

- > Create additional partitions within a single server

- > Expand the number of servers and system partitions across multiple servers

- > Expand clusters across physical servers and system partitions. In addition, the speed at which a cluster can expand is phenomenal – IT staff can add a cluster node in less than 15 minutes

Additional *Tru64 UNIX* scalability features include:

- > File systems can grow to multiple terabytes
- > Very Large Memory (VLM) technology for data-intensive computing requirements
- > Partitioning that allows a single system to be divided into up to eight partitions, each with a separate operating system image for segregation of test and production environments
- > Support for up to millions of concurrent users
- > Common cluster addressing using a single host name to access data and applications for any system in the cluster

Single system image management is a breakthrough feature unique to Compaq clusters

Compaq offers a wide variety of high availability services designed to keep you in business all the time

Disaster Tolerance Completes the Solution

Compaq provides disaster tolerance for solutions built on *AlphaServer* systems running *Tru64* UNIX with *StorageWorks* Data Replication Manager (DRM). DRM is built on software that provides either synchronous or asynchronous data shadowing over distances. It is synchronous up to 70 kilometers. Beyond that, data replication is asynchronous at this time. DRM is configured with storage at both the primary and remote locations. Each location may be either a single system or a cluster. By utilizing DRM with clustered systems one achieves the advantages of high availability and data continuity in the event of a disaster.

Services to Ensure High Availability

Special efforts are required to assure the highest levels of availability. Compaq offers a broad range of high availability services designed to keep you in business, all the time. *AlphaServer* GS series enable organizations to achieve high availability through server consolidation. Compaq consolidation services offer the necessary system integration services, architectural methodology, and expertise to help you maintain high availability in the most cost-effective way. For extreme availability needs, Compaq will partner with your organization to deliver up to 99.999 percent uptime.

Availability Assessment:

This service provides an assessment of the computing environment and availability objectives including hardware, system software and the physical environment.

Installation and Startup

Services: These services ensure that the hardware and operating system have been correctly installed from the outset. Services include equipment unpacking, inspection, assembly, installation, testing, diagnosis, installation of service tools and orientation. Software is also configured and tested.

Availability Review:

This service offers a customized and comprehensive assessment of computing objectives and availability with an emphasis on management of the system, the applications, the network, system software, hardware and the physical environment. Compaq works with you to prioritize availability risks through an analysis of your business goals and provides specific recommendations.

Availability Partnership:

This customized service provides a continuous improvement plan for maximizing the availability of your computing environment. Compaq analyzes the physical environment, hardware configuration, software products, network functions and overall operations. Upon completion of the analysis, strategies are recommended to help meet your availability goals. Recommendations may include a resident engineer, an on-site spares program, or a change management plan.

99.999% Uptime Guarantee:

For business critical environments requiring minimum downtime, Compaq offers a 99.999 uptime guarantee with *AlphaServer GS Series* systems. Based on a unique partnership between Compaq and your IT organization with the uptime guarantee, Compaq will share the responsibility and cost of downtime with you. By partnering with Compaq, you will achieve proactive services and the responsiveness needed to keep your system and business up and running.

Internet Security Health Check:

If your business is connected to the Internet, this is a must-have service. Using a comprehensive security risk detection and analysis solution from Internet Security Systems, Inc. (ISS), Compaq security experts assess your basic Internet configuration, including communication services, operating systems, key applications and routers. Compaq provides a detailed report identifying vulnerabilities, prioritizing security risks and recommending a plan of action. Follow-up services are available to help you implement Compaq's recommendations.

Network Management:

Compaq has extensive experience delivering network management solutions around the world. Services include network health check, network optimization and a network performance advisory service. Compaq can assess and implement network performance solutions and monitor network performance while lowering WAN and LAN cost.

System Management Support:

This service provides advanced system management expertise and assistance to augment your IT staff. A variety of additional Compaq services are available for your full range of server consolidation needs. See compaq.com/services/ for more information.

Summary

For organizations experiencing rapid growth and requiring constant uptime, a proven and reliable high-availability server consolidation solution provides the virtually unstopable service demanded by users, partners, and customers. Compaq's enterprise server consolidation solution provides the unparalleled availability and performance required to keep your critical operations in business.

The advanced availability features of the *AlphaServer* GS Series, further enhanced with the Compaq *Tru64* UNIX and *TruCluster* technology – the high availability and simple cluster management solution - help ensure

continuous uptime. Features such as on-line maintenance and upgrades, an internal network of service processors, resilient power subsystems, high availability external subsystems, and advanced reporting make the GS Series the industry's most highly available RISC/UNIX system. In addition, Compaq high availability services will help your organization achieve and maintain extreme availability.

If you need ultra-high availability, Compaq's server consolidation solutions will meet your needs. Regain control of your enterprise by contacting your authorized Compaq value added reseller today or visiting Compaq on the web at compaq.com.

For more information on the *Tru64* UNIX operating system and *TruCluster* Server, visit us at tru64unix.compaq.com

For more information on *AlphaServer* GS Series visit us at: compaq.com/alphaserver/gs_series.html

To learn more about server consolidation visit compaq.com/solutions/serverconsolidation

compaq.com

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, the Compaq logo, ActiveAnswers, CustomSystems, NonStop, and OpenVMS Registered in U.S. Patent and Trademark Office. Alpha, AlphaServer, StorageWorks, Tru64, and TruCluster are trademarks of Compaq Information Technologies Group L.P. Microsoft and Windows NT are registered trademarks of Microsoft Corporation in the United States and/or other countries. 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. Compaq Computer Corporation shall not be liable for technical or editorial errors or omissions contained herein. The information in this document is subject to change without notice.

Copyright ©2001 Compaq Computer Corporation. All rights reserved. Printed in the U.S.A.

Extreme Availability with Compaq's UNIX Enterprise Server Consolidation Solution White Paper prepared by High Performance Server Division

First Edition (December 2000) Rev. A. Second Edition (July 2001) Rev. B

Project #

Rel.#XX/XXXX XX XX XX

COMPAQ

Inspiration Technology