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Why Buy Compaq Memory?

In today's business environment, the very ability of a department or an entire company to do business may hang on the reliability and accessibility of its server network. The fate of mission-critical data and programs rests on the reliability of the memory in which they are stored. Compaq has developed industry-leading quality standards and performance testing to ensure that the memory modules used in Compaq servers meet the highest standards.

EXECUTIVE SUMMARY

There has been and continues to be a worldwide shortage of SIMMs to meet the industry's growing demands, and servers are requiring larger and larger memory capacities. The temptation has never been greater to let standards slip to ease the search for adequate supplies of usable memory. However, the Compaq mission and business strategy are based on this tenet: Compaq will not sacrifice quality to achieve greater quantity of shipped products. For this reason, Compaq has established and maintains the highest standards for memory in the industry. This paper explains the risks of using non-Compaq memory in a Compaq server.

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Why Buy Compaq Memory?

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INTRODUCTION

In purchasing or upgrading a mission-critical server, it is imperative to know that the memory used will be of high quality and 100% compatible with the other components and subsystems of the server. For this reason, Compaq subjects memory modules to the toughest testing and qualification process in the industry. Compaq quality and compatibility testing identifies the most reliable memory for use in each Compaq server. Compaq designers and engineers, with their intimate knowledge of all Compaq server subsystems, are uniquely qualified to advise customers about the best memory configurations to ensure reliable access to mission-critical data stored on Compaq systems.

It is not unusual for a Compaq customer to consider purchasing memory from a third-party memory distributor. The logic goes like this: Since a finite number of memory manufacturers produce all the SIMMs (Single In-Line Memory Modules) used in the computer industry, is there any real difference between memory modules with a Compaq label and memory modules without a Compaq label, particularly if both originate from the same memory manufacturer? A customer who does not ask that question before trying third-party memory modules may be headed for trouble—because all memory is *not* created equal.

The purpose of this paper is to explain the risks of using non-Compaq memory in a Compaq server. This paper identifies:

- Typical memory problems that can affect operation of servers.
- Industry practices that may reduce the reliability of memory purchased from third-party distributors.
- Industry leading standards that Compaq has established for memory used in Compaq servers.

THE NATURE OF MEMORY

Good, reliable memory is the result of several factors:

- sound design
- quality manufacturing processes
- rigorous, real-world testing
- identifying and rejecting flawed parts
- diligently correcting problems if they are discovered

Every memory subsystem, however well designed, has the possibility of experiencing a soft or hard memory device failure. Soft errors, which often result from a temporary loss of charge in a DRAM (Dynamic Random Access Memory) cell, cause data to be stored incorrectly in a memory location. Subsequent accesses can correctly store data into that same cell. A hard error, on the other hand, is a physical failure within a DRAM cell that prevents data from being stored reliably in one or more locations. Failure of a single DRAM can abruptly halt a system.

Because the possibility of a failure exists for every memory device, schemes have been developed to provide a measure of data protection in the event of bit errors. **Parity**, the simplest scheme, detects odd numbers of bit errors and halts the system before the errors go farther. To detect and act upon memory errors without halting the server, **Compaq Error Checking and Correcting Memory** (ECC) has been designed into memory subsystems for Compaq ProSignia 300 servers, the Compaq ProSignia 500 5/120 server, and all Compaq ProLiant servers. It can detect single and double bit errors and can correct single bit errors without interrupting system operation. Uniquely with Compaq servers, ECC errors are logged into Compaq Server Health Logs, which store information in non-volatile RAM for access by administrators.

These data protection schemes are extremely valuable in providing a safety net for *good* memory. However, they cannot compensate for bad memory.

The integrity of any memory system begins with the reliability of its SIMMs. Unfortunately, the very nature of memory operation presents the greatest challenge in identifying SIMMs that will work reliably in a specific server.

Memory operates under continuously changing conditions. An operating system puts great stress on memory—stress that changes in cause and intensity. Moreover, key operating parameters such as temperature, signal strength, and current all fluctuate. Not surprisingly, most memory problems result from the interaction of a unique set of individual stresses that occur randomly. This means that memory failure patterns are not predictable. Therefore, only tests that stress memory modules with random data patterns can uncover the potential for most memory failures.

INDUSTRY PRACTICES AFFECTING MEMORY QUALITY

The random nature of memory errors and the interdependence of server components demand exacting memory standards and extreme care in selecting memory for use in high availability servers. Only rigorous, real-world testing and continual vigilance can spot potential problems and ensure that the components and subsystems of a server will work together reliably.

Memory Manufacturers

Most memory systems today are designed primarily for the desktop PC market, which has different requirements than the server market. Many server manufacturers continue to use memory subsystems that have been designed for desktop PCs and offer little or no memory protection. Unfortunately for users, memory testing by manufacturers is limited and typically performed at the DRAM level only, before DRAMs are assembled into SIMMs. Because manufacturers rarely do real-world testing, many potentially serious memory problems may not surface during manufacturer testing.

DRAM problems usually occur because the manufacturer has not designed the DRAMs to handle the actual conditions to which they will be subjected in an operating environment. Manufacturer testing is inadequate to identify randomly occurring memory problems. Equally important, manufacturers do not test their SIMMs in all server products. SIMMs that appear to function well in one server model may fail in another. Another important consideration is that characteristics and quality of SIMMs from a manufacturer can vary significantly from lot to lot. Compounding that problem are variations between SIMM revision levels from the same manufacturer. The fact that SIMMs of a previous revision level performed well in a given system under real-world tests is no guarantee that the next revision level of the same SIMM will perform identically. For all these reasons, reliance on testing and quality checks by the memory manufacturer leaves the door wide open for memory problems and server downtime.

Third-Party Vendors

For their part, third-party vendors simply distribute SIMMs and memory modules produced by memory manufacturers. They generally do no quality or compatibility testing of their own; they rely on the testing and quality measures of the manufacturers. In general, third-party vendors also lack in-depth knowledge of server systems. Without clear understanding of the interdependency of server subsystems, third-party vendors cannot anticipate many potential memory problems. Rarely does a third-party vendor have full technical knowledge of specific Compaq system(s).

Unfortunately, another point of potential risk has arisen. Compaq has determined that some third-party vendors have sold products that had been mislabeled as Compaq memory.

INDUSTRY STANDARDS FOR MEMORY

Worldwide, three organizations work cooperatively to develop standards for electronic components. In the U.S. the Solid State Products Engineering Council, better known by its acronym JEDEC, develops standards to achieve a common definition of the functionality and mechanical features of electronic components. JEDEC is a council operating under the auspices of the Electronic Industries Association (EIA). The EIA has counterparts in Japan (the EIAJ) and in Europe (the IEC). These organizations and their subcommittees meet periodically and attempt to maintain some consistency among standards developed by each organization.

Within JEDEC, the JC-42 committee develops standards for memory devices to assure that parts from all suppliers function in the same manner. These standards do not, however, assure that parts from all suppliers will work in the same application. The JD-42 committee develops standards for the functionality of memory devices such as DRAMs, SRAMs (Static Random Access Memory), EPROMs (Erasable Programable Read Only Memory), and memory modules. The functionality includes definition of operating modes of the devices and pin assignments in various package or module types. It does not include standardization of signal timing for operating the memory device.

As an industry leader, Compaq strongly supports the development of industry standards and participates in the JC-42 memory committee to ensure that:

- Standards for new memory devices or modules provide the functionality needed for Compaq products.
- Compaq designers are developing products that include the standards being developed within the industry.

Standards are very valuable to the industry and to users for producing interchangeable parts. Before assuming that parts are "standard," however, users should consider two important points:

- Setting industry standards is a time consuming process, frequently requiring 6 to 24 months. For parts that are new to the industry, the standard may not yet have been defined. It is not uncommon that the first parts available in the industry and the first used by manufacturers may not conform exactly to what later will be adopted as the standard.
- The fact that a memory component meets an industry standard does not guarantee that it has been tested and performs satisfactorily in all applications.

COMPAQ QUALITY STANDARDS

Compaq takes a proactive role in verifying the quality and reliability of components used in Compaq products. Compaq servers are designed to use industry standard components, and Compaq purchases memory components only from certified suppliers whose SIMMs meet Compaq specifications. Compaq provides a more thorough evaluation of a memory module than any memory manufacturer.

Compaq is a certified ISO 9000 factory. The company purchases industry standard SIMMs and then assembles them into memory modules designed specifically for Compaq servers. For use in Compaq memory subsystems Compaq purchases SIMMs only from manufacturers that have been designated as approved Compaq vendors. Before a manufacturer is added to the Compaq Authorized Vendor List, Compaq engineers thoroughly investigate the designs, manufacturing processes, testing, and quality assurance of SIMMs produced by that vendor. Only manufacturers that meet Compaq standards are placed on the list of approved vendors from which Compaq purchasing agents can procure memory.

When a lot of purchased SIMMs arrives from the manufacturer, the SIMMs do not go directly into component inventory. Rather, they are held until the lot passes Compaq in-house qualification tests. Compaq quality and compatibility testing screens memory arriving from manufacturers to detect and eliminate potential problems and to identify reliable memory for use in each Compaq product. The specifications for each Compaq server identify approved memory modules that have passed this exacting scrutiny.

As an initial level of in-house testing, Compaq engineers do full characterization of each SIMM revision for use in specific memory configurations. For this characterization, Compaq engineers run early production memory samples through a large battery of tests that have proven effective in uncovering memory design problems. These tests check timing and I/O voltages, confirm that the SIMM is within the specified parameter range, and ensure that it performs acceptably.

A Compaq-designed meatgrinder test bombards the memory randomly to apply real-world stress. Meatgrinder is a system level test that runs under the Microsoft Windows NT operating system. It subjects memory to the kind of stress it will have to withstand under actual operating conditions with many applications running. This testing frequently uncovers significant memory problems. For example, it has revealed basic problems in SIMM design that cause memory failures. It has also spotted occasions when a manufacturer has shipped to Compaq not the approved SIMM that was ordered, but a new, as yet unapproved revision of that SIMM. That practice is totally unacceptable because Compaq qualifies and approves specific memory revisions individually.

If purchased SIMMs pass this initial battery of tests, they are received into Compaq inventory. If purchased SIMMs fail this initial battery of tests, however, they are rejected. When in-house testing uncovers a memory problem, Compaq notifies the memory manufacturer and works with the manufacturer to assist in resolving the problem.

During production, if new or additional problems arise with received SIMMs, Compaq tests a much larger sample from each lot of memory on Compaq's Advent Tester, a multimillion-dollar, state-of-the-art memory testing machine. At this point, each sample tested must achieve a 0.1% average quality level to be accepted. If a single failure occurs in the sample, then the entire lot of memory is tested. In this single-point testing, individual SIMMs that do not meet this standard are rejected.

As new memory manufacturers are entering the market, Compaq is identifying and resolving increasing numbers of serious memory problems through in-house qualification testing—problems that otherwise would plague system users. If an unusual or extraordinarily severe memory problem arises with SIMMs from a specific manufacturer, Compaq has and will continue to develop additional test procedures and work with the manufacturer to resolve those problems.

SO WHY BUY COMPAQ MEMORY?

There are several advantages in using genuine Compaq-brand memory. First, Compaq ensures that every memory component authorized for use in a specific Compaq server will work in that server. Compaq provides thorough evaluation of memory modules on their own and as they interact with the other components and subsystems in the server. Compaq does not accept, use, or ship memory suspected of having problems.

Second, no one outside the Compaq organization has comparable knowledge of and experience with Compaq systems. Therefore, Compaq engineers are uniquely qualified to evaluate a customer's changing server needs and to identify the most cost-effective memory configuration to optimize reliability of Compaq servers.

Third, Compaq protection against faulty memory extends even further through the Compaq warranty. Compaq is confident of the quality and testing performed on Compaq components. Therefore the company warrants all products manufactured or distributed by Compaq Computer Corporation. This warranty is not affected by the installation or use of parts not manufactured or distributed by Compaq; that is, third-party parts including memory. However, the Compaq warranty *will not* cover Compaq products that have been damaged or rendered defective by the installation or use of third-party parts.

The bottom line? Customers who use Compaq memory know that they are using a verified product that has no bad design techniques, inadequate grounding, or other basic flaws. They will have the highest degree of confidence that the memory will work flawlessly in their Compaq systems. If, on the other hand, customers use memory components not purchased from Compaq, they cannot be *sure* that the memory won't be functionally incompatible, that it won't have functional violations, or that it won't be too slow for their systems.

CONCLUSION

There has been and continues to be a worldwide shortage of SIMMs to meet the industry's growing demands, and servers are supporting larger and larger memories. The temptation has never been greater to let standards slip to ease the search for adequate supplies of usable memory. However, the Compaq mission and business strategy are based on this tenet: *Compaq will not sacrifice quality to achieve greater quantity of shipped products.* For this reason, Compaq has established and maintains the highest standards for memory in the industry and is the best choice for building a reliable server solution.