WHITE PAPER

January 2001

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NOTE: *The founding of Compaq in 1982, and its creation of the first PC that was truly compatible with an IBM PC, defined the idea of compatibility in the PC industry. The very origin of the Compaq name demonstrates this focus:* ***COMPA****tibility +* ***Q****uality =* ***COMPAQ****.*

Industry Standards in Compaq Deskpro and iPAQ Desktops and Deskpro and Professional Workstations

ABSTRACT

This paper demonstrates a number of important points and addresses common questions related to industry standards:

- *Compaq Deskpro PCs and Workstations do not require proprietary options and software solutions. Customers can choose from a wide range of 3rd party options and software, which lowers the cost of upgrading and servicing PCs.*
- *The overall solution for Compaq Deskpro PCs and Workstations is designed for a corporate computing environment, using industry-standard design specifications and components. This ensures interoperability, compatibility, and ease of implementation within customer environments.*
- *Compaq leads the PC industry in the development and promotion of industry standards by partnering with other companies and working with industry forums. This allows Compaq to provide PCs with longer and more stable lifecycles.*

INTRODUCTION

Where industry standards exist, Compaq strives to ensure that all of its products and components comply. Where industry standards do not exist, Compaq strives to ensure compatibility with other industry products to the greatest extent possible.

Compaq goes to great lengths to ensure that the components and software drivers incorporated into its PCs meet or exceed industry standards. As rigorous tests are completed and issues identified, information is fed back to the supplier, whose engineers and designers work closely with their Compaq counterparts. Only when Compaq quality goals are met is the component incorporated into a product bearing the Compaq name.

In cases where the improvements made to Compaq components exceed the requirements of other computer manufacturers, component suppliers sometimes elect not to make all of the Compaq required changes to their general-market product. As a result, components integrated into Compaq products may have different features than the same brand name component found in non-Compaq PCs or sold as stand-alone components. This ***does not*** *mean that the Compaq implementation is proprietary. On the contrary, it is completely industry standard, but has improved functionality and/or higher quality and reliability. Although the Compaq-installed component or software driver may differ slightly from the product available on the open market, it is industry standard. If the device available on the market is fully compliant with industry standards, it will work in a Deskpro or Workstation Series computer.*

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SOFTWARE

There are guidelines and good practices of software design, but there is not a single set of industry standards for software. As with many PC components, software standards have evolved over time into de facto standards from a variety of sources including, but not limited to, first-to-market solutions, popular solutions, development guides, and industry groups. The following table identifies common industry questions concerning software and the way Compaq addresses these industry questions:

Software Compatibility	
Customer Concern	**Response**
Does Compaq use proprietary solutions?	■ Compaq uses industry standard components and drivers. During extensive product testing, Compaq may request changes only for performance, compatibility, or quality issues that sometimes result in unique revisions. We then work with the specific industry suppliers to incorporate these changes into their public releases. ■ Compaq plays a major role in implementing and stabilizing new standards for the industry. Occasionally these new standards can result in compatibility issues with older technologies. Compaq believes including new standards promotes longer and more stable lifecycles and supports the customer better over time.
Does Compaq use obsolete drivers on new platforms?	■ In order to ensure the highest-level quality, Compaq uses software and drivers that have been rigorously stress-tested in an *integrated environment* with other hardware and software options we deliver. Software and hardware vendors usually test their Web driver for their device only, not in an integrated environment with many other devices. ■ Deploying the latest drivers on new platforms does not always guarantee a good user experience, due to untested interoperability and compatibility issues. Compaq provides later versions of drivers on the Web after proper testing for those customers that chose to upgrade; however we do not rush to provide the latest versions since they are not guaranteed to be stable. Software is only changed if integration issues are introduced when new modules are added. ■ Compaq implements a “Stable and Consistent” message on certain program families to ensure few or no changes in software over time for the many customers who require this.

Software Compatibility	
Customer Concern	**Response**
Why doesn't Compaq add additional, popular 3rd party drivers to its software images?	■ Compaq requires every driver installed in its image to meet a high standard before shipping it to the customer. Compaq only provides certified (for example, Microsoft® Logo) drivers in its software images and on the Web. ■ Compaq works very closely with Microsoft to ensure that we support the latest options possible in the retail operating system. This leverages both Compaq and Microsoft testing facilities to ensure the greatest compatibility and quality.

HARDWARE

Compaq *Deskpro* and Workstation platforms support industry standard add-in and expansion devices. The table below shows some of the more common standards supported. **Since the standard versions are constantly changing, please refer to your product documentation to determine which standards a specific product supports.**

Hardware Compatibility Supported Hardware Standards	
Memory	Intel PC100 and PC133 SDRAM Memory Specification* DIMM Connector per JEDEC 168-pin DIMM standard. Intel® PC SDRAM Serial Presence Detect (SPD) Specification. RDRAM connectors - Direct Rambus RIMM Connector Specification. RIMM modules - Direct Rambus RIMM Module Specification. SPD - Direct Rambus SPD Specification. Continuity Modules - Direct Rambus RIMM Continuity Module Specification.
Hard Drives	ATA-33, ATA-66, ATA-100, ANSI ATA/ATAPI Specification, ATA/ATAPI Drive Self Test
CD, DVD, CD-RW and other ATAPI Drives	ANSI ATA/ATAPI, SFF 8070, SFF 8090
Storage Expansion Bays	5 ¼" form factor (ASE and metric screws provided) per ANSI ATA-ATAPI Specification. Two Standard IDE connectors available (supports 4 devices) Diskette drive connector available (two supported)
Peripheral Component Interconnect (PCI)	PCI compliant, as defined by the PCI Special Interest Group. See product specific documentation for exact revision
AGP (Accelerated Graphics Port)	AGP expansion slot meets the Accelerated Graphics Port Interface Specification

Hardware Compatibility Supported Hardware Standards	
NIC (Network Interface Controller)	IEEE 802.3 10BASE-TX Ethernet IEEE 802.3u 100BASE-TX Fast Ethernet Intel/IBM Alert on LAN Intel/IBM Wake On LAN Intel Wired for Management Compliant
Serial ports	EIA RS-232 compliant with NS16C550 Compatible UARTs
Parallel port	Standard Mode IBM PC/XT, PC/AT, and PS/2 Compatible Bi-directional Parallel Port Enhanced Parallel Port (EPP) Compatible - EPP (IEEE 1284 Compliant), IEEE 1284 Compliant Enhanced Capabilities Port (ECP)
Keyboard/Mouse	8042 keyboard controller uses Phoenix Firmware and is connected to PS/2 connectors
USB (Universal Serial Bus)	Universal Serial Bus Specification
Video Connector	VESA DDC2B compliant. VESA VSIS compliant
Energy Conservation	EPA ENERGY STAR Compliant
Microsoft Windows® Logo	Microsoft WHQL, PC99, and Fast Boot compliant
EMC/Safety	Meets all applicable EMC and Safety Standards. Refer to the Safety and Regulatory guide on the *Compaq Reference Library* CD.
Legacy PC-AT standards	Support for interrupt controllers, timers, counters, DMA controllers, Real Time Clock, and floppy drive.

* Most specifications are linked to their respective Web sites. Refer to this White Paper at http://www.compaq.com/support/techpubs/whitepapers/ to access the URLs. Refer to document 13SE-1200A-WWEN.

FIRMWARE (BIOS)

Compaq *Deskpro* and Workstation platforms typically implement Compaq-designed firmware. Compaq BIOS, whether licensed or internally developed, is industry standard. Industry standards define most of the interfaces and components of BIOS designs, but there is no single industry standard BIOS. BIOS interface standards have been forged from industry groups and de facto standards. As with any component of the system, the firmware developers and testers take great care in providing support for the latest industry standard functionality. Internal Compaq test teams exhaustively test the BIOS products for compatibility. Compaq also submits its firmware products to extensive testing from outside sources such as Microsoft Windows Hardware Quality Labs (WHQL). While Compaq BIOS designs meet these standards, it may contain value-add features that lack industry standards. In these cases Compaq works within the industry with partners to standardize BIOS functionality where appropriate.

Compaq BIOS designs undergo a rigorous quality assurance process, which includes both internal and independent compatibility testing. Compaq participates in large industry gatherings, which allow third party hardware and software providers to test new designs in the latest Compaq *Deskpro* and Workstation platforms. These meetings allow the Compaq BIOS designers to test against the latest hardware and software products before they are available to the market. Many Compaq systems equipped with Compaq BIOS designs are recognized by Microsoft, Intel, and other partners as reference systems for development. Compaq works closely with its vendors to ensure optimal system integration.

Compaq BIOS products provide the customer with a wide range of configuration options. While Compaq may not have designed or contributed to the specification formation, Compaq designs implement the standards in a timely and thorough manner to assure the customer of a fully flexible product.

The following table shows some of the more common standards supported by Compaq BIOS.

Firmware Compatibility	
Technology/ Standard	**Standard's value to the product**
Advanced Configuration Power Interface (ACPI)*	ACPI allows operating system controlled configuration and Power Management. This interface is necessary to fully unleash the power of Windows 98 and Windows 2000 products.
Plug and Play	Plug and Play is the technology that supports automatic configuration of PC hardware and interfaced devices in the Windows 95 operating system.
Wired for Management (WfM)	The Wired for Management (WfM) Initiative is an industry-supported effort to make systems easily manageable and universally managed in a network environment, without sacrificing agility or performance. This initiative's value is to enable products to be centrally managed over networks to reduce Total Cost of Ownership (TCO).
BIOS Boot Specification	The BIOS Boot Specification provides the user with increased flexibility in selecting the unit boot media order (diskette drive, hard- drive, CD-ROM, and third-party plug-in adapter-controlled media).
ATAPI Removable Media Device BIOS Specification	This specification provides the BIOS interface for large capacity ATA removable ATA devices.
Multiprocessor Specification (MPS)	Specification utilized to provide multiprocessor and system configuration information for Windows NT® 4.0
BIOS32 Service Directory	Provides a single searchable signature for BIOS services that are designed to be utilized by 32-bit BIOS clients.
Post Memory Manager	Defines a method for allocating RAM buffers to be used by option ROM configuration needs during POST.
El Torito CD-ROM Boot Specification	Standardizes information needed to make a CD-ROM bootable.
Boot Integrity Services (BIS)	Ensures that a boot image download through the network has not been corrupted.
Alert on LAN	Allows BIOS to send a notification to the network when the system encounters certain hardware or software failures, such as the system does not successfully boot.
Preboot Execution Environment (PXE)	Allows BIOS to boot a system without an operating system installed on its hard drive and download the software from a server.
* Most specifications are linked to their respective Web sites. Refer to this White Paper at http://www.compaq.com/support/techpubs/whitepapers/ to access the URLs. Refer to document 13SE-1200A-WWEN.	

LEADERSHIP IN INDUSTRY STANDARDS

Compaq is committed to working with the industry to ensure compatibility and establish standards. Compaq designs implement these standards in a timely and thorough manner to assure the customer of a fully flexible product. The following table highlights activities in which Compaq has led in the formation of various Industry Standards.

Compaq Partnerships and Desktop Standards Leadership

Technology/ Standard	Compaq's Role in the Standard
Advanced Configuration Power Interface (ACPI)*	■ Critical early input to the ACPI specification ■ First OEM to supply Microsoft with both ACPI hardware and firmware to develop ACPI support in both Windows 98 and Windows 2000 ■ Intel recommends several Compaq products as reference designs for its Instantly Available PC initiative due to the support of the ACPI "Suspend to RAM" sleep state.
Plug and Play	■ Started shipping Plug and Play ready hardware 18 months prior to the release of Windows 95 ■ Released the Plug and Play BIOS 9 months prior to any other vendor ■ Co-authored the Plug and Play specification that was then made available to the industry for implementation
Peripheral Component Interconnect (PCI)	■ Co-authored PCI 1.0, 2.0, 2.1, 2.2 specs ■ Primary author of PCI electrical specification ■ First PCI-to-PCI bridge chip ■ First processor with PCI Bus (Alpha 21066) ■ First to ship Pentium® PCI system in 1994 ■ PCI SIG steering committee directors since inception
Universal Serial Bus (USB)	■ Co-authored the USB specification ■ Developed and licensed the ASIC VHDL code (OHCI) to over 20 ASIC suppliers to establish USB as a standard in the industry ■ Shipped USB connectors on Compaq *Deskpro* Series PCs since 3Q96 ■ Allows legacy keyboard and mouse support
Drive Self Test (DST)	Compaq developed DST in collaboration with several leading hard-drive manufacturers and the industry standards body ANSI standardized it. Drive Self Test is now part of the ANSI ATA/ATAPI-5 specification. Compaq enhanced DST to give a user access to this self-test in F10 Computer Setup. This enhancement of DST is called Drive Protection System (DPS).

Compaq Partnerships and Desktop Standards Leadership	
Technology/ Standard	**Compaq's Role in the Standard**
Desktop Management Interface (DMI)	■ Founding member of DMTF ■ Co-author of the original DMI Specification, which is now known as System Management BIOS Reference Specification or SMBIOS ■ Current member of the DMTF Steering and Technical Committees ■ *Deskpro* Series PC was the first commercial desktop to introduce desktop manageability ■ First PC vendor to feature manageability across the entire commercial line
SMART (Self Monitoring Analysis and Reporting Technology) hard-drives	Led the development effort and co-authored the specifications for SMART hard drives which became part of the ATA/ATAPI specification
Net PC Technologies	Co-authored the Net PC specification and was one its most active promoters. Shipped one of the first Net PCs in 1997.
Web-Based Enterprise Management (WBEM)	■ Drove definition of Web-Based Enterprise Management (WBEM) architecture ■ Drove involvement of other key participants and broad industry support
Wired for Management (WfM)	Co-authored the WfM specification and was one of its most active participants. First PC vendor to ship WfM compliant systems
BIOS Boot Specification	Co-author of a standard to allow the end user selection of multiple boot devices and the ability to change the change the device boot order.
ATAPI Removable Media Device BIOS Specification	Co-author of a standard for accessing data on ATAPI removable media for high capacity.
Security	Led the formation of the BioAPI Consortium (Biometrics) to establish industry standards for the Application Programming Interfaces (API) for biometric technologies. One of the first vendors to ship units implementing Boot Integrity Services (BIS) standard.
Enhanced Disk Drive Specification	Contributed to enhancements included in version 3.0 of the specification, which provided compatibility between fixed and removable media.

ACRONYMS

AGP – Accelerated Graphics Port	OHCI –Open Host Controller Interface
ANSI – American National Standards Institute	PC-AT – Personal Computer introduced in 1984
API – Application Program Interface	PCI – Peripheral Component Interconnect
ASIC – Application Specific Integrated Circuit	POST – Power On Self Test
ATA – AT Attachment	PS/2 – Personal System/2
ATAPI – AT Attachment Packet Interface	PXE – Preboot Execution Environment
BIS – Boot Integrity Services	SMART – Self Monitoring Analysis and Reporting Technology
DMI – Desktop Management Interface	SMBIOS – System Management BIOS Reference Specification
DMTF – Distributed Management Task Force	SPD – Serial Presence Detect
DPS – Drive Protection System	UART – Universal Asynchronous Receiver Transmitter
ECP – Enhanced Capabilities Port	USB – Universal Serial Bus
EIA – Electronic Industries Association	VESA – Video Electronics Standards Association
EMC – Electromagnetic Compatibility	VHDL – VHSIC Hardware Description Language
EPP – Enhanced Parallel Port	VSIS – Video Signal Standard
IEEE – Institute of Electrical and Electronics Engineers	WBEM – Web-Based Enterprise Management
JEDEC – Joint Electronic Device Engineering Council	WfM – Wired for Management
MPS – Multiprocessor Specification	WHQL – Windows Hardware Quality Labs
NIC – Network Interface Controller	

Notice

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First Edition (January 2001)