CHAPTER 4

Workstation PC 99

This chapter provides a summary of the key requirements for workstations designed as PC 99 systems. If there is a conflict with requirements or recommendations made elsewhere in this guide, the items in this chapter have precedence for workstations. Unless a specific requirement or exception is defined in this chapter, all PC 99 requirements apply as defined in Chapter 3, "PC 99 Basic Requirements."

Important: The system requirements defined in this chapter provide guidelines for designing PC systems that will result in the optimal user experience with typical Win32-based applications running under the Microsoft Windows 2000 Professional operating system. These design requirements are not basic system requirements for running the Windows 2000 Professional operating system.

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Workstation Design Requirements

This chapter describes the requirements that define a workstation optimized to run Windows 2000 Professional and to support Win32-based applications or 64-bit software. Workstation PC is a platform for users whose principal computing tasks involve running mission-critical networked applications, engineering or scientific applications, media-authoring tools, or software-development tools.

Although Windows 2000 Professional is used on stand-alone systems, the PC 99 system requirements support the more common use of Windows 2000 Professional as a platform for network productivity.

The key design issues for workstations include processor, memory, and bus architecture requirements that support intensive computational activities.

Note: It is recognized that OEMs supply Workstation PC systems to customers with specific feature requirements. For example, a customer might want to insert network adapters at the end-user site. However, a Workstation PC system submitted for compliance testing must include all required features.

4.1. Workstation meets all requirements for Office PC 99

Required

Each component indicated as a requirement for an Office PC system is also a requirement for workstations, as defined in Chapter 3, "PC 99 Basic Requirements."

Note: Systems designed to run only on Windows 2000 are not required to meet PC 99 requirements for legacy Plug and Play support. If the system is designed to run either Windows 98 or Windows 2000, it must meet all PC 99 requirements for legacy Plug and Play support.

4.2. Workstation performance meets Workstation PC 99 minimum requirements

Required

Minimum Workstation PC 99 performance requirements include the following:

- Microprocessor performance equivalent to a RISC-based processor or Intel Architecture 400 MHz or greater processor
- 128 MB RAM, minimum
- Minimum 512K L2 cache (per processor for multiple processors)

PC 99A correction: The minimum required L2 cache is 256K per processor for Workstation systems.

The system must be able to cache all the physical memory that it claims to support.

4.3. Workstation supports multiple processors

Recommended

For systems in which more than one Intel Architecture processor can be installed, the system must employ those processors symmetrically and must comply with the ACPI 1.0 specification and *MultiProcessor Specification* (MPS), *Version 1.4* or later. Support for both MPS 1.4 and ACPI helps customers through the transition from Windows NT 4.0 to Windows 2000. ACPI will eventually supersede MPS.

An ARC-compliant or ACE-compliant RISC-based system meets the requirements for multiprocessor support.

If multiprocessor support is provided, each processor must have a separate L2 cache.

4.4. Workstation RAM can be expanded

Recommended

If the capability for expanding RAM is implemented, workstation RAM must be capable of being expanded to 1 GB and should be capable of being expanded to at least 2 GB. The system must be able to cache all the physical memory that it claims to support.

4.5. Workstation system memory includes ECC memory protection

Required

The system memory and L2 cache must be protected with Error Correction Code (ECC) memory protection. All ECC RAM visible to the operating system must be cacheable. The ECC hardware must be able to detect at least a double-bit error in one word and to correct a single-bit error in one word, where “word” means the width in bits of the memory subsystem. A detected error that cannot be corrected must result in a system fault.

4.6. Workstation includes APIC support

Required

The workstation must include Advanced Programmable Interrupt Controller (APIC) support that complies with ACPI 1.0 by including the Multiple APIC Description Table (Section 5.2.8).

Features such as targeted interrupts, broadcast interrupts, and prior-owner interrupts must be supported. Intel Architecture processor implementations can use the Intel APIC component.

4.7. Workstation includes high-performance components

Recommended

The basic PC 99 requirements support high-performance such as bus mastering for I/O and storage and write combining for processors that support this capability.

Recommended: Workstation PC should ensure that drivers are tuned for 32-bit or 64-bit performance.

4.8. Workstation supports 64-bit I/O bus architecture

Required for 64-bit platforms

For PCI, 64-bit workstations must support the 64-bit physical address space. PCI adapters must be able to address any location in that address space. This is a recommendation for 32-bit workstations.

PC 99A clarification: All PCI adapters, including 32-bit PCI adapters, must be able to address the full physical address space on a 64-bit platform. For 32-bit PCI adapters, this means that they must be able to support the Dual Address Cycle (DAC) command to permit them to transfer 64-bit addresses to the adapter or device (that is, addresses that are above the low 4 GB address space). Adapters

that cannot provide this support will not be able to access the full address space on a 64-bit platform.

4.9. Workstation does not include ISA expansion slots

Required

A workstation must not include ISA expansion slots. ISA devices cannot meet the high-performance requirements for workstations, resulting in performance bottlenecks.

4.10. Graphics subsystem supports workstation performance demands

Required, with special conditions depending on PC 99 market category

This requirement is for a workstation designed to support high-resolution graphics applications. A Workstation PC does not have to meet this requirement if it is designed for financial or transaction-based markets and is not intended to support graphics-intensive applications.

For a workstation designed to support graphics-intensive applications, the following support must be provided:

- 4 MB of display RAM.
- 3-D hardware acceleration based on Microsoft Direct3D, OpenGL, or both methods.

  Direct3D hardware designed to support OpenGL-based applications must be capable of meeting the OpenGL rasterization rules. Direct3D drivers must report through the appropriate capabilities bit whether the hardware actually conforms to OpenGL requirements.

  For information about requirements for 3-D hardware acceleration supported by Direct3D, see Chapter 14, “Graphics Adapters.” For information about OpenGL rasterization requirements and conformance rules, see the web site at http://www.sgi.com/Technology/OpenGL/arb.html.

The following features are recommended for the graphics subsystem:

- 1280 × 1024 × 24 bpp resolution should be supported for workstation systems intended for use with computer-aided design (CAD) or other high-performance graphical applications.
- Hardware that implements 32-bpp display modes, for example, display hardware for high-end engineering workstations, should implement RGB-mode rasterization.

4.11. Storage components rely on SCSI controller

Recommended

SCSI is a flexible I/O bus that supports good performance for access and throughput, meeting a workstation’s intensive data transfer needs. For more information about related requirements, see Chapter 11, “SCSI.”

4.12. Workstation includes multiple hard drives

Recommended

Recommended: Hardware acceleration of redundant array of inexpensive disks (RAID) drives.

Multiple hard drives can be incorporated for improved performance (multiple spindle access and striping with RAID 0) or for data integrity (RAID 1/5).

If multiple hard drives are implemented, the design must provide a means for the operating system to determine the boot drive. One implementation of boot-drive determination in multiple-drive systems is defined in Section 5.0 of the *Compaq, Intel, Phoenix BIOS Boot Specification, Version 1.01*. The format defined in this specification is what Windows 2000 uses for determining the boot drive as new bootable devices are introduced for servers. The system designer can use an equivalent method for boot-drive determination, but the method must ensure that the boot drive is recognized by the Windows 2000 Professional operating system.

For all related requirements for storage, see Chapter 18, "Storage and Related Peripherals."

Workstation PC 99 References

The following represents some of the references, services, and tools available to help build hardware that is optimized to work with Windows operating systems.

Accelerated Graphics Port Interface Specification, Revision 1.0 and later
http://developer.intel.com/pc-supp/platform/agfxport/

Advanced Configuration and Power Interface Specification, Revision 1.0 and later
http://www.teleport.com/~acpi/tech.htm.

Compaq, Intel, Phoenix BIOS Boot Specification, Version 1.01
http://www.microsoft.com/hwdev/respec/pnpspecs.htm

Microsoft Windows 2000 DDK
MSDN Professional subscription

MultiProcessor Specification, Version 1.4
Intel part number 242016-002
http://developer.intel.com/design/pro/datashts/242016.htm

OpenGL conformance rules from the OpenGL Architectural Review Board
http://www.sgi.com/Technology/openGL/arb.html
UseNet news group for OpenGL at comp.graphics.opengl

Checklist for Workstation PC 99

If a recommended feature is implemented, it must meet the PC 99 requirements for that feature as defined in this document.

4.1. Workstation meets all requirements for Office PC 99
Required

4.2. Workstation performance meets Workstation PC 99 minimum requirements
Required

4.3. Workstation supports multiple processors
Recommended

4.4. Workstation RAM can be expanded
Recommended

4.5. Workstation system memory includes ECC memory protection
Required

4.6. Workstation includes APIC support
Required

4.7. Workstation includes high-performance components
Recommended

4.8. Workstation supports 64-bit I/O bus architecture
Required for 64-bit platforms

4.9. Workstation does not include ISA expansion slots
Required

4.10. Graphics subsystem supports workstation performance demands
Required, with special conditions depending on PC 99 market category

4.11. Storage components rely on SCSI controller
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4.12. Workstation includes multiple hard drives
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