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# PC 99 Design Issues

"PC 99" is a collection of PC system definitions and bus and device design requirements for 1999–2000. This chapter summarizes the design goals and key issues for PC 99.

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# PC 99 Goals

The goals for PC 99 include the following:

- Advancing the quality of PC hardware, firmware, and device drivers to maximize customer benefit, satisfaction, and ease of use. This will result in greater customer satisfaction and lower cost of ownership and support.

- Ensuring the availability of quality hardware and drivers that support advanced features in Windows 98 and Windows 2000 Professional, while also ensuring the availability of lower-cost PCs that provide a good user experience with Windows 98 and Windows 2000.

- Encouraging innovation so manufacturers and designers can pursue new design solutions and make advances for hardware.

To this end, the PC 99 guidelines refer to existing industry standards or specify performance goals or benchmarks rather than prescribing fixed hardware implementations. Where this is not possible, for example, for CPU and RAM requirements, it is because acceptable benchmarks were not available. When

appropriate benchmarks and tests are available, these will be incorporated in the design guidelines.

The specific guidelines were selected for inclusion in this guide based on an evaluation of possible system and device features to determine how the requirements would support the PC 99 goals. Some guidelines are defined to provide clarification of available system support or design issues specifically related to the Windows 98 and Windows 2000 operating system architectures.

# Legacy Migration Road Map

ISA-based devices continue to be the reason for many problems and support issues related to PC configuration. The most common causes for PC customer support calls continue to be resource conflicts or loss of functionality occurring when end users install ISA devices such as modems, audio, or multimedia devices. In addition, even with the performance capabilities of current processors and the advanced multitasking capabilities of Windows 98 and Windows 2000, there is still a performance impact when a fast processor has to access a slow bus such as ISA.

To improve system performance, reduce customer support costs, and ensure true ease of use in PC systems and peripherals, manufacturers must plan to migrate all components in their systems away from ISA and legacy devices. With the addition of ACPI support and manageability features in Windows 98 and Windows 2000, the operating systems provide a foundation for configuration, power management, and central administration of systems and devices.

As discussed throughout the history of these *Design Guides*, this migration has to be undertaken on a step-by-step basis. The first step, as defined in the PC 97 design guidelines, was elimination of non-Plug and Play devices from new systems. The second step, defined in the PC 98 guidelines, was the elimination of add-on devices that use legacy ports or the ISA bus.

The ultimate goal, however, is the complete elimination of the ISA bus.

The following summarizes the planned migration road map:

- All PC 99 systems types, like PC 98, are designed and shipped without ISA-based add-on devices and also without ISA expansion slots. If system-board devices such as BIOS ROM, Super I/O, audio, and keyboard controller are included, then each device must meet Plug and Play design specifications either as an ACPI device object (the preferred implementation) or as an ISA Plug and Play device.

  Printers are the only devices that can use COM or LPT ports. Manufacturers are strongly encouraged to begin implementing USB and IEEE 1394 connections for printers.

- ATA and legacy AT Attachment Packet Interface (ATAPI) devices should migrate toward IEEE 1394.

- Modems, scanners, and other input and imaging devices must not use legacy buses. USB is recommended for modems, and SCSI or IEEE 1394 is recommended as the default I/O bus for scanners and other imaging devices.

- Multiple solutions are immediately available for audio, the most common being PCI and USB.

- No graphics adapters can be implemented on ISA (a PC 97 requirement). AGP or PCI are the recommended connections.

The PC 99 guidelines allow OEMs to continue to provide legacy mouse devices and keyboards, but USB solutions are encouraged. Legacy and proprietary solutions for game devices are not compliant with PC 99 requirements.

Complete elimination of the ISA bus from system designs is expected to be broadly implemented across all category of PC designs beginning in the PC 99 time frame.

# PC 99 System Types

This section describes the category of system types defined in the PC 99 guidelines. The guidelines for each of these system types provide a starting feature set that encourages differentiation among hardware manufacturers and among product lines based on the addition of advanced features and innovative implementations.

The PC 99 systems defined in this guide do not present a set of definitions for the minimum or best hardware required to run Windows 98 or Windows 2000. Instead, this specification describes the hardware that will deliver to end users an optimal level of performance when running Win32®-based applications under Windows 98 or Windows 2000.

## PC 99 Consumer and Office Issues

The Consumer PC and Office PC system types describe mass-market categories. The vast majority of PCs in manufacturers' engineering plans meet the basic requirements defined for these system types in this guide. The basic levels of performance and capabilities specified for the PC 99 system type should be obtainable.

In this guide, a distinction is drawn between a PC designed for use in a home environment and a PC designed for use in a corporate environment. These distinctions are categorized as Consumer PC and Office PC, respectively.

It is expected that a single OEM system will meet the PC 99 basic requirements and that separate model numbers will designate the "Consumer" or "Office" characteristics. Each of these categories is a variation on the PC 99 basic requirement.

**Consumer PC.** These PCs are designed for non-networked environments, however, they will most likely participate with a public network such as the Internet. This category includes PCs intended for the home market designed especially for entertainment and game playing, plus those PCs intended for Small Office/Home Office (SOHO) markets. Whatever the destination market, the Consumer PC system contains a baseline of hardware features and technologies that can support the performance requirements for either market. The true differentiation among PCs intended for either entertainment or SOHO use is the software included with the system.

Consumer PC systems come equipped for immediate connection to the Internet using a modem or other public network access device. To support running games, graphical applications, and entertainment and educational media titles, a Consumer PC system includes higher quality graphics capabilities than are required for Office PC system.

**Office PC.** The greatest differentiating feature of an Office PC system is that it supports requirements intended to reduce TCO in the corporate environment, including support for an upgradable BIOS and remote boot capabilities. An Office PC system is designed to run productivity applications, particularly in a network environment, and it comes equipped with a network adapter.

The following tables summarize the basic components for each system type.

**Note:** Acronyms used in these summary tables are defined in the Glossary that follows the Appendixes in this guide.

**Consumer PC 99 System Summary**

| PC 99 reference | Required | Recommended |
|---|---|---|
| **System requirements** Chapter 3, "PC 99 Basic Requirements" | 300 MHz processor, 128K L2 cache, and 32 MB RAM<br><br>PC 99 basic minimum, including OnNow support | 64 MB RAM |
| **System buses** Part 3 | 2 USB ports<br><br>No ISA add-on devices or expansion slots | IEEE 1394<br><br>Device Bay |
| **I/O devices** Chapter 13, "I/O Ports and Devices" | PC 99 basic minimum (keyboard and pointing device, plus connections for serial and parallel devices) | Devices use USB or other non-legacy connection<br><br>IrDA-compliant IR devices |
| **Graphics and video components** | PC 99 basic minimum plus | AGP |

| | | |
|---|---|---|
| Chapter 14, "Graphics Adapters" Chapter 15, "Video and Broadcast Components" | hardware support for 3-D acceleration | Analog video input and capture |
| | | Analog television tuner |
| | | Television output |
| **Audio components** Chapter 17, "Audio Components" | — | PC 99 audio |
| | | Digital ready |
| | | Support music synthesis |
| **Storage components** Chapter 18, "Storage and Related Peripherals" | PC 99 basic minimum CD or DVD drive | IEEE 1394 as the host controller for secondary storage |
| **Communications** Chapter 19, "Modems" Chapter 20, "Network Communications" | Internal 56-Kbps V.90 data/fax modem | High-speed public network communications support |

**Office PC 99 System Summary**

| PC 99 reference | Required | Recommended |
| --- | --- | --- |
| **System requirements**<br>Chapter 3, "PC 99 Basic Requirements" | 300 MHz processor, 128K L2 cache, and 64 MB RAM<br><br>PC 99 basic minimum, including OnNow support and Manageability Baseline | — |
| **System buses**<br>Part 3 | 2 USB ports<br><br>No ISA add-on devices or expansion slots | IEEE 1394<br><br>Device Bay |
| **I/O devices**<br>Chapter 13, "I/O Ports and Devices" | PC 99 basic minimum (keyboard and pointing device, plus connections for serial and parallel devices) | Devices use USB or other non-legacy connection<br><br>IrDA-compliant IR devices<br><br>Smart card |
| **Graphics and video components**<br>Chapter 14, "Graphics Adapters"<br>Chapter 15, "Video and Broadcast Components" | PC 99 basic minimum | 3-D hardware acceleration<br><br>DVD-Video and MPEG-2 playback |
| **Audio components**<br>Chapter 17, "Audio Components" | — | PC 99 audio |
| **Storage components**<br>Chapter 18, "Storage and Related Peripherals" | PC 99 basic minimum<br><br>CD or DVD drive | IEEE 1394 as the host controller for secondary storage |
| **Communications**<br>Chapter 19, "Modems"<br>Chapter 20, "Network Communications" | Network adapter with NDIS 5.0 driver and support for remote new system setup | Internal 56-Kbps V.90 data/fax modem or other public network communications support |

# Mobile PC Design Issues

For mobile PC users, the issues of greatest importance are portability (weight) and availability (battery life). Many of the projected uses for Office and Consumer PC systems include CPU-intensive and memory-intensive activities that demand significant power and heat dissipation, which create enormous design challenges. Some solutions appropriate for PC 99 desktop systems will not work physically in the notebook environment.

New external buses, support for multimedia applications, and other changes in PC computing challenge mobile PC designers to incorporate features that users want in a way that does not reduce the value of the core system. The OnNow and ACPI standards allow the operating system to take over the critical operations, such as dynamic configuration and power management, in support of mobile PCs.

The overall goal for mobile PC design is the same as for Office and Consumer PC systems—enhanced user experience—but the design tradeoffs are different. The PC 99 guidelines present mobile PC requirements in a manner that will encourage industry innovation across a wide range of design solutions without creating extreme power demands. Mobile PC requirements allow OEMs the flexibility they need to manage power and heat considerations in their designs.

The key mobile PC design issues include:

- Low weight and small size
- Available battery life to meet user expectations
- Management of power demands and heat dissipation on mobile PCs to ensure reliable operation of internal components
- Docking or port replication design, with issues related to device configuration and alternating current (AC) versus battery power connections

A docked platform cannot always be equivalent to a desktop PC in functionality, although designers strive to achieve this. Therefore, the PCs described in these guidelines include exceptions and qualifications for some basic requirements as they apply for either mobile PCs and the mobile/docking station pair. Complete details are defined in Chapter 6, "Mobile PC 99." The following table summarizes the key components.

**Mobile PC 99 System Summary**

| PC 99 reference | Required | Recommended |
|---|---|---|
| **System requirements**<br>Chapter 3, "PC 99 Basic Requirements" | 233 MHz processor, 128K L2 cache, and 32 MB RAM<br><br>Smart Battery or ACPI Control Method battery<br><br>PC 99 basic minimum, including OnNow support<br><br>Manageability Baseline if Windows 2000 is preloaded | 64 MB RAM<br>for Windows 2000 installations |
| **System buses**<br>Part 3 | 1 USB port<br><br>CardBus<br><br>No ISA add-on devices or expansion slots | IEEE 1394<br><br>Device Bay<br><br>Zoomed Video on CardBus<br><br>Support hot-pluggable devices without system reboot |
| **I/O devices**<br>Chapter 13, "I/O Ports and Devices" | PC 99 basic minimum (keyboard and pointing device, plus connections for serial and parallel devices) | Devices use USB or other non-legacy connection<br><br>IrDA-compliant IR devices |
| **Graphics and video components**<br>Chapter 14, "Graphics Adapters"<br>Chapter 15, "Video and Broadcast Components" | $800 \times 600 \times 16$ bpp resolution at 60 Hz<br><br>Modified requirements if 3-D hardware acceleration is supported | AGP  ("frame AGP")<br><br>DVD-Video playback capabilities<br><br>Television output |
| **Audio components**<br>Chapter 17, "Audio Components" | — | PC 99 audio, with qualifications |
| **Storage components**<br>Chapter 18, "Storage and Related Peripherals" | PC 99 basic minimum | CD or DVD drive |
| **Communications**<br>Chapter 19, "Modems"<br>Chapter 20, "Network Communications" | Integrated V.34 modem (or just CardBus slot) | Support alternative methods for network connection and remote new system setup |

# Workstation PC Design Issues

A Workstation PC system is a platform that goes beyond the requirements for a corporate client platform as articulated for Office PC systems, focusing on common design issues for professional workstations used for resource-intensive computing activities.

Software that might run on such platforms includes, but is not limited to, engineering and scientific applications such as CAD/CAM and other forms of simulation, media and content creation, software development, financial applications, and other types of mission-critical client-server applications.

**Workstation PC 99 System Summary**

| PC 99 reference | Required | Recommended |
|---|---|---|
| **System requirements**<br>Chapter 3, "PC 99 Basic Requirements" | RISC-based or 400 MHz processor; 512K L2 cache (per processor); 128 MB RAM; ECC memory protection<br><br>Office PC 99 basic minimum, including OnNow support and Manageability Baseline | Multiple processors<br><br>RAM can be expanded to at least 1 GB; 2 GB recommended |
| **System buses**<br>Part 3 | 2 USB ports plus APIC support<br><br>No ISA add-on devices or expansion slots | IEEE 1394<br><br>Device Bay |
| **I/O devices**<br>Chapter 13, "I/O Ports and Devices" | PC 99 basic minimum (keyboard and pointing device, plus connections for serial and parallel devices) | Devices use USB or other non-legacy connection<br><br>IrDA-compliant IR devices |
| **Graphics and video components**<br>Chapter 14, "Graphics Adapters"<br>Chapter 15, "Video and Broadcast Components" | If supporting graphics-intensive applications: 4 MB display RAM, and 3-D hardware acceleration | $1280 \times 1024 \times 24$ bpp resolution<br><br>RGB-mode rasterization if supporting 32-bpp display modes |
| **Audio components**<br>Chapter 17, "Audio Components" | — | PC 99 audio |
| **Storage components**<br>Chapter 18, "Storage and Related Peripherals" | PC 99 basic minimum<br><br>CD or DVD drive | SCSI controller<br><br>Multiple hard drives |
| **Communications**<br>Chapter 19, "Modems"<br>Chapter 20, "Network Communications" | Network adapter with NDIS 5.0 driver and support for remote new system setup | High-speed dial-up link, with NDIS 5.0 driver |

# Entertainment PC Design Issues

The Entertainment PC is differentiated from the Consumer PC by its greater ease of use and the range and quality of its multimedia capabilities. For example, the graphics, video, and audio subsystems for Entertainment PCs are designed to optimize the capabilities of software that uses Microsoft DirectX® interfaces.

Following are the key design challenges for Entertainment PC systems:

- Combining a high-performance 2-D and 3-D graphics subsystem designed for the best games with better-than-television quality, full-screen, MPEG-2 motion video to deliver DVD movies, digital television (DTV), and so on.

- Enabling connection to large-screen displays, including standard televisions, for a more realistic graphics experience than smaller desktop monitors.

- Implementing a high-fidelity audio subsystem that equals consumer stereo systems, enabling delivery of rich content such as games with positional 3-D audio, professionally mastered music CDs, and so on.

- Enabling new media types to the PC for video, audio, and information data, such as analog and DTV signals from broadcast, cable, and satellite links.

- Enabling PC connections to consumer-electronic devices such as camcorders, VCRs, and home-theater stereo systems by way of USB and IEEE 1394.

- Providing home appliance usability for ease of use, in both desktop ("2-foot") and family room ("10-foot") usage models.

- Extending human input device support with remote control, game input controls, and other control devices that use USB, IEEE 1394, and other external connections.

- Bringing advanced but easy-to-use communications capabilities to the home, and integrating these with entertainment functions. Examples include caller ID, family-room speaker phone and video phone, and so on.

The Entertainment PC guidelines are intended to provide much room for innovation, such that OEMs will design to a variety of form factors. In addition to traditional desktop multimedia PC designs, Entertainment PCs will be designed for the PC Theater category. Notice that although the Entertainment PC guidelines call out some of the key design differences related to 2-foot and 10-foot usage models, it is not intended as a comprehensive specification of PC Theater design issues.

Whether defined for use on the desktop or in the family room, Entertainment PC guidelines are defined to deliver the best digital home entertainment of any platform or combination of devices. The following table summarizes the Entertainment PC 99 system components.

**Entertainment PC 99 System Summary**

| PC 99 reference | Required | Recommended |
| --- | --- | --- |
| **System requirements** <br> Chapter 3, "PC 99 Basic Requirements" | 300 MHz processor with 128K L2 cache and 64 MB RAM <br><br> PC 99 basic minimum, including OnNow support | — |
| **System buses** <br> Part 3 | 2 USB ports <br><br> No ISA add-on devices or expansion slots | Device Bay <br><br> Three IEEE 1394 ports, one easily accessible |
| **I/O devices** <br> Chapter 13, "I/O Ports and Devices" | PC 99 basic minimum (keyboard and pointing device, plus connections for serial and parallel devices) | Devices use USB or other non-legacy connection <br><br> IrDA-compliant IR devices <br><br> All input devices are USB HID compliant |
| **Graphics components** <br> Chapter 14, "Graphics Adapters" <br> Chapter 16, "Monitors" | 3-D hardware acceleration, with additional texture and performance requirements | Large-screen color monitor <br><br> Television output |
| **Video and broadcast components** <br> Chapter 15, "Video and Broadcast Components" | DVD-Video and MPEG-2 playback | Digital broadcast or satellite television support <br><br> Analog video input and capture <br><br> Analog television tuner <br><br> DTV support |
| **Audio components** <br> Chapter 17, "Audio Components" | PC 99 minimum audio | Digital ready <br><br> Support music synthesis |
| **Storage components** <br> Chapter 18, "Storage and Related Peripherals" | PC 99 basic minimum <br><br> DVD drive and DVD-Video playback | IEEE 1394 as the host controller for secondary storage |
| **Communications** <br> Chapter 19, "Modems" | Internal 56-Kbps V.90 data/fax modem | High-speed dial-up link with NDIS 5.0 support |

# PC 99 Design Issues and Compliance Dates

The requirements in this guide are intended to apply to PC systems and peripherals designed for delivery in the fourth quarter of 1999, which means that compliance testing for these guidelines will begin July 1, 1999.

This guide specifies many requirements that represent only incremental changes to existing designs, not changes that require a new design cycle. Most of these changes are "choice of supplier" questions, or clarify and strengthen BIOS and driver implementation details first presented in earlier *Design Guides*.

Compliance testing for any PC 99 guidelines that require significant hardware design changes will begin January 1, 2000, or other dates to be identified.