

PC 98 Design Issues

“PC 98” is a collection of PC system definitions and bus and device design requirements for 1998–99. This chapter summarizes the design goals and issues for PC 98.

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PC 98 Goals

The goals for PC 98 include the following:

- Advancing the quality of PC hardware, firmware, and device drivers by driving PC hardware platform initiatives and technical capabilities to maximize customer benefit, satisfaction, and ease of use. This will result in greater customer satisfaction and lower cost of support.
- Ensuring the availability of high-quality hardware, including hardware that supports advanced Windows 98 and Windows NT features while also ensuring the availability of lower-cost PCs that best run Windows 98 and Windows NT.
- Encouraging innovation so manufacturers and designers can pursue new design solutions and make advances for hardware. PC 98 enables new uses and new users by advancing new platform types and new usage models.

To this end, the PC 98 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 yet available. When appropriate benchmarks and tests are available, these will be incorporated in the design guidelines.

Selection of guidelines included in this guide was based on an evaluation of features to determine how the requirements and recommendations would support PC 98 goals. Two additional considerations governed selection:

- Clarification of system support or design related to Windows 98 and Windows NT operating system architecture.
- Assurance of driver quality for both Windows 98 and Windows NT.

Basic PC 98 System Types

The design requirements and recommendations in this document provide guidance for building systems that run the Windows family of operating systems. The system type designated as “Basic PC 98” is not a set of definitions for the minimum, optimal, or best hardware required to run Windows 98 or Windows NT. Instead, this specification describes the hardware that will deliver to end users an optimal level of performance when running Windows-based applications under Windows 98 or Windows NT.

Basic PC 98 Consumer and Office Issues

The Basic PC 98 system type describes a mass-market category. The vast majority of PCs now in manufacturers’ engineering plans will be able to meet the basic requirements defined in this guide. The basic levels of performance and capabilities specified for the Basic PC 98 system type should be easy to obtain.

These guidelines are open-ended. This specification provides a starting feature set that encourages differentiation among hardware manufacturers and among product lines by adding advanced features and innovative implementations.

In this guide, a new distinction is drawn between a Basic PC designed for use in a home environment and a Basic PC designed for use in a corporate environment. These distinctions are categorized as Consumer PC 98 and Office PC 98, respectively.

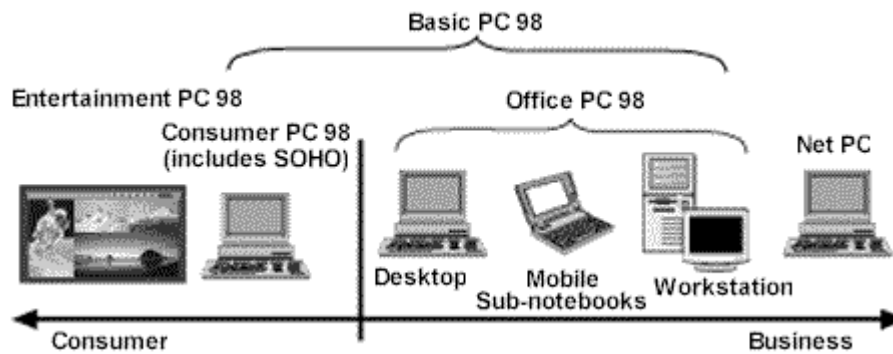
It is expected that a single OEM system will meet the Basic PC 98 specification and that a separate model number will add the “Consumer” or “Office” characteristics. Each of these categories is a variation on Basic PC 98, and each is based on the following characteristics:

- **Consumer PC.** Consumer PC 98 provides design guidelines for PCs designed for non-networked environments. This includes PCs intended for the home market in support of entertainment and game playing, plus PCs intended for Small Office/Home Office (SOHO) markets. Whatever the destination market, the Consumer PC 98 contains essentially the same hardware features and technologies, representing a baseline that can support the performance requirements for either market. The true differentiation between PCs intended for either entertainment or SOHO use is the software included with the system.

Consumer PC 98 also comes equipped for immediate connection to the Internet using dial-up communications. To support running games, graphical applications, and entertainment and educational media titles, Consumer PC 98 includes higher quality graphics capabilities than are required for Office PC 98.

- **Office PC.** The greatest differentiating feature of Office PC 98 is that it supports PC 98 requirements intended to reduce TCO in the corporate environment, including support for an upgradable BIOS and remote boot capabilities.

Office PC 98 is designed to run productivity applications, particularly in a network environment. Office PC 98 comes equipped with a network adapter.



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

Consumer PC 98 System Summary

PC 98 reference	Required	Recommended
System requirements “Basic PC 98”	Basic PC 98 minimum, including complete OnNow support	—
System buses “USB”; “IEEE 1394”; “PCI”	Basic PC 98 minimum (USB and PCI) No Industry Standard Architecture (ISA) add-on devices CardBus for mobile PCs	IEEE 1394 Device Bay
I/O devices “I/O Ports and Devices”	Basic PC 98 minimum	Universal Serial Bus (USB) game pad Devices use external bus Remote control
Graphics and video components “Graphics Adapters”; “Video Components”	Hardware support for 2-D graphics acceleration and some 3-D acceleration features Driver support for 3-D software acceleration	3-D hardware acceleration Accelerated Graphics Port (AGP) Video port Analog television tuner Television output
Audio components “Audio Components”	—	PC 98 audio Digital ready Support music synthesis
Communications “Modems”	Internal 33.6-Kbps V.34-1996 modem	High-speed dial-up link with Network Driver Interface Specification, Version 5.0 (NDIS 5.0), driver support
Storage components “Storage and Related Peripherals”	Bus mastering 8x CD-ROM	DVD-ROM with DVD-Video playback capabilities

Office PC 98 System Summary

PC 98 reference	Required	Recommended
System requirements “Basic PC 98”	Basic PC 98 minimum, including complete OnNow support Manageability Baseline	—
System buses “USB”; “IEEE 1394”; “PCI”	Basic PC 98 minimum (USB and PCI) No ISA add-on devices CardBus for mobile PCs	IEEE 1394 Device Bay
I/O devices “I/O Ports and Devices”	Basic PC 98 minimum	Devices use external bus
Graphics and video components “Graphics Adapters”; “Video Components”	Driver support for 3-D software acceleration	2-D and 3-D hardware acceleration AGP Television output Video port PC 98 DVD-Video and MPEG-2 playback
Audio components “Audio Components”	—	PC 98 audio
Communications “Modems”; “Networking Communications”	Network adapter with NDIS 5.0 driver	Internal 33.6-Kbps V.34-1996 modem or high-speed dial-up link
Storage components “Storage and Related Peripherals”	Bus mastering	8x CD-ROM or DVD-ROM

Entertainment PC 98 Design Issues

The *PC 97 Hardware Design Guide* introduced the Entertainment PC as a distinct category of Windows-based PC, differentiated from the Basic PC by its ease of use and the breadth 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.

Since its introduction, nearly all key Entertainment PC technologies and design points have either appeared in innovative new products or progressed technically toward realization. Some key technologies have been adopted and advanced faster than expected.

Entertainment PC 98 aims to accelerate this momentum by appropriately evolving key system components, as well as by adding some new technologies that will support feature and performance demands that will be placed on the PC hardware industry by consumers and software developers in 1998. Compared to last year's model, Entertainment PC 98 will run faster, will deliver new types of high-quality audio, video, and data content from a wider variety of sources, will better enable the PC Theater "10-foot" usage model, and will maximize the quality of user experience for multimedia applications.

It is hoped that the Entertainment PC-8 guidelines will enable and promote innovation within the PC market by defining PCs targeted at high-quality entertainment and communications experiences along with ease-of-use features that will overcome barriers to adoption for new users. An Entertainment PC 98 system is optimized for the following uses:

- **Games.** The best titles, with the most complex, realistic graphics and audio.
- **Education.** The most engaging titles, with full-screen video, interactive animation, and so on.
- **Active Internet.** Enhanced web communications capabilities, with personalized and animated web sites, chat rooms, and so on.
- **Personal communications.** Multimedia e-mail, Internet audio phone, video phone, and so on.
- **Interactive, high-resolution television and movie viewing.** Higher video quality, real-time links to content producers, and so on.
- **Connection with traditional consumer-electronics devices.** Home theater surround audio such as Dolby Digital (AC-3) for games and DVD movies, and fast and easy capture, editing, and playback of personal video.

Following are the key design challenges for Entertainment PC 98:

- 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 can provide.
- Implementing a high-fidelity audio subsystem on par with 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 types of “digital pipes” into the PC for video, audio, and information data, such as analog and DTV signals from broadcast, cable, and satellite links.
- Enabling PC connections, using USB and IEEE 1394, to consumer-electronic devices such as camcorders, VCRs, and home-theater stereo systems.
- 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.

It is intended that the Entertainment PC 98 guidelines 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. PC Theater systems are fundamentally targeted at a 10-foot usage model and contain the necessary hardware, software, and industrial design to enable users to enjoy PC-enhanced entertainment content in the family-room environment. It should be noted that although the Entertainment PC 98 guidelines attempt to 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 98 guidelines are defined to deliver the best digital home entertainment of any platform or combination of devices. The following table summarizes the Entertainment PC 98 system components.

Entertainment PC 98 System Summary

PC 98 reference	Required	Recommended
System requirements “Basic PC 98”	Basic PC 98 minimum, including complete OnNow support	—
System buses “USB”; “IEEE 1394”; “PCI”	Basic PC 98 minimum No user-accessible ISA expansion slots Two USB ports, both easily accessible Two IEEE 1394 ports, one easily accessible	Device Bay
I/O devices “I/O Ports and Devices”	Basic PC 98 minimum All input devices are Human Interface Device-compliant (HID-compliant) and use an external bus interface Game pad or joystick included	Remote control supporting standard button requirements
Graphics components “Graphics Adapters”; “Monitors”	Full AGP implementation 2-D and 3-D hardware acceleration	Large-screen color monitor Television output
Video and broadcast components “Video and Broadcast Components”	PC 98 DVD-Video and MPEG-2 playback Analog video input and capture Analog television tuner DTV support	Digital broadcast or satellite television support
Audio components “Audio Components”	PC 98 audio Support 3-D audio, independent sample rates for input and output, and music synthesis	Digital ready
Communications “Modems”	Internal pulse-coded modulation (PCM) modem	High-speed dial-up link with NDIS 5.0 support
Storage components “Storage and Related Peripherals”	Bus mastering DVD-ROM drive and DVD-Video playback	External IDE devices use IEEE 1394

PC 98 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 1998, which means that compliance testing for these guidelines will begin July 1, 1998.

This guide specifies requirements that represent only incremental changes to existing silicon 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 raised in *PC 97 Hardware Design Guide*.

Compliance testing for any PC 98 guidelines that require significant hardware design changes will begin January 1, 1999.

Legacy Migration Road Map

ISA-based devices remain as the most troubling area for support issues related to PC configuration. The most common causes for PC customer support calls are resource conflicts or loss of functionality occurring when end users install ISA devices such as modems, audio, or multimedia devices.

To reduce the barriers to satisfactory user experience and to reduce the cost of customer support, designers must migrate away from incorporating ISA devices in PC systems designed for Windows 98 and Windows NT. Therefore, the most dramatic PC 98 requirements emphasize the movement away from dependency on ISA and other legacy devices.

Although these requirements might seem radical, the discussion of migration is not new. In fact, migration away from legacy devices is a fundamental issue for all hardware guidelines, beginning with the migration toward Plug and Play devices.

Processor performance has improved steadily since the ISA bus was first defined; today's processor is executing more than 300 times faster than the original PC. Even with the advanced multitasking implementations of the Windows family of operating systems, there is still a performance impact when a very fast processor has to access a relatively slow bus such as ISA. Hardware migration away from ISA, coupled with improved software techniques, will result in an improved user experience.

Every system and device manufacturer is aware of the support burden related to configuration issues for legacy devices. Often, when users add new systems to their PCs, they upset the delicate balance of system resources assigned to accommodate a collection of ISA and proprietary device implementations. These users think they are simply installing a new application or a new modem, but they lose functionality elsewhere in their systems and only have customer support to turn to in resolving the resulting problems.

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.

Of course, this migration has to be undertaken on a step-by-step basis. The first step is elimination of non-Plug and Play devices from new systems. With the addition of ACPI support and Zero Administration features in the Windows 98 and Windows NT operating systems, Microsoft is providing a foundation in the operating system for configuration, power management, and central administration of systems and devices.

Intel and Microsoft are aware that most system-board designs for 1998 include the ISA bus, and that COM and LPT ports will be included in systems for legacy device support. However, under the PC 98 guidelines, the system must not ship with add-on devices that use these ports or the ISA bus. The ultimate goal for future designs is the complete elimination of the ISA bus.

The following list summarizes the planned migration road map:

- PC 98 systems are designed and shipped without ISA-based add-on devices. 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.

For Entertainment PC 98, the requirement is the same as for Network PC:
No ISA expansion slots shall be exposed for end-user access.

- For PC 98, printers are the only devices that can use COM or LPT ports. Manufacturers are encouraged to prepare for migration toward USB and IEEE 1394, which are the recommended implementations for PC 98 printers.
- IDE 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 and for PC 98, the most common being PCI and USB.
- No graphics can be implemented on ISA (a PC 97 requirement). Also, higher performance graphics should migrate away from PCI slave devices and toward PCI master devices, and then on to AGP.

PC 98 allows OEMs to continue to provide legacy mouse devices and keyboards, but encourages use of USB solutions. Legacy and proprietary solutions for game devices are not compliant with PC 98 requirements.

