C H A P T E R 2

PC 98 Design Initiatives

This chapter presents additional information about the key PC 98 design initiatives. Complete references for specifications and implementations discussed in this chapter are presented in the “Basic PC 98” chapter in Part 2 of this guide.

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OnNow and ACPI for PC 98

The OnNow design initiative is a comprehensive, system-wide approach to system and device power control based on a group of new specifications. OnNow is the term for a PC that is always on and responds immediately to user requests or other events, but it appears to be off when not in use.

Since *PC 97 Hardware Design Guide* was published, the following industry advances have been made on the OnNow design initiative:

- Completion of *Advanced Configuration and Power Management Interface Specification, Revision 1.0.* The ACPI specification defines a new cross-platform interface to the system board. This interface enables the operating system to implement operating system–directed power management and Plug and Play on a broad array of PCs, including servers, business systems, and consumer PCs. ACPI allows system manufacturers to build systems consistent with the OnNow design initiative for instantly available PCs.

  Intel and other system-board manufacturers are now implementing the ACPI specification, and OEMs are beginning large-scale manufacturing of ACPI systems.

- Completion of bus power management specifications and device class power management reference specifications for most device classes.

  Specifications have been made widely available in the industry, and manufacturers are beginning to implement OnNow-based power management capabilities in their product lines.

- Implementation of ACPI support in operating systems, enabling a generic system-event mechanism for Plug and Play, configuration control, and power management.

  Microsoft provides full driver-level support for the ACPI specification in Windows 98 and Windows NT 5.0 operating systems. Using the assembler, debugger, and compatibility testing tools provided by Microsoft, system manufacturers have been able to design, develop, and test ACPI chip sets, firmware, and system boards.

- Implementation of OnNow power management policy plus device driver and application interfaces so that device designers and driver writers can create and test OnNow-capable devices and peripherals.

The key design progress for OnNow and ACPI focuses on the following capabilities:

- Migration of system configuration from the Plug and Play BIOS to ACPI. ACPI leverages the Plug and Play BIOS data structures in a way that is compatible with both Windows 98 and Windows NT 5.0 but independent of processor architecture implementations.
- Migration of legacy power management from BIOS Advanced Power Management (APM) 1.2 to ACPI for Windows 98 and Windows NT 5.0.
- Clarification of design issues and requirements for hardware and software in support of the OnNow-capable PC.

Current information about specifications and progress for this initiative, including details for technical implementations, can be found on the web site at http://www.microsoft.com/hwdev/onnow.htm.

Win32 Driver Model

The Win32® Driver Model (WDM) is designed to allow binary compatibility for targeted device classes written for Windows 98 and Windows NT 5.0 and future versions of these operating systems. For bus and device classes with WDM support, driver developers write only small minidrivers to expose device-specific features and can maintain one driver source-code library for minidrivers that run on both Windows 98 and Windows NT.

The WDM core provided by Microsoft for Windows 98 and Windows NT 5.0 is a subset of Windows NT kernel services, with new cross-platform application programming interfaces (APIs) for Plug and Play and power management. For each bus class and device class with WDM-based support, Microsoft provides a class driver, which is a device abstraction for a particular class of devices.

Microsoft provides the WDM core services, which are documented in the Windows NT 5.0 DDK. WDM support for Windows 98 and Windows NT includes the following:

- USB and IEEE 1394 buses
- HID-compliant devices
- WDM digital audio
- Still and video imaging
- DVD decoding
- WDM modems

Key support for many devices relies on the WDM Stream class driver, which optimizes data flow in the operating system kernel.

For related PC 98 requirements, see the driver requirements for the specific bus and device class that includes WDM support in Windows 98 and Windows NT 5.0. Implementation details are provided in the Windows NT 5.0 DDK.

Manageability Initiatives

The purpose of the manageability initiatives described in this guide is to help plan, deploy, proactively maintain, and centrally control a distributed computing environment in order to reduce the overall cost of owning and managing computers. To do this, management technology must bring together information from different technology disciplines to provide services oriented toward management functions, which can in turn decrease TCO.

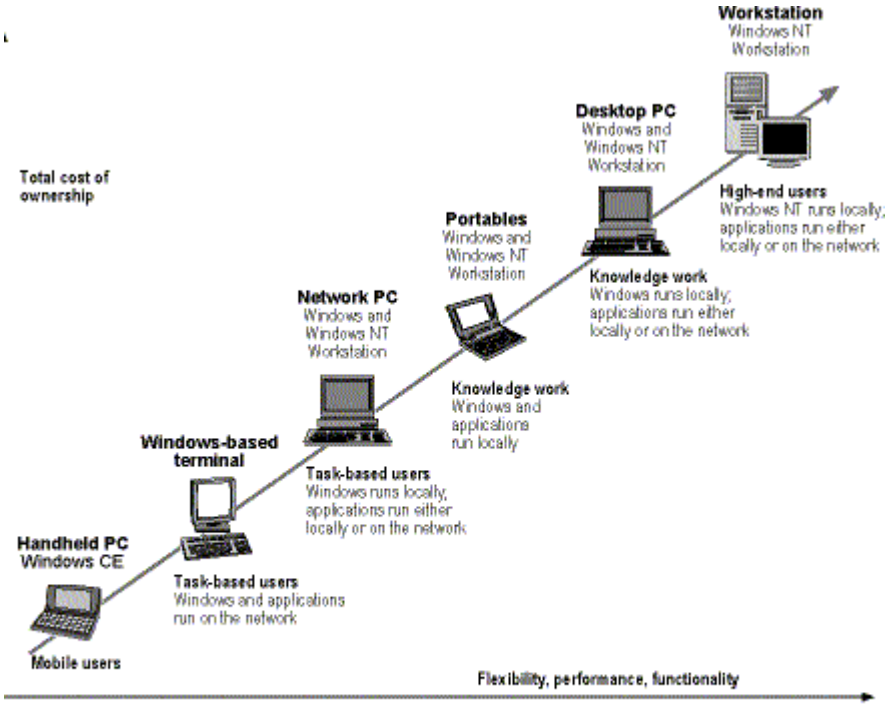
To succeed in significantly reducing TCO, management solutions must adapt to the needs and tasks of the environment to be managed. The solutions must therefore be open, flexible, and extensible: They need to support new technologies and integrate management functions supplied by more than one vendor. Such systems must conform to appropriate existing standards and have sufficient flexibility to extend support to emerging standards and technologies.

Providing management solutions requires establishing a management infrastructure in the operating system, exposing this infrastructure, and then building the tools to use it. This includes:

- Providing instrumentation as the infrastructure for manageability.
- Supporting management tools.
- Supporting new developments such as policy management in Windows 98 and Windows NT 5.0.
- Providing interfaces for enterprise management vendors.

For hardware platform designers, the technology used for platform instrumentation is of direct interest because it is a design element for their systems. Some 1997 PC platforms were instrumented with the Desktop Management Interface (DMI), as described in the *Network PC System Design Guidelines* (attached as Appendix E in the References part of this guide).

In the PC 98 time frame, a new Windows Management Instrumentation (WMI) component becomes a requirement when it is implemented in the Windows 98 and Windows NT 5.0 operating systems.



A related initiative, the Network PC (Net PC) design initiative, defines the reference design for the Net PC, a new member of the PC family that uses Intel Architecture or other microprocessor architectures and that runs the Windows 98 or Windows NT Workstation operating systems.

The Net PC is designed to reduce the cost of business computing by optimizing the design for users who do not require the flexibility and expandability of the traditional PC, and by allowing organizations to centrally manage their information technology. Although the types of business users will vary, the Net PC will be ideally suited for those involved in activities such as data entry, transaction processing, and intranet and Internet access.

The current version of the defining specification, *Network PC System Design Guidelines*, can be downloaded from http://www.microsoft.com/hwdev/netpc.htm and http://developer.intel.com. Version 1.0b is included as Appendix E in the References part of this guide.

There are several high-level design goals for Net PC, including:

- Reduce TCO in the corporate environment by designing a PC that is completely optimized for lowest TCO—centrally controllable and managed, and completely capable of being enumerated and configured through software.
- Work with the Zero Administration initiative for Windows. For more information on this initiative, see http://www.microsoft.com/management/.
- Build on existing investments in Windows-based PC computing for the corporate environment.
- Support the broadest range of applications.
- Maximize corporate return on investment in the corporate computing infrastructure.

Because the Net PC is a catalyst for improving TCO across all platforms, these guidelines are referred to in the PC 98 requirements as background information for Office PC 98. The following summarizes key Net PC design requirements:

- Completely deterministic hardware. All devices can be detected and configured by software—consequently, no ISA devices.
- OnNow-enabled, including ACPI.
- Remote operating system installation capabilities.
- No end-user accessible internal expansion capabilities (“sealed case”).
- Platform management instrumentation based on Windows hardware instrumentation for supporting operating systems such as Windows 98 and Windows NT 5.0 (based on DMI for operating systems that do not support Windows hardware instrumentation).

Notice that references to the Net PC requirements are made in this guide only to provide a context for certain Office PC 98 requirements. The actual Net PC requirements are defined in *Network PC System Design Guidelines, Version 1.0b* or higher.

Device Bay and Modular PC Design

Device Bay is a technology that enables adding and upgrading peripheral devices without opening the chassis and without turning off or rebooting the PC. Device Bay also enables peripheral devices to be easily swapped between platforms.

The *Device Bay Interface Specification* is an industry specification co-authored, jointly owned, and managed by the Compaq Computer Corporation, Intel Corporation, and Microsoft Corporation. This introduction and overview to Device Bay is based on Draft Revision 0.79, dated June 30, 1997. Availability of the Device Bay specification will be announced on the web site at http://www.device-bay.org.

The Device Bay specification defines an architecture that supports hot swapping of devices and interoperability of peripherals and platforms. A bay can be built into the chassis of any PC system that meets the operating system requirements plus all the requirements for connector receptacle, bus interface, mechanical form factor, connector receptacle, power and thermal, and controller logic as defined for bays in the Device Bay specification.

The bus interface requirement is crucial. Device Bay devices must use one or both of the industry-standard extensible bus interfaces: IEEE 1394 or USB. These buses provide a broad range of bandwidths and scalable performance to support the requirements of PC peripherals for at least the next five years.

Device Bay Device Categories

Device Bay provides manageability and interoperability for a range of PC peripherals and PC categories, including business and consumer desktop computers and portable computers, Net PC systems, and home-theater technology.

The Device Bay technologies support devices for mass storage, security, and communications and connectivity, and a variety of other devices. Device Bay technology allows OEMs, retailers, and end users to easily add peripherals in order to support specific application needs. For example, an IEEE 1394 hard drive could be added to provide a large storage medium for digital imaging or audio authoring, a DVD-ROM drive could be added to enable DVD-Video playback, or a smart card reader could be added for secure online banking or shopping.

Device Bay technologies also support swapping a hard disk drive—and thus a set of data and applications—between a desktop system and a laptop PC. And in the corporate environment, a hard disk drive could be removed from a failed system and inserted into a working system, minimizing employee downtime and thus lowering TCO.

Storage Devices. Storage is currently near the top of users' shopping lists for hardware upgrades. Users want a means of transporting large files. Device Bay supports both removable and fixed-media storage devices, including hard disk drives, tape backup, high-density floppy disk drives, CD-ROM, DVD-ROM, DVD-RAM, magneto-optical, and other removable media devices.

Communications and Connectivity Devices. Modem cards are also among the most popular end-user PC upgrades. Device Bay supports this device class, including AT-style modems, Integrated Service Digital Network (ISDN) adapters, network adapters, cable interfaces, and wireless infrared (IR) and radio frequency (RF) devices. Device Bay supports multiple-usage models and connections using USB and IEEE 1394 buses.

Security Devices. The current lack of security has been cited by consumers as a primary reason why they do not make online purchases over the Internet. Device Bay supports security devices that provide a means for user authentication. For home users, a smart card reader can enable secure credit-card shopping over the Internet. Higher levels of security can be achieved with encryption security devices. Adding a Device Bay smart card reader to a corporate or mobile system also provides a high level of data security, meeting requirements for PCs purchased by the U.S. government.

Device Bay Benefits

This section summarizes the potential benefits that Device Bay offers to end users and hardware manufacturers.

Benefits of Device Bay for End Users. The following list shows some of the ways Device Bay features can benefit end users:

- Device Bay bays are accessible. Devices can be inserted without opening the case.
- Devices inserted into Device Bay-capable bays are automatically configured, and devices can be inserted into, removed from, and swapped among Device Bay-capable bays while the PC is powered up.
- Fear of obsolescence is reduced because future higher performance peripherals will work in Device Bay bays and, as time goes on, earlier Device Bay peripherals will be accepted by future Device Bay-enabled systems.
- A broad diversity of peripherals can be Device Bay devices, and PCs can be quickly and easily reconfigured to a user's specific application needs at any given time.

Benefits of Device Bay for OEMs. The following list shows some of the ways Device Bay features can benefit OEMs:

- Device Bay's modular nature allows for cost-effective delivery of tailored PC configurations. Device Bay simplifies the manufacturing process and system configuration, allowing OEMs to design and deliver customized systems while optimizing manufacturing and distribution processes.
- Device Bay enables simplified product design and rapid adoption of new technologies into product lines, without altering either PC system design or manufacturing processes, because of standardized Device Bay form factors and device interfaces.
- Device Bay reduces obsolescence issues for OEMs.
- Device Bay lowers support costs and TCO. A principal goal of the Device Bay specification is to reduce support costs related to improper installation of new peripherals. Device Bay design ensures that many current configuration conflicts will be eliminated, thus reducing support calls.

Benefits of Device Bay for IHVs. The following list shows some of the ways Device Bay features can benefit independent hardware vendors (IHVs):

- Device Bay enables development of new product segments and enables faster integration of devices by OEMs into their platforms. Implementing new designs based on Device Bay will also mean more rapid adoption of new technologies once an installed base of Device Bay-enabled systems is present.
- Device Bay specifies a standardized design for device interfaces, connectors, and form factors. The enhanced interoperability of Device Bay ensures that IHVs have a clear indication of what to build and that they can realize great economies of scale for connectors, casings, and other components.

PC 98 and Device Bay

Device Bay is recommended for PC 98 systems. The following features are required to implement Device Bay in a PC system design:

- One USB and one IEEE 1394 port for each Device Bay-capable bay in the system, power for the bay (compliant with the Device Bay specification), and a controller for the bay (Device Bay Controller, compliant with the Device Bay specification).
- Peripherals that interface with either the USB bus, the IEEE 1394 bus, or both, and that support relevant USB device class specifications.

PC 98 compliance testing for Device Bay is expected to begin January 1, 1999, subject to availability of hardware components. For complete requirements, see the "Basic PC 98" chapter in Part 2 of this guide. See also the respective chapters for USB, IEEE 1394, and specific peripheral device requirements.

DirectX and DirectShow for Windows and Windows NT

The Microsoft DirectX foundation provides low-latency interfaces to media hardware. Previously, the primary market focus for these technologies was entertainment titles, but these APIs also provide a solid foundation for the media services required for Internet applications. They also provide the media foundation for a broad range of productivity applications, enabling high-performance media with hardware acceleration.

Microsoft DirectDraw® is the Windows system component that allows direct manipulation of video display memory, hardware block transfers (bit-blters), hardware overlays, and page flipping. DirectDraw performs the common functions required by both hardware and software emulation implementations while maintaining compatibility with the Windows Graphics Device Interface (GDI). This provides compatibility with existing Windows applications and device drivers. The user will experience the highest quality performance when using new hardware that provides built-in DirectDraw acceleration and rendering capabilities.

Direct3D® is a DirectX technology that provides access to hardware acceleration for 3-D rendering. Some basic and general 3-D capabilities will become pervasive in entertainment software by the end of 1998. These capabilities should be provided in all graphic cards to improve the performance of 3-D games, business graphics, Internet 3-D file viewing (virtual reality modeling language, or VRML), and professional 3-D applications.

DirectShow™ (formerly known as ActiveMovie™) provides access to hardware acceleration for MPEG-1 playback, which will become increasingly important for high-performance video in the context of games, Internet content viewing, computer-based training, and desktop video conferencing. Some PC 98 hardware requirements ensure support for video playback on all PCs running Windows operating systems.

DirectSound® provides a low-level and high-performance audio API, including 3-D sound spacialization (DirectSound3D) and MIDI (DirectMusic™) APIs.

DirectInput® provides a low-level and high-performance input device API to support keyboards, mouse devices, joysticks, and so on. DirectPlay® provides a collaborative communications layer.

For PC 98, all related drivers must support relevant DirectX capabilities, including DirectDraw Video Port Extensions (VPE) for graphics device drivers.

Other Design Initiatives for PC 98 Hardware

The following summarizes the important design directions and issues for PC 98.

Graphics Adapters. Requirements for 2-D and 3-D acceleration are refined for PC 98, and new requirements are introduced for supporting a video port and DirectDraw VPE for improved display of video playback.

Video, Still Image, and Broadcast Capabilities. New support and capabilities in the operating system, including kernel-streaming support implemented under WDM as well as hardware advances in the industry, have influenced changes in the hardware design requirements for video and still-image components. Principally, PC 98 guidelines for video technologies clarify requirements for MPEG-2 playback and define performance requirements for data transfer and playback quality. New requirements are defined for digital broadcast or satellite television.

Audio. The PC 98 requirements specify guidelines for digital-output readiness and new performance metrics.

Storage. The PC 98 requirements complete the migration to bus master support for all controllers and devices. Other changes clarify implementation requirements for DVD, again emphasizing the importance of bus mastering. The migration away from ISA and toward IEEE 1394 for storage is emphasized in the design recommendations.

Modems. New requirements, including new guidelines for controllerless and software modems, are defined for PC 98 so as to stay abreast with changes in the current specifications and in the modem industry. An important design issue is the emphasis on migration away from ISA.

Networking Communications. All network devices, including network interface cards, Asynchronous Transfer Mode (ATM), and ISDN implemented as a network adapter, must be implemented with NDIS 5.0 drivers and new Windows-style INF files. In addition, all network adapters must have performance capabilities for filtering multiple multicast addresses in order to support new “push” technologies for applications such as Microsoft Internet Explorer 4.0. For a PC 98 system that uses a network adapter as a boot device to support installing the operating system, the network adapter must be compatible with remote new system setup capabilities defined for manageability.

Complete details about the design changes and new requirements are provided in Part 4 of this guide.