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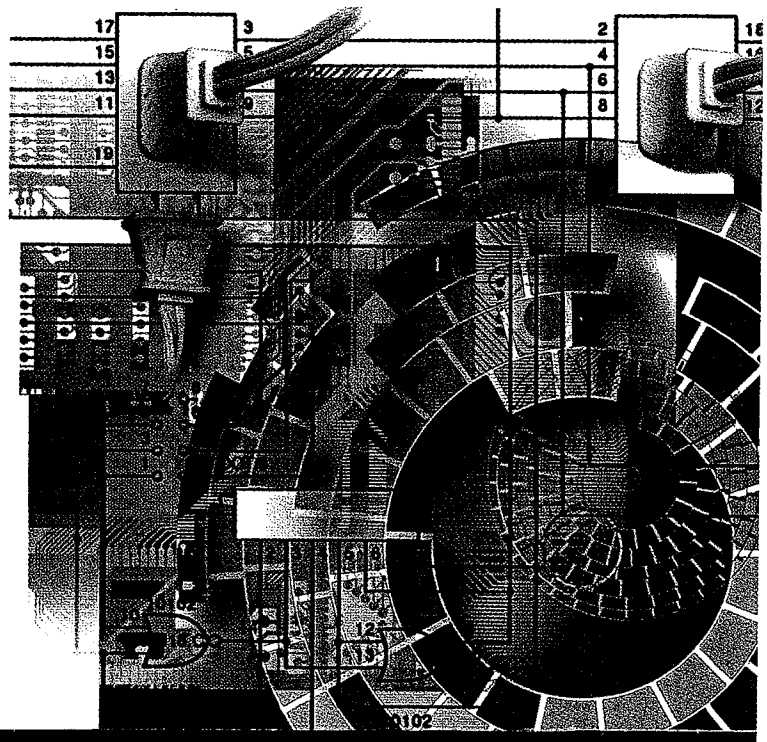
Designed for Microsoft® Windows™95

Hardware Design Guide for Microsoft® Windows™ 95

A Practical Guide for Developing Plug and Play PCs and Peripherals



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Hardware Design Guide for Microsoft® Windows™ 95

A Practical Guide for Developing Plug and Play PCs and Peripherals

Microsoft Corporation

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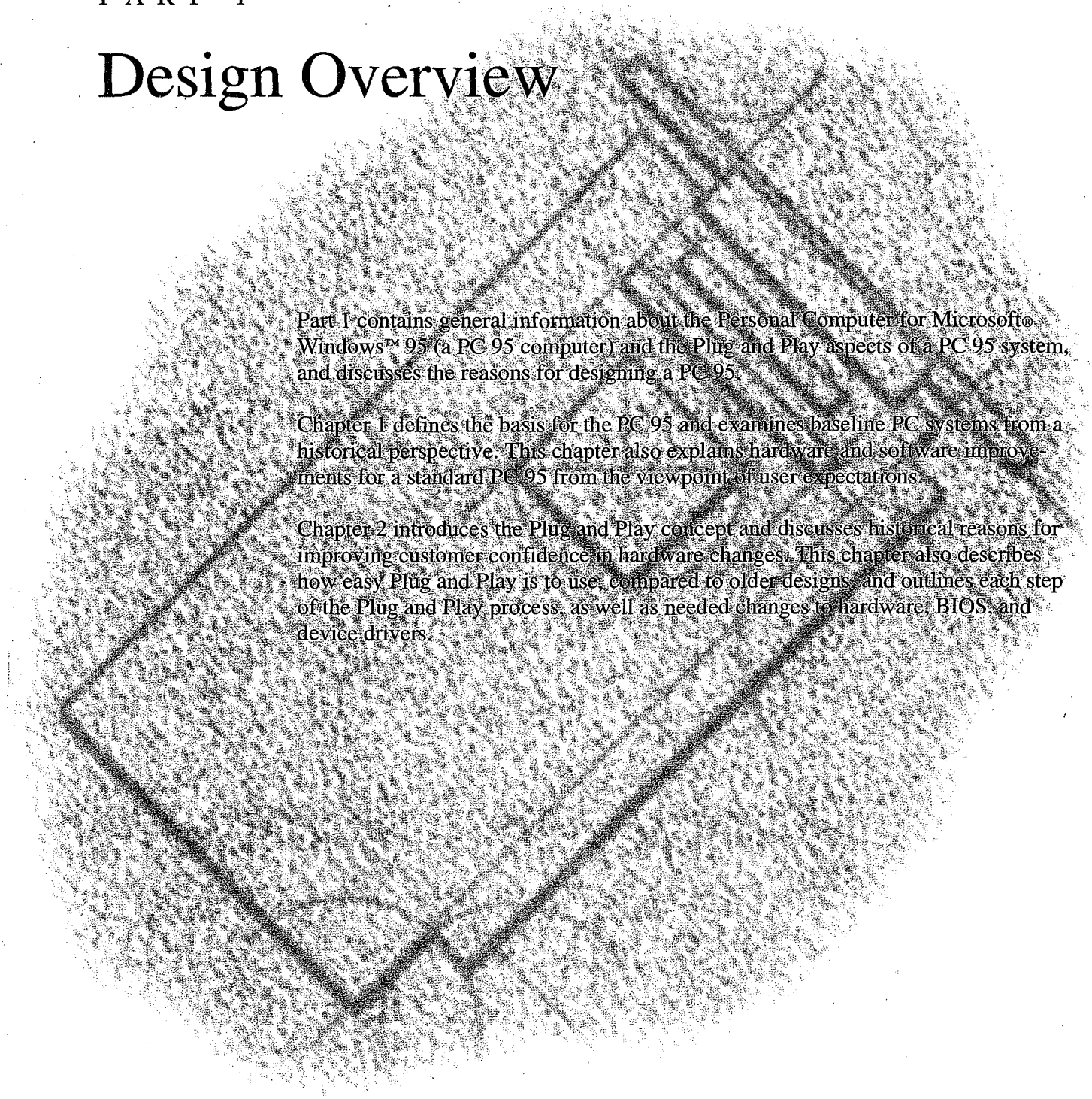
PART 1

Design Overview



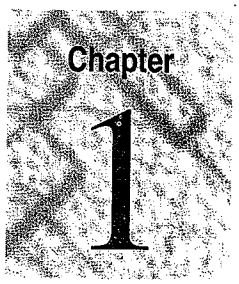
Part 1 contains general information about the Personal Computer for Microsoft® Windows™ 95 (a PC 95 computer) and the Plug and Play aspects of a PC 95 system, and discusses the reasons for designing a PC 95.

Chapter 1 defines the basis for the PC 95 and examines baseline PC systems from a historical perspective. This chapter also explains hardware and software improvements for a standard PC 95 from the viewpoint of user expectations.

Chapter 2 introduces the Plug and Play concept and discusses historical reasons for improving customer confidence in hardware changes. This chapter also describes how easy Plug and Play is to use, compared to older designs, and outlines each step of the Plug and Play process, as well as needed changes to hardware, BIOS, and device drivers.

CHAPTER 1

The PC 95



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Note PC 95 refers to a platform designed to be the minimum standard PC for Microsoft® Windows™ 95 during 1995. By early 1995, almost all new PCs are expected to meet these criteria.

The *PC 95* is a new platform consisting of three key elements—a minimum set of hardware features, *Plug and Play* components, and Windows 95. This platform provides the user with a PC that is easy to use and configure. In a sense, it offers the power of a PC without the hassles commonly associated with complex devices. With the PC 95, complexities are handled internally; the user sees only a device that is as easy to use as any other appliance in the home.

This chapter introduces the PC 95, discusses its costs and benefits, and describes the relationships between the hardware, Plug and Play, and Windows 95.

The PC 95 requirements define the basic hardware platform necessary to qualify for the Microsoft® Windows™ 95 Logo. The logo also indicates that Windows 95 is preinstalled and has passed the Microsoft Windows 95 *Hardware Compatibility Tests* (HCT), so users will not have to worry about hardware and software compatibility. For more information about meeting the requirements for the Windows 95 Logo program, contact the Microsoft Compatibility Labs (MCL) at 206-635-4949.

What Is a PC 95?

The PC 95 is the physical realization of the concept that the power of computers should extend to the ordinary user. Combining the advantages of the Plug and Play hardware and software architecture, the standardized features of the PC hardware design, and the easy-to-use, attractive interface of Windows 95, the PC 95 establishes a new standard. It is simple, versatile, and usable.

The PC 95 also specifies as standard certain features that have only been options, in the past. Users and software developers can count on the availability of these standard features, making product design and purchase decisions easier.

Baseline PC systems have evolved incrementally over the years. The basic PC was defined in 1981 with the shipment of the IBM® PC. Many advances since then have become standard, including the 16-bit AT® bus, VGA display technology, and the 386 (80386) CPU architecture. A number of optional features have also increased in popularity, notably, audio, CD-ROM, *small computer system interface* (SCSI), modems, mice, and alternate expansion buses such as the *Peripheral Component Interconnect* (PCI) bus and the Personal Computer Memory Card International Association *(PCMCIA)* bus. The arrival of Windows 95 is an opportunity to raise the standard for what users and manufacturers expect in a basic PC.

The PC 95 represents the current standard for a Windows 95–based PC, the next logical step in this evolution. The PC 95 provides hardware specifically designed and optimized for both Plug and Play and Windows 95.

Plug and Play

The Plug and Play initiative is a set of hardware and software specifications that define a minimum Plug and Play system. Implementations of these specifications are found throughout the PC 95, including a Plug and Play BIOS, Plug and Play methods of identifying and configuring hardware resource requirements for expansion cards and peripherals, and operating system software that recognizes and uses the Plug and Play features of the system.

A Plug and Play system contains a Plug and Play BIOS that identifies and configures the integrated resources on the PC system. For example, the system BIOS identifies *motherboard* devices such as parallel ports and display adapters, and allocates their *resources*.

Expansion cards and peripheral hardware must also be designed to implement the Plug and Play specifications. This guide includes the design criteria for Plug and Play expansion *devices* and peripheral hardware in addition to the descriptions of hardware requirements and recommendations for the PC 95.

Plug and Play software, such as Windows 95, uses the features of Plug and Play hardware to identify the resources of all devices in the system, including attached peripherals such as Plug and Play printers. When the software "knows" the system resources, it can use the unique features of each device, optimizing system performance.

The Windows 95 Operating System

Windows 95 is one of the most significant updates yet to the core Windows product line. Windows 95 offers compatibility with existing applications while introducing many easy-to-use features that increase productivity.

Plug and Play is one of the key ways in which Windows 95 enhances ease of use. Windows 95 fully supports all of the configuration management, resource arbitration, and device *enumeration* functions defined in the Plug and Play specifications. Windows 95 enumerates the PC system devices (by retrieving identification from the devices), places the information in a system data structure called the *hardware tree*, and determines the resources available on each of the devices. Windows 95 also examines the resources for all of the devices, configures the devices so they don't conflict with one another, and loads the appropriate device drivers.

In essence, Windows 95 performs a dynamic configuration of the system using only the resources and device drivers requested by the system devices. If the configuration of the system changes—for example, if a portable PC is plugged into a *docking station* with a SCSI host adapter—Windows 95 reenumerates the system, reconstructs the hardware tree and device resource information with the new capabilities of the SCSI host adapter, and loads the appropriate device driver for the new device. Hardware designs that allow flexible allocation of all of the resources on the PC enhance the dynamic nature of Windows 95.

Windows 95 maintains backward compatibility in a number of ways with older, non–Plug and Play systems. Windows 95 can be used on an older PC that is not Plug and Play enabled, and will attempt to identify the devices and resources that are available. If a device driver is available for the older hardware, Windows 95 identifies the driver and loads it.

Windows 95 supports the changing hardware resources of docking mobile systems by examining the system hardware and, often, automatically choosing the correct configuration. For example, a multiconfiguration portable PC might have two states called "docked" and "undocked." Undocked might mean, for example, no network adapter or audio adapter. The Windows 95 detection routine calls the system BIOS, determines the system configuration state, then selects the proper hardware profile and loads the appropriate device drivers for the current system configuration. The docking station can also change this state by generating dynamic docking and undocking events.

Windows 95 also enables more cooperative behavior between applications. Each time Windows 95 identifies a change in the system, it notifies applications—for example, switch on battery power, establish fast network connection, or switch to low-resolution display. With this capability, applications can make smart decisions based on the new information, such as stop background reformatting, download all new mail messages, use smaller fonts, or determine network identifier based on the user's location and the available hardware.

Windows 95 also supplies an increased amount of useful information about the PC system configuration, for example, the identities and allocated resources of the devices attached to the system.

The availability in Windows 95 of dynamic configuration, PCMCIA support, *warm docking* or *hot docking*, and other new capabilities creates many opportunities for new business products, better hardware, and new applications for the PC 95.

The PC 95 concept means increased ease of use and more flexible hardware configuration for users. But Windows 95 is also designed to run well on almost any PC-compatible system that runs Microsoft® Windows™ 3.1 in enhanced mode and has a 386 or later microprocessor, at least 4 MB RAM, and a VGA display. In fact, although this configuration represents the minimum PC capable of running Windows 95, it will typically run the user's existing applications better than Windows 3.1, and will be a good fit for users who are upgrading their existing operating system. These systems will not, however, offer all the benefits available with a Plug and Play–enabled system.

This guide defines an improved baseline PC, or reference system, for running Windows 95. With a common baseline system, users can count on a minimum set of features with any PC purchase, applications can begin to rely on these features, and the industry as a whole will benefit.

The New Hardware Standards

The PC 95 concept sets a baseline minimum hardware standard for the next generation of PCs. This standard includes hardware requirements for a variety of different PC systems and peripherals. The resulting base system meets the requirements of Plug and Play and is easy to use and configure.

This list is an overview of some of the requirements for a desktop PC 95. (It is not a complete list.)

- A Plug and Play system BIOS (version 1.0a or later)
- A 386 or compatible architecture, minimum (for example, 386, 486, Pentium™, and so on)
- 4 MB RAM, minimum
- Flat-frame buffer display, with at least 640 × 480 × 8 bits per pixel (bpp)
- A dedicated mouse port or integrated pointing device
- One serial and one parallel port, minimum

For more information about the requirements and recommendations for a desktop PC 95, see Chapter 3, "The Desktop PC 95."