White-box is the term used by the industry to refer to what would otherwise be called *generic* PCs—that is, PCs assembled from a collection of industry-standard, commercially available components. The white-box designation comes from the fact that historically most of the chassis used by this type of system have been white (or ivory or beige).

The great thing about white-box systems is that they use industry-standard components that are interchangeable. This interchangeability is the key to future upgrades and repairs because it ensures that a plethora of replacement parts will be available to choose from and will be interchangeable. For many years, I have recommended avoiding proprietary systems and recommended more industry-standard white-box systems instead.

Companies selling white-box systems do not usually manufacture the systems; they assemble them. That is, they purchase commercially available motherboards, cases, power supplies, disk drives, peripherals, and so on and assemble and market everything together as complete systems. Some companies such as HP and Dell manufacture some of their own systems as well as assemble some from industry-standard parts. In particular, the HP Pavilion and Dell Dimension lines are composed largely of mainstream systems made with mostly industry-standard parts. PC makers using mostly industry-standard parts also include high-end game system builders such as Alienware (owned by Dell). Other examples include Gateway and eMachines (owned by Acer), whose PCs are also constructed using primarily industry-standard components. Note that there can be exceptions for all these systems; for example, I know that some of the Dell Dimension XPS systems use proprietary parts such as power supplies. I recommend avoiding such systems, due to future upgrade and repair hassles.

Others using industry-standard components include Acer, CyberPower, Micro Express, and Systemax, but hundreds more could be listed. In overall total volume, this ends up being the largest segment of the PC marketplace today. What is interesting about white-box systems is that, with few exceptions, you and I can purchase the same motherboards and other components that any of the white-box manufacturers can (although we would probably pay more than they do because of the volume discounts they receive). We can assemble a virtually identical white-box system from scratch ourselves, but that is a story for Chapter 19, "Building or Upgrading Systems."

PC Design Guides

For several years Intel and Microsoft released a series of documents called the "PC *XX* Design Guides" (where *XX* designates the year) as a set of standard specifications to guide both hardware and software developers creating products that work with Windows. The requirements in these guides were part of Microsoft's "Designed for Windows" logo requirement. In other words, if you produced either a hardware or software product and you wanted the official "Designed for Windows" logo to be on your box, your product had to meet the PC *XX* minimum requirements.

Following are the documents that have been produced in this series:

- "Hardware Design Guide for Microsoft Windows 95"
- "Hardware Design Guide Supplement for PC 95"
- "PC 97 Hardware Design Guide"
- "PC 98 System Design Guide"
- "PC 99 System Design Guide"
- "PC 2000 System Design Guide"
- "PC 2001 System Design Guide"

These documents are available for download from the Microsoft website (www.microsoft.com/whdc/archive/pcguides.mspx).

Most nonuniversal cables include only one or two 3 1/2-inch drive connectors. These omit the edge connectors shown in Figure 10.7.

In addition to the connectors, the cable has a special twist that inverts the signals of wires 10–16. These are the wires carrying the Drive Select (DS) and Motor Enable signals for each of the two drives. Old floppy disk drives have DS jumpers designed to enable you to select whether a given drive should be recognized as A: or B:. (Really old ones allow a third and fourth setting as well.)

You might not even know that these jumpers exist because the twist in the cable prevents you from having to adjust them, and as such they have been eliminated from most drives. When two floppy disk drives are installed in one system (admittedly a rarity nowadays), the cable electrically changes the DS configuration of the drive that is plugged in after the twist. Thus, the twist causes a drive physically set to the second DS position (B:) to appear to the controller to be set to the first DS position (A:). The adoption of this cable has enabled the use of a standard jumper configuration for all floppy disk drives, regardless of whether you install one or two drives in a computer.

If you install only a single floppy disk drive, it plugs in to the connector after the twist, which causes the drive to be recognized as drive A:. Although it's seldom necessary today, some systems have a BIOS setup option enabling you to swap drives A: and B: without adjusting drive cables.

Note

The original Shugart SA400 floppy interface made for 5 1/4-inch floppy drives supported up to four drives on a single cable. However, IBM modified the controller pinout to support only two drives and eliminate the need to change DS jumpers on the drive.

How the OS Uses a Floppy Disk

To the OS, data on your PC disks is organized in tracks and sectors, just as on a hard disk drive. *Tracks* are narrow, concentric circles on a disk; *sectors* are pie-shaped slices of the individual tracks. A 3 1/2-inch 1.44MB floppy disk drive has the following specifications:

- Bytes per sector: 512
- Sectors per track: 18
- Tracks per side: 80
- Track width (mm): .115
- Sides: 2
- Capacity (KiB): 1,440
- Capacity (MiB): 1.406
- Capacity (MB): 1.475

The floppy disk's capacity can actually be expressed in various ways. For example, what we call a 1.44MB disk really stores 1.475MB if you go by the correct decimal prefix definition for a megabyte. The discrepancy comes from the fact that in the past floppies were designated by their kilobinary (1,024-byte) capacities, which were originally (and improperly) abbreviated as KB. To prevent ambiguities in binary versus decimal number interpretations, the International Electrotechnical Commission (IEC) has designated KiB as the correct abbreviation for kilobinary.

Despite the IEC standards, the traditional method when discussing floppy drives or disks is such that a floppy disk with an actual capacity of 1,440KiB is instead denoted as a 1.44MB disk, even though it

Network Architecture Overview

The architecture on which you choose to base your network is the single most important decision you make when setting up a LAN. The architecture defines the speed of the network, the medium access control mechanism it uses (for example, collision detection, token passing, and so on), the types of cables you can use, the network interface adapters you must buy, and the adapter drivers you install.

The Institute of Electrical and Electronic Engineers (IEEE) has defined and documented a set of standards for the physical characteristics of both collision-detection and token-passing networks. These standards are known as IEEE 802.3 (Ethernet) and IEEE 802.5 (Token-Ring), respectively. IEEE 802.11 (Wi-Fi) defines wireless versions of Ethernet.

Note

Be aware, however, that the colloquial names Ethernet and Token-Ring actually refer to earlier versions of these architectures, on which the IEEE standards were based. Minor differences exist between the frame definitions for true Ethernet and true IEEE 802.3. In terms of the standards, IBM's 16Mbps Token-Ring products are an extension of the IEEE 802.5 standard.

New Token-Ring installations are rare today and are not covered here.

The most common choice today for new networks is Ethernet (both wired and wireless). In rare cases, you may encounter a Token-Ring or ARCnet network. Network data-link architectures you might encounter are summarized in Table 17.2. The abbreviations used for the cable types are explained in the following sections.

Table 17.2 LAN Architecture Summary

Network Type	Speed	Maximum Number of Stations	Transmission Types	Notes
Ethernet	10Mbps	1,024	Category 3 UTP or better (10BASE-T), Thinnet RG-58 coax (10BASE-2), Thicknet coax (10BASE-5), fiber-optic (10BASE-F)	Replaced by Fast Ethernet; backward compatible with Fast or Gigabit Ethernet when using UTP.
Fast Ethernet	100Mbps	1,024	Category 5 UTP or better	The most popular wired networking standard, rapidly being replaced by Gigabit Ethernet.
Gigabit Ethernet	1,000Mbps	1,024	Category 5 UTP or better	Recommended for new installations; uses all four signal pairs in the cable.
10 Gigabit Ethernet	10,000Mbps	1,024	Category 6a UTP or better	Uses all four signal pairs in the cable.
802.11a Wireless Ethernet	Up to 54Mbps	1,024	RF 5GHz band	Short range; interoperable with dual-band 802.11n.
802.11b Wireless Ethernet	Up to 11Mbps	1,024	RF 2.4GHz band	Interoperable with 802.11g/n.
802.11g Wireless Ethernet	Up to 54Mbps	1,024	RF 2.4GHz band	Interoperable with 802.11b/n.

ACPI goes far beyond the previous standard, APM, which consisted mainly of processor, hard disk, and display control. ACPI controls not only power but also all the Plug and Play (PnP) hardware configuration throughout the system. With ACPI, system configuration (PnP) and power-management configuration are no longer controlled via the BIOS Setup; they are instead controlled entirely within the OS.

ACPI enables the system to automatically turn internal peripherals on and off (such as CD-ROM drives, network cards, hard disk drives, and modems) as well as external devices such as printers, monitors, or any devices connected to serial, parallel, USB, video, or other ports in the system. ACPI technology also enables peripherals to turn on or wake up the system. For example, a telephone answering machine application can request that it be able to respond to answer the telephone within 1 second. Not only is this possible, but if the user subsequently presses the power or sleep button, the system only goes into the deepest sleep state that is consistent with the ability to meet the telephone answering application's request.

ACPI enables system designers to implement a range of power-management features that are compatible with various hardware designs while using the same OS driver. ACPI also uses the Plug and Play BIOS data structures and takes control over the Plug and Play interface, providing an OS–independent interface for configuration and control.

ACPI defines several system states and substates. There are four Global System states, labeled from G0 through G3, with G0 being the fully operational state and G3 being mechanically turned off. Global System states are immediately obvious to the user of the system and apply to the entire system as a whole. Within the G0 state, there are four CPU Power states (C0–C3) and four Device Power states (D0–D3) for each device. Within the C0 CPU Power state, there are up to 16 CPU Performance states (P0–P15).

Device Power states are states for individual devices when the system is in the G0 (Working) state. The device states may or may not be visible to the user. For example, it may be obvious when a hard disk has stopped or when the monitor is off; however, it may not be obvious that a modem or other device has been shut down. The Device Power states are somewhat generic; many devices do not have all four Power states defined.

Within the G1 Global Sleep state are four Sleep states (S1–S4). The G2 Global Soft Off state is also known as the *S5 Sleep state*, in which case the system is powered off but still has standby power. Finally, G3 is the Mechanical Off state, where all power is disconnected from the system.

The following list shows the definitions and nested relationship of the various Global, CPU/Device Power, and Sleep states:

- **G0 Working**—This is the normal working state in which the system is running and fully operational. Within this state, the Processor and Device Power states apply. The Device Power states are defined as follows:
  - **G0/D0 Fully-On**—The device is fully active.
  - **G0/D1**—Depends on the device; uses less power than D0.
  - **G0/D2**—Depends on the device; uses less power than D1.
  - **G0/D3 Off**—The device is powered off (except for wakeup logic).
- The Processor Power states are defined as follows:
  - **G0/C0 CPU On**—Normal processor operation.
  - **G0/C1 CPU Halted**—The processor is halted.
  - **G0/C2 CPU Stopped**—The clock has been stopped.
  - **G0/C3 CPU/Cache Stopped**—The clock has been stopped and cache snoops are ignored.