How a Motherboard Brings It All Together

Memory Slots: Memory slots usually come two or four to a board and are often color-coded to tell you where to place matching memory cards (called dual-channel). Modern motherboards use memory based on the DDR (double-data rate) technology—DD3 is the current standard and DDR4 is on the horizon.

Power Supply Connections: Your computer's power supply provides power to the motherboard via this connector, and then the motherboard distributes that power as needed to the rest of the system. This basic ATX-style power connector is a mainstay of motherboard design, although it has evolved over time from a 20-pin connector to one using 24 pins.

Battery: Allows the BIOS chip to keep itself alive, remembering its configuration settings as well as the system date and time.

BIOS: When you turn on your computer, this is the first component to come to life, providing enough code to wake up the rest of the hardware. It also contains code to support specific types of processors, drives, and other functions that might need updating occasionally.

SATA Connectors: Each connector, or **header**, is designed for a serial-ATA hard drive, providing delivery of data from hard and optical drives.

Port 80 Display: A two-digit display provides codes used in troubleshooting a disabled PC. These displays are not found on all motherboards.

Chipset: The **chipset**, which was until recently based on a two-chip North and South philosophy, is secondary only to the processor in determining the performance and capabilities of a PC. Most modern designs combine North and South functions into a single chip, with some functions even moving into the CPU packaging pending the specific motherboard and CPU combination. You can learn more about these functions in the next spread.

CPU Socket: This determines what kind of **microprocessor**, or **CPU**, the motherboard uses. The vast majority of boards are designed to work with processors from either **Intel** or **AMD**. Motherboards do not work with all CPUs from the same company. The socket and board are designed for specific lines of microprocessors, with a specific size, shape, and number of pins.

Front Panel Connectors: Wires from these lead to the front of the PC for the on/off switch, reset switch, power light, and hard drive light.

Bus: To send data to any of the other motherboard components—a **write** operation—the microprocessor, or another component, raises the voltages of a combination of 24 of the traces that make up the **address bus**. This combination of traces, or **lines**, is the unique address of something on the **internal bus**, such as a location in memory; one of the components located on the motherboard itself, such as expansion cards inserted in the board's add-in slots; or a device, such as a disk drive on the **external bus**, also called the **expansion bus**.

The processor puts the data it wants to write on a bank of electrical traces, the **data bus**, by raising the voltages on some to represent ones and leaving voltages unchanged on others to represent zeros. Other lines are used to pass **control signals** for common specific commands, such as read and write commands for memory and each input/output device.

Expansion Slots: These slots allow you to plug in special circuit boards called an **expansion cards**. The design of the slots has changed over the years. The **legacy** PCI slot was once the most common and still appears on some designs. It's used for functions that do not require great quantities or speed in data transmissions.

Because all devices are on the same buses, they all receive the same signals on the data and control buses. The memory controller, expansion cards, and other input/output devices along the bus constantly monitor the command lines. When a signal appears on the write command line, for example, all the input/output devices recognize the command. The devices, alerted by the write command, turn their attention to the address lines. If the address specified on those lines is not the address used by a device, it ignores the signals sent on the data lines.

If the signals on the address lines match the address used by the adapter, the adapter accepts the data sent on the address lines and uses that data to complete the write command.

PCI-Express slots are best known for being paired with powerful graphics cards that push video, games, and so on to your computer's display. They come in multiple sizes and are the do-all, fit-all slot for a variety of expansion board types, not just graphics. The shorter ones here are **x1 PCI-E** slots and are common to all PCI Express slots. To handle graphics and sound data faster, the PCI-E slot can be expanded to **x4**, **x8**, or, shown here, **x16** slots, where the numbers represent multiples of the speed of an x1 PCI-E slot. Their ability to move data is indicated by the multiplier factor in their designations.

The Motherboard: As its name implies, the motherboard is the uniting element among all the chips and circuitry that make up a computer. Devices communicate with each other through the motherboard's circuits, from which they also draw their power. Motherboards come in different **form factors** that align the board with different sizes and styles of computer cases. They also come with different sockets, slots, and connectors that determine what types of gizmos you can use with your computer.

Ports: An **input/output panel** holds the miscellaneous ports on the back and front of the PC that are used for communicating with external devices. Here you find USB connectors, video connectors like DVI and HDMI, eSATA connectors, and a host of audio input/output ports.