How Microprocessors Work

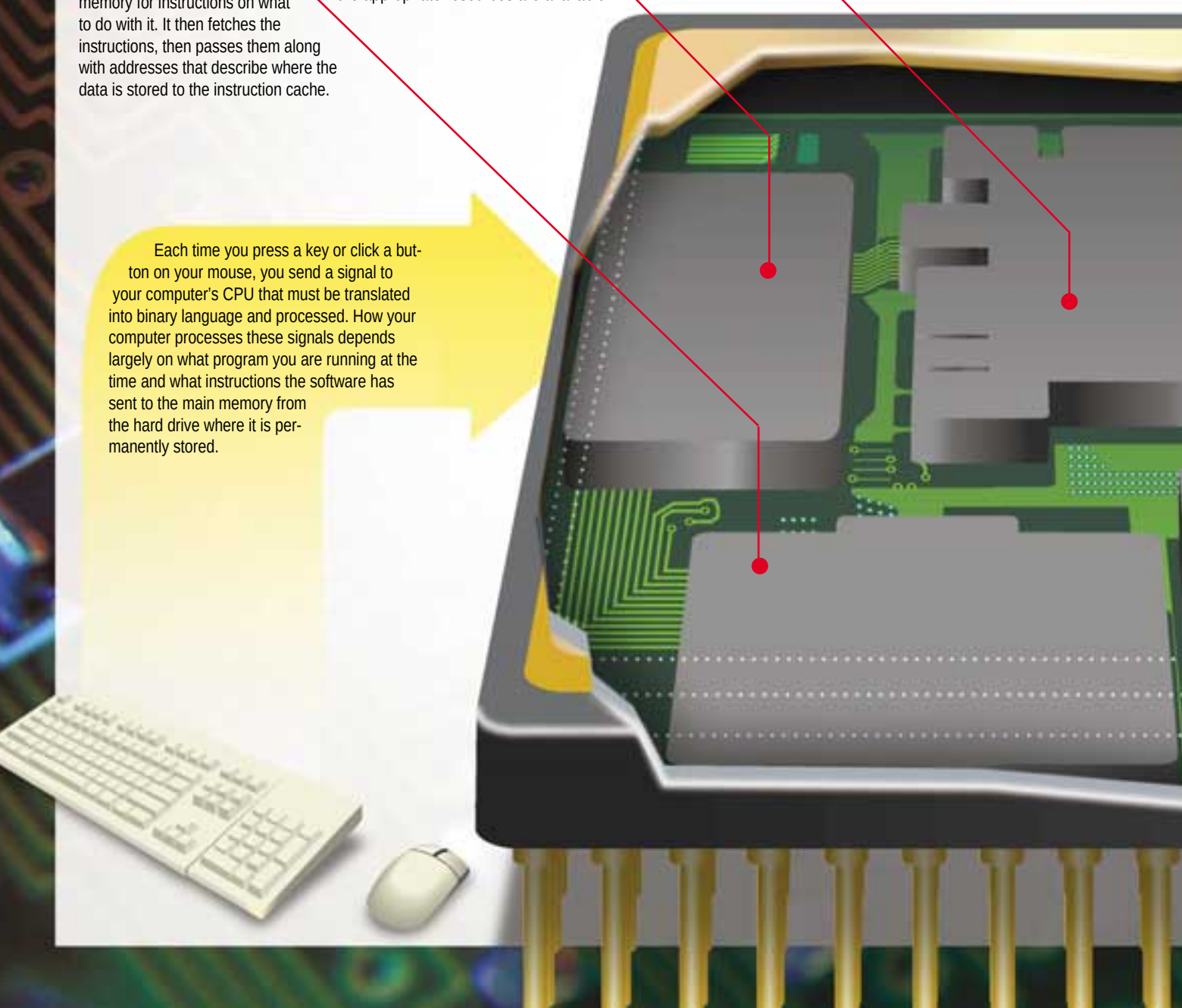
The complex maze of circuitry that makes up a microprocessor chip is divided into several different areas, each of which performs a specific function. Some areas specialize in retrieving data from a computer's main memory (RAM) or hard drive, while others translate data from standard text and machine language commands into binary digital code that the processor can understand. Still other portions of a processor are dedicated solely to performing the millions of mathematical and Boolean logic operations that are necessary each second for a computer to perform its tasks.

Whatever their function, each of the components of a microprocessor is vital in enabling your computer to help you compose letters, send e-mail, keep track of your finances, or surf the Web.

Control Unit
The "control room" of a microprocessor, the control unit oversees the processing of instructions from the instruction cache, routes instructions to the decode unit for translation to binary, sends data that needs processing to the ALU and FPU, and directs the storing of processed data in memory registers where it will stay until needed.

DCU (Data Cache Unit)
Data that is in line to be processed by the control unit, ALU (arithmetic logic unit), or FPU (floating-point unit) is stored temporarily in the DCU until the appropriate resources are available.

Prefetch Unit
The prefetch unit monitors all incoming data and looks in the instruction cache and the main memory for instructions on what to do with it. It then fetches the instructions, then passes them along with addresses that describe where the data is stored to the instruction cache.



Each time you press a key or click a button on your mouse, you send a signal to your computer's CPU that must be translated into binary language and processed. How your computer processes these signals depends largely on what program you are running at the time and what instructions the software has sent to the main memory from the hard drive where it is permanently stored.

Decode Unit
Instructions from a microprocessor's instruction set and external commands from users go here for translation from standard text and machine language into binary digital code. Binary code uses strings of 1s and 0s (which signify "yes" or "no", "on" or "off") in place of letters and base ten numerals (0 to 9).

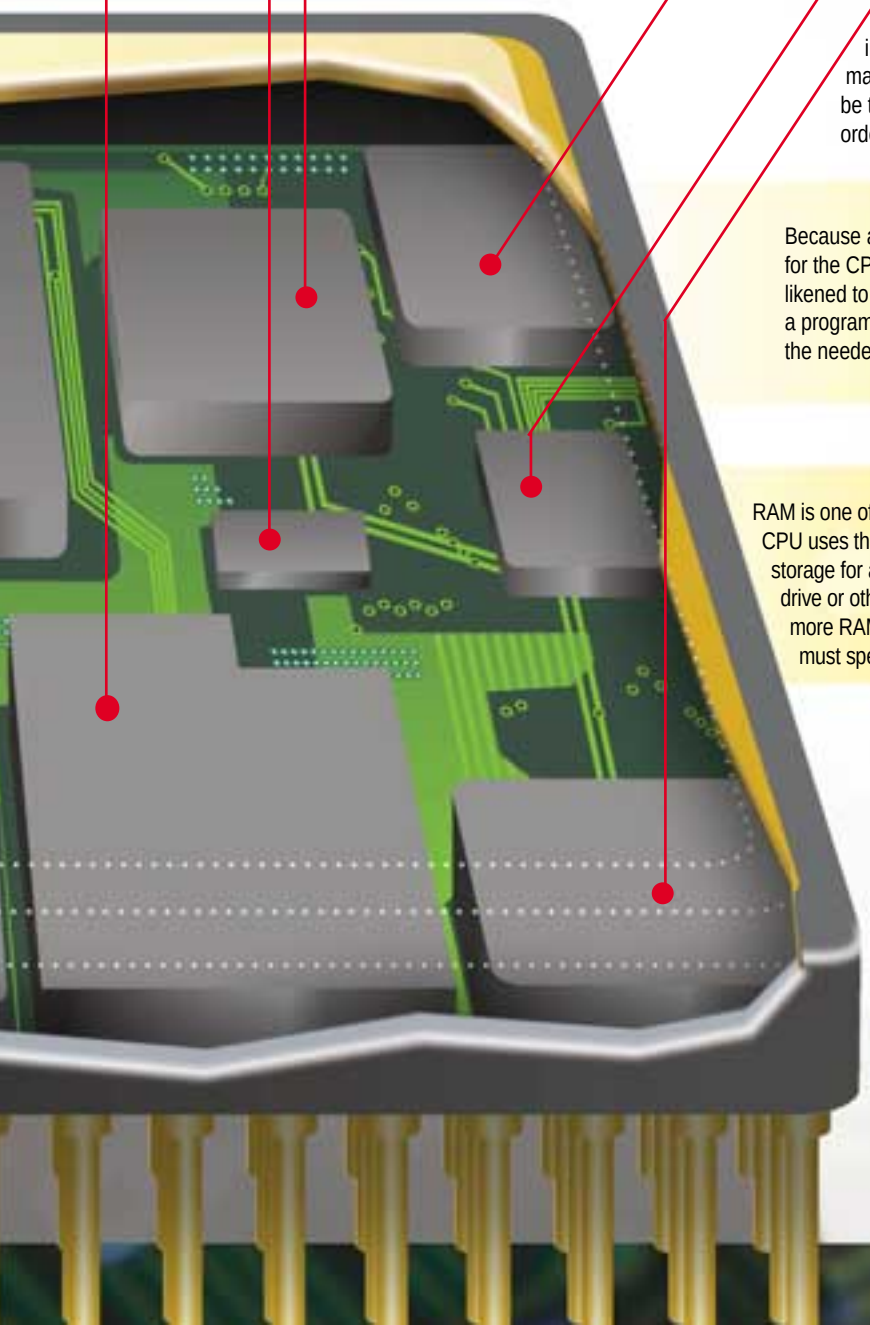
Register
Memory registers are small supplies of dynamic memory placed at strategic points throughout a processor's architecture. Registers store data that has been processed until it is ready to move on to further calculation, output to the user, and so on.

FPU
Sometimes known as math co-processors, FPUs handle complex mathematical operations that include floating-point numbers, or numbers that are or contain fractions of integers. FPUs once were separate microchips on the motherboard, but they are now included in a CPU's architecture to increase speed and efficiency.

ALU
The ALU does the math and processes the Boolean logic operations necessary for a computer to perform calculations and compare input values to preset values. The ALU is capable of working only with binary digits that represent integers, or whole numbers.

Instruction Cache
The instruction cache is a silicon waiting room where instructions from a CPU's instruction set and external software instructions wait in line to be carried out by the control unit.

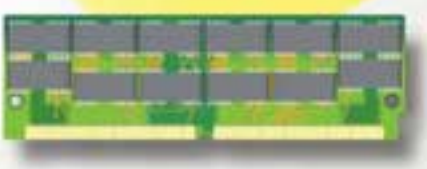
Instruction Set
All CPUs come with preloaded sets of instructions that tell them how to function and respond to external commands. These instructions are stored permanently in the electronic pathways of circuitry that make up this portion of a processor and need to be translated into binary by the decode unit in order to be executed.



Because all software is essentially lists of instructions for the CPU, the hard drive where the PC stores software can be likened to a giant, external instruction set. When your computer runs a program stored on the hard drive, the CPU constantly checks for the needed instructions and loads them into main memory.



RAM is one of a PC's most vital components. The CPU uses this "digital warehouse" as temporary storage for all of the instructions from the hard drive or other storage media that it will use. The more RAM a PC has, the less time its CPU must spend waiting for more instructions, producing faster overall PC performance.



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