

Computer Basics

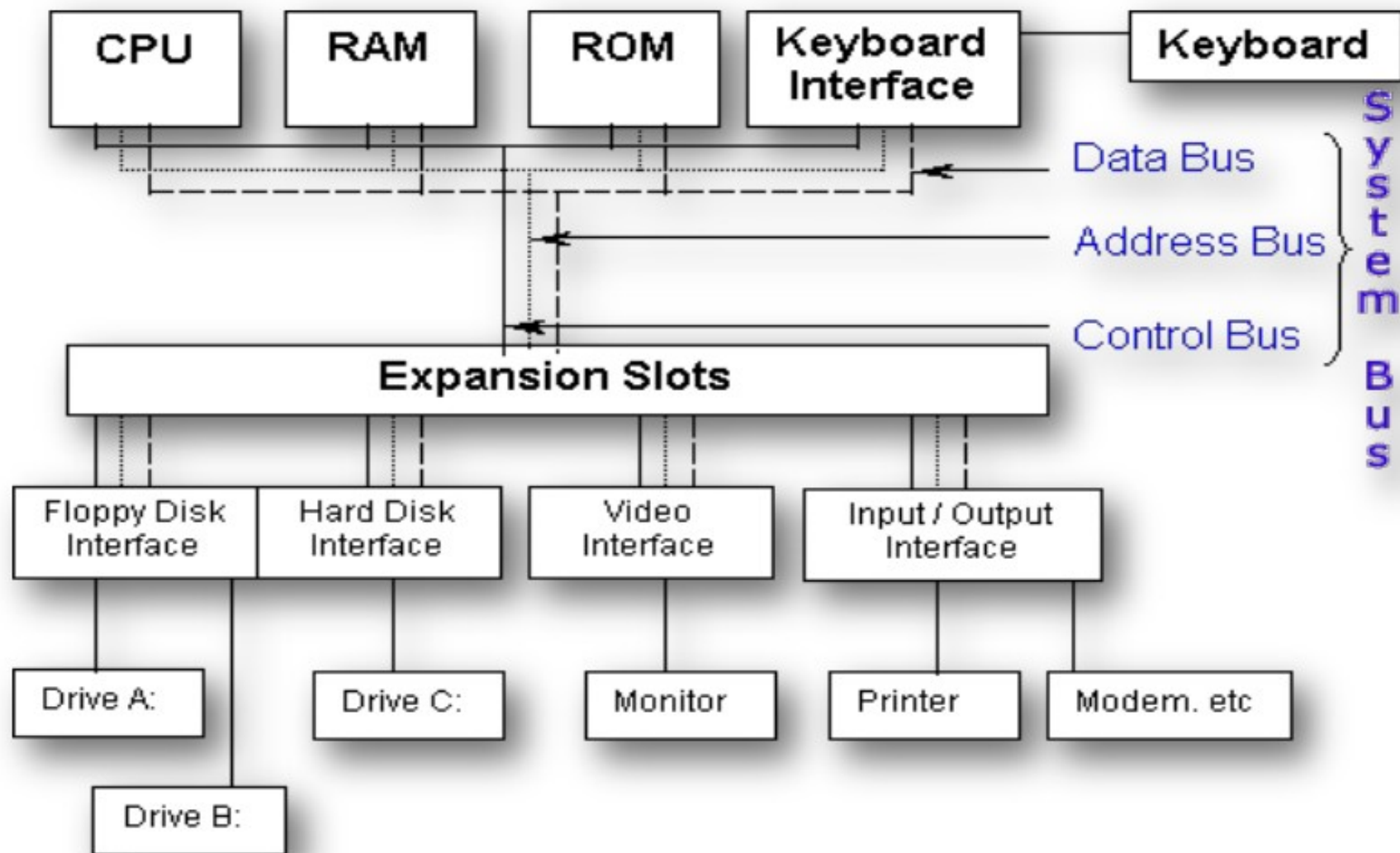
Processors 2

The Processor

Understanding Processor Terminology:

5) Control Bus

- The control bus enables the CPU to monitor and maintain control of the events that occur on the Address and Data Buses.
- All events that occur on the Buses are timed by a very stable clock circuit.
- Example:
 - consider the case where the CPU needs to write data to memory. The basic sequence of events may be as follows:
 - CPU accesses the memory location by placing the address on the Address Bus.
 - CPU puts data on the Data Bus.
 - CPU selects the memory chips to be written to.
 - CPU activates the 'write' signal on the Control Bus.



System Buses



The Processor

Understanding Processor Terminology:

6) Math co-processor (ALU)

- It performs arithmetic operations on the data (add, subtract, multiply, and divide), and also performs logical operations such as comparing two data strings and determining whether they are the same.
- Overall system performance increases because the CPU can focus on logic functions while the math co-processor executes complicated mathematical functions.

The Processor

Understanding Processor Terminology:

6) Math co-processor (ALU)

- In earlier computers, the processor was one chip and the math co-processor was a separate chip on the system board 80486SX. In newer systems, the processor chip includes a built-in math co-processor. All CPU chips, starting with the 80486DX, have a built-in math co-processor

The Processor

Understanding Processor Terminology:

7) MMX (MultiMedia eXtensions)

- MMX is an old instruction set, but my point with putting this in here is for you to see that processor manufacturers will install instructions into the processor for whatever is a hot technology at the time in order to increase performance when using that technology.
- After the Pentium was developed, Intel introduced a feature called MultiMedia eXtensions, or MMX. MMX added 57 new instructions that were built into the processor and told the system how to work with audio, video, and graphics.
- When MMX was developed, both home and business users seemed to be heading toward the world of multimedia, and it made sense to enhance the processor and make it “multimedia aware.” Running any kind of multimedia application on a processor that supports MMX gives you a major performance increase over a processor that doesn’t support MMX technology.

The Processor

Understanding Processor Terminology:

8) Hyperthreading

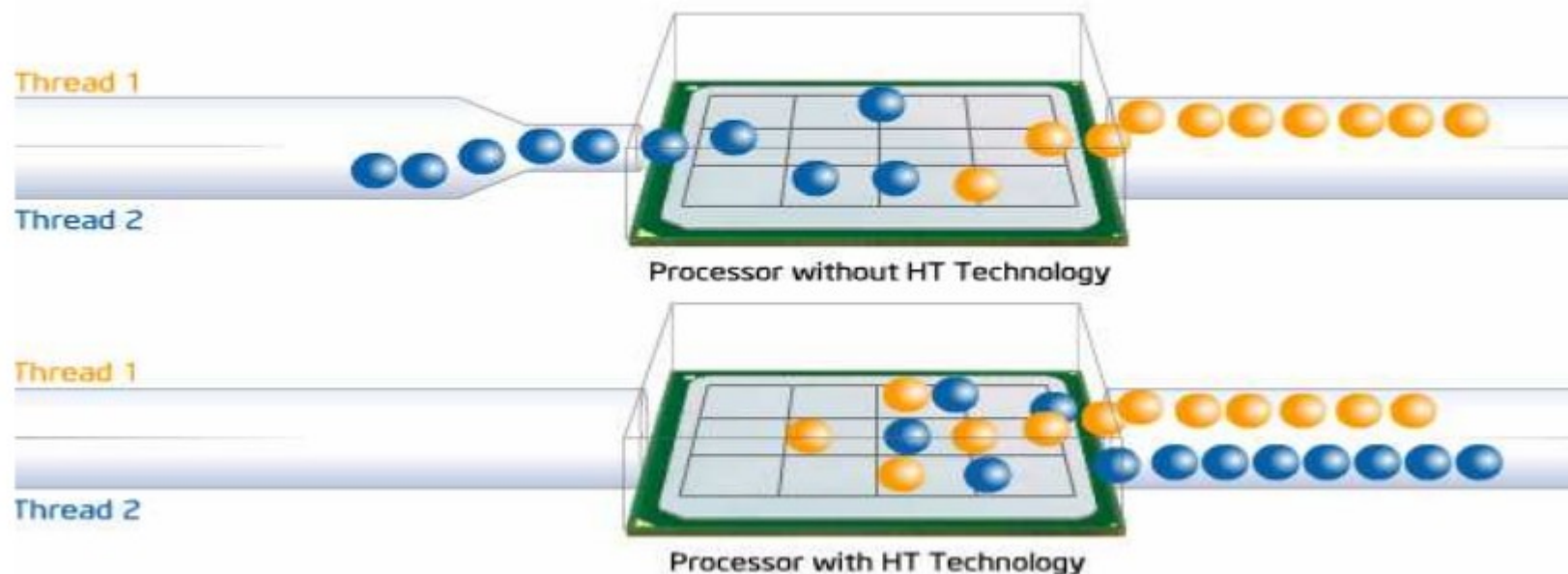
- Hyperthreading is a feature designed by Intel that was placed in the Pentium processors. Hyperthreading technology, or HTT, allows a processor to logically act as two different processors by being able to execute simultaneous threads.
- A thread is a part of an application that executes at any given time. For example, when running Microsoft Word, one thread accepts keystrokes, and another thread runs the spell checker while you type. Thus, two parts of the application run at the same time.
- For a system to truly be able to take advantage of multithreaded applications, you normally need a system that has multiple processors — one processor to run one thread at a time. With hyperthreading, one processor can run more than one thread at a time, increasing performance by 15 to 30 percent.

The Processor

Understanding Processor Terminology:

8) Hyperthreading

- HT Technology is helpful when running multi-threaded applications or multiple tasks at once- such as running anti virus software during using your evryday software.



The Processor

Understanding Processor Terminology:

9) Multicore

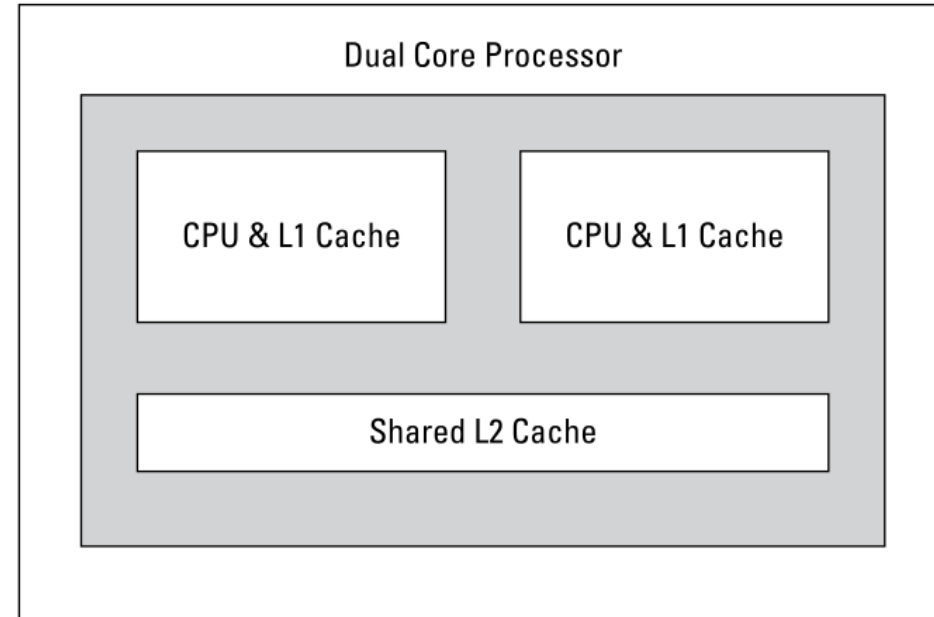
- A multicore processor combines a number of independent processors and the L1 cache from those processors onto a single processor chip. The benefit of a multicore processor is that it can execute multiple threads at the same time without hyperthreading because you essentially have multiple processors in one chip package.
- A multicore processor has the benefit of having multiple processors' core features — such as superscalar execution, pipelining, and threading — all packaged into one physical processor. The core features also include each core having its own L1 cache memory. Multicore processors also have a block of shared L2 cache between the two processors in the multicore chip.

The Processor

Understanding Processor Terminology:

9) Multicore

- A huge benefit of being only one chip on the motherboard is that the one multicore chip draws less power than two separate processors would.



The Processor

Understanding Processor Terminology:

9) Multicore

- A number of different flavors of multicore processors are available today, such as dual-core, triple-core, and quad-core processors.
- **Dual core:** Has two cores in one chip package, with each core typically having 128K of L1 cache and 512K of shared L2 cache.
- **Triple core:** Has three cores in one chip package with each core typically having 128K of L1 cache. Most triple-core processors also have 512K of L2 cache per core and share a block of cache memory, known as L3 cache.
- **Quad core:** Has four cores in one chip package with each core typically having 128K of L1 cache. Most quad-core processors also have 512K of L2 cache per core and share a block of L3 cache (2MB–6MB).

The Processor

Understanding Processor Terminology:

10) Virtualization Support

- One of the newest features to come from processors in recent years is virtualization support. Virtualization allows you to run multiple computers, known as virtual machines (VMs), on one physical computer. Each virtual machine runs a separate operating system with virtual resources assigned to it such as CPUs, virtual hard drives, and memory.
- In order to use virtualization software with your system, your processor must support it and virtualization must be enabled in the BIOS. I don't know how many times I have installation virtualization software such as Hyper-V and then go to start a VM and I receive an error. After this happens, I check the BIOS settings and find out that virtualization support is disabled. A quick change of that setting to "enable" and we are able to run virtual machines!

The Processor

Understanding Processor Terminology:

10) Virtualization Support

- Depending on the manufacturer of the processor you will find that the virtualization extensions are called something different. If you have an Intel processor the virtualization feature is called Intel VT (for Intel Virtualization Technology), but if your processor is an AMD processor then the virtualization feature you must enable is called AMD-V (for AMD Virtualization).
- To run virtualization software such as Microsoft's Hyper-V, you must have a processor that supports it and it must be enabled in the system BIOS.

The Processor

Understanding Processor Terminology:

11) Architecture (32-bit or 64-bit)

- When purchasing a system, you should always investigate whether the system has a 32-bit processor or a 64-bit processor. The 64-bit processors are needed to run today's 64-bit operating systems and software, and will outperform the 32-bit systems.
- Virtualization software — such as Microsoft's Hyper-V — is only available with 64-bit editions of Windows, such as Windows 8.1 or Windows Server. If you do not have a 64-bit computer and a 64-bit edition of Windows 8.1, you are unable to run Hyper-V. My point being if that was your goal and you did not investigate the architecture of the processor before purchasing the second-hand computer, you may not be able to run the software you want.

The Processor

Understanding Processor Terminology:

12) Integrated GPU

- New processors today may have an integrated graphics processing unit (GPU), which would take care of the video calculations and processing for the system. If the processor does not have an integrated GPU and you need to run heavy graphics applications, you will most likely need to purchase a video card with a dedicated GPU in it.
- One of the downfalls of using an integrated GPU is that it will use system RAM as its memory, while a dedicated GPU is an expansion card that has the GPU and its own memory for video processing. This is important because if you have 16GB of RAM in the system and an integrated GPU, the GPU is using some of that 16GB of RAM. A dedicated GPU would not, as it has its own memory on the graphics card.

The Processor

Understanding Processor Terminology:

12) Integrated GPU

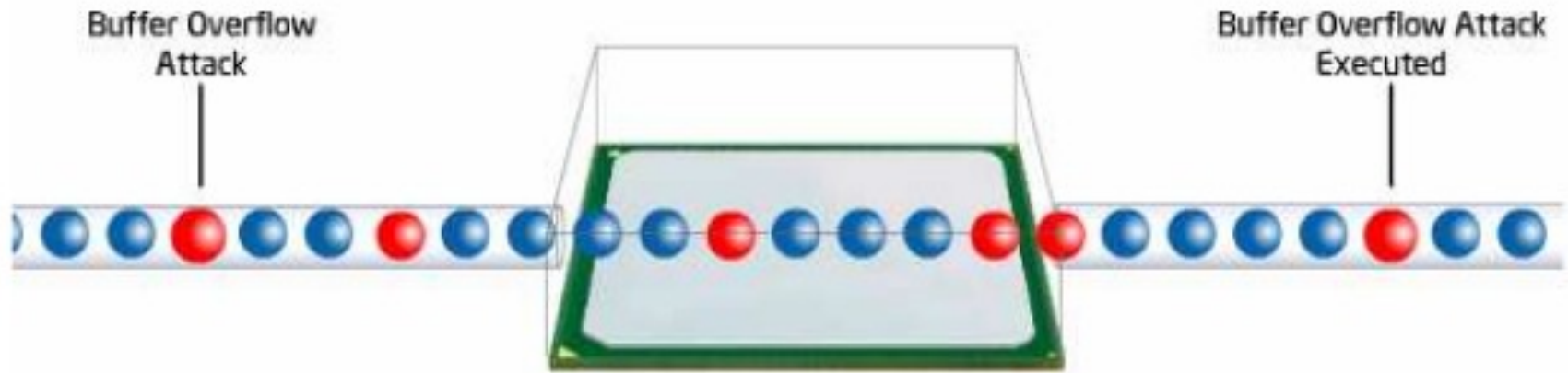
- The benefit of the integrated GPU is that it is less expensive and also uses less power than a dedicated GPU. The integrated GPU would also produce less heat, meaning you wouldn't need to worry about cooling as much.
- Remember that the CPU performs logic operations, the NPU (Neural Processing Unit) performs mathematical calculations, and the GPU takes care of video operations.

The Processor

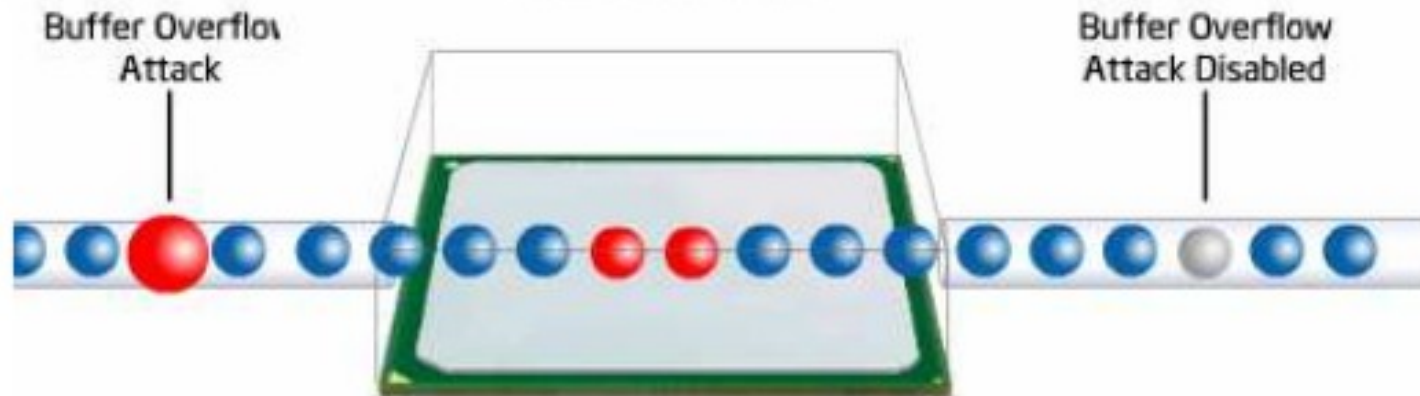
Understanding Processor Terminology:

13) Execute Disable Bit

- Execute Disable Bit (EDB) is a security feature that allows the processor to flag different areas of memory that are, and are not, allowed to run code. This is a great security feature as it is a method to help prevent buffer overflow attacks.
- Buffer overflow attacks are when the hacker submits code to areas of memory in order to run that code. Now with EDB, the code submitted into memory by the hacker would not have permission to execute unless it is running from an area flagged for code execution.
- To take advantage of EDB you must have a processor that supports it, and you must enable it in the BIOS/UEFI.



Processor without Execute Disable Bit



Processor with Execute Disable Bit

The Processor

Understanding Processor Terminology:

14) Throttling

- Throttling (a feature built into a lot of newer processors today) involves the CPU sensing when it is going to overheat and then reducing its speed to lower the heat to an acceptable range.
- Processors that support throttling have a built-in thermal sensor (a high-tech thermometer) that monitors the temperature of the processor. When the processor detects that it is going to overheat — maybe, because of a fan failure — the processor drops its speed so that the temperature drops to an acceptable range.

The Processor

Understanding Processor Terminology:

15) Overclocking

- Overclocking, a big feature for PC enthusiasts, involves running a piece of hardware faster than the speed at which it is rated. A number of devices can be overclocked, such as video adapters and (of course) processors
- Although you might be able to overclock the processor, it is not recommended because overclocking can result in an unstable system or even hardware failure.

The Processor

Understanding Processor Terminology:

16) VRM

- The voltage regulator module (VRM) is responsible for regulating the voltage that is delivered to the processor. The VRM is located on the motherboard (or appears as its own device in the system) and provides the correct running voltage to the processor.
- Some VRMs use a jumper on the motherboard to determine how much voltage is supplied to the processor, and other VRMs sense what the processor needs on startup. Typically, VRMs on the motherboard sense what voltage the processor needs and then supply that voltage.

The Processor

Understanding Processor Terminology:

17) Chip packaging

- Chip packaging refers to how the chip is constructed and delivered to the consumer.
- The chip package defines the appearance or form factor of the chip. Many chip packages have been used over the years.

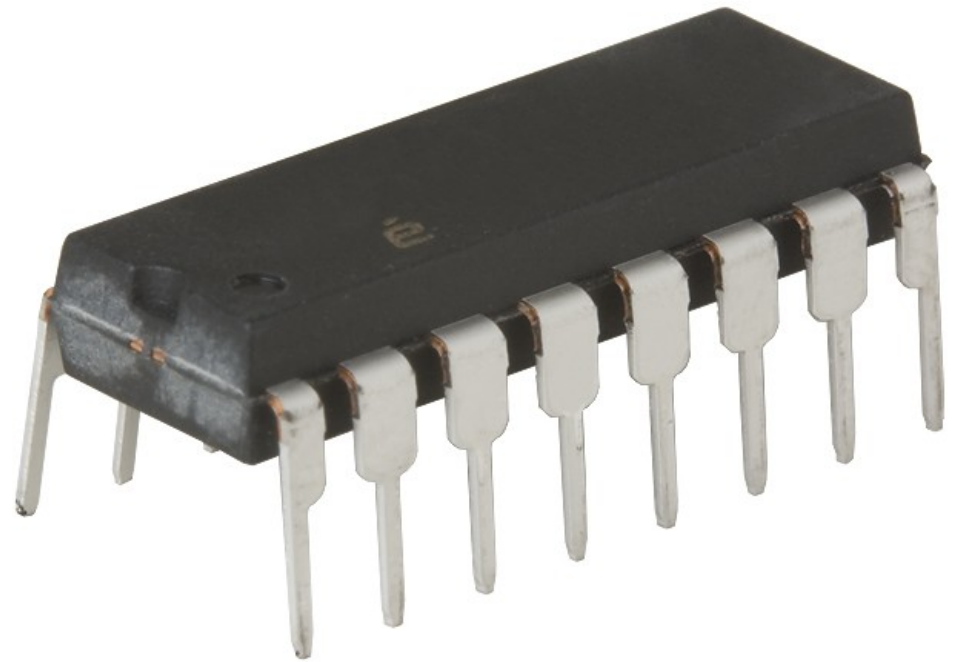
The Processor

Understanding Processor Terminology:

17) Chip packaging

- **Dual inline package (DIP) chip:**

- A rectangular chip with two rows of 20 pins.
- Pin 1 is located at the end of the chip that has a square notch carved into it.
- It is important to identify pin 1 because when you add a DIP chip to the motherboard, you have to match pin 1 on the chip with pin 1 in the chip socket.
- Older processors (such as the 8088) and many math co-processor chips use the DIP chip style.
- Although they are no longer used for CPUs, DIP chips are still used for cache memory and BIOS chips on motherboards. They are also found on memory modules. (See Book 2, Chapter 3 for a discussion of memory modules.)



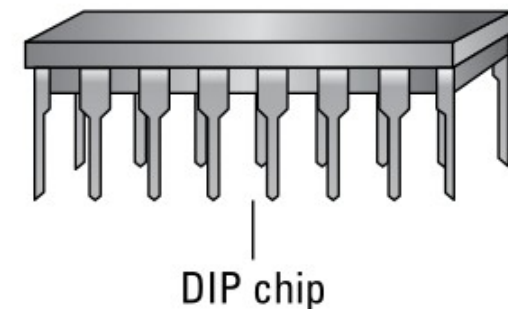
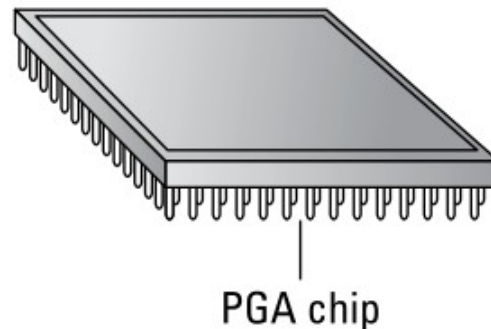
The Processor

Understanding Processor Terminology:

17) Chip packaging

- **Pin grid array (PGA) chip:**

- One of the most popular processor chip packages in use today, the PGA chip is a square chip with an array of pins filling up the shape of the chip.
- In general, the PGA chip uses hundreds of pins. You can locate pin 1 on the PGA by identifying the corner of the PGA chip that has the corner cut off — that corner is where pin 1 is located. The Figure compares a DIP (right side) with a PGA (left side) chip type.



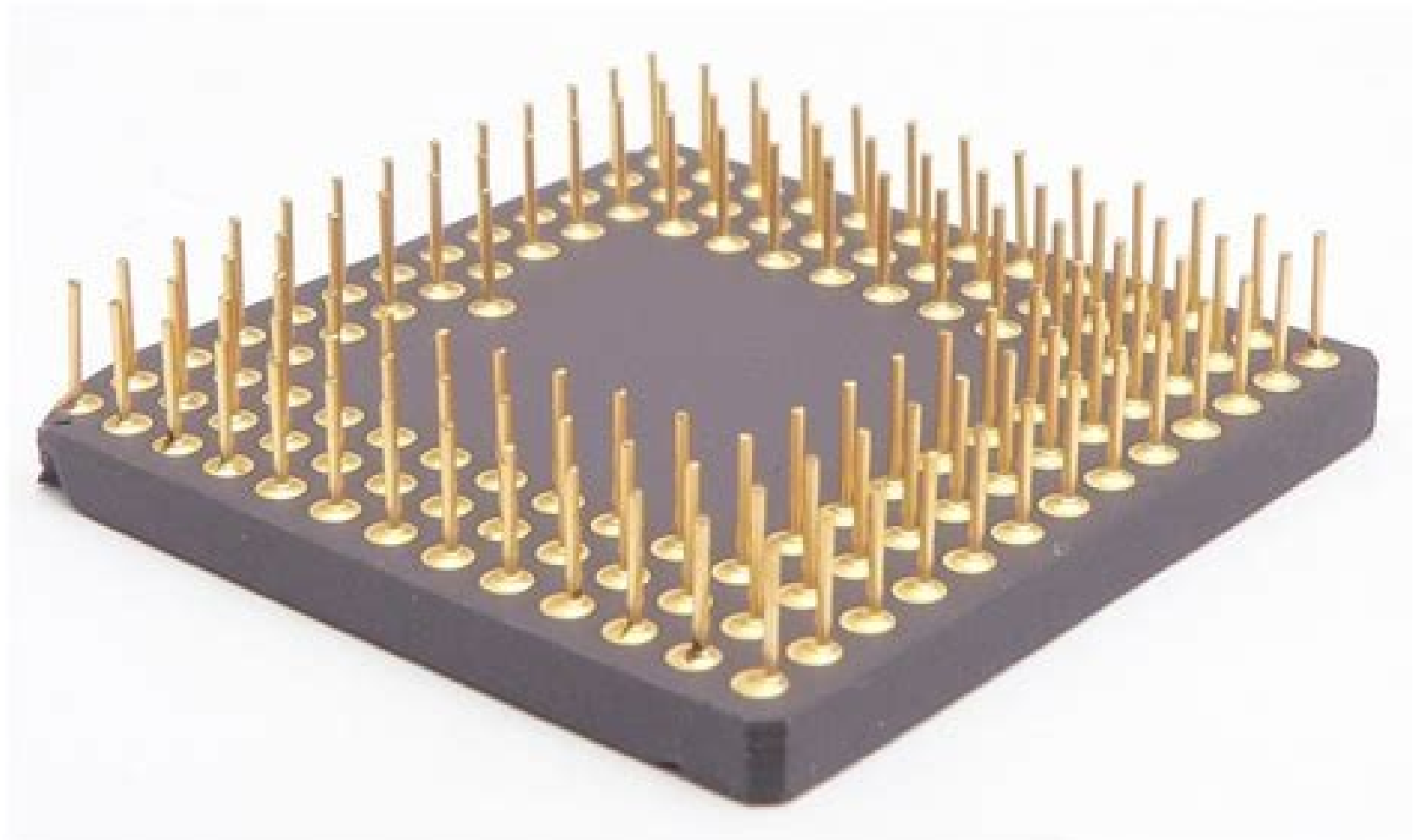
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Understanding Processor Terminology:

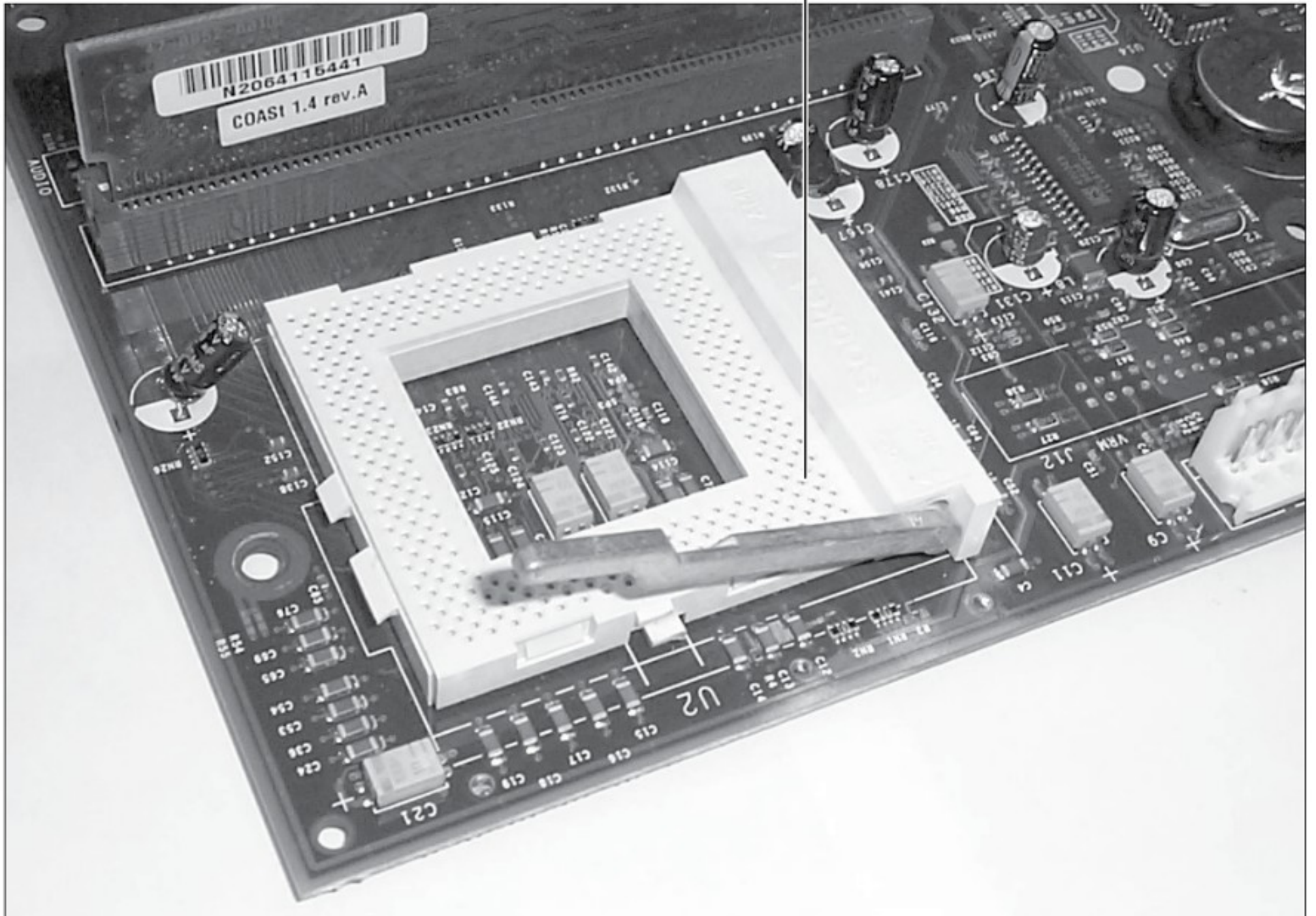
17) Chip packaging

- **Pin grid array (PGA) chip:**

- Today's implementations of processors typically fit into a zero insertion force (ZIF) socket.
- The ZIF socket is ideal for upgrading processors (especially compared with the days before ZIF sockets were used) because the ZIF socket has a lever (on the side of the socket) that you lift to raise the chip from the socket.
- Because the chip is automatically raised out of the socket, you can simply remove the chip out of the socket with little effort! Before ZIF sockets were used, you had to pry the chip out of the socket while trying to ensure that you did not damage the chip or the pins.
- With the ZIF socket, after the processor is raised, you can replace the old chip with a new one. In the past, not all boards used ZIF sockets, so you had to get some special extractors to pull the chip out (carefully!).



Socket 7 ZIF socket



The Processor

Understanding Processor Terminology:

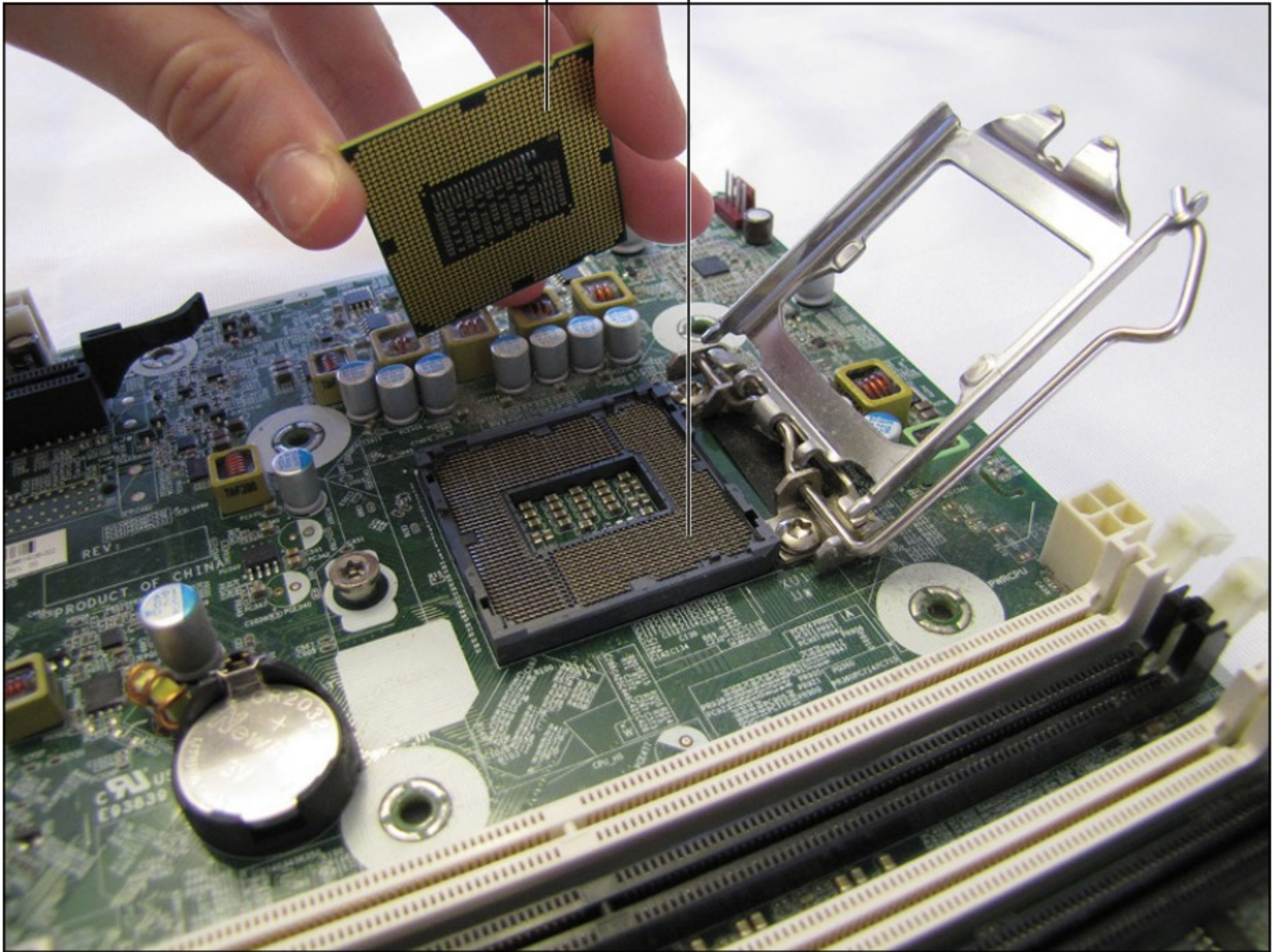
17) Chip packaging

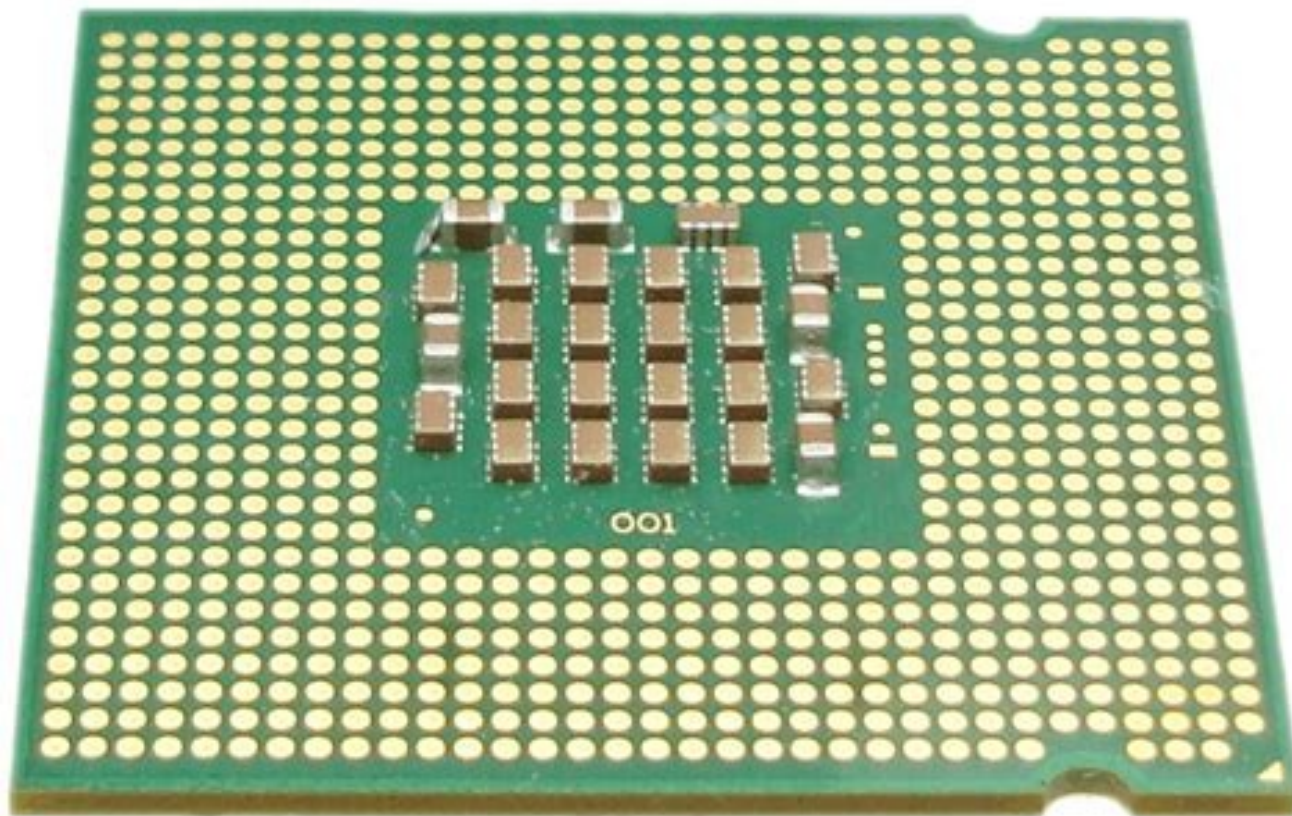
- **Land grid array (LGA) chip:**

- A chip packaging style similar to PGA is the LGA, which has a rectangular packaging style and contacts instead of pins on the bottom side of the chip.
- These contacts make a connection to the contacts within the LGA socket on the motherboard when the processor is placed in the LGA socket.
- The LGA socket is similar to a ZIF socket in the sense that it is designed to make it easy for someone to remove the processor from the system.
- The LGA socket uses a surface plate to hold the chip in place.

Intel Core i5 processor

LGA socket (socket 1155)





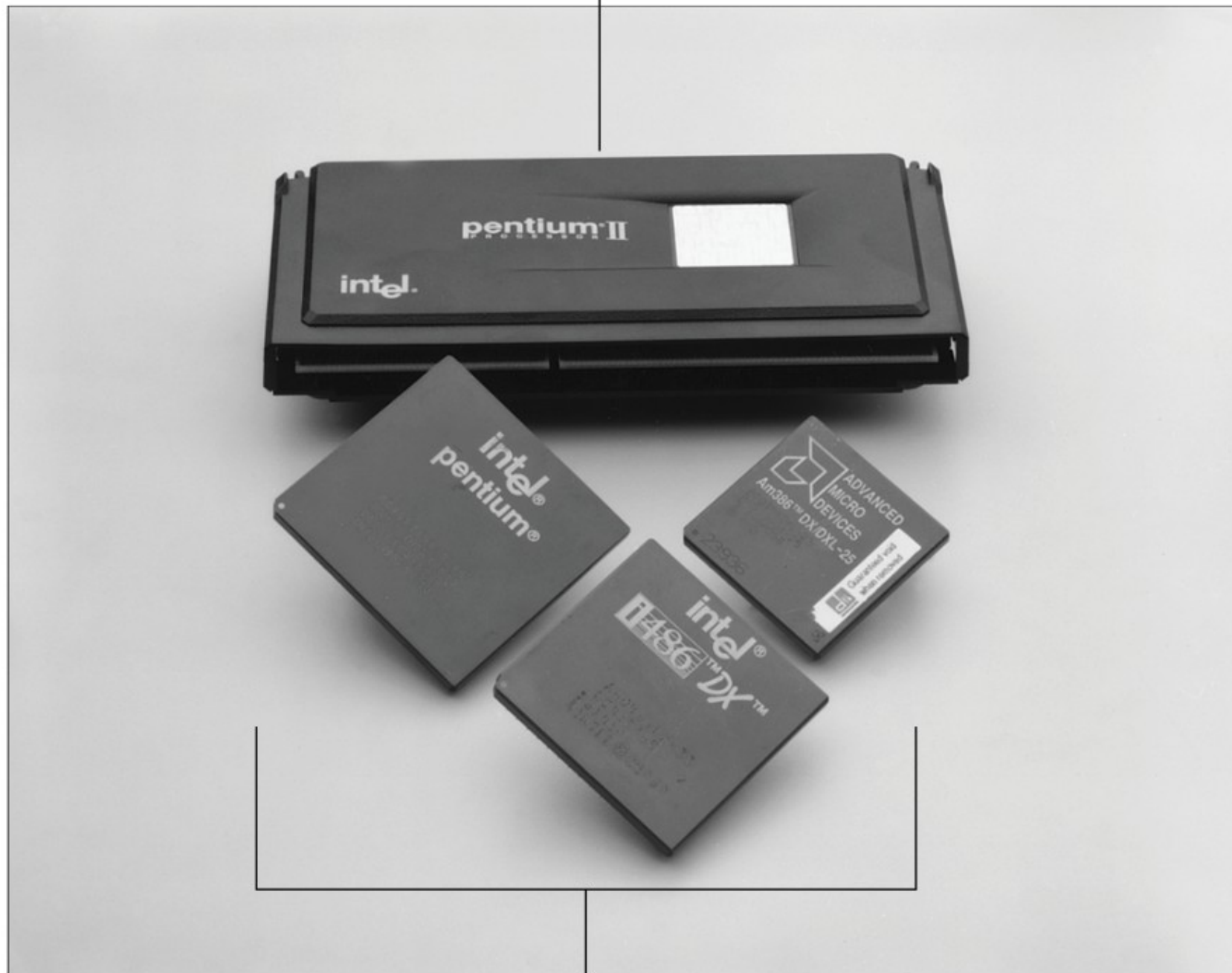
The Processor

Understanding Processor Terminology:

17) Chip packaging

- **Single Edge Contact (SEC) chip:**
 - A chip package type that was popular with the Pentium II processors, the SEC chip is a huge cartridge surrounded by a plastic casing.
 - The newer version, SEC2, is implemented as a card that is inserted into a slot on the motherboard and doesn't have the big plastic casing around it.
 - It is important to stress that the SEC and SEC2 are inserted into a slot and not a socket.
 - The older Pentium II processor used the SEC, while newer processors, such as the Pentium 4 and Intel Core i7 series, are using the PGA and LGA.

SEC chip



PGA chips

Thanks For Attention