LECTURE NOTES ON Computer Organization

By

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Identify the names, purposes, and characteristics of internal components

This section discusses the names, purposes, and characteristics of the internal components of a computer.

After completing this section, you will meet these objectives:

- Identify the names, purposes, and characteristics of **motherboards**.
- Explain the names, purposes, and characteristics of **CPUs**.
- Identify the names, purposes, and characteristics of **cooling systems**.
- Identify the names, purposes, and characteristics of **ROM and RAM**.
- Identify the names, purposes, and characteristics of **adapter cards**.
- Identify the names, purposes, and characteristics of **storage drives**.
- Identify the names, purposes, and characteristics of **internal cables**.

1. Identify the names, purposes, and characteristics of motherboards

- The motherboard is the main printed circuit board and contains the **buses**, or **electrical pathways**, found in a computer. These buses allow data to travel between the various components that comprise a computer. Figure 1 shows a variety of motherboards.
- A motherboard is also known as the **system board**, the **backplane**, or the **main board**. The motherboard accommodates the **central processing unit (CPU)**, RAM, expansion slots, heat sink/fan assembly, BIOS chip, chipset, and the embedded wires that interconnect the motherboard components. Sockets, internal and external connectors, and various ports are also placed on the motherboard.

- The form factor of motherboards pertains to the **size** and **shape** of the board. It also describes the physical layout of the different components and devices on the motherboard. The form factor determines how individual components attach to the motherboard and the shape of the computer case. Various form factors exist for motherboards, as shown in Figure 2.

1. Identify the names, purposes, and characteristics of motherboards

- The most common form factor in desktop computers was the **AT**, based on the IBM AT motherboard. The AT motherboard can be up to approximately one **foot wide**. This cumbersome size led to the development of smaller form factors. The placement of heat sinks and fans often interferes with the use of expansion slots in smaller form factors.
- A newer motherboard form factor, ATX, improved on the AT design. The ATX case is designed to accommodate the integrated I/O ports on the ATX motherboard. The ATX power supply connects to the motherboard via a single 20-pin connector instead of the confusing P8 and P9 connectors used with some earlier form factors. Instead of using a physical toggle switch, the ATX power supply can be powered on and off using signaling from the motherboard.

Form Factors	
AT	Advanced Technology
ATX	Advanced Technology Extended
Mini-ATX	Smaller footprint of Advanced Technology Extended
Micro-ATX	Smaller footprint of Advanced Technology Extended
LPX	Low-Profile Extended
NLX	New Low-Profile Extended
BTX	Balanced Technology Extended

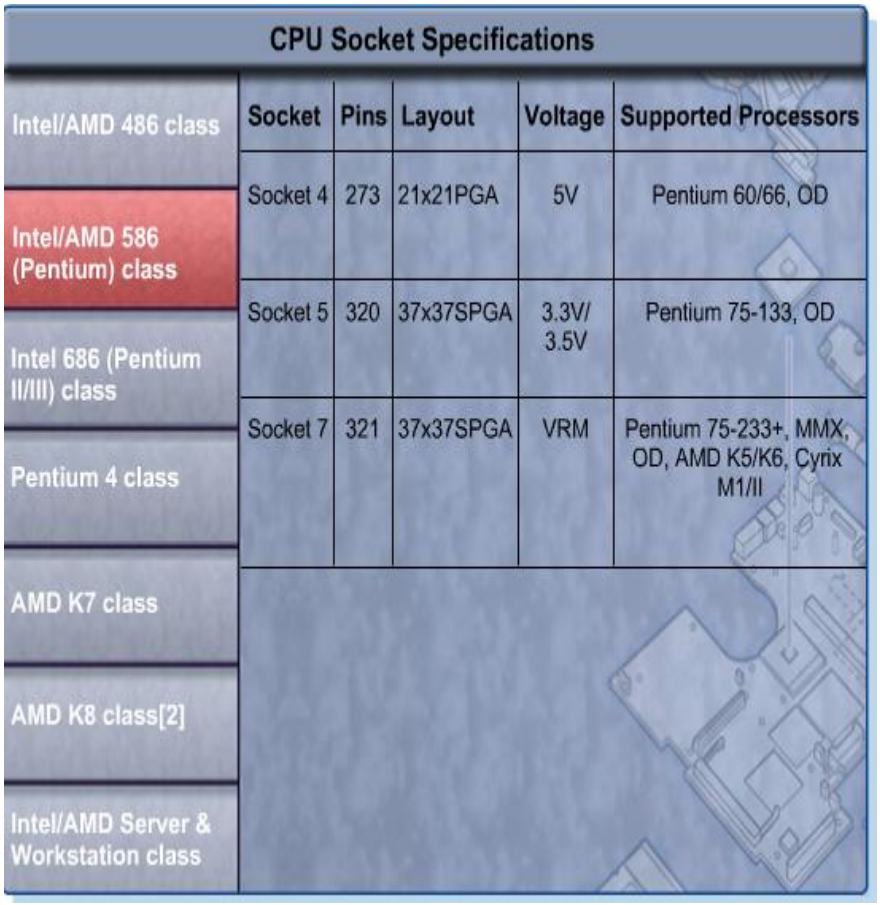
2. Identify the names, purposes, and characteristics of CPUs

- The ***central processing unit (CPU)*** is considered the **brain** of the computer. It is sometimes referred to as the processor. Most calculations take place in the CPU. In terms of computing power, the CPU is the most important element of a computer system. CPUs come in different form factors, each style requiring a particular slot or socket on the motherboard. Common CPU manufacturers include Intel and AMD.
- The CPU socket or slot is the connector that interfaces between the motherboard and the processor. Most CPU sockets and processors in use today are built around the **pin grid array (PGA)** architecture, in which the pins on the underside of the processor are inserted into the socket, usually with zero insertion force (ZIF). ZIF refers to the amount of force needed to install a CPU into the motherboard socket or slot. Slot-based processors are cartridge-shaped and fit into a slot that looks similar to an expansion slot. Figure 1 lists common CPU socket specifications.

CPU Socket Specifications

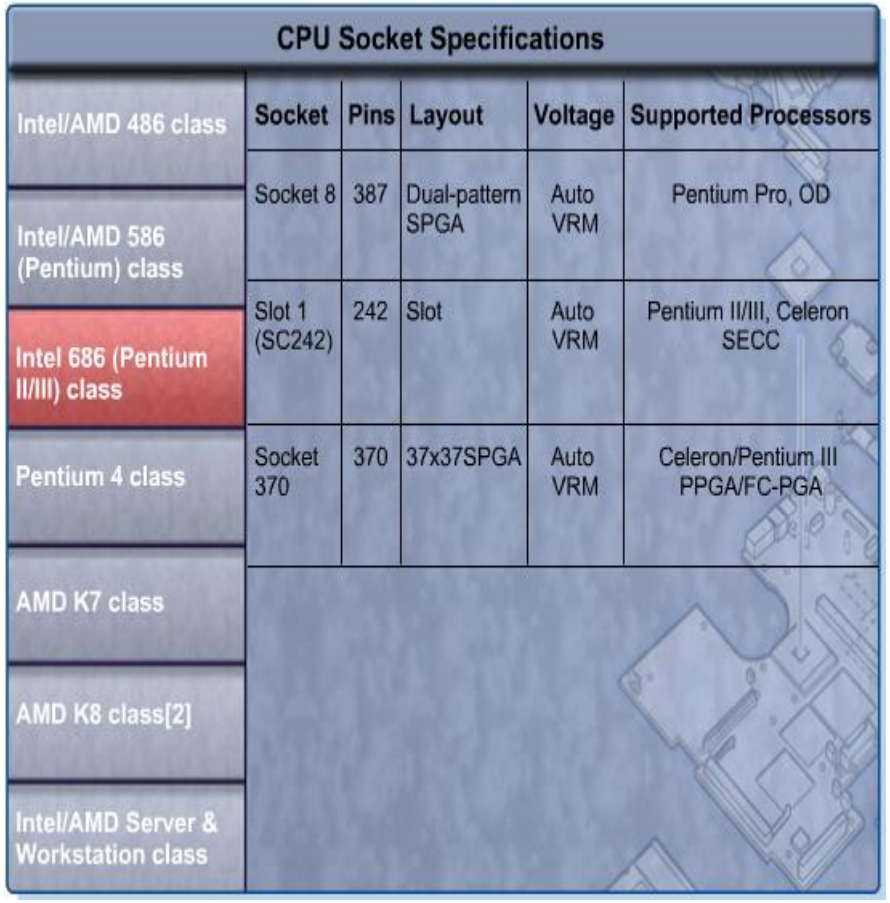
	Socket	Pins	Layout	Voltage	Supported Processors
Intel/AMD 486 class	Socket 1	169	17x17 PGA	5V	486 SX/SX2, DX/DX2, DX4 OD
Intel/AMD 586 (Pentium) class	Socket 2	238	19x19 PGA	5V	486 SX/SX2, DX/DX2, DX4 OD, 486 Pentium OD
Intel 686 (Pentium II/III) class	Socket 3	237	19x19 PGA	5V/3.3V	486 SX/SX2, DX/DX2, DX4, 486 Pentium OD, AMD 5x86
Pentium 4 class	Socket 6	235	19x19 PGA	3.3V	486 DX4, 486 Pentium OD
AMD K7 class					
AMD K8 class[2]					
Intel/AMD Server & Workstation class					

2. Identify the names, purposes, and characteristics of CPU



CPU Socket Specifications

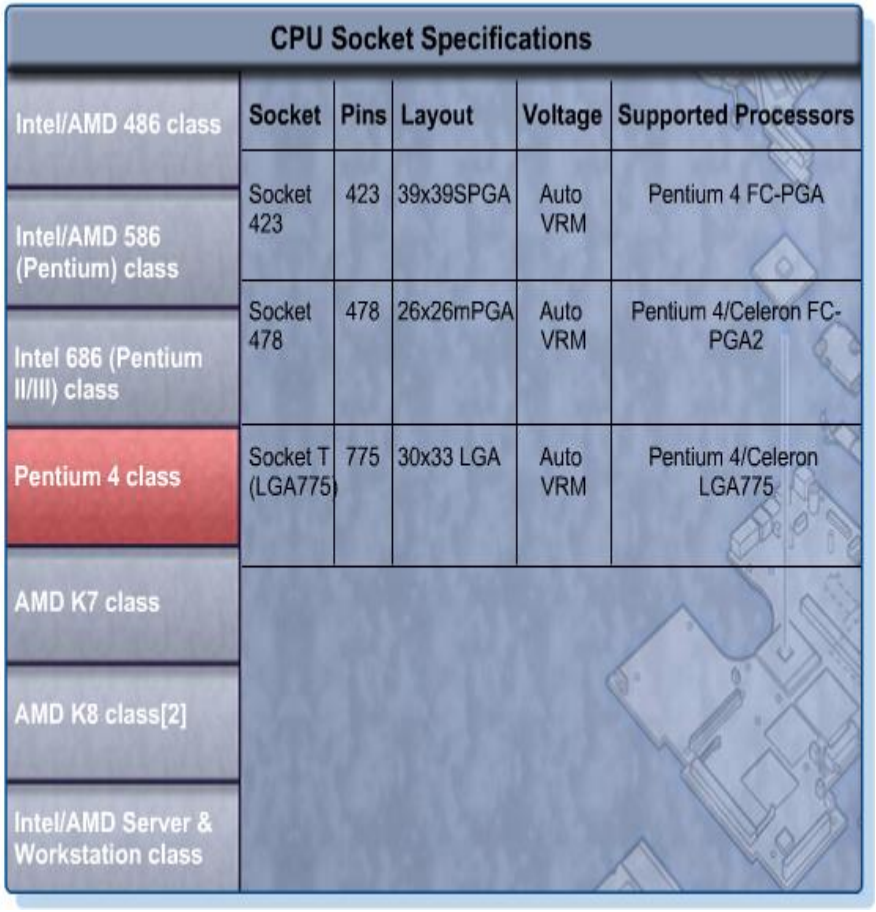
	Socket	Pins	Layout	Voltage	Supported Processors
Intel/AMD 486 class					
Intel/AMD 586 (Pentium) class	Socket 4	273	21x21PGA	5V	Pentium 60/66, OD
Intel 686 (Pentium II/III) class	Socket 5	320	37x37SPGA	3.3V/ 3.5V	Pentium 75-133, OD
Pentium 4 class	Socket 7	321	37x37SPGA	VRM	Pentium 75-233+, MMX, OD, AMD K5/K6, Cyrix M1/II
AMD K7 class					
AMD K8 class[2]					
Intel/AMD Server & Workstation class					



CPU Socket Specifications

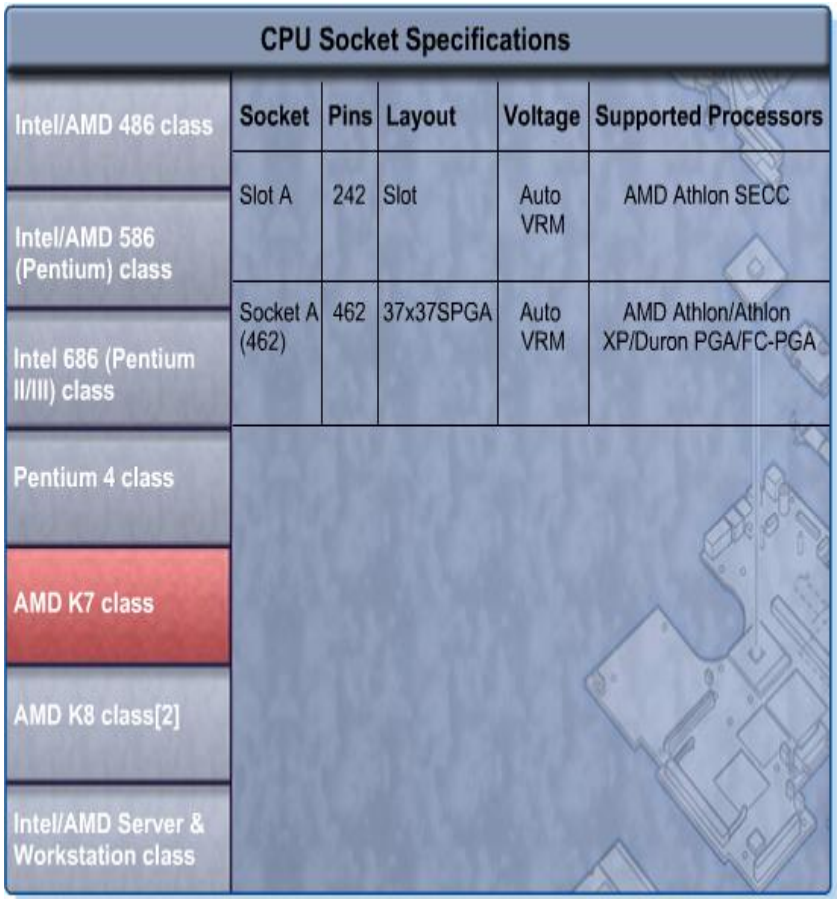
	Socket	Pins	Layout	Voltage	Supported Processors
Intel/AMD 486 class					
Intel/AMD 586 (Pentium) class	Socket 8	387	Dual-pattern SPGA	Auto VRM	Pentium Pro, OD
Intel 686 (Pentium II/III) class	Slot 1 (SC242)	242	Slot	Auto VRM	Pentium II/III, Celeron SECC
Pentium 4 class	Socket 370	370	37x37SPGA	Auto VRM	Celeron/Pentium III PPGA/FC-PGA
AMD K7 class					
AMD K8 class[2]					
Intel/AMD Server & Workstation class					

2. Identify the names, purposes, and characteristics of CPU



CPU Socket Specifications

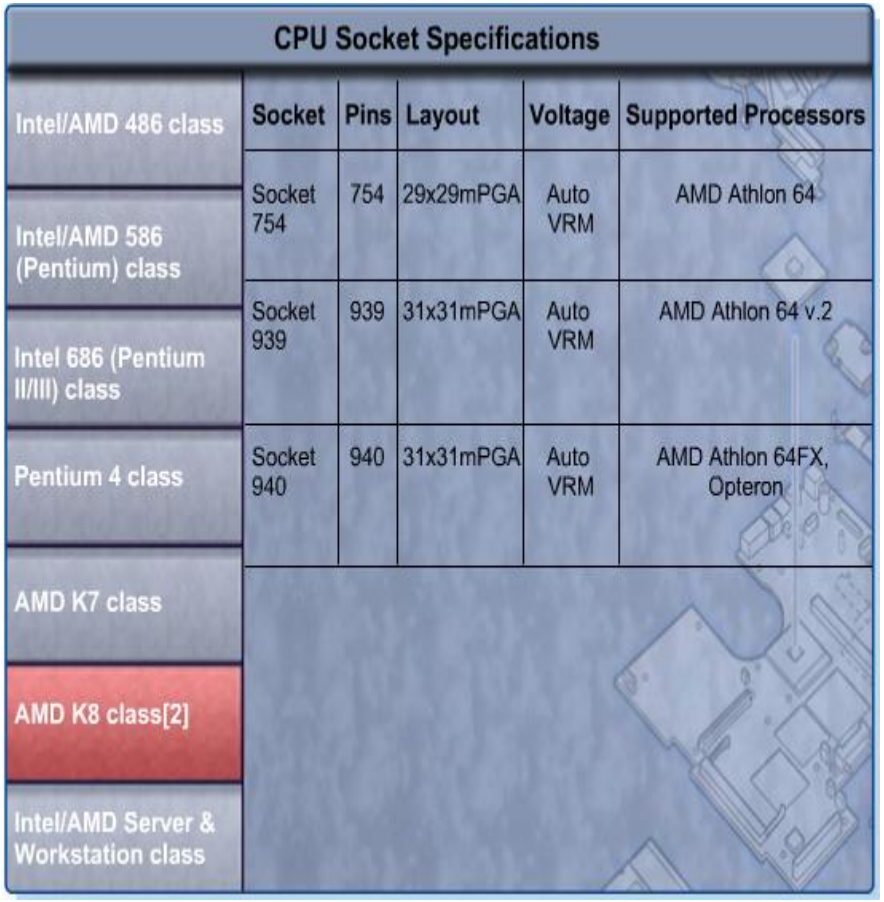
	Socket	Pins	Layout	Voltage	Supported Processors
Intel/AMD 486 class					
Intel/AMD 586 (Pentium) class	Socket 423	423	39x39SPGA	Auto VRM	Pentium 4 FC-PGA
Intel 686 (Pentium II/III) class	Socket 478	478	26x26mPGA	Auto VRM	Pentium 4/Celeron FC-PGA2
Pentium 4 class	Socket T (LGA775)	775	30x33 LGA	Auto VRM	Pentium 4/Celeron LGA775
AMD K7 class					
AMD K8 class[2]					
Intel/AMD Server & Workstation class					



CPU Socket Specifications

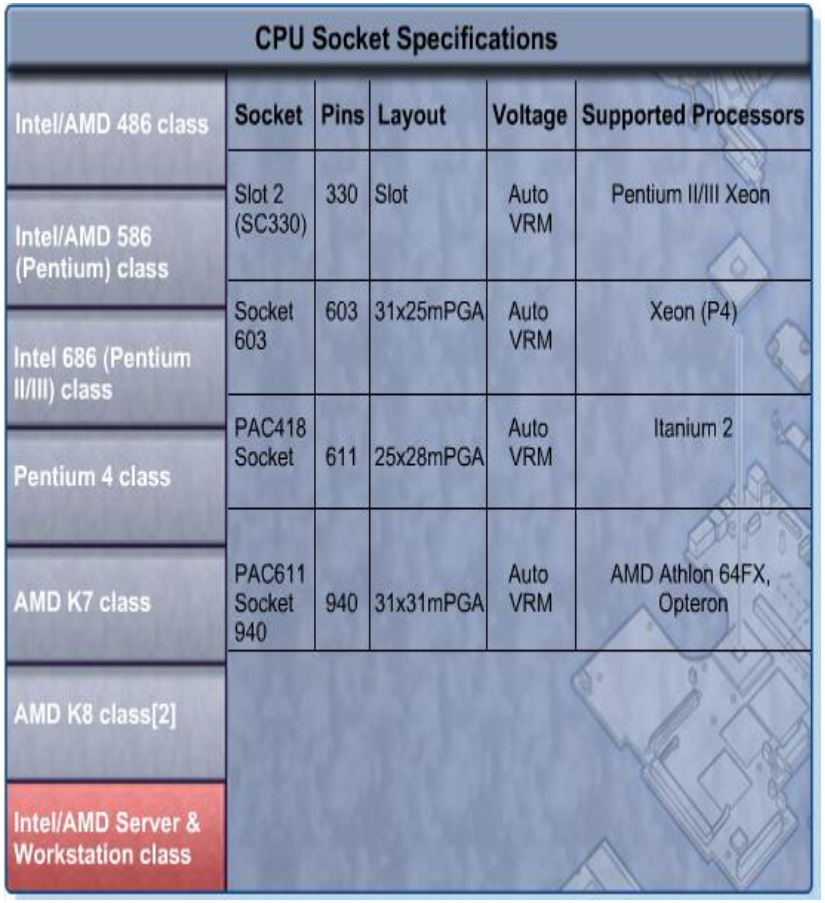
	Socket	Pins	Layout	Voltage	Supported Processors
Intel/AMD 486 class					
Intel/AMD 586 (Pentium) class	Slot A	242	Slot	Auto VRM	AMD Athlon SECC
Intel 686 (Pentium II/III) class	Socket A (462)	462	37x37SPGA	Auto VRM	AMD Athlon/Athlon XP/Duron PGA/FC-PGA
Pentium 4 class					
AMD K7 class					
AMD K8 class[2]					
Intel/AMD Server & Workstation class					

2. Identify the names, purposes, and characteristics of CPU



CPU Socket Specifications

	Socket	Pins	Layout	Voltage	Supported Processors
Intel/AMD 486 class					
Intel/AMD 586 (Pentium) class	Socket 754	754	29x29mPGA	Auto VRM	AMD Athlon 64
Intel 686 (Pentium II/III) class	Socket 939	939	31x31mPGA	Auto VRM	AMD Athlon 64 v.2
Pentium 4 class	Socket 940	940	31x31mPGA	Auto VRM	AMD Athlon 64FX, Opteron
AMD K7 class					
AMD K8 class[2]					
Intel/AMD Server & Workstation class					



CPU Socket Specifications

	Socket	Pins	Layout	Voltage	Supported Processors
Intel/AMD 486 class					
Intel/AMD 586 (Pentium) class	Slot 2 (SC330)	330	Slot	Auto VRM	Pentium II/III Xeon
Intel 686 (Pentium II/III) class	Socket 603	603	31x25mPGA	Auto VRM	Xeon (P4)
Pentium 4 class	PAC418 Socket	611	25x28mPGA	Auto VRM	Itanium 2
AMD K7 class	PAC611 Socket 940	940	31x31mPGA	Auto VRM	AMD Athlon 64FX, Opteron
AMD K8 class[2]					
Intel/AMD Server & Workstation class					

2. Identify the names, purposes, and characteristics of CPU

- The **CPU executes a program**, which is a sequence of stored instructions. Each model of processor has an **instruction set**, which it executes. The CPU executes the program by processing each piece of data as directed by the program and the instruction set. While the CPU is executing one step of the program, the remaining instructions and the data are stored nearby in a special memory called ***cache***. **There are two major CPU architectures related to instruction sets:**
    1. **Reduced Instruction Set Computer (RISC)** – Architectures use a relatively ***small set of instructions***, and RISC chips are designed to execute these instructions very rapidly.
    2. **Complex Instruction Set Computer (CISC)** – Architectures use a ***broad set of instructions***, resulting in fewer steps per operation.

Some CPUs incorporate hyperthreading to enhance the performance of the CPU. With hyperthreading, the CPU has multiple pieces of code being

2. Dual, Triple, Quad Core Processors

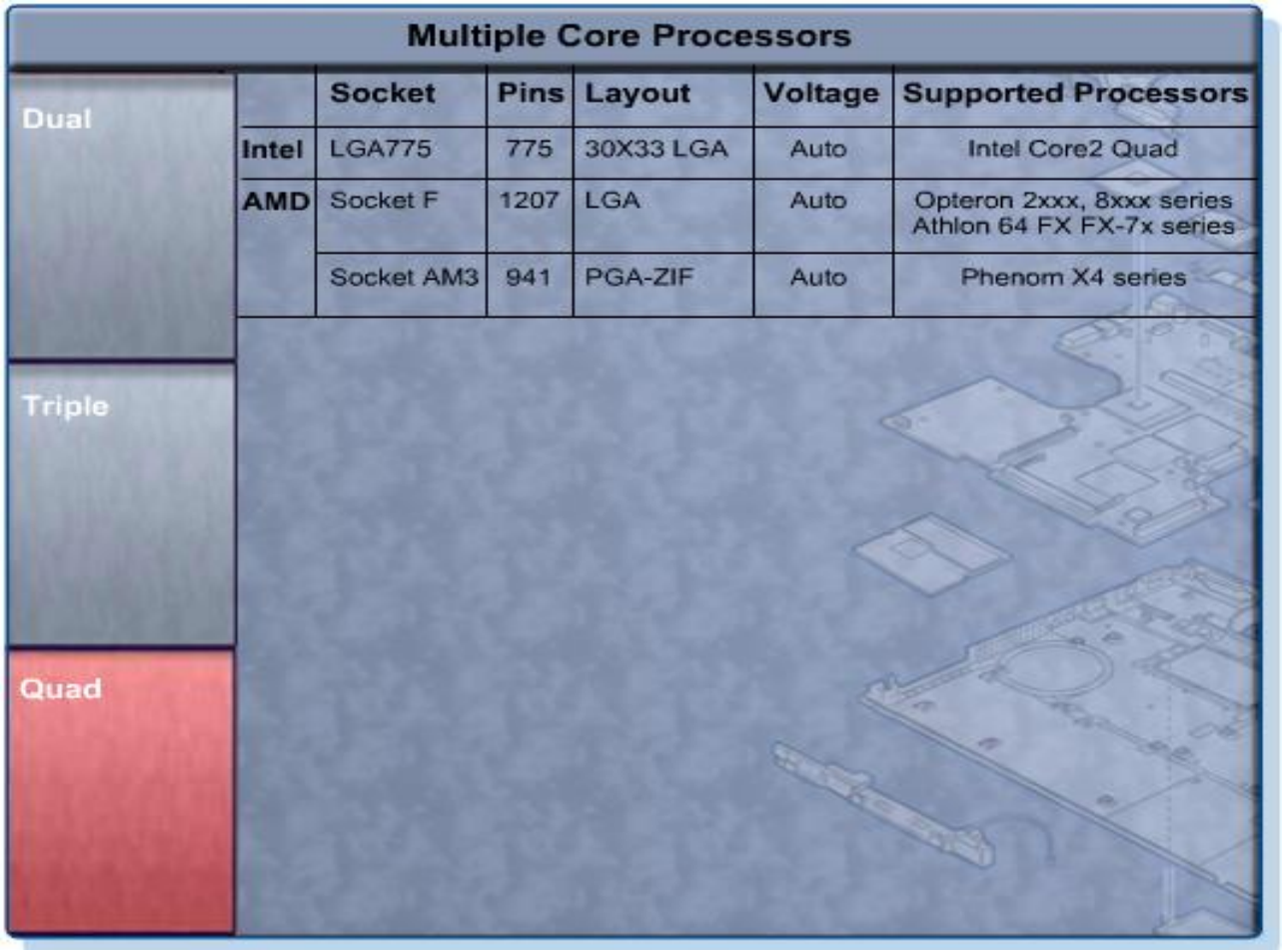
Multiple Core Processors

		Socket	Pins	Layout	Voltage	Supported Processors
Dual	Intel	Socket T (LGA775)	775	30X33 LGA	Auto VRM	Pentium XE Intel Core 2 Duo Intel Core 2 Extreme
		Socket M	478	Micro-FCPGA	Auto VRM	Intel Core Solo Intel Core Duo Intel Core 2 Duo (T5x00, T7x00 and T8x00) Intel Celeron M
Triple	AMD	Socket S1 (Replaced Socket 754)	638	PGA-ZIF	Auto	Athlon 64 X2 Turion 64 X2; Mobile Sempron; Turion 64 (MK series only)
		Socket AM2 (Supports DDR2 but not DDR Memory)	940	PGA-ZIF	Auto	Athlon 64 Athlon 64 X2 Athlon 64 FX Opteron Sempron Phenom
Quad		Socket AM2+ (Added support for DDR3)	940	PGA-ZIF	Auto	Athlon 64 Athlon 64 X2 Opteron Phenom series : Phenom X2
		Socket AM3	940	PGA-ZIF	Auto	Phenom II (excluding 940 and 920) Athlon II

Multiple Core Processors

		Socket	Pins	Layout	Voltage	Supported Processors
Dual	AMD	Socket AM3	941	PGA-ZIF	Auto	Phenom X3
Triple						
Quad						

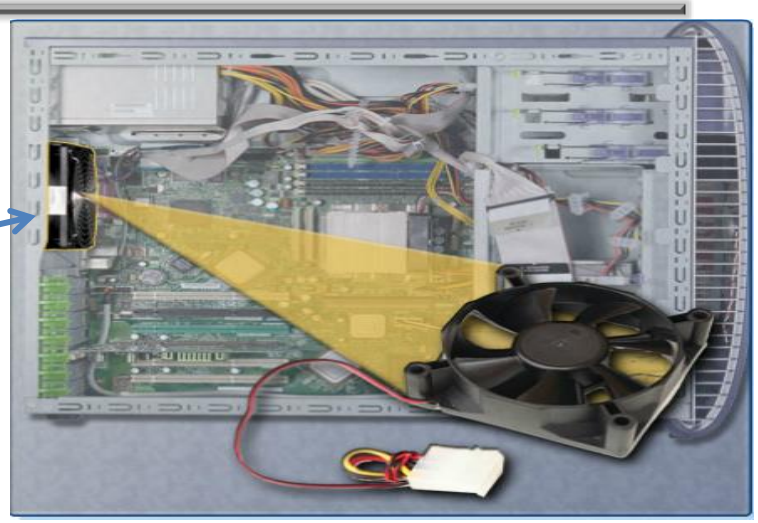
2. Dual, Triple, Quad Core Processors

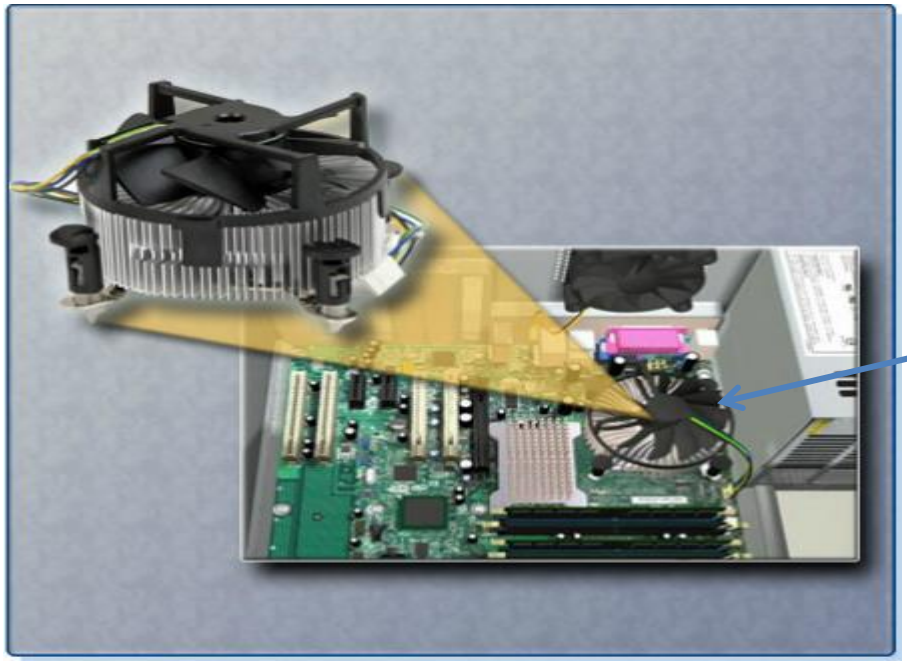


3. Identify the names, purposes, and characteristics of cooling systems

Electronic components generate heat. Heat is caused by the flow of current within the components. Computer components perform better when kept cool. If the heat is not removed, the computer may run slower. If too much heat builds up, computer components can be damaged.

Increasing the air flow in the computer case allows more heat to be removed. **A case fan**, shown in Figure 1, is installed in the computer case to make the cooling process more efficient.





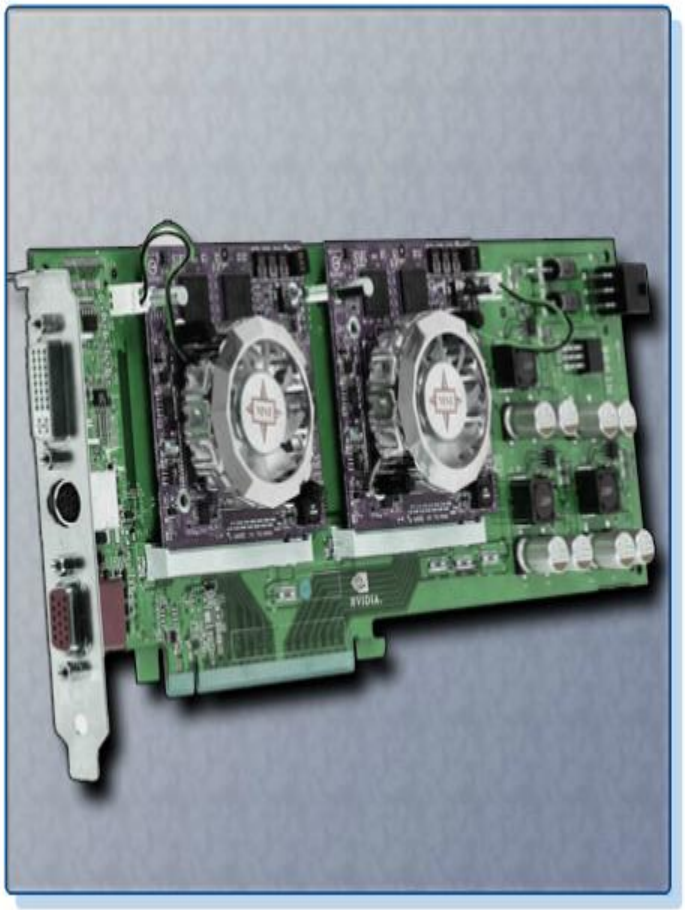
In addition to case fans, a heat sink draws heat away from the core of the CPU. **A fan on top of the heat sink,** shown in Figure 2, moves the heat away from the CPU.

3. Identify the names, purposes, and characteristics of cooling systems

Other components are also susceptible to heat damage and are sometimes equipped with fans. Video adapter cards also produce a great deal of heat. Fans are dedicated to cool the graphics-processing unit (GPU), as seen in Figure 3.

Computers with extremely fast CPUs and GPUs may use a water-cooling system. A metal plate is placed over the processor and water is pumped over the top to collect the heat that the CPU creates. The water is pumped to a radiator to be cooled by the air, and then re-circulated.

Graphic Card Cooling System



Quiz

What meaning the following concepts:

1. *IT*
2. *European Professional Informatics Societies (CEPIS)*
3. *Operating System (OS)*
4. *Hardware(H/W)*
5. *Software(S/W)*

What is the purpose of a heat sink installed on a processor?

- to set the processor voltage
- to cool the processor
- to set the processor speed
- to ground the processor

Which CPU is manufactured as a multi-core processor with one of the cores disabled?

- dual core
- triple core
- quad core
- RISC core