Computer Maintenance

Unit Subtitle: Motherboards

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Lesson Objectives

- Describe the function of the motherboard.
- Identify the different types of motherboards and their characteristics.
- Identify the main components of the motherboard.
- Determine the capabilities and limitations of the system.
- Considerations when purchasing a motherboard.

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Lesson Objectives

- Recognize Expansion Card Architecture.
- Recognize the relationship between the CPU and Bus speeds and how to control them.
- Recognize the hardware configuration using DIP switches, jumpers, and CMOS.
- Identify the components of the typical board system layout.

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Lesson Objectives

- Identify the characteristics of various other motherboard layout types.
- Describe troubleshooting techniques and maintenance tips.
- Remove and install a motherboard on a PC.
- Sketch and label the components of a motherboard in a PC.

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Motherboard Functions

- Houses the CPU
- Allow all devices to communicate with the motherboard and with each other
- Determine the capabilities and limitations of the system

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Types of Motherboards

Type of Motherboard	Description
AT	▪ Oldest type of motherboard still used in some systems ▪ Uses P8 and P9 power connections (see Figure 5-1) ▪ Measures 30.5 cm × 33 cm (12 inches × 13 inches)
Baby AT	▪ Smaller version of AT. Small size is possible because motherboard logic is stored on a smaller chip set. ▪ Uses P8 and P9 power connections ▪ Measures 33 cm × 22 cm (12 inches × 8.7 inches)
ATX	▪ Developed by Intel for Pentium systems ▪ Has a more conveniently accessible layout than AT boards ▪ Includes a power-on switch that can be software-enabled and extra power connections for extra fans ▪ Uses a P1 connector (see Figure 5-1) ▪ Measures 30.5 cm × 24.4 cm (12 inches × 9.6 inches)
Mini ATX	▪ An ATX board with a more compact design ▪ Measures 28.4 cm× 20.8 cm (11.2 inches × 8.2 inches)

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Main Components on a Motherboard

- System clock
- CPU and its chip set
- System bus with expansion slots
- Jumpers and DIP switches
- ROM BIOS
- CMOS configuration chip and its battery
- RAM
- RAM cache (L2) (optional)
- Ports directly on the board
- Power supply connections

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Selection of a Motherboard Determines…

- CPU types and speeds
- Chip set on the board
- Memory cache type and size
- Types and number of expansion slots: ISA, PCI, and AGP
- Type of memory: ECC, EDO, SDRAM, SIMMs, or DIMMs
- Type of memory: what kind and how much? SRAM and DRAM

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Considerations When Selecting a System Board

- Type of case
- ROM BIOS
- Type of keyboard connector
- Presence/absence of proprietary video and/or proprietary local bus slots
- Presence/absence of IDE adapters and SCSI controller
- Presence/absence of COM ports, LPT ports, and mouse port

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The System Clock

- Keeps the beat for motherboard activities
- Frequency is measured in megahertz (MHz)
- Wait state
  - Occurs when the CPU must wait for another component

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The Chip Set

- Set of chips on the system board that collectively controls the memory cache, external buses, and some peripherals
- Intel dominates the market
  - Most compatible with the Pentium family of CPUs
  - Investment in R&D has led to other developments (eg, PCI bus, universal serial bus, AGP, and Accelerated Hub Architecture)

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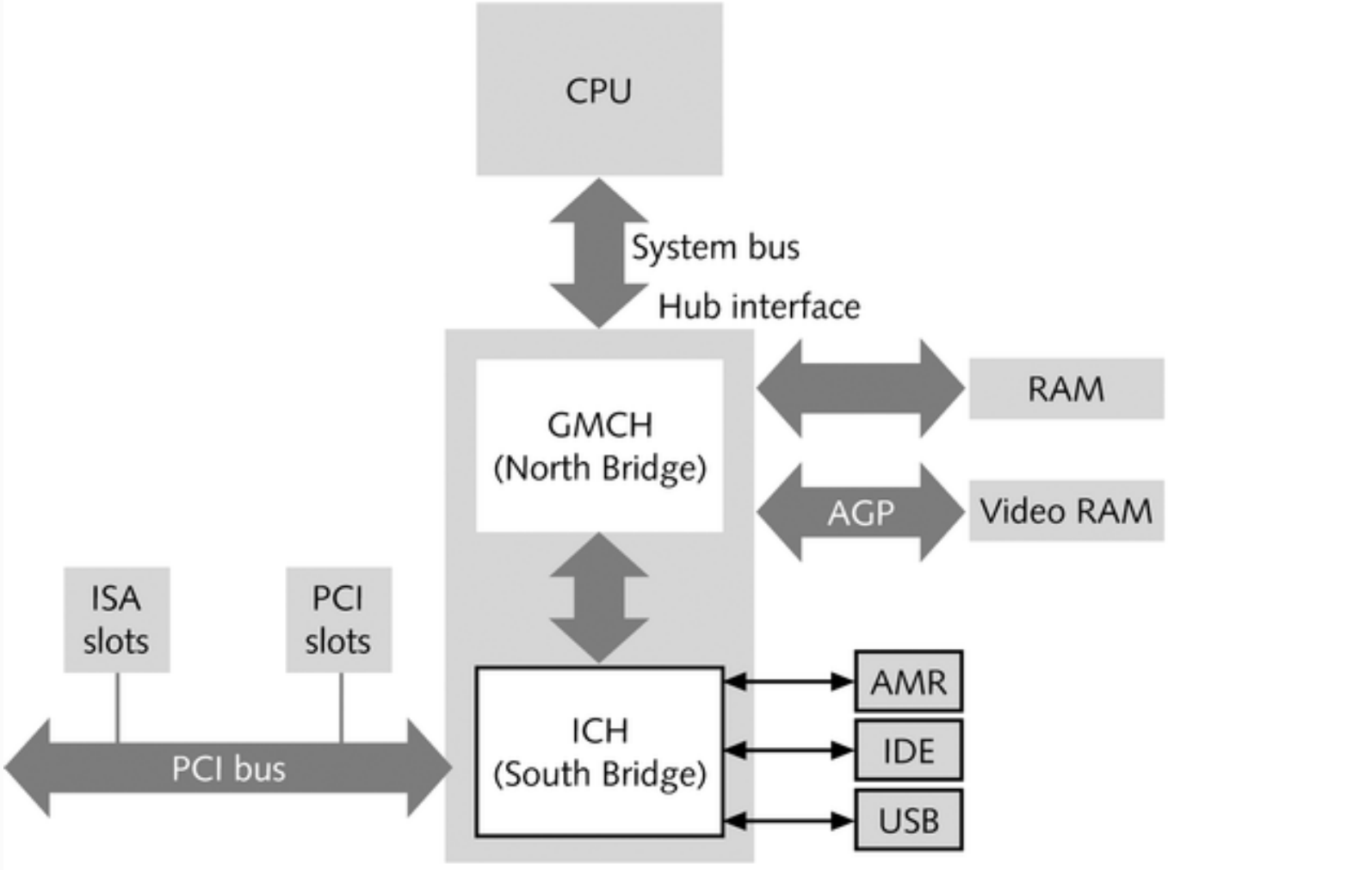
Intel 800 Series of Chip Sets



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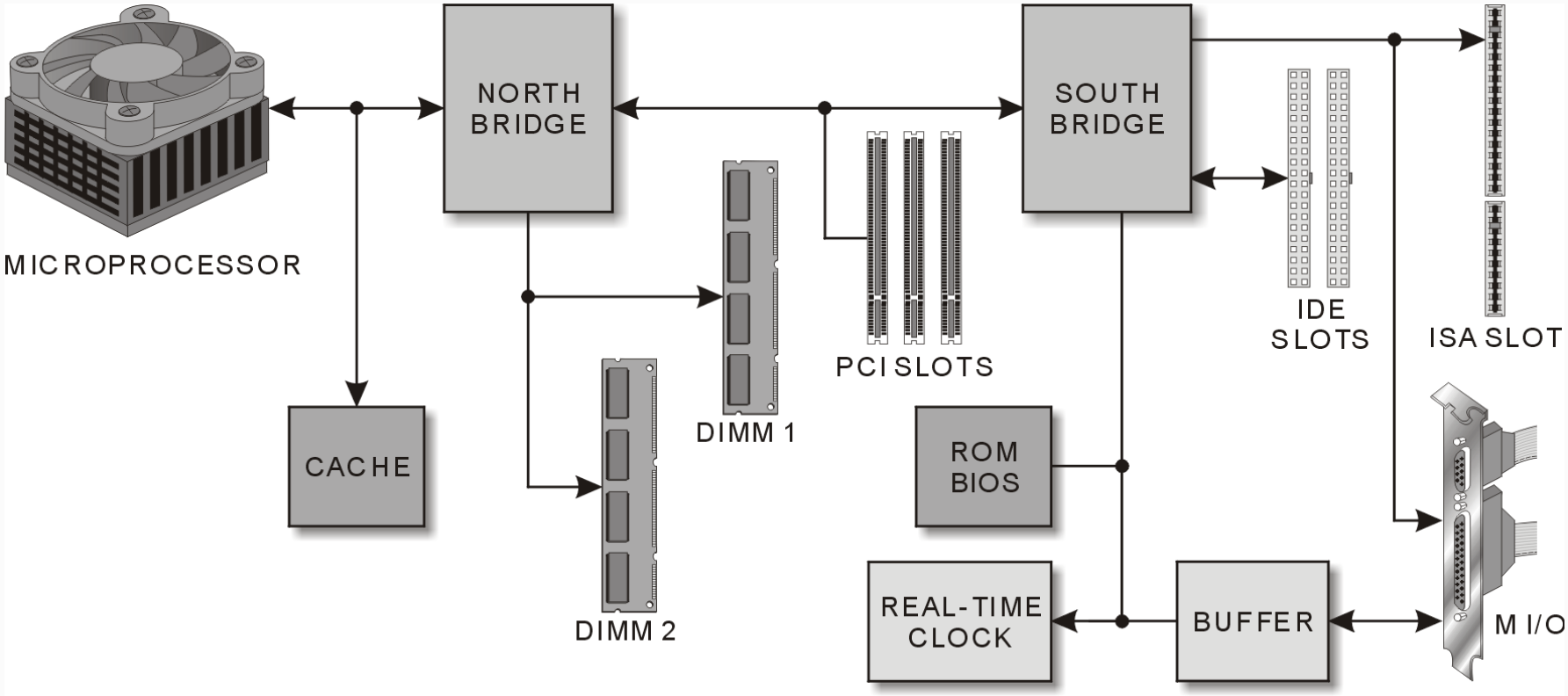
Typical Pentium Chipset



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Buses Types

Bus Type	Description
Address bus	The address bus is a uni-directional pathway, which means that information can only flow one way.
Data bus	The data bus is a bi-directional pathway for data flow, which means that information can flow in two directions.
Control bus (Front Side Bus)	The control bus carries the control and timing signals needed to coordinate the activities of the entire computer.

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Buses and Expansion Slots

- Today's PCs have four or five buses, each with different speeds, access methods, and protocols.
- Bus evolution
- So many buses because a single speed is not practical
- A bus carries electrical power, control signals, memory addresses, and data.
- On-board ports

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Buses Listed by Throughput

Bus	Bus Type	Data Path in Bits	Address Lines	Bus Speed in MHz	Throughput in gigabytes/sec, megabytes/sec, or megabits/sec
System bus	Local	64	32	66, 75, 100 . . .	Up to 3.2 GB/sec
AGP	Local video	32	NA	66, 75, 100 . . .	Up to 528 MB/sec
PCI	Local I/O	32	32	33, 66	Up to 264 MB/sec
VESA or VL Bus	Local video or expansion	32	32	Up to 33	Up to 250 MB/sec
FireWire	Local I/O or expansion	1	Addresses are sent serially	NA	Up to 1.2 Gb/sec (gigabits)
MCA	Expansion	32	32	12	Up to 40 MB/sec
EISA	Expansion	32	32	12	Up to 32 MB/sec
16-bit ISA	Expansion	16	24	8.33	8 MB/sec
8-bit ISA	Expansion	8	20	4.77	1 MB/sec
USB	Expansion	1	Addresses are sent serially	3	Up to 480 Mbps

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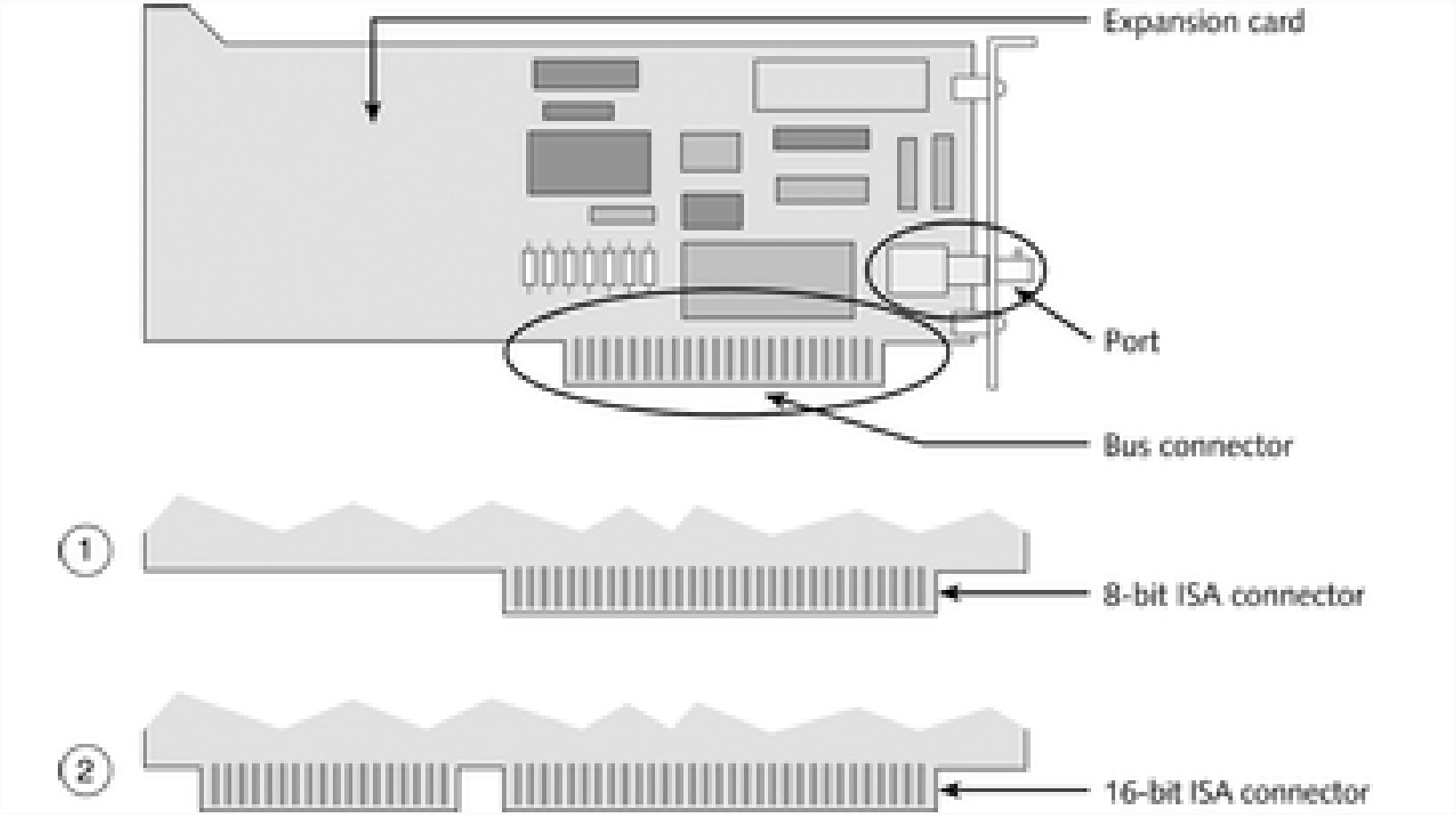
Expansion Types and Architecture



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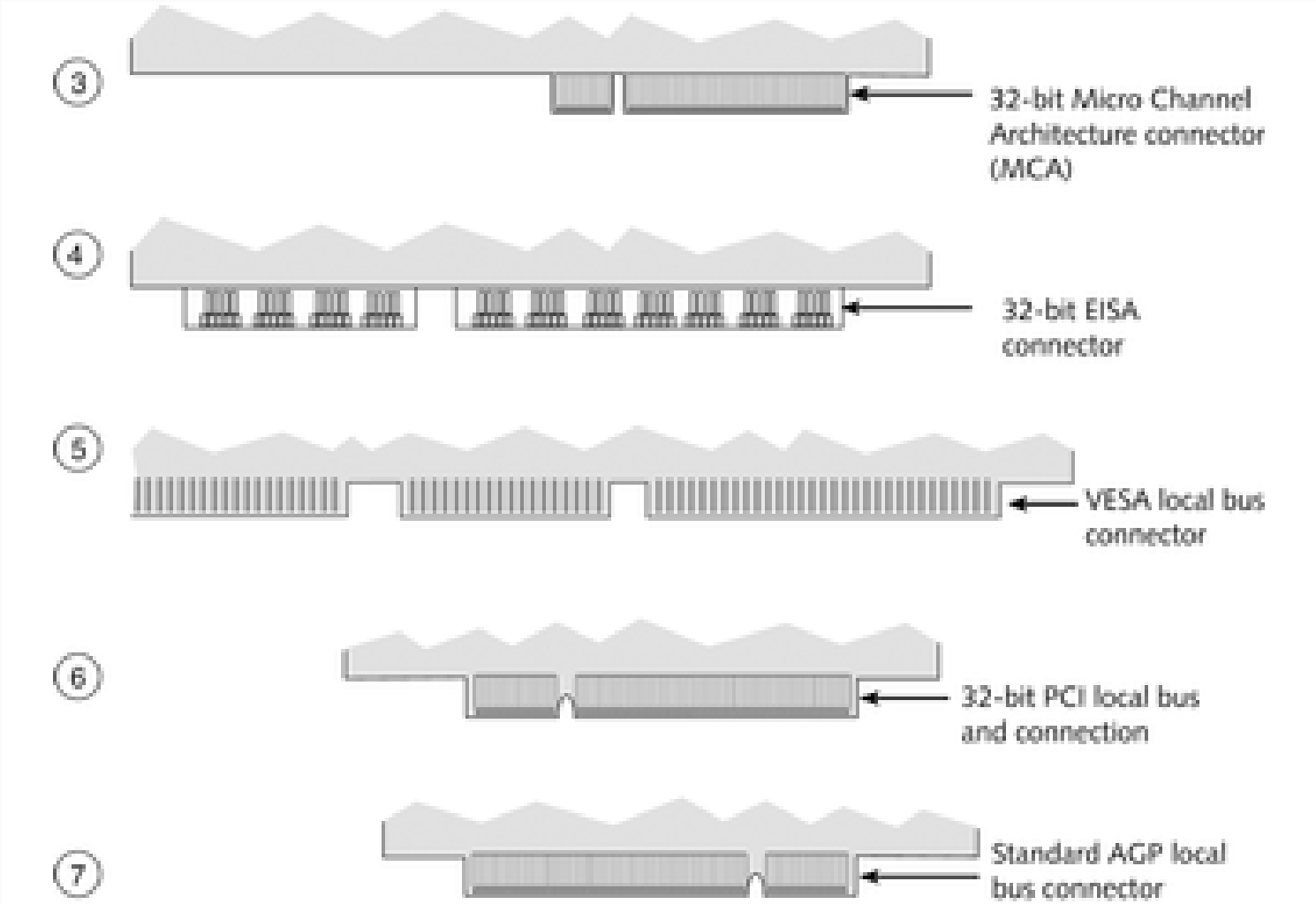
Buses Types and Architecture



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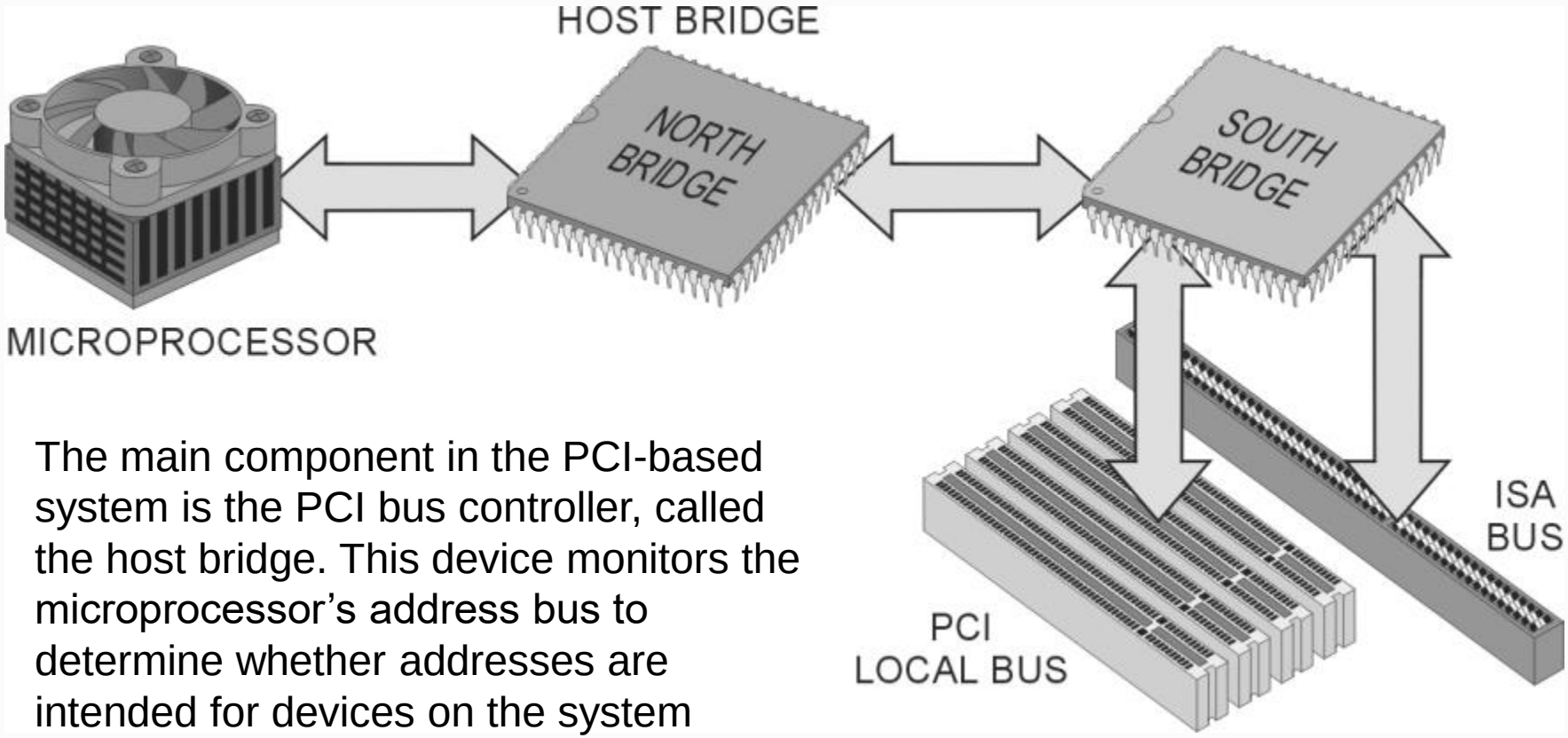
PCI Bus Structure



The main component in the PCI-based system is the PCI bus controller, called the host bridge. This device monitors the microprocessor's address bus to determine whether addresses are intended for devices on the system board, in a PCI slot, or in one of the system board's other expansion slots.

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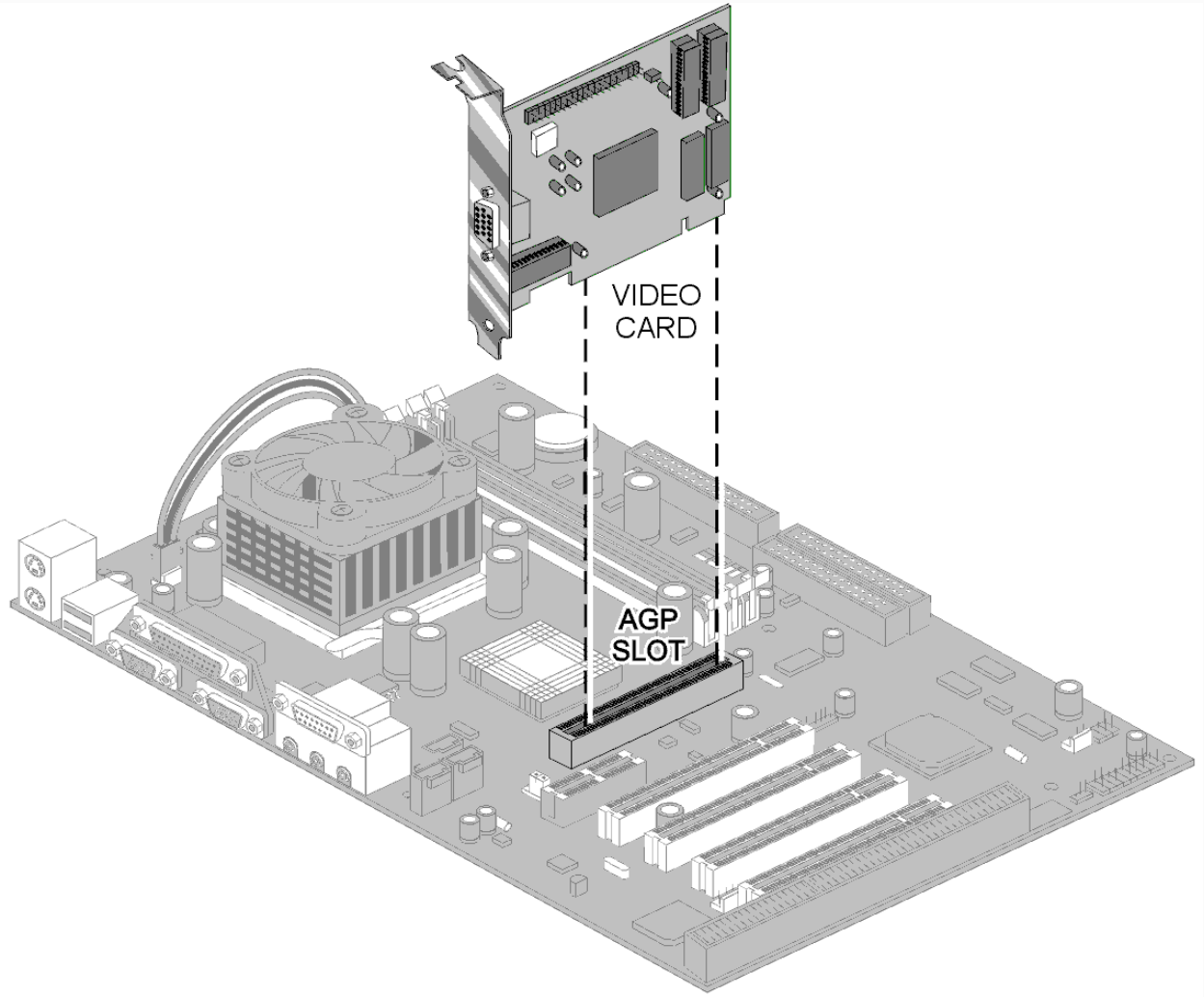
An AGP Slot



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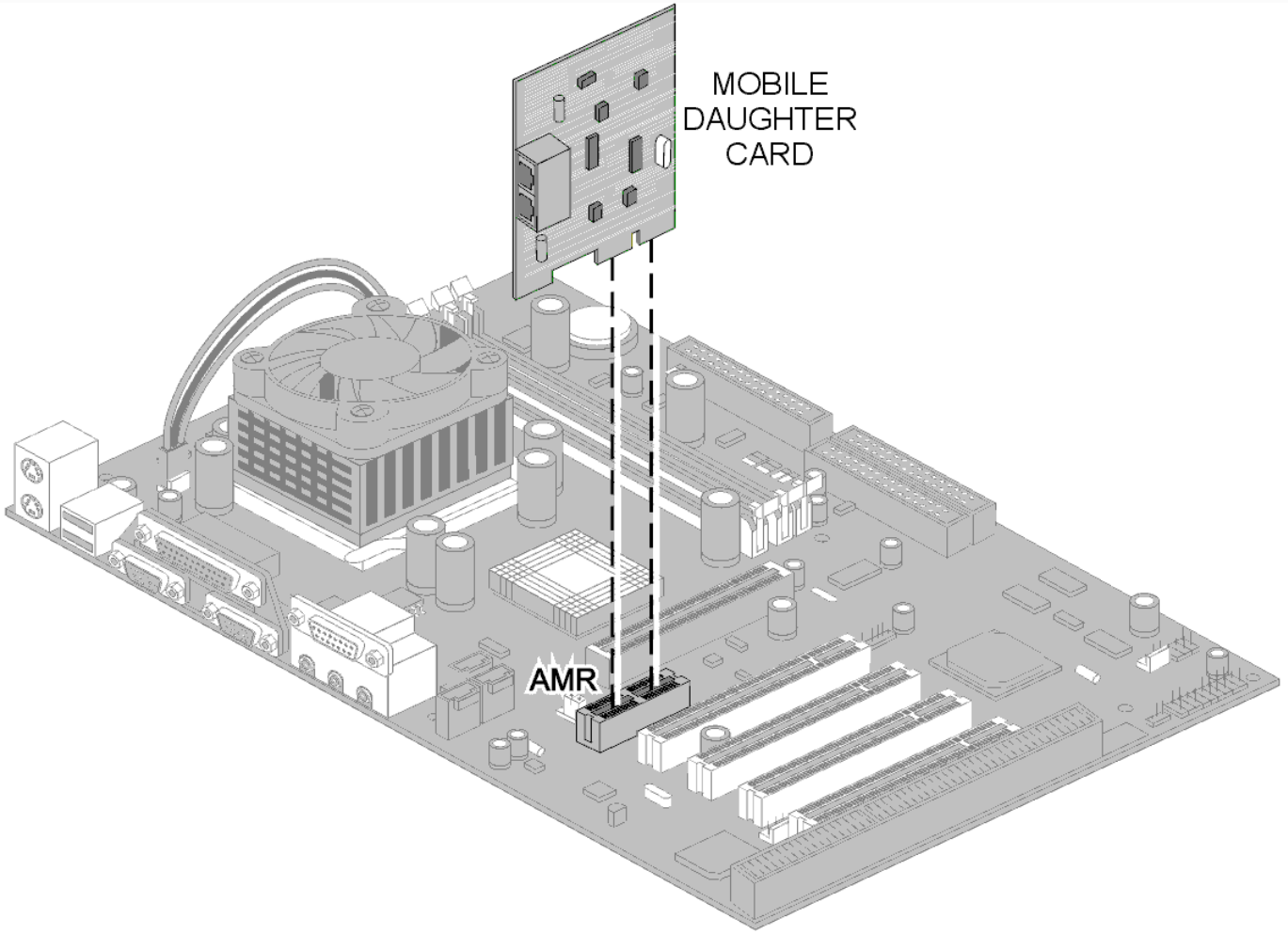
Audio/Modem Riser Components



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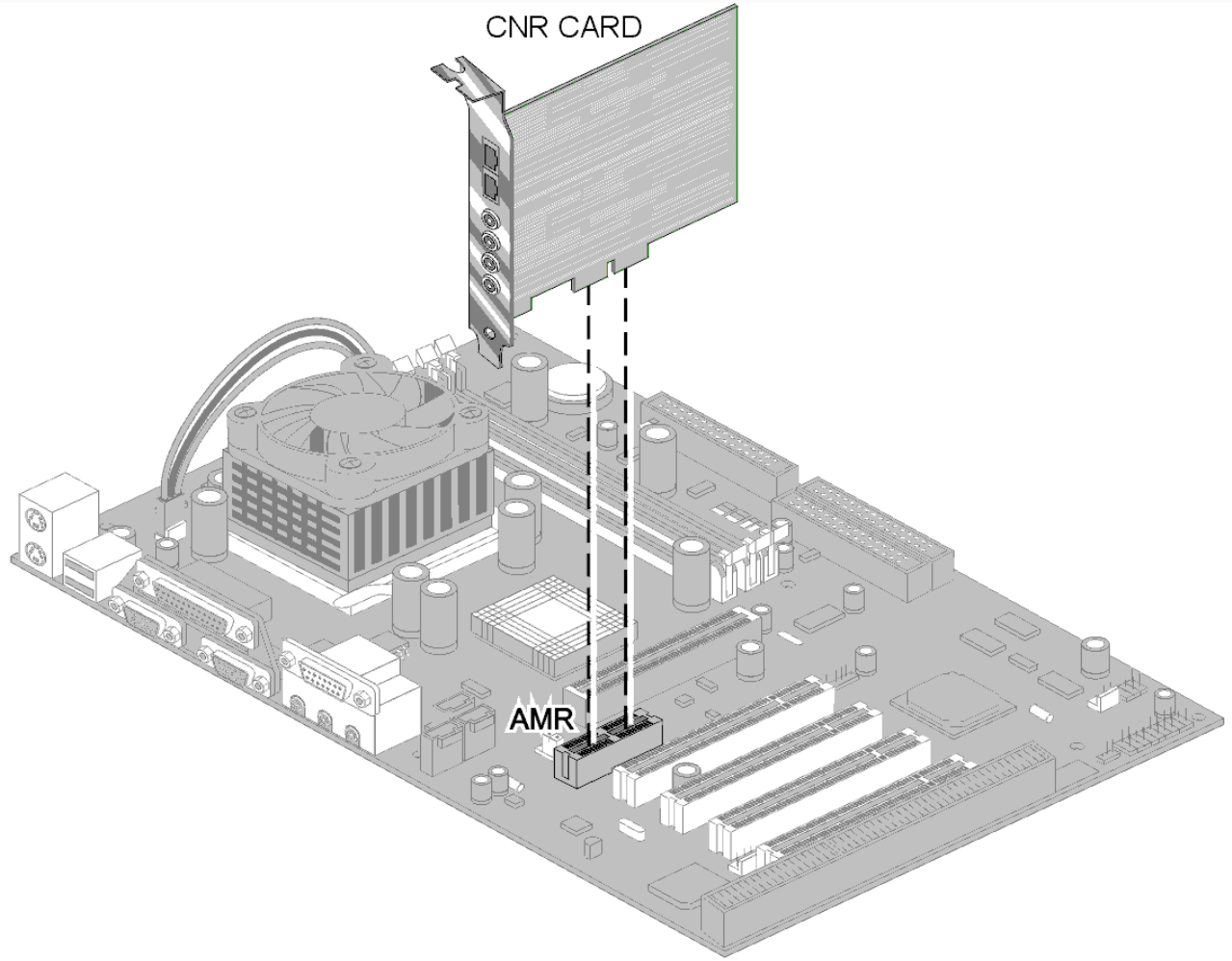
Communications and Networking Riser Card



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Relationship of the CPU Speed to Bus Speed

- When the multiplier that determines the CPU speed is large, overall performance of the system is not as good as when the multiplier is small
- Change the speed of a computer by
  - Changing the speed of the system bus, or
  - Changing the multiplier that determines the speed of CPU

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CPU and Bus Speeds

Bus or Device	How Speed Is Determined	How Controlled
CPU	Processor speed = system bus speed × multiplier. Typical speeds are 500 MHz, 800 MHz, and 1 GHz.	Jumpers, DIP switches on the motherboard, CMOS setup set the multiplier.
Memory bus or system bus	Motherboard manufacturer recommends the speed based on the processor and processor's rated speed. Typical values are 100 MHz, 133 MHz, 200 MHz, 400 MHz, and 533 MHz.	Set by jumpers, DIP switches, or in CMOS setup. Most commonly set by jumpers.
PCI bus	System bus speed divided by 2 (divided by 3 for faster boards)	Setting the speed of the system bus sets the speed of the PCI bus.
ISA bus	Runs at only one speed: 8.33 MHz.	NA

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Hardware Configuration

- Tells the CPU what hardware components are present in the system and how they are set up to interface with the CPU
- Provides for on the motherboard in three ways:
  - DIP switches
  - Jumpers
  - CMOS

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Setup Data Stored by DIP Switches

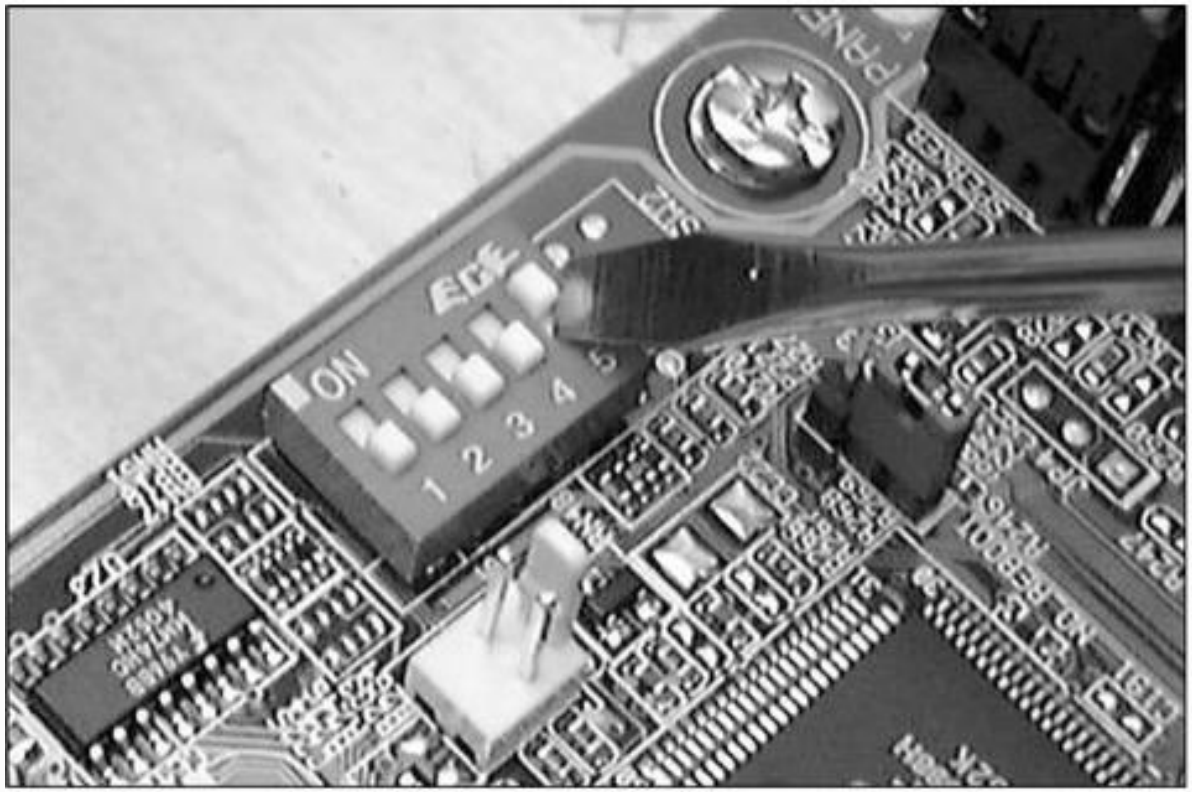

Figure 5-18 DIP switches are sometimes used to store setup data on motherboards

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Setup Data Stored by Jumpers

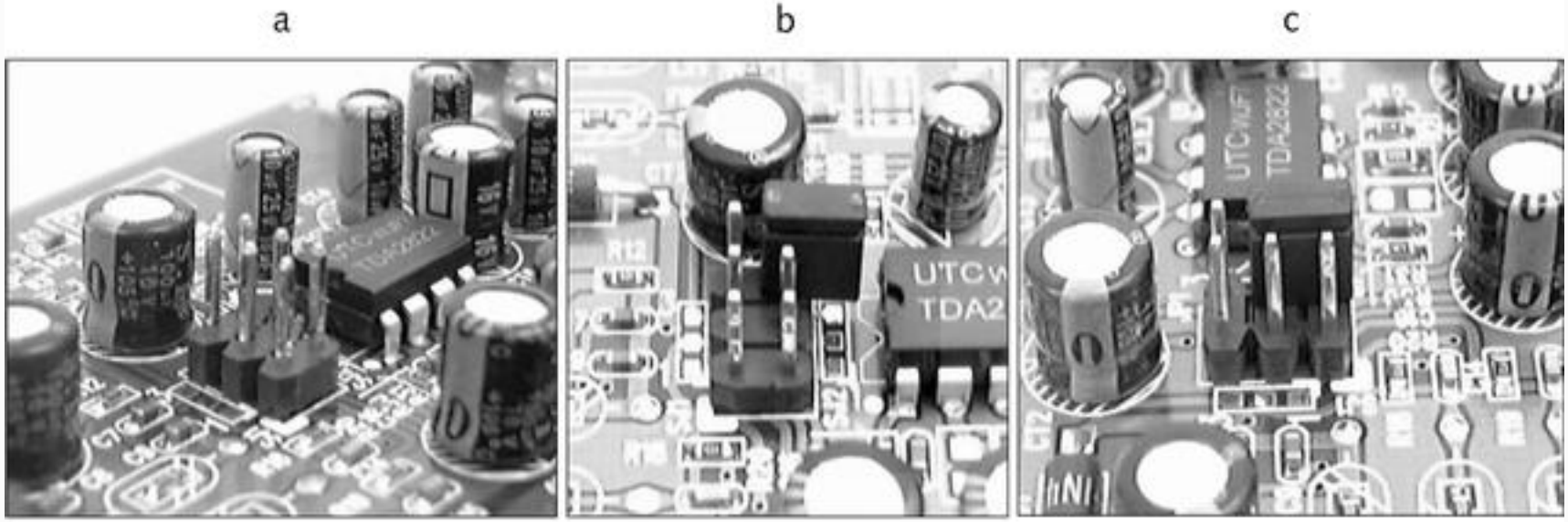

Figure 5-19 A 6-pin jumper group on a circuit board (a) has no pins covered, (b) has a cover parked on one pin, and (c) is configured with two jumpers capped or covered

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Setup Data Stored by Jumpers

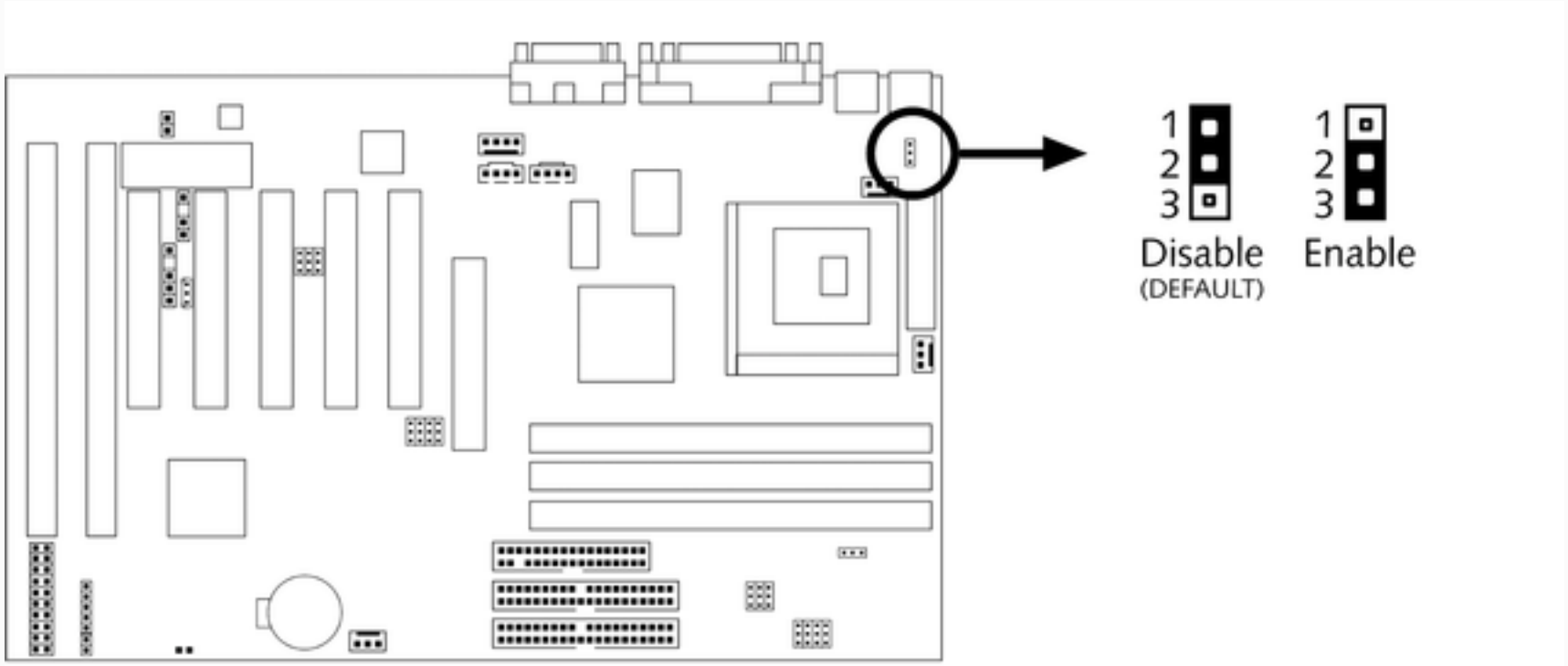

Figure 5-20 The keyboard power-up jumper allows you to use your keyboard to power up the computer

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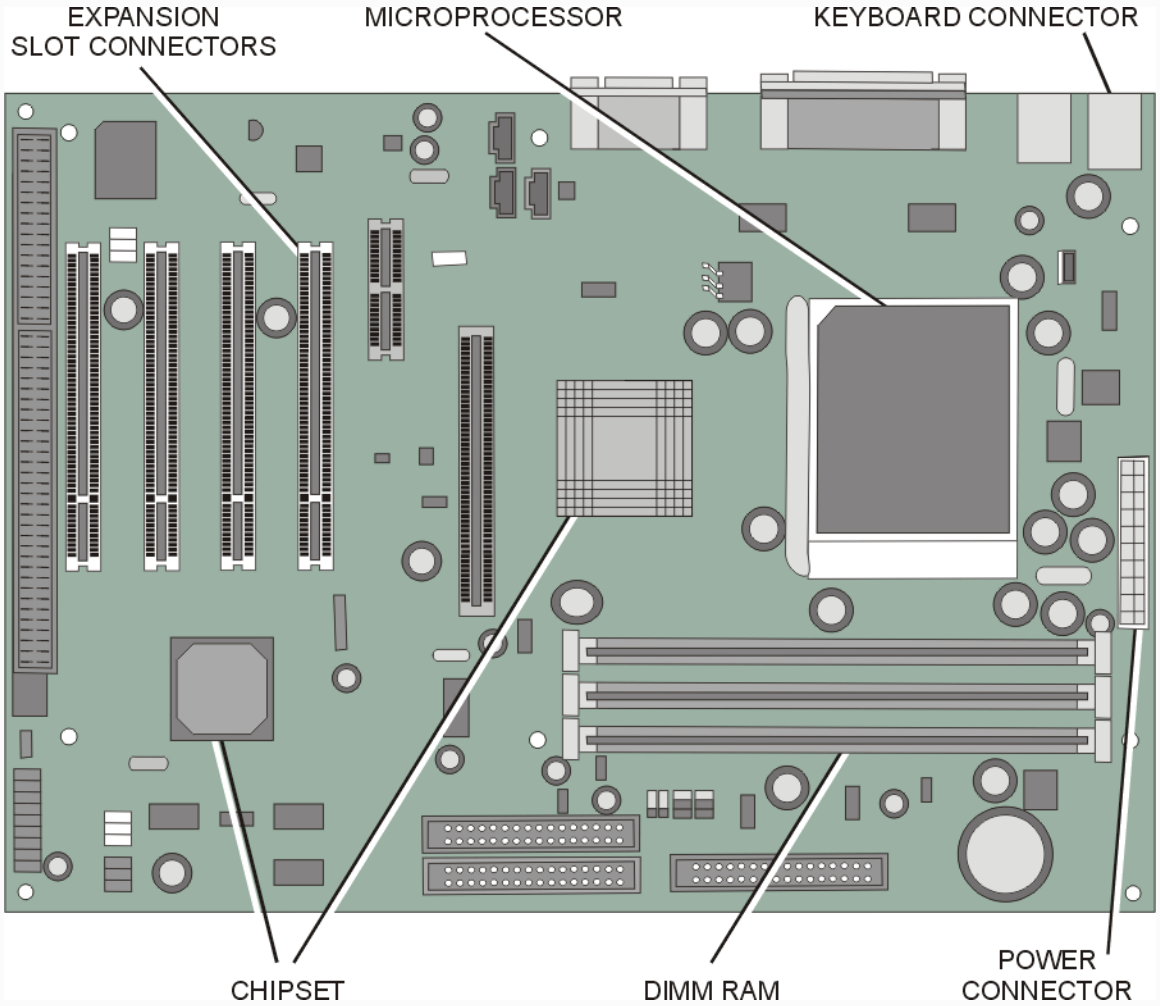
A Typical System Board Layout



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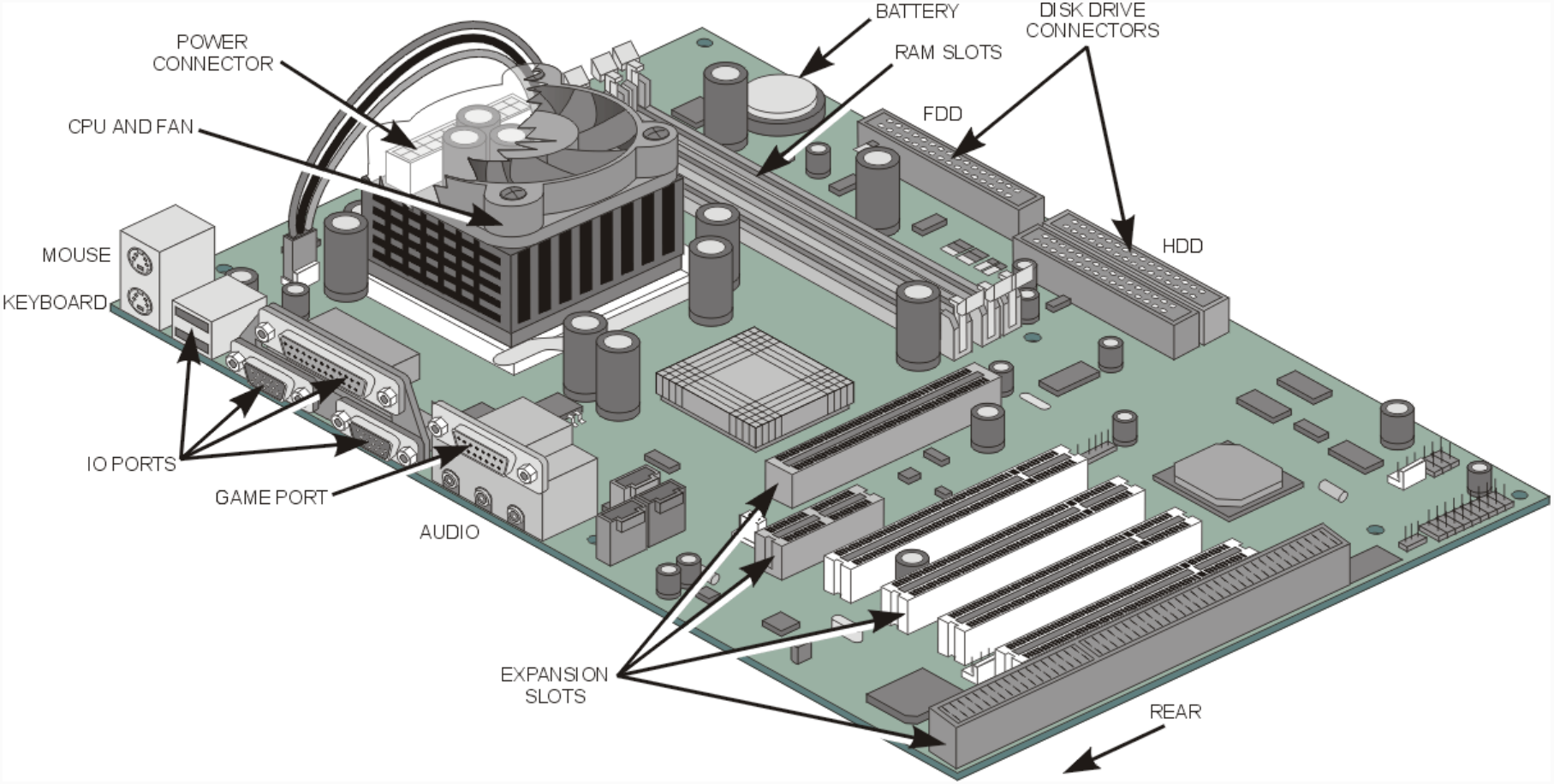
An ATX Pentium System Board



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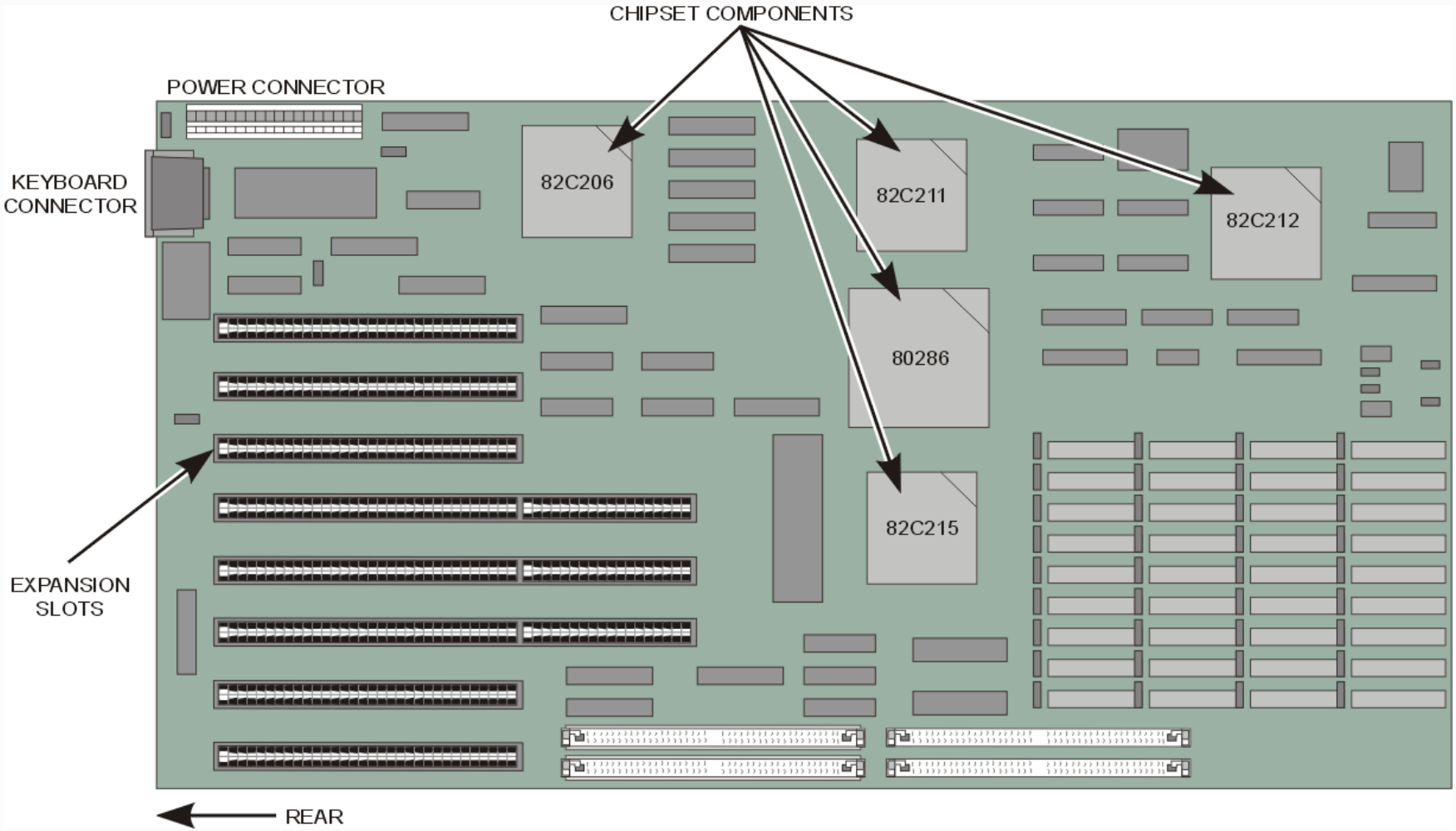
Baby AT System Board



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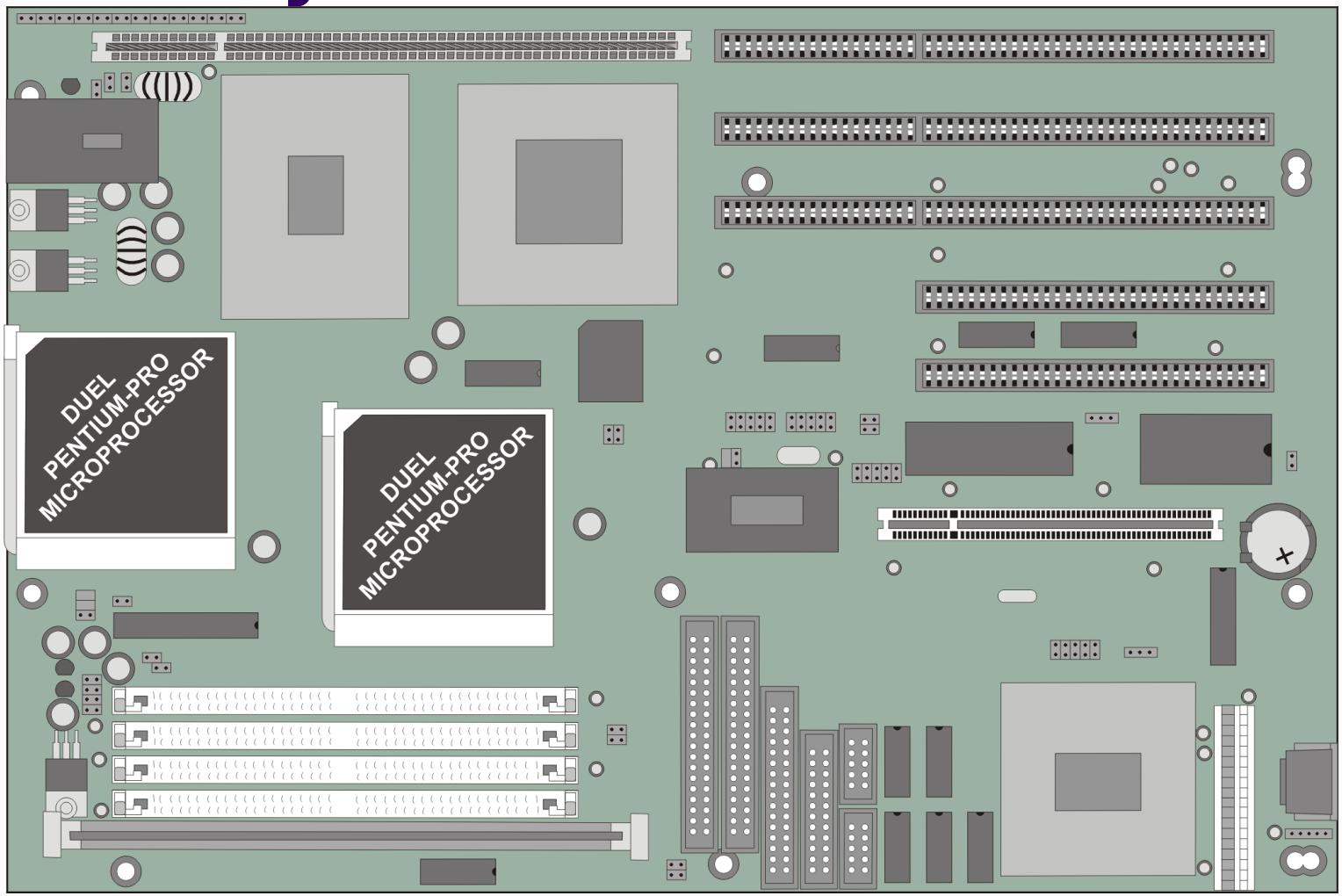
A Dual-Processor System Board



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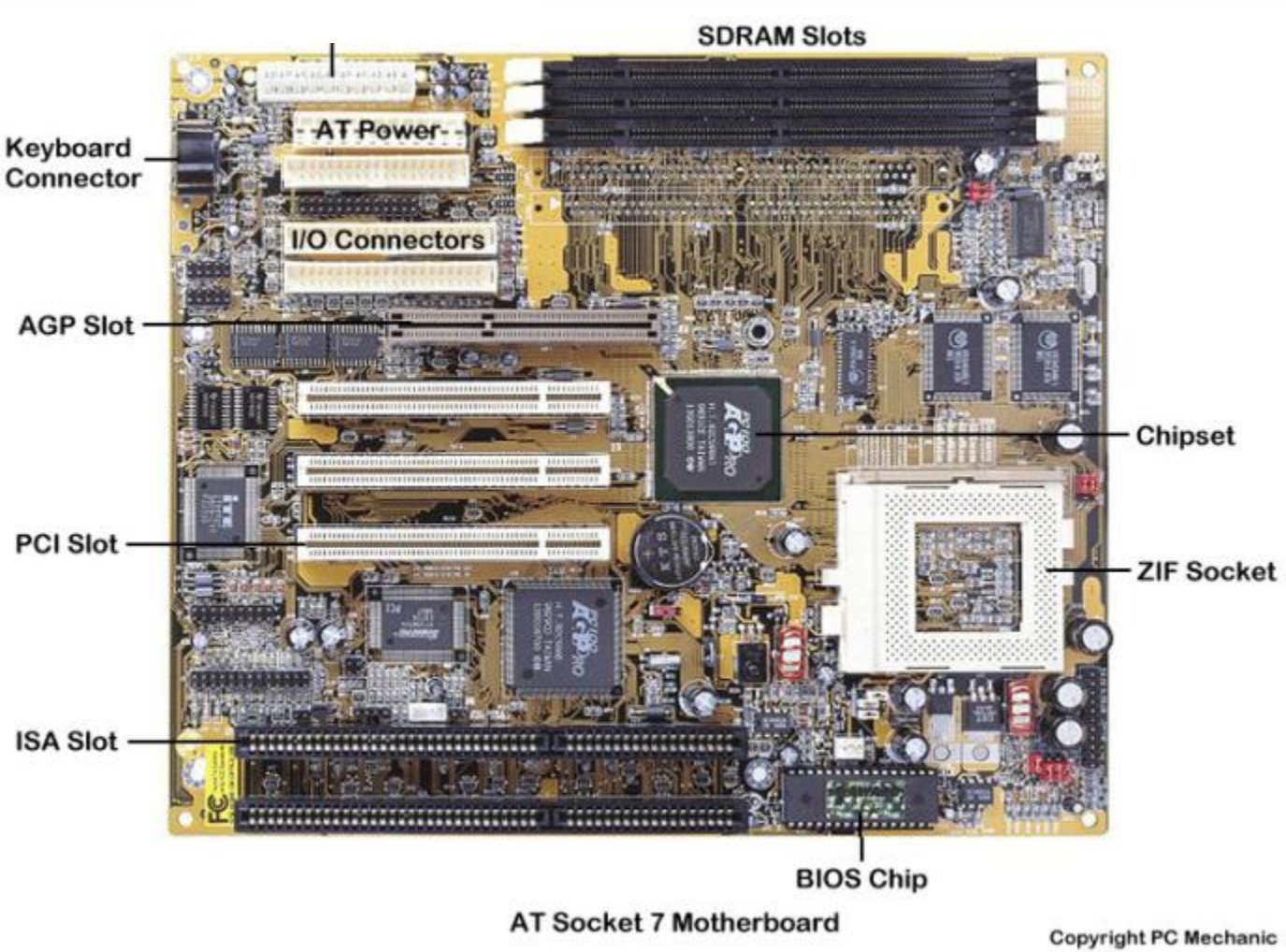
Full-size AT System Board



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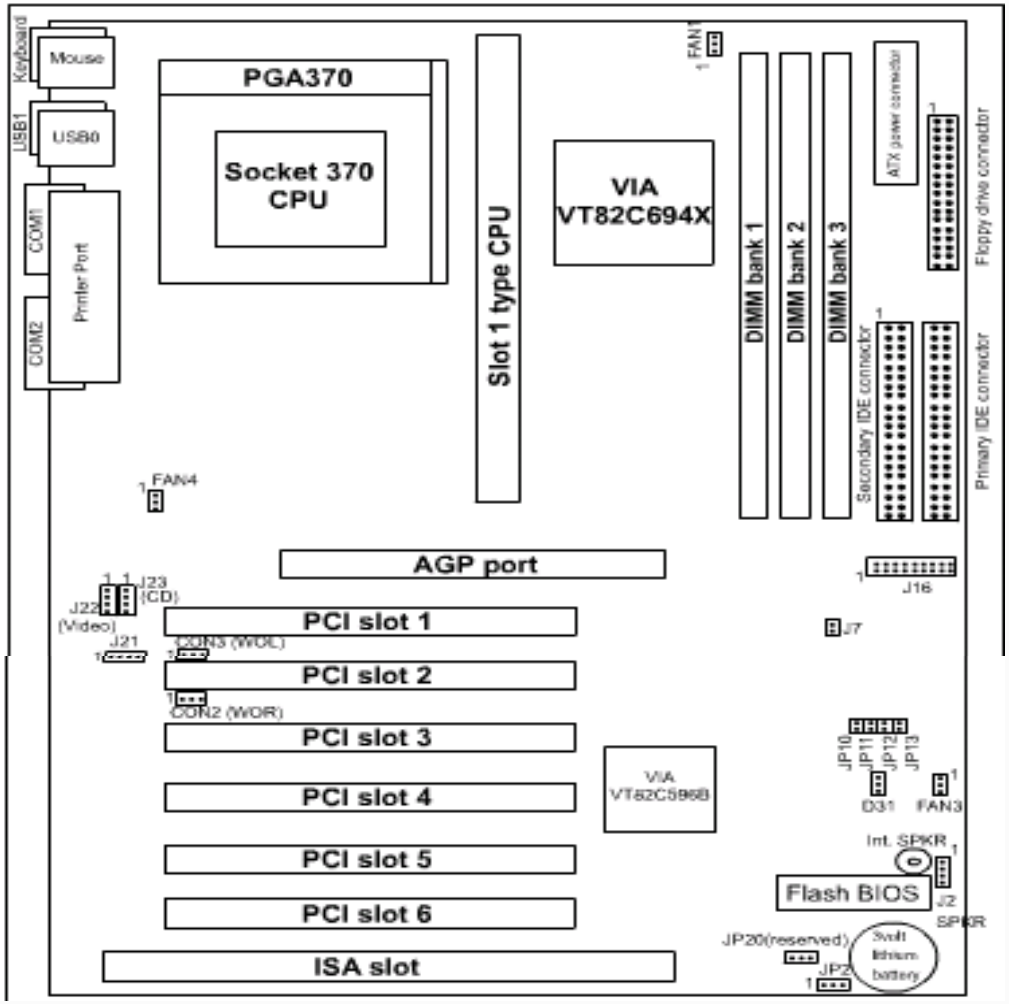

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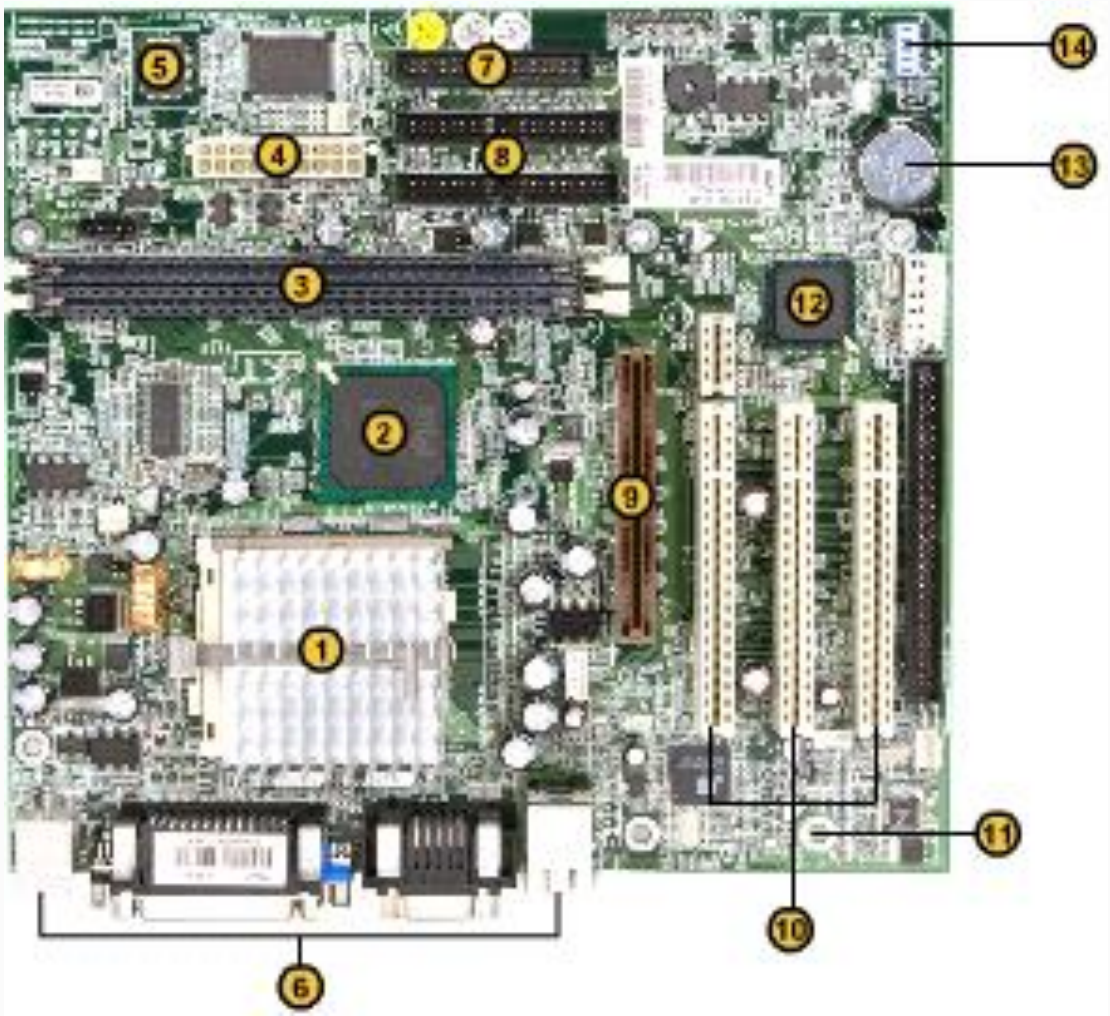
Full-size ATX System Board



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Troubleshooting and maintenance

- If the motherboard is not working properly, the problem is often caused by a component that is not functioning properly.
- One should remove a component not required for basic operation and then start the computer to see if the problem still exists. Repeat this with different components until you find the one that is causing the error.

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Troubleshooting and maintenance continued

- If no components are found to be faulty, the computer may have a loss of power or a virus.
- Diagnostic software to test your motherboard may be purchased at most computer stores.
- Always check the documentation that is included with your system board to determine the proper settings.

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Troubleshooting and maintenance continued

- To prevent the computer from overheating, verify that the fan is working properly. Many motherboards have built-in thermometers that will shut down the computer before it overheats.
- To clean your motherboard, you can use a can of compressed air to blow away the dust.

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