Discovering Computers

Technology in a World of Computers, Mobile Devices, and the Internet

Chapter 6

Inside Computers and Mobile Devices

Objectives Overview

Describe the various computer and mobile device cases and the contents they protect

Describe multi-core processors the components of a processor, and the four steps in a machine cycle

Identify characteristics of various personal computer processors on the market today, and describe the ways processors are cooled

Explain the advantages and services of cloud computing

Define a bit, and describe how a series of bits represents data

Explain how program and application instructions transfer in and out of memory

Objectives Overview

Differentiate among the various types of memory

Describe the purpose of adapter cards, USB adapters, and ExpressCard modules

Explain the function of a bus

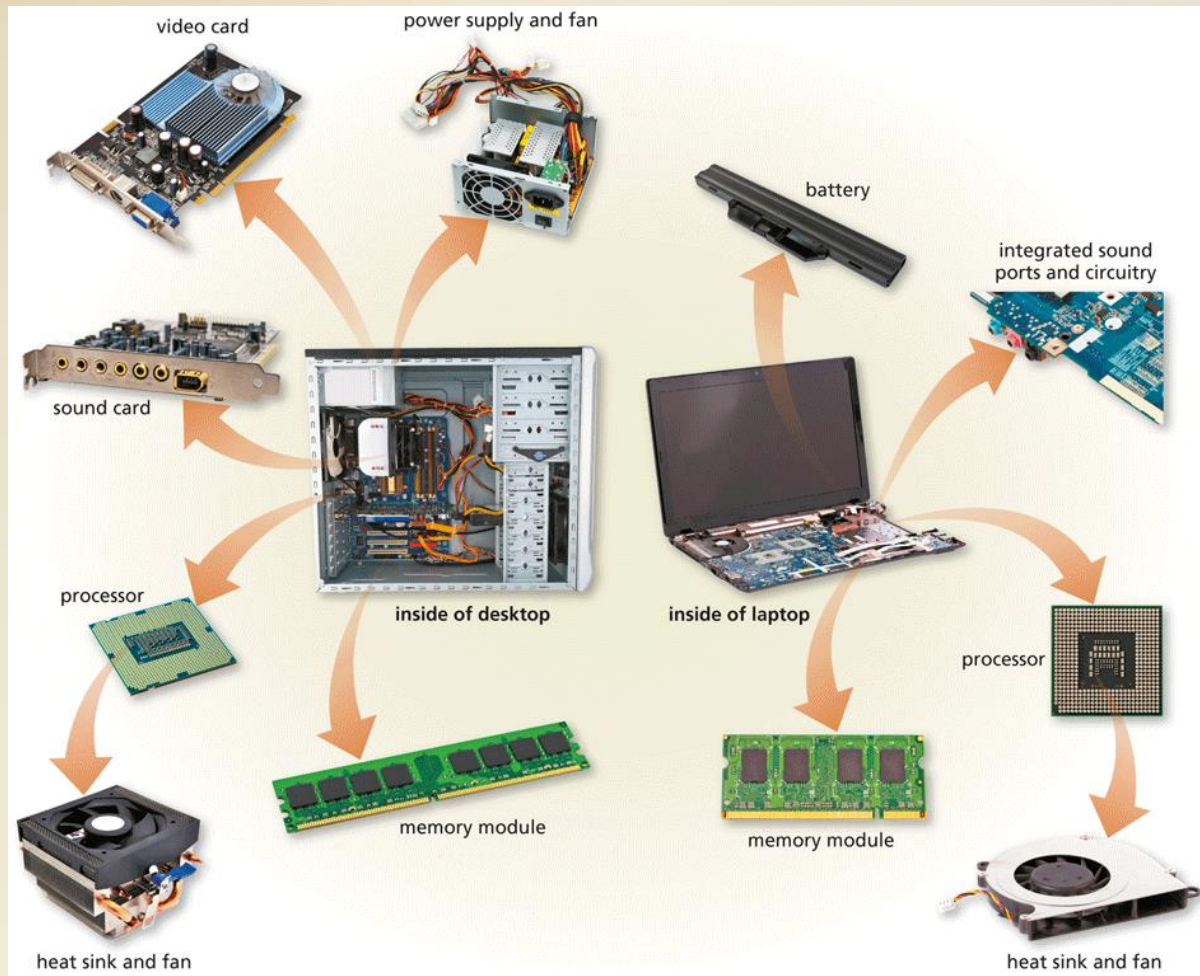Explain the purpose of a power supply and batteries

Understand how to care for computers and mobile devices

Inside the Case

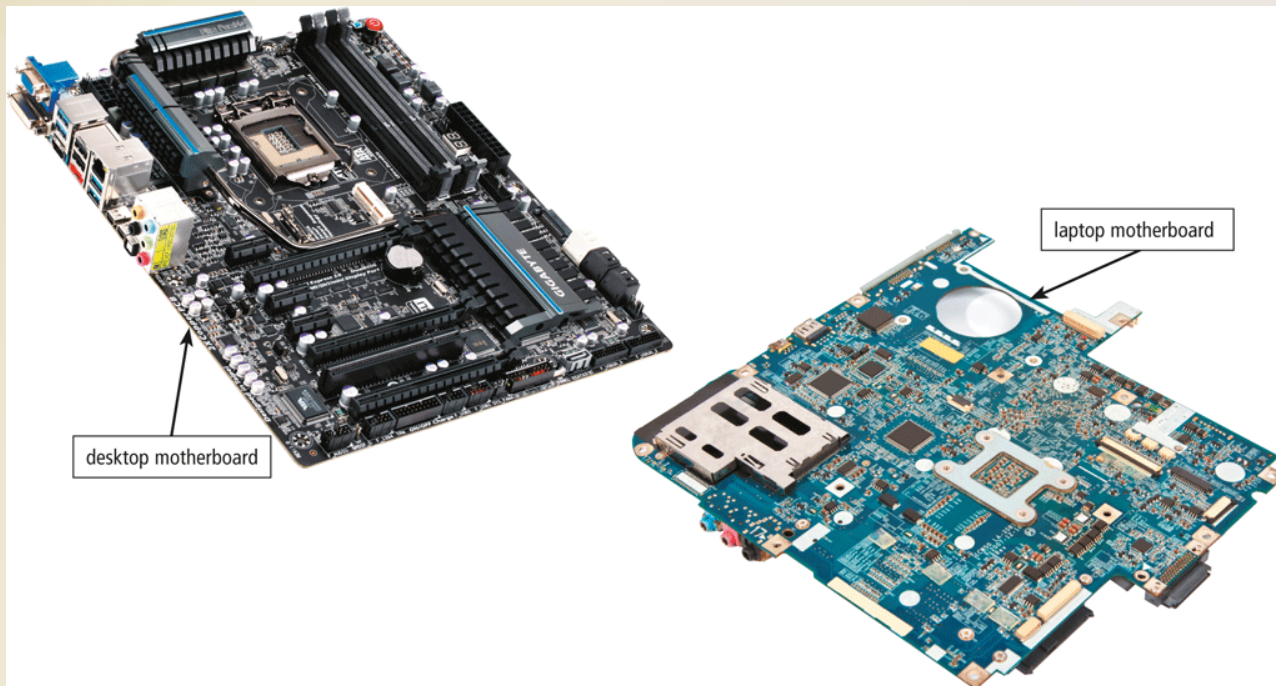- The case contains and protects the electronics of the computer or mobile device from damage

Inside the Case

Inside the Case

- The **motherboard** is the main circuit board of the computer
  - A computer **chip** contains integrated circuits

laptop motherboard

desktop motherboard

Processors

- The **processor**, also called the **central processing unit** (**CPU**), interprets and carries out the basic instructions that operate a computer
  - Contain a control unit and an arithmetic logic unit (ALU)
- A **multi-core processor** is a single chip with two or more separate processor cores

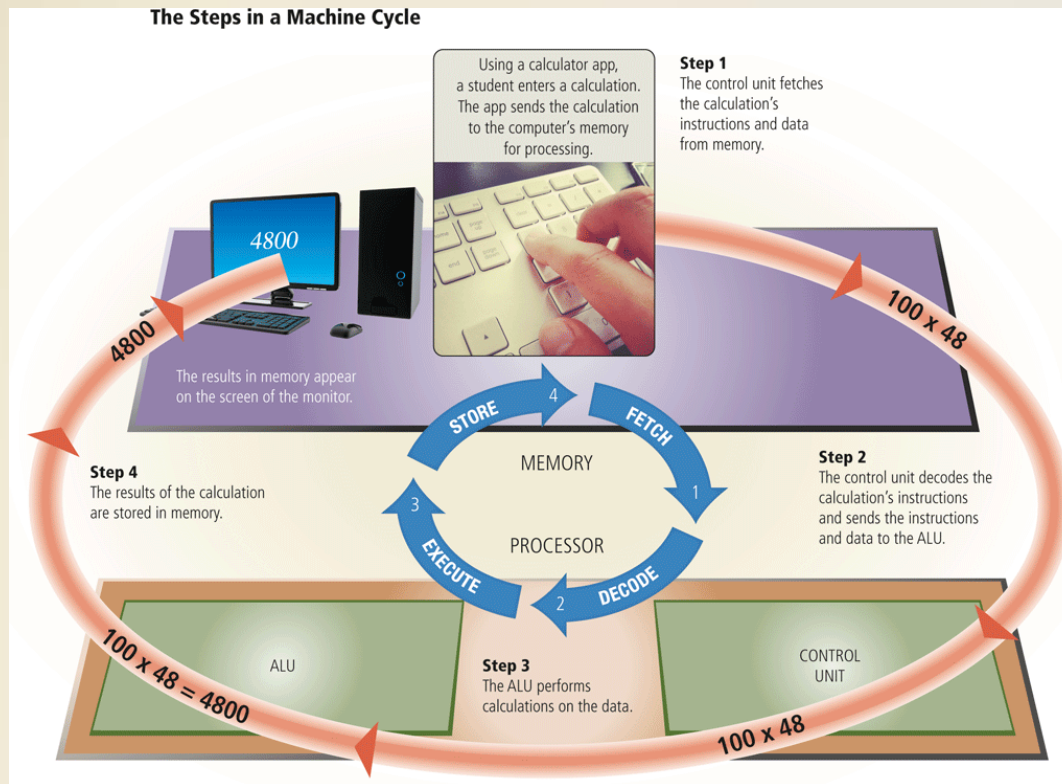Discovering Computers 2014: Chapter 6
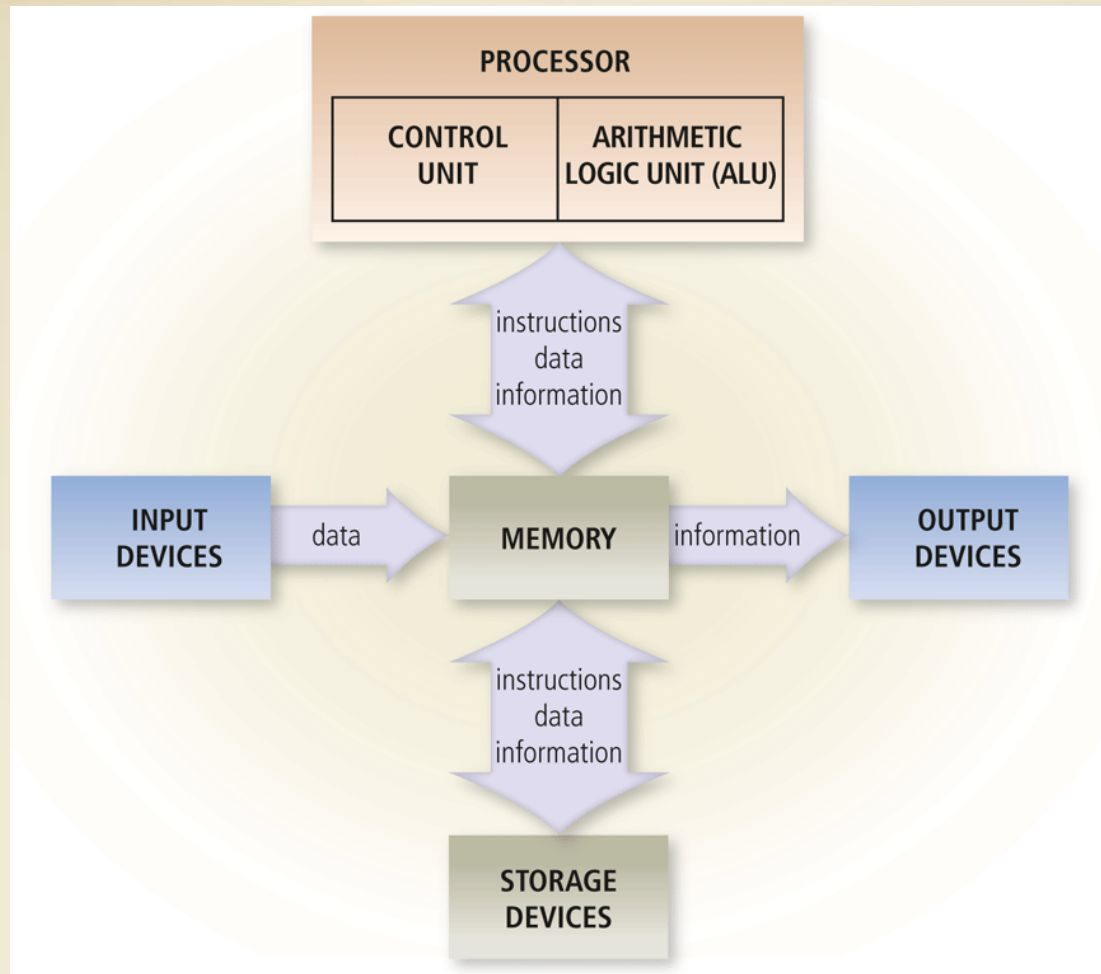
Processors

Processors

- The **control unit** is the component of the processor that directs and coordinates most of the operations in the computer

- The **arithmetic logic unit** (ALU) performs arithmetic, comparison, and other operations

Processors

- For every instruction, a processor repeats a set of four basic operations, which comprise a machine cycle

The Steps in a Machine Cycle

Using a calculator app, a student enters a calculation. The app sends the calculation to the computer's memory for processing.

Step 1
The control unit fetches the calculation's instructions and data from memory.

The results in memory appear on the screen of the monitor.

Step 4
The results of the calculation are stored in memory.

Step 2
The control unit decodes the calculation's instructions and sends the instructions and data to the ALU.

Step 3
The ALU performs calculations on the data.

STORE — FETCH — DECODE — EXECUTE

MEMORY

PROCESSOR

ALU

CONTROL UNIT

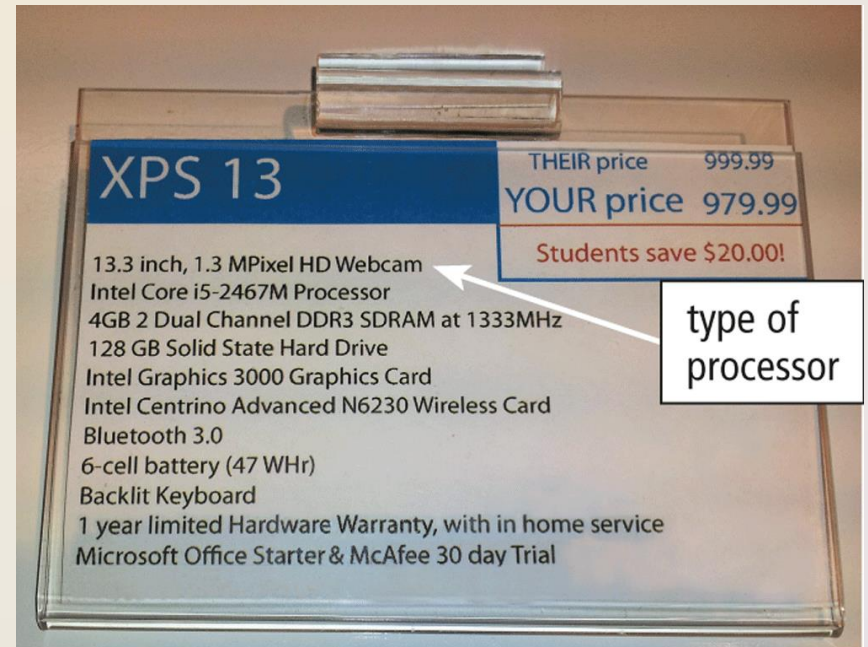4800

100 x 48

100 x 48 = 4800

100 x 48

Processors

The processor contains registers, that temporarily hold data and instructions

The **system clock** controls the timing of all computer operations

- The pace of the system clock is called the **clock speed**, and is measured in **gigahertz** (**GHz**)

Processors

- The leading manufacturers of personal computer processor chips are Intel and AMD

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128 GB Solid State Hard Drive
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Intel Centrino Advanced N6230 Wireless Card
Bluetooth 3.0
6-cell battery (47 WHr)
Backlit Keyboard
1 year limited Hardware Warranty, with in home service
Microsoft Office Starter & McAfee 30 day Trial

type of processor

Processors

- A processor chip generates heat that could cause the chip to malfunction or fail

- Require additional cooling

  - Heat sinks

  - Liquid cooling technology

  - Cooling mats
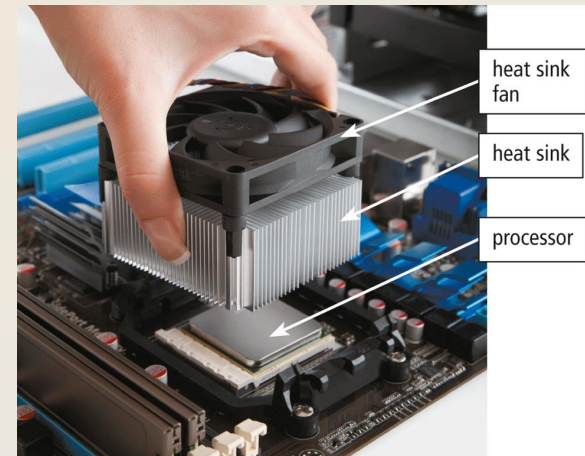
Cloud Computing

- Home and business users choose cloud computing for a variety of reasons

Accessibility	Cost savings
Space savings	Scalability

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Data Representation

Analog signals are continuous and vary in strength and quality
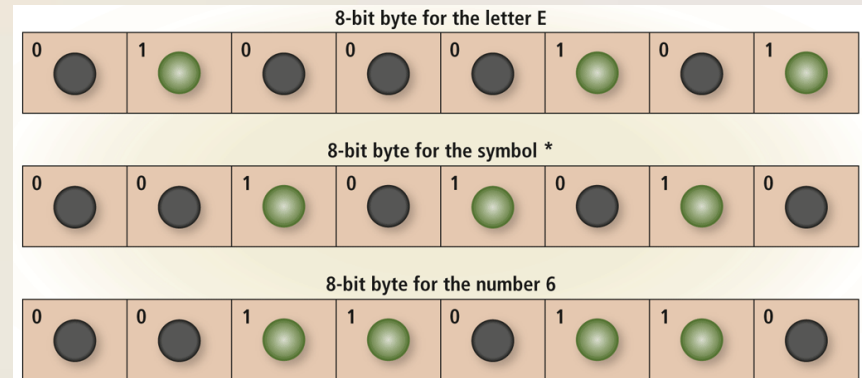
Digital signals are in one of two states: on or off

- Most computers are digital
- The **binary system** uses two unique digits (0 and 1)
  - **Bits** and **bytes**

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Data Representation

The circuitry in a computer or mobile device represents the on or the off states electronically by the presence or absence of an electronic charge

Eight bits grouped together as a unit are called a byte. A byte represents a single character in the computer or mobile device

Binary Digit (BIT)	Electronic Charge	Electronic State
I	● (green)	ON
O	● (black)	OFF

8-bit byte for the letter E
0 1 0 0 0 1 0 1

8-bit byte for the symbol *
0 0 1 0 1 0 1 0

8-bit byte for the number 6
0 0 1 1 0 1 1 0

Data Representation

How a Letter Is Converted to Binary Form and Back

Step 1
A user presses the capital letter **T** (SHIFT+T keys) on the keyboard, which in turn creates a special code, called a scan code, for the capital letter **T**.

Step 2
The scan code for the capital letter **T** is sent to the electronic circuitry in the computer.

Step 4
After processing, the binary code for the capital letter **T** is converted to an image and displayed on the output device.

Step 3
The electronic circuitry in the computer converts the scan code for the capital letter **T** to its ASCII binary code (01010100) and stores it in memory for processing.

Memory

- **Memory** consists of electronic components that store instructions waiting to be executed by the processor, data needed by those instructions, and the results of processing the data

- Stores three basic categories of items:

The operating system and other programs	Applications	Data being processed and the resulting information

Memory

- Each location in memory has an address

- Memory size commonly is measured in gigabytes (GB) or terabytes (TB)

Memory

- The system unit contains two types of memory:

Volatile memory

Loses its contents when power is turned off

Example includes **RAM**

Nonvolatile memory

Does not lose contents when power is removed

Examples include ROM, flash memory, and CMOS

Memory

How Program Instructions Transfer in and out of RAM

Memory

- Two common types of RAM chips exist:

Dynamic RAM (DRAM)

Static RAM (SRAM)

Table 6-1 Common DRAM Variations	
Name	**Comments**
SDRAM (Synchronous DRAM)	• Synchronized to the system clock • Much faster than DRAM
DDR SDRAM (Double Data Rate SDRAM)	• Transfers data twice, instead of once, for each clock cycle • Faster than SDRAM
DDR2	• Second generation of DDR • Faster than DDR
DDR3	• Third generation of DDR • Designed for computers with multi-core processors • Faster than DDR2
DDR4	• Fourth generation of DDR • Faster than DDR3
RDRAM (Rambus DRAM)	• Much faster than SDRAM

Memory

- RAM chips usually reside on a **memory module** and are inserted into **memory slots**

memory chips

single inline memory module

dual inline memory module
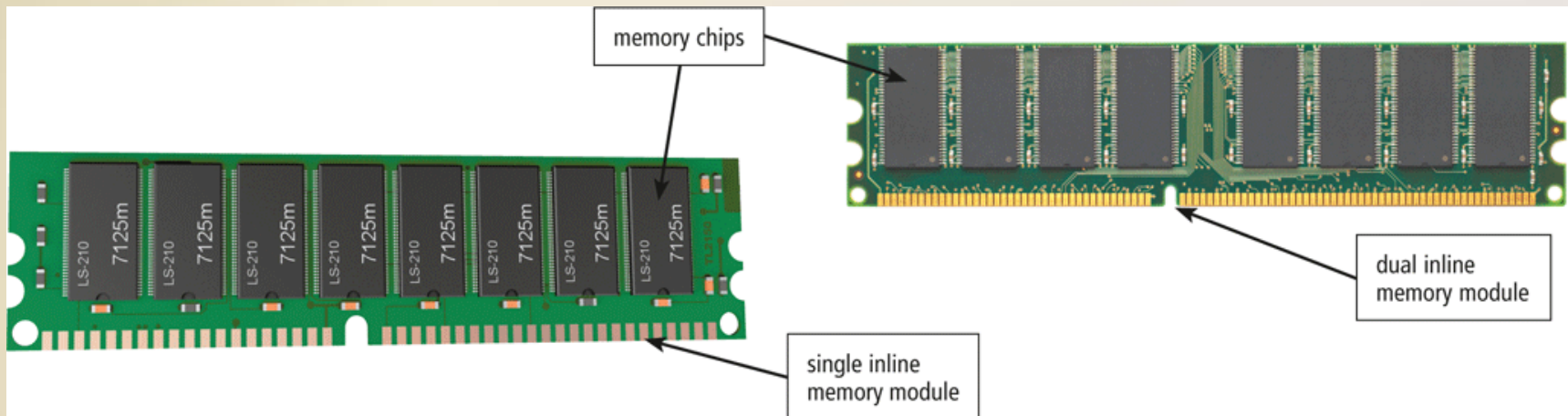
Memory

- **Memory cache** speeds the processes of the computer because it stores frequently used instructions and data
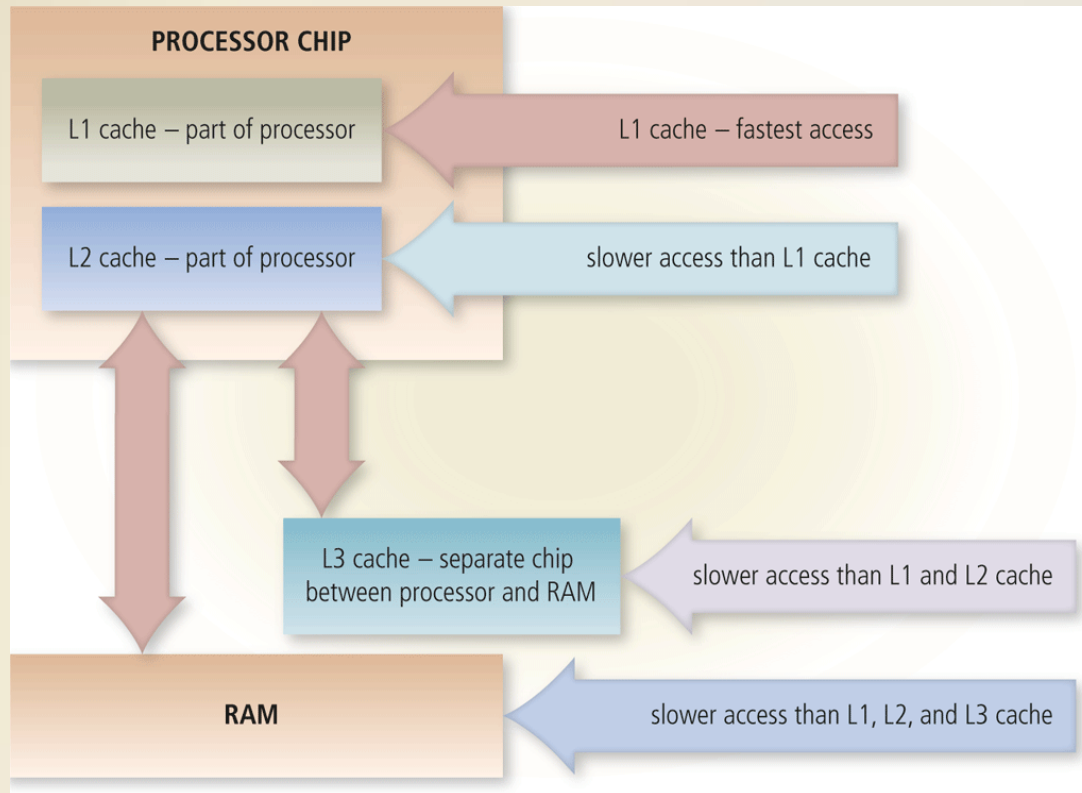
Memory

Read-only memory (**ROM**) refers to memory chips storing permanent data and instructions

- **Firmware**

Memory

- **Flash memory** can be erased electronically and rewritten
  - CMOS technology provides high speeds and consumes little power

Memory

- **Access time** is the amount of time it takes the processor to read from memory
  - Measured in nanoseconds

Table 6-2   Access Time Terminology

| Term	Abbreviation	Speed
Millisecond	ms	One-thousandth of a second
Microsecond	μs	One-millionth of a second
Nanosecond	ns	One-billionth of a second
Picosecond	ps	One-trillionth of a second

10 million
operations = 1 blink

Adapters

- An **adapter card** enhances functions of a component of a desktop or server system unit and/or provides connections to peripherals
  - Sound card and graphics card
- An **expansion slot** is a socket on a desktop or server motherboard that can hold an adapter card

| Table 6-3	Adapter Cards
Type	**Purpose**
Bluetooth	Enables Bluetooth connectivity
MIDI	Connects to musical instruments
Modem	Connects to transmission media, such as cable television lines or phone lines
Network	Provides network connections, such as to an Ethernet port
Sound	Connects to speakers or a microphone
TV tuner	Allows viewing of digital television broadcasts on a monitor
USB	Connects to high-speed USB ports
Video	Provides enhanced graphics capabilities, such as accelerated processing or the ability to connect a second monitor
Video capture	Connects to a video camera

Adapters

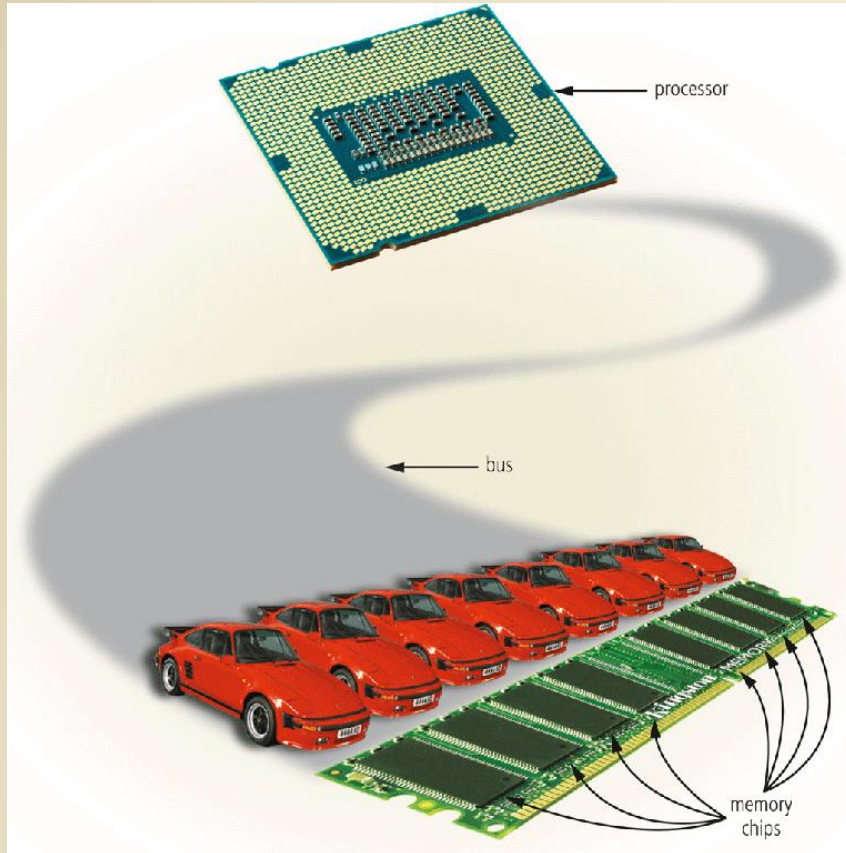- With **Plug and Play**, the computer automatically can recognize peripheral devices as you install them

video card

sound card

expansion slots

motherboard
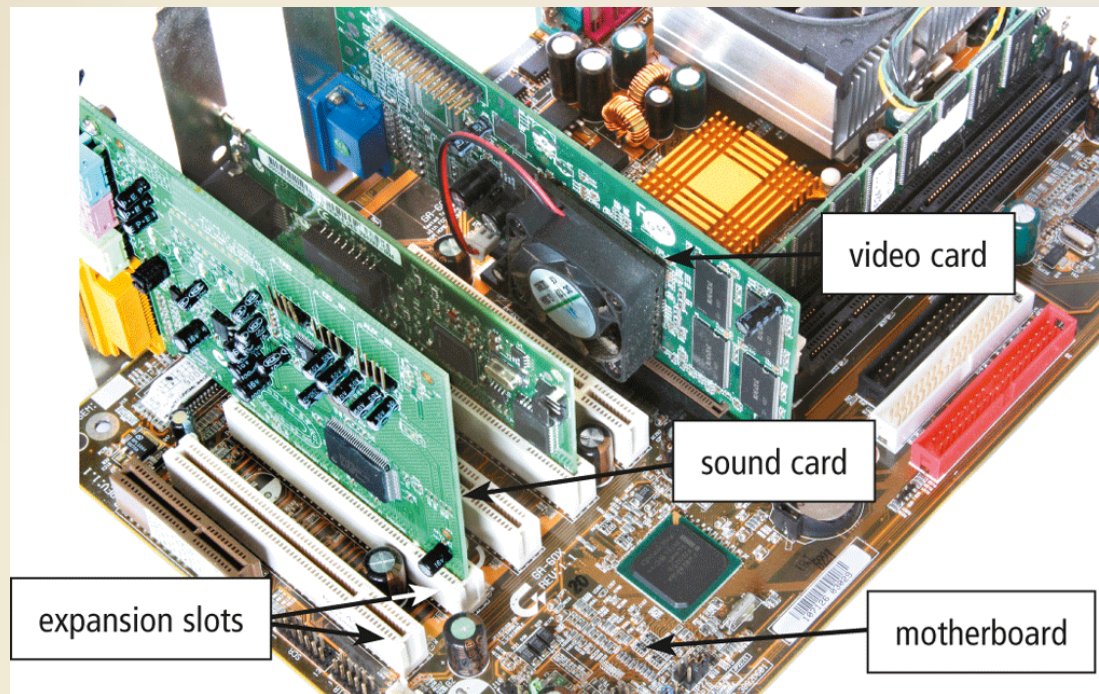
Adapters

- Adapters for mobile computers are in the form of a removable flash memory device

  – **USB adapter**

  – ExpressCard module


two sizes of ExpressCard modules
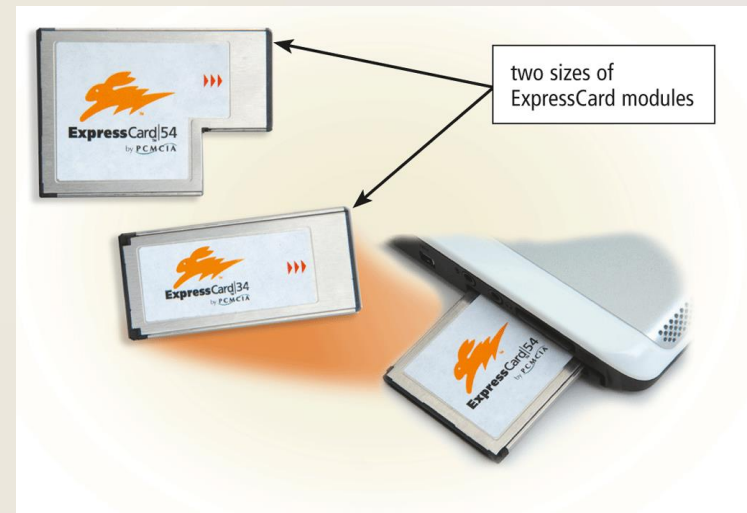
Buses

- A **bus** allows the various devices both inside and attached to the system unit to communicate with each other
  - Data bus
  - Address bus
- **Word size** is the number of bits the processor can interpret and execute at a given time
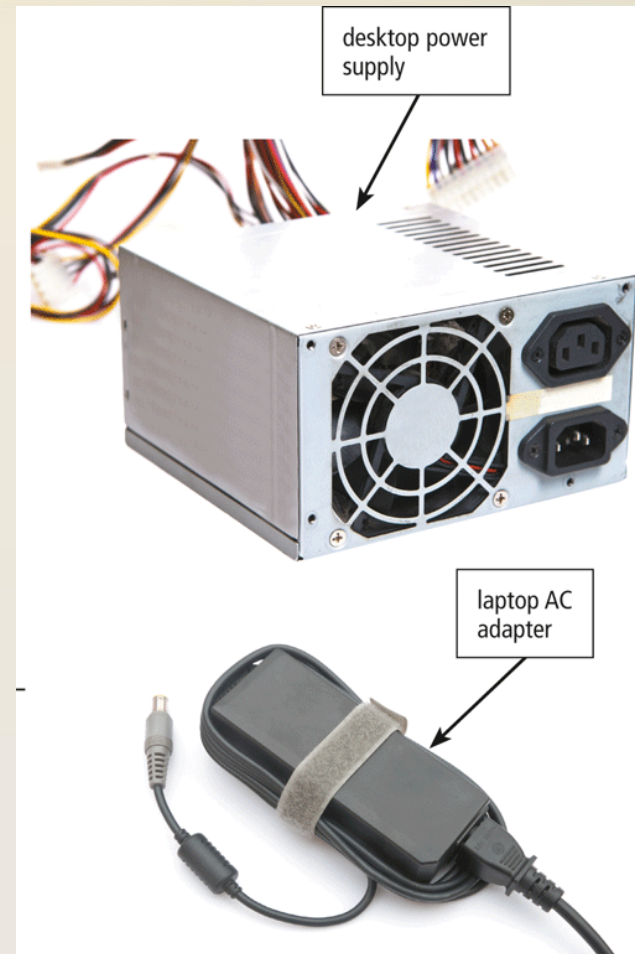
Buses

- A computer might have these three types of buses:

System bus

Backside bus

Expansion bus

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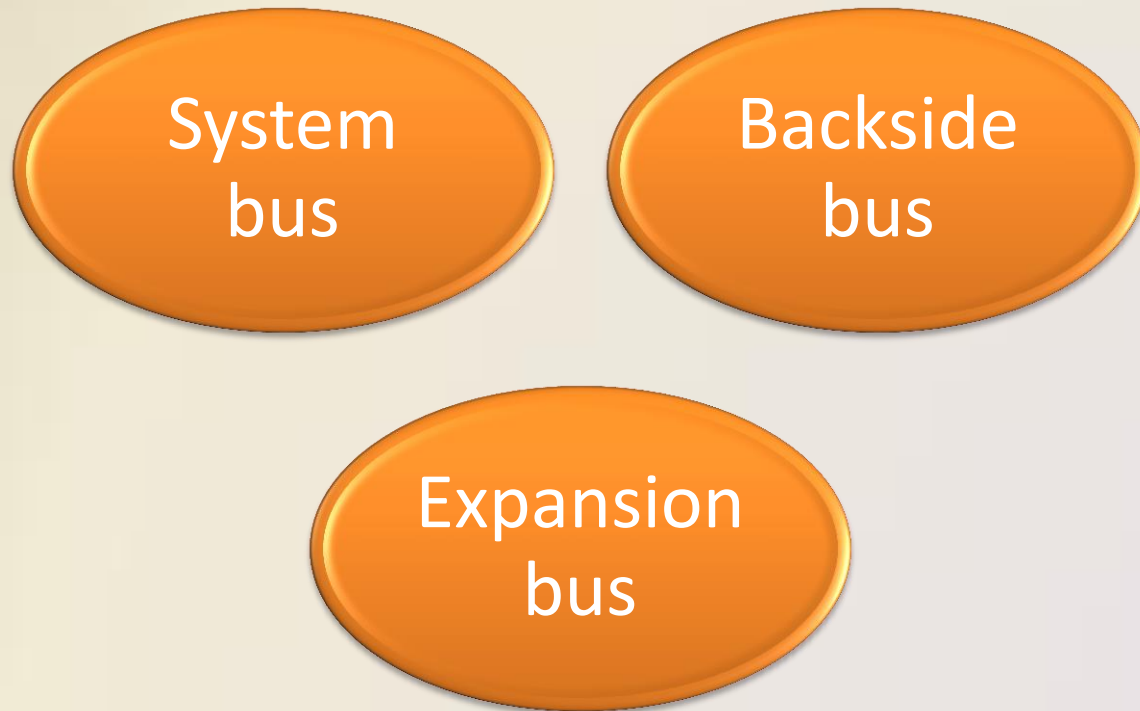
Power Supply and Battery

- The **power supply** or laptop AC adapter converts the wall outlet AC power into DC power

desktop power supply

laptop AC adapter

Power Supply and Battery

- Mobile computers and devices can run using either a power supply or batteries

- Batteries typically are rechargeable lithium-ion batteries

laptop battery

smartphone battery

Summary

Various components inside computers and mobile devices

Types of processors, steps in a machine cycle, and processor cooling methods

Advantages and services of cloud computing

How memory stores data and described various types of memory

Adapters, buses, power supplies and batteries

Ways to care for computers and mobile devices

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Chapter 6 Complete