COMP 100 Intro to Info Technology

Fall Semester,
2010

Lec-04 Components of Computer

Objectives of Chapter 4 Components of system Units

- Differentiate among various styles of system units
- Differentiate among the various types of memory
- Identify chips, adapter cards, and other components of a motherboard
- Describe the types of expansion slots and adapter cards
- Describe the components of a processor and how they complete a machine cycle
- Explain the differences among a serial port, a parallel port, a USB port, a FireWire port, and other ports
- Identify characteristics of various personal computer processors on the market today
- Describe how buses contribute to a computer's processing speed
- Define a bit and describe how a series of bits represents data
- Describe the importance of standardization in IT industry
- Explain how programs transfer in and out of memory

The System Unit

What is a system unit?

- Case that contains electronic components of the computer used to process data
  - Sometimes called the chassis

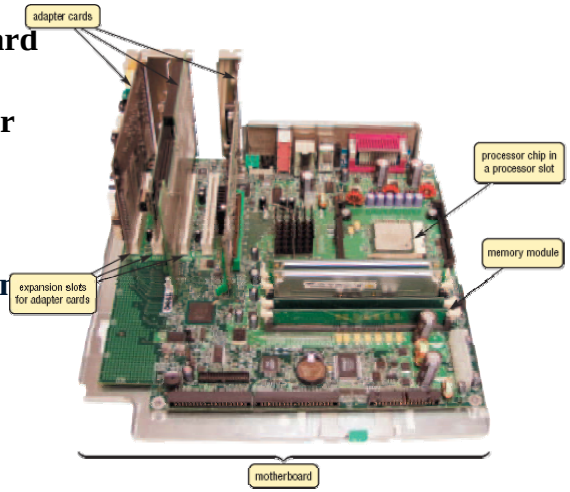
What are common components inside the system unit?

- Processor
- Memory
- Adapter cards
  - Sound card
  - Video card
- Ports
- Drive bays
- Power supply

The System Unit

What is the motherboard?

- Main circuit board in system unit
- Contains adapter cards, processor chips, and memory chips
- Also called system board



The System Unit

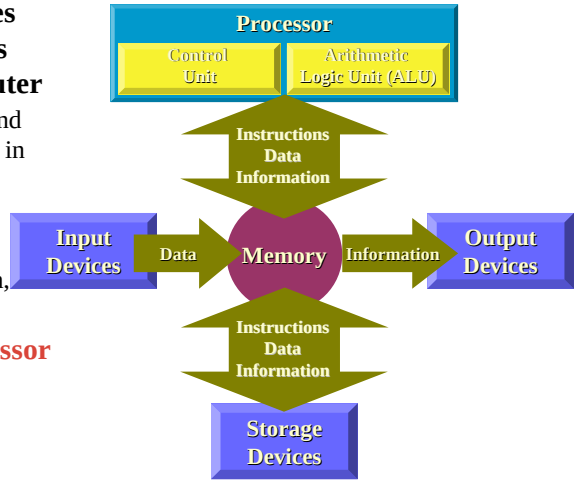
What is a chip?

- **Small piece of semi-conducting material on which integrated circuits are etched**
  - Integrated circuits contain many microscopic pathways capable of carrying electrical current
- **Chips are packaged so they can be attached to a circuit board**

Processor

What is the central processing unit (CPU)?

- **Interprets and carries out basic instructions that operate a computer**
  - **Control unit** directs and coordinates operations in computer
  - **Arithmetic logic unit (ALU)** performs arithmetic, comparison, and logical operations
- **Also called the processor**



Assembly Language

Operating instructions used directly by CPU:

- arithmetic such as add and subtract
- logic instructions such as and, or, and not
- data instructions such as move, input, output, load, and store
- control flow instructions such as goto, if ... goto, call, and return

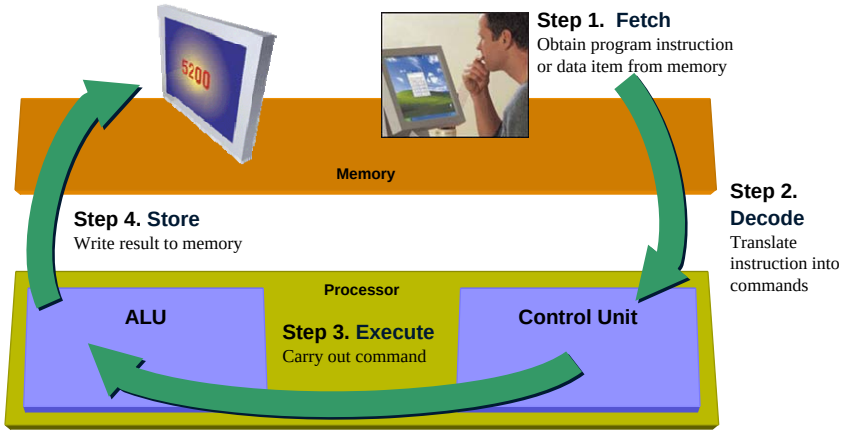
Example:

```
load a, reg1
load b, reg2,
add reg1,reg2,
store reg2, c
```


Processor

What is a machine cycle?

- **Four operations of the CPU comprise a machine cycle**



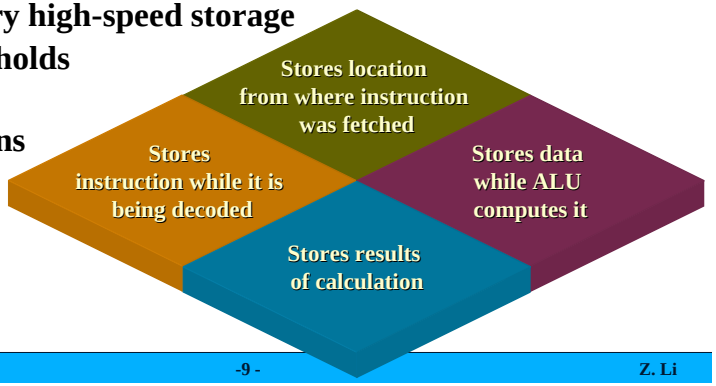
Processor

What is pipelining?

- CPU begins fetching second instruction before completing machine cycle for first instruction
- Results in faster processing

What is a register?

- Temporary high-speed storage
- area that holds data and
- instructions



Processor

What is the system clock?

- Controls timing of all computer operations
- Generates regular electronic pulses, or ticks, that set operating pace of components of system unit

Each tick is a clock cycle

Pace of system clock is clock speed Most clock speeds are in the gigahertz (GHz) range (1 GHz = one billion ticks of system clock per second)

Processor speed can also be measured in millions of instructions per second (MIPS)

Processor

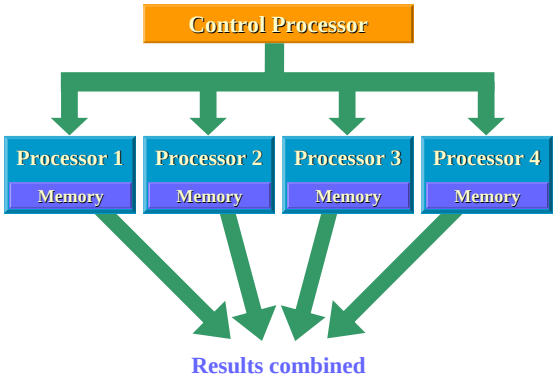
What are heat sinks, heat pipes, and liquid cooling?

- Heat sink—component with fins that cools processor
- Heat pipe—smaller device for notebook computers
- Liquid cooling—uses a continuous flow of fluids to transfer heat away

Processor

What is parallel processing?

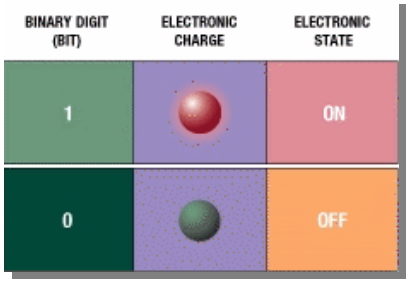
- Using multiple processors simultaneously to execute a program faster
- Requires special software to divide problem and bring results together



Data Representation

How do computers represent data?

- **Most computers are digital**



- Recognize only two discrete states: on or off
- Use a **binary system** to recognize two states
- Use Number system with two unique digits: 0 and 1, called **bits** (short for binary digits)

Number system (review)

Each number system has a base

Base (*B*): different number of objects it can represent in a single digit notation and the actual notations for all these objects

***B* for Binary, Octal, Decimal, Hexadecimal ?**

Multi-digit notation (*n* digits) : convention to represent numbers (objects) beyond a single digit

- **Fixed length vs. variable length**

General notation of numbers: $d_n d_{n-1} \ldots d_1$

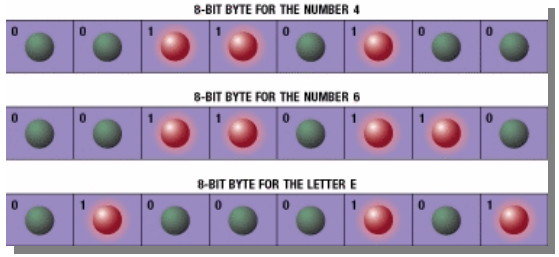
Value = $d_n \times Bn\text{-}1 + d_{n-1} \times B^{n-2} + \ldots + d_1 \times B^0$

Examples: 24 under base 2?, 8? 10?, 16?

Data Representation

What is a byte?

- **Eight bits grouped together as a unit**
- **Provides enough different combinations of 0s and 1s to represent 256 individual characters**
  - Numbers
  - Uppercase and lowercase letters
  - Punctuation marks
  - Other



Data Representation in Computers

- **ASCII—American Standard Code for Information Interchange (single byte encoding)**
- **GB2312—Guo Biao(國標): 信息交換用漢字編碼字符集 基本集(Double byte encoding) (Chinese Coded Character Set of Information Exchange – Basic Set)**
- **Unicode—coding scheme capable of representing all world's languages (Two byte encoding extended to four bytes)**

Symbol	ASCII	Unicode
0	0011 0000	00000000 00110000
1	0011 0001	00000000 00110001
2	0011 0010	00000000 00110010
3	0011 0011	00000000 00110011

Data Representation

How is a letter converted to binary form and back?

Step 1.
The user presses the capital letter D (shift+D key) on the keyboard.

Step 2.
An electronic signal for the capital letter D is sent to the system unit.

Step 3.
The signal for the capital letter D is converted to its ASCII binary code (01000100) and is stored in memory for processing.

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

Memory

What is memory?

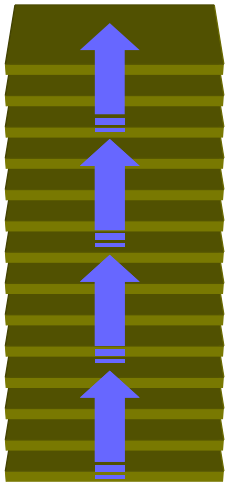
- Electronic components that store instructions, data, and results
- Consists of one or more chips on motherboard or other circuit board
- Each byte stored in unique location called an address, similar to seats in a concert hall

How is memory measured?

Term	Abbreviation	Approximate Size
Kilobyte	KB or K	1 thousand bytes
Megabyte	MB	1 million bytes
Gigabyte	GB	1 billion bytes
Terabyte	TB	1 trillion bytes

Memory

What is random access memory (RAM)?



Memory chips that can be read from and written to by processor

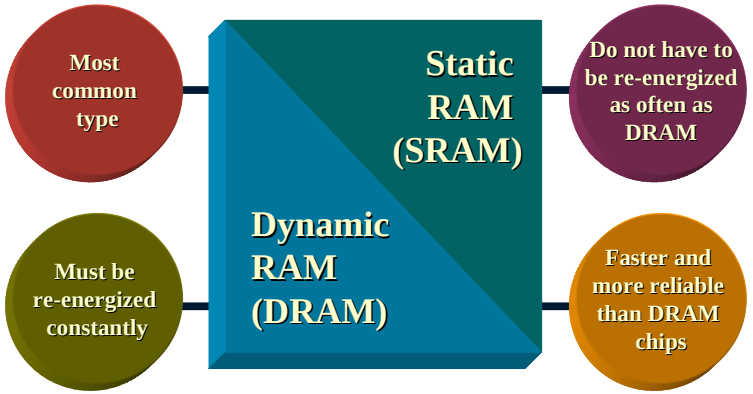
Also called main memory or primary storage

Most RAM is volatile, it is lost when computer's power is turned off

The more RAM a computer has, the faster it responds

Memory

What are two basic types of RAM chips?



Newer Type: Magnetoresistive RAM (MRAM)

Memory

How much RAM do you need?

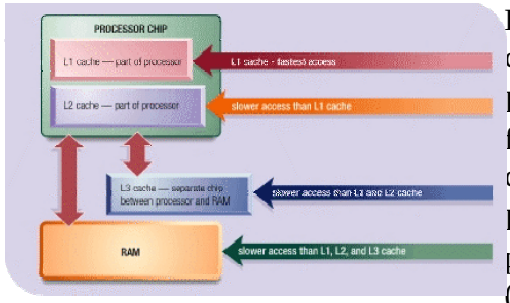
- **Depends on type of applications you intend to run on your computer**

RAM	256 MB to 1 GB	512 MB to 1 GB	2 GB and up
Use	• Home and business users managing personal finance • Using standard application software such as word processing • Using educational or entertainment CD-ROMs • Communicating with others on the Web	• Users requiring more advanced multimedia capabilities • Running number-intensive accounting, financial, or spreadsheet programs • Using voice recognition • Working with videos, music, and digital imaging • Creating Web sites • Participating in video conferences • Playing Internet games	• Power users creating professional Web sites • Running sophisticated CAD, 3D design, or other graphics-intensive software

Memory

What is cache?

- **Helps speed computer processes by storing frequently used instructions and data**
- **Also called memory cache**
  - L1 cache built into processor
  - L2 cache slower but has larger capacity
  - L2 advanced transfer cache is faster, built directly on processor chip
  - L3 cache is separate from processor chip on motherboard (L3 is only on computers that use L2 advanced transfer cache)



Memory

What is read-only memory (ROM)?

Memory chips that store permanent data and instructions

Nonvolatile memory, it is not lost when computer's power is turned off

Three types:

Firmware—Manufactured with permanently written data, instructions, or information

EEPROM (electrically erasable programmable read-only memory)—Type of PROM containing microcode programmer can erase

PROM (programmable read-only memory)—Blank ROM chip onto which a programmer can write permanently

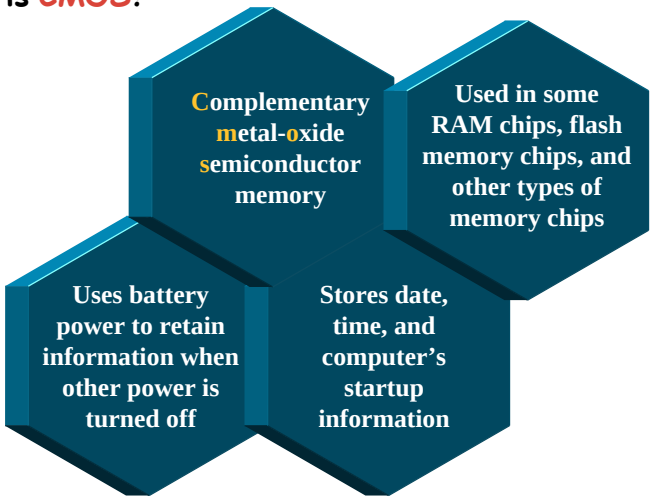
Memory

What is flash memory?

- **Nonvolatile memory that can be erased electronically and rewritten**
- **Used with PDAs, digital cameras, smart phones, music players, digital voice recorders, printers, Internet receivers, and pagers**

Memory

What is CMOS?



Memory

What is access time?

- Amount of time it takes processor to read data from memory
- Measured in nanoseconds (ns), one billionth of a second
- It takes 1/10 of a second to blink your eye; a computer can perform up to 10 million operations in same amount of time

Term	Speed
Millisecond	One-thousandth of a second
Microsecond	One-millionth of a second
Nanosecond	One-billionth of a second
Picosecond	One-trillionth of a second

Expansion Slots and Adapter Cards

What is an adapter card?

- Enhances system unit or provides connections to external devices called peripherals
- Also called an expansion card

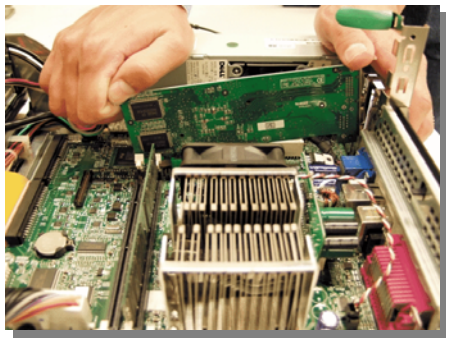
TYPES OF ADAPTER CARDS

Adapter Card	Purpose
Disk controller	Connects disk drives
FireWire	Connects to FireWire devices
Graphics accelerator	Increases the speed at which graphics are displayed
MIDI	Connects musical instruments
Modem	Connects other computers through telephone or cable television lines
Network	Connects other computers and peripherals
PC-to-TV converter	Connects a television
Sound	Connects speakers or a microphone
TV tuner	Allows viewing of television channels on the monitor
USB 2.0	Connects to USB 2.0 devices
Video	Connects a monitor
Video capture	Connects a camcorder

Expansion Slots and Adapter Cards

What is an expansion slot?

- An opening, or socket, on the motherboard that can hold an adapter card
- With Plug and Play, the computer automatically configures cards and other devices as you install them



Expansion Slots and Adapter Cards

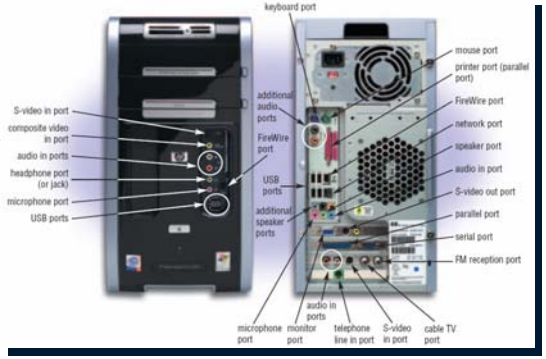
What are PC cards, and flash memory cards?

- A PC card adds memory, storage, sound, fax/modem, communications, and other capabilities to notebook computers
- A flash memory card allows users to transfer data from mobile devices to desktop computers
  - USB Flash drive

Ports and Connectors

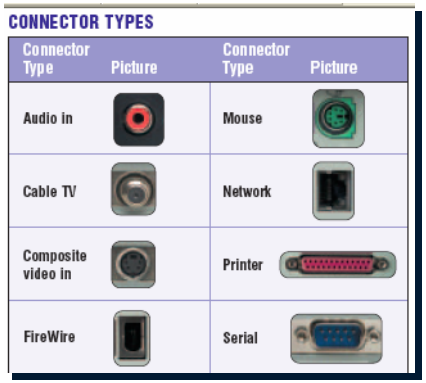
What are ports and connectors?

- Port connects external devices to system unit
- Connector joins cable to peripheral
  - Available in one of two genders: male and female



Ports and Connectors

What are different types of connectors?



Ports and Connectors

What is a serial port?

- Transmits one bit of data at a time
- Connects slow-speed devices, such as mouse, keyboard, modem

What is a parallel port?

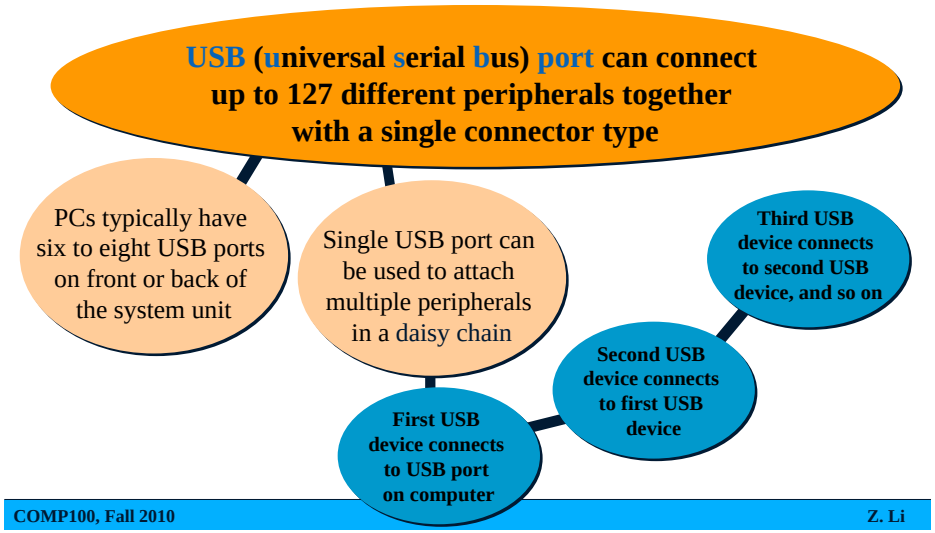
- Connects devices that can transfer more than one bit at a time, such as a printer

Importance of standardization on interfaces

- Hardware
- Software

Ports and Connectors

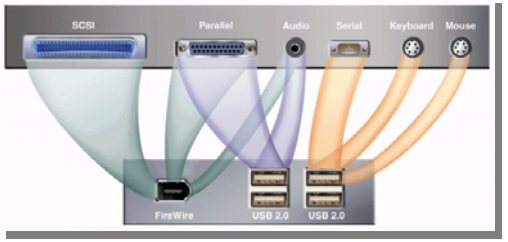
What are USB ports?



Ports and Connectors

What are special-purpose ports?

- **Allow users to attach specialized peripherals or transmit data to wireless devices**
  - MIDI (Musical Instrument Digital Interface) port
  - SCSI (small computer system interface) port
  - IrDA (Infrared Data Association) port
  - Bluetooth port



Buses

What is a bus?

- **Channel that allows devices inside computer to communicate with each other**
  - System bus connects processor and RAM
  - Bus width determines number of bits transmitted at one time
  - **Word size** is the number of bits processor can interpret and execute at a given time

Power Supply

What is a power supply?