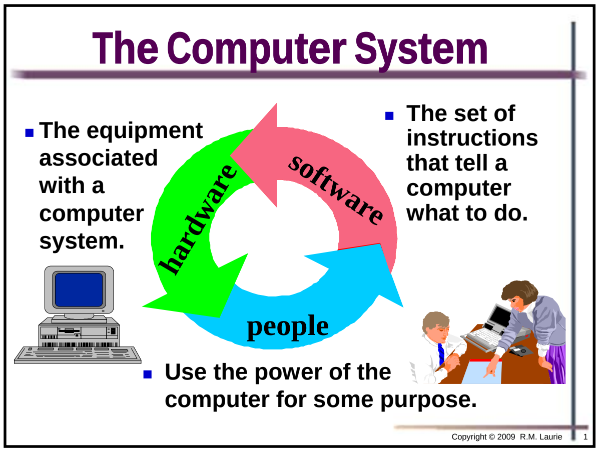
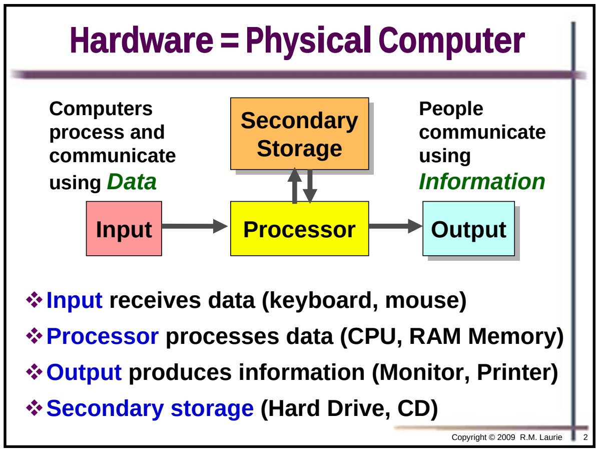


The Computer System

- The equipment associated with a computer system.
- The set of instructions that tell a computer what to do.
- Use the power of the computer for some purpose.

Copyright © 2009 R.M. Laurie 1



Hardware = Physical Computer

Computers process and communicate using *Data*

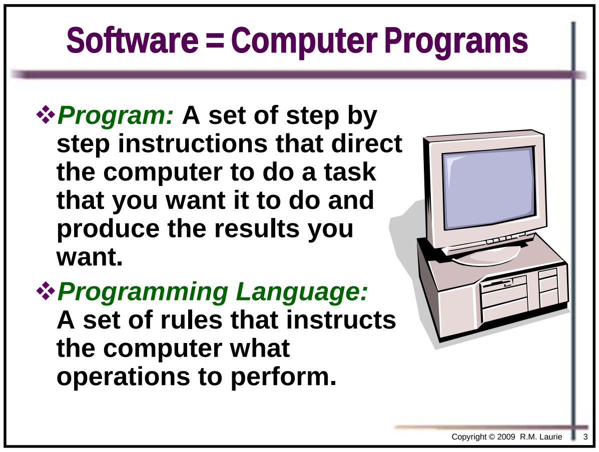
Secondary Storage

People communicate using *Information*

Input → Processor → Output

- ❖ Input receives data (keyboard, mouse)
- ❖ Processor processes data (CPU, RAM Memory)
- ❖ Output produces information (Monitor, Printer)
- ❖ Secondary storage (Hard Drive, CD)

Copyright © 2009 R.M. Laurie 2



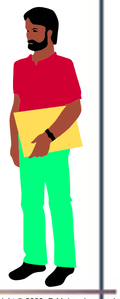
Software = Computer Programs

- ❖ *Program:* A set of step by step instructions that direct the computer to do a task that you want it to do and produce the results you want.
- ❖ *Programming Language:* A set of rules that instructs the computer what operations to perform.

Copyright © 2009 R.M. Laurie 3

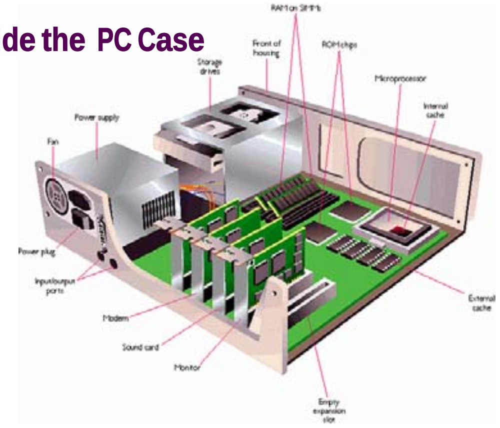
People = End Users & Programmers

- ❖End User's
  - ◆Utilize computer resources
  - ◆Utilize software applications
- ❖Programmers
  - ◆**Analyze** a problem and create a solution algorithm
  - ◆**Code** the solution algorithm into a specific programming language
  - ◆**Verify** program works using known test data

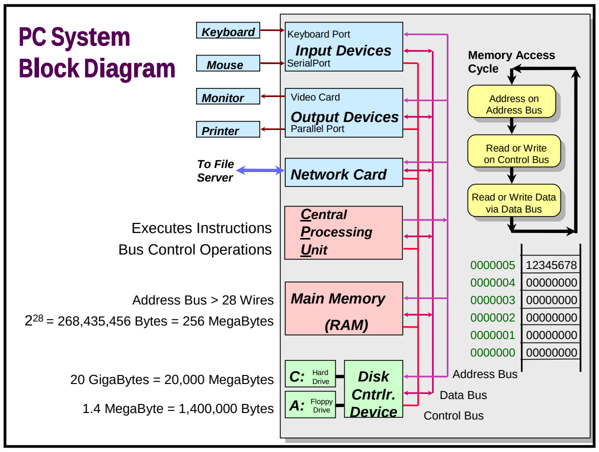


4

Inside the PC Case



PC System Block Diagram



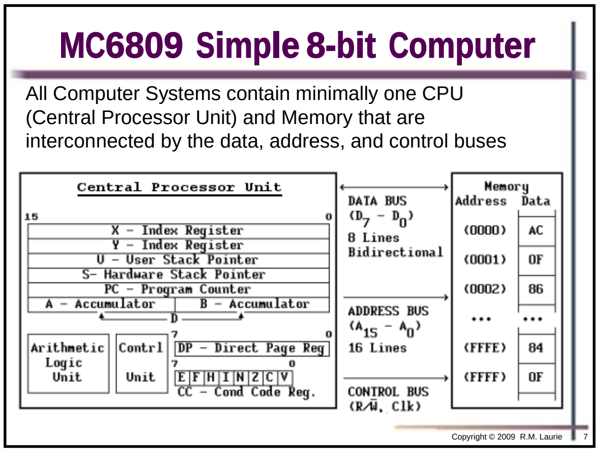
Executes Instructions
Bus Control Operations

Address Bus > 28 Wires
2^{28} = 268,435,456 Bytes = 256 MegaBytes

20 GigaBytes = 20,000 MegaBytes

1.4 MegaByte = 1,400,000 Bytes

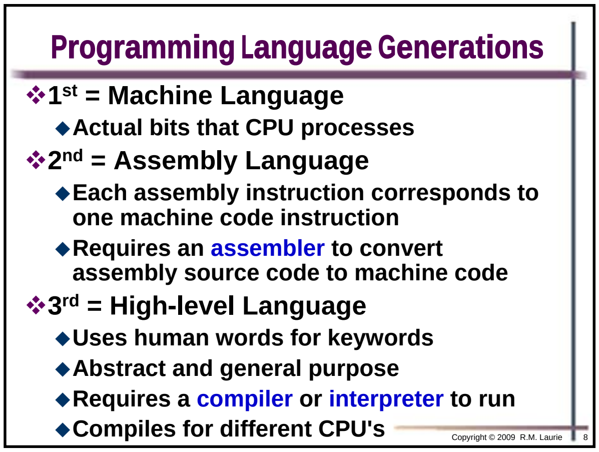
0000005	12345678
0000004	00000000
0000003	00000000
0000002	00000000
0000001	00000000
0000000	00000000



MC6809 Simple 8-bit Computer

All Computer Systems contain minimally one CPU (Central Processor Unit) and Memory that are interconnected by the data, address, and control buses

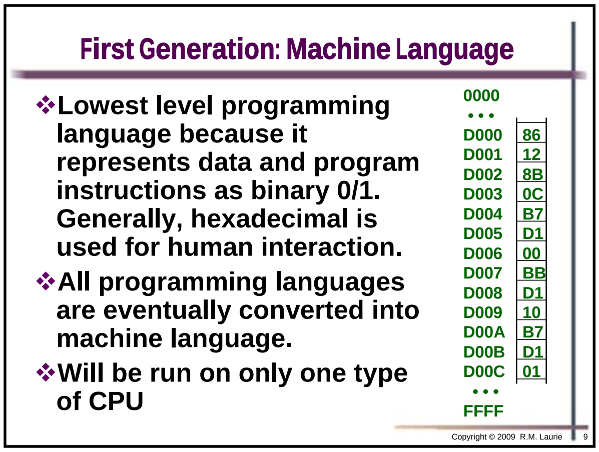
7



Programming Language Generations

- 1st = Machine Language
  - Actual bits that CPU processes
- 2nd = Assembly Language
  - Each assembly instruction corresponds to one machine code instruction
  - Requires an assembler to convert assembly source code to machine code
- 3rd = High-level Language
  - Uses human words for keywords
  - Abstract and general purpose
  - Requires a compiler or interpreter to run
  - Compiles for different CPU's

8

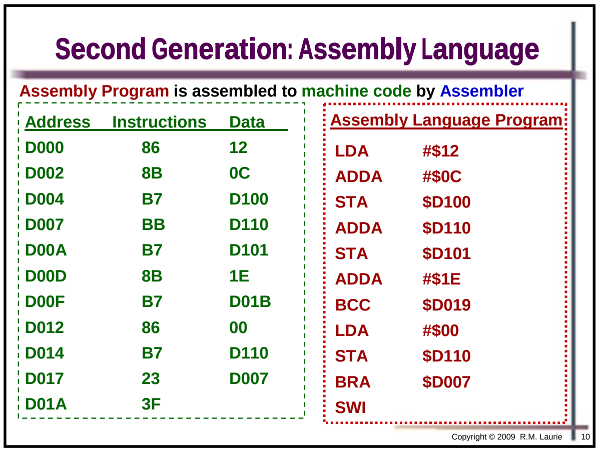


First Generation: Machine Language

- Lowest level programming language because it represents data and program instructions as binary 0/1. Generally, hexadecimal is used for human interaction.
- All programming languages are eventually converted into machine language.
- Will be run on only one type of CPU

0000	
• • •	
D000	86
D001	12
D002	8B
D003	0C
D004	B7
D005	D1
D006	00
D007	BB
D008	D1
D009	10
D00A	B7
D00B	D1
D00C	01
• • •	
FFFF	

9



Second Generation: Assembly Language

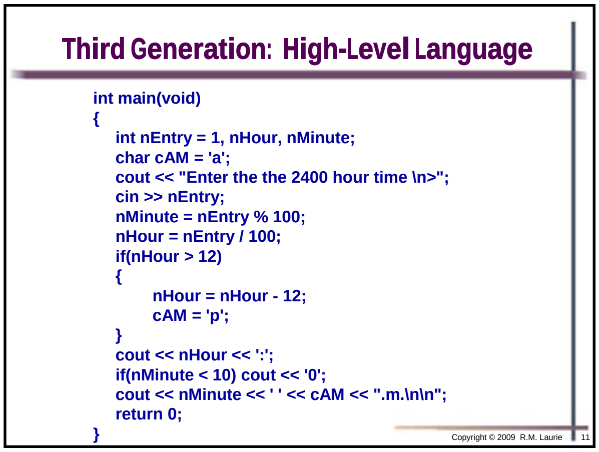
Assembly Program is assembled to machine code by Assembler

Address	Instructions	Data
D000	86	12
D002	8B	0C
D004	B7	D100
D007	BB	D110
D00A	B7	D101
D00D	8B	1E
D00F	B7	D01B
D012	86	00
D014	B7	D110
D017	23	D007
D01A	3F	

Assembly Language Program

```
LDA     #$12
ADDA    #$0C
STA     $D100
ADDA    $D110
STA     $D101
ADDA    #$1E
BCC     $D019
LDA     #$00
STA     $D110
BRA     $D007
SWI
```

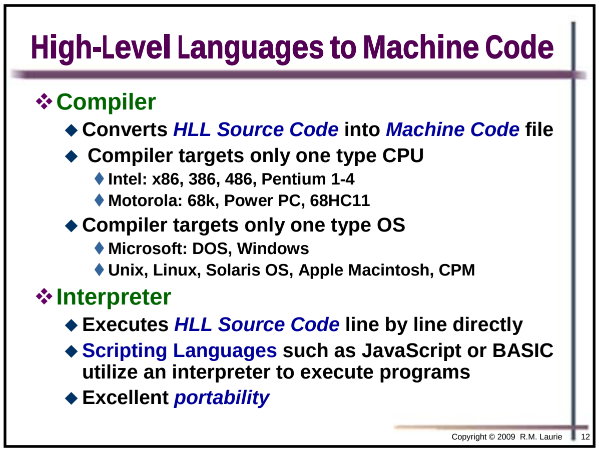
10



Third Generation: High-Level Language

```
int main(void)
{
    int nEntry = 1, nHour, nMinute;
    char cAM = 'a';
    cout << "Enter the the 2400 hour time \n>";
    cin >> nEntry;
    nMinute = nEntry % 100;
    nHour = nEntry / 100;
    if(nHour > 12)
    {
        nHour = nHour - 12;
        cAM = 'p';
    }
    cout << nHour << ':';
    if(nMinute < 10) cout << '0';
    cout << nMinute << ' ' << cAM << ".m.\n\n";
    return 0;
}
```

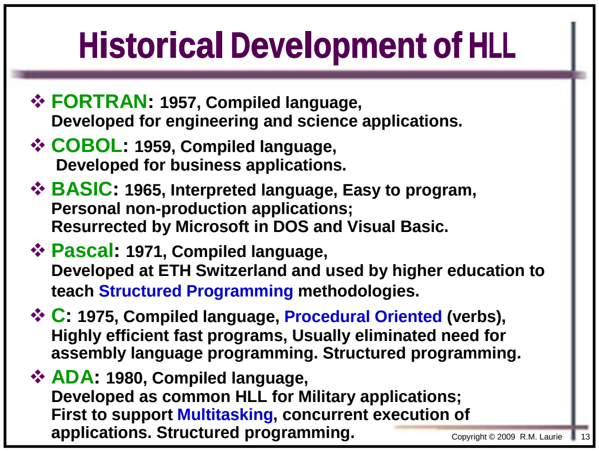
11



High-Level Languages to Machine Code

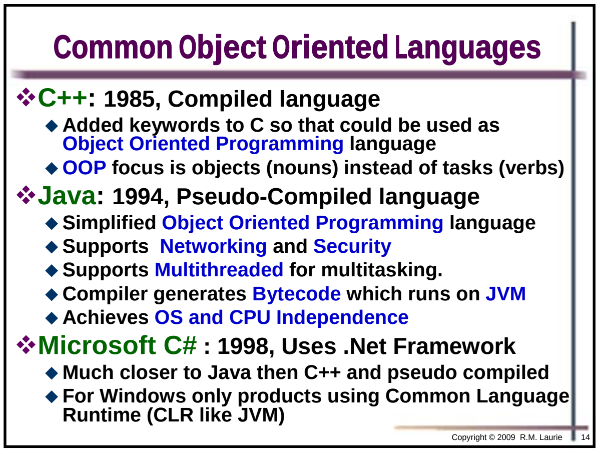
- **Compiler**
  - Converts *HLL Source Code* into *Machine Code* file
  - Compiler targets only one type CPU
    - Intel: x86, 386, 486, Pentium 1-4
    - Motorola: 68k, Power PC, 68HC11
  - Compiler targets only one type OS
    - Microsoft: DOS, Windows
    - Unix, Linux, Solaris OS, Apple Macintosh, CPM
- **Interpreter**
  - Executes *HLL Source Code* line by line directly
  - Scripting Languages such as JavaScript or BASIC utilize an interpreter to execute programs
  - Excellent *portability*

12



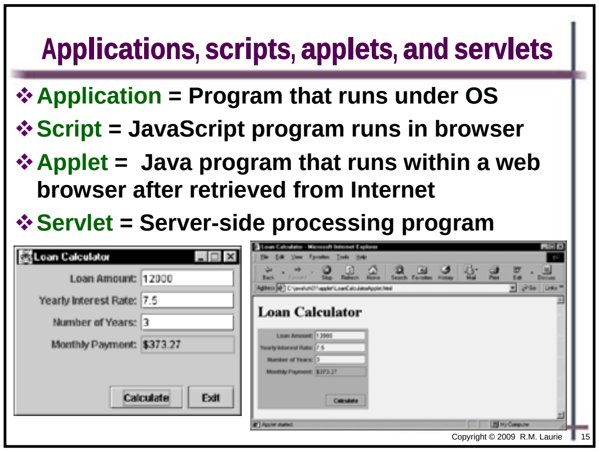
Historical Development of HLL

- ❖ FORTRAN: 1957, Compiled language,
  Developed for engineering and science applications.
- ❖ COBOL: 1959, Compiled language,
  Developed for business applications.
- ❖ BASIC: 1965, Interpreted language, Easy to program,
  Personal non-production applications;
  Resurrected by Microsoft in DOS and Visual Basic.
- ❖ Pascal: 1971, Compiled language,
  Developed at ETH Switzerland and used by higher education to teach Structured Programming methodologies.
- ❖ C: 1975, Compiled language, Procedural Oriented (verbs),
  Highly efficient fast programs, Usually eliminated need for assembly language programming. Structured programming.
- ❖ ADA: 1980, Compiled language,
  Developed as common HLL for Military applications;
  First to support Multitasking, concurrent execution of applications. Structured programming.



Common Object Oriented Languages

- ❖ C++: 1985, Compiled language
  - ◆ Added keywords to C so that could be used as Object Oriented Programming language
  - ◆ OOP focus is objects (nouns) instead of tasks (verbs)
- ❖ Java: 1994, Pseudo-Compiled language
  - ◆ Simplified Object Oriented Programming language
  - ◆ Supports Networking and Security
  - ◆ Supports Multithreaded for multitasking.
  - ◆ Compiler generates Bytecode which runs on JVM
  - ◆ Achieves OS and CPU Independence
- ❖ Microsoft C# : 1998, Uses .Net Framework
  - ◆ Much closer to Java then C++ and pseudo compiled
  - ◆ For Windows only products using Common Language Runtime (CLR like JVM)



Applications, scripts, applets, and servlets

- ❖ Application = Program that runs under OS
- ❖ Script = JavaScript program runs in browser
- ❖ Applet = Java program that runs within a web browser after retrieved from Internet
- ❖ Servlet = Server-side processing program

Loan Calculator

Loan Amount: 12000

Yearly Interest Rate: 7.5

Number of Years: 3

Monthly Payment: $373.27