

Lesson 4: Software embedded into a System- Part 1 ROM image and Programming Languages

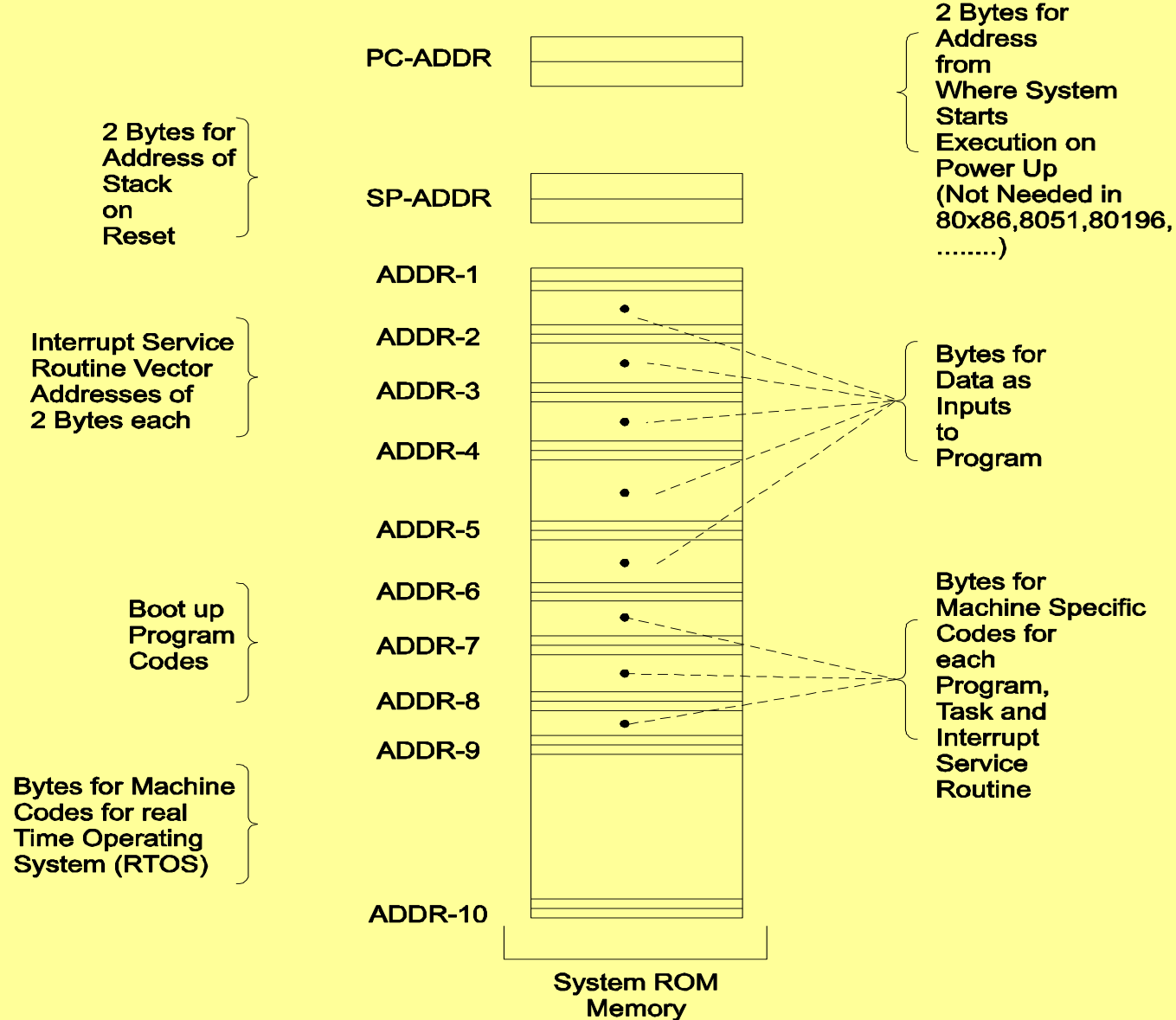
Outline

- ROM image
- Programming Languages

1. ROM Image

- Final stage software also called ROM image*

* (Just as an image is a unique sequence and arrangement of pixels, embedded software is also a unique placement and arrangement at each ROM address of bytes for instructions and data.)



System ROM memory embedding the software, RTOS, data, and vector addresses

Final machine software

- Bytes at each address defined for creating the ROM image.
- By changing this image, the same hardware platform work differently and can be used for entirely different applications or for new upgrades of the same system.

Distinct ROM image in a distinct Embedded System

- Hardware elements between the distinct systems can be identical but it is the software that makes a system unique and distinct from the other.

Compressed Codes and Data

- ROM image may alternatively be compressed software (for example, the zip format) and data (for example, the pictures in jpg or gif format) along with the software required for decompression algorithm

Outline

- ROM image
- Programming Languages

1. Machine Language Coding

- Programmer defines the addresses and the corresponding bytes or bits at each address.
- Used in configuring some specific physical device or subsystem like transceiver, the machine code- based coding is used

2. Assembly Language Coding

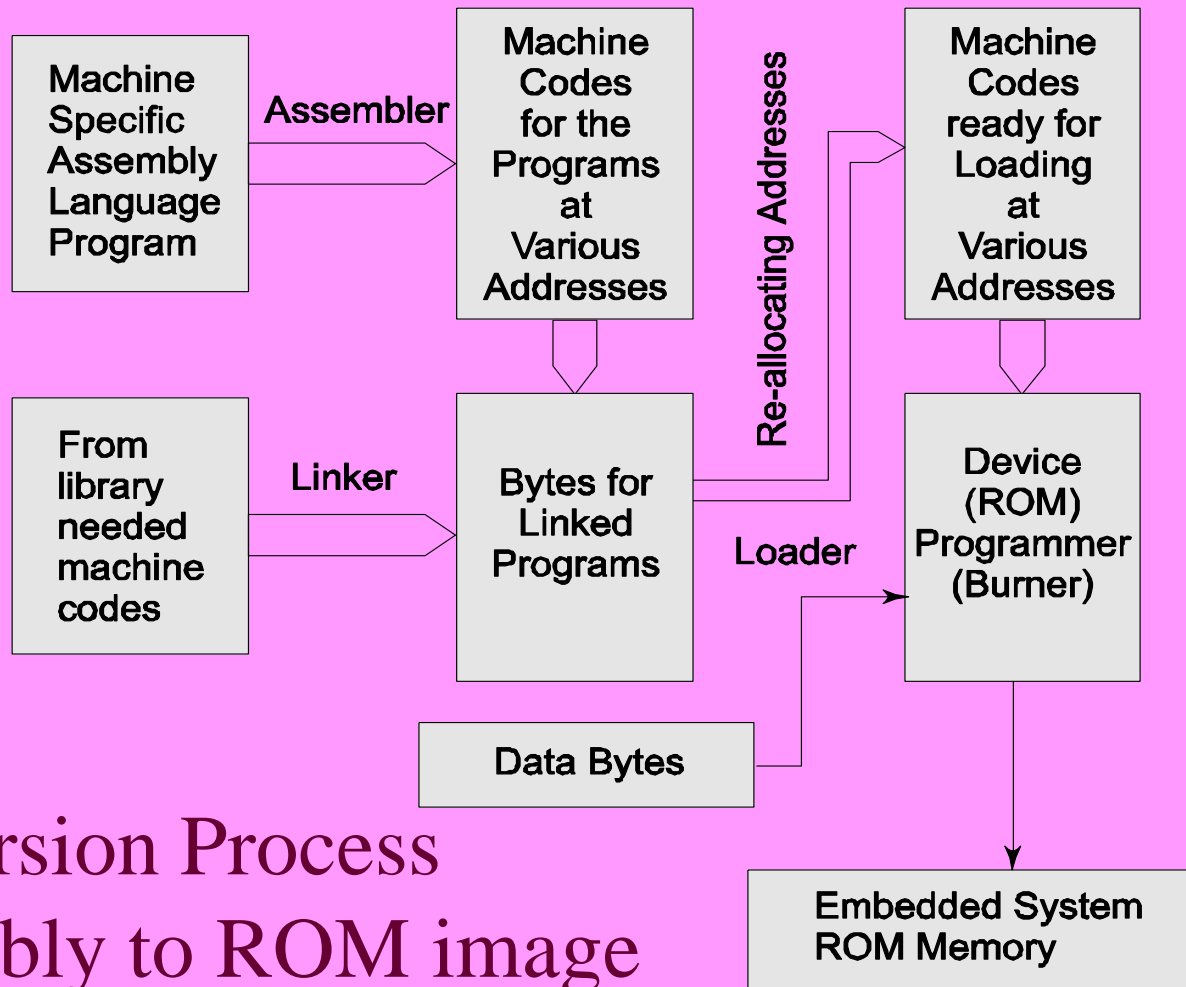
- Needed for Invoking Processor Specific Instructions
- Requires understanding of the processor and instruction set.
- A program or a small specific part coded in the assembly language using an Assembler (software used for developing codes in assembly).

Three steps when using assembly language

- 'Assembler',
- 'Linker' and
- 'Locator'

before finally burned at the ROM

Assembly



Conversion Process Assembly to ROM image

3. Programming language EmbeddedC or C++ or Visual C++ or Java .

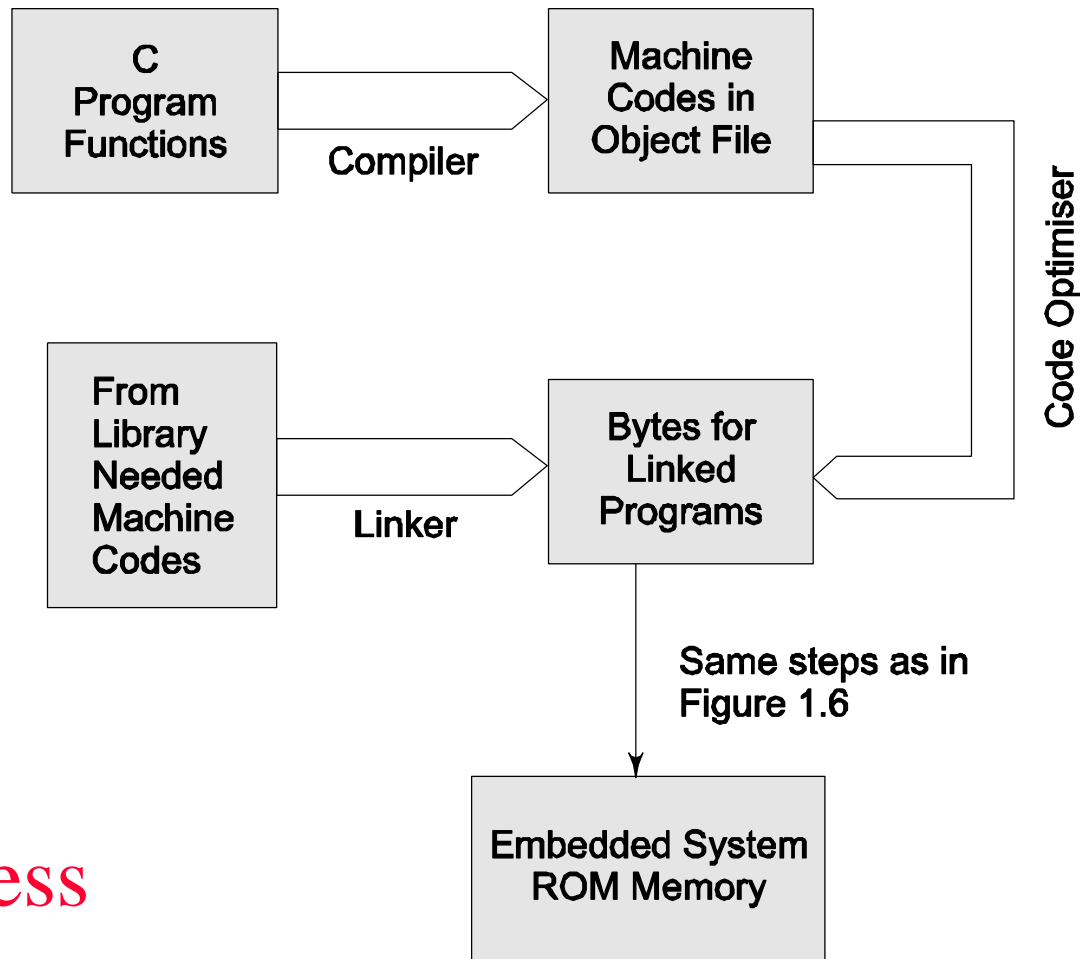
Embedded C has commends to send byte(s) at port addresses

Enables operations using bytes and bits

Compiler

- **Generates an object file. Using linker and locator, the file for ROM image is created for the targeted hardware. C++ and Java are other languages used for software coding.**

Converting a C program into ROM image



Process

Summary

We learnt:

- (i) embedded software as ROM image
- (ii) conversion steps from high level language codes to assembly and then to the ROM image

We learnt:

(iv) high level language used for software development is Embedded C, C++, visual C++ or Java

End of the Lesson –4