Embedded Software Development

<Training Topic /Lesson Name>

Lesson Objectives

- *Embedded Software Overview*
- *Embedded Software Development Flow*
- *Software Flow*

Section 1

Embedded Software Overview

Embedded Software Overview

- *Definition*
- *Features*
- *Common Components*
- *What is needed to start*

Definition

- *Embedded software is computer software, written to control machines or devices that are not typically thought of as computers. It is typically specialized for the particular hardware that it runs on and has time and memory constraints. This term is sometimes used interchangeably with firmware*

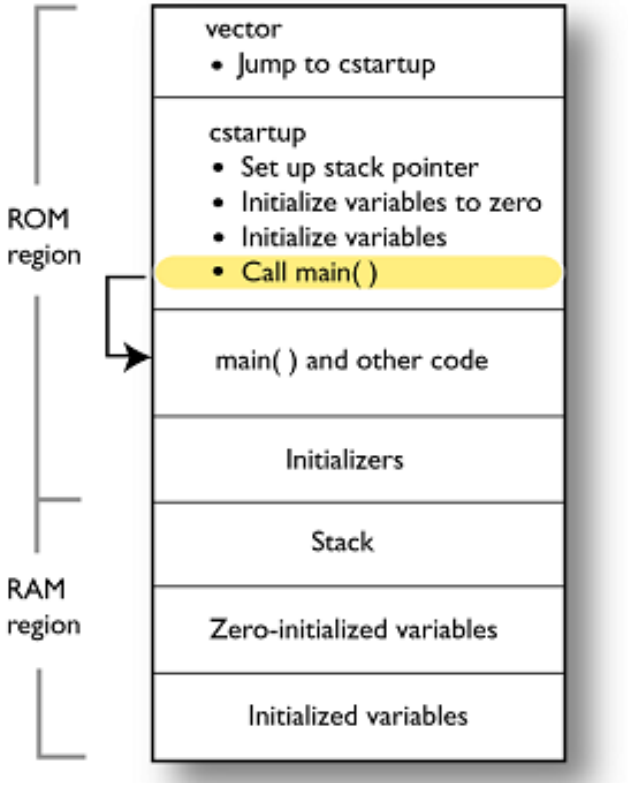
(wiki)

Features

- *Acts directly with and on the hardware*
- *Quite limited resources.*
- *Using a “Non-hosted environment”*

Common Components

- *Reset vector*
- *Startup code*
- *Application code*
- *Libraries*
- *Interrupt/Exception Handler*



What is needed to start?

- *Development suites*
- *Development board*
- *Debug Adapter*
- *Software device driver*
- *Documents and other resources.*

Section 2

Embedded Software Development Flow

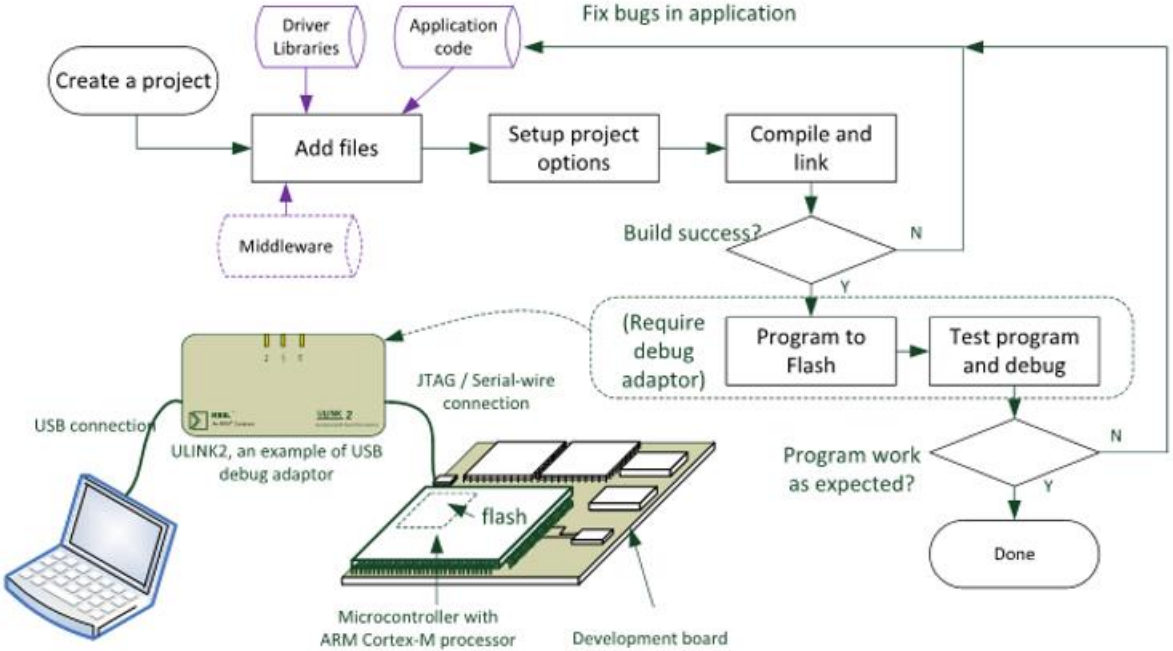
Embedded Software Development Flow

- *Software Development Steps in IDE*
- *Development Flow*
- *Compilation Flow*

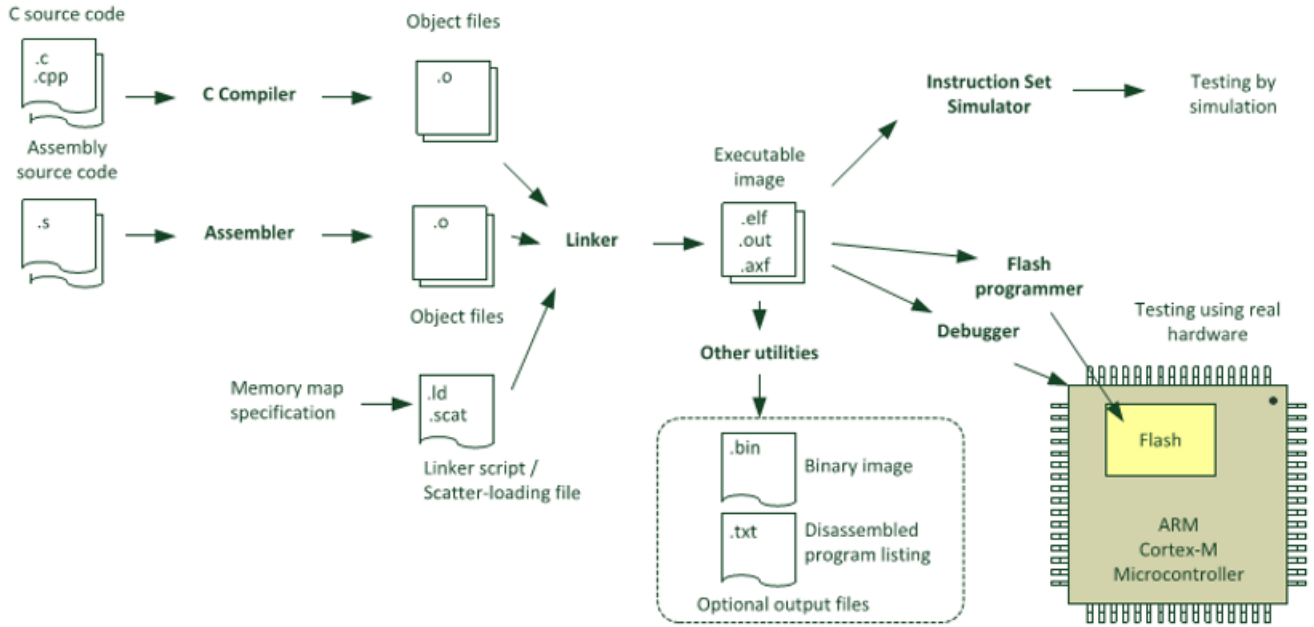
Software Development Steps in IDE

- *Create project*
- *Setup project option*
- *Compile & Link*
- *Flash Program*
- *Execute & Debug*

Development Flow

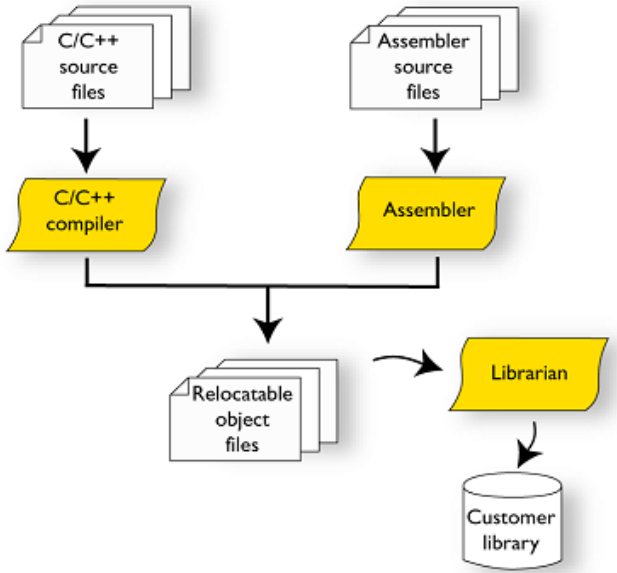


Compilation Flow

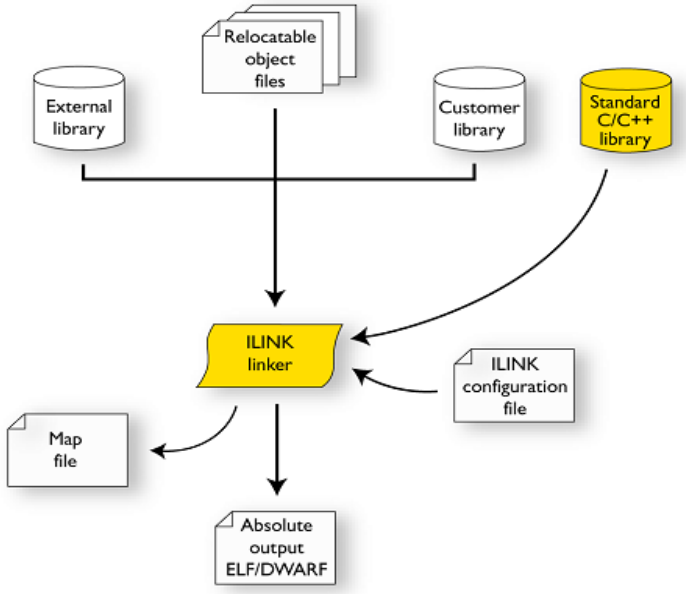


Embedded Software Development Flow

IAR Compilation Flow



IAR Link Flow



Section 3

Software Flow

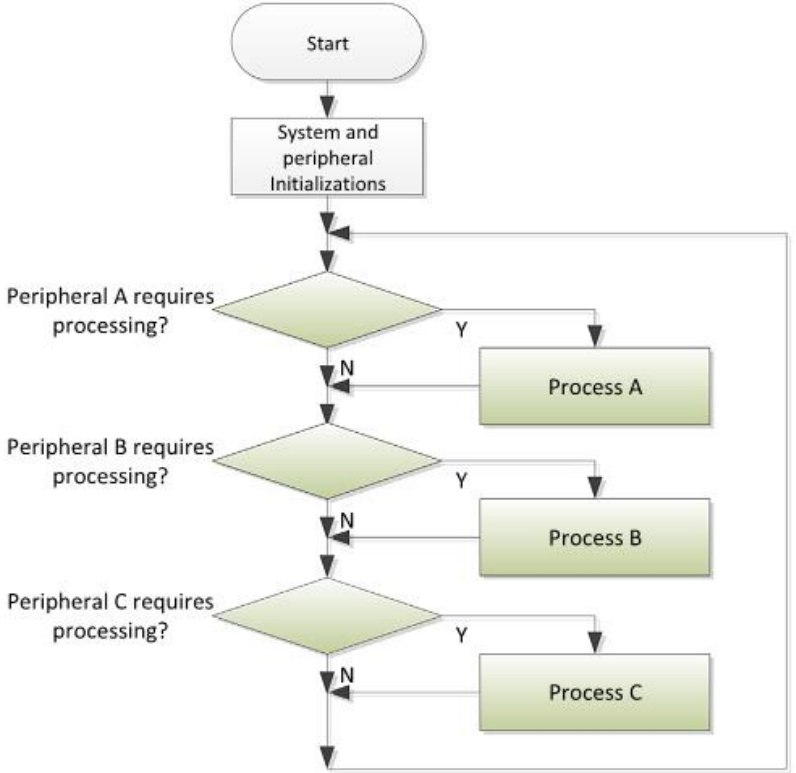
Software Flow

- *Definition and Key Differences*
- *Advantages and disadvantages*
- *Interrupt Process*
- *Interrupt Handler Features*

Definition and Key Differences

Polling

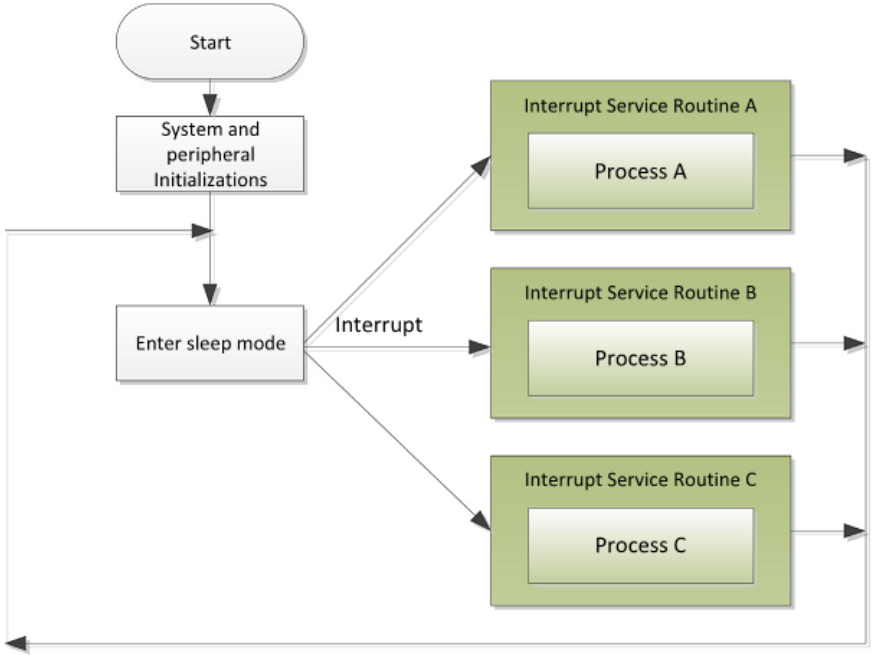
- *In polling is not a hardware mechanism, its a protocol in which CPU steadily checking the status of a peripheral. e.g. read data from an input keyboard.*
- *Polling is relatively straightforward in design and programming with the sacrifice of system performance.*



Definition and Key Differences

Interrupt

- *Interrupt is a hardware mechanism in which, the device notices the CPU that it requires its attention. Interrupt can take place at any time.*
- *When CPU gets an interrupt signal, CPU stops the current process and a handler (software to service the interrupt) is executed. CPU returns to where it left off in the main program.*



Advantages and disadvantages

Polling

- Advantages:
  - Easy to code, simple for simple applications
  - Easy to debug, find errors, monitor the execution of the program
  - The activities in the program can be easily predicted
  - Resources are used, shared between functions clearly.
- Disadvantages:
  - Difficult to develop for complex programs
  - Slow response to events
  - Always consume energy at the highest level
  - Waste of resources, microcontroller capabilities.

Interrupt

- Advantages of interrupts:
  - Faster response speed than polling
  - Can use low power mode and interrupt will wake up the CPU
  - Support Nested Interrupt (interrupt with higher priority will be executed and interrupt execution of interrupt with lower priority).
- Disadvantages:
  - Debug is more complicated
  - Resources can be used unexpectedly.

Interrupt Process

- CPU waits until the current instruction has finished being executed.
- Save the contents of internal registers of the CPU & the state information within Control Unit
- The PC is loaded with address of the Interrupt Service Routine (ISR)
- ISR is executed.
- Return program from interrupt.

Interrupt Handler Features

- Differs from subroutine because it is executed at any time due to interrupt, not due to Call
- Should be implemented as small as possible
- Should be executed in short-time.

Lesson Summary

- *Embedded Software, or firmware, is program that specialized for particular processor*
- *Embedded software developments including: Create project, compile & link to generate imagine; load & debug in hardware*
- *There are two kinds of software flow: pooling & interrupt.*

Thank you