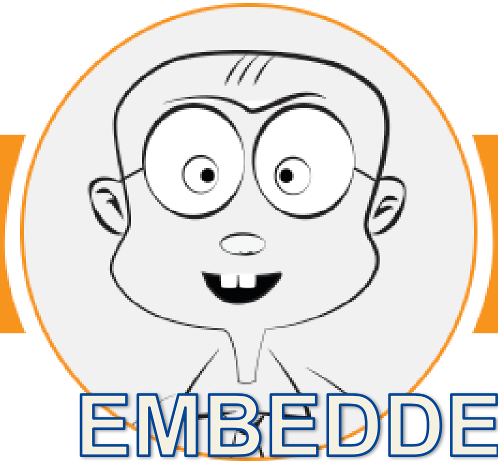

EMBEDDED SYSTEM COURSE

LECTURE 2: EMBEDDED SOFTWARE DEVELOPMENT

Learning Goals

- Understanding how the does the code has been compiled, and generated to an image.
- Understand how does loading/debugging process happen.
- Understand most basis concepts regarding software engineering: pooling & interrupt.
- Having knowledge on how to access peripheral via memory mapped.

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Embedded Software Overview

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)

Embedded Software Overview

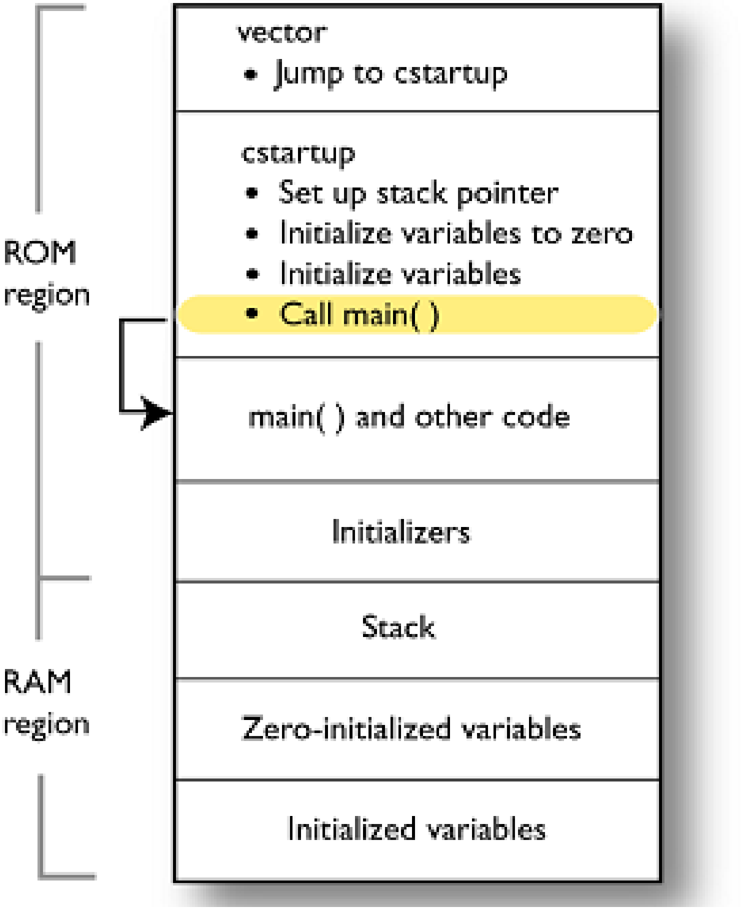
Features:

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

Embedded Software Overview

Common Components:

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



Embedded Software Overview

What is needed to start:

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

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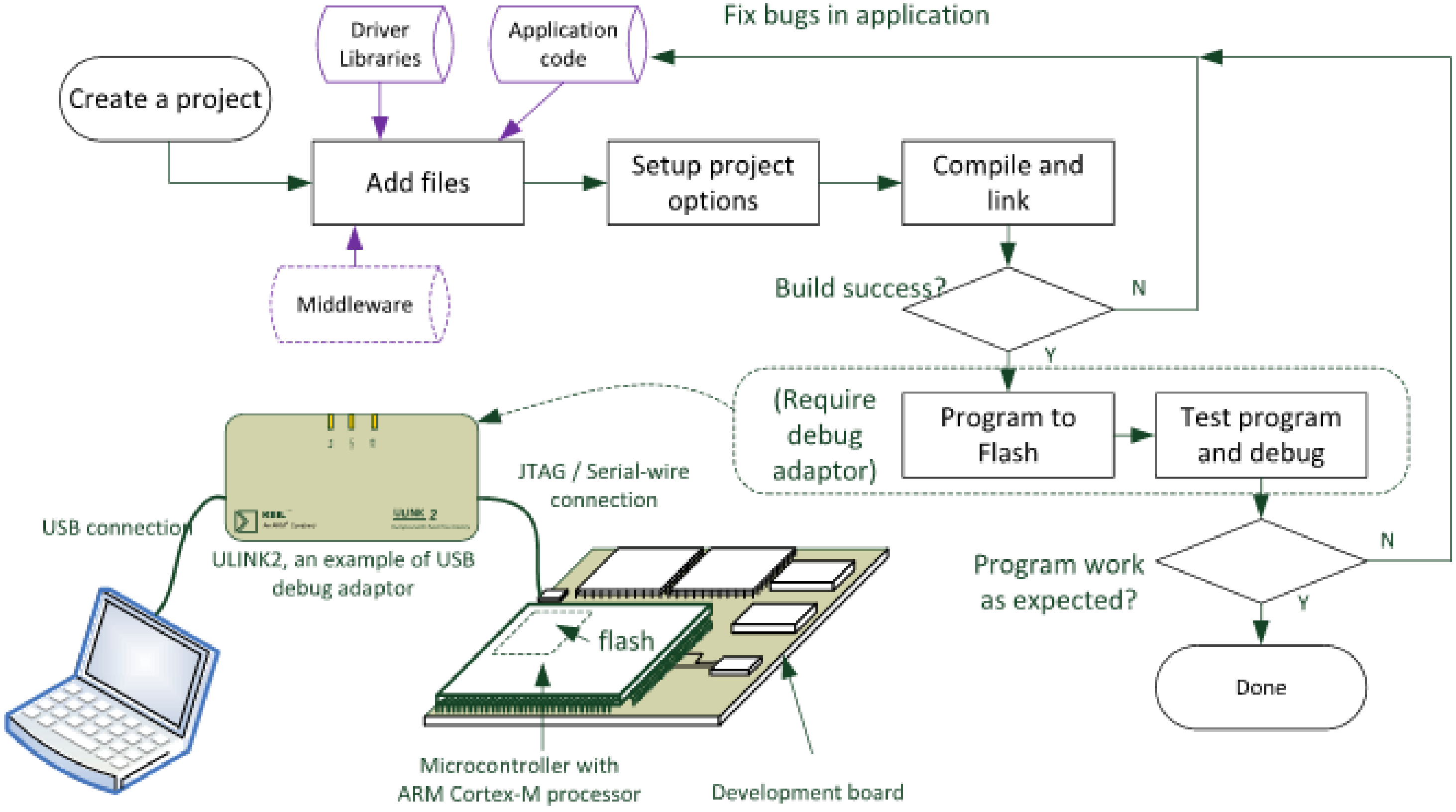
Embedded Software Development Flow

Software Development Steps in IDE

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

Embedded Software Development Flow

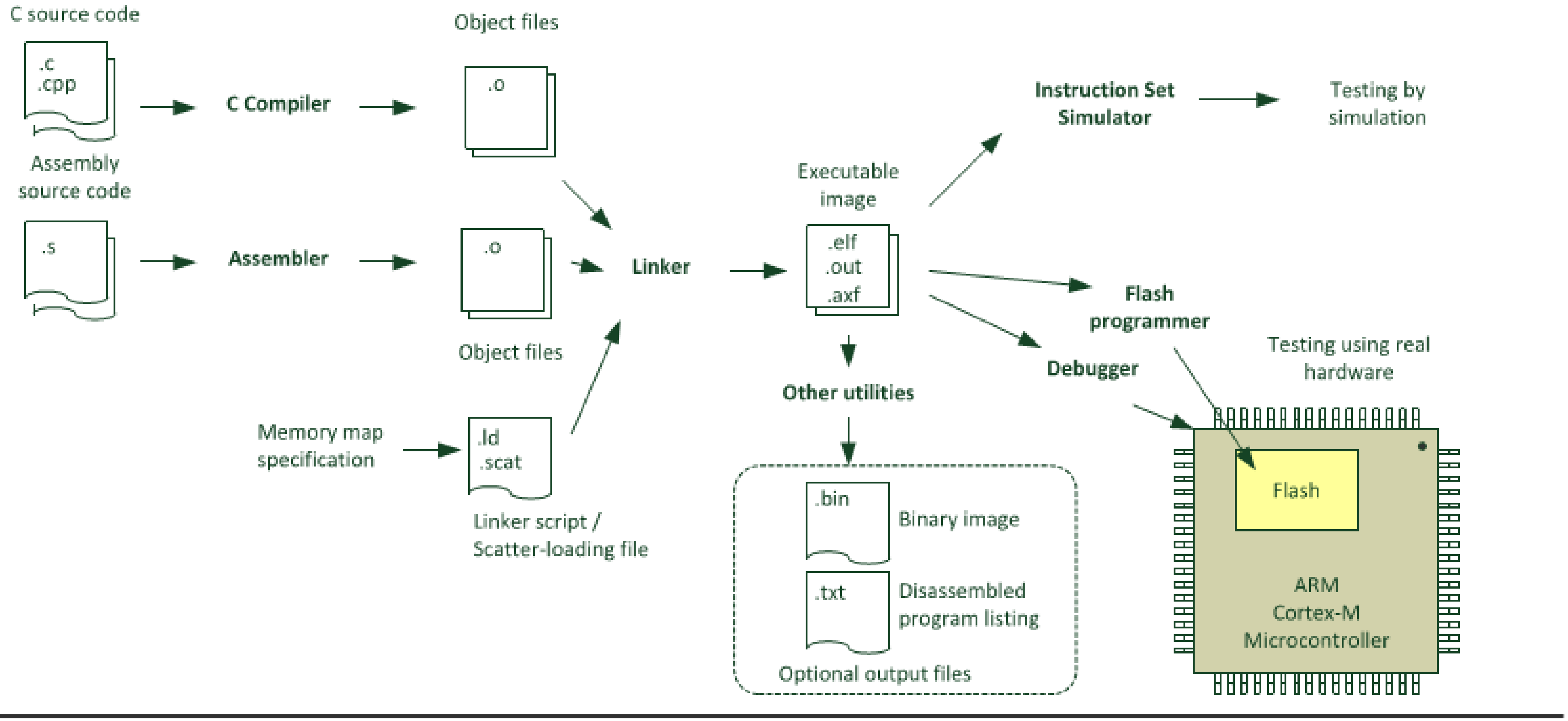
Development Flow



A simplified software development flow

Embedded Software Development Flow

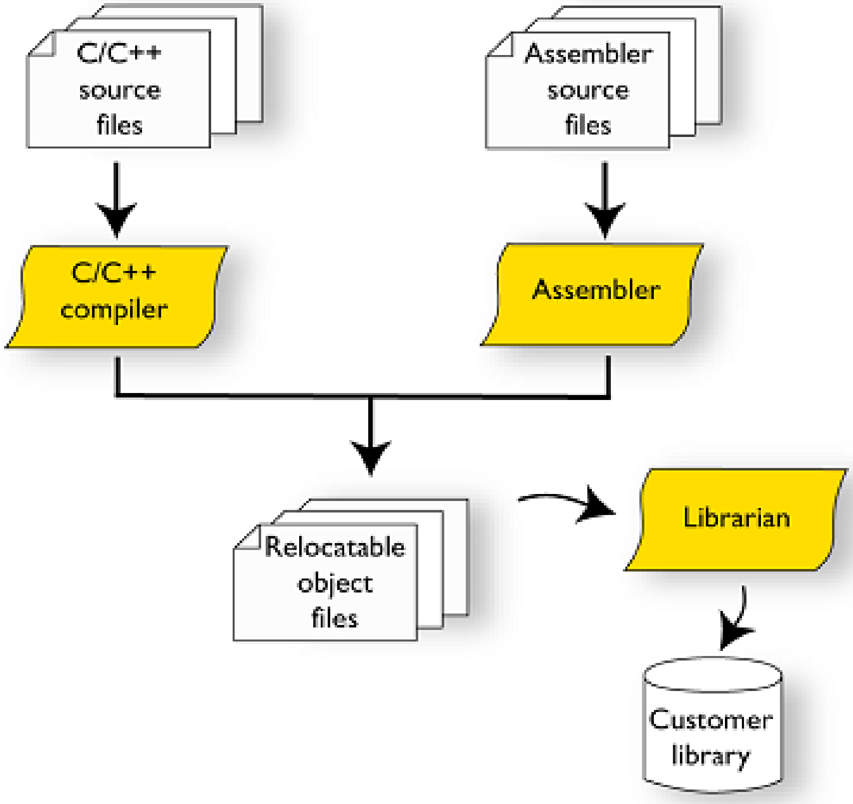
Compilation Flow



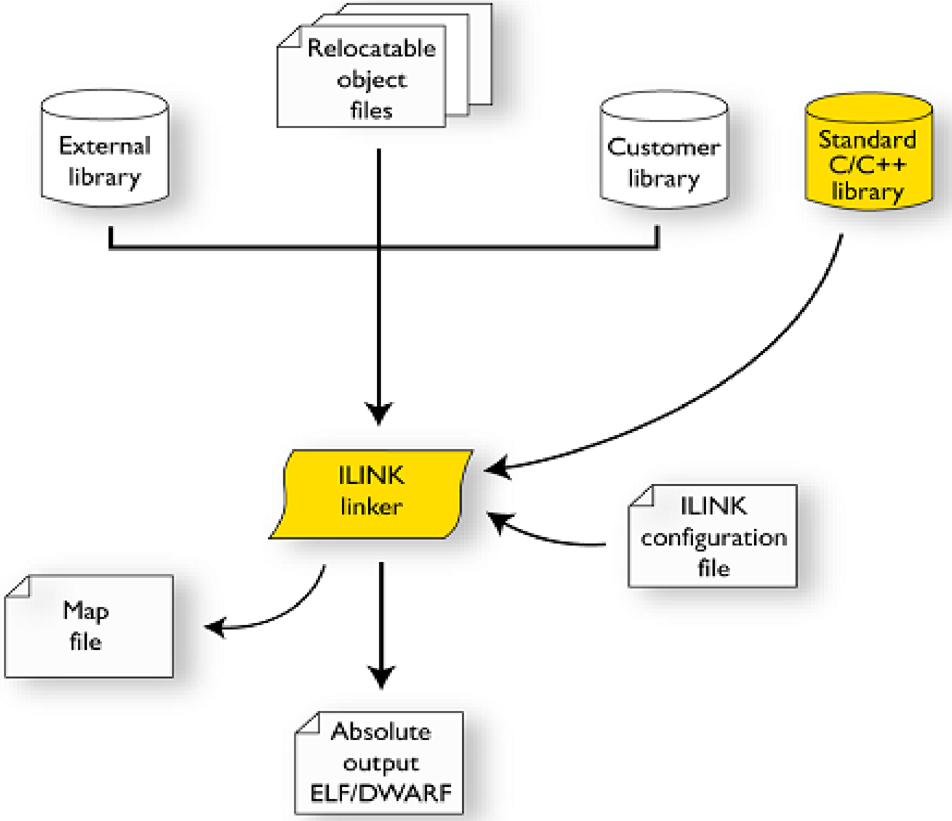
Common software compilation flow

Embedded Software Development Flow

IAR Compilation Flow



IAR Link Flow



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Software Flow

Pooling

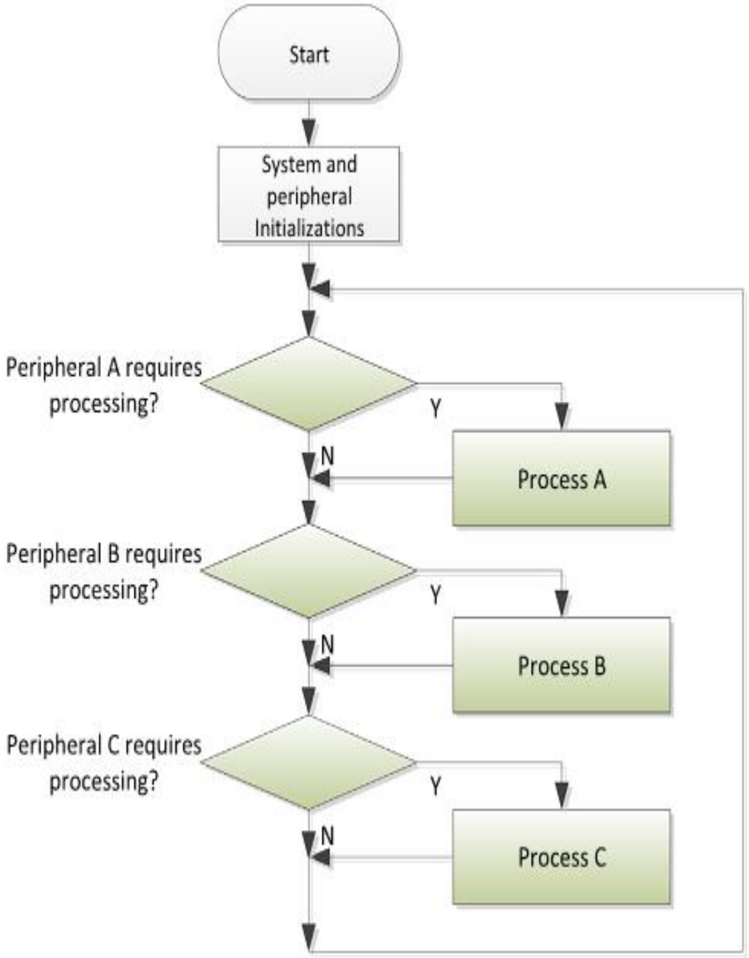
- Continuously checking the status of a peripheral; e.g. read data from an input keyboard.
- Polling is relatively straightforward in design and programming with the sacrifice of system performance.

Interrupt

- Device "interrupts" CPU to indicate that it needs service.
- These events only occur if the interrupt is enabled.
- A handler (software to service the interrupt) is executed.
- CPU returns to where it left off in the main program.

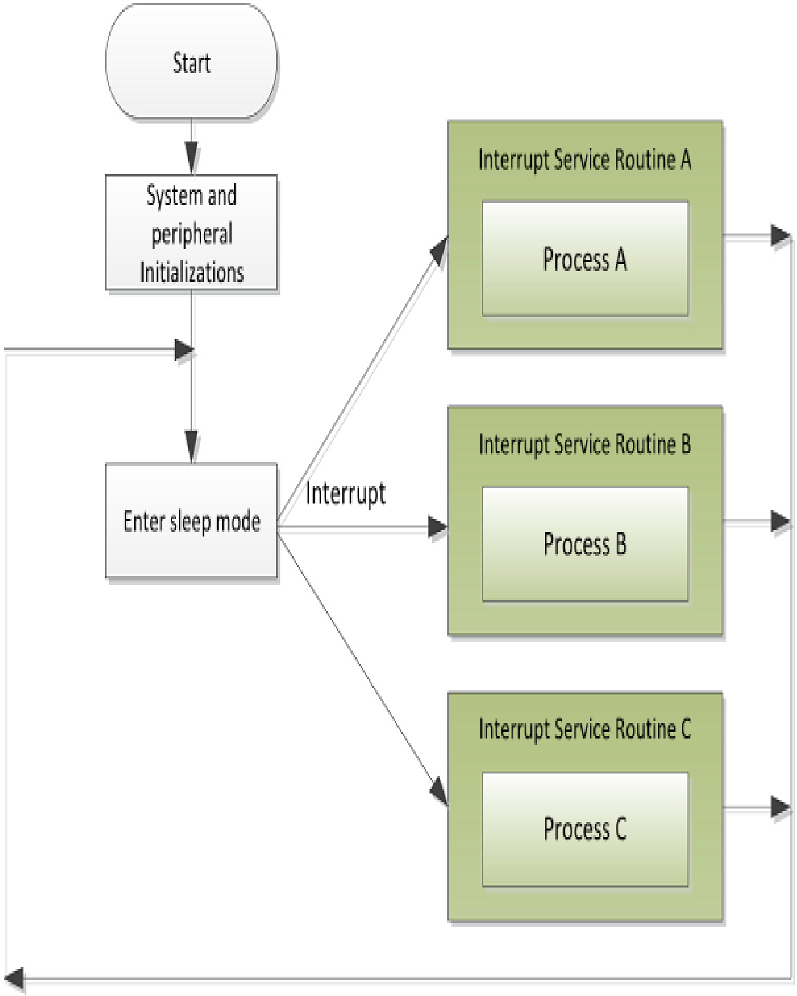
Software Flow

Pooling



Start
System and peripheral Initializations
Peripheral A requires processing?
Y
N
Process A
Peripheral B requires processing?
Y
N
Process B
Peripheral C requires processing?
Y
N
Process C

Interrupt



Start
System and peripheral Initializations
Enter sleep mode
Interrupt
Interrupt Service Routine A
Process A
Interrupt Service Routine B
Process B
Interrupt Service Routine C
Process C

Software Flow

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.

Software Flow

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.

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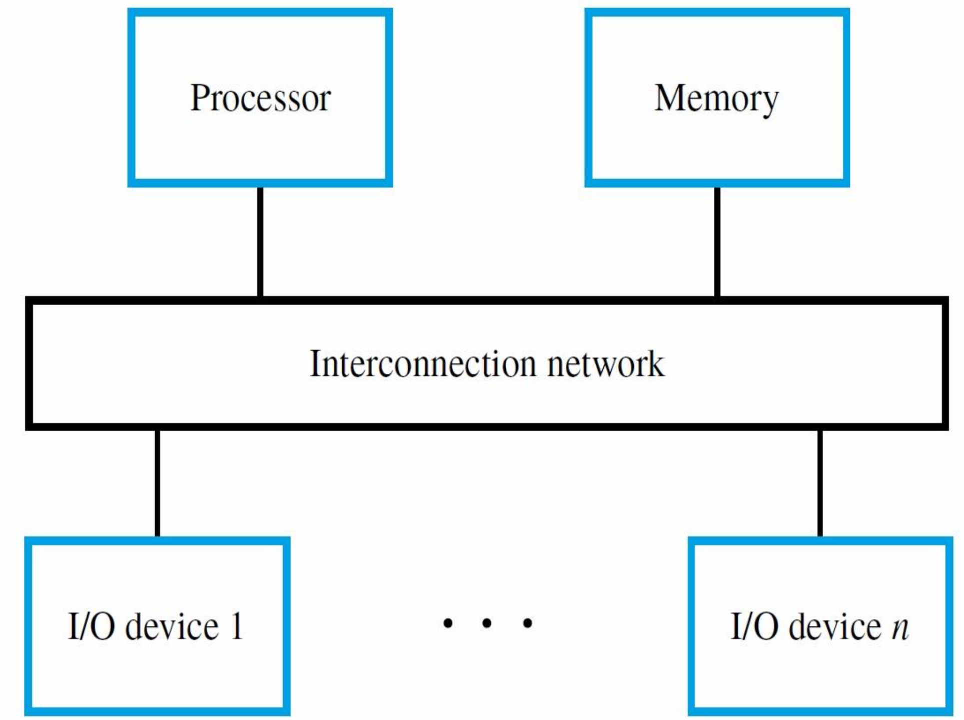
Input Output Basic

Accessing I/O Devices

- Computer system components communicate through an interconnection network

- Memory-mapped I/O allows I/O registers to be accessed as memory locations. As a result, these registers can be accessed using only Load and Store instructions



Input Output Basic

I/O Device Interface

- Provides the means for data transfer and exchange of status and control information

- Includes data, status, and control registers accessible with Load and Store instructions

- Memory-mapped I/O enables software to view these registers as locations in memory

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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.

- Peripheral (IO) registers are memory-mapped and therefore can be accessed as the memory.

Question and Answer

Thanks for your attention !

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