

# Lesson 1

# Introduction

Lecturer: Harvard Tseng

ARM is a Company

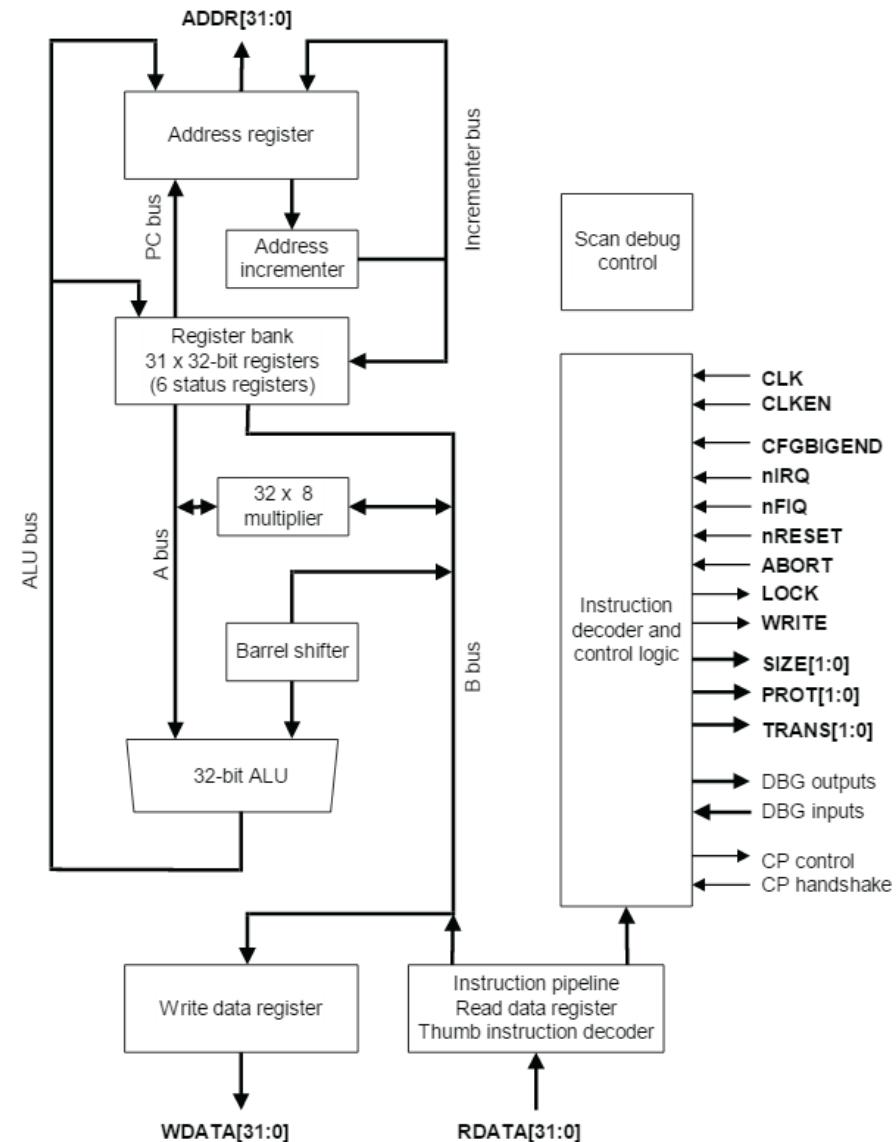


### ARM Holding plc (ARM)

Founded	November 27, 1990
Headquarters	Cambridge, England, United Kingdom
Revenue	£968.3 million (2015)
Net income	£339.7 million (2015)
Website	<a href="http://arm.com">arm.com</a>

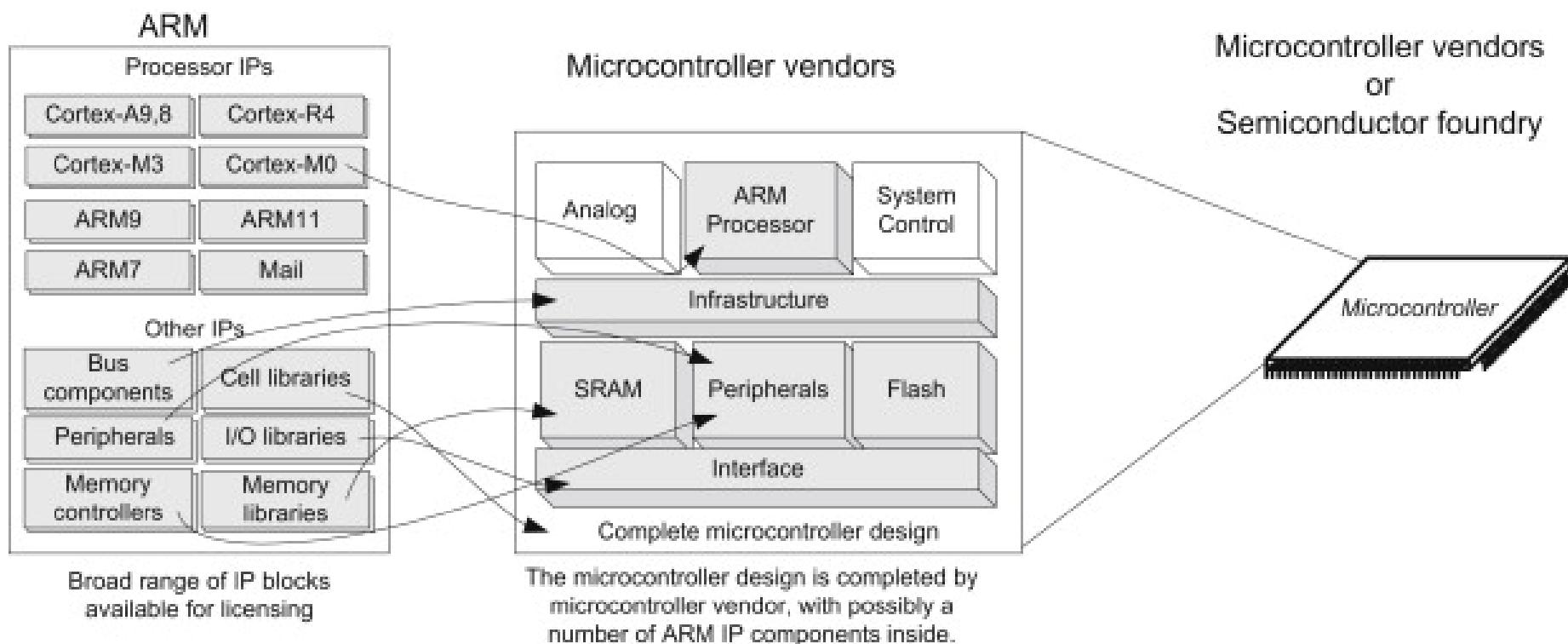
# ARM is an Architecture of CPU

- Advanced RISC Machine



# How ARM Earns Money?

- By intellectual property (IP) licensing.



# Silicon Vendors

- Apple Inc.
- MediaTek Inc.
- Qualcomm Inc.
- ...

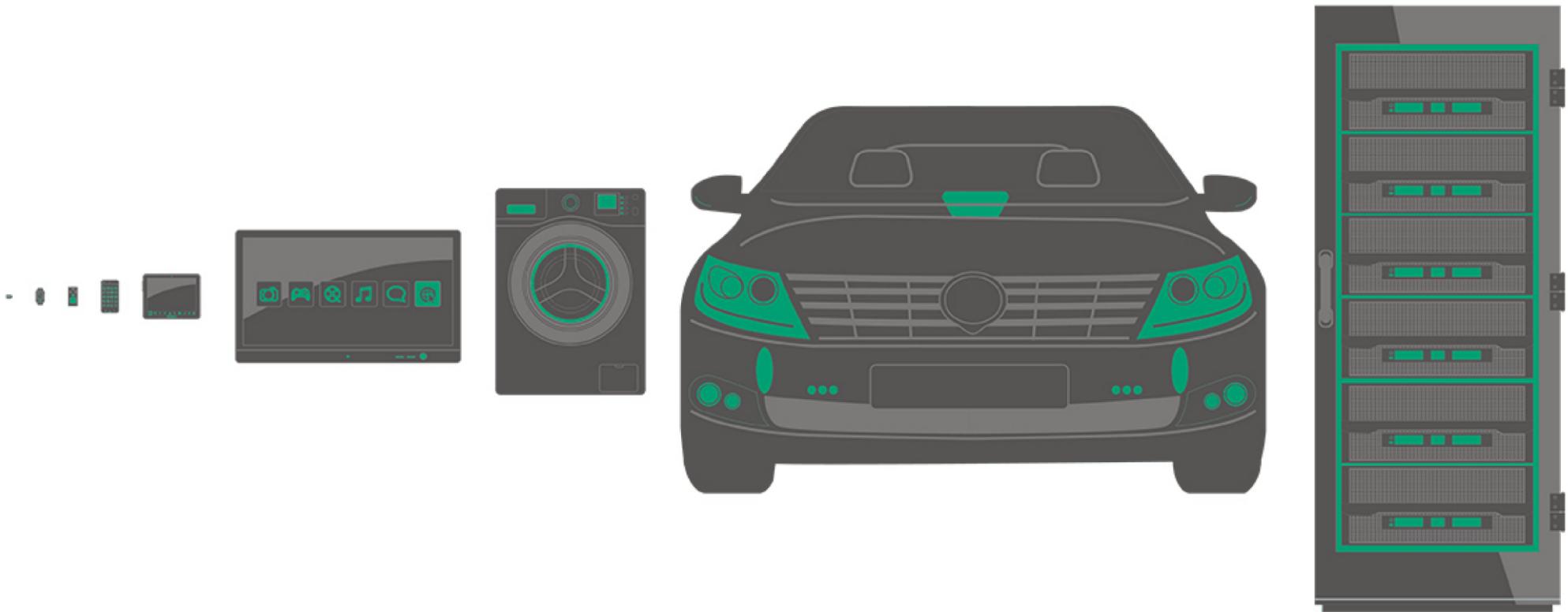


# Microcontroller Vendors

- STMicroelectronics (ST)
- Texas Instruments Inc. (TI)
- NXP Semiconductors N.V. (NXP)
- ...



# Sensors to smartphones to servers



# Broad Market Penetration



smartphone



tablet



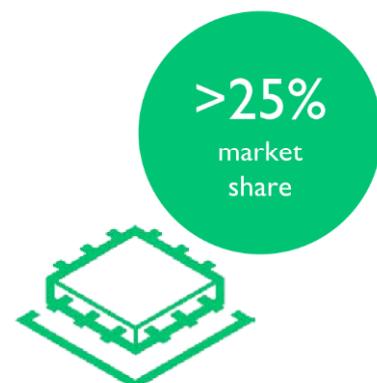
wearables



storage



automotive  
infotainment



microcontrollers



wireless  
connectivity

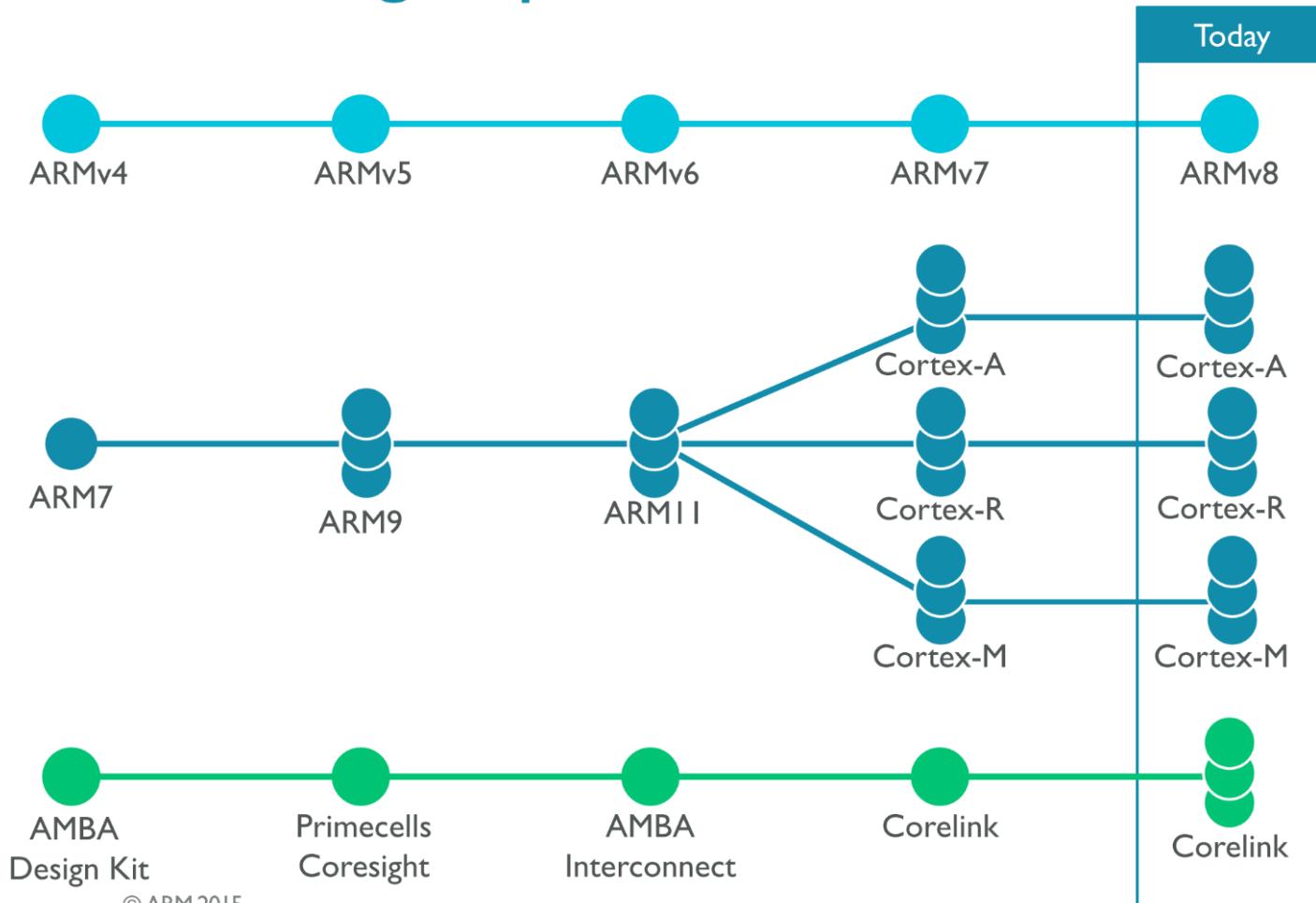


consumer  
electronics

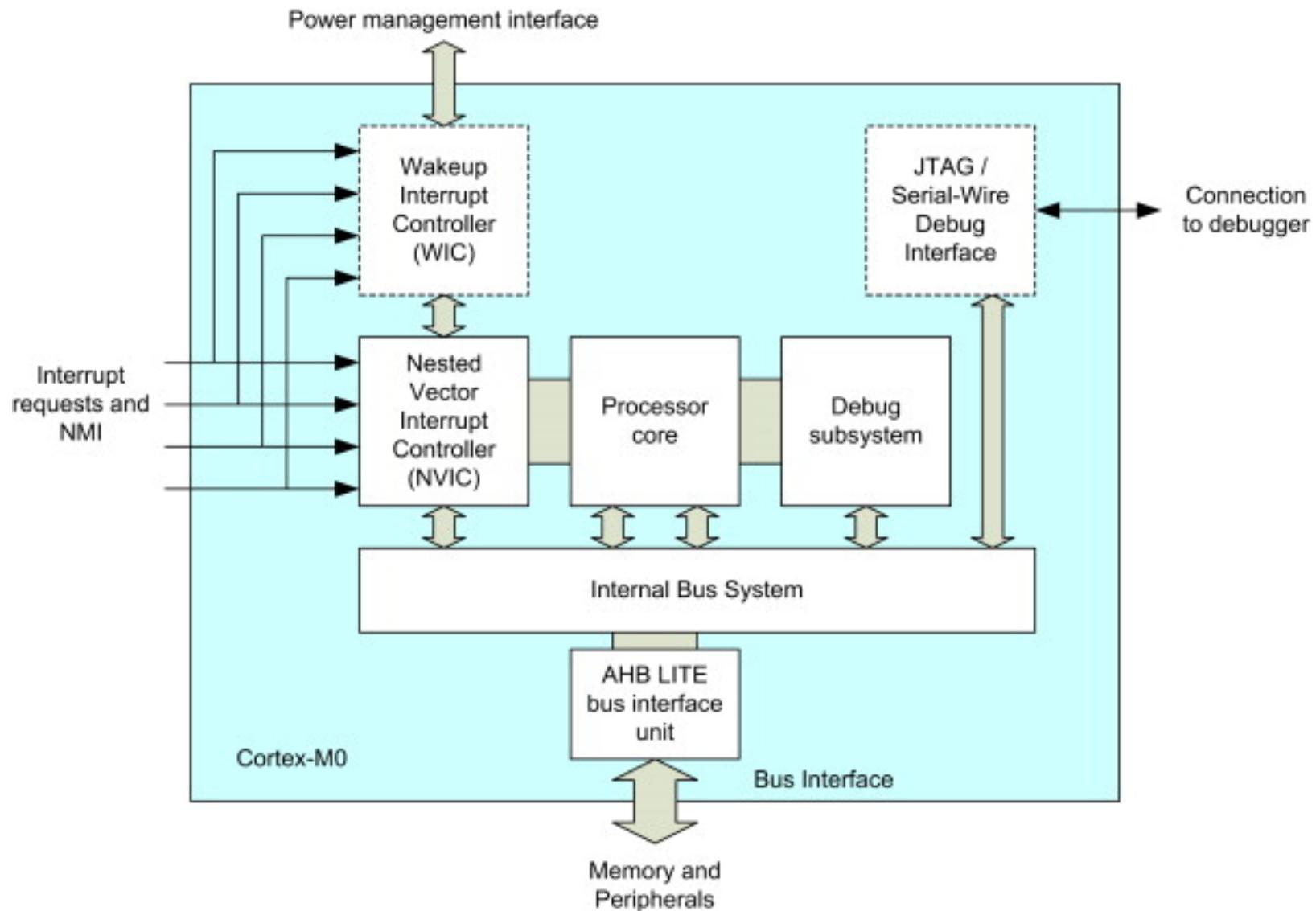
ARM

# Cortex-M Series

# Investing in processor innovation



# Simplified Block Diagram

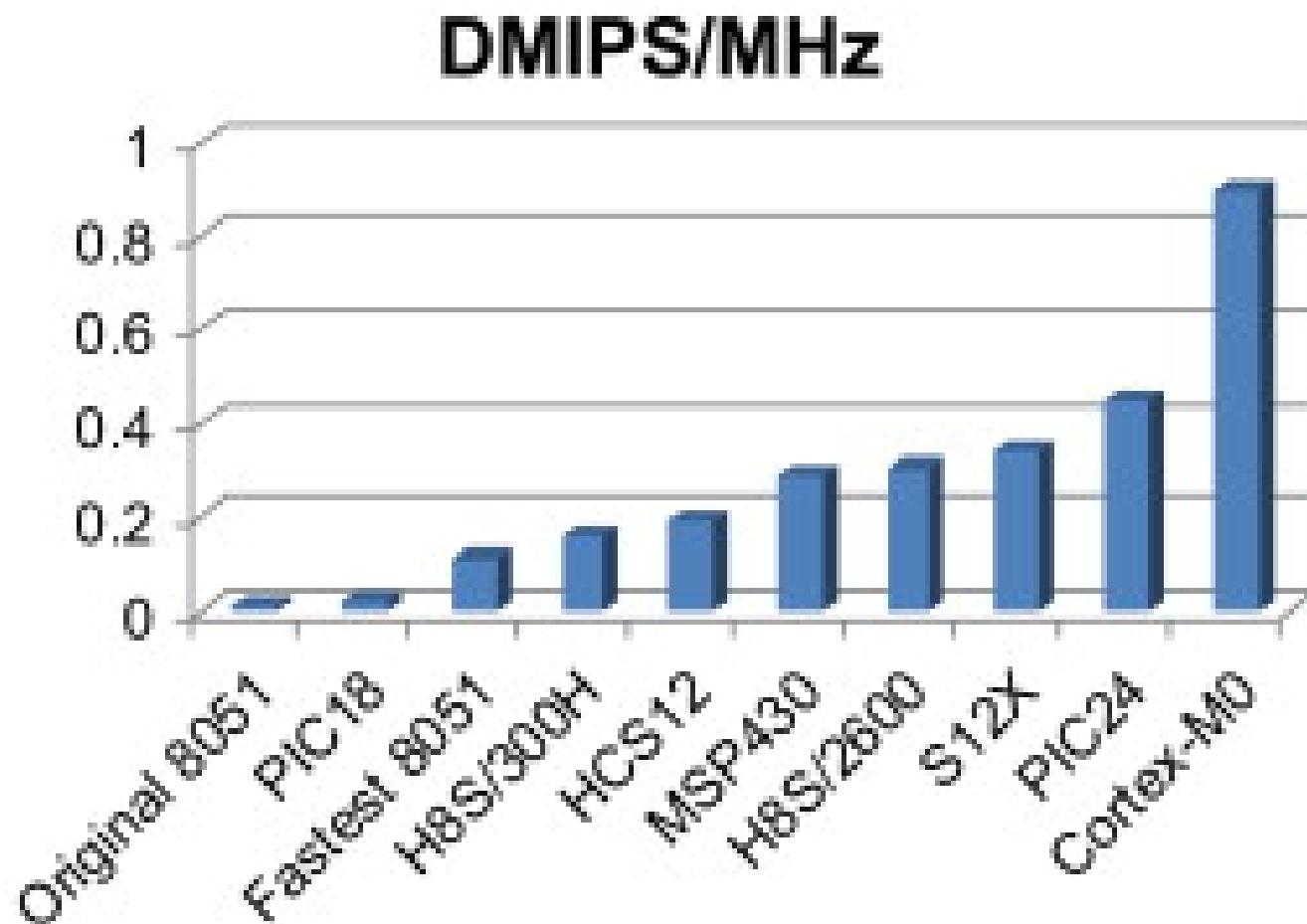


# Advantages of the Cortex-M Processor

- Energy Efficiency
- Limitations in 8-Bit and 16-Bit Architectures
- Easy to Use, Software Portability
- Wide Range of Choices

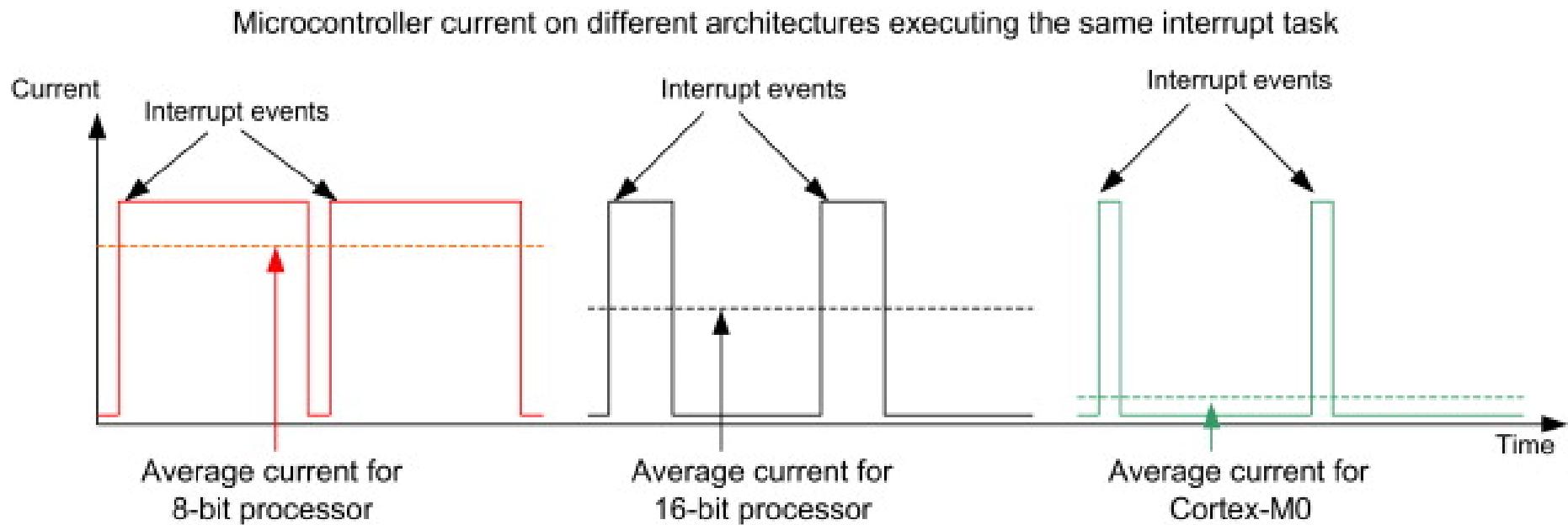
# Why choose Cortex-M?

- High efficiency

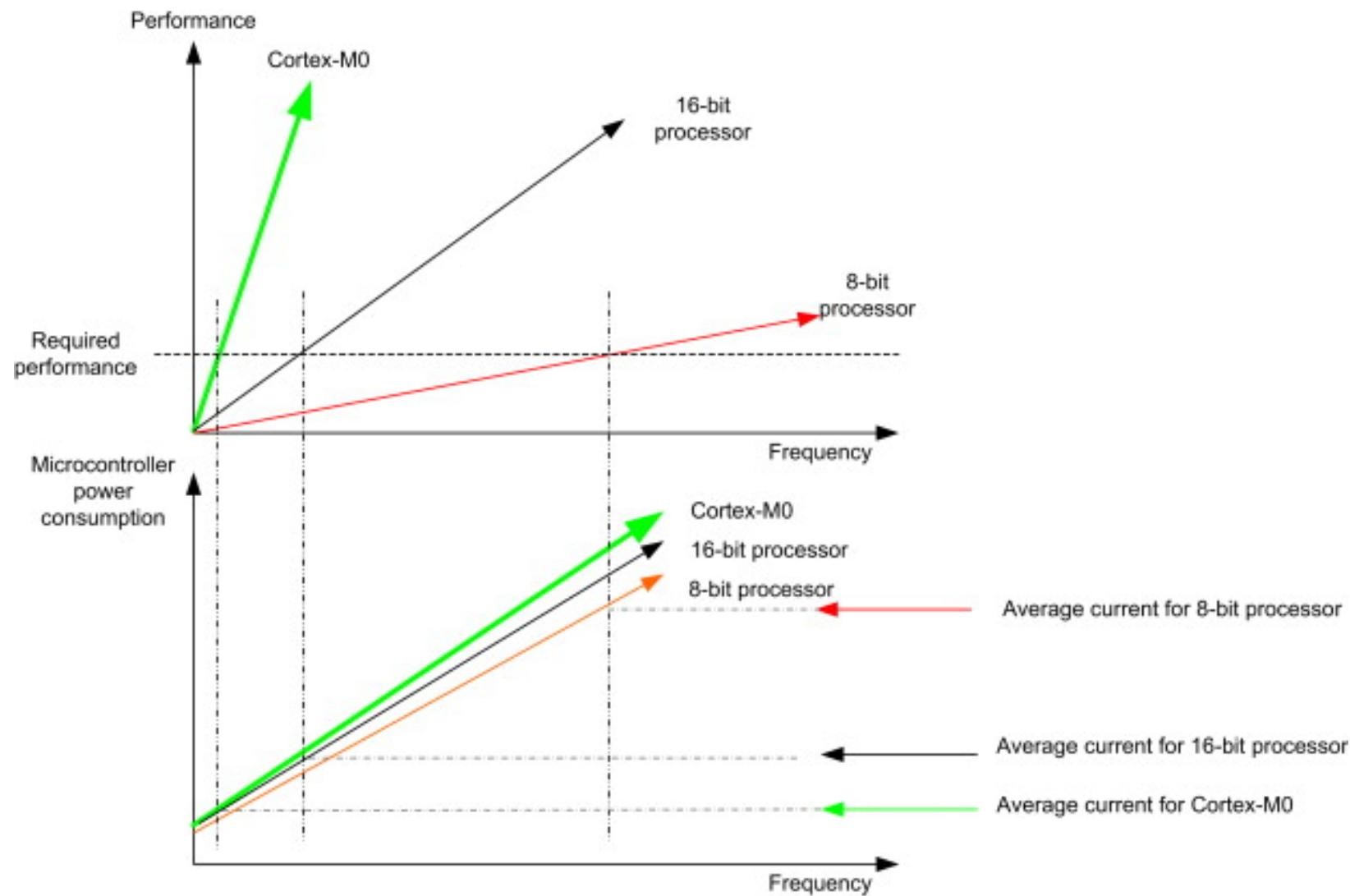


# Why choose Cortex-M?

- Low-power features



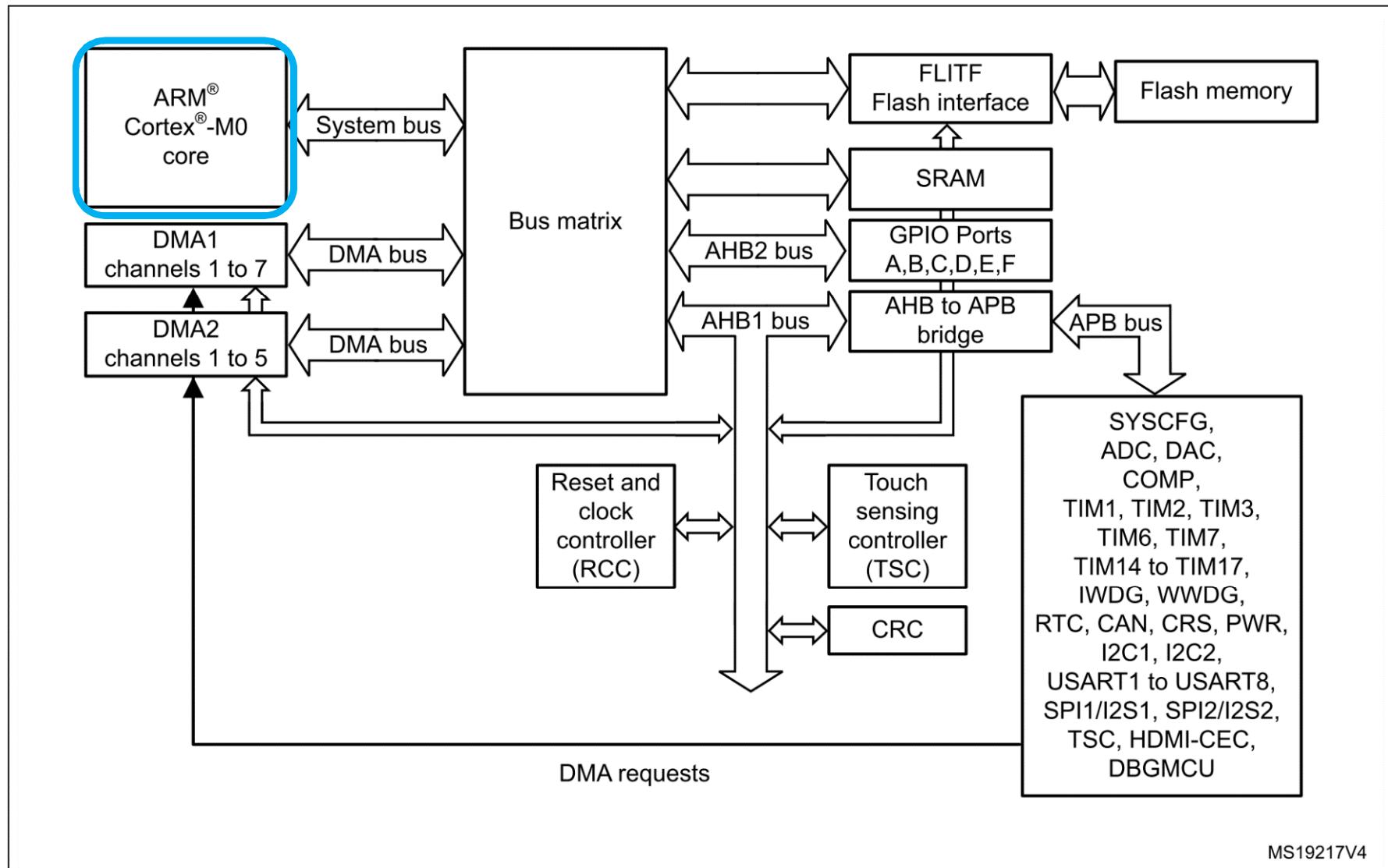
# Why choose Cortex-M?

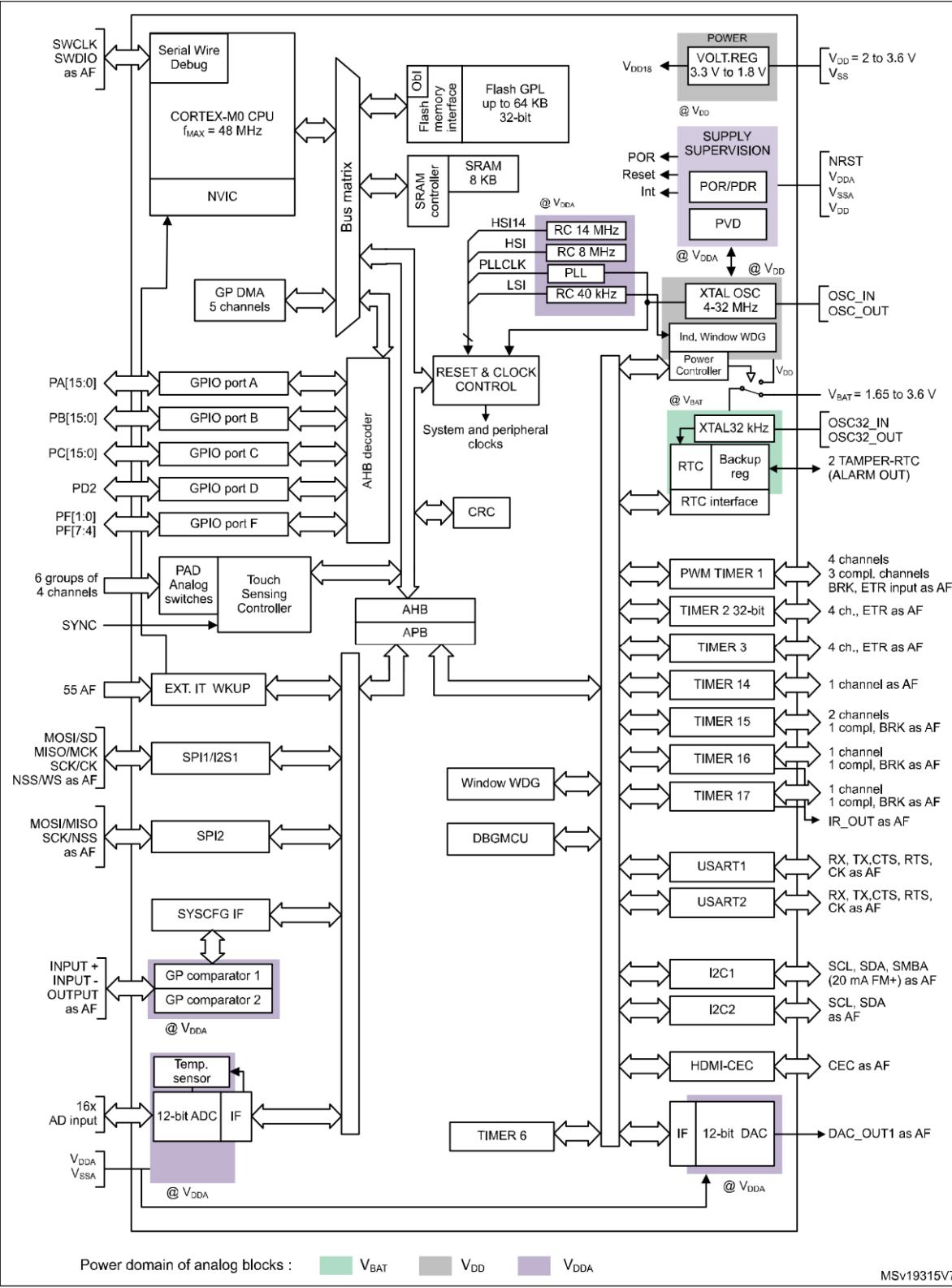


# STM32F0x8

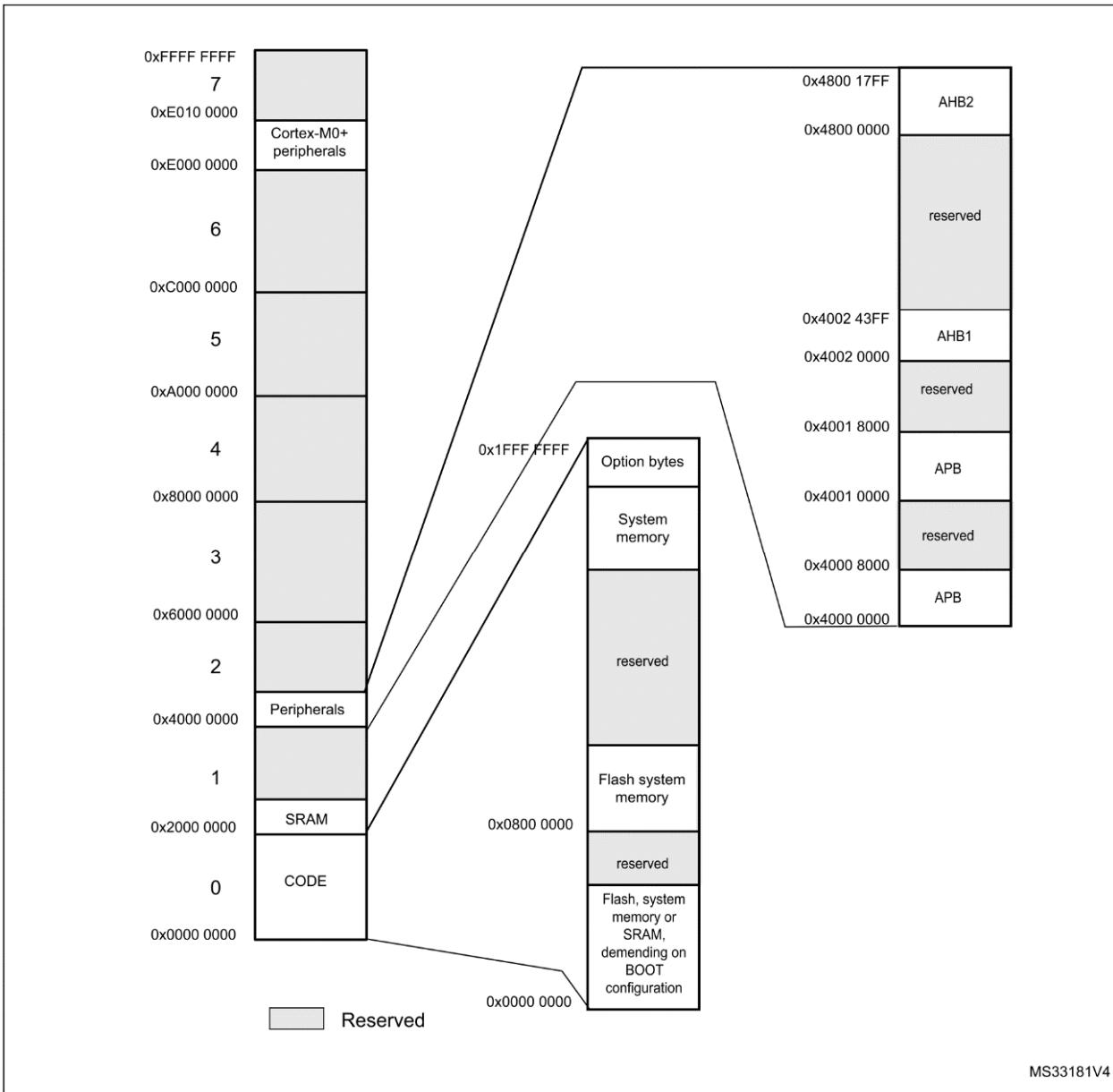
Advanced ARM®-based 32-bit MCUs

# System Architecture





# Memory Map

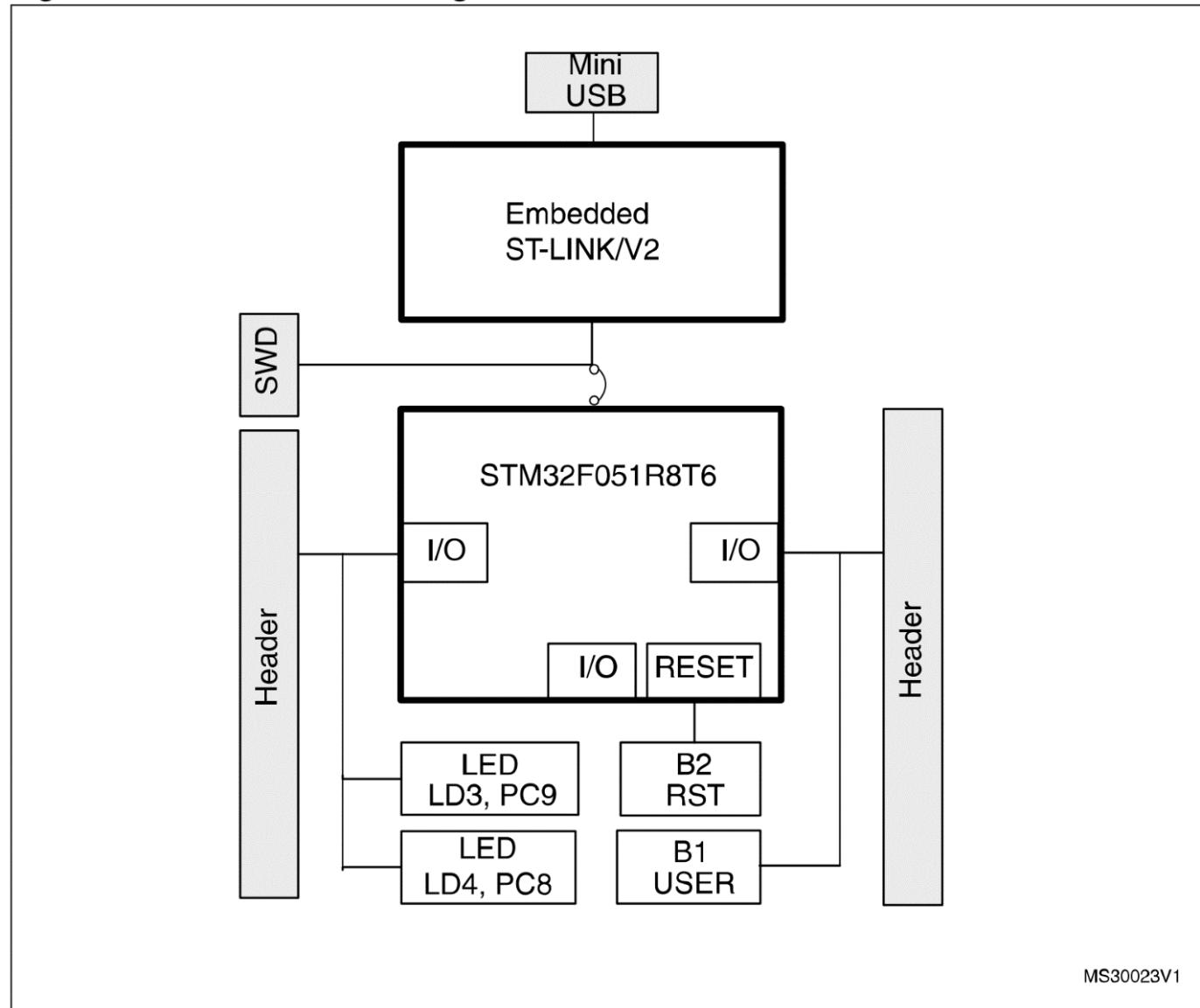


# Reference Manual

- Some MCU vendors call it datasheet
- [Download](#) (RM0091)

# Development Board

Figure 2. Hardware block diagram

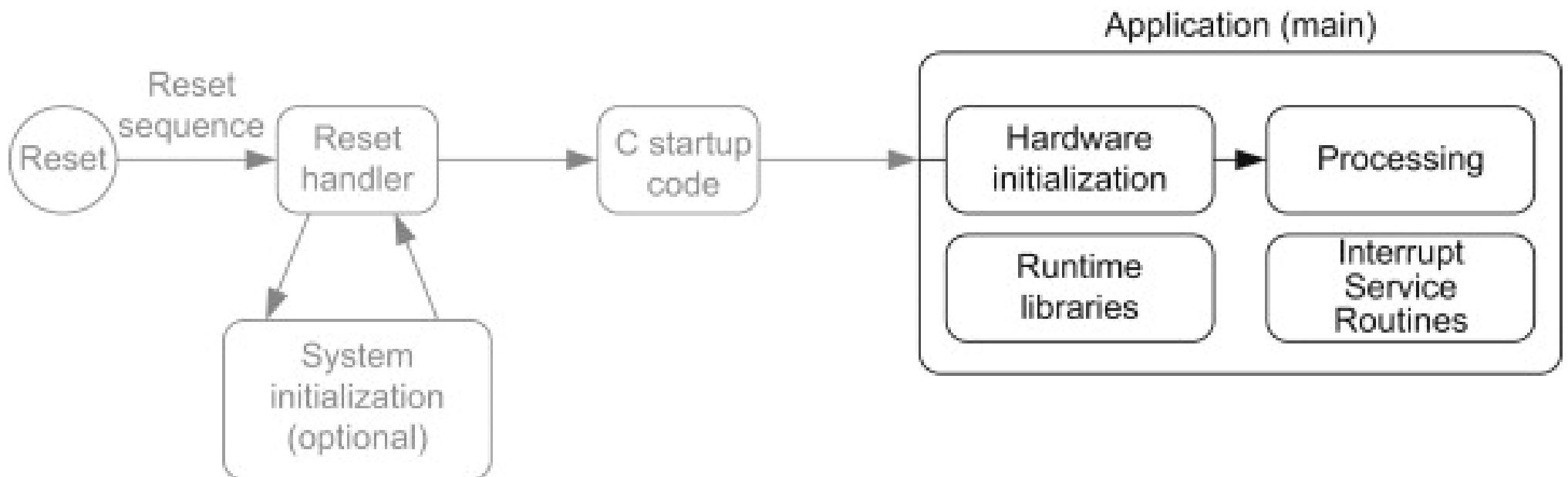


# Cortex-M0 Programming

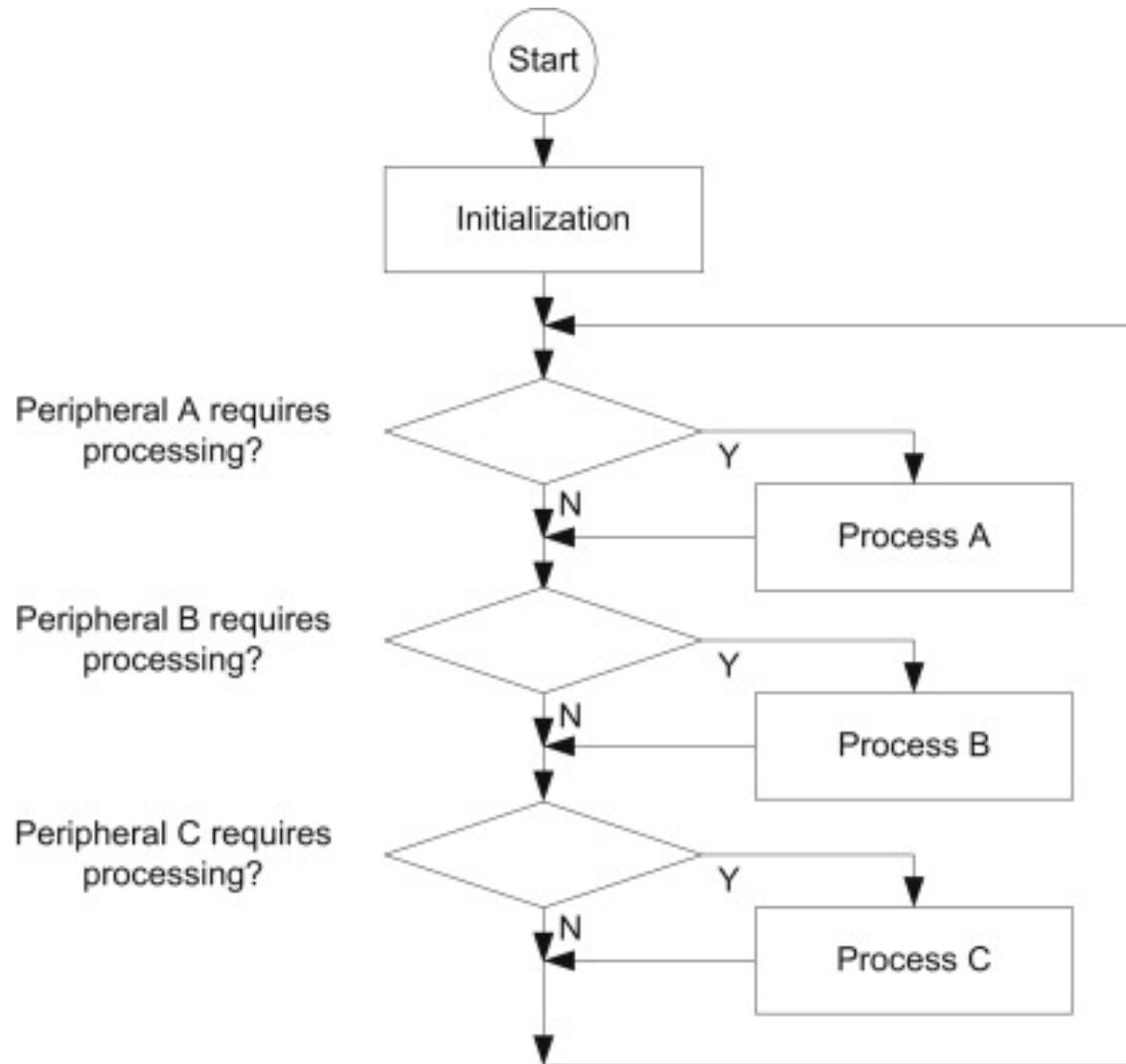
# When a Microcontroller Starts

startup\_stm32f0xx.s

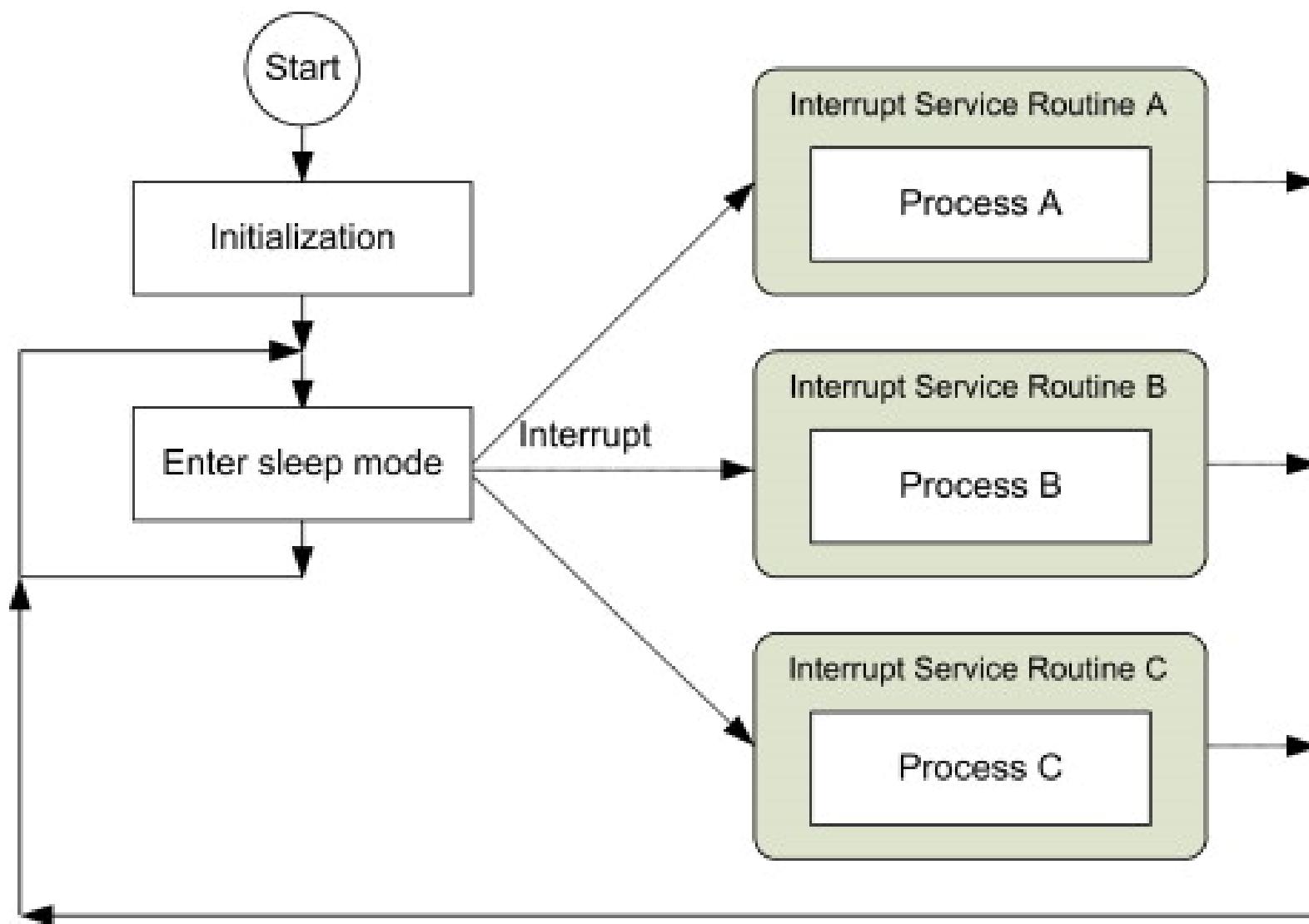
system\_stm32f0xx.c



# Polling



# Interrupt Driven



# IDE

Integrated Development Environment

# Development Toolchain

- IAR EWARM
  - 30-day evaluation edition
  - 32-Kbyte Limited QuickStart edition (16-Kbyte limitation for Cortex M0)
- Keil MDK-ARM
  - MDK-Lite (32-Kbyte code size limitation)
- ARMmbed
  - Free Online Development Tools
- GCC-based IDE



**ARMmbed**

# What do IDE Contain?

- C/C++ compilers
- Debuggers

# Keil MDK Version 5 Development Kit



# Step1. Install IDE

- Download from [Kile](#).

## MDK Editions

MDK is available in various editions. [Compare Editions >](#)

### MDK-Lite

Product evaluation, small projects, and education. Code size restricted to 32 Kbyte.

[Learn more >](#)

 [Download & Install](#)

### MDK-Cortex-M

For ARM Cortex-M based microcontroller projects.

[Learn more >](#)

 [Request a Quote](#)

### MDK-Plus

For Cortex-M, ARM7, ARM9. Includes middleware (IPv4 Networking, USB Device, File System, Graphics).

[Learn more >](#)

 [Request a Quote](#)

### MDK-Professional

For Cortex-M, Cortex-A, ARM7, ARM9. Includes middleware (IPv4/IPv6 Networking, USB Host & Device, File System, Graphics, mbed components).

[Learn more >](#)

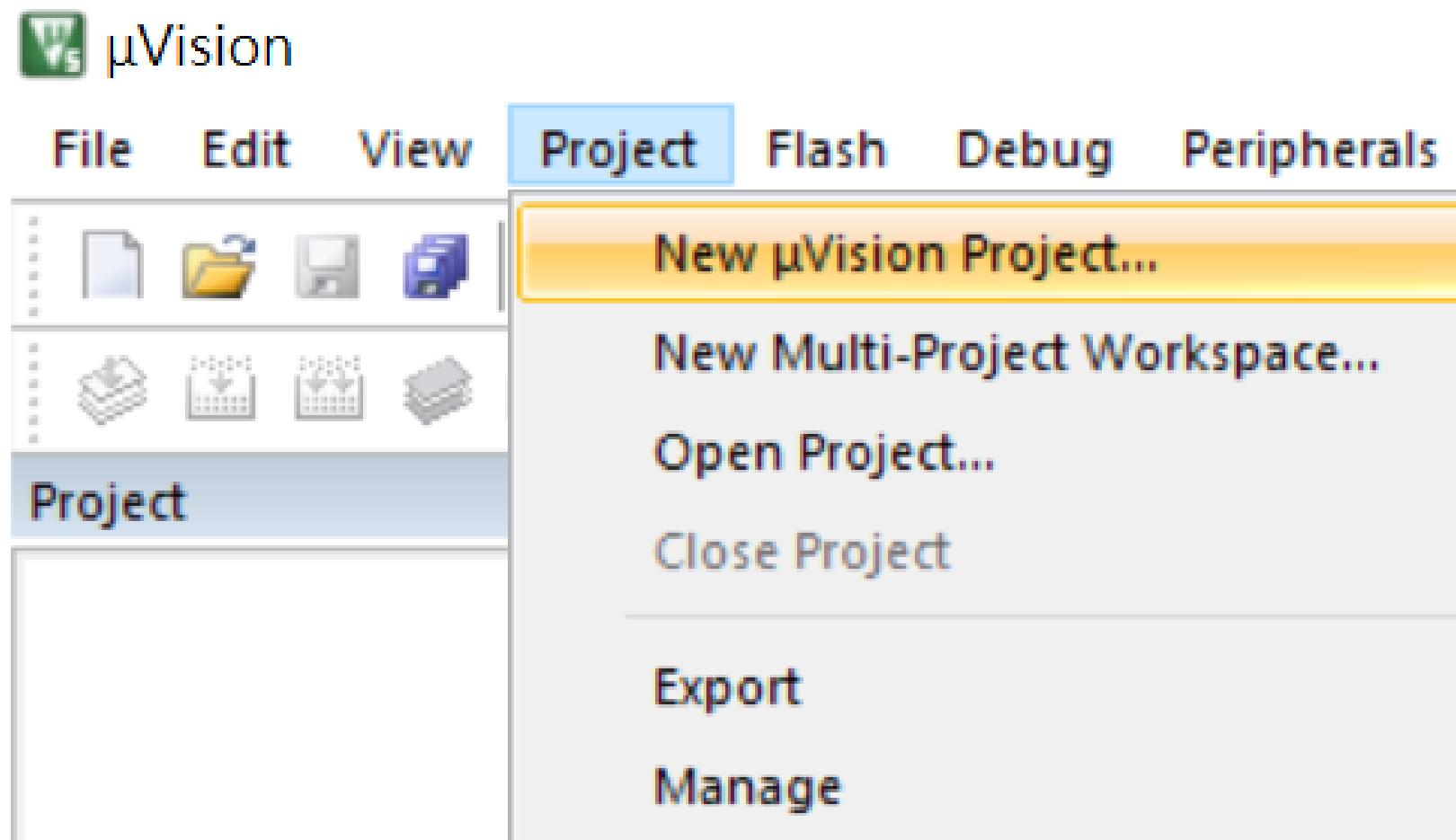
 [Request a Quote](#)

# Step2. Install Software Packs

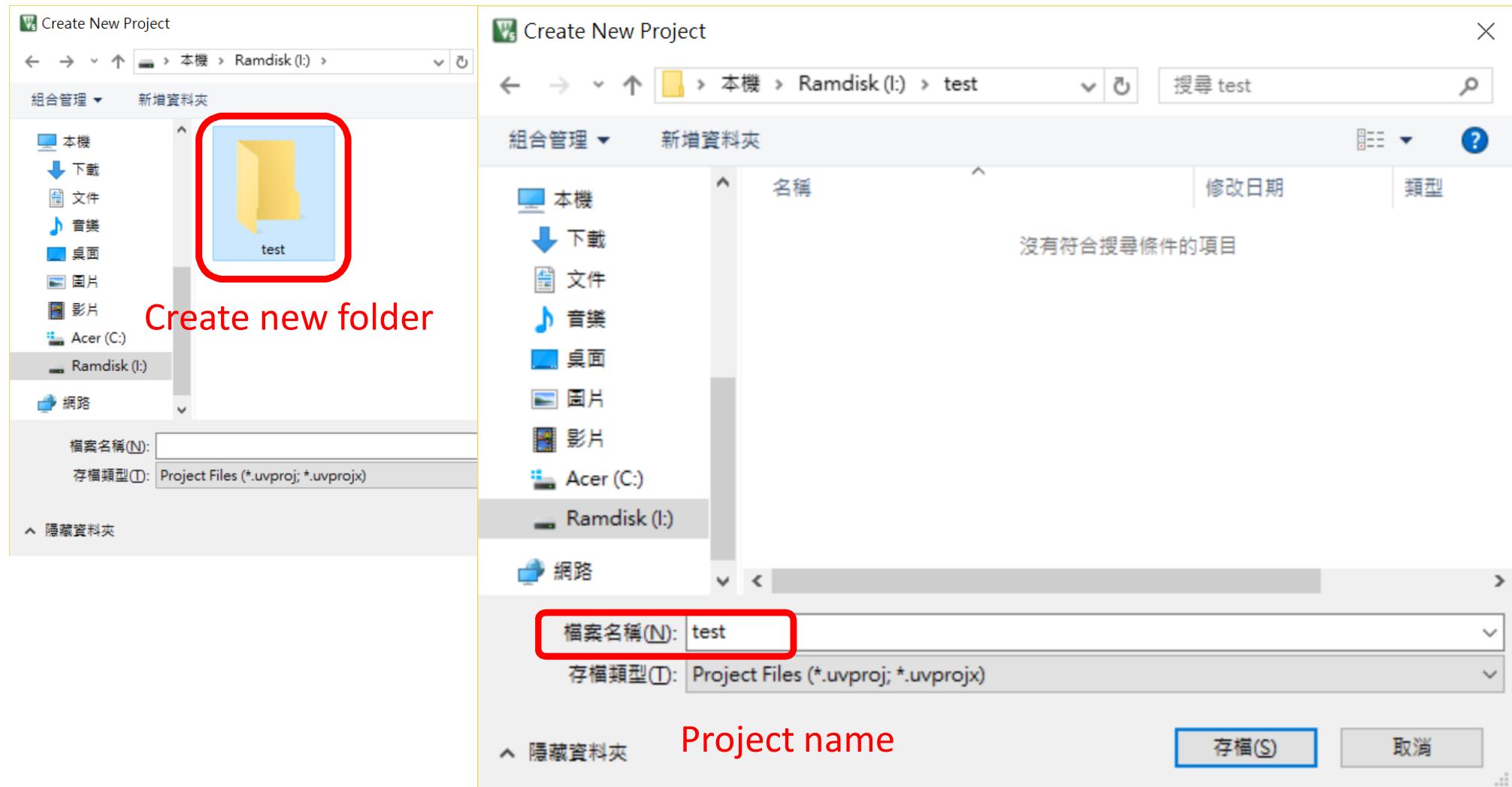
- Download from [Kile](#).

- [!\[\]\(526085d6630c7f4d740dc85d88afd688\_img.jpg\) STM Nucleo Boards Support and Examples](#) BSP 1.6.0 
- [!\[\]\(21d90c4fcd531f158509e4357fcdaf99\_img.jpg\) STM32F0 Series Device Support and Examples](#) BSP DFP 1.5.0 
- [!\[\]\(8b39af2fb42105f29a225622093b9bde\_img.jpg\) STM32F1 Series Device Support, Drivers and Examples](#) BSP DFP 2.1.0 
- [!\[\]\(d465cf380027106720ecc25365bf1f24\_img.jpg\) STM32F2 Series Device Support, Drivers and Examples](#) BSP DFP 2.6.0 
- [!\[\]\(c9816504199ebea51bf28c7d7abff92e\_img.jpg\) STM32F3 Series Device Support and Examples](#) BSP DFP 1.3.0 
- [!\[\]\(7acd03e9b5af78f07b93c600be4b941a\_img.jpg\) STM32F4 Series Device Support, Drivers and Examples](#) BSP DFP 2.9.0 
- [!\[\]\(9993bfc5a1ea586e907aec446edf3bb5\_img.jpg\) STM32F7 Series Device Support, Drivers and Examples](#) BSP DFP 2.7.0 
- [!\[\]\(2201d0bdf516d3fb43c6eefe143fd5a0\_img.jpg\) STM32L0 Series Device Support and Examples](#) BSP DFP 1.6.0 
- [!\[\]\(f8eccd4d235fe5e9e1f9544c2c7346b6\_img.jpg\) STM32L1 Series Device Support and Examples](#) DFP 1.0.2 
- [!\[\]\(9bd3e5f06c3f617d813624df353431ce\_img.jpg\) STM32L4 Series Device Support, Drivers and Examples](#) BSP DFP 1.2.0 

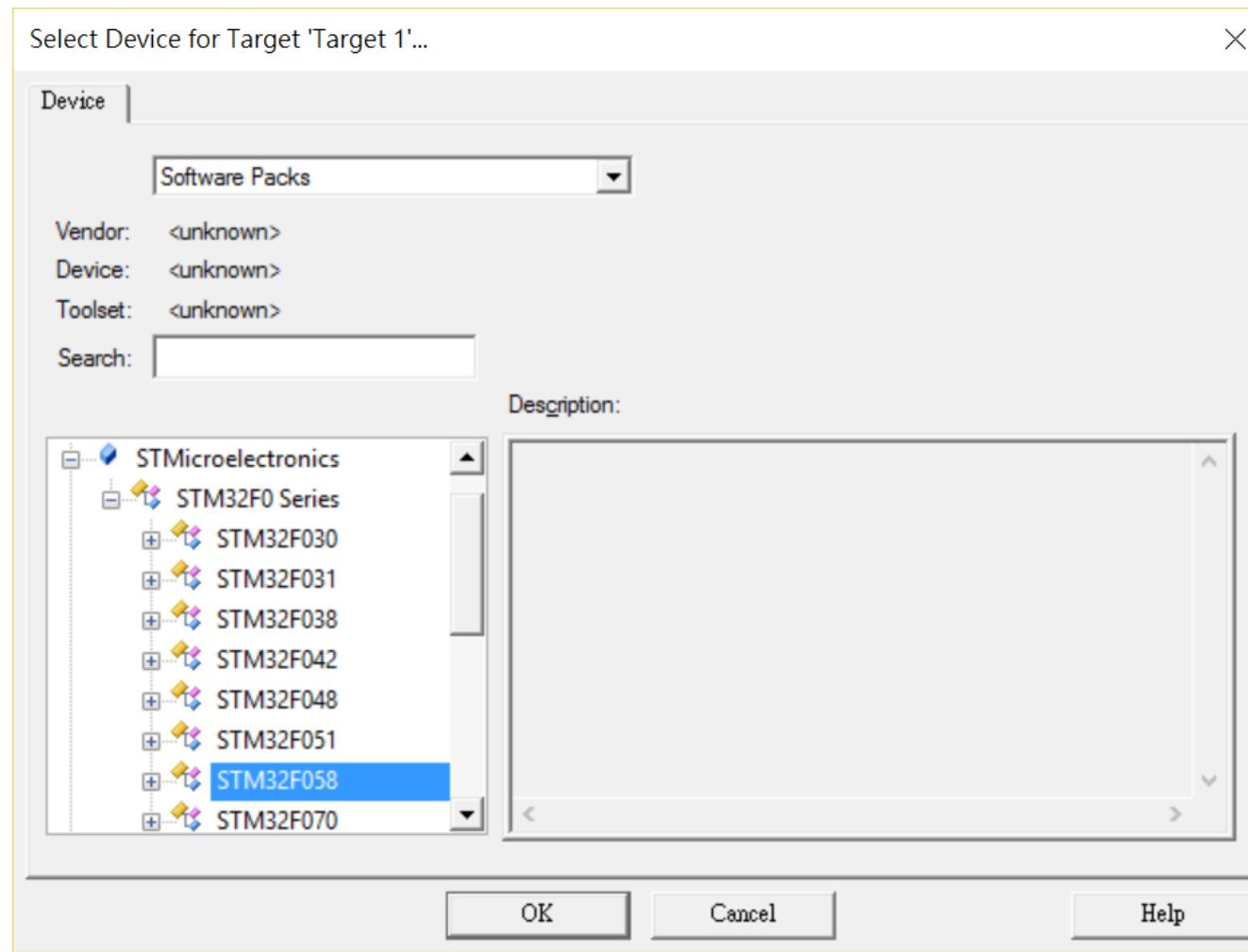
# Step3. Create a New Project



# Step3. Create a New Project



# Step4. Select Device



# Step5. Add Software Component

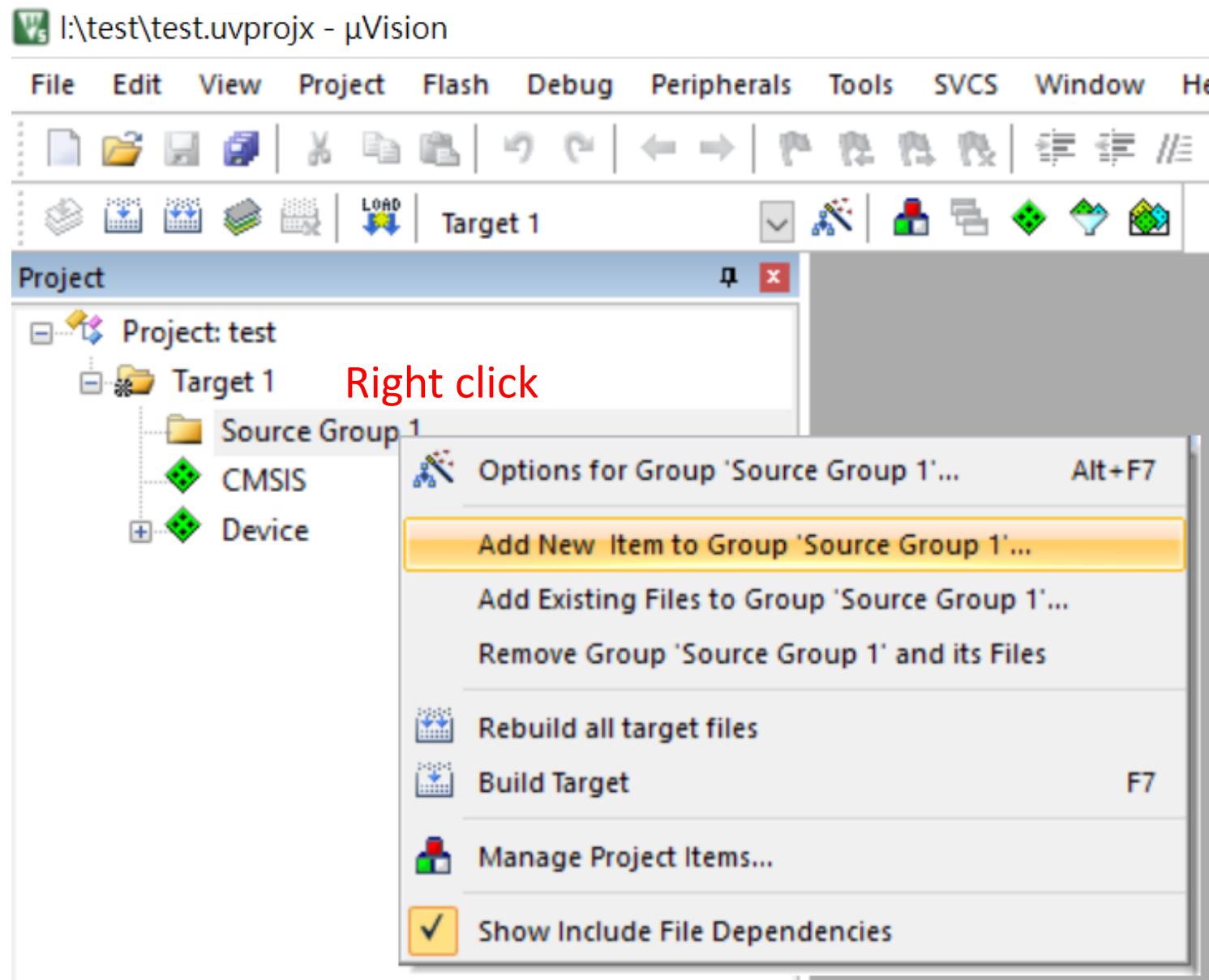
Manage Run-Time Environment

Software Component	Sel.	Variant	Version	Description
CMSIS	<input checked="" type="checkbox"/>		4.3.0	<a href="#">Cortex Microcontroller Software Interface Components</a>
CORE	<input type="checkbox"/>		1.4.6	<a href="#">CMSIS-CORE for Cortex-M, SC000, and SC300</a>
DSP	<input type="checkbox"/>		1.0	<a href="#">CMSIS-DSP Library for Cortex-M, SC000, and SC300</a>
RTOS (API)	<input checked="" type="checkbox"/>			<a href="#">CMSIS-RTOS API for Cortex-M, SC000, and SC300</a>
CMSIS Driver	<input type="checkbox"/>			<a href="#">Unified Device Drivers compliant to CMSIS-Driver Specifications</a>
Compiler	<input type="checkbox"/>			ARM Compiler Software Extensions
Device	<input type="checkbox"/>	Startup		<a href="#">Startup, System Setup</a>
File System	<input type="checkbox"/>		2.2.3	System Startup for STMicroelectronics STM32F058xx Devices
Graphics	<input type="checkbox"/>	MDK-Pro	6.7.0	<a href="#">File Access on various storage devices</a>
Network	<input type="checkbox"/>	MDK-Pro	5.32.2	<a href="#">User Interface on graphical LCD displays</a>
USB	<input type="checkbox"/>	MDK-Pro	7.1.0	<a href="#">IPv4/IPv6 Networking using Ethernet or Serial protocols</a>
		MDK-Pro	6.7.0	<a href="#">USB Communication with various device classes</a>

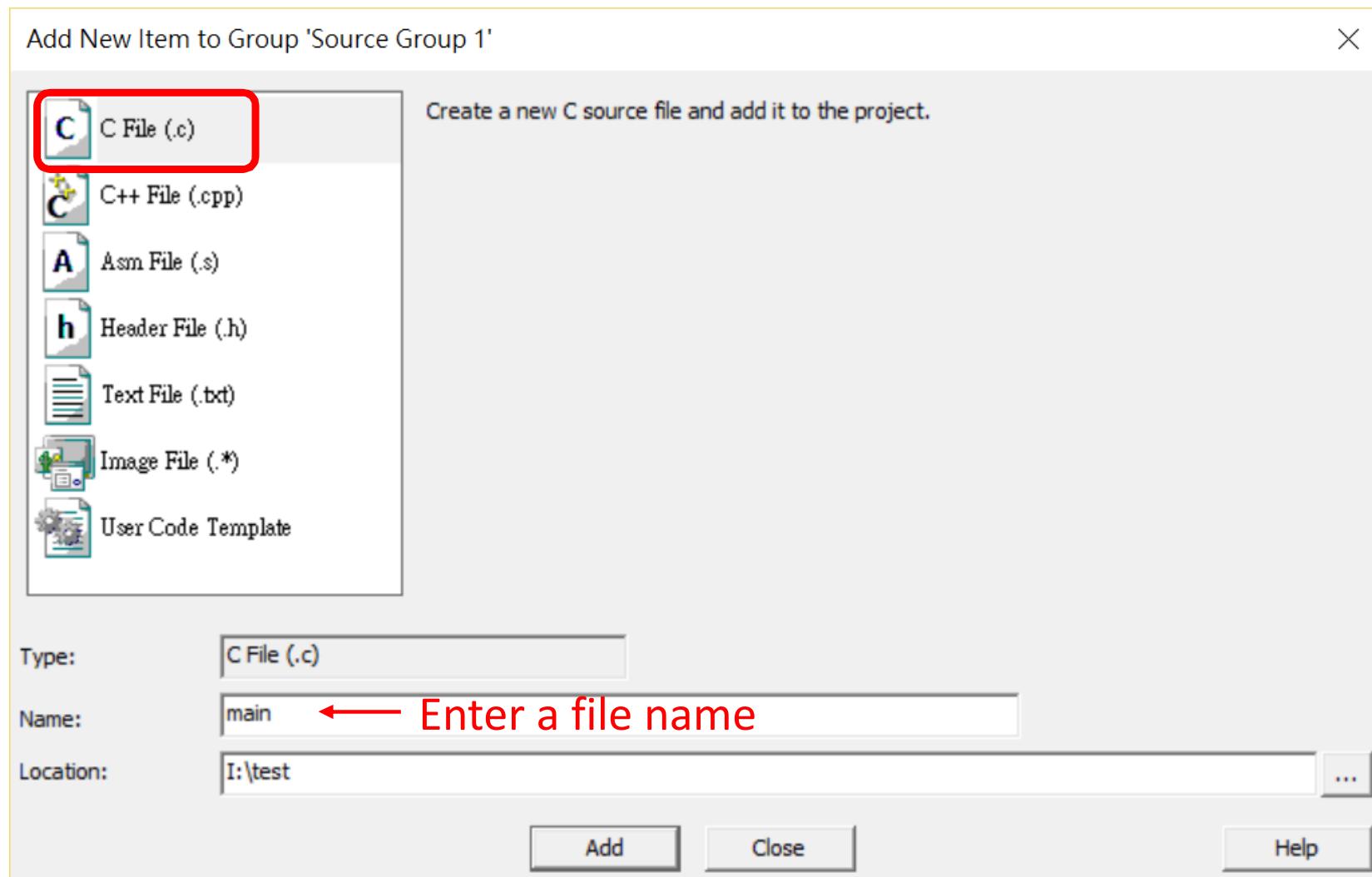
Select these two

core\_cmx.h  
startup\_<device>.s  
system\_<device>.c

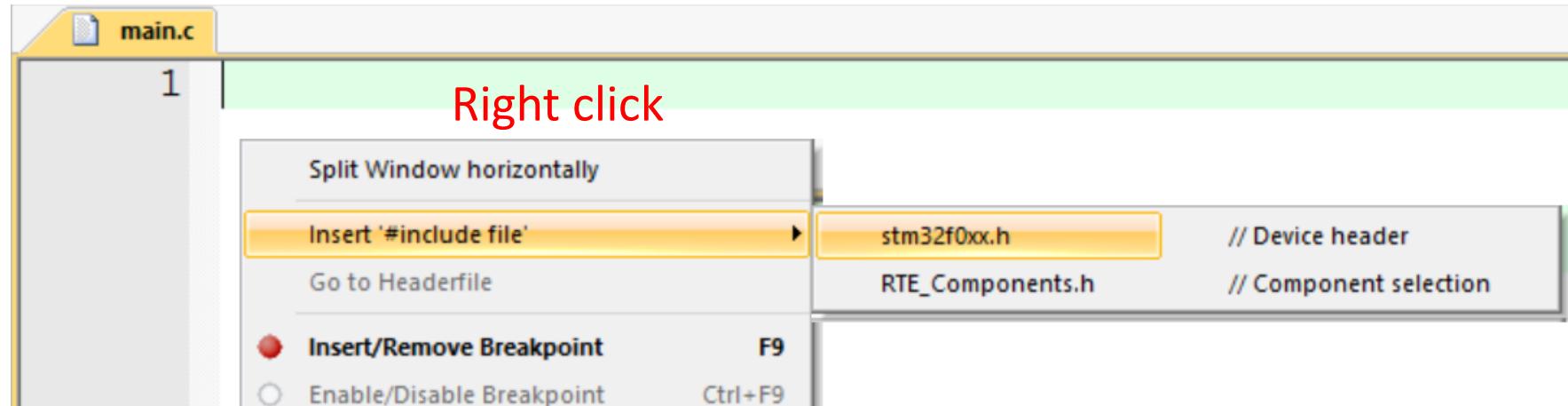
# Step6. Add main.c



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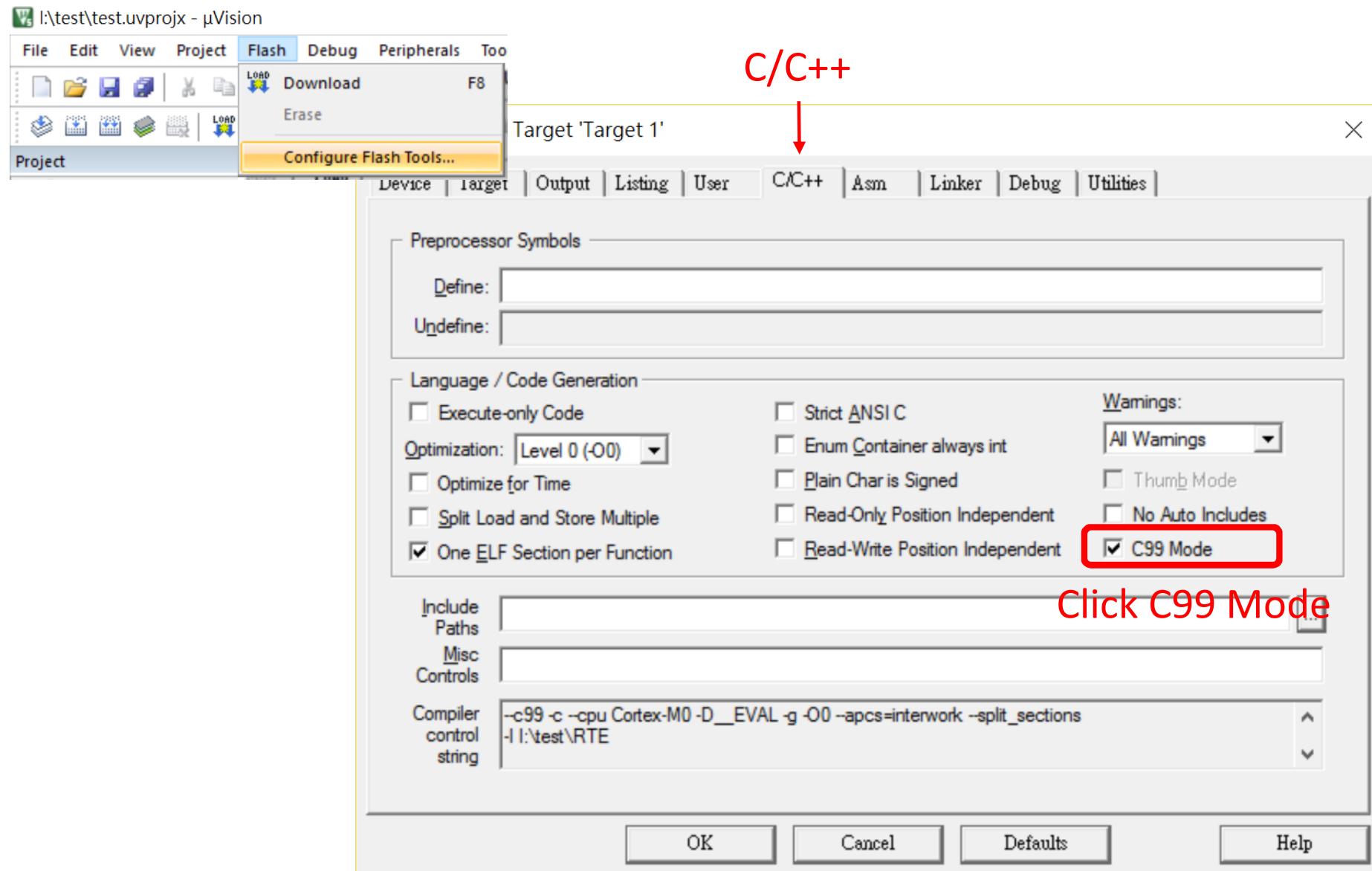


# Step7. Include Device Header

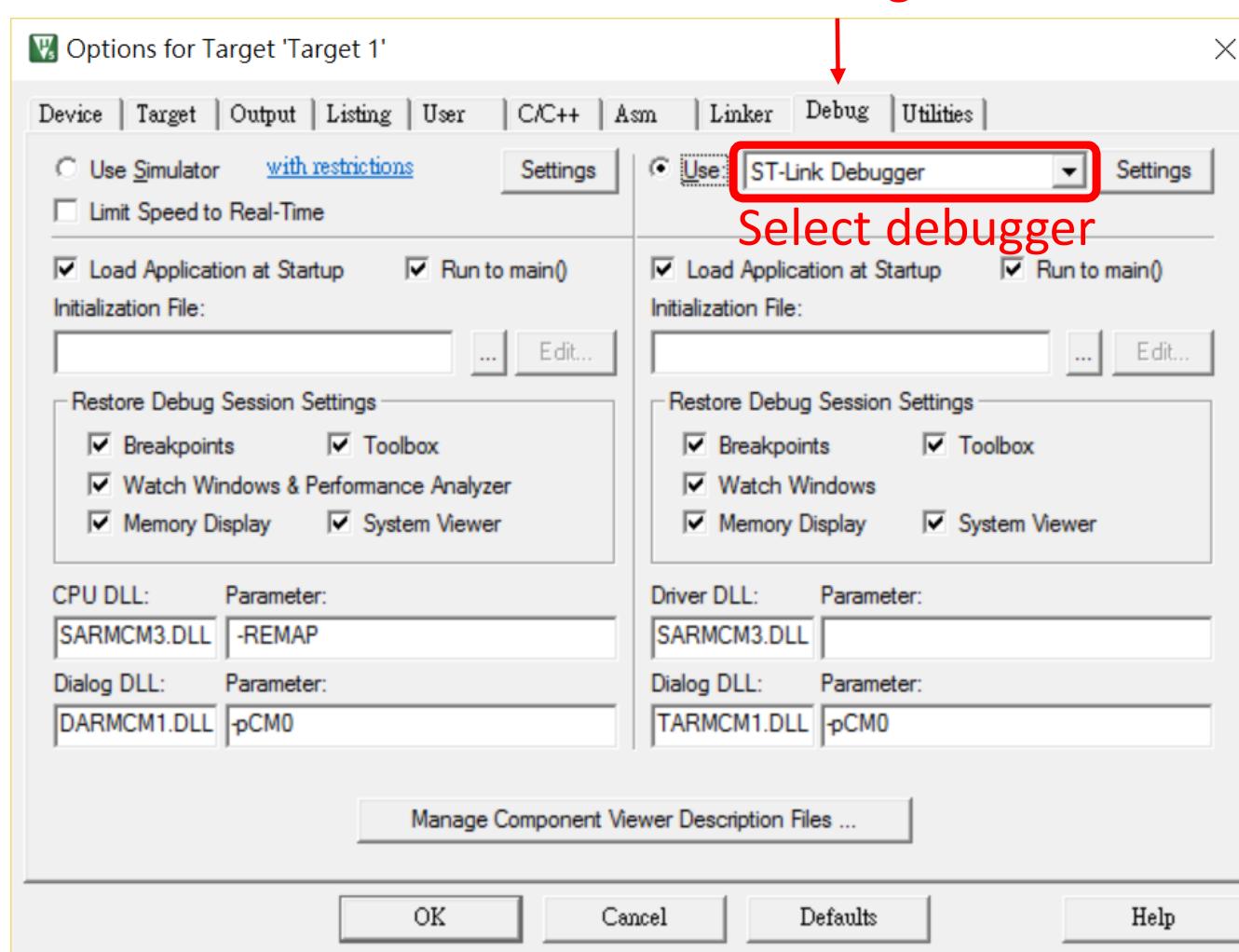


```
main.c*
1 #include "stm32f0xx.h" // Device header
2
```

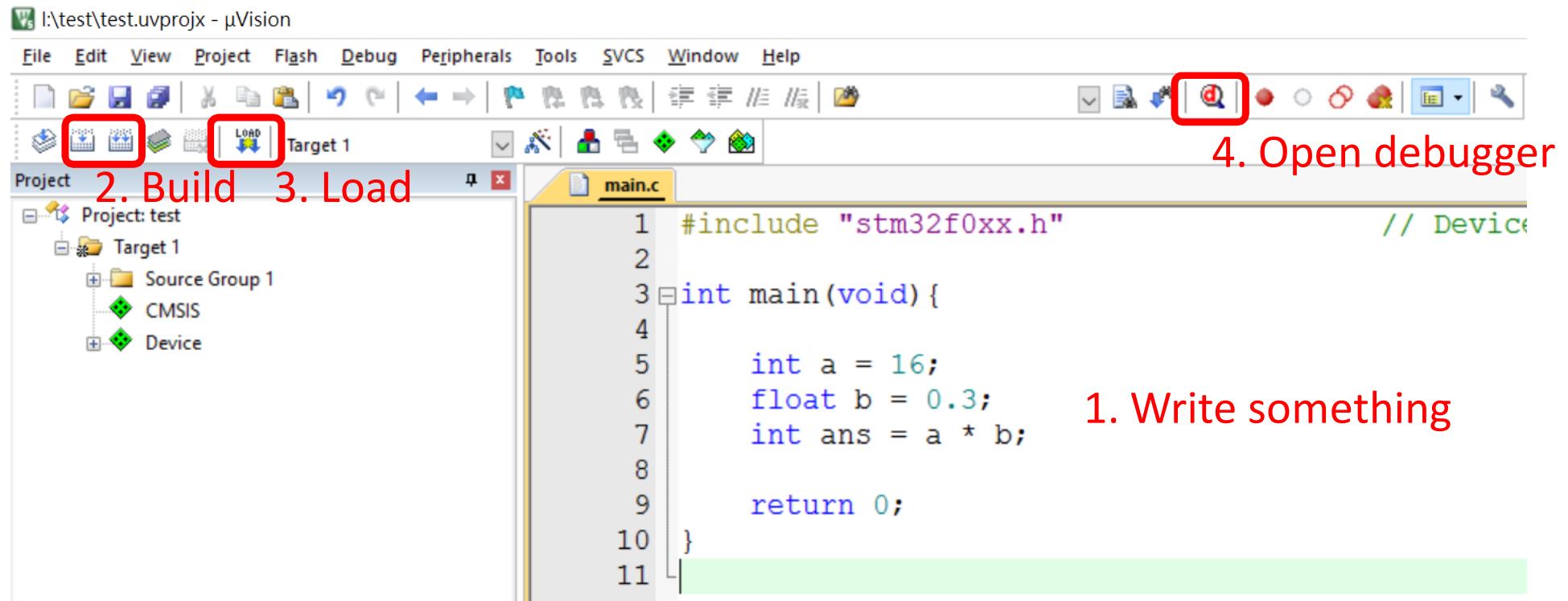
# Step8. Configure Flash



# Step8. Configure Flash



# Step9. Test



# Install Debugger USB Driver

- If your board debugger doesn't work, download from [ST](#).

Home › Embedded Software › Development Tool Software › **STSW-LINK009**

**STSW-LINK009** ACTIVE

ST-Link, ST-Link/V2, ST-Link/V2-1 USB driver signed for XP, Windows7, Windows8

 Download Databrief



QUICK VIEW

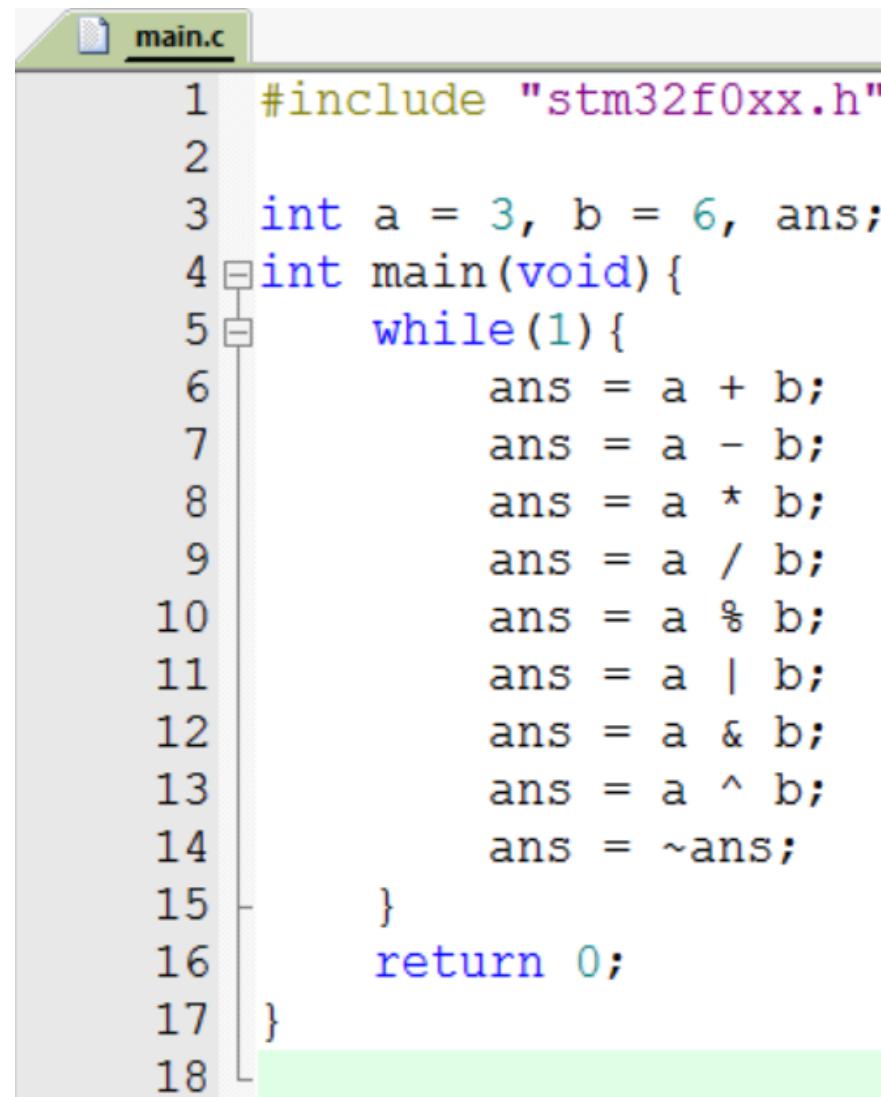
DESIGN

GET SOFTWARE

# Exercise

Do it back home.

# Basic C Operator



```
main.c
1 #include "stm32f0xx.h"
2
3 int a = 3, b = 6, ans;
4 int main(void){
5     while(1){
6         ans = a + b;
7         ans = a - b;
8         ans = a * b;
9         ans = a / b;
10        ans = a % b;
11        ans = a | b;
12        ans = a & b;
13        ans = a ^ b;
14        ans = ~ans;
15    }
16    return 0;
17 }
18
```

# Use Debugger

- Review answer step by step.
- Monitor the variable you want.
- Set break points.