LAB0: GETTING STARTED

LAB REQUIREMENTS

- Software:
  - Keil MDK
    - You can download a free version of Keil MDK-ARM tool (MDK-Lite) here: https://www.keil.com/arm/demo/eval/arm.htm. You do not need a serial number or license key for this version.
    - You may also need to download the Keil MDK5 legacy support for **Cortex-M devices** at: http://www2.keil.com/mdk5/legacy/

- Hardware:
  - Nucleo F401RE: http://mbed.org/platforms/ST-Nucleo-F401RE/

HARDWARE SETUP

To enable the download and debugging features on your Nucleo F401RE board, use the following steps to upgrade the firmware:

1. https://developer.mbed.org/teams/ST/wiki/ST-Link-Driver

and the firmware should be upgraded:

2. https://developer.mbed.org/teams/ST/wiki/Nucleo-Firmware

More details on debugging can be found at:

https://mbed.org/blog/entry/Debugging-on-mbed-enabled-platforms/

PROJECT DEVELOPMENT

Blink LED example program using the ST Discovery board:

Register and login in mbed platform (developer.mbed.org). Click on Compiler icon to launch the online IDE. You can search for "Nucleo_blink_led" in the IDE and import it or you can click on this link:
https://developer.mbed.org/teams/ST/code/Nucleo_blink_led/
And import it from there. Compile the code and download it on the board.

Now export the code for Keil UVision. We will connect a Keil MDK development system using real target hardware using the built-in ST-Link V2 debug adapter.

LOADING A PROJECT INTO MDK

Project files are displayed in File Explorer with the Microvision icon, shown above. To load a project into MDK, do one of the following:

- Menu: Within MDK, select menu item Project->Open Project…, navigate to the project directory, and select the .uvproj file.
- File Explorer: double click on the .uvproj file.

Note that for all lab exercises, the Keil MDK project has been created for you, so that you can simply open and modify using Keil MKD as required.

Alternatively, you can use the mbed online compiler to create and develop a project (follow this link http://mbed.org/handbook/mbed-Compiler for details on how to do this). The online project can also be downloaded and ported to Keil MDK running on your local machine (see http://www.keil.com/appnotes/docs/apnt_207.asp for details on how to do this).

BUILDING THE PROJECT

Build the project using one or more of the following toolbar buttons (listed from left to right):

- Translate current file (e.g. compile or assemble)
- Build the target files whose source files have changed and create output file
- Rebuild all of the target files and create output file

- You may need to install the hardware support package for your platform. This can be done by clicking the package installer button in Keil MDK: 

DOWNLOADING THE PROGRAM IMAGE TO THE MICROCONTROLLER PROGAM MEMORY (FLASH MEMORY)

Download the program to the MCU flash using one of these methods:

- Toolbar button: 

- Menu: Flash->Download
- Accelerator keys: Alt+A+D

Note: if the download fails, please check:

- The firmware has been installed on mbed board (hardware setup)
  Install Keil MDK5 legacy support for Cortex-M devices (http://www2.keil.com/mdk5/legacy/)
- If you get the flash error, you need to set the correct target for flash:

1. Open the dialog Options for Target and select the tab Utilities. Then press the button Settings to open the dialog Cortex-M Target Driver Setup with the tab Flash Download selected.
2. Press the button Add to open the dialog to select a Flash algorithm. Then select the Flash Algorithm you need to target, i.e. STM32F4xx 512kB Flash.

USING THE DEBUGGER

Begin or end a debugger session using one of these methods:

- Toolbar button: 
- Menu: Debug->Start/Stop Debug Session
- Accelerator keys: ctrl+F5

Control the target program execution with the following toolbar buttons (shown from left to right above):

- Reset MCU
- Run program execution (F5)
- Stop program execution
- Step one line in program, entering a subroutine (F11)
- Step one line in program, executing and returning from a subroutine (F10)
- Step out of current function (ctrl+F11)
- Run to cursor (ctrl+F10)

Right-clicking on a line of code will bring up a context menu with various options, including:

- Setting and clearing breakpoints
- Adding a variable to a watch window
- Navigating to definitions or uses of symbols (functions and variables)

The View menu can be used to open different windows to help in debugging, including:

- Disassembly
- Symbols
- CPU registers
- Call stack
- Variable watch windows
- Memory windows
- System viewer (MCU and peripheral control registers)

Enter Debug mode by clicking on the Debug icon.  Select OK if the Evaluation Mode box appears.
Note: You only need to use the Load icon to download to FLASH and not for RAM operation if it is chosen.

Click on the RUN icon.  Note: you stop the program with the STOP icon. 

The LEDs on the STM32F4 Discovery board will now blink in succession.

Modified by Dr. Ali Ahmadinia, California State University San Marcos

REFERENCES

Getting Started with Keil uVision MDK:

www2.keil.com/docs/default-source/default-document-library/mdk5-getting-started.pdf?sfvrsn=0

Keil uVision MDK :

http://www.keil.com/arm/mdk.asp

Getting started with Keil uVision:

http://www.keil.com/product/brochures/uv4.pdf

Useful links to other user manuals:

http://www.keil.com/arm/man/arm.htm