Quick Start Guide

Overview

embARC is an open software platform designed to help accelerate the development and production of embedded systems based on DesignWare® ARC® processors. This article provides a step by step guide to help users get started with embARC in embedded projects.

Please visit https://www.embarc.org/index.html for more information on embARC.

Development Environment

The development environment used in this article is the following:

Development host operating system:

- **Windows 7**

Development Toolchain for Target Platform:

- **GNU Toolchain for DWC ARC Processors, version 2015.06**

Target platform:

- **ARC EM Starter Kit (EMSK), version 1.1.**

The EMSK is a low-cost, versatile solution for rapid software development supporting multiple members of the ARC EM processor family, including EM4, EM6, EM5D, EM7D, EM9D and EM11D cores. The EMSK is compatible with Digilent Pmod extension board and serial console over USB. For more information on the EMSK, please visit to the following:

- https://www.embarc.org/platforms.html
- http://www.synopsys.com/dw/ipdir.php?ds=arc_em_starter_kit.

The EMSK is updated by Synopsys on a regular basis. As of the writing of this article, the following versions of the EMSK have been released and are supported in embARC: v1.1, v2.0, v2.1, v2.2

EM5D and EM7D are supported starting with version 2.0, EM9D and EM11D are supported starting with version 2.2.

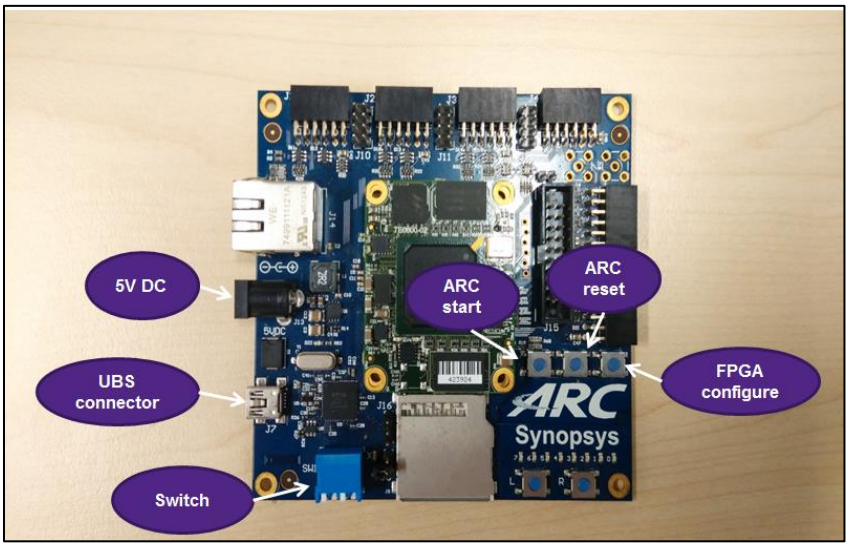


Figure 1. ARC EMSK Board

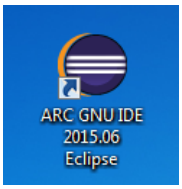
NOTE: The blue switch box in Figure 1 is used for ARC core selection. Bit 1 and Bit 2 of the Switch are provided to select the core configuration. Please refer to EMSK documentation for core selection options for your version of the EMSK.

For EMSK v1.1 used in this article, if Bit 1 and Bit 2 are OFF, ARC EM4 is selected. If Bit 1 is OFF and Bit 2 is ON, ARC EM6 is selected. The selected core configuration is downloaded to the FPGA after power on or after the FPGA configure button is pressed (see Figure 1). The configuration process takes up to 20 seconds and a green LED will be ON during this period. The green LED will turn OFF once the core configuration is complete.

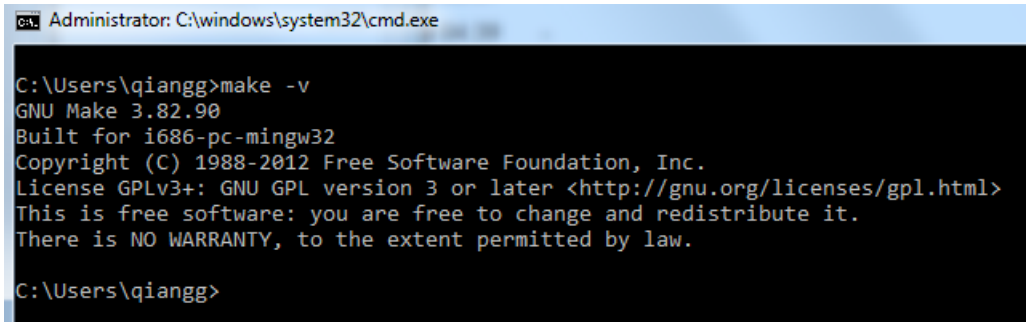
Getting Started

Preparing the host development environment

1) Sign up for an account on embARC User Forums at https://forums.embarc.org/ in order to download required software.
   NOTE: the downloads category will only be visible after you have registered on the embARC forums.
2) Download the Eclipse IDE with GNU Toolchain for ARC Processors from link provided under https://forums.embarc.org/categories/downloads and run the Windows installer named *arc_gnu_ide_<version>_win_install*, where <version> should be the latest available version of the IDE.
   Default setting for installing arc_gnu_ide_win_install is recommended.



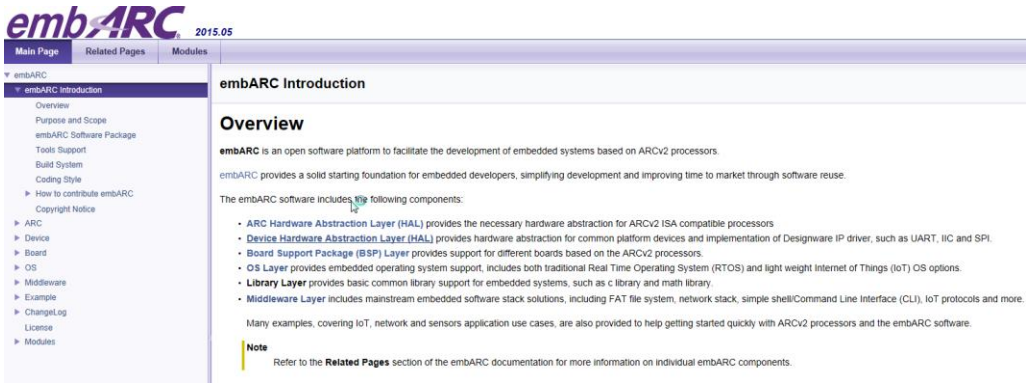
3) Open Windows 7 command line (go to the Start Button and in “Search programs and files” text box type “***cmd***” and enter “***make -v***”) to confirm GNU make is configured successfully.



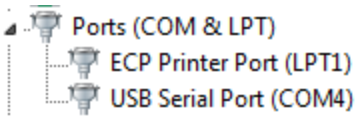
4) Download a text editor for your project, such as vim, emacs and sublime.
5) Download the embARC software from https://forums.embarc.org/categories/downloads . The embARC software archive is named *embARC201505.zip*. Extract the zip file in desired project folder.

   You can access the embARC Documentation in html format under **\doc\ embARC_Document.html**

   You can navigate using the left sidebar. The content is structured according to the general embARC architecture.

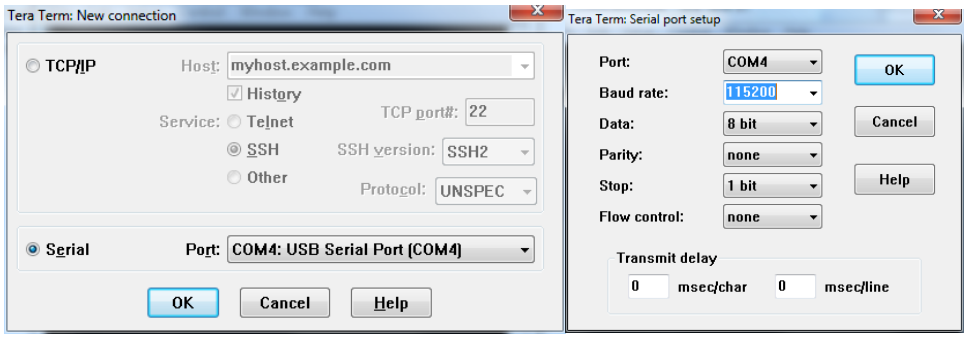


6) Use the USB cable provided with the EMSK to connect the EMSK to the development host / PC. Open the Windows 7 Device Manager to confirm USB Serial Port is functioning correctly.

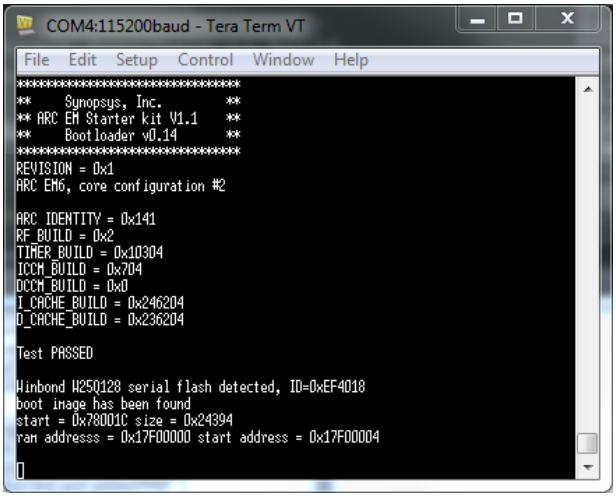


If you do not see the USB Serial Port, please try to update the software driver for the Digilent JTAG-USB from:
https://www.digilentinc.com/Products/Detail.cfm?NavPath=2,66,828&Prod=ADEPT2 .

7) Download Tera Term as the terminal emulator from http://logmett.com/index.php?/products/teraterm.html. You may use other terminal emulators however we will use Tera Term in this article.
The baud rate of the terminal emulator should be set to 115200.



8) Press ARC reset on EMSK board and you see the EMSK bootloader information in the terminal window as shown below.

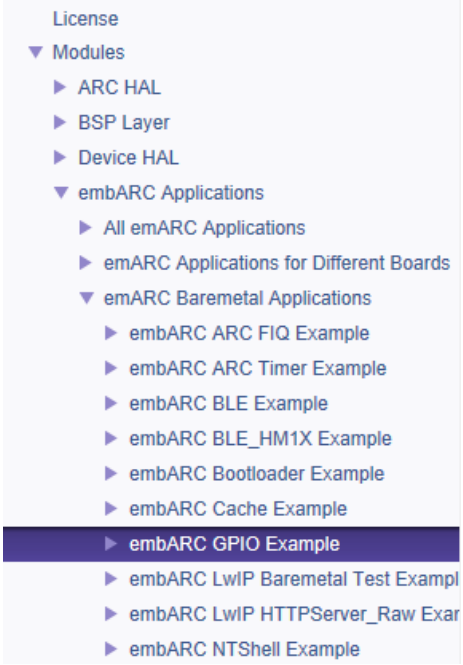


9) Your development host and EMSK are now successfully configured for use with embARC.

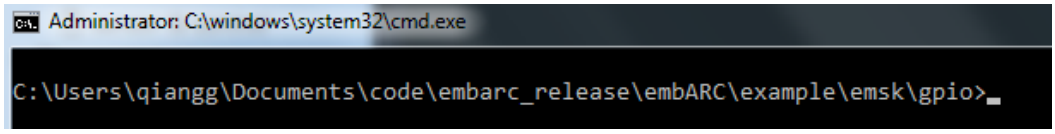
Build and run embARC gpio project from the command line

The embARC gpio example is a simple program that flashes LEDs 0-7 on the EMSK board in a loop and prints message to the console each time a button is pressed or a dipswitch is toggled. This simple example is used to demonstrate how to quickly get embARC software up and running on the EMSK.

Users may also navigate to the gpio example documentation for additional details.



1) Go to **\embARC\example\emsk\gpio** in command line.



2) The gpio example consists of two files, main.c and the makefile for the application.

```
C:\Users\qiangg\Documents\code\embarc_release\embARC\example\emsk\gpio>ls
main.c  makefile
```

3) The default settings for the board (BOARD), board version (BD_VER) and core (CUR_CORE) are “emsk”, “11” and “arcem6”, respectively.
Enter “***make cfg***” command to display the current configuration.

```
C:\Users\qiangg\Documents\code\embarc_release\embARC\example\emsk\gp
"=======Current Configuration======="
"Host OS            : Msys"
"Board              : emsk"
"Hardware Version   : 11"
"Core Configuration : arcem6"
"CPU Clock HZ       : 30000000"
"Peripheral Clock HZ: 50000000"
"Build Toolchain    : gnu"
"Optimization Level : O2"
"Debug Jtag         : usb"
"======Supported Configurations of emsk-11======"
"Boards (BOARD)                 : emsk"
"Core Configurations (CUR_CORE) : arcem4 arcem4cr16 arcem6 arcem6gp"
"Build Toolchains (TOOLCHAIN)   : gnu mw"
"Debug Jtags (JTAG)             : usb opella"
```

NOTE: Users may override these setting by directly specifying BOARD, BD_VER, CUR_CORE and TOOLCHAIN on the command line, for example to compile for EMSK 2.1 and ARC EM7D processor:

make BOARD=emsk BD_VER=21 CUR_CORE=arcem7d TOOLCHAIN=gnu

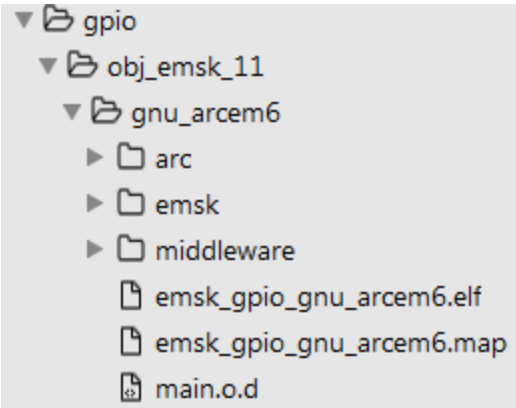
4) Since we are using the GNU Toolchain, the options.mk file in **\embARC\options** should be modified to set the GNU tool chain as default as follows:

```
##
# Compile Toolchain
# Refer to toolchain.mk
##
TOOLCHAIN ?= gnu

##
# additional options
# compile link assembler
```

Alternatively you can also specify the TOOLCHAIN on the make command line directly, e.g. ***make TOOLCHAIN=gnu***

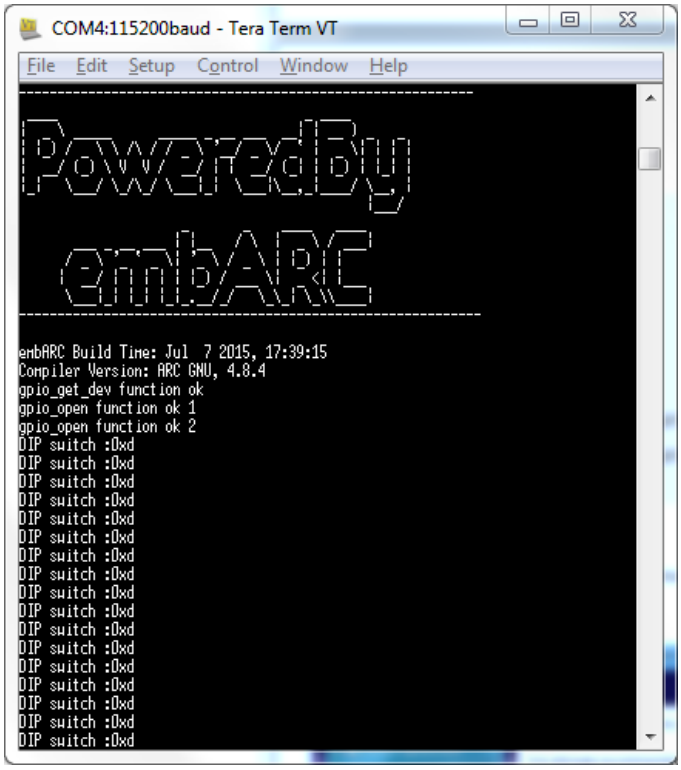
5) Enter "***make***" in command line. Observe that the gnu_arcem6 folder is generated automatically.



6) Enter "***make run***" in command line to run the program on the target. The console displays messages about GDB/openOCD connecting to the target, downloading and starting the program.

```
GNU gdb (ARCompact/ARCv2 ISA elf32 toolchain 2015.06) 7.9.1
Copyright (C) 2015 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.  Type "show copying"
and "show warranty" for details.
This GDB was configured as "--host=i686-w64-mingw32 --target=arc-elf32".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<https://github.com/foss-for-synopsys-dwc-arc-processors/toolchain/issues>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from obj_emsk_11/gnu_arcem6/emsk_gpio_gnu_arcem6.elf...done.
Remote debugging using | openocd --pipe -s  C:/arc_gnu/share/openocd/scripts -f
snps_em_sk_v1.cfg
Open On-Chip Debugger 0.9.0-dev-g8a252b3 (2015-06-08-13:44)
Licensed under GNU GPL v2
For bug reports, read
        http://openocd.sourceforge.net/doc/doxygen/bugs.html
_start () at arc_startup.s:67
67      arc_startup.s: No such file or directory.
Loading section .init, size 0x158 lma 0x10000000
Loading section .text, size 0x312c lma 0x10000158
Loading section .rodata, size 0x588 lma 0x10003284
Loading section .vector, size 0x400 lma 0x10003c00
Loading section .data, size 0x70 lma 0x10004000
Start address 0x10000004, load size 15484
Transfer rate: 210 KB/sec, 1935 bytes/write.
Continuing.
```

The program output is shown in the terminal window. You can observe LEDs 0-7 flashing on the EMSK and any button press or dipswitch change will be shown on the terminal.



7) To exit the program, press Ctrl+ "***c***" in command line window, then press "***q***", "***y***" and "***y***" to exit GDB.

NOTE: Similar instructions for the Eclipse IDE are available from https://embarc.org/getting-started.html .

For any additional support on embARC, please post a question on embARC Forums at https://forums.embarc.org/