BIOS Workshop (Rev 5.93) Setup Guide

Introduction

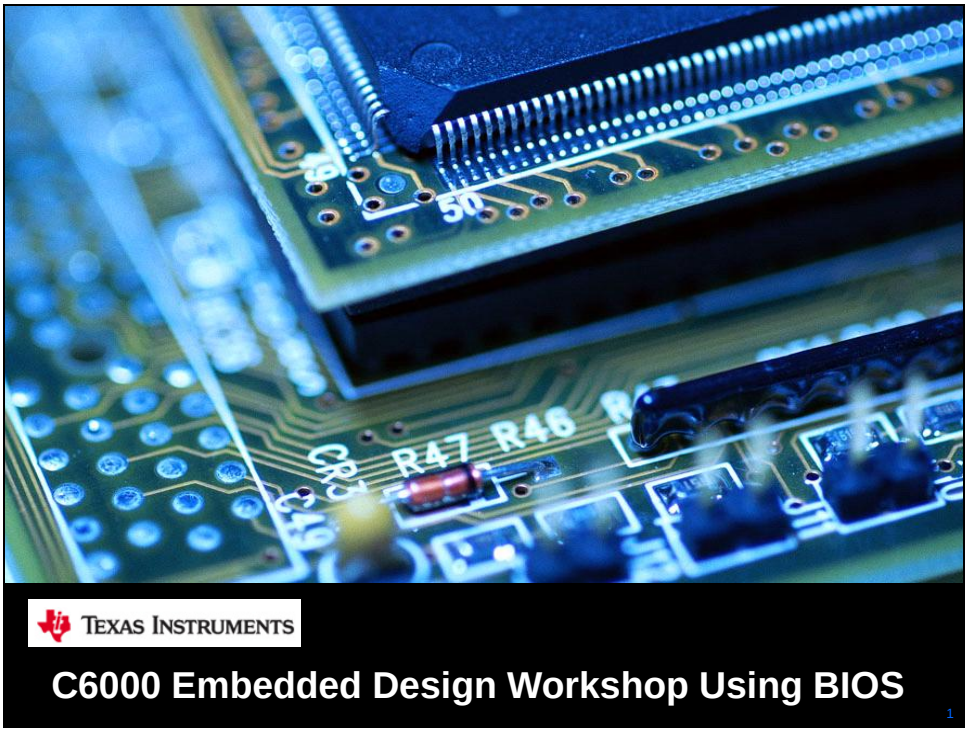
The purpose of this chapter is to detail how to set up the workshop environment for the C674x+ DSP/BIOS System Integration Workshop.

As you go through these steps, please email any questions or suggestions to the author (email listed below).

Workshop Version: 5.93 (BIOS5.41, CCSv4.2.3, OMAP-L138 EVM with OMAP-L138 SOM)

All of the files you need to set up the latest rev of the TTO BIOS Workshop have the proper links and installation instructions shown below. If a link is not provided (or broken), please refer to the BIOS Workshop wiki site for updates and new posts.

If you find any errors or discrepancies in this document, please send an email to the author – Eric Wilbur – at ericw@ti.com. Thanks.



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Introduction & Hardware Needed

BIOS Workshop Wiki Site

For the latest information, downloads and support, visit the TTO's BIOS Workshop wiki site at:

http://processors.wiki.ti.com/index.php/TMS320C64x+_DSP_System_Integration_Workshop_using_DSP/BIOS

Hardware Needed

Currently, this workshop is based on the OMAP-L138 EVM (from LogicPD) and Spectrum Digital XDS510. You can also use the on-board USB emulation, but the "load program" times are 3x slower. We actually purchased the full EVMs (including the OMAP-L138 SOM and LCD screen - however, the 6748 SOM, LCD and User I/F board are NOT used for the workshop labs currently). If you want more information about the options you have, please refer to the BIOS workshop wiki site (link shown above).

You can purchase the OMAP-L138 EK (Experimenter Kit) and XDS510 emulator from Digikey and other suppliers (again…see the wiki page).

List of Files/Tools You Will Need:

- This setup guide
- CCS v4.2.3 (download includes BIOS 5.41.10.36 and CGT tools 7.2.0)
- C6748 EVM Drivers and BSL code
- C6748 Software Development Kit (SDK)
- C6748 XDC tools
- Labs.zip and Sols.zip from wiki
- TTO Target Configuration File (.ccxml) (from wiki site)
- Spectrum Digital XDS510 emulator (recommended)
- Audio Example (contained in SDK download)
- DSPLib library (dsplib64x+)
- Latest Target Content (BIOS 6.32, XDC 3.22 and IPC 1.23) for the SYS/BIOS lab
- GEL files (copy the GEL files from Labs\techdocs to BSL location)
- Music (MP3 files – as determined by instructor, add a shortcut to \music folder on desktop for the students to use)

PART A – Software Setup Procedure

STEP 1 – Download and Install CCSv4 from here:

http://processors.wiki.ti.com/index.php/Download_CCS

The current version is 4.2.3 as of May 2011. Make sure you download the "Full DVD Image". This download requires a TI login.

Do NOT use the default installation directory. Instead, install to:

```
C:\CCStudio_v4.2.3
```

So that the final directory name for CCSv4 is:

```
C:\CCStudio_v4.2.3\ccsv4\
```

Wiki "C6748 Getting Started Guide":

Refer to the C6748 "Getting Started Guide" for additional information that may help your installation procedure (not required, just potentially helpful):

http://processors.wiki.ti.com/index.php/GSG_C6748:_Installing_the_SDK_Software

STEP 2 – Download/Install EVM Drivers, BSL, GEL

Hint: THIS STEP HAS ALREADY BEEN PERFORMED – the files are located in the \Labs\evmc6748_v1-1 folder once you download and install Labs.zip. So, no further work is required. However, if you'd like to know where it came from…read onward…

Download and install "EVM Drivers and BSL" from the Logic PD site:

http://www.logicpd.com/product-support

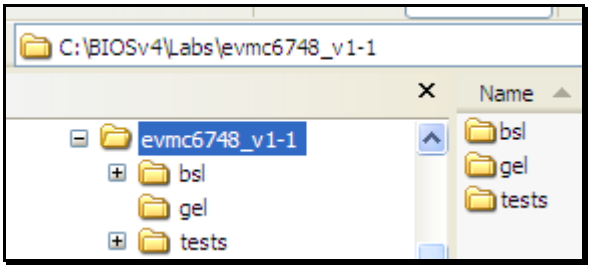
This requires a login id and registration of your product.

On the product support page, these files are labeled "TMS320C6748 SOM-M1 GEL, CCS Setup, & BSL Files" (use the version for CCSv4). Click on the zip file and download. Unzip the contents. You will see a folder named:

```
\evmc6748_v1-1
```

Place this folder here:

```
C:\BIOSv4\Labs\evmc6748_v1-1
```



Note: this directory contains a \GEL directory which has LogicPD's gel file in it. This file is unstable – do NOT use it. In a future step, you will acquire a new and more stable GEL file to put in the \gel directory with the above path.

Note: BIOS 5.41.10.36 and CGT 7.2.0

These come standard with CCSv4.2.3. Therefore, the steps to download these individually have been skipped. If your download of CCSv4.2.3 contains a different version of BIOS or CGT, please download these separately to match the exact configuration – BIOS 5.41.10.36 and CGT 7.2.0.

STEP 3 – Download C6748 SDK and XDC tools

All software downloads for this board (other than BSL/EVM) can be found at:

http://software-dl.ti.com/dsps/dsps_public_sw/sdo_sb/targetcontent/omap_l138/1_00/latest/index_FDS.html

Link to that page and then download:

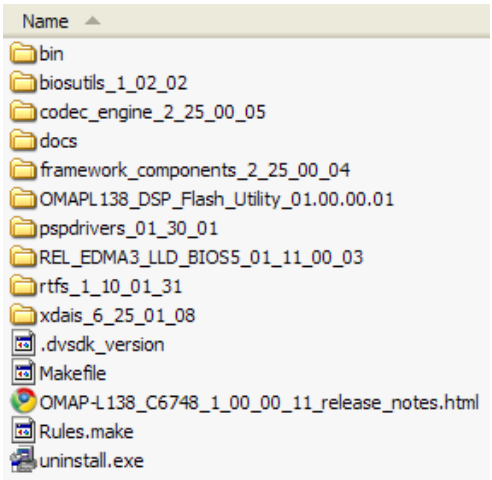
- C6748_setupwin32_1_00_00_11.exe
- xdctools_setupwin32_3_16_01_27.exe

Create a new directory: C:\TI to store the SDK and xdctools.

Double-click on the C6748_setupwin32_xxx.exe file. Install all of the tools to the following (default) directory:

C:\TI\C6748_dsp_1_00_00_11\

Here's a quick screen shot of which tools get installed:



As shown, this SDK includes Codec Engine, Framework Components, Flash Utility, PSP, EDMA3 LLD, RTFS and xDAIS.

Next, double-click on the xdc tools .exe and install them to:

C:\TI\xdctools_3_16_01_27

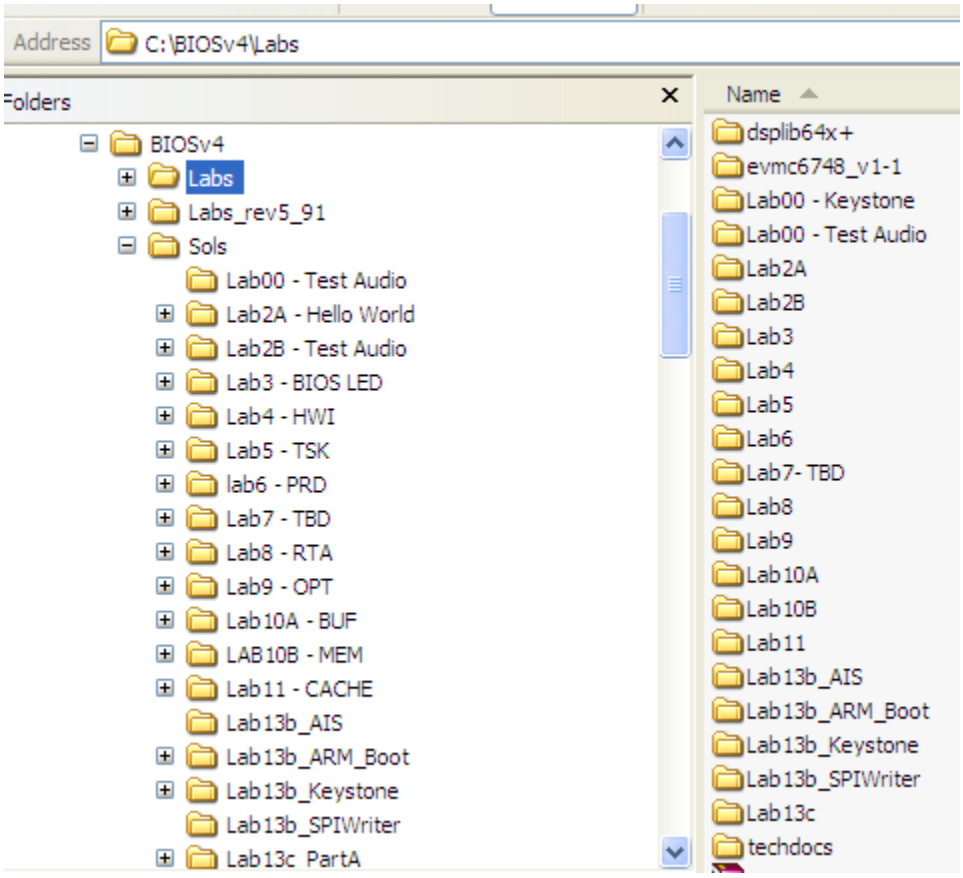
STEP 4 – Download and Install Labs.zip and Sols.zip

Link to the BIOS workshop wiki site and download the labs and solutions ZIP files. Make sure you get the latest rev. Create the following directory structure:

`C:\BIOSv4\Labs` (unzip labs.zip and place ***contents*** into this folder)

`C:\BIOSv4\Sols` (unzip sols.zip and place ***contents*** into this folder)

Make sure you don't copy the contents such that there is a `\Labs\Labs\` directory – copy the CONTENTS of the zip file BENEATH the zip file's \Labs directory into the `C:\BIOSv4\Labs` and the same with the solutions. You should end up with something that looks like this (not exactly because some lab numbers or names change, but you get the idea):



STEP 5 – Replace the Logic PD GEL File with TTO GEL

Hint: THIS STEP HAS ALREADY BEEN DONE FOR YOU. The proper files are in the Labs.zip folder already. However, if you'd like to know how to create this yourself, read on…

In a previous step, you downloaded the BSL code from Logic PD to the following path:

```
C:\BIOSv4\Labs\evmc6748_v1-1
```

In this path, you will find a directory named \gel. Inside that folder, you will see the original GEL file from Logic PD. Once again, this gel file is NOT stable (it stalls often in initializing the DDR clocks). There are two ways to get the latest stable GEL file: (1) download it from the BIOS workshop wiki or (2) copy it from the \Labs\techdocs directory already on your machine.

The recommended method is to copy this file (source):

```
C:\BIOSv4\Labs\techdocs\GEL_TTO\OMAPL138_EVM_TTO.gel
```

And save it to the the following location (destination):

```
C:\BIOSv4\Labs\evmc6748_v1-1\gel
```

STEP 6 – Copy Target Config Files to Proper Location

CCS needs a target config file that describes the target you plan to connect to. This workshop primarily uses the XDS510, but may also use the on-board USB emulation XDS100v1. So, we have created TWO .ccxml files to start with and the students will create a third during the workshop. You have two choices to acquire these files: (1) download from the BIOS workshop wiki or (2) copy them from the \Labs\techdocs directory already on your machine.

The recommended method is to copy the files from this path (source):

```
C:\BIOSv4\Labs\techdocs\TargetConfigFiles_TTO\
```

To this path (destination):

```
C:\Documents and Settings\userid\user\CCSTargetConfigurations
```

Copy both of these files to the specified destination directory:

- `XDS100v1_USB_EVM6748_TTO.ccxml`
- `XDS510_USB_EVM6748_TTO.ccxml`

STEP 7 – Download and Install DSP Lib

Hint: THIS STEP HAS ALREADY BEEN PERFORMED FOR YOU. Again, it is part of the Labs.zip folder already. However, if you'd like to know how to get access to this yourself, read on…

A DSP Lib function is used in the optimizations chapter. This library must be downloaded an installed in the proper place to match the student guide instructions.

Go here to download the C64x+ DSP Library for Windows (SPRC265.zip):

http://focus.ti.com/docs/toolsw/folders/print/sprc265.html

Unzip the library and place the folder \dsplib64x+ at the following location:

```
C:\BIOSv4\Labs\dsplib64x+\
```

STEP 8 – Download and Install Latest Target Content

The lab on SYS/BIOS requires the latest BIOS6.32, XDC 3.22 and IPC 1.23 tools. Here is the general link to all of the target content software:

http://software-dl.ti.com/dsps/dsps_public_sw/sdo_sb/targetcontent/

Here is the specific link to BIOS 6.32:

http://software-dl.ti.com/dsps/dsps_public_sw/sdo_sb/targetcontent/bios/sysbios/6_32_00_28/index_FDS.html

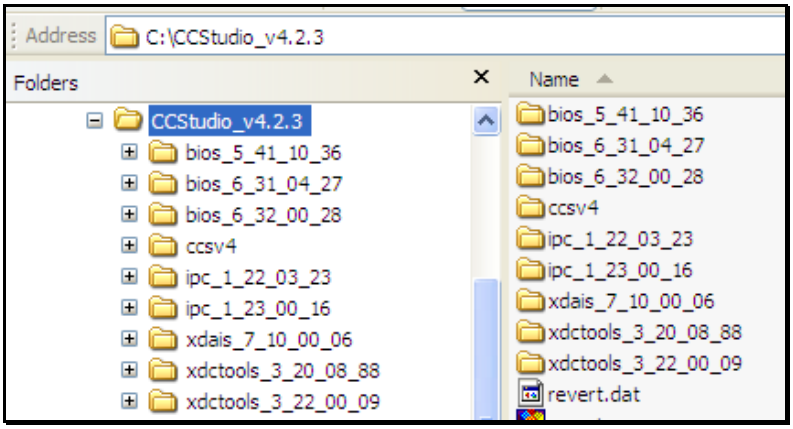
Specific link for XDC 3.22:

http://software-dl.ti.com/dsps/dsps_public_sw/sdo_sb/targetcontent/rtsc/3_22_00_09/index_FDS.html

Specific link for IPC 1.23:

http://software-dl.ti.com/dsps/dsps_public_sw/sdo_sb/targetcontent/ipc/1_23_00_16/index_FDS.html

After downloading all of these tools, place them IN the following directory (as shown):



STEP 9 – Additional "Goodies"

The following items are important for the workshop to run smoothly and be comfortable for the participating students. The most important item in this list is the modification to the eclipse.ini file. Sometimes, especially when working with SYS/BIOS, a user might get a "JVM Heap Low" warning or error. Increasing the virtual memory sizes for eclipse helps this.

1. When CCSv4 has been installed, we need to modify eclipse.ini file located at \ccsv4\eclipse\eclipse.ini. Open this file in a text editor and make sure the first 4 lines read as follows (edit them to match if they don't) – basically we are just using bigger numbers in the bottom 3 lines below (512, 512, 128) – increasing the virtual memory size for eclipse:

   ```
   -vmargs
   -Xms512m
   -Xmx512m
   -XX:MaxPermSize=128m
   ```

   Save the file and overwrite the existing settings.

2. It is helpful to add a Microsoft Windows plug in that allows a user to open a DOS CMD window at the current location in Windows Explorer. Google this plug in and install it into the O/S. It allows a user to right click on a folder and say "open a CMD prompt here".

3. Download the free editor: Notepad ++ editor. Add a desktop shortcut and ASSOCIATE the following files to it (.ini, .log, .txt, .c, .tcf, .cfg, .gel, .h, .cmd, .map, .mak, .s62, .h62).

4. Purchase a copy of Beyond Compare (or use WinMerge), install it and add a desktop shortcut.

5. Right-click on the shortcut for CCSv4.2.3 and select Properties. Under "Target", just after \eclipse.exe, add a –clean. So it would be "…\eclipse.exe –clean". This will clean the workspace each time eclipse is invoked. Very handy for workshop environments.

6. Make sure AISgen is ver 1.7c or later and there is a shortcut on the desktop. Double-click on the shortcut to make sure it runs (no errors). If there is an error, it is most likely due to .NET framework not being installed on the PC.

7. Need VOLUME shortcut in system tray and default VOLUME set to MAXIMUM.

8. Ensure Microsoft .NET framework 3.5 or higher is installed on the host PC (for AISgen).

9. MP3 files for instructional purposes with a shortcut on the desktop to these files.

Step 10 – Flash Utilities (AISgen and SPIWriter)

All of the flash utility files ALREADY EXIST in the labs.zip file on the wiki. The instructor needs to perform two additional steps:

1. Create a shortcut to the AISgen.exe file as per the step below
2. Make sure .NET framework 3.5 or higher is installed on the host PC.

If you'd like to know more about where these files were downloaded and installed from, see the Appedix topic.

REQUIRED – Create desktop shortcut to AISgen utility.

Create a desktop shortcut icon to the following path:

```
C:\BIOSv4\Labs\Lab14b_AIS\AISgen_d800k006.exe
```

You are now finished with installing ALL software. You can proceed to setting up the hardware, testing the software, and if you want to explore other areas, you can read the Appendix.

PART B – Connect the EVM to Your PC

Physical Connection

Connect power and the USB cable to the board. Make sure all DIP switches (on S2 and S7) are OFF (down position) – this will change in a moment, however. Watch out, there are TWO mini USB connectors on this board – one near the RJ-45 connector and one on the top left part of the board near the serial port. The one you want to connect to is the one on the TOP LEFT of the board near the serial port. If you are using the XDS510/560, connect it to the JTAG header now.

*** CAUTION – Set the DIP switches on S7 Properly ***

In the LogicPD quickstart guide, you'll find a picture that looks like this:

Table 2.10 – S7 DIP Switch Functions

Switch	OFF Position	ON Position
S7:1*	Baseboard LCD drive enabled.	Baseboard LCD drive disabled.
S7:2	Baseboard audio enabled. Associated McASP lines connect to baseboard audio only.	Baseboard audio disabled. Associated McASP lines are available on audio expansion connector.
S7:3	OMAP-L138 I/O runs at 3.3V	OMAP-L138 I/O runs at 1.8V
S7:4	No connection	
S7:5	BOOT[1]	
S7:6	BOOT[2]	
S7:7	BOOT[3]	
S7:8	BOOT[4]	

*Note: S7:1 indicates slide 1 on the S7 DIP switch, S7:2 indicates slide 2 on the S7 DIP switch, and so on.

A default boot mode has been defined by pulling all boot pins (BOOT[0:7]) to a default sta on the SOM. The default boot mode is SPI1 Flash; for the purpose of this QuickStart Gui leave the boot mode set to SPI1 Flash. All available boot modes are described in Table 2. however, the use of these boot modes fall outside the scope of this document.

Table 2.11 – S7 DIP Switch Boot Modes

		DIP Switch Setting—S7[5:8]			
		BOOT[4]	BOOT[3]	BOOT[2]	BOOT[1]
	Boot Mode	S7:8	S7:7	S7:6	S7:5
	NOR EMIFA	OFF	ON	ON	ON
	NAND-8 EMIFA	OFF	OFF	OFF	ON
Default	SPI1 Flash	OFF	OFF	OFF	OFF
	UART2	ON	ON	OFF	OFF
	EMU Debug	ON	OFF	OFF	ON

This is EASY to miss, but the DEFAULT is set to all switches to the OFF position which is SPI1 Flash mode. Oops. We want EMU Debug. Following the two diagrams, you'll see that switches 5 and 8 of switch S7 must be UP or ON.

CHANGE THE DIP SWITCHES NOW or you will forget and you'll have intermittent problems down the line that are tough to identify.

Also, you can link to this URL for further help:

http://processors.wiki.ti.com/index.php/How_to_connect_to_the_OMAP-L138/C6748_EVM_board_using_CCS%3F

PART C – Verify Board & Tools are Working Properly

Make sure you have audio cables hooked up to the board properly. Load the PSP audio example, build, load and run. We will first verify the hardware is set up properly, then move on to the software.

Hardware Verification

Print out and follow the instructions for Lab1 of the workshop – simple audio pass through using a BSL example. If it works, your hardware is setup properly. If not, follow the suggestions in that lab.

Software (Tools) Verification

Load the keystone lab from the solutions directory of the workshop. Rebuild all, download to the target and run. Verify its operation. If it builds properly, you have properly loaded the SDK and other tools properly.

You're finished with the set up for this workshop. Please provide any feedback you have (suggestions, ambiguities, problems) to the author (Eric Wilbur) at ericw@ti.com. If you'd like to try other examples to test out the board, you can proceed with the next section. Also, check out the Appendix for further reading.

Appendix

This appendix contains additional setup information that can be used as necessary.

Flash Utilities – AISgen and SPIWriter Set Up

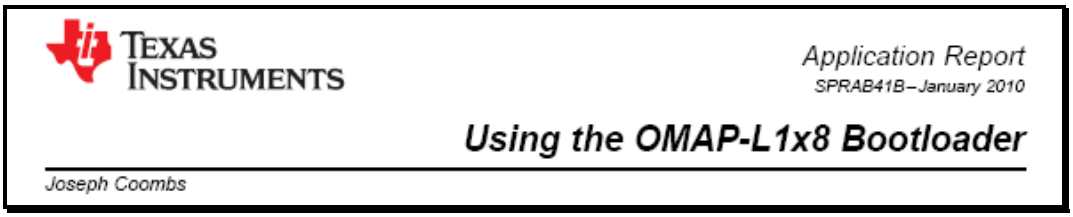
In the PART A procedure, you were instructed what to do with these files. If you have a desire to know WHERE and how these files were acquired, you may read further…

1. **Download AISgen utility.**

   Download the pdf file from here:

   http://focus.ti.com/general/docs/lit/getliterature.tsp?literatureNumber=sprab41b&fileType=pdf

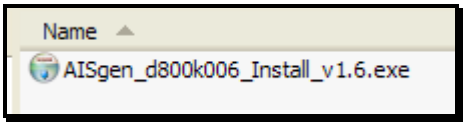
   A screen cap of the pdf file is here:



   Download the AISgen tool from here:

   http://focus.ti.com/general/docs/lit/getliterature.tsp?literatureNumber=sprab41b&fileType=zip

   The contents of this zip are shown here:



2. **Create directories to hold tools and projects.**

   Three directories need to be created:

   - `C:\BIOSv4\Labs\Lab14b_keystone` – will contain the audio project (keystone) to build into a `.OUT` file.
   - `C:\BIOSv4\Labs\Lab14b_SPIWriter` – will contain the `SPIWriter.out` file used to program the flash on the EVM.
   - `C:\BIOSv4\Labs\Lab14b_AIS` – contains the `AISgen.exe` file (shown above) and is where the resulting AIS script (bin) will be located after running the utility (`.OUT` → `.BIN`)

   Place the "*keystone*" files into the `\Lab14b_keystone\Files` directory. Users will build a new project to get their `.OUT` file.

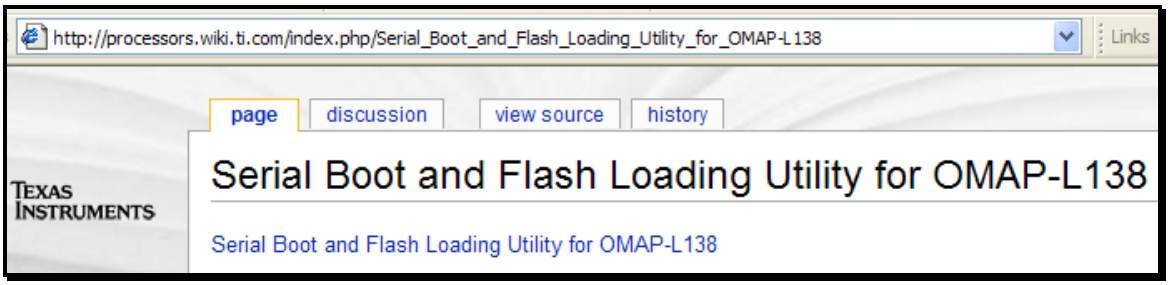
   Place the recently downloaded `AISgen.exe` file into `\Lab14b_AIS` directory.

3. **Download SPI Flash Utilities.**

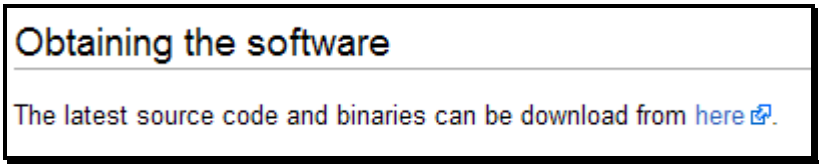
   You can find the SPI Flash Utility here:

   http://processors.wiki.ti.com/index.php/Serial_Boot_and_Flash_Loading_Utility_for_OMAP-L138

   This is actually a TI wiki page:

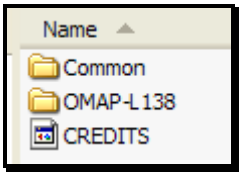


   From here, locate the following and click "here" to go to the download page:



   This will take you to a SourceForge site that will contain the tools you need to download.

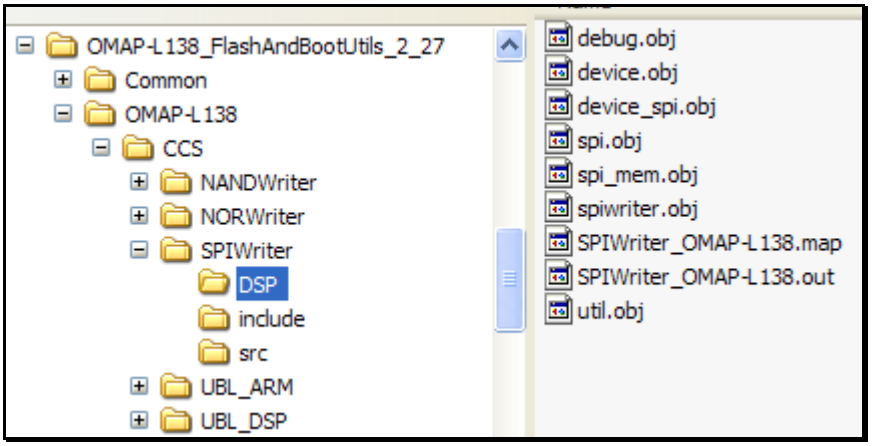
   Click on the latest version under OMAP-L138 and download the tar.gz file. UnTAR the contents and you'll see this:



   The path we need is `\OMAP-L138`. If we dive down a bit, we will find the `SPIWriter.out` file that is used to program the flash with our boot image (`.bin`).

4. **Copy the SPIWriter.out file to** `\Lab14b_SPIWriter\` **directory.**

   Shown below is the initial contents of the Flash Utility download:



   Copy the following file to the `\Lab14b_SPIWriter\` directory:

   `SPIWriter_OMAP-L138.out`

5. **Install AISgen.**

   Find the download of the AISgen.exe file and double-click it to install. After installation, copy the resulting .exe file to:

   `C:\BIOSv4\Labs\Lab14b_AIS\AISgen_d800k006.exe`

   Create a desktop shortcut to this .exe file.

6. **Install Microsoft .NET framework 3.5 or above.**

7. **Create the keystone project.**

   Create a new CCSv4 BIOS project with the source files listed in `C:\BIOSv4\Lab14b_keystone\Files`. Create this project in the neighboring `\Project` folder. Also, don't forget to add the BSL library and BSL includes (as normal) Make sure you use the RELEASE configuration only.

Creating Your Own Target Config Files

In PART A (procedure), you were instructed how to download/copy these files. If you would like to create your own target config files instead of using the ones already created, read on. Also, the students will create their own target config file during the workshop to use throughout.

New Target Configuration File (.ccxml)

You have several choices when it comes to the target configuration file (.ccxml).

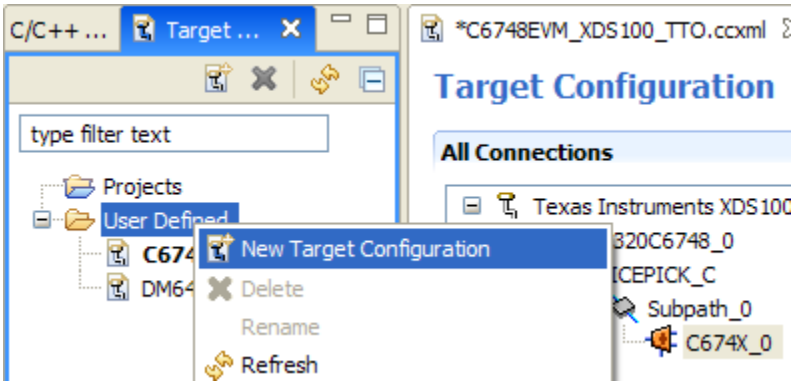
First, it depends on whether you plan to use the on-board USB emulation (XDS100v1) or the MUCH faster XDS510USB from Spectrum Digital. It is HIGHLY recommended you use the XDS510USB instead of the on-board emulation for speed purposes. GEL files and program downloads run 3-5x faster – a real key when you build/load/run often during lab time.

You may decide to create your own target config file. If so, follow these instructions. The on-board USB (XDS100v1) is shown as an example. The procedure to create an XDS510 target config file is similar – you just need to choose "Spectrum Digital XDS510USB Emulator" instead.

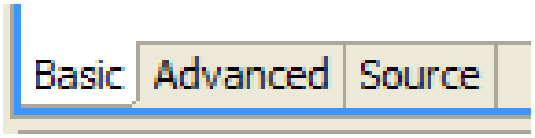
In CCSv4,

Select: View → Target Configurations

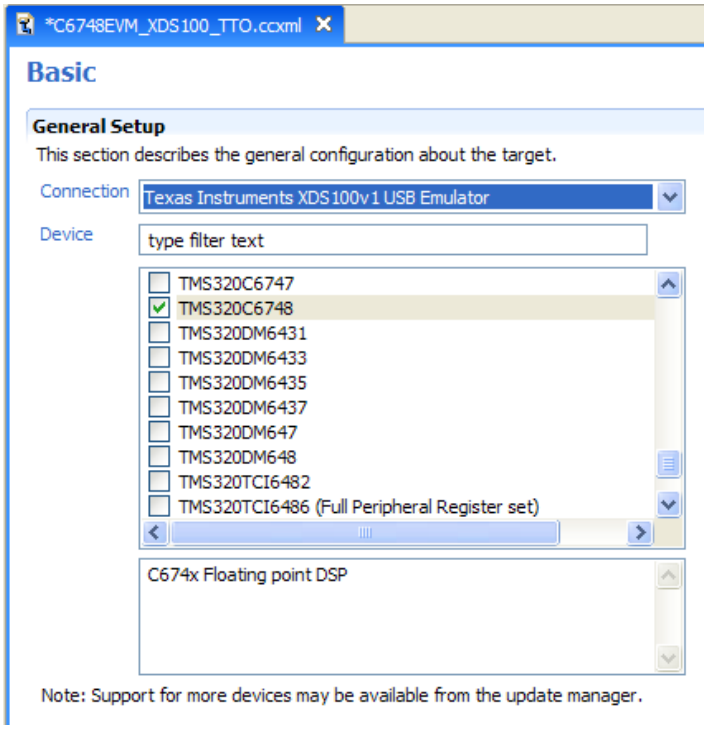
Right-click on "User Defined" and click on "New Target Configuration".



Look down below at the TAB display. You'll see the following:



We will be using the Basic and Advanced tabs. First, in the Basic tab, select the proper emulator and device in the window as shown in the next diagram…



Select Connection: Texas Instruments XDS100v1 USB Emulator

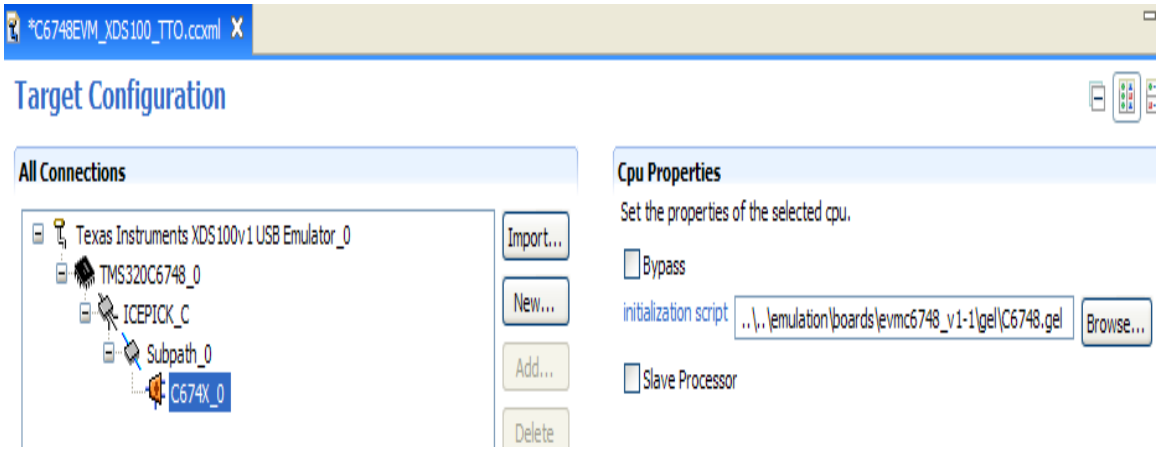
Select Device: TMS320C6748

A note to the wise: you will see several "EVMs" listed in the device list. If you select a "board" vs. a "device", a GEL file will automatically be selected for you – obviously one that matches your board. However, if you select a DEVICE, as we have, there will be no GEL file associated with this device or the board you are hooked to. In effect, we are setting up an "emulation" board (like our own custom board). This can be a major stumbling block if you pick a device and then NOTHING works in CCS because you're missing all of those nice GEL commands that set up stuff like, uh, DDR, PLL, EMIF, you know, unimportant stuff like that. Buyer beware. ;)

Now to the GEL file selection. The C6748 EVM comes with a GEL file for a DEVICE, not the board. Don't ask why, just accept it. We must now point CCS to this GEL file so it gets loaded during our debug sessions.

Click on the Advanced Tab. Expand all of the + signs (as shown below) and click on the CPU:

You will now see a screen that looks like the following.



You may have to expand the window to the right a bit to see the Browse button. The "Initialization Script" is the GEL file.

First, you must download the updated TTO C6748 GEL file from the wiki (or copy it from C:\BIOSv4\Labs\techdocs\GEL_TTO). The original LogicPD file sometimes gets hung up in the DDR setup portion. The one on the wiki (and in your \Labs directory) is WAY more stable. It is named C6748_TTO.gel. Once downloaded, place this file at the following location exactly and then point to it in the target config file GUI shown above:

```
C:\BIOSv4\Labs\evmc6748_v1-1\gel
```

Finally, click the "Save" button to save the .ccxml file.

You now have the TTO's ccxml file for the workshop and it is properly configured to connect to the C6748 EVM board.

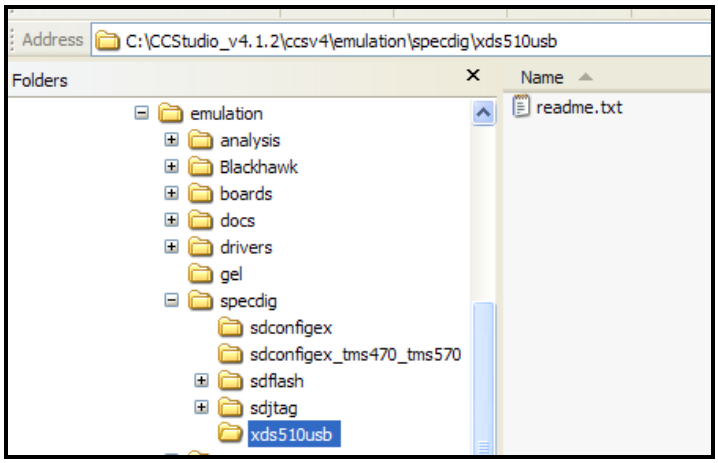
Spectrum Digital XDS510 Driver Setup

Hint: UPDATE – The author has successfully just followed the "Yes, this time only" path through the dialogue box when installing the USB driver for the XDS510 emulator or on-board emulator (XDS100v1). So, the recommended way to do this is just follow this path and let it go. If you have problems connecting or suspect a problem with the USB driver, follow the instructions below…

OPTIONAL Driver Setup

It is not exactly intuitive how do point your XDS510 to the proper driver. Drivers in CCS are placed in a different location altogether and it is confusing as to exactly what to do without a ton of trial and error. The author was actually able to successfully use the old driver located in the CCSv3 directory, but thinks it is best to use the latest that comes with CCSv4 – IF you can find it. ☺

A likely location of the drivers would be the following directory:



However, there is only a .txt file located here. Hmmm. Where could they be? Onward…

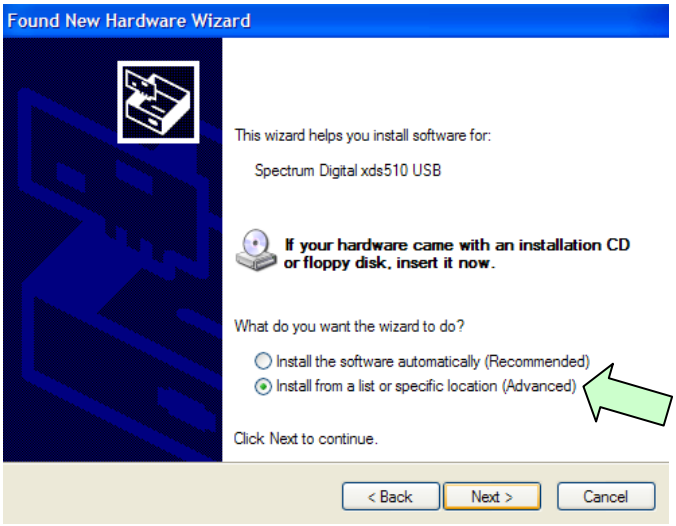
1. **Install CCSv4 as per previous steps.**
   This might be obvious, but you never know. If you don't have CCSv4 properly installed, then the XDS510 drivers won't exist either. Nuff said.

2. **Plug in the XDS510 into your PC's USB port.**
   As usual, the "Found New Hardware" wizard will appear. Follow the steps below to properly point the wizard to the driver files.

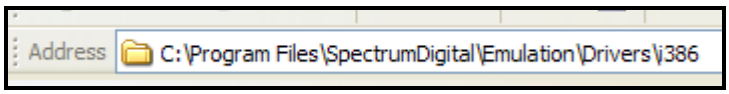
3. Follow the screen caps below…exactly…

Don't let Windows search for the driver:

Install from a specific location:



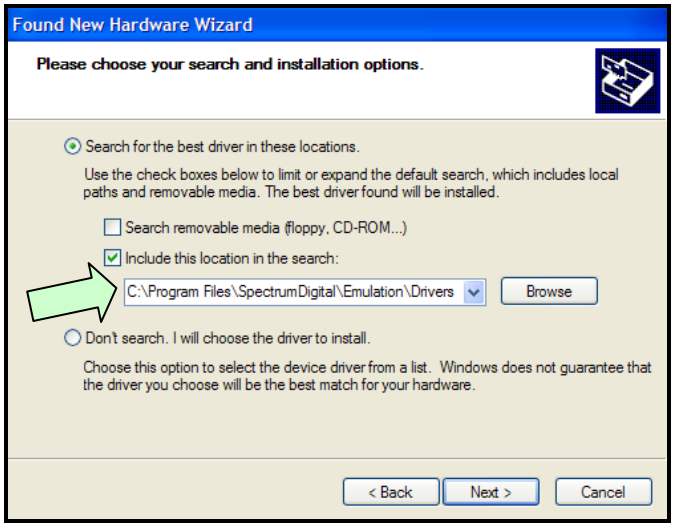
Browse to this exact path:



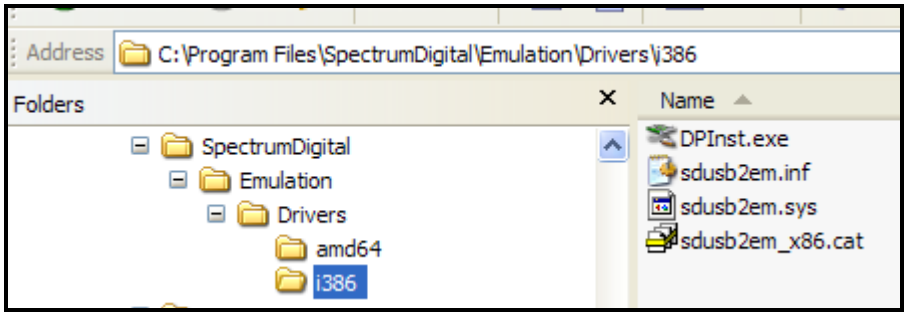
With CCSv4, this is where the drivers are installed – in Program Files. Aha!

So, check the "Include this location in the search" and uncheck everything else.

Type in the above path into the dialogue box below:



Here's an explorer view of the correct path for Win2K, XP, Vista32:



Click Next and let the driver install. You're done.

For Vista64, choose "amd64". For Win7, "amd64" will probably work but untested.