Student Installation Guide - Rev 4.00

Introduction

The objective of this guide is to walk you, the student, through all of the necessary steps to download and install all of the tools for the TI-RTOS Kernel Workshop as well as the C6000 Embedded Design Workshop. Please RTFM – Read the Fine Manual – and EVERY step whether you think it pertains to you or not. Having a clean install of all of these tools is CRITICAL for everyone to keep time/pace as the workshop begins. If you don't prepare properly, the instructor must take time to help you install tools which takes time away from other students. SO DO YOUR PART.

Details about HOW to configure and use the TI-RTOS kernel (SYS/BIOS), as well as Code Composer Studio (CCS) will be taught live and all students will have plenty of opportunities to practice these skills during the lab exercises. Trust the author – getting all these tools in the right place and working together to create projects is 80% of the battle – and a skill you need to acquire. The "getting started" "hello world" "out of box" experience is crucial and sometimes the most difficult challenge you will face in your application. ;-) So, that's where we start…

Note: This installation guide covers all installation details for BOTH the TI-RTOS Kernel Workshop (2 days) as well as the C6000 Embedded Design Workshop (2 days).
Note: **Total download and install time of all tools is 2-3 hours – so plan accordingly.**

For future reference, the main Wiki for the TI-RTOS Kernel Workshop is here:
http://processors.wiki.ti.com/index.php/TI-RTOS_Workshop

The C6000 Embedded Design Workshop wiki is here:
http://processors.wiki.ti.com/index.php/C6000_Embedded_Design_Workshop

Topics

Note: as of 5/15/15, this workshop and installation guide will no longer be updated.

Workshop Equipment & Requirements

You must provide:

- Windows computer using Windows XP or greater.

  You are required to provide your own Windows laptop computer. It should have an available USB port. You will also need at least 1.5 GB of space available on your disc drive to hold the necessary software.

  If you have a Mac or Linux notebook computer, we have seen students be successful running the development tools in a virtual machine, such as VMware or VM Fusion. That said, we cannot guarantee that our instructors will be able to help you with managing these types of environments.

- Audio headphones (to watch videos pertaining to YOUR target when waiting for others to finish labs, if time allows)

- A means of watching .mp4 videos (media player)

- Pen or pencil and notepad to take notes

- Before coming to the workshop, you should install ALL the software outlined in this document – please be considerate and follow ALL instructions carefully. If not, precious class time will have to be taken to help solve your specific installation problems. If the install is unsuccessful, you will be asked to team up with another student during the labs.

Provided at the workshop (Take Home)

If you are paying to attend the 2-day TI-RTOS Workshop, the following items (as well as lunch) will be provided. You will be able to take ONE of the following items home with you at the end of the day.

If you are doing this workshop on your own, then you will need to purchase ONE of these items from the TI eStore or one of TI's authorized distributors.

- MSP-EXP430F5529 LaunchPad

- Tiva-C LaunchPad

- F28069 Control Stick

- Printed Lab Manual (if you want the full student manual with the slides, you can download and print it yourself or just use the PDF to follow along with the instructor). The key manual to have PRINTED is just the lab procedures which will be provided for you in class.

Provided at the workshop (For in-class use only)

For C6000 users, you will be loaned a C6748 LCDK (Low Cost Dev Kit) along with an XDS510 emulator – sorry, you can't take those home with you. ☺

- C6748 LCDK (~$200)

  https://estore.ti.com/TMDXLCDK6748-TMS320C6748-DSP-Development-Kit-LCDK-P2998.aspx

- Spectrum Digital XDS510 USB Emulator (~$990)

  http://www.spectrumdigital.com/product_info.php?cPath=22&products_id=29

- 1/8" stereo patch cord (male to male) for C6000 2-day attendees

Download Checklist

Integrated Development Environments (IDE)

❑ **Code Composer Studio v6.0+**   http://processors.wiki.ti.com/index.php/Download_CCS

You can download either the web installer or offline installer. The web installer is smaller, but the off-line installer is more flexible. If you have a fast internet access, we suggest the off-line installer.

> ***Note:*** If you already have CCSv6.0 or newer on your laptop, there is no need to download or install CCS unless you want to add new components. However, if you only have CCSv5.5 or older, you must download and install CCSv6 or none of the labs will work.

Clicking the link for either installer, you will be directed to log in (or create a free) my.TI account. Then, once you agree to the export conditions you will either be e-mailed a link or be directed to a web page with the link. Workshop labs will NOT work with CCSv5.5 or older (that workshop has been archived) – we have made the jump to CCSv6 and so must you to run any labs in this workshop (6.1.0 is now the latest as of Feb 2015 which will work fine).

Workshop Course Materials

❑ **TI-RTOS Workshop Manual (PDF)**   **TI_RTOS_Workshop_Student_Guide.pdf**
❑ **Workshop Lab Files (ZIP)**   **TI_RTOS_Workshop_Lab_Files.zip**
❑ **Installation Document (PDF)**   **TI_RTOS_Workshop_Installation_Guide.pdf**

For 4-day C6000 students only:
❑ **C6000 Workshop Manual (PDF)**   **C6000_Embedded_Design_Workshop_Student_Guide.pdf**

These files are all found at the workshop's wiki page: http://processors.wiki.ti.com/index.php/TI-RTOS_Workshop

Download Latest TI-RTOS SDK and BIOS tools

As of the CCSv6.0 release, no RTOS tools are installed other than XDC. So, after installing CCS later in this document, you will also need to install the tools listed below. This workshop now takes advantage of all of the new TI-RTOS SDK releases available as of April 2014 along with CCSv6. So, make sure you download the following tools carefully and then install them when told to later in this document.

❑ **Download latest TI-RTOS for YOUR architecture (Windows Version):**

First, you must download the TI-RTOS SDK for YOUR architecture provided at this link:

http://www.ti.com/tool/ti-rtos

Click the *Get Software* button and this will take you to the download page (snapshot as of 4/17/15):

TI-RTOS 2.x Product Releases

Version	Description	C2000	MSP430	SimpleLink Wireless MCUs	Sitara	Tiva C	C6000
2.12.00.24	Added support for MSP432. (24 Mar 2015, Release Notes)		Windows Linux				
2.11.01.09	Added support for CC26xx, including device drivers. Maintenance update for CC3200. (30 Jan 2015, Release Notes)			Windows Linux			
2.10.01.38	Update includes a new version of the SYS/BIOS kernel, NDK, IPC and Instrumentation, as well as new PWM and DMA-based UART drivers for Tiva C devices. (17 Nov 2014, Release Notes)	Windows Linux	Windows Linux			Windows Linux	
2.01.00.03	Update to support the latest CC3100 and CC3200 SDKs. (01 Aug 2014, Release Notes)		Windows Linux	Windows Linux		Windows Linux	
2.00.02.36	Support for CC3200 is available in the TI-RTOS for SimpleLink Wireless MCUs product. This release also adds support for the CC3100 into the TI-RTOS for MSP430 and TI-RTOS for TivaC products. (13 Jun 2014, Release Notes)	Windows Linux	Windows Linux	Windows Linux		Windows Linux	
2.00.01.23	This release separates TI-RTOS into multiple products based on devices: C2000 (includes Concerto), C6000, MSP430, Sitara, and Tiva C. MSP-EXP430FR5969LP and EK_TM4C1294XL drivers and board support were also added. Code Composer Studio users are required to use CCSv6.x (or higher) and are recommended to use the App Center in CCS to download TI-RTOS. (24 Apr 2014, Release Notes)	Windows Linux	Windows Linux		Windows Linux	Windows Linux	Windows Linux

<u>**MSP430 USERS**</u> – MUST have TI-RTOS ver 2.12.00.24 or later or the labs WILL NOT WORK (change in API).

Click on the "Windows" link of the latest release for YOUR architecture as shown in the table above.

For your information, all of the TI-RTOS related tools can be found on this page:

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

You can see the huge, long list of tools. Keep in mind that tools are MATCHED together. You can't use an old BIOS release with a new UIA or new XDC, etc. This is actually one of the most common errors new users make.

C6000 users have the same tools but usually they are a rev or two back. The point here is that the tools matching is handled FOR YOU by creating these SDKs with matched tools.

When you install the TI-RTOS SDK package, the installer will attempt to ALSO install the proper version of XDC if you don't already have it. In effect, the TI-RTOS SDK package installer is forcing this MATCHING of all the tools which is fantastic (in the author's opinion) because it helps all users make fewer mistakes in this critical area of getting the right SET of tools.

Download Latest Driver Libraries for Your Target

Once again, MSP430 and Tiva-C users are in luck – you get the driver libraries WITH the TI-RTOS SDK download. However, C28x and C6000 users will need to download driver libraries and install them. We plan to simply blink an LED in this workshop (sounds simple, but we decided to keep the application simple so we could focus on the TI-RTOS kernel concepts).

A driver library, specific to your target, is necessary to enable us to write code to blink the LED, set up hardware timers and perform delay functions.

MSP430 and Tiva-C USERS ONLY – SKIP THIS SECTION (no need to download driver libraries)

C28x and C6000 USERS ONLY – follow the steps in this section to download your driver libraries…

❑ **C6000 or C28x USERS – download the latest driver library**

Only download the libraries (xWare) for YOUR specific target:

      ❑   **C28x Users – Control Suite**   http://www.ti.com/tool/controlsuite
      ❑   **C6000 Users – MCSDK**   OMAPL-138-MCSDK

C6000 Users – once you get to the MCSDK download page, download the following:

C6000 Users – Yes, it says OMAP-L138 MCSDK (Multi-core SDK). Even though we use the C6748 LCDK in the workshop, this SDK covers the C6748 (single core DSP) as well as the OMAP-L138 (ARM9 + C674x CPU). So this IS the correct SDK for C6000 users in the TI-RTOS workshop.

Installation

Code Composer Studio

Note: If you already have CCSv6.0 or higher installed on your machine, you can skip the CCS installation procedure. If you want to ADD a target or two to your CURRENT installation, simply run the installation again and install these new components.

Install Code Composer Studio 6.0 or newer

1. **If you haven't already done so, download CCS.**

   (Refer to the *Download Checklist* for details.)

2. **Disable anti-virus (e.g. McAfee) and spyware protection, firewall, etc. if possible.**

3. **If you downloaded the full, all-in-one installer <u>you must unzip it first</u>.**

   Windows makes zip files look like folders, but trying to run an installer from a zipped file does not work well. <u>**PLEASE UNZIP THE INSTALLER BEFORE INSTALLATION**</u>.

4. **Run the CCS Installer AFTER you have UNZIPPED IT.**

   `ccs_setup_6.1.0.00104.exe`   (this version was available when this document was printed)

5. **When the installation program runs, accept the license agreement and click** *Next*.

6. **Note about CCS installations:**

   When the "*Choose Installation Location*" dialog appears, we suggest that you install Code Composer in the default `C:/TI` folder. If the install program ever asks you if you want to install CCS as a plugin to Eclipse, do **NOT** say yes. Click *Next*.

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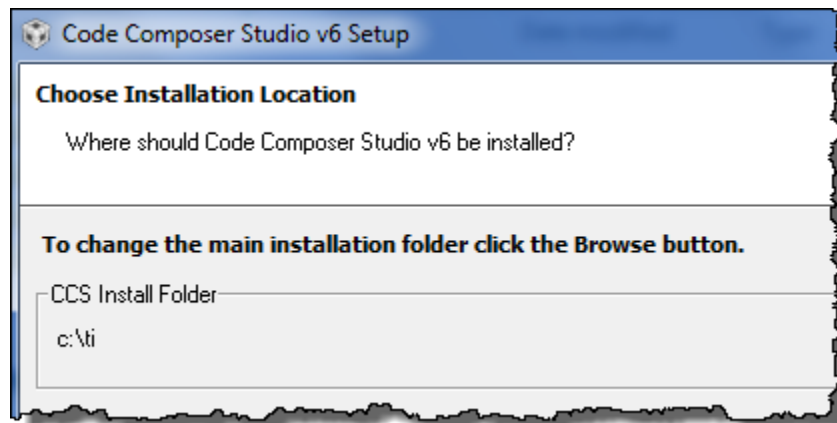
7. **Choose the devices you plan to use in the Processor Support dialogue.**
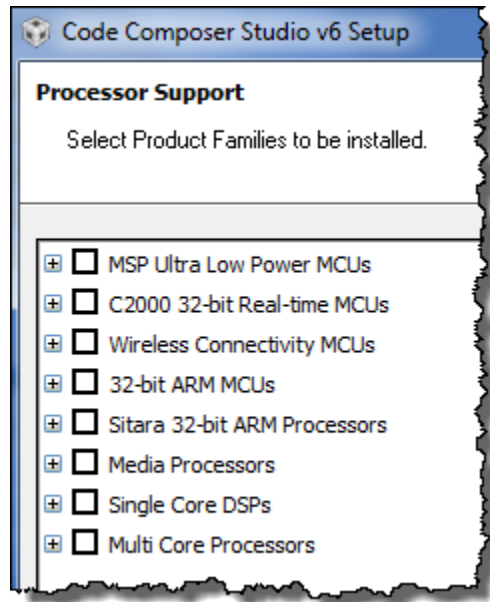

Choose the following for your target:

- C28x users choose C2000

- C6000 users choose Single Core DSPs (however, if you want OMAP-L138 support which is NOT required for the workshop, choose *Media Processors → Integra Device Support*)

- MSP430 users choose MSP

- Tiva-C users choose 32-bit ARM MCUs

The more devices you choose means a longer installation time. If you have a slower computer, we recommend choosing as few as possible. (It's not really about CPU performance; installations are all about copying a lot of files.)

When done selecting processors, click **Next**.

8. **Choose the emulation drivers (C6000 USERS – PAY CLOSE ATTENTION HERE).**

The next screen checks the boxes for the emulator drivers based on your target selections in previous dialogues. They are probably already correct. However, **C6000 users** must check the box for "Spectrum Digital Emulators and Boards" because the Spectrum Digital XDS510 will be used in class. If you are NOT a C6000 user, don't worry about this.
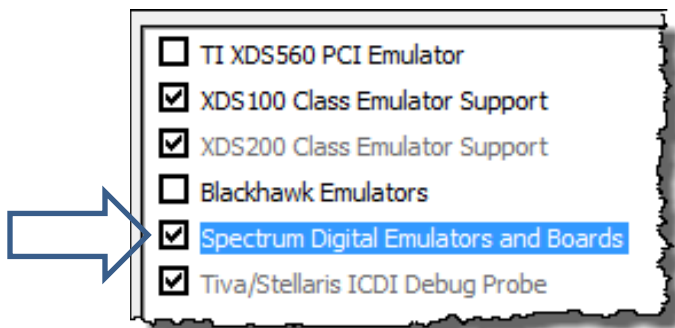
Make sure the selections are correct and then click Next…

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9. AFTER INSTALLATION – Install updates, manage license.

After installation of CCSv6.0 (or higher), open CCS and allow it to install any new tools and then select *Help → Check for Updates*. Update all of the tools related to your architecture or emulator and the TI Emulators. Check each one that applies and then click *Next* and follow the instructions. After the updates have been completed, close CCS and re-open it to allow the changes to take effect.

Also, click *Help → Code Composer Studio Licensing Info* and select the proper license. Most users should choose the 90-day evaluation license unless you have already purchased a license.

C6000 USERS – do <u>NOT</u> select the "FREE" License option. This will NOT support the XDS510 emulator we use in the workshop. <u>Please make sure you select the "EVAL" license</u> which gives you 90 days use of CCS with ANY emulator you choose.

Increase Java Memory For TI-RTOS Config

If you don't follow these steps, you may encounter a "JVM heap low error". This is common because the TI-RTOS Kernel and CCS assume a very minimal memory footprint on the host PC. The author has experienced this more times than not, so that's why the following step is here.

10. Modify ccstudio.ini to increase java memory footprint.

The INI file for TI's version of Eclipse is named `ccstudio.ini`. It is located here (assuming you installed CCS at the default location of `C:\TI`):

    C:\TI\ccsv6\eclipse\ccstudio.ini

Open this file (via WordPad – not Notepad due to the line returns) and you'll see two settings that need to be modified. Near the bottom of the file, you will see these settings – and modify them to reflect the new settings shown:

- `Xms40m` → `Xms256m`

- `Xmx384m` → `Xmx1024m`

Save your `ccstudio.ini` file.

Note – this setting will only apply to the CURRENT install of CCS. If you install a later version, you'll need to modify the new `ccstudio.ini` file just as above.

If you do NOT make these changes, CCS still works fine, the labs will work fine...but you may get annoyed at the constant reminder when working in CCS with TI-RTOS that the JVM heap is low. The author increased these two settings to 128m and 512m respectively and STILL continued to get JVM heap low errors – however, they have gone away with the settings above.
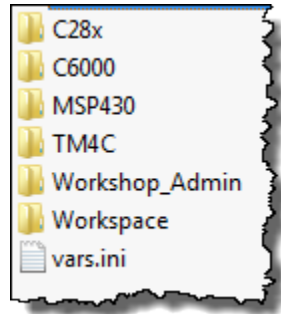
Install the Workshop Lab and Solution Files

11. Unzip the labs_sols.zip file and place at your root folder.

You should have downloaded a file named (version might be same or higher):

```
TI_RTOS_labs_sols_rev2.60.zip
```

Unzip the contents of this folder and you will see the following list of files and folders:

```
C28x
C6000
MSP430
TM4C
Workshop_Admin
Workspace
vars.ini
```

Create a new folder named `C:\TI_RTOS` (or choose your default root drive) and copy ALL of these files and folders to this new folder::

```
C:\TI_RTOS
```

This folder now contains all of the labs and solution files for all architectures supported by this workshop. This is NOT the TI-RTOS SDK that you downloaded earlier. This is the author's set of lab/solution files and all supporting documentation needed for the workshop.

Once unzipped and located at your root directory, expand the list of files/folders and double-check you see this at `C:\TI_RTOS`:

```
C28x
C6000
MSP430
TM4C
Workshop_Admin
Workspace
vars.ini
```
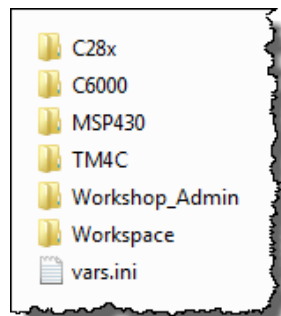
12. Download the latest student guides.

Verify you have downloaded the latest Workshop PDF file (it was on the list of required downloads earlier), as you will be referring to this throughout the workshop. If you are only taking the first two days of the workshop (TI-RTOS Kernel), your PDF is located here:

TI_RTOS_Workshop_Student_Guide.pdf

If you are a 4-day C6000 student, the first two days are covered by the PDF listed above. However, days 3 and 4 are located in a separate PDF document here:

C6000_Embedded_Design Workshop_Student_Guide.pdf

Install TI-RTOS SDK

13. Install your new TI-RTOS SDK.

In a previous step, you downloaded the TI-RTOS SDK for your architecture. It is now time to install this package.

Double-click on the `.exe` file and install the TI-RTOS SDK to:

`C:\TI`

The SDK installer will attempt to also install XDC tools if you don't already have the proper version. If it wants to install it, let it. If it says "you already have the latest", then say "ok". Again, these package installs are doing their best to MATCH the proper tools sets together which is a huge benefit.

Warning – some users decide to place these tools in another folder besides `C:\TI`. Yes, you can make CCS "discover" the right path, but it doesn't often find it correctly which causes all sorts of problems in the labs. They are fixable – just a waste of precious in-class time. So, PLEASE do yourself and others a favor and install these tools in `C:\TI`.

After installation, use Windows Explorer to make sure it installed properly.

Install xWare For Your Target – C6000 and C28x

MSP430 and Tiva-C users can skip the next two steps…

This class requires driver libraries to set up clocks, interrupts, timers and peripherals like GPIO to blink LEDs on the board. You were asked previously to download your specific target's driver library – it is now time to install it.

14. C6000 and C28x USERS ONLY – install your driver library now.

MSP430 and Tiva-C users have their driver libraries contained inside the TI-RTOS SDK download. However, C6000 and C28x users need to install their driver libraries because they are NOT contained (yet) in the TI-RTOS SDK download.

In a previous step, you downloaded the installer for your xWare:

- C28x users downloaded the latest ControlSuite

- C6000 users downloaded the latest MCSDK

Please install this library at `C:\TI` if you haven't already done so. If you already have this library on your laptop – and it is the LATEST version, just leave it alone.

Make Sure All Tools (Min) are Installed Properly

15. **Comment regarding CCSv6.0 vs. CCSv5.5 (or older).**

    As stated earlier, CCSv6.0 or newer is a REQUIREMENT for this workshop. All labs have been tested against CCSv6.0.0/6.0.1 and the stock tools they use plus the TI-RTOS SDK tools for each architecture along with the other mentioned tools.

    If you are still using CCSv5.5 or earlier, you will have problems in the labs.

    The MIN configuration is CCSv6.0 with the following BIOS tools installed:

    - XDC 3.30.01.25, BIOS 6.40.01.15, UIA 1.04.00.06

    First, XDC is installed along with CCSv6.0+. All TI-RTOS SDKs include BIOS and UIA as sub products in the packages. The later TI-RTOS packages (ver 2.00.02.36 and later) include newer versions of BIOS and UIA – that's fine. Just let the SDK install along with possibly XDC and you'll be ready for the labs.

    As of April 2015, the workshop was upgraded to use the following versions of tools:

    - CCSv6.1.0.00104

    - TI-RTOS ver 2.12.00.24 for MSP430 & MSP432 devices

    - TI-RTOS ver 2.10.01.38 (for Tiva and C2000), ver 2.00.01.23 for C6000

    - XDC ver 3.30.6.67_core

    - all of the latest compilers as of 12/01/14 for every architecture

16. **Open CCS and allow auto-discovery of all new tools installs.**

    After installing all of the new tools, you need to open CCS (again) and allow the auto discovery tool to FIND these new tools and install them into CCS. CCS auto discovery paths are typically set for `CCS_INSTALL_PATH` plus `C:\TI`. The author has witnessed CCS NOT auto discover every new tool the FIRST time CCS is invoked. Simply run CCS, allow auto discovery to run, then close CCS and re-open it again to see if it discovers any new tools the second time. ***Warning***: If you put tools in folders other than `C:\TI`, your mileage may vary.

    At this time, you can also check to make sure your license is working properly via *Help →
    Code Composer Studio Licensing Info*.

    FYI – at the beginning of the workshop, you will be given a USB key that has some videos on it related to your architecture. If you get done with a lab and the optional lab before others (you're one of those fast people), you can take some time to watch some selected architecture videos. If you think you're one of those people, double make sure you bring headphones with you to class.

    Having optional labs and videos available helps the faster users get more out of the lab time vs. twiddling their thumbs waiting for others – of course, you could also just check email or call your boss to tell him/her how wonderful and valuable this workshop has been !

That's it. You're done.