

PhyCORE-OMAP44XX Compact 7 Quickstart PD12.x

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1 Introduction

The Quickstart document is intended as a startup guide for working with the Windows Embedded Compact 7 Board Support Package (BSP) for the phyCORE-OMAP44XX platform. This BSP provides a fundamental software platform for development, deployment, and execution on the phyCORE-OMAP44XX.

1.1 Quickstart Overview

The QuickStart contains instructions for:

- Host Setup
- Board Setup
- Building a BSP
- Flashing Images

1.2 System Requirements

The following components included in the phyCORE-OMAP44XX Compact 7 Rapid Development Kit are necessary for completing the instructions in the Quickstart:

- phyCORE-OMAP44XX System on Module
- phyCORE-OMAP44XX Carrier Board
- AC adapter supplying 12 VDC adapter, center positive
- Ethernet patch cable
- Serial Cable (RS-232)
- PHYTEC Kit CD
- Windows Compact 7 Evaluation Kit (includes a 90-day evaluation version of Microsoft Visual Studio 2008)

Optional:

- LCD (LCD014, LCD017, LCD017_104S)
- SD Memory Card, 2GB non SDHC recommended

1.3 Technical Support

PHYTEC Rapid Development Kits are backed by a Startup Guarantee. Free technical support for the Quickstart such as host or board setup, installation, image building, and deployment is available by contacting support@phytec.com.

Technical support packages are available for purchase for more in-depth questions beyond the scope of the Quickstart by contacting sales@phytec.com.

2 Getting Started

2.1 Host Setup

Complete host setup including tool installation and unpacking of required files is the first step in beginning development.

The phyCORE-OMAP44XX has been developed and tested under Windows 7 Professional with Service Pack 1 (x 64). The desktop PC used for development needs to be running Windows 7 Professional or Ultimate with Service Pack 1 (x32 or x64). Please remove any previous versions of Windows CE and Visual Studio prior to the install process.

2.1.1 Tools Installation

Visual Studio 2008 with Service Package 1 and Windows Embedded Compact 7 Platform Builder make up the software tools required. Platform Builder provides an integrated development environment with tools for building, developing, downloading, and debugging Windows Embedded Compact 7 OS Designs in Visual Studio.

The install must be in the following order:

1. Visual Studio 2008
2. Service Package 1 (SP1)
3. Windows Embedded Compact 7 Platform Builder

The RDK provides an evaluation of both Visual Studio 2008 and Windows Embedded Compact 7 Platform Builder. Otherwise, these components as well as SP1 may be downloaded and installed from Microsoft:

Component	Download location
Visual Studio 2008	http://www.microsoft.com/windowseembedded/en-us/downloads/download-windows-embedded-compact-ce.aspx
Windows Embedded Compact 7 Platform Builder	http://www.microsoft.com/windowseembedded/en-us/downloads/download-windows-embedded-compact-ce.aspx
Service Package 1 (SP1)	http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=10986

2.1.1.1 Visual Studio 2008

Install Visual Studio 2008 on the host PC by inserting the DVD labeled **Visual Studio 2008 Professional Edition** included with the Rapid Development Kit into the DVD ROM drive. The setup should launch automatically. If not, open a *Windows Explorer* window, go to the DVD drive, change to the directory *VS* and start **setup.exe** manually.

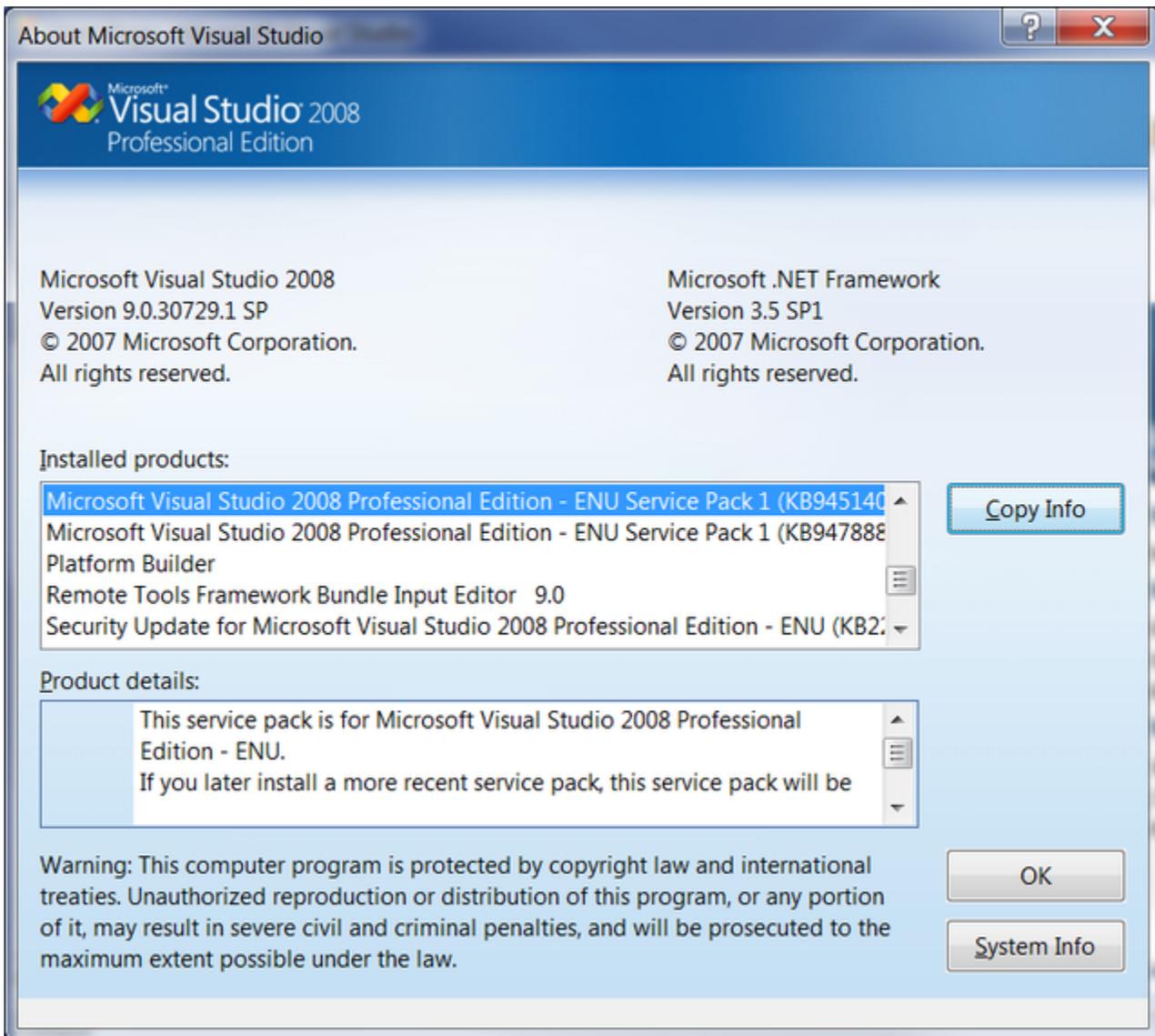
Select *Install Visual Studio 2008* to continue through instructions for program setup. Requests for product activation keys may be made to Microsoft and requires an MSDN subscription.



2.1.1.2 SP1

Service Pack 1 (SP1) may be installed at this point from the reference link provided [\[here\]](#). Service packs as well as other installed products are viewed in Visual Studio 2008 via the About Microsoft Visual Studio. Installation of Service Pack 1 can be validated:

1. In Visual Studio 2008 go to Help -> About Microsoft Visual Studio
2. Under Installed products: find Microsoft Visual Studio 2008 Professional Edition – ENU Service Pack 1 (KB945140) KB945140
3. Product details: for more information on the installation

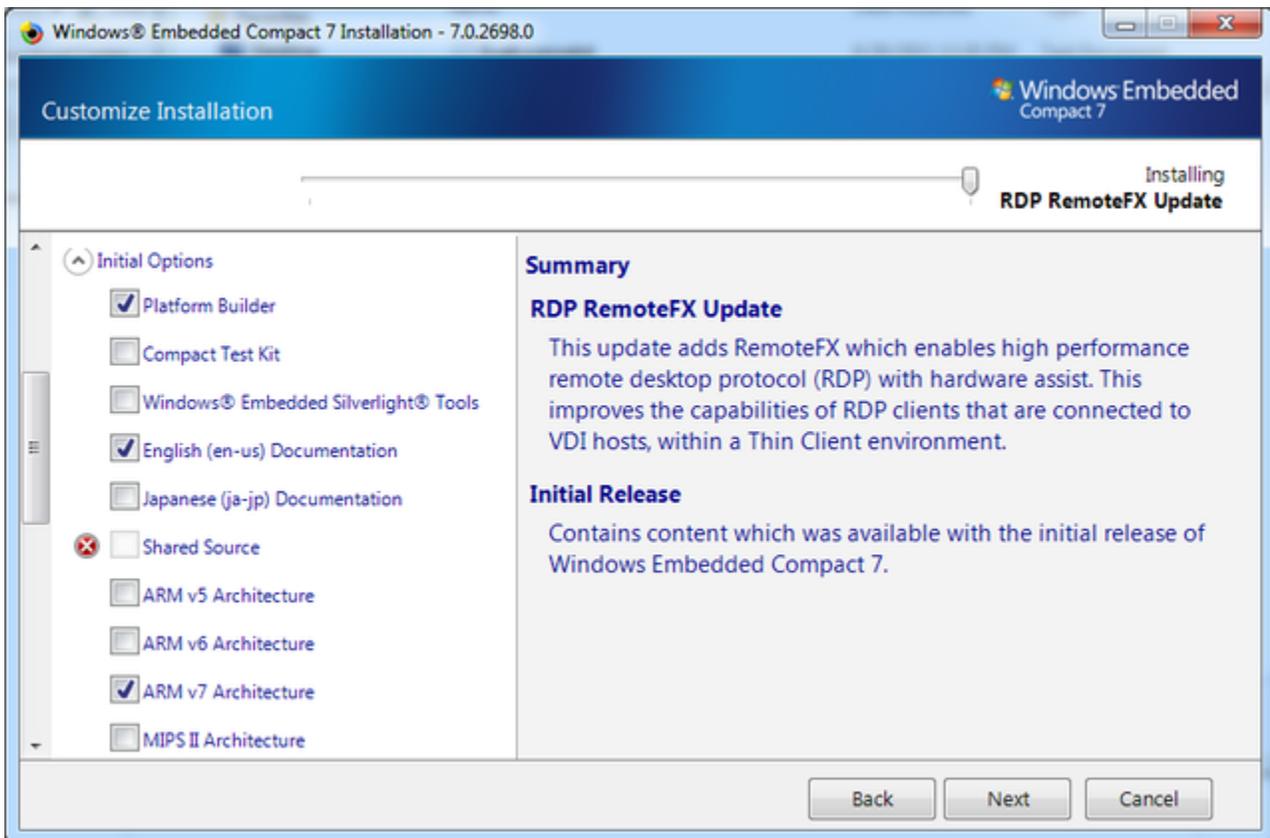


2.1.1.3 Windows Embedded Compact 7 Platform Builder

To install the Platform Builder Snap-in for Visual Studio 2008, insert the DVD labeled **Windows Embedded Compact 7** included with the Rapid Development Kit into the DVD ROM drive. The setup should start automatically. If not, open a *Windows Explorer* window, go to the DVD drive and start **setup.p.exe** manually.

When completing the instructions, be sure to select *Custom Install* over *Full Install* to eliminate support for unneeded processor architectures, therefore, reducing the amount of disk space from 51.36GB to 10GB. Similarly, this will limit updates to only those necessary, directly correlating to shortened update time. In this case, the selection of the *ARM v7 Architecture* is required and can be modified at any point in the following way:

1. Go to Program Features (*Control Panel -> Programs -> Program Features*)
2. Highlight *Windows Embedded Compact 7* from the list of installed programs
3. Select *Change*
4. In *Customize Installation*, select *Modify*
5. Select/Deselect from *Initial Options* based on specific needs

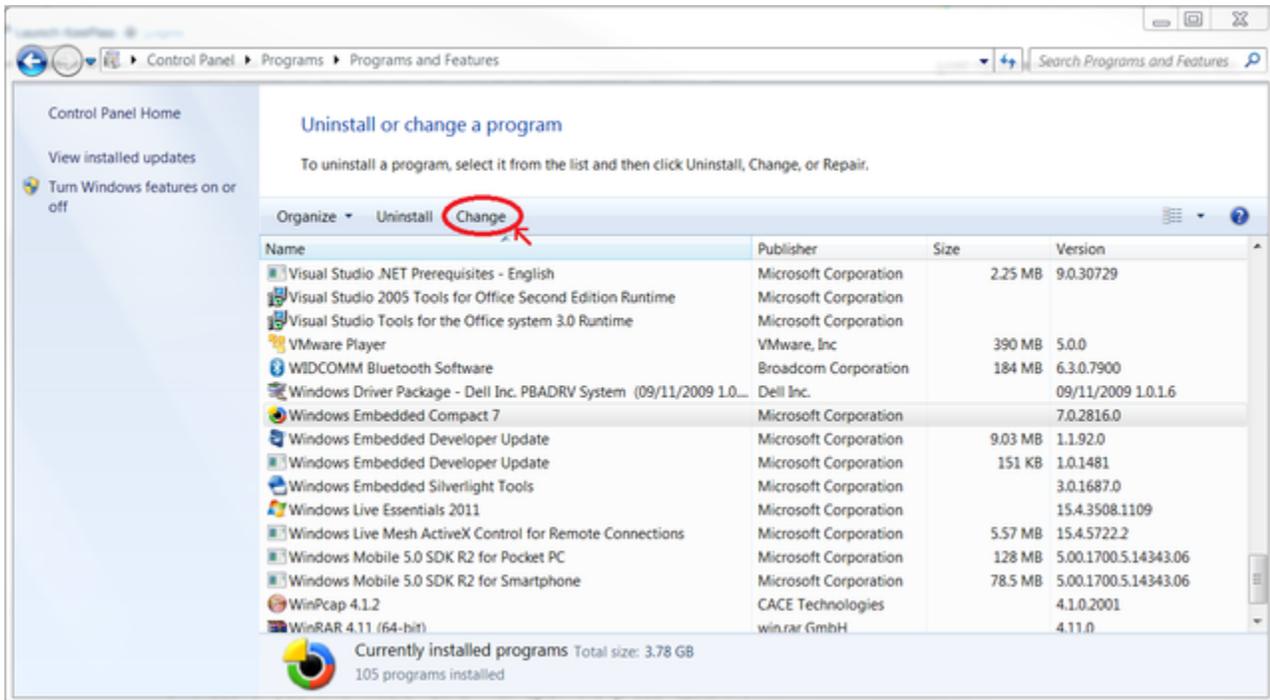


Update Tool for Platform Builder

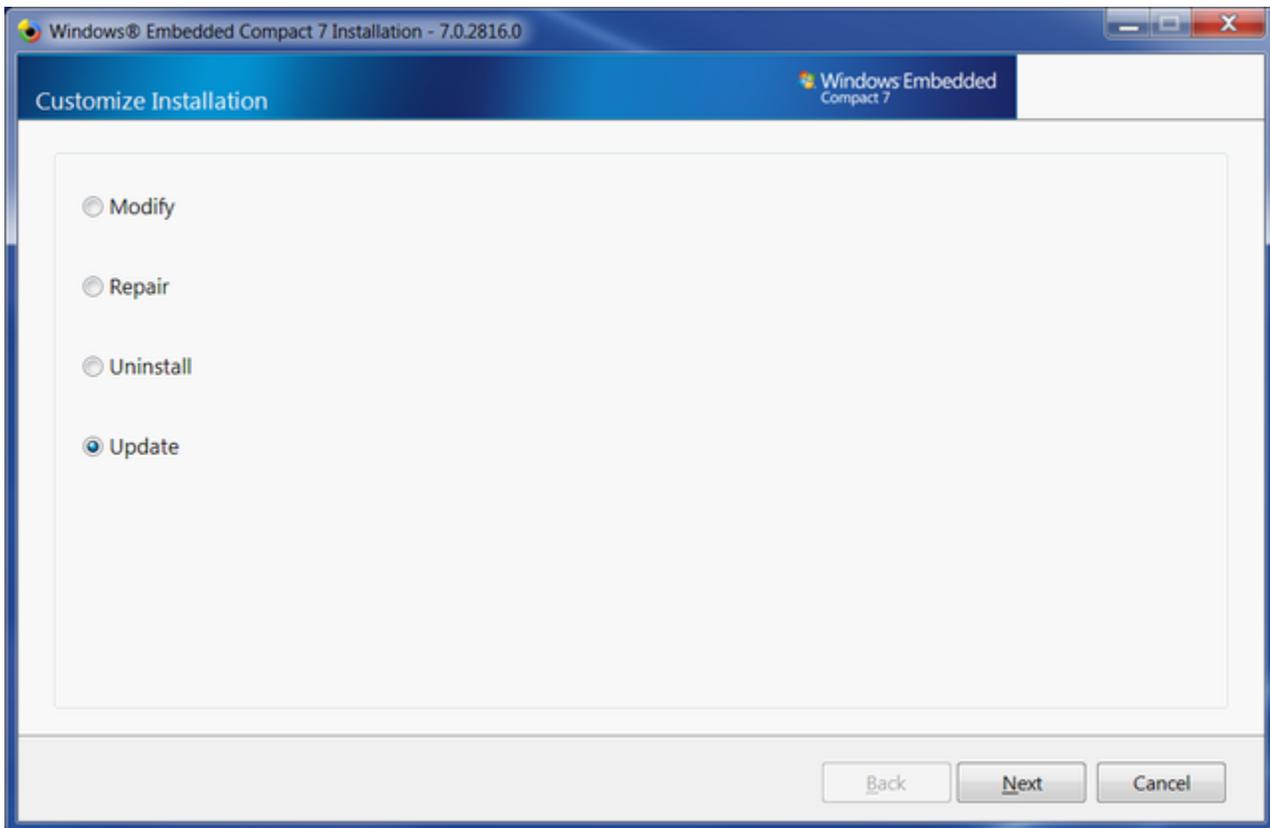
Windows Embedded Developer Updates (WEDU) is a helpful tool to receive notifications for new updates in Visual Studio. The process of manually checking for, installing, and configuring updates is simply replaced by an Add-in to the *Tools* menu, installed through the Compact 7 toolkit.

These updates can be setup and configured through Windows Embedded Compact 7. To apply registration, automatic configuration, and updates the Windows Embedded Compact 7 installer must be accessed:

1. Go to Program Features (*Control Panel -> Programs -> Program Features*)
2. Highlight Windows Embedded Compact 7 from the list of installed programs
3. Select *Change*

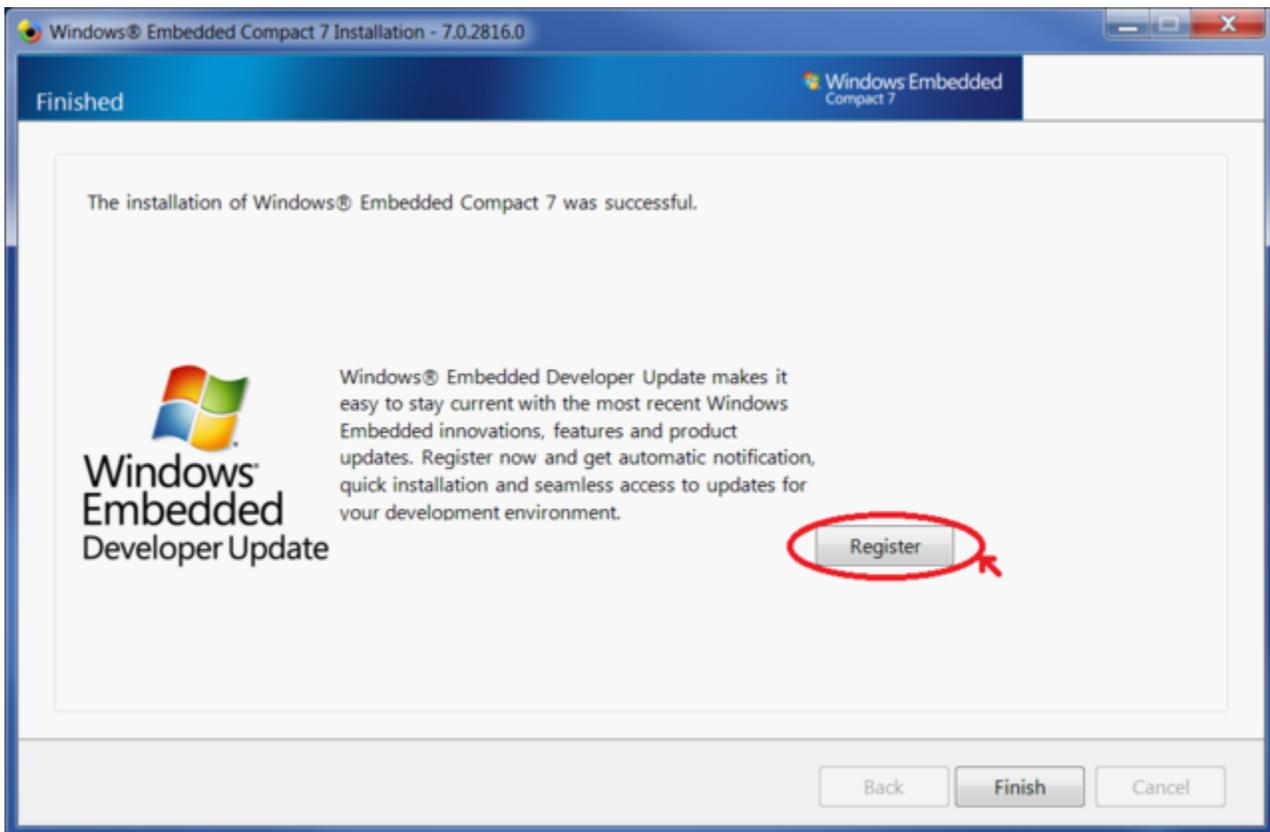


By selecting *Update*, the installer provides a walk through for registration, update configuration, and execution of updates.

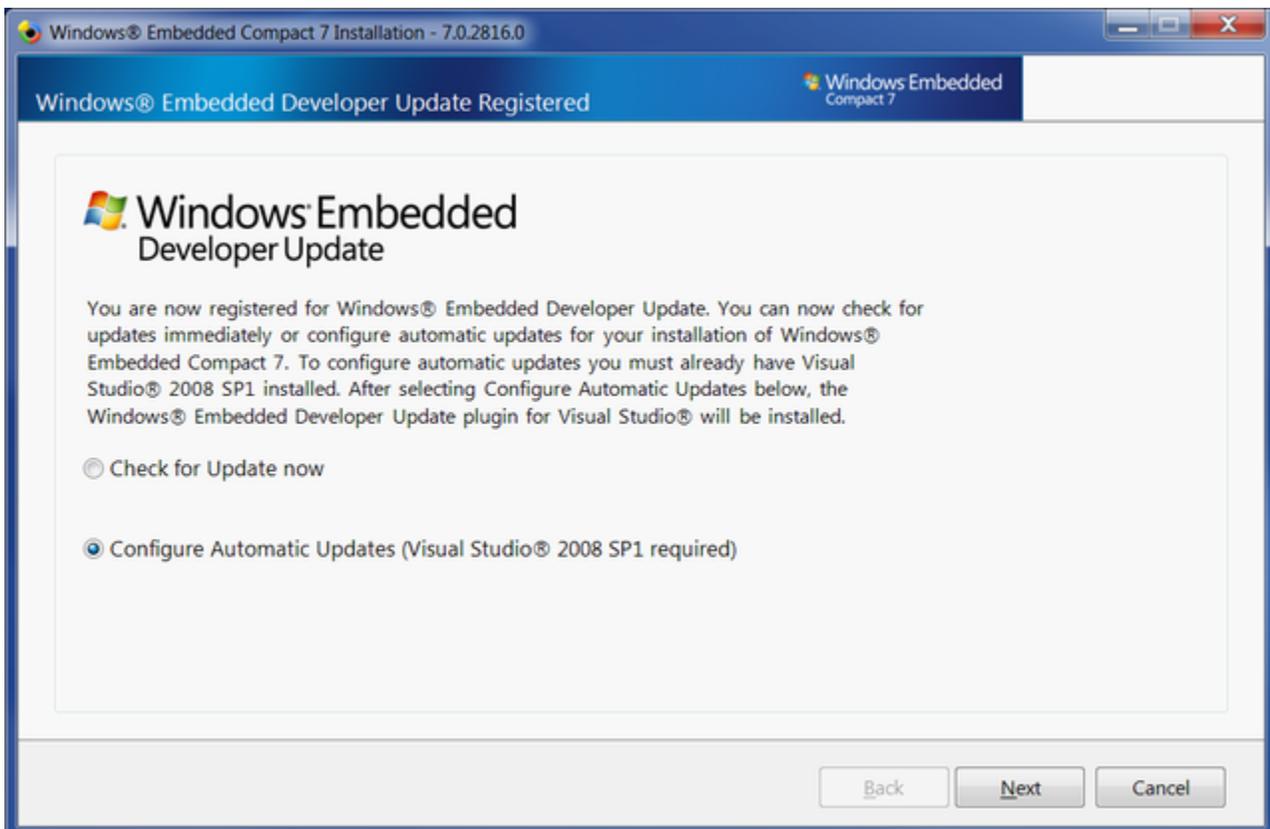


Registration is required to receive automatic notification, installation, and simple access to updates with WEDU. The registration process most likely was done during the initial installation of Windows Embedded Compact 7. However, if registration has yet to be completed, the installer provides the option to:

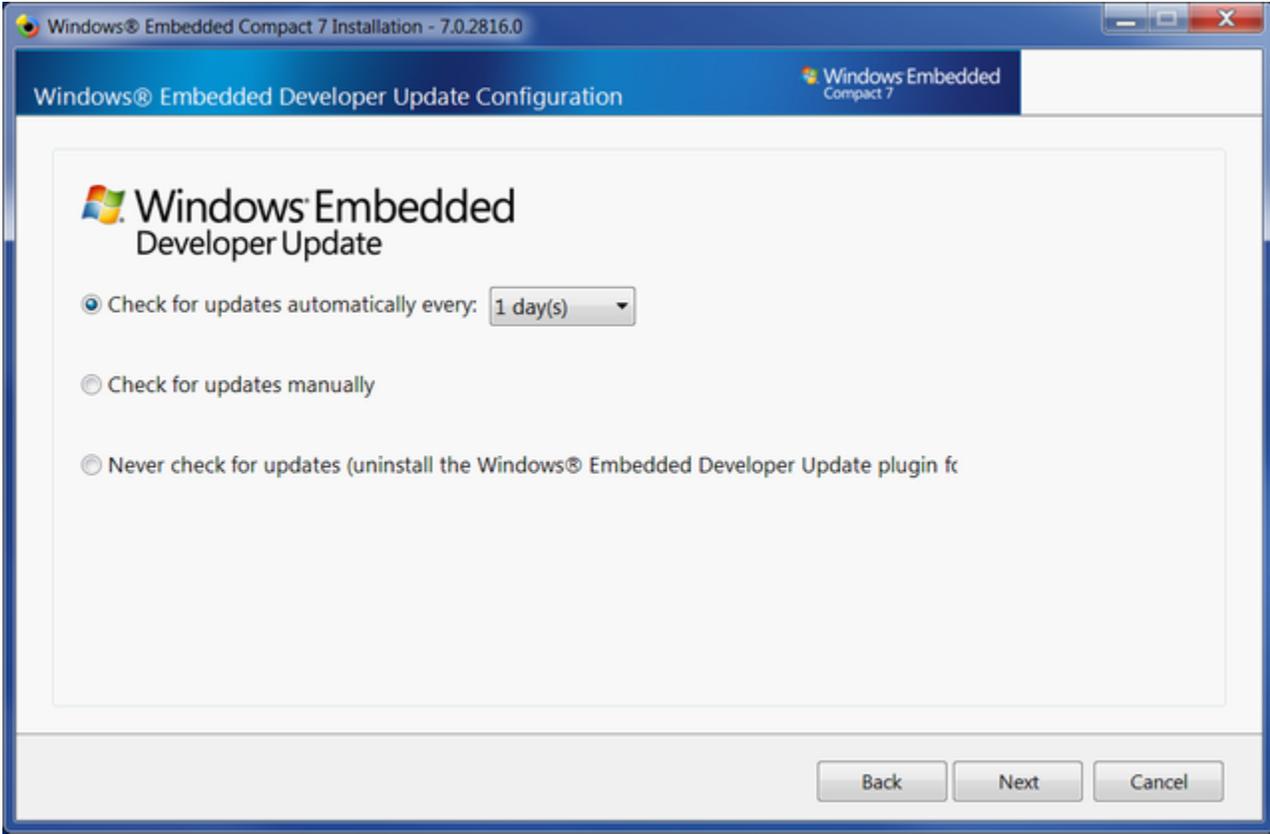
1. Select *Register*
2. Complete all required fields in the registration form
3. Select *Finish*



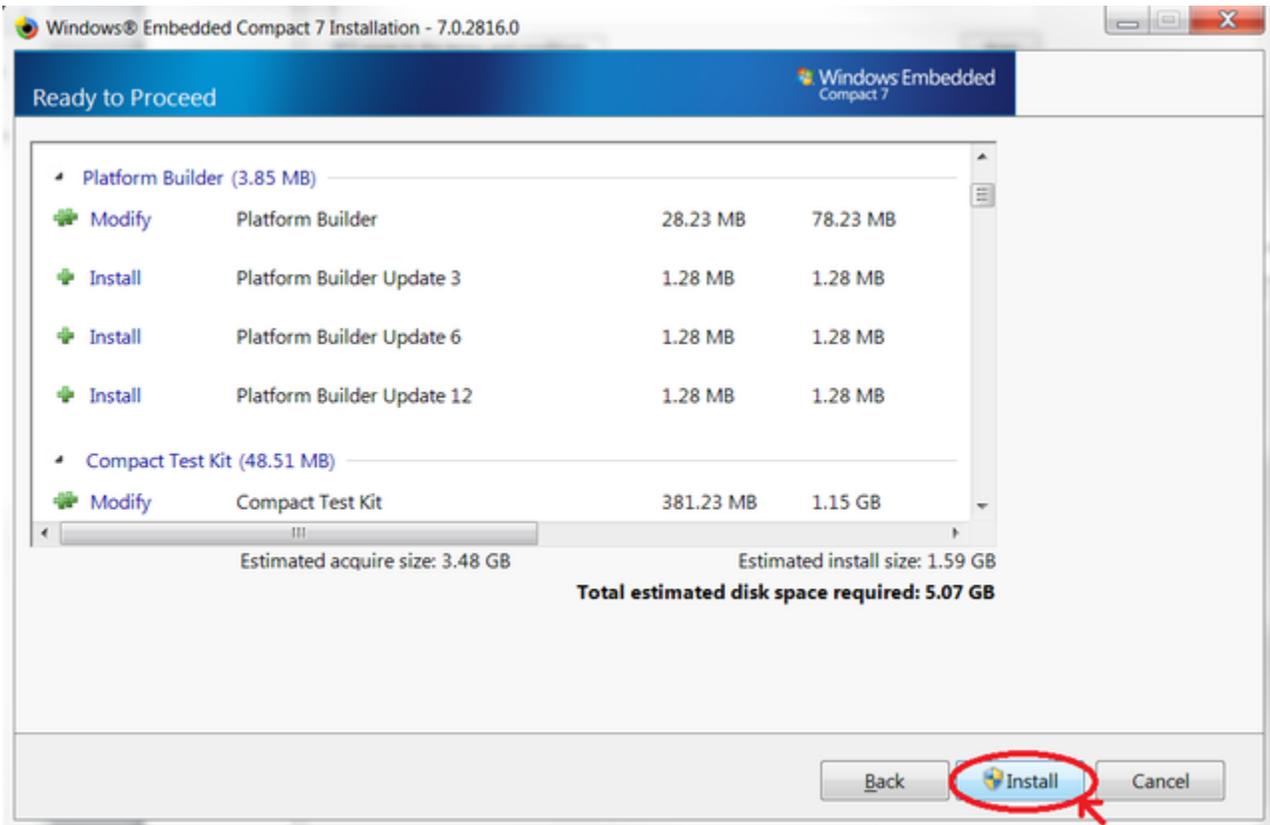
WEDU can be configured to automatically apply updates after registration. Select *Configure Automatic Updates (Visual Studio 2008 SP1 required)* to not only turn on or off automatic updates, but install the Windows Embedded Developer Update Add-in for Visual Studio 2008 that can be accessed via the **Tools** menu.



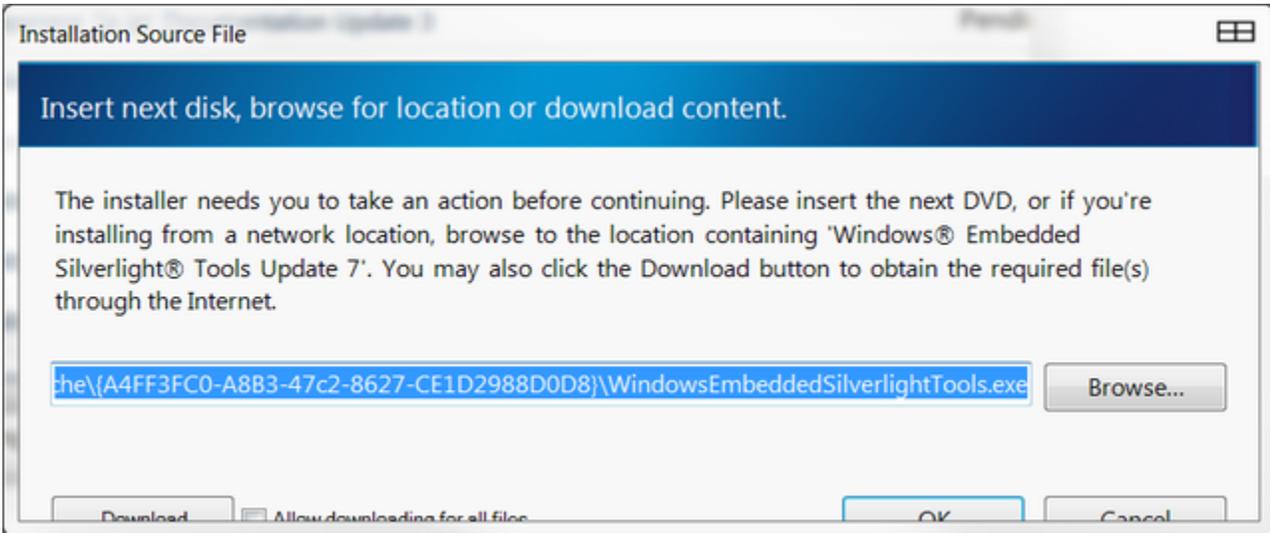
From the options, WEDU can be tailored to specific requirements, in this example *Check for updates automatically every:* is selected with the drop down menu choice of *1 day(s)*.



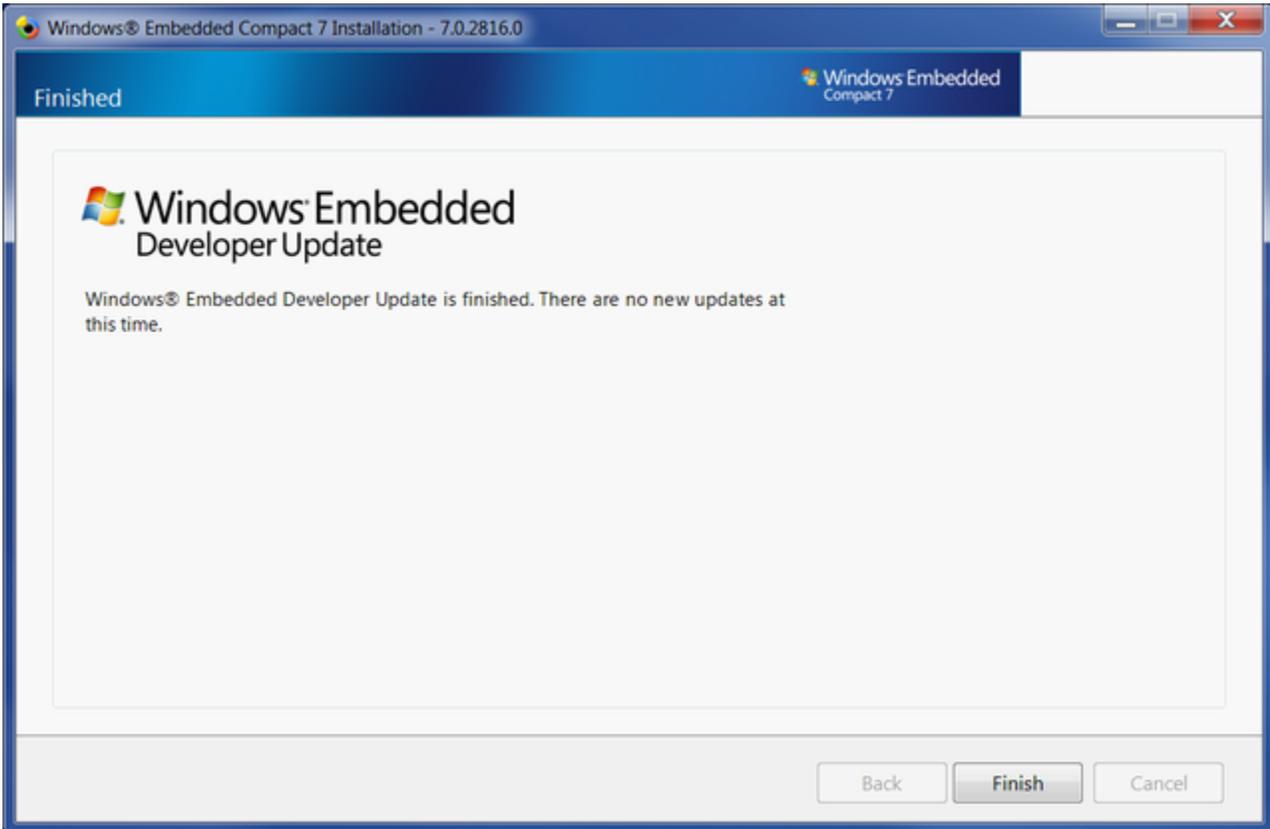
The Windows Embedded Compact 7 Installer will check for modifications and updates, after reviewing the proposed alterations, select *Install*.



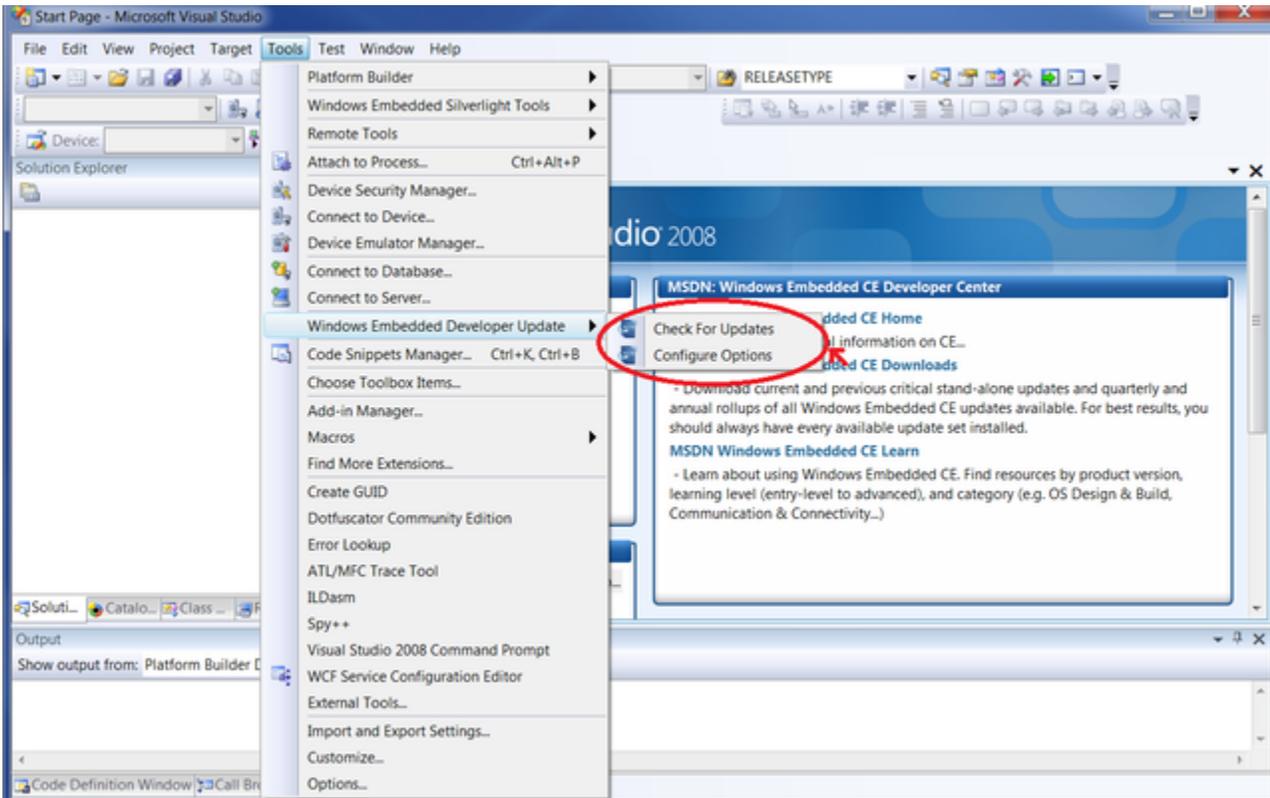
The installation source file is needed to perform current and subsequent updates, based on installation preferences insert the installation disk, browse to the location containing the update, or select *Download* to acquire the requested files from the Internet.



Acquisition and install make up the two part update process, upon successful update, *Finish* can be selected.



Updates can be automated or performed manually in Visual Studio 2008 (SP1 required) by the WEDU Add-in, *Tools -> Windows Embedded Developer Update*. *Check for Updates* and *Configure Options* are used for manually performing an update check and modification to existing update configuration options, respectfully.



2.1.2 File Installation

The phyCORE-OMAP44XX BSP can be installed by the executable file, the current version is labeled Phytec_OMAP4_Compact7.exe, on the PHYTEC FTP [\[here\]](#).

By installing the files to C:\WINCE700 directory directly, there is potential to overwrite binaries used by other BSPs. Therefore, it is recommended to install to an alternate directory such as C:\Phytec\OMAP44XX, back up existing files, and manually copy necessary files.

The following gives a general overview of each file system with corresponding directory location and description:

Files	Location	Description
OMAP4Phytec	WINCE700\Platform	Sample BSP, adapts the OS to phyCORE-OMAP44XXhardware
OMAP4Phytec_Demo	WINCE700\OsDesigns	Sample OS Design for phyCORE-OMAP44XX
phyCORE-OMAP4430_SDK	phyCORE-OMAP44XX_CE7_SDK.msi	Sample SDK, set of libraries for developer to link without access to the OS design

The files, either Source or Binary, can be unpacked in the following way:

1. Move the top-level directory WINCE700\Platform\OMAP4Phytec and all its subdirectories and files to C:\WINCE700\Platform
2. Move the top-level directory WINCE700\OsDesigns\OMAP4Phytec_Demo and all its subdirectories and files to C:\WINCE700\OsDesigns
3. If Binary directories were unpacked and modules will be added that are built against the BSP, install the phyCORE-OMAP4430_CE7_SDK . Accept the default installation path of C:\Program Files (x86)\Windows CE Tools\SDKs\phyCORE_OMAP4430_SDK.



2.2 Board Setup

Power and host-PC connections to the target device as well as preparation of external media devices such as a SD Memory Card must be made. The hardware manual, included with the Rapid Development Kit, may be referred to for specific connection and location information.

2.2.1 Power

The primary input power for the phyCORE-OMAP44XX Carrier Board comes from the wall adapter jack, X6. Upon application of power, LEDs D14 - D17 should light up (green) and initial serial data will be sent by UART3 (top connector P1). The Carrier Board provides options for a warm reset or system power ON/OFF without the removal of the power source through push buttons S7 and S3, respectively.

2.2.2 Serial

A serial connection is used as system communication for boot-up interaction throughout start-up and as a monitoring/debugging interface. This connection is made between the Host and UART3, top connector P1 on the phyCORE-OMAP44XX .

The following provides a summary of the serial settings required to allow console access over the serial port in a communications program on the host such as [PuTTY](#):

Setting	Value
Bits per second	115200 bsp
Data bits	8-bits
Stop-bit	1
Flow Control	None

2.2.3 Ethernet

The Ethernet connection is used for flashing, downloading, and debugging images and applications. Connect the cross-over Ethernet cable to the Ethernet connector on the target (X9) and appropriate network card on the host. LINK (green) and SPEED LEDs (yellow) on the connector verify the connection.

2.2.4 SD Memory Card

A SD Memory Card that is properly formatted, holds the correct files, and inserted on the Carrier Board at SDMMC1 (X11) can be used to boot the BSP. This is accomplished by using the provided prepsd.bat tool:

1. Insert the SD Card into the host machine
2. Open a command prompt with administrator privileges
Right-click *Start->All Programs->Accessories->Command Prompt* and select *Run As Administrator*
3. Format the SD Card using 16k allocation units and set the partition to bootable for inserted SD Card (J: is the volume used in the following example).

```
prepsd.bat J: 16k
```
4. Copy the files, from the correct directory to the SD Memory Card, Binary/SDCard_\$(LCDModel) (where \$(LCDModel) is LCD014, LCD017, LCD017_104S), in order:

MLOebootsd.rawboot.cfgNK.bin

1. Properly eject the SD Card from host system
2. Insert the SD Card into the SDMMC1 (X11) slot of the Carrier Board

Note: prepsd.bat is a personal script, if executed a user is at their own risk

2.3 Booting

The bootloader, one of the key software components included in the BSP, completes the required hardware initializations to download and run operating system images. The initial bootstrapper, bootloader, and NK make up the three software components needed to boot Windows Compact 7.

The RDK comes with binary images preinstalled. To update the images, the newly built as described in [Section 3.3](#) or the default located on the PHYTEC America FTP [[here](#)] can be used. Refer to the [Flashing Images](#) section for information on how to flash these images.

2.3.1 Initiating and Restarting Boot

The boot process is initiated by powering on or resetting the device as described in [Section 2.2.1](#). A power on or reset will start the ROM Bootloader (located in the OMAP44xx itself) and it will attempt to load the XLDR (MLO) from a prioritized list of locations. The default configuration of the RDK would have the order of NAND, then SDCard. For further configuration details see [Section 2.3.3](#).

Booting may need to be restarted for access to the EBOOT configuration menu [Section 2.3.3.1](#) to change current settings or to refresh broadcasted 'BOOTME' messages in the connection establishment between Platform Builder and the target device, [Section 2.4](#).

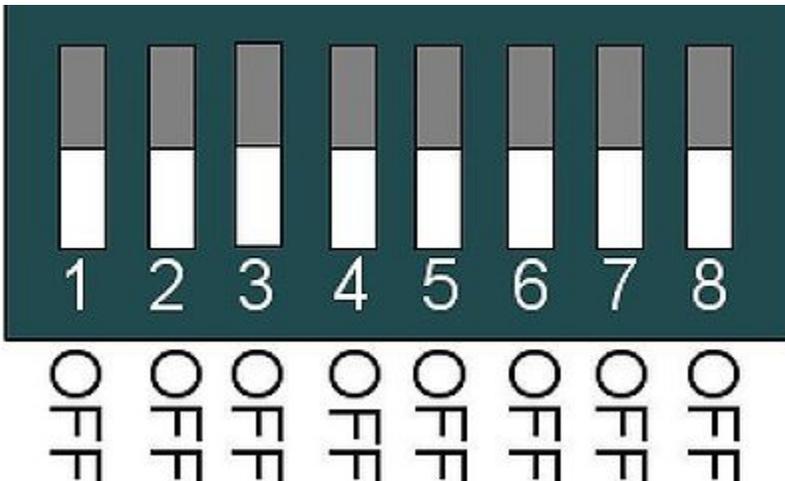
2.3.2 Boot Mode

The boot mode, selected from the S5 dipswitch on the Carrier Board, determines the location of where the MLO is loaded from. The media-specific version of MLO will determine where EBOOT is loaded from.

2.3.2.1 NAND Boot

To boot from NAND, using the following switch settings:

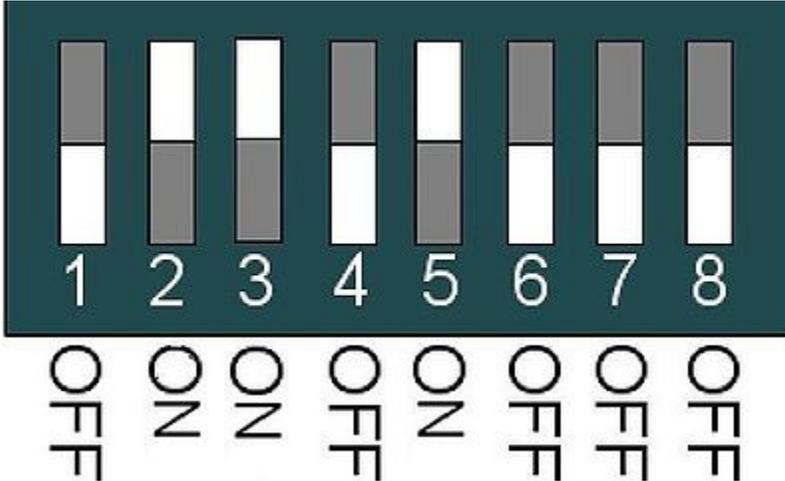
S2-1 to S2-8 OFF



2.3.2.2 SD Card Boot

The SD Memory Card must be formatted and marked bootable as described in [Section 2.3.1.4](#). To boot from SD Memory Card use the following switch settings:

S2-2, S2-3, and S2-5 ONS2-1, S2-4, S2-6 to S2-8 OFF



2.3.3 EBOOT

Loaded by MLO, EBOOT is used for downloading and launching the Operating System image (NK.bin. by default). EBOOT provides a default boot configuration as well as a method of setting that configuration and in some instances, modifying the media it supports.

2.3.3.1 Configuration Menu

By default, EBOOT gives five seconds to enter the configuration menu, in which the space key must be pressed. The wide variety of functions EBOOT provides in the configuration menu is given by the following:

- [1] Show Current Settings
- [2] Select Boot Device
- [3] Select Debug Device
- [4] Network Settings
- [5] eMMC Utilities
- [6] Set Device ID
- [7] Save Settings
- [0] Exit and Continue

2.3.3.2 Booting Options

The location of where NK.bin should be loaded and executed from is determined by EBOOT. If the configuration menu is not entered, the default environment will be used to continue the boot process. However, entering the EBOOT configuration menu allows the user to select the boot device and modify the default environment:

A variety of boot device selections is provided by EBOOT. For the Quickstart, two of the boot device selections are used, *LAN911x Ethernet* and *NK from external SD slot*. The boot device selection can be modified by:

1. Start the bootloader
2. Enter the configuration menu by pressing space at boot up
3. Select EBOOT menu item [2] to enter the Select Boot Device menu
4. Make boot device selection by entering the number corresponding to choice
 - Enter 1 for LAN911x Ethernet to download an image over Ethernet
 - Enter 6 for NK from external SD slot to download SD Card image
5. Select EBOOT menu item [7] to Save Settings

2.4 KITL Connection

The Kernel Independent Transport Layer (KITL) is an interface for device communication through debug message services, kernel debugger support, target control, release directory file system, and remote tools.

The KITL connection between the device and Platform Builder is made available over Ethernet. When the KITL output is enabled, to have a successful boot, there must be an association between the target device and Platform Builder. A one-time initial establishment between Platform Builder and the target device must be done. Thereafter, the connection will then be recognized for target attachment by selecting the proper device.

2.4.1 Create a KITL Connection

For a particular device, a KITL connection must be created once. This two part setup is done by adding a new device specific to the target in a Platform Builder target developed solution file and establishing a connection by responding to the bootloader network broadcasted 'BOOTME' messages, as outlined by the following:

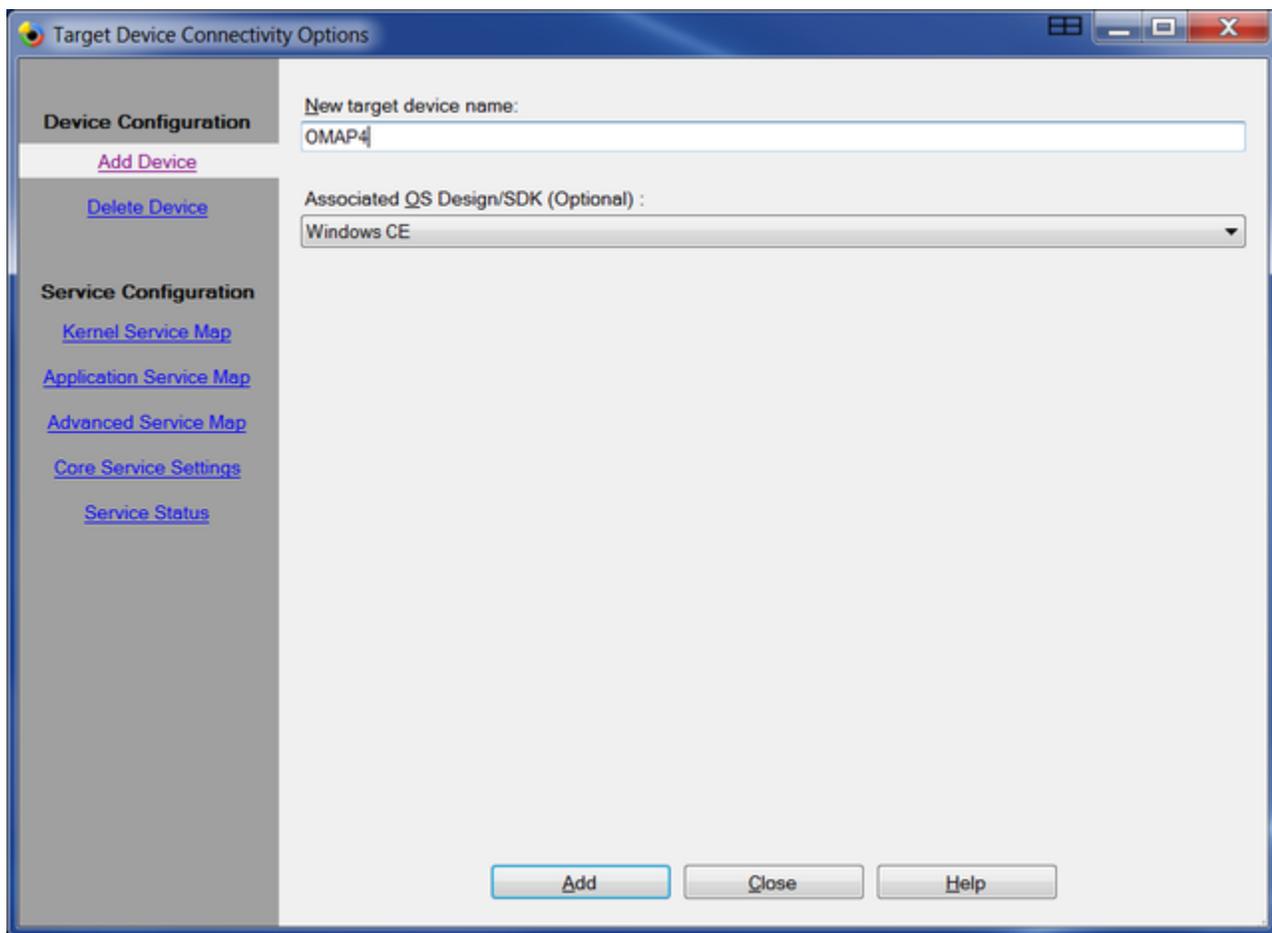
Open Target Developed Solution File In Visual Studio, open a target developed solution file, such as the default NK.bin included in the Rapid Development Kit Binaries:

1. In Visual Studio, go to *File->Open Project/Solution*
2. Browse to the SDCard directory that matches the LCD Panel Binary/SDCard_{\$LCDModel} (where {\$LCDModel} is LCD014, LCD017, LCD017_104S)
3. Under, Binary/SDCard_{\$LCDModel}, select NK.bin (where {\$LCDModel} is LCD014, LCD017, LCD017_104S)

Add Device

A new device must be added for the phyCORE-OMAP44XX in Platform Builder through the *Target Device Connectivity Options dialog box*.

1. In Platform Builder, go to *Target->Connectivity Options*
2. Select *Add Device*
3. Type *OMAP4* for the *New target device name*
4. Select **Windows CE** for the *Associated OS Design/SDK*
5. Click *Add*



The *Kernel Service Map* property settings for the newly created *OMAP4* device should be set to the following:

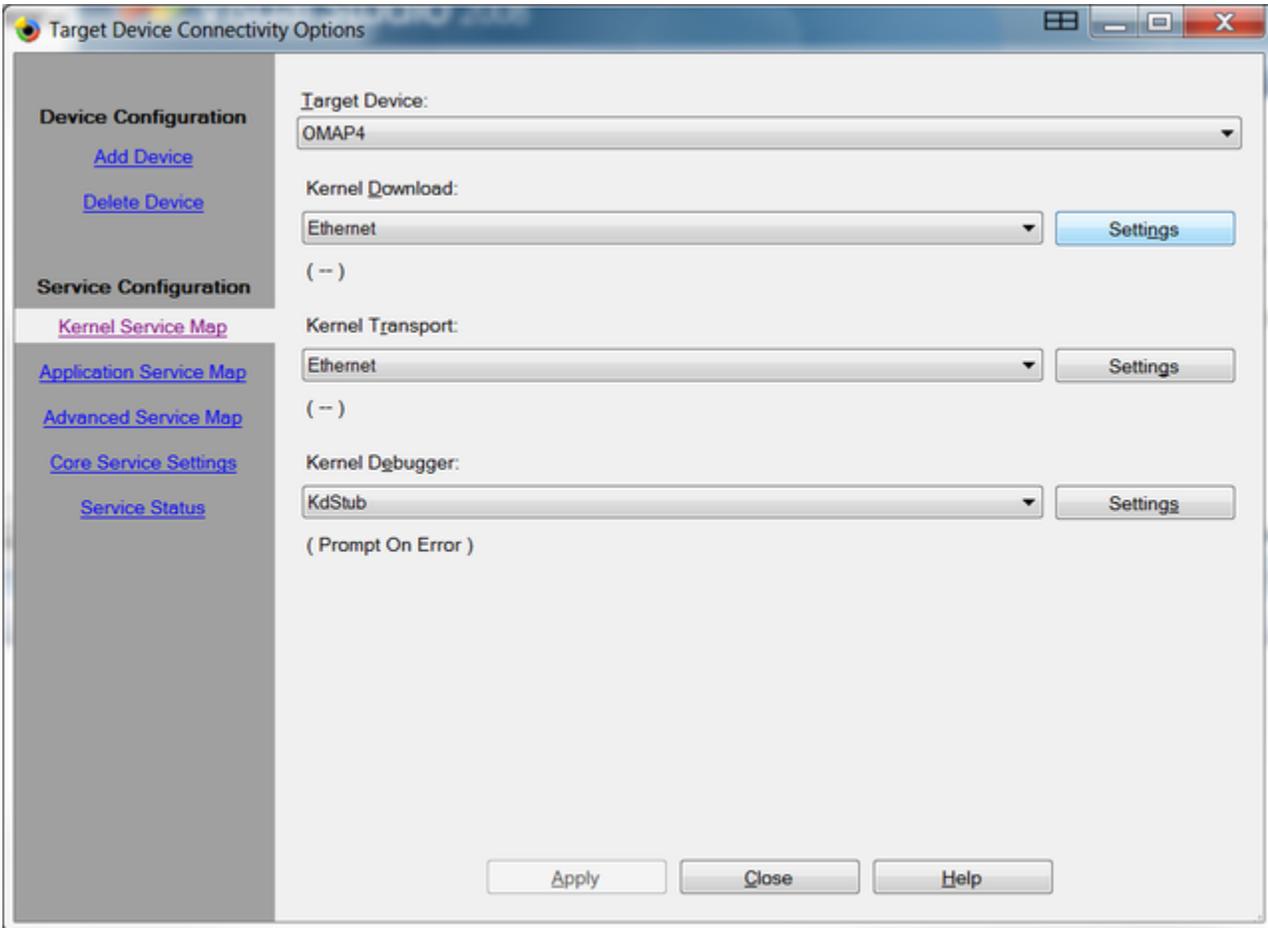
Property	Selection
Kernel Download	Ethernet
Kernel Transport	Ethernet
Kernel Debugger	KdStub

Communication Link Setup

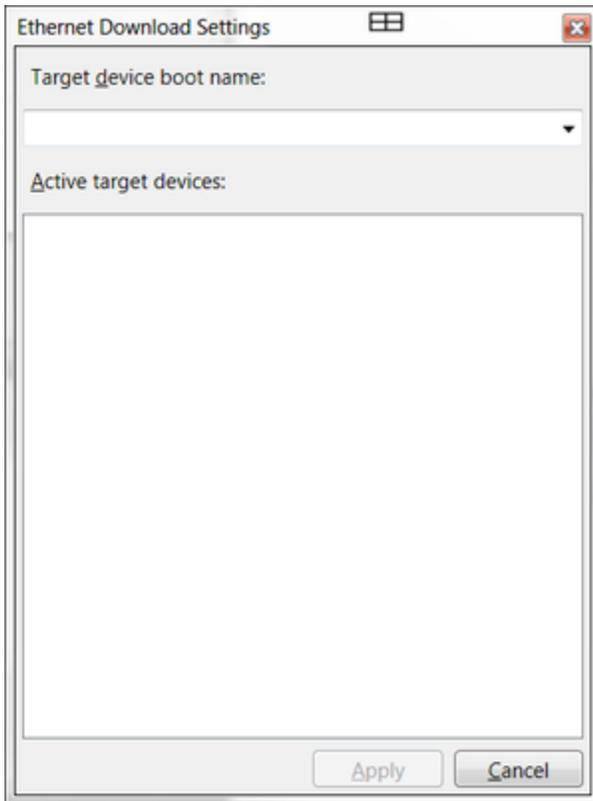
A communication link is created upon acknowledgement in Platform Builder of a target device's bootloader broadcast of 'BOOTME' messages over the network. Therefore, to establish a connection, Platform Builder must be in a listening state while EBOOT is in the proper configuration to broadcast.

The Ethernet Download Settings window is used to view Platform Builder and device connectivity state, this window is opened in the following way:

1. With *OMAP4* selected as the *Target Device* in the *Target Device Connectivity Options* dialog window
2. Click Settings of Kernel Download: Ethernet to open the Ethernet Download Settings window

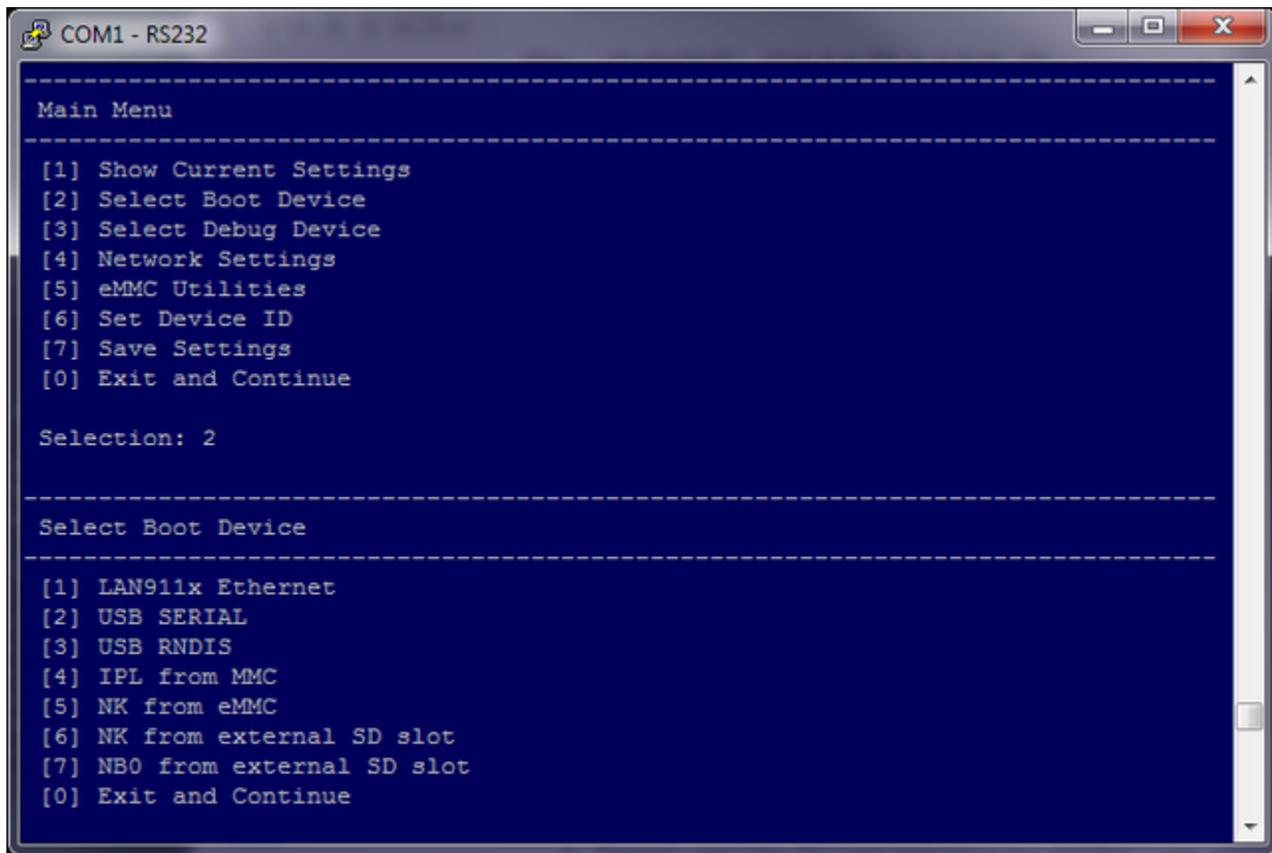


Keep the *Ethernet Download Settings* window open, acting in a listening state it will remain empty waiting for a 'BOOTME' message as a request from EBOOT on the target device.



Broadcast 'BOOTME' messages over the network from the target device:

1. Boot the target device and enter the EBOOT configuration menu, as described in [Section 2.3](#)
2. Using the serial console in the EBOOT Configuration Main Menu, enter *[2]* to *Select Boot Device*
3. Enter *[1]* to select *LAN911x Ethernet*
4. Enter *[0]* to Exit and Continue



```
COM1 - RS232
-----
Main Menu
-----
[1] Show Current Settings
[2] Select Boot Device
[3] Select Debug Device
[4] Network Settings
[5] eMMC Utilities
[6] Set Device ID
[7] Save Settings
[0] Exit and Continue

Selection: 2
-----
Select Boot Device
-----
[1] LAN911x Ethernet
[2] USB SERIAL
[3] USB RNDIS
[4] IPL from MMC
[5] NK from eMMC
[6] NK from external SD slot
[7] NBO from external SD slot
[0] Exit and Continue
```

As the serial console displays a series of 'BOOTME' messages, Platform Builder acknowledges the broadcast of the device by adding the device name to Active target devices in the Ethernet Download Settings window. The serial console displays the Device Name prior to issuing 'BOOTME' broadcast messages, the Device Name, **SDP4430-61953** matches Target Device Name in Platform Builder.

```

COM1:115200baud - Tera Term VT
File Edit Setup Control Window Help
-----
Main Menu
-----
[1] Show Current Settings
[2] Select Boot Device
[3] Select Debug Device
[4] Network Settings
[5] eMMC Utilities
[6] Set Device ID
[7] Save Settings
[0] Exit and Continue

Selection: 0
INFO: Invalid (or out of date) args structure, using defaults
+LAN911xInit(0x10000000, 0x10000000, 0x80000030)
LAN9118: Chip Id 9221 Revision 0
Auto Negotiation done
-LAN911xInit(mac = 50:2d:f4:02:f2:01, rc = 1)
INFO: Boot device uses MAC 50:2d:f4:02:f2:01
INFO: *** Device Name SDP4430-61953 ***
+EbootSendBootmeAndWaitForTftp
Sent BOOTME to 255.255.255.255

```

Ethernet Download Settings

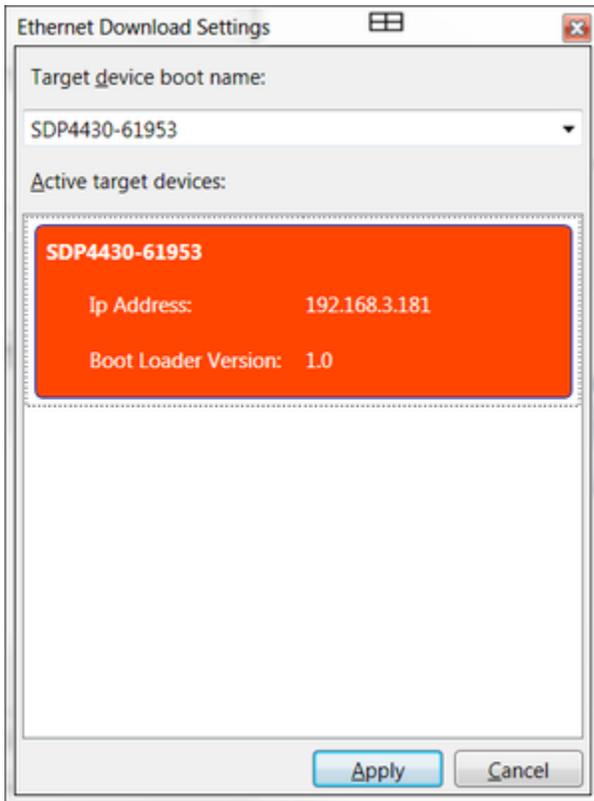
Target device boot name:

Active target devices:

SDP4430-61953

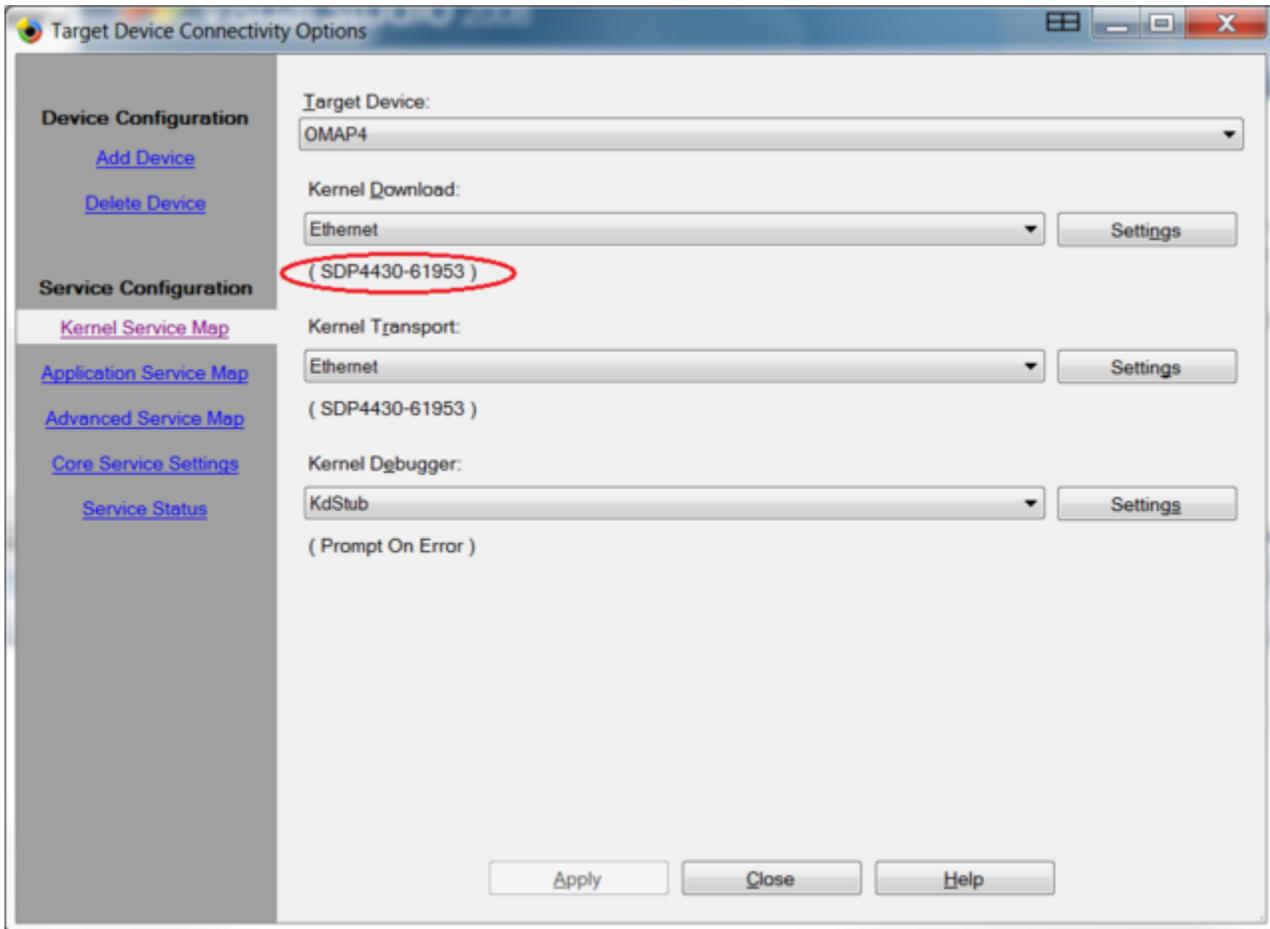
Apply Cancel

By highlighting the device, additional information including the IP Address and Boot Loader Version will be displayed. By clicking *Apply*, the communication between Platform Builder and the target device will be finalized.



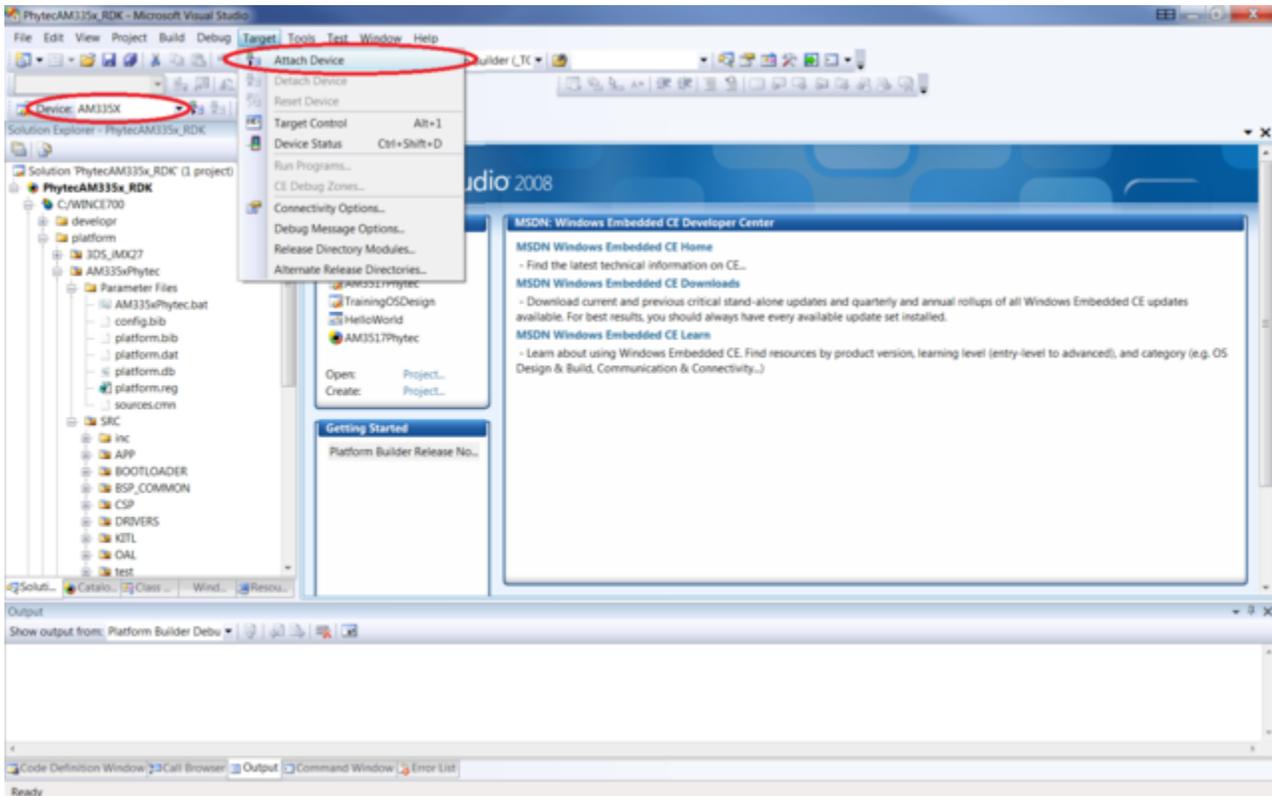
2.4.2 Verify Connection

With Platform Builder and the device being associated, any KITL connection to the board (Debug output, debugger, test transport, etc) will work. The connection to a device can be verified in the Target Device Connectivity Options window (*Target -> Connectivity Options*). With OMAP4 selected as the Device, the target boot name associated with the device will be present:

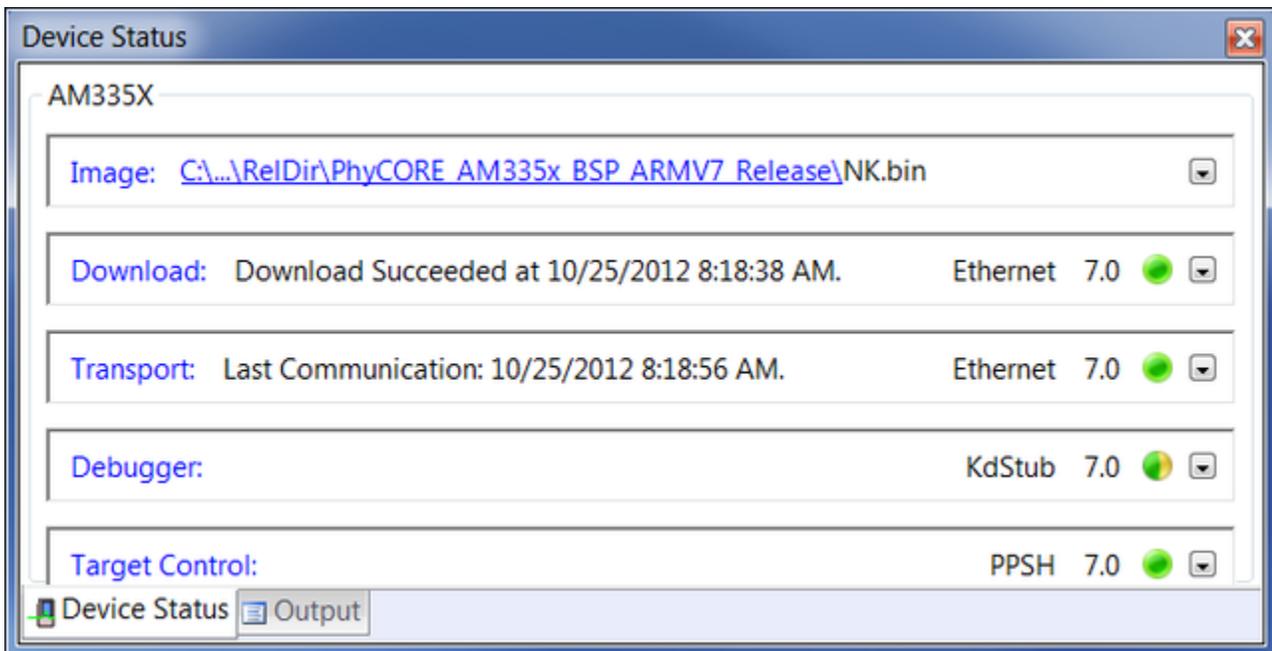


2.4.3 Attach Target

Having established and verified a KITL connection, Platform Builder can be connected to a target device. This connection between Platform Builder and the device must be made when images are to be downloaded or to successfully boot when the KITL output is enabled. In Platform Builder, with *OMAP4* selected as the device, simply select *Attach Device* or go to *Target->Attach Device*.



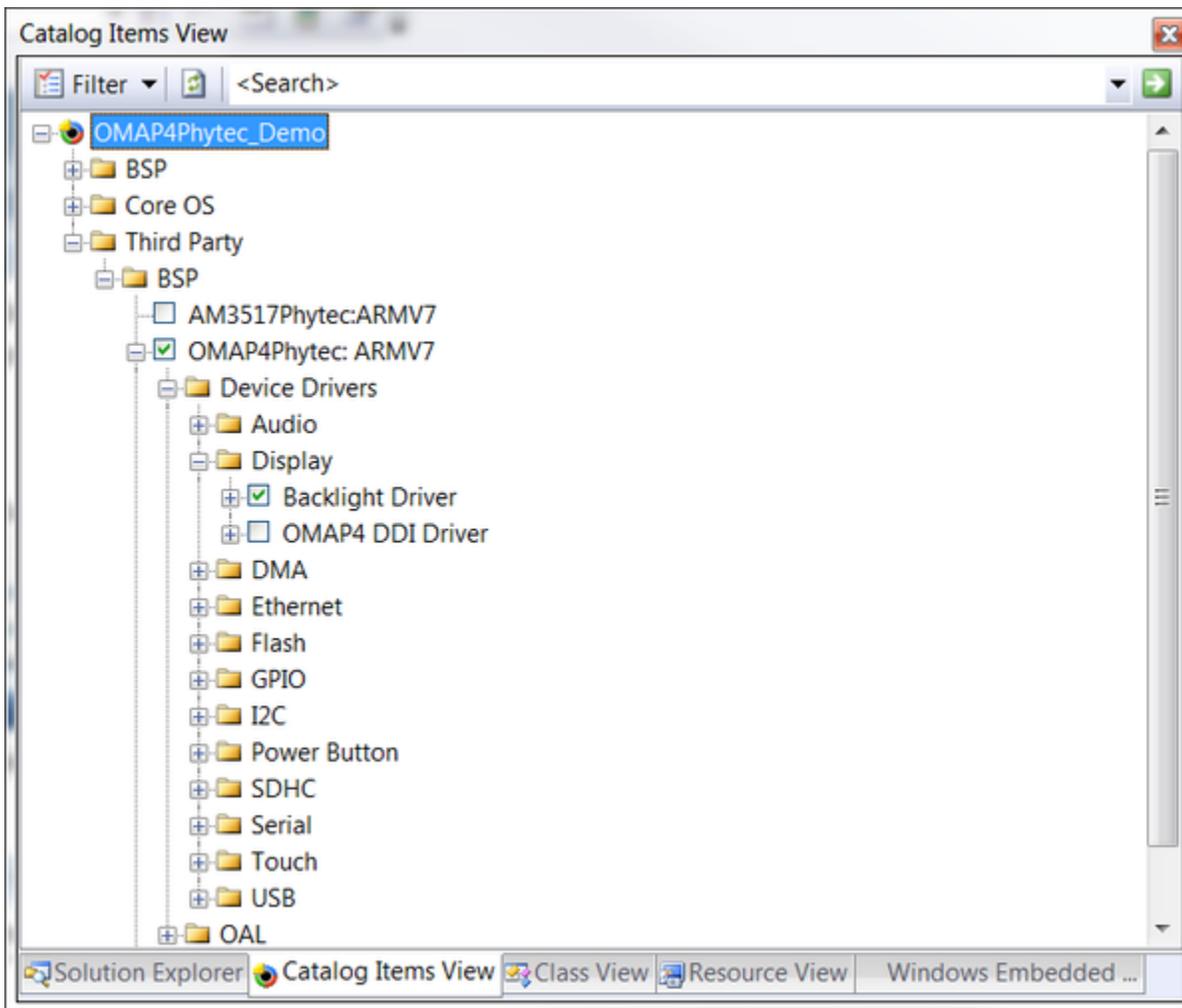
The Device Status window can be used to monitor the connection between Platform Builder and the target device. The window should open automatically following the attachment of the target, otherwise, in Platform Builder go to *Target->Device Status*.



3 Building a BSP

The sample OS Design included with the development kit allows demonstration of how to work with Platform Builder to build a custom BSP solution for the phyCORE-OMAP44XX. The OS images generated using Platform Builder as NK.bin files can be downloaded to a device as described in [Section 2.3](#) by a KITL connection, setup in [Section 2.4](#).

3.1 OS Design Setup



3.3 Building the OS Design

The OS Image can be built by performing a **Sysgen** on the solution; done by *Build->Build Solution*.

A **Sysgen** can also be executed via the command prompt, opened from *Build->Open Release Directory in Build Window*:

```
blddemo -q
```

A full build is expected to take 20-30 minutes, this estimate will vary depending on the OS features and Host performance. For future modifications to the same sample OS Design, a full Sysgen is not required and taking advantage of optimized build options specific to modifications will shorten the build time.

The files generated can be found in C:\WINCE700\OsDesigns\OMAP4Phytec_Demo\OMAP4Phytec_Demo\RelDir under the build configuration selected.

3.4 Creating a new SDK for an OS Design

A new SDK is necessary when modifications are made to the sample OS Design to allow headers and libraries for the OS configuration to be up-to-date for application development.

The SDK can be created as a MSI file after a fresh build by the following:

1. Select *Project->Add New SDK* with current OS configuration opened in *Visual Studio's Solution Explorer*
2. Complete relevant sections to label and name resulting SDK MSI installer file
3. Find the newly created SDK in Visual Studio's Solution Explorer
4. Right Click and select Build

SDK1 Property Pages

Creating a new SDK for an OS Design

General

SDK Name: Phytec_OMAP4430_SDK

Product Name: PCM-049 phyCORE-OMAP44xx

Product Version: Major: 11 Minor: 1 Build: 1

Company Name: PHYTEC America LLC

Company Website: phytec.com

OK Cancel Apply

SDK1 Property Pages

General

Install

License Terms

Readme

CPU Families

Development Language

Additional Folders

Emulation

MSI Folder Path: C:\WINCE700\OSDesigns\OMAP4Phytec_Demo\OMAP4Phytec_Demo\SDKs\SDK1\MSI

MSI File Name: Phytec_OMAP4430_SDK.msi

Locale: U.S. English

OK Cancel Apply

After exiting the project and uninstalling any previous SDK's, the new SDK can be installed by running the MSI file, the installation should be similar to that of [2.1.2](#).

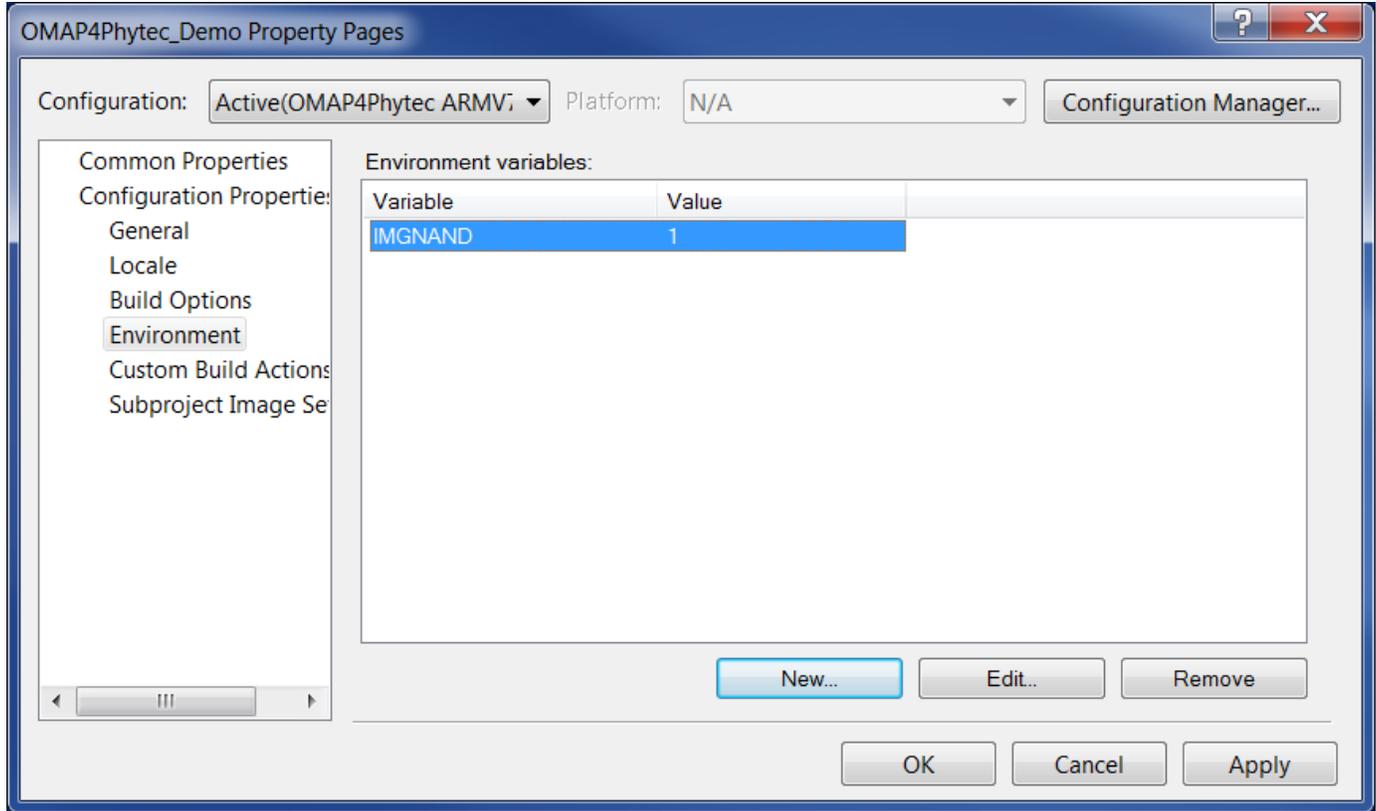
4 Flashing Images

The three software components, MLO, EBOOT, and NK needed to boot Windows Compact 7, if modified will have to be updated in NAND Flash.

4.1 Building Images to be Flashed

The build environment must be modified to allow flashing. Flashing files to NAND, in Visual Studio/Platform Builder, assuming the OS has already been built, is done by setting the environment variable IMG NAND=1 and making a Run-Time image. To build under this configuration:

1. In Visual Studio/Platform Builder, go to *Project->Properties->Configuration Properties->Environment*
2. Set the IMG NAND environment variable equal to 1 (IMG NAND = 1)
3. Select *Build->Make Run-Time Image*



This can also be done via the command prompt, opened from *Build->Open Release Directory in Build Window*, and executing:

```
set IMG NAND = 1
makeimg
```

The images created are located in the Release Directory, as mentioned in [Section 3.3](#) and include:

File	Name
x-loader	xldrnd.bin
bootloader	ebootnd.bin
OS	NK.bin

4.2 Flashing NK.bin

NK.bin can be burned to NAND Flash with Platform Builder or SD Memory Card using file built in [Section 4.1](#). By downloading NK.bin to the device with either Platform Builder or SD Memory Card, as described in [Section 2.3.4.2](#), the bootloader will automatically program NK.bin into NAND flash.

4.3 Flashing Bootloaders

The initial bootstrap loader and bootloader can also be flashed to NAND by a combination of SD Card booting and Platform Builder image downloading:

1. Boot the OS from SD Card as described in [Sections 2.3.3.2](#) and [2.3.4.2](#)
2. In Platform Builder, go to *Project->Properties->Configuration Properties->General*
3. Select either xldrnd.bin or ebootnd.bin, built in [Section 4.1](#), from the Target file name for debugger drop down menu.
4. Boot the system, connect to the device, and download the image

