

Getting Started

With Windows CE and the Topaz i.MX25 Development Kit

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1 Introduction

This document describes how to get started with application development and will take you through the following subjects:

- How to install the development environment so you can successfully develop applications for Windows Embedded CE 6.0 R3 running on the Topaz platform
- How to flash your Windows Embedded CE 6.0 R3 image¹ to the Topaz
- How to create, deploy and debug a simple managed application
- Where to get more information

The Topaz development kit comes with a pre-installed Windows CE image that will automatically run when you power up the board. You can power the board through the provided power adapter or by connecting a mini USB (type B) connector. Note

that powering the Topaz through USB may not work (especially with a large LCD), depending on the amount of current your PC (or powered hub) can deliver. It is therefore recommended to always power the Topaz using a dedicated 5V power supply.



Figure 1 - Mini USB Type B

It is important to check your device is running the latest version of the Windows CE image. GuruCE will release new images containing new features and bug fixes when needed. The latest version can always be found at this link: <http://guruce.com/topaz/release/latest>

For instructions on how to upgrade the firmware in your device please read “Upgrading the firmware” below.

2 Software Requirements

2.1 Windows Embedded CE Application Development

If you are developing an application targeting Windows CE 6.0 R3 running on the Topaz board you need:

- **Visual Studio 2008 with Service Pack 1**
Download the evaluation version from <http://msdn.microsoft.com/en-us/vstudio/default.aspx>
- **Windows CE 6.0 R3 Topaz SDK**
Download from <http://guruce.com/topaz/release/latest>

¹ Please refer to the “Topaz BSP User Guide” for information on how to create a custom OS Design for the Topaz platform.

2.1.1 Important Installation Notes

For a successful installation you need to follow this exact sequence when installing the above items:

1. Install Visual Studio 2008
2. Install Visual Studio 2008 Service Pack 1
3. Install the Topaz SDK²
 - a. Double click on the SDK installer file (TopazSDKrXXX.msi where XXX is the release version number).
 - b. Simply follow the installation wizard and within a few clicks your SDK is installed.

3 Upgrading the firmware

3.1 Install Topaz Flasher

If your Topaz board is not running Windows CE, or you want to update it to a later version, you can flash the Topaz with new images by following these steps:

1. Download the flash update application from the GuruCE web site (<http://guruce.com/topaz-flasher>)
2. Download the 32-bit or the 64-bit version of the Topaz Flasher (“Topaz Flasher x86.msi” or “Topaz Flasher x64.msi”) depending on your operating system.
3. Run the installer and Follow the installation wizard:

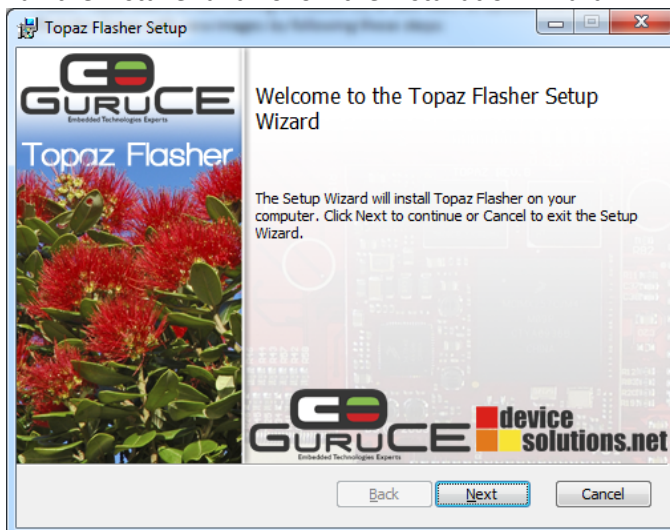


Figure 2 - Welcome Screen

Click “Next” on the “Welcome to the Topaz Flasher Setup Wizard” dialog.

² The SDK is built for use with Visual Studio 2008. Please contact us if you need an SDK built for use with Visual Studio 2005 (see also <http://guruce.com/blogpost/installing-ce-60-sdks-on-systems-with-only-vs2008-installed>). Unfortunately, VS2010 does not support Smart Device Development (yet).



Figure 3 – EULA

Read the GuruCE End-User License agreement. If agreed select the “I accept the terms in the License Agreement” checkbox and click “Next”.

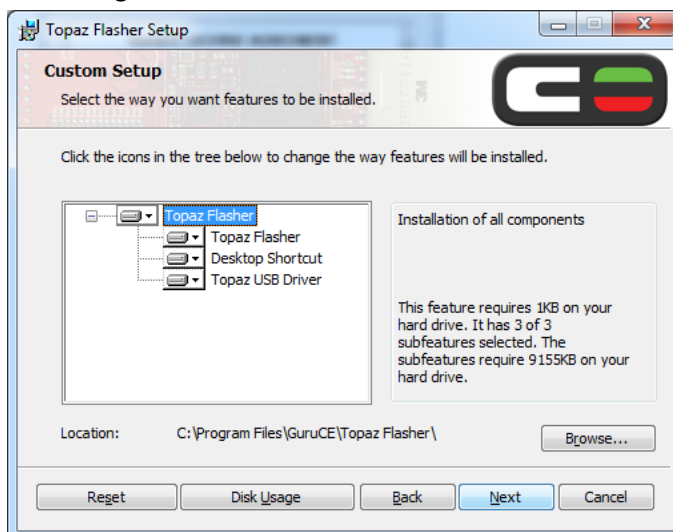


Figure 4 - Custom Setup

Here you can customize the setup procedure. By default all options will be installed (recommended):

- Topaz Flasher
This installs the Topaz Flasher utility.
- Desktop Shortcut
This places a shortcut to the Topaz Flasher on the Desktop for easy access.
- Topaz USB Driver
This is the USB driver that will allow the Topaz Flasher to communicate with the Topaz whilst in “flash mode”.

You can also change the location the Topaz Flasher will be installed to by clicking on the “Browse...” button.

Once you’ve made the selections you like click “Next” to continue the installation procedure.

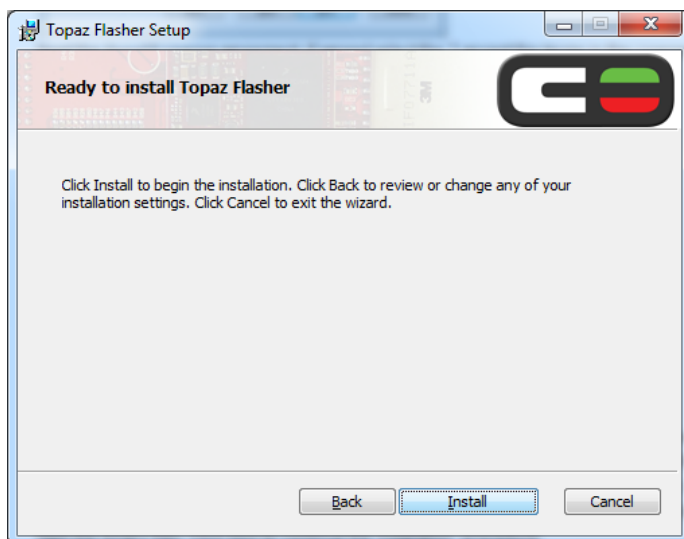


Figure 5 - Ready to install

Click on the “Install” button to start the installation.

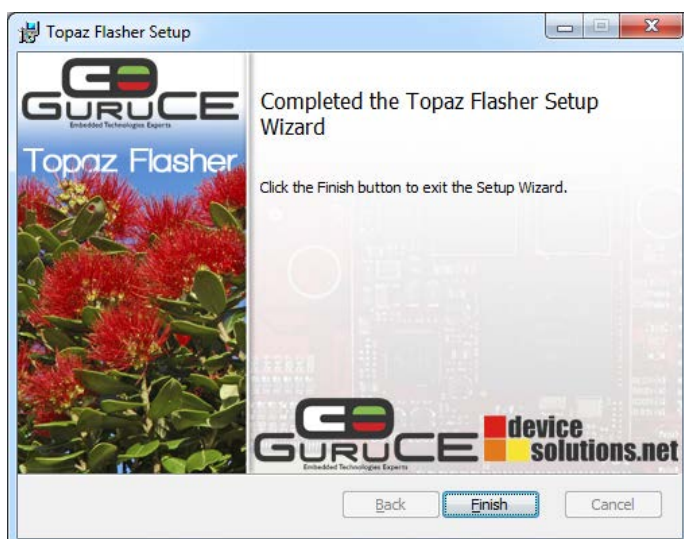


Figure 6 - Setup Completed

Click “Finish” to exit the installation.

3.2 Connecting the Topaz

1. Start the Topaz Flasher Utility
2. If you want to update the firmware on the Topaz development kit you’ll have to put the board in “flash mode”. On the back of the Topaz board you’ll find SW1 which is used to select the boot mode of the Topaz. Set SW1 as follows:

SW1-1 = ON

SW1-2 = ON

SW1-3 = X (don’t care)

SW1-4 = X (don’t care)

Please refer to sections “Boot Mode Configuration” and “Flash Mode” for a more detailed description of SW1.

3. Power the board by connecting a mini USB type B cable to the Topaz board and the PC where the Topaz Flasher utility is running.
4. If this is the first time you connect a Topaz board to this particular USB port, the OS will notify you a new USB device is detected and it should install the correct Topaz i.MX25 driver automatically if you included the “Topaz USB Driver” component when installing the Topaz Flasher (see Figure 4 above).

If you haven't installed the Topaz USB Driver or the Operating System does not automatically install the right driver, point the “Found new hardware wizard” to subfolder “Topaz Driver” in the Topaz Flasher installation folder (usually C:\Program Files\GuruCE\Topaz Flasher\Topaz Driver”.

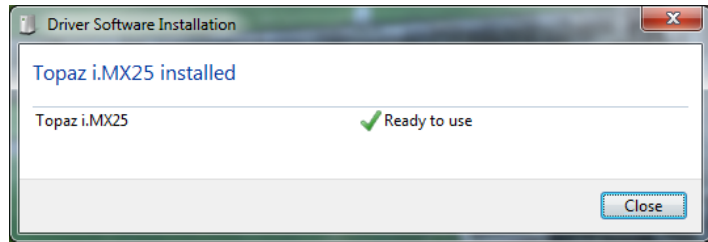


Figure 7 - Driver Software Installation

If the driver is correctly installed the Topaz Flasher utility will now show “Topaz Initialized”:

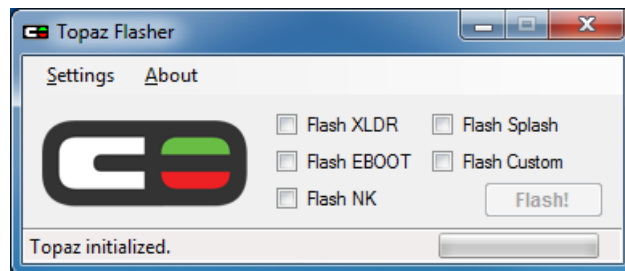


Figure 8 - Topaz Flasher Initialized

3.3 Upgrading firmware

1. Make sure the Topaz board is in flash mode (see “Flash Mode” below)
2. Double click on the Topaz Flasher shortcut created on the desktop or start the Topaz Flasher from the start menu (Start -> All programs -> Topaz Flasher -> Topaz Flasher).
3. The Topaz flasher will wait until a Topaz board is connected through USB:

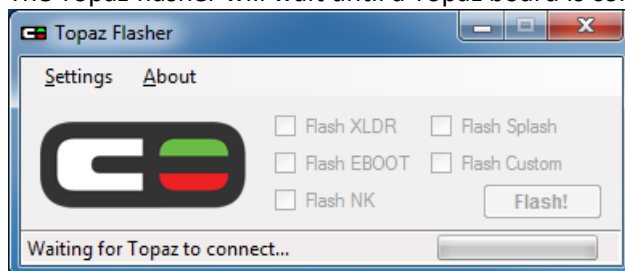


Figure 9 - Topaz Flasher waiting for Topaz

4. If the USB cable wasn't already connected then connect it to the Topaz and the PC running the Topaz Flasher now. The connection with the Topaz board will be established and the

Topaz will be initialized:

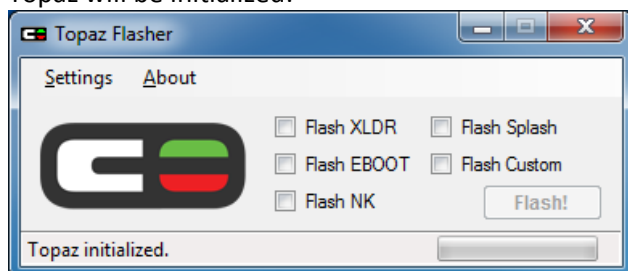


Figure 10 - Topaz initialized

5. Select the binaries which need to be updated. If you check any of the three checkboxes and that binary is not selected in the Flash Settings dialog and that binary is not found in the current folder then this dialog will appear allowing you to browse and select the binaries:

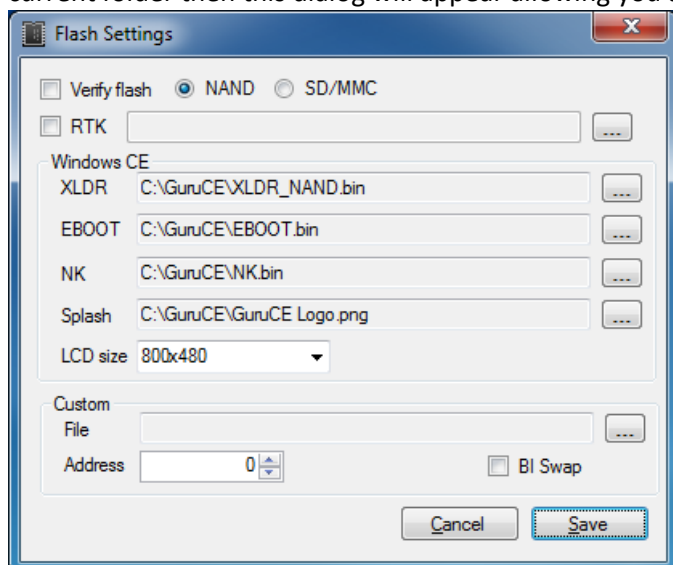


Figure 11 - Flash Settings

You can open the Flash Settings dialog at any time (and change the binaries pointed to) by clicking “Flash...” from the “Settings” menu.

Note that the Topaz Flasher can handle .bin and .nb0 (flat image) files.

The following is a description of the options:

- **NAND / SD/MMC**
Select NAND if you want to flash to internal NAND flash. Set to SD/MMC if you created a kernel for SD and want to flash to SD. Note that you need to make a hardware mod to the Topaz DevKit to allow flashing to SD.
- **Verify flash**
If you check this checkbox the flash written to the Topaz will be verified to see if the flash contains the expected values. If you check this box upgrading firmware takes a bit longer.
- **RTK**
The Runtime kernel is only used when the Topaz i.MX25 is in “flash mode” (see “Flash Mode” below). This kernel is uploaded to the Topaz over USB and is responsible for setting up SDRAM, initializing flash, erasing flash and programming flash. You can think of the RTK being the “USB (& flash) driver” on the Topaz side. This option is currently not used but present for future use.

- XLDR
This is the 1st stage bootloader, responsible for setting up SDRAM and launching EBOOT.
 - EBOOT
This is the 2nd stage bootloader, responsible for showing a bootmenu to the user, downloading a kernel from Platform Builder, setting up debug connections, programming the MAC address, loading and launching the CE kernel from Flash, etc.
 - NK
This is the Windows CE kernel.
 - Splash
This is the boot splash image that will be displayed as soon as the Topaz is powered up. Bitmap (.bmp), Jpeg (.jpg) and PNG (.png) are supported image formats. The image can be any size and will be resized according to the LCD size setting. The Topaz Flasher will only scale an image down, never up.
 - LCD size
Set this to the resolution of the LCD connected to your Topaz.
 - Custom
These options can be used to flash a custom file into flash. You can use this option if you would like to flash a linux bootloader for instance.
 - Save button
This persists the settings so you don't have to point to the binaries again the next time you use the Topaz Flasher and returns to the main window.
 - Cancel button
Cancels any changes you've made and returns to the main window.
6. Click the "Flash!" button to upgrade the firmware.

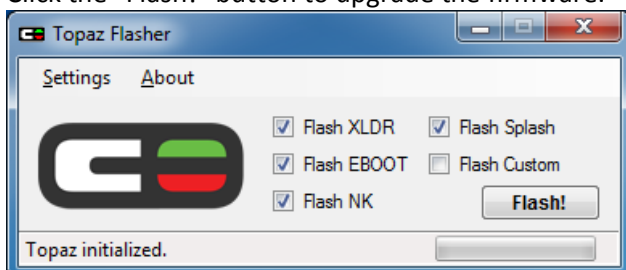


Figure 12 - Flash!

The progress bar will show progress per file. XLDR will take a very short time to program, EBOOT a bit longer and NK will take the longest.

7. If you see this dialog you've successfully upgraded the firmware on the Topaz:

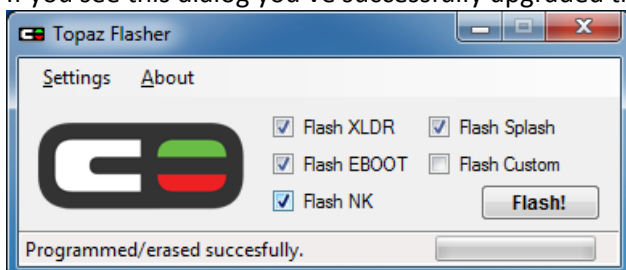


Figure 13 – Programmed/erased successfully

8. Set SW1 back to normal mode:

SW1-1 = OFF

SW1-2 = OFF

SW1-3 = X (don't care)
 SW1-4 = X (don't care)

Please refer to sections "Boot Mode Configuration" and "Normal mode" for a more detailed description of SW1.

- Now power-cycle the Topaz and Windows CE should appear shortly (if it doesn't make sure the options in the bootmenu are set to launch the existing image in NAND):



Figure 14 - Topaz Windows CE

3.4 Boot Mode Configuration Switch

3.4.1 Normal mode

In "Normal Mode" the boot mode configuration switch (SW1) has the following settings:

SW1-1 = OFF
 SW1-2 = OFF
 SW1-3 = X (don't care)
 SW1-4 = X (don't care)

See Table 1 and Figure 15 for reference.

	OFF	ON		
1	<input type="checkbox"/>		BOOT	0
2	<input type="checkbox"/>			1
3	X	X		2
4	X	X		GP 1-04

Table 1 - Normal Mode

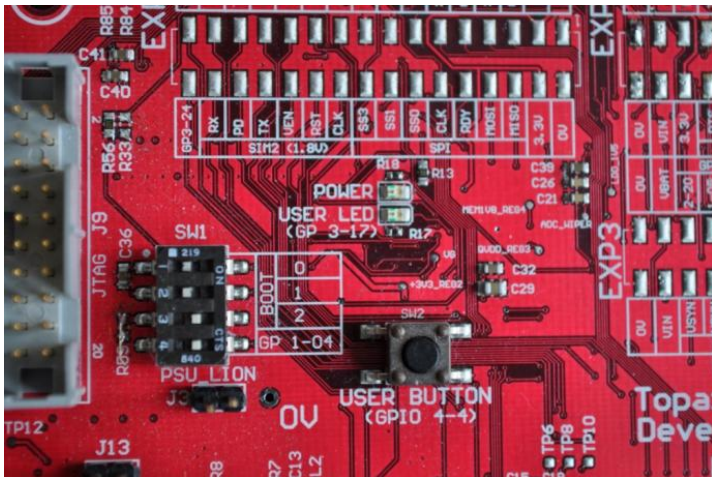


Figure 15: Boot Mode Configuration Switch (SW1) showing “Normal Mode”

3.4.2 Flash Mode

For “Flash Mode” the boot mode configuration switch (SW1) has to be set as follows (see also Table 2):

- SW1-1 = ON
- SW1-2 = ON
- SW1-3 = X (don't care)
- SW1-4 = X (don't care)

	OFF	ON	
1		<input type="checkbox"/>	BOOT
2		<input type="checkbox"/>	
3	X	X	1
4	X	X	2
			GP 1-04

Table 2 - Flash Mode

4 Application development

This contains a step-by-step procedure how to create a simple application for the Topaz i.MX25 Development Kit.

4.1 Creating a debug connection

There are several ways to connect to your device and setup a debug connection. The most commonly used debug connectivity methods are ActiveSync or CoreCon.

This tutorial will describe how to connect and deploy via CoreCon. The following files are required on the device to be able to use CoreCon for debugging and deploying:

- clientshutdown.exe
- CMAccept.exe
- ConmanClient2.exe
- DeviceDMA.dll
- eDbgTL.dll
- TcpConnectionA.dll

The standard Windows CE image for the Topaz module already includes these files so you can immediately start developing applications using Visual Studio 2008³.

If you are creating your own kernel image you'll have to make sure these files are copied onto the target. You can either include them in the image (by adding entries to project.bib for instance) or by copying them to the CE device through FTP or ActiveSync.

The needed files can be found in the following directory (after installing Visual Studio 2008):
%ProgramFiles%\Common Files\Microsoft Shared\CoreCon\1.0\Target\wce400\ armv4i.

4.2 Creating a Simple C# Application

This example will show you how to create a simple managed C# application targeting the Topaz using Visual Studio 2008.

4.2.1 Creating your application

- 1) Open Visual Studio and select **New | project** from the **File** menu.
- 2) Navigate to the **Visual C#** language and select the **Smart Device** project type.

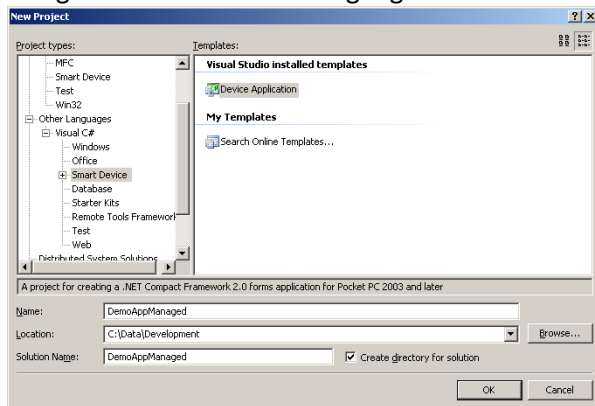


Figure 16: New Project

- 3) Name the solution **DemoAppManaged** and select **OK**. Visual Studio will generate the necessary files.
- 4) Make sure **Topaz** is selected as your target. If it is not selected, right click on the **DemoAppManaged** project and select **Change Target Platform**. In the pop-up dialog select the **Topaz SDK**.
- 5) Figure 17 shows the generated files.

³ Please refer to the "Topaz BSP User Guide" for details on how to create a Windows CE kernel that includes the correct files for debugging with Visual Studio 2005.

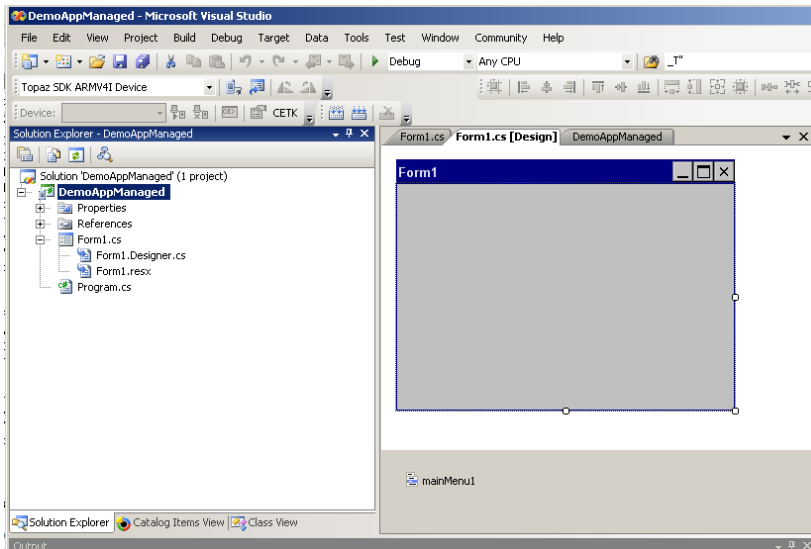


Figure 17: DemoAppManaged

4.2.2 Setting up the connection

- 1) Power up the Topaz
- 2) When the system has booted you'll need to get the IP address of the Topaz. There are several ways to do this:
 - Double click the network icon in the lower right corner and check the detailed view for the IP address, -or-
 - On the target's command line (start | Run | cmd.exe) run ipconfig.exe, -or-
 - Configure a static IP in the boot loader menu (see "Configure Topaz to use a static IP" below), -or-
 - Check the list of assigned IP addresses in your DHCP server, -or-
 - Check the ARP table on your router
- 3) Click on menu **Tools** in Visual Studio. Select **Options** and browse to **Device Tools -> Devices**.
- 4) In the **Options** dialog select the **Properties** for the **Topaz SDK ARMV4I Device** (see Figure 18)

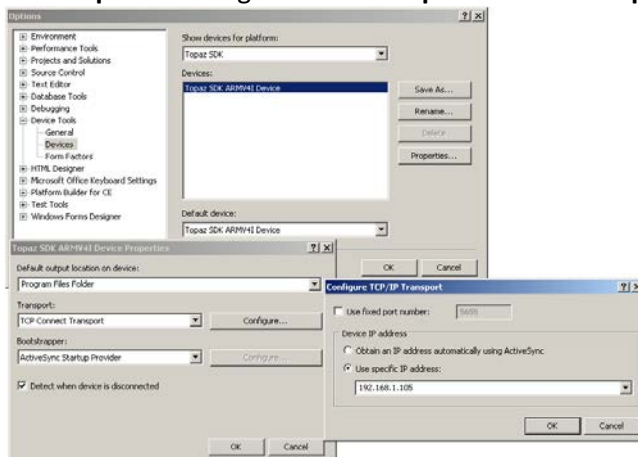


Figure 18: Configuring Connectivity Options

- 5) In the **Topaz SDK ARMV4I Device Properties** window select **Configure**
- 6) In the **Configure TCP/IP Transport** dialog select **Use specific IP address** and enter the IP address of the Topaz retrieved in step 2) above
- 7) Select **OK** 3 times to get back to the solution
- 8) On the Topaz Target start:
 1. Conmanclient2.exe

2. CMAccept.exe

You can start these programs through telnet or by clicking Start -> Run on the device. Note that if using Telnet you will need to open two telnet windows (since ConmanClient2 does not return).

- 9) Now you need to connect to the target within 2 minutes (otherwise you'll have to start CMAccept again). In Visual Studio click **Connect to Device** on the **Tools** menu:

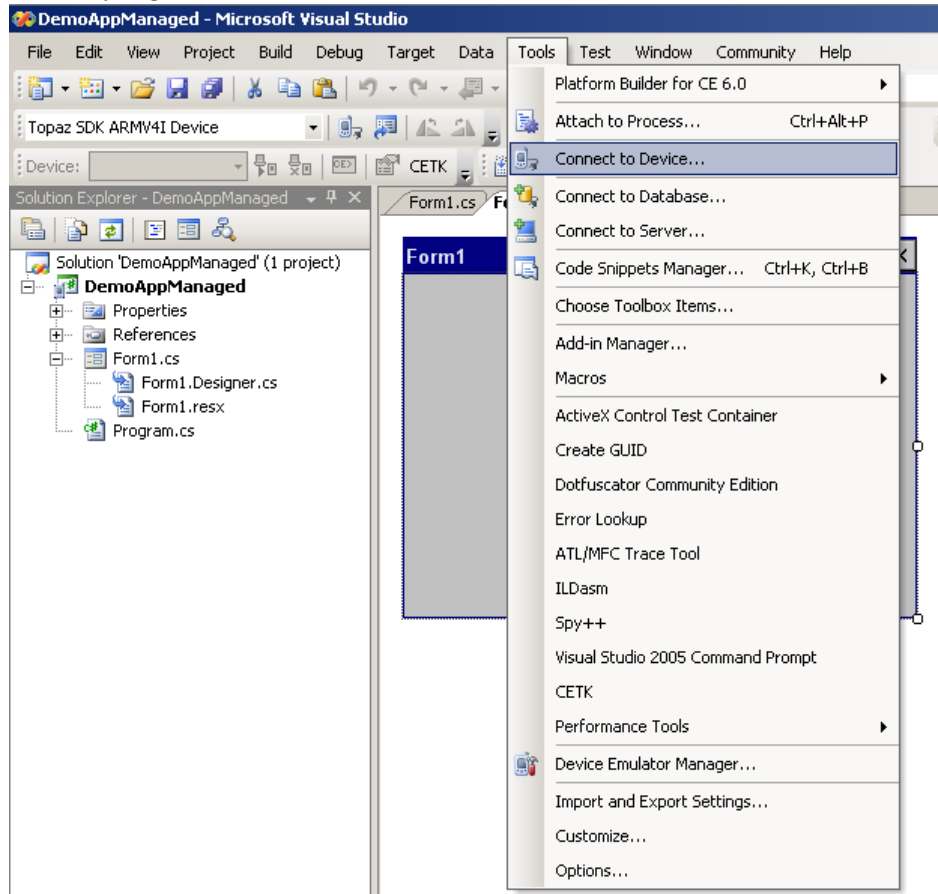


Figure 19: Connect to Device

- 10) You are now connected to the Topaz device.



Figure 20: Connection succeeded

4.2.3 Debugging your application

To start debugging your application press F5 or navigate to the **Debug** menu and select **Start debugging**. The application will start running on the Topaz. You can set breakpoints and view variables in the same way as you would in a normal desktop application.

4.2.4 Accessing hardware from your application

The Topaz SDK contains headers and libraries for direct access to hardware from your application. Headers and libraries are provided for ADC, CAN, SPI, I2C, GPIO, GPT and PWM. The headers in the

SDK are for use in native code but managed code (C#) wrappers are available as well. Please contact GuruCE for more information.

4.3 Configure Topaz to use a static IP

This section describes how you can configure the Topaz Development Kit to use a static IP. This can be useful when you're targeting a Topaz board without a display⁴.

The bootloader menu contains items that can be used to configure the IP settings of the Topaz device.

4.3.1 Serial connection

- 1) Connect Serial RS232 a null-modem cable between the Topaz development kit and a PC
- 2) Open your favorite terminal (like HyperTerm or TeraTerm for instance) and setup a serial connection at 115,200 baud, 8 data bits, no parity, 1 stop bit and no flow control
- 3) Power the board and the following message should appear on your terminal:

```
Microsoft Windows CE Bootloader Common Library Version 1.4 Built Apr 13 2010 13:48:31
Microsoft Windows CE Ethernet Bootloader 1.0 for MX25 3DS (Apr 13 2010 14:05:08)
INFO: Bootloader launched from NAND
INFO: OEMPlatformInit: Initialized NAND flash device.
INFO: Loading boot configuration from NAND
System ready!
Preparing for download...

Press [ENTER] to launch image stored in NAND flash or [SPACE] to cancel.

Initiating image launch in 2 seconds.
```

- 4) Hit space to enter the boot loader menu. The following menu will then appear on your terminal:

⁴ In this case a small application that outputs the IP address on the serial port at boot-up is another solution to get easy access to the IP address of a headless device.

Topaz i.MX25 Boot Menu

```
[0] IP Address : 0.0.0.0
[1] Set IP Mask : 0.0.0.0
[2] Set Gateway : 0.0.0.0
[3] Set MAC Address : 0-50-C2-3F-90-6A
[4] DHCP : Enabled
[5] Boot Delay : 3
[6] Select Boot Device : NK from NAND
[7] Reset to Factory Default Configuration
[8] Format OS NAND Region
[9] Format All NAND Regions
[C] Clean registry & databases : Disabled
[B] Bootloader Shell
[W] KITL Work Mode : Interrupt
[K] KITL Enable Mode : Disabled
[P] KITL Passive Mode : Disabled
[E] Select Ether Device : FEC
[U] Select Windows CE Debug UART : Disabled
[D] Download Image Now
[L] Launch Existing Flash Resident Image Now
[M] MMC and SD Utilities
[R] Reset
[S] Save Settings
```

Selection:

- 5) Press '0' and enter the IP address, eg. 192.168.1.100
- 6) Press '1' for configuring the IP mask, eg. 255.255.255.0
- 7) Press '2' for entering the gateway, eg. 192.168.1.1
- 8) Press '4' to toggle the use of DHCP. Make sure DHCP is disabled
- 9) When done, press 'S' to save the settings to NAND
- 10) Press 'L' to launch the image using the new IP settings

For a complete description of the Boot loader and the boot loader options please refer to the "Topaz BSP User Guide" available on the GuruCE Topaz download page:

<http://guruce.com/topaz/release/latest>

5 About us

5.1 GuruCE

GuruCE offers deep technical knowledge of the Windows Embedded CE (Windows Embedded Compact Edition) operating system. The consultants of GuruCE are among the best in Windows CE BSP & driver development, training and consulting.

GuruCE can help you and your company get to market faster by taking care of all the Windows CE low-level issues so that your experts can focus on what they do best, or we can teach you how to do it yourself through training by one of our consultants. We can help you with general system design (both hardware & software), application design & development, real-time embedded design issues and driver development.

5.2 Blog

For tips & tricks on Windows CE and other related issues please have a look at our blog:
<http://guruce.com/blog>.

5.3 Support options

GuruCE offers various support options. Please visit <http://guruce.com/support> for more information.

GuruCE APAC/NZ

Contact: Michel Verhagen
Email : michel@guruce.com
Phone : +64 (0)7 929 5807
Mobile : +64 (0)21 104 6208

240 Ohiwa Harbour Road
RD2, Opotiki, 3198
New Zealand

GuruCE EMEA/NL

Contact: Erwin Zwart
Email : erwin@guruce.com
Phone : +31 (0)728 503 119
Mobile : +31 (0)629 512 116

Tuin van Halo 19
Heerhugowaard, 1705 TD
The Netherlands