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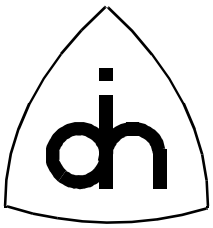

OTX DSP C54x SDK Debugging Guide

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1. Abstract

This document describes how to debug DSP SDK (Software Development Kit) applications in the OTX (Odin Telecom FrameworX) Hardware driver. It describes how to connect and configure a DSP debug session. It assumes that the reader already has general knowledge about the overall structure of the OTX Hardware Driver (as described in the Programmer's Guide for OTX Hardware API, Doc. No. 1412-1-SAA-1006-1) and the overall structure of the DSP SDK (as described in Programmer's Guide for OTX DSP C54x Software Development Kit, Doc. No. 1412-1-SAA-1007-1).

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3. Debugging without a Debugger

Debugging without a Debugger might sound like a contradiction in terms. However, it is referring to a debug method which can be applied without any additional hardware or software, other than the OTX Nic board, the OTX Hardware driver, and the OTX DSP SDK.

All of the DSP SDK applications define a variable called g_debugDataS. This variable is a struct containing field which can be assigned values at different places in the code. Below is an example of the debug struct used in the DspDemo1 example program:

```
typedef struct Demo1NotifyGetDebugDataS {
  unsigned short      nData0;
  unsigned short      nData1;
  unsigned short      nData2;
  unsigned short      sqBuf[300];
} Demo1NotifyGetDebugDataS;
```

The DSP code sets the different fields in the struct and passes the struct the host application (by calling OtxDspSetHostEvent() with the DEMO1_NOTIFY_DEBUG_DATA IO Control code.) The DSP code can either send the Debug struct as a response to a host initiated DSK IO Control command (as in the DspDemo1.c application) or the DSP code can send the Debug struct as an unsolicited event (e.g. when the DSP code detects a certain error condition, or periodically when a DSP timer expires).

4. Debugging with a Debugger

If the debug method described in Chapter 3: "Debugging without a Debugger" is inefficient, there is another, more extensive, way to debug. The method involves acquiring of a third-party debugger (Code Composer), an Emulator board, and an OTX Emulator adapter board.

4.1 Required Software and Hardware for Code Composer

The OTX DSP SDK applications has been debugged using the following software and hardware.

Software:

- Windows 95 or later operating system
- Code Composer version 4.02 by Texas Instruments
- Emulator Board driver, ge54xwd32.dll, Version 1.0.0.2, by DSP Research
- OTX Hardware Driver, and OTX DSP SDK

Hardware:

- OTX Nic boards (Vidar-5x4-ASM and Vidar-5x16-PCI)
- OTX Hermod Active Emulator Adapter board (HMA-1057-1)
- Tiger Emulator board for C54x by DSP Research (ISA Bus)

4.2 Configuring a Debug Session with Code Composer

Before a Code Composer debug session can be started Code Composer needs to be configured. Code Composer needs the following information:

- Emulator board driver
- Number of DSPs on the target

This information is entered using the CC_SETUP.EXE (supplied with Code Composer) utility.

To configure Code Composer, please see the following configuration flow:

1. Install the Emulator board (by DSP Research) in an empty ISA slot.
2. Boot the PC in Windows 95.
3. Install the Code Composer software
4. Copy the Emulator Board driver (ge54xwd32.dll; supplied by DSP Research) to the %WINDIR%\ti\drivers directory.
5. Start CC_SETUP.EXE.
6. Drag the ge54xwd32 object from “Available Board Types” window pane and drop it on the “My System” object in the “System Configuration” window pane.
7. Right-click on the ge54xwd32 object in “System Configuration” window pane. Choose “Properties”
8. Select the “Board Name & Data File” tab.
9. Enter a more descriptive board name in the “Board Name” field (e.g. Vidar-5x4-ASM or Vidar-5x16-PCI).
10. Select the “Board Properties” tab.
11. Enter the IO address to be used for the Emulator board. This address must match the settings of the Dip switch S1 on the Emulator board. E.g. 0x220, which means that all four positions of S1 should be in the OFF position.
12. Select the “Processor Configuration” tab.

13. Click on “TMS320C54xx” in the list of “Available Processors”.

14. Enter a name for the processor in the “Processor Name” field (e.g. DSP_0 for the first DSP). Click on “Add Single”. Repeat this step for every processor on the OTX Nic or ASM board (i.e. 4 processors for Vidar-5x4-ASM and 16 processors for Vidar-5x16-PCI).

15. Close the Board Properties dialog by clicking “Finish”.

16. At this point it is recommend to save this configuration in a Code Composer Setup file (*.ccs). To to this, choose File/Export from the menu, enter a name for the configuration file (e.g. Vidar-5x4-ASM.ccs), and click Save.

Code Composer is now configured. Now the hardware needs to be connected. To do this, please see the following flow:

1. Set the dial on the OTX Hermod Emulator Adapter to the correct JTAG chain (which varies depending on the target OTX Nic or ASM board). Vidar-5x4-ASM uses JTAG chain 3 and Vidar-5x16-PCI uses JTAG chain 7.

2. Attach the OTX Hermod Emulator Adapter to BJ3 connector on the OTX Nic.

3. Attach the Emulator board cable (ribbon cable) to the Emulator connector (J4) on the Hermod Emulator Adapter. The connector is keyed and will only fit in one direction.

4. Attach the other end of the Emulator board cable to the Emulator board (in the Code Composer PC).

The hardware and software debug configuration is now complete.

4.3 Running a Debug Session with Code Composer

The following flow describes how to start a debugging session with Code Composer using the DspDemo1 demo program (using a Thor-2-PCI and Vidar-5x4-ASM).

1. Make sure that host application PC (where the Thor-2-PCI/Vidar-5x4-ASM is installed) is properly connected to the Code Composer PC (via the Emulator cable).

2. Compile the DspDemo1.out program with Symbolic Debug information (the -g command line switch to CL500.EXE)

3. Copy the DspDemo.out file to the directory where DspDemo1.exe is located (e.g. Demos\DspSdk\Pci\DspDemo1\W32\Release).

4. Start DspDemo1.exe on the OTX Target PC.

   DspDemo1 /D

The /D command line switch is important to make the program stop right after it has made the OtxDspRunProgram() API call.

5. Start Code Composer on the Code Composer PC.

6. Choose “File/Load Program” from the Code Composer (Parallel Debug Manager) menu. Open the DspDemo1.out file from the location where it was compiled (e.g. Dsp\C54x\DspDemo1\DspDemo1.out). Code Composer should now load this DSP program to all four DSPs on the Vidar-5x4-ASM.

7. Click on the “Run” button in the Code Composer (Parallel Debug Manager) window. All four “heart-beat” LEDs on Vidar-5x4-ASM should now start blinking.

8. Once all DSPs are started from Code Composer, press any key in the DspDemo1.exe program (on the host application PC). DspDemo1 will now call the OtxDspRestartProgram() API function. This is an important step since it resynchronizes the DSP code (started by Code Composer) with the OTX Hardware driver. OtxDspRestartProgram() resets the HPI communication buffers, and send the OTXDSP_SDK_IO_START_PROGRAM and OTXDSP_SDK_IO_INIT_TIMER DSP IO Control codes to the DSP.

9. At this point it is safe to open a specific DSP window from the Code Composer (Parallel Debug Manager) window (e.g. Vidar-5x4-ASM/DSP0). The DSP code can be halted and breakpoints and watches can be set.

When the Code Composer debugging session is to be terminated it is important to follow a couple of rules:

- Make sure that all the DSP are running (not halted) when the host application is exited.
- If the host application is to be restarted without Code Composer (without the /D switch) make sure that Code Composer (Parallel Debug Manager) is closed before restarting the host application.

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