Freescale Semiconductor
Application Note

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eDINK for MPC8560ADS

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eDINK (e500 core Demonstrative Interactive Nanokernel), an enabling and debugging tool for e500 processors, has been ported to the MPC8560ADS pilot board. Most of the work was performed on the low level BOOT ROM like CPU initialization, FLASH configuration, DDR configuration, setting the I/O, etc. After eDINK comes up, the user will see the active eDINK command prompt. Typing 'help' at the command prompt will bring up several commands, which are a superset of all the commands that were built up over time and support many different boards. eDINK running on the MPC8560ADS board supports only a subset of all these listed commands. See Section 7, "Supported Commands," for more information.

Contents

1 Introduction

This release of eDINK has been ported from eDINK running on a platform simulator. The following features are added in this release:

- support for MPC8560ADS board in MPC8540 mode only
- either the DDR memory or SDRAM memory in the local bus can act as system memory

- Level 1 data and instruction cache are turned on
- Level 2 unified cache is turned on
- Branch prediction is enabled
- Address streaming is enabled
- DDR dll patch has been applied
- local bus dll patch has been added
- Serial driver provided is for DUART only, there is no CPM based serial driver. Therefore, eDINK is currently limited to run in MPC8540 mode only.

The source tree for eDINK can be obtained from the DINK website. The limited and full source tree for this distribution is available from the DINK website. Extracting the full source tree will provide the following:

- src/: directory which contains all the eDINK related source files
- save_obj/: directory which contains the networking object files (make sure to copy these object files to obj/ directory before compiling)
- obj/: empty directory which is used during compilation
- makefile: note that based on cross compiler locations, these environment variables may have to be changed - PREFIX, LDFLAGS, AS, CC, LD, OBJCOPYCFLAGS, AFLAGS, LDFLAGS. This makefile should be reviewed carefully before recompilation.
- edink.bin, edink.src, edink: the functional binary/srec/elf file which can be programmed into the on-board FLASH of the MPC8560ADS board. To do so without compiling, program FLASH with any one of these images which is supported by the FLASH programmer.
- edink-flash.xml: FLASH programmer configuration file to be used with CodeWarrior 1.1 (CodeWarrior Development Studio, PowerQUICC III Edition, version 1.0.4, Build 40406). Note that the specific build and version number may not be necessary in order to use this file.

2 Programming the FLASH with the Shipped Working eDINK Binary File (edink.bin)

The last 4MB of the 16MB on board FLASH of the MPC8560ADS board is used to program the eDINK image. This working image can be programmed using any standard FLASH Programmer Utility that can communicate with the MPC8560ADS pilot board. Note that the FLASH Programmer utility should support programming the raw binary file.

The following steps are involved in programming the on-board FLASH:

1. Suppose that the starting address of the FLASH is 0xFF000000, then the last 4MB of FLASH area starts at 0xFFC00000 and the end address of the FLASH is 0xFFFFFFFF
2. Erase only the last 4MB (i.e. from 0xFFC00000 to 0xFFFFFFFF)
3. Program the edink-working.bin image starting at address 0xFFC00000
4. Note that the image size in this case is 0x400000 (which is 4MB)

2.1 Programming edink.bin with CodeWarrior

Based upon the above description, a specific example of FLASH programming using CodeWarrior 1.1 (CodeWarrior Development Studio, PowerQUICC III Edition, version 1.0.4, Build 40406) is provided below. Also, the edink-flash.xml file is provided with this release, which consists of the settings required for the FLASH programmer. In order to make use of this file, first invoke the FLASH programmer by clicking on 'Tools->Flash Programmer'. Then use the 'Load Settings…' tab and point to the edink-flash.xml file. CodeWarrior FLASH Programmer window captures are provided in Figure 1, Figure 2, Figure 3, and Figure 4 for reference.

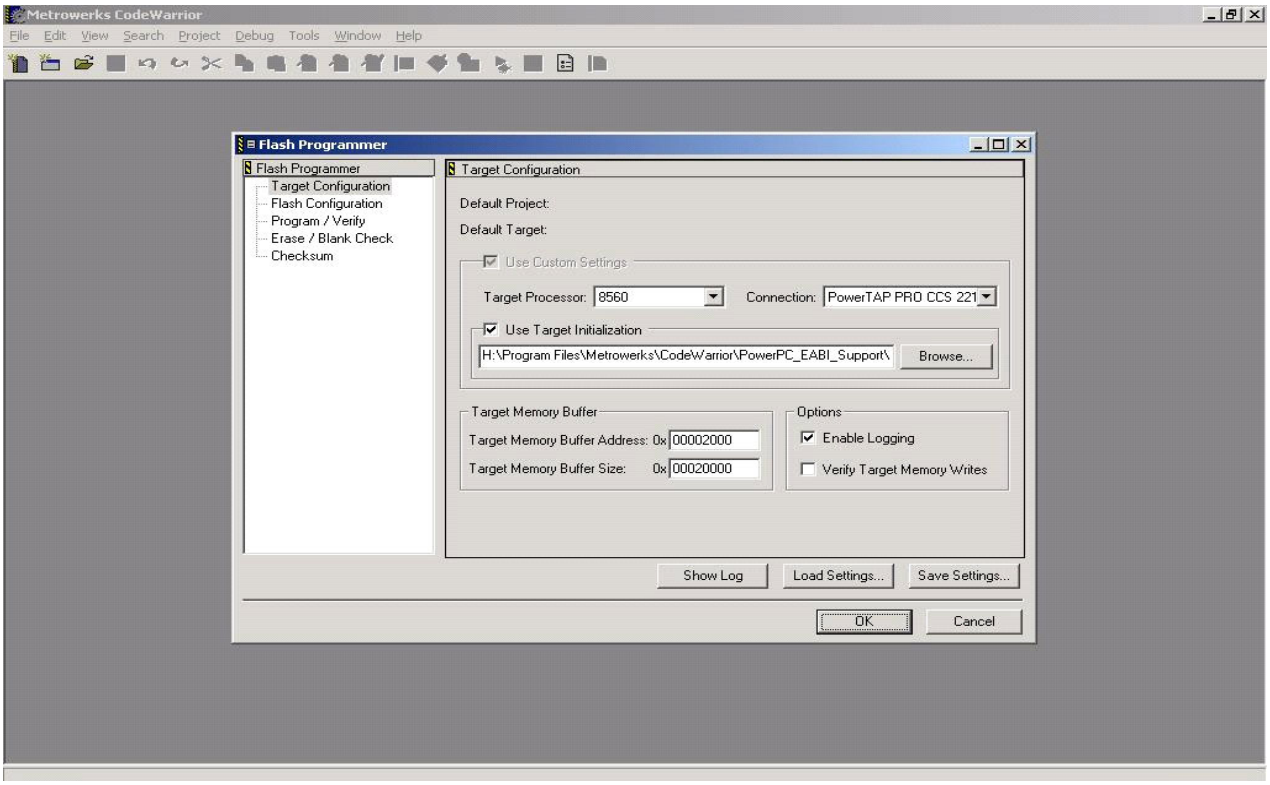

Figure 1. Target Configuration for FLASH Programmer

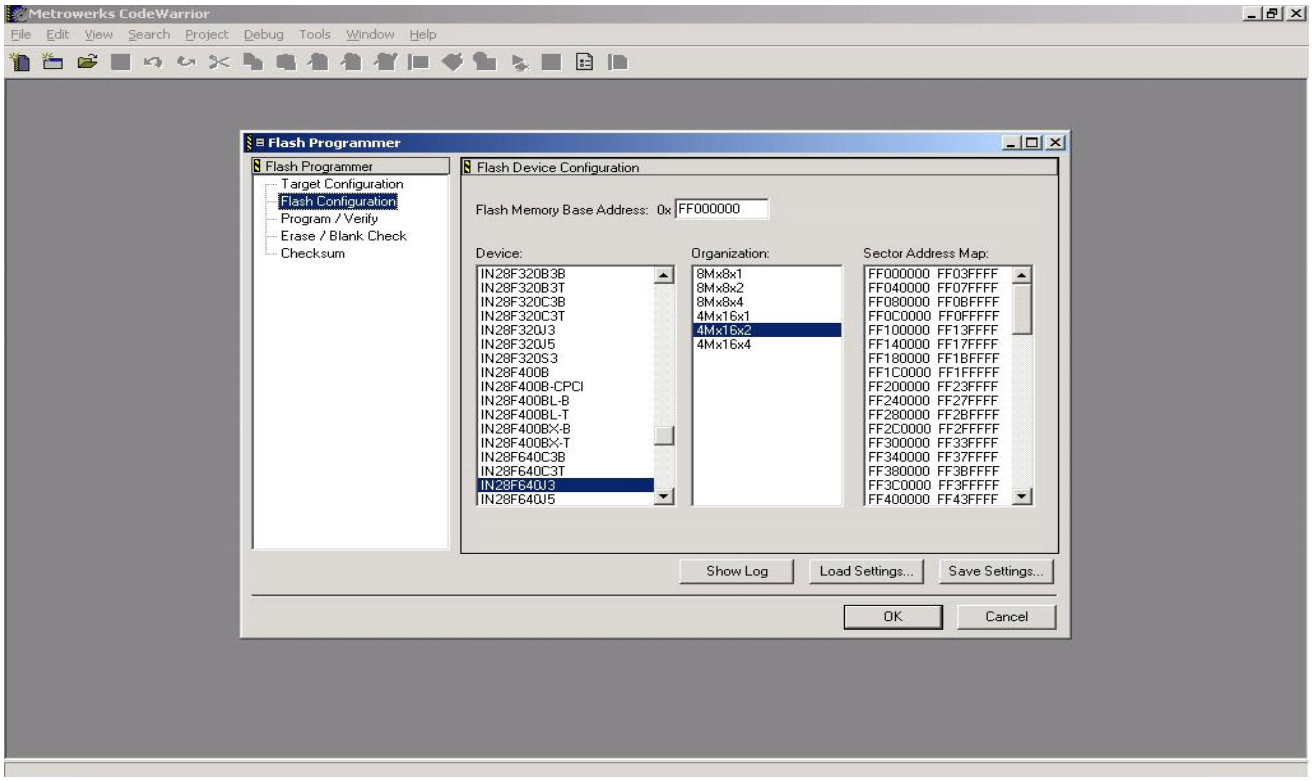

Figure 2. FLASH Device Configuration for FLASH Programmer

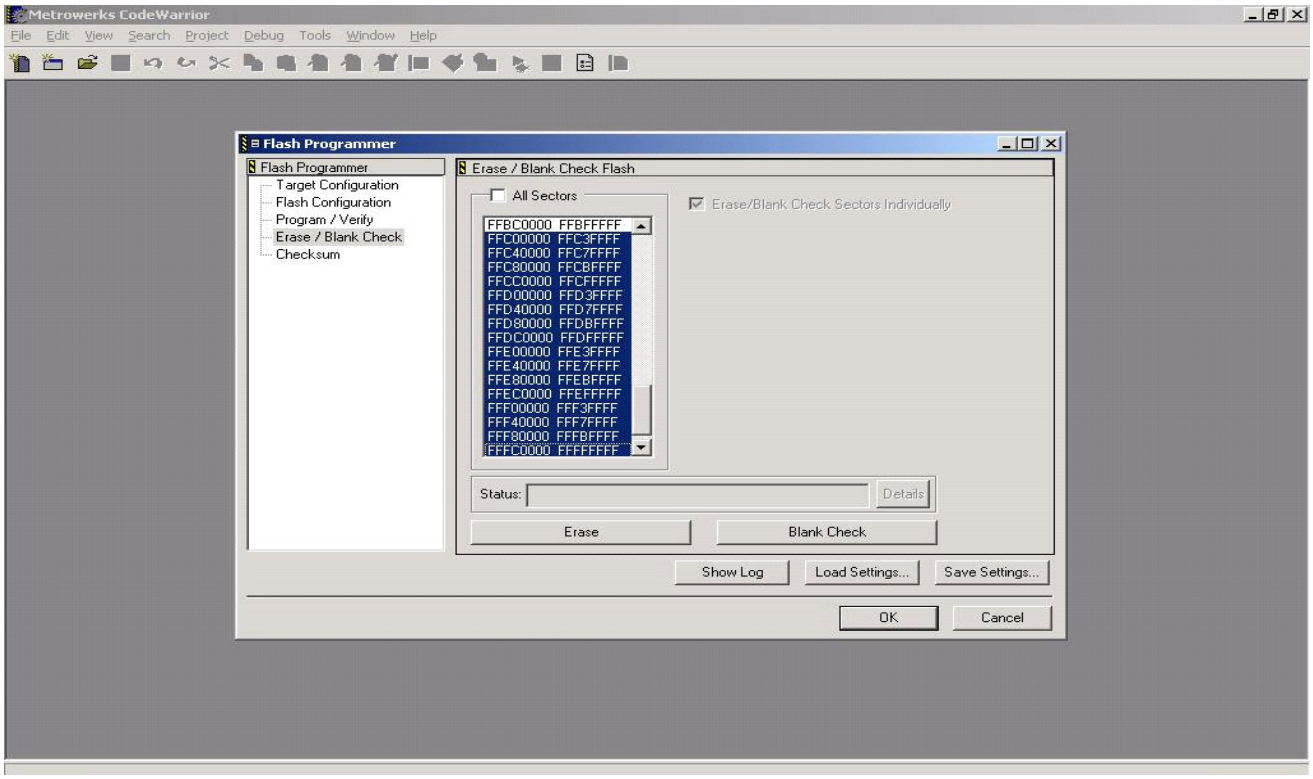

Figure 3. Erase/Blank Check Tab for FLASH Programmer

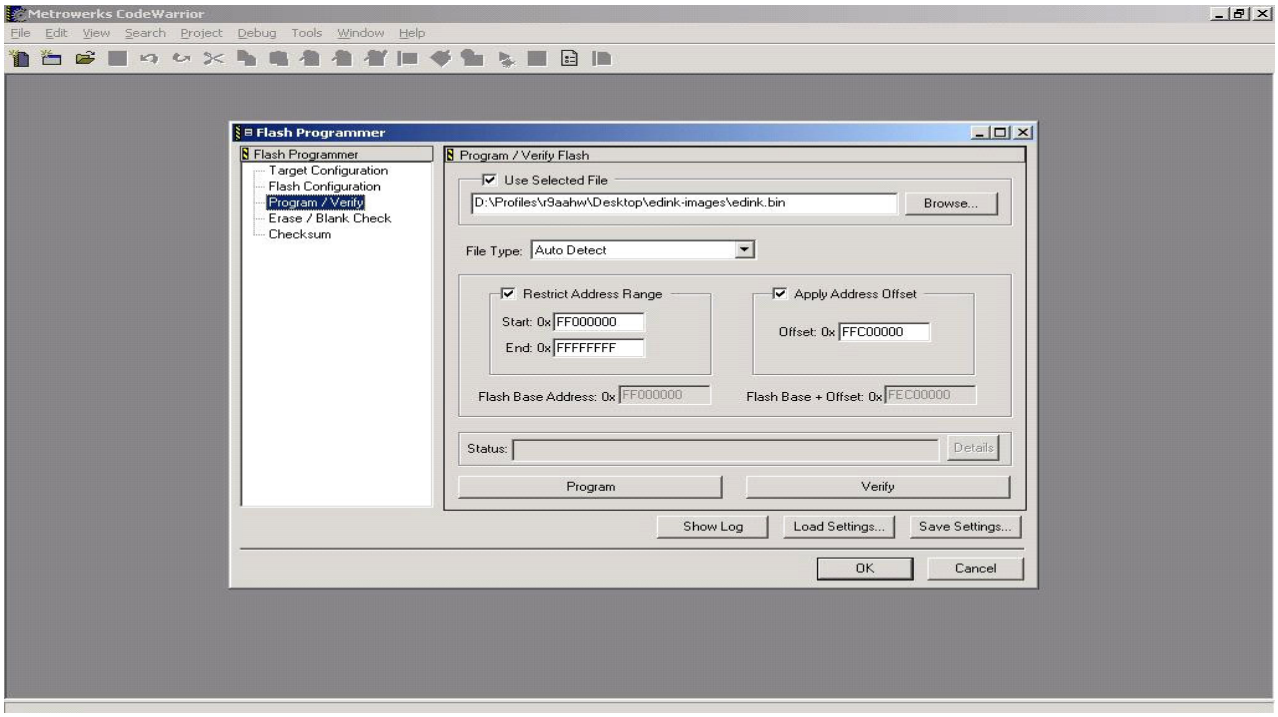

Figure 4. Program/Verify Tab for FLASH Programmer

3 Recompiling the SOURCE

Extract the full source tree in the $EDINK_BASE directory.

src, save_obj, and obj directories, which contain the source codes and object files required to build eDINK executable, will exist after extraction.

Also, the makefile will be located in the $EDINK_BASE.

Modify the makefile so that it points to the toolchain. Note that in order to build eDINK executable, a PowerPC EABI toolchain modified to support e500 is required.

```
%cp save_obj/* obj/
```

```
%make
```

make will generate the edink.bin file in obj/ directory. It will also generate the elf binary (eDINK) and s-record (edink.src).

4 Board Settings –Jumpers and Switches

In order to program the FLASH, some kind of a debugger needs to be run and communicated over the COP/JTAG interface. The following switch settings are recommended when the debugger is run. For each of the switch settings, the value of pin 1 is shown first, followed by the value of pin 2, then 3, and so on. Here, 0 means “ON” and 1 means “OFF”. Please refer to the MPC8540ADS Pilot1 Quick Reference Guide document that comes with the MPC8560ADS board for a detailed description of the switches on board.

Also, note that the switch settings mentioned here are one of the many possible configurations for which eDINK runs.

SW1 = 111111

SW2 = 111111

SW3 = 001111

SW4 = 00010011

SW5 = 0011111111

SW6 = 01001011

SW7 = 11111111

SW9 = 10

SW10 = 01111100

SW11 = 10100100 (position 2 = 0/1 for MPC8540 mode/MPC8560 mode); (position 7 = 0/1 for rev2/rev1 silicon)

SW12 = 1001100000

SW13 = 1000

SW14 = 0000

SW15 = 011101

SW16 = 0000

SW17 = 10000100

SW18 = push button; no configuration needed

SW19 = push button; no configuration needed

SW20 = 011011

SW21 = push button; no configuration needed

SW22 = 0101 (if CodeWarrior with PowerTAP Pro is being used; for any other debugger type, find out what this switch would be from MPC8540_ADS_Quick_Guide_rev1.9.doc, which is shipped with the MPC8560ADS board)

SW23 = 010110

SW24 = push button

SW25 = 011110

SW26 = push button

SW27 = push button

SW28 = push button

SW29 = 0010

SW30 = not mounted (optional)

For FLASH programming, also make sure that J2 jumper is set to “EN”. This will ensure that the FLASH can be programmed. The FLASH programming will not be successful if this jumper is “DIS”.

5 Preparing to Run eDINK

- Program the FLASH with edink.bin using the debugger's FLASH programming capability
- Power cycle off the board
- Change the board settings, keeping everything identical to what is described in Section 4, except for the following:
  — SW3 = 111111 (boot out from FLASH)
- Connect a serial cable between the upper serial port of the board to any of the COMx ports of the PC. Setup a hyperterminal for COMx port of the PC with these features: baud = 9600, parity = none, stop bit = 1, data bits = 8, flow control = none
- Power on the board

5.1 A Test Run

This example run is when DDR is acting as system memory. Expect to see the following on the hyperterminal:

```
G



CONSOLE I/O ACTIVE



CONFIGURATION
=============
  FC0E0000 = 00460148
  FC0E0004 = 87330000
  FC0E0008 = 00010000
  FC0E000C = 83830377
  FC0E0010 = 07000000



DDR REGISTERS
=============
  FC002000 = 00000007
  FC002080 = 80000002
  FC002108 = 37344321
  FC00210C = 00000800
```

```
  FC002110 = C2000000
  FC002118 = 00000062
  FC002124 = 05200100
  FC002F00 = 00000000
  FC002F04 = 00000000
  FC002F08 = 00000018
  FC002F0C = 00000000


COPY
000BC000
00100000


OK


R
R
S
T
U
VGO=000036A4

W


I/O system initialized...
Environment is not valid...
Skipping system setup...
RealTime Clock: not running/set.
Memory Enabled: [ 128MB at CL=0 ]
Caches Enabled: [ L1I(32K), L1D(32K), L2(256K) ]
Register Inits: [ 32 GPRs, 227 SPRs ]
```

```
                    ##  ##            ##
                    ##  ##            ##
                    ##                ##
     ######    #######  ##  #######   ##    ##
    ##    ##  ##    ##  ##  ##    ##  ##   ##
    ########  ##    ##  ##  ##    ##  ######
    ##        ##    ##  ##  ##    ##  ##   ##
     ######    ######   ##  ##    ##  ##    ##


   Version : 13.1.1, GCC Build
  Released : May 13, 2003 Built on Jun 30 2004 14:41:10
Ported by  : Freescale's NCSD Applications Group, Austin, TX
    System : MPC8560ADS Evaluation Board
    IDProc : PVR=8020 BUS=3ns (133330kHz)
 Processor : MPC8540 V1.0 @ 800 MHz, 266 MHz CCB, 133 MHz memory, 66 MHz PCI
    Memory : 128MB at CL=0

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Refer to `history.c' for release info, changes, errata and fixes.

EDINK[MPC8540] {1} >>
```

6 Default Program Settings

The code on AS IS basis would use the DDR as system memory. Do the following to use local bus SDRAM instead:

- Uncomment out "#define LOCAL_SDRAM_AS_SYS_MEM"
- Comment out "//#define DDR_AS_SYS_MEM"

When DDR is selected as system memory, DDR memory testing can also be selected before copying data and text section from FLASH memory to DDR memory. Note that DDR testing will drastically increase boot up time. It takes about 30–40 minutes to boot up with the DDR memory test enabled. In order to provision for DDR memory test do the following:

- Uncomment "//#define DDR_MEMORY_TEST"

Note that LOCAL_SDRAM_AS_SYS_MEM and DDR_AS_SYS_MEM should not be defined simultaneously.

For a complete description of the memory map for eDINK, please refer to the ‘Creating eDINK for DINK32 Code using the e500 ISS’ application note located at online at http://www.freescale.com/files/netcomm/doc/app_note/AN2336.pdf.

7 Supported Commands

Following is the list of all the commands that do not work. For a complete description of these commands, please refer to DINK32 User’s Manual, located online at http://www.freescale.com/files/soft_dev_tools/doc/ref_manual/DINK32UM.pdf.

Commands that do not work on MPC8560ADS platform are as follows:

BM, DEV, ENV, FU, ID, NM, PCF, PMAPPER, RMN, SB, TE, TM, W, BO, CRC, FS, LO, MI, PD, PM, PNG, RST, TR, TI, SH, STTY, TAU.

8 Conclusion

The MPC8560ADS board can be used to run the eDINK that is created for MPC8540 processor. This eDINK has a lot of optimization features turned on. Running applications under this eDINK environment have been verified. This eDINK could be used to run benchmark applications because of the many optimization features enabled. Since eDINK for MPC8540 is ported from eDINK for e500 ISS, it is worthwhile to look into this application note ‘Creating eDINK for DINK32 Code using the e500 ISS’ located online at http://www.freescale.com/files/netcomm/doc/app_note/AN2336.pdf. Also, the reader may want to refer to the ‘DINK32 PowerPC Debugger User’s Manual’.

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