

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.

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

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

- 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 0xFFFFFFF)
- 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.

Metrowerks CodeWarrior	
<u>File Edit View Search Project Debug Tools V</u>	/indow Help
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S Flash Progr Flash Config - Program /V - Erase / Blash - Checksum	Immer Immer ner guration guration Default Project: erly Default Project: Default Target: Immer & Check Use Custom Settings Target Processor: 6560 Target Processor: 6560 Immer Connection: PowerTAP PR0 CCS 221 Immer Immer Target Initialization H: VProgram Files/Metrowerks/CodeWarrior/PowerPC_EABI_Support Browse Target Memory Buffer Options Target Memory Buffer Options Target Memory Buffer Size: 0x/0002000 Image Memory Buffer Size: 0x/0002000 Image Memory Buffer Size: 0x/0002000
	Show Log Load Settings Save Settings
	OK Cancel

Figure 1. Target Configuration for FLASH Programmer



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

Metrowerks CodeWarrior				_ 8 ×
The Eak View Search Project Debug roots Window Help				
SI Flash Programmer Flash Programmer - Target Configuration - Program / Verify Created Under Charles	S Flash Device Configuration Flash Memory Base Address: 0x	F000000		
Checksum	Device: IN28F320838 IN28F320C38 IN28F320C38 IN28F320C37 IN28F3203 IN28F32053 IN28F4008 IN28F4008-CPC1 IN28F4008L-8 IN28F4008L-8 IN28F4008L-7 IN28F4008-4 IN28F4008-7 IN28F40038 IN28F4003 IN28F4003 IN28F4003 IN28F4003 IN28F4003 IN28F4003 IN28F4003 IN28F4003 IN28F4003 IN28F4005 IN28F405 IN28F4005 IN28F455 IN28F4555 IN28F4555555 IN28F4555555555555555555555555555555555555	Organization: BMx8x1 BMx8x2 BMx8x4 4Mx16x4 4Mx16x2 4Mx16x2 4Mx16x2	Sector Address Map: FF000000 FF03FFFF FF040000 FF07FFFF FF020000 FF07FFFF FF140000 FF17FFFF FF140000 FF17FFFF FF240000 FF17FFFF FF220000 FF27FFFF FF220000 FF27FFFF FF220000 FF27FFFF FF220000 FF27FFFF FF220000 FF27FFFF FF320000 FF37FFFF FF320000 FF37FFF FF320000 FF37FFFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FFFF FF320000 FF37FFFF FF320000 FF37FFFF FF320000 FF37FFFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FFF FF320000 FF37FF FF320000 FF37FF FF320000 FF37FF FF320000 FF37FF FF320000 FF37FF FF320000 FF37FF FF320000 FF37FF FF320000 FF37FF FF320F FF320F FF320F FF320F FF320F	
		Show Log	Load Settings	
			OK Cancel	





Figure 3. Erase/Blank Check Tab for FLASH Programmer

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Metrowerks CodeWarrior Edit View Search Pro	iect Debug Tools Window Help		
	Elash Programmer Tash Programmer Taget Configuration Flash Configuration Program/ Vetity Erase / Blank Check Checksum	Program / Veiily Flash Vise Selected File D:VProfiles \19aahw\Desktop\edink.images\edink.bin Browse File Type: Auto Detect Vise Restrict Address Range Vise Apply Address Offset Offset: 0x FF000000 End: 0x FFFFFFF Flash Base Address: 0x FF000000 Flash Base + Offset: 0x FEC00000 Status: Program Veiify	
		Show Log Load Settings Save Settings	

Figure 4. Program/Verify Tab for FLASH Programmer

Recompiling the SOURCE 3

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).

Board Settings – Jumpers and Switches 4

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.



Board Settings –Jumpers and Switches

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

SW1 = 111111SW2 = 111111SW3 = 001111SW4 = 00010011SW5 = 0011111111SW6 = 01001011SW7 = 11111111SW9 = 10SW10 = 01111100SW11 = 10100100 (position 2 = 0/1 for MPC8540 mode/MPC8560 mode); (position 7 = 0/1 for rev2/rev1 silicon) SW12 = 1001100000SW13 = 1000SW14 = 0000SW15 = 011101SW16 = 0000SW17 = 10000100SW18 = push button; no configuration neededSW19 = push button; no configuration neededSW20 = 011011SW21 = push button; no configuration neededSW22 = 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 = 010110SW24 = push buttonSW25 = 011110SW26 = push buttonSW27 = 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 = 0000800



Preparing to Run eDINK

- FC002110 = C2000000FC002118 = 00000062
- FC002124 = 05200100
- FC002F00 = 00000000
- FC002F04 = 00000000
- FC002F08 = 00000018
- FC002F0C = 00000000

C	ΟP	Υ

000BC000

00100000

OK

R

- R
- S

Т

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]



Default Program Settings

				##	##			##						
				##	##			##						
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	######			###	##	#####	##	##	##					
	##	##	##	##	##	##	##	##	##					
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Ver	sion :	13.1	L.1, G	CC B	uild									
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Sys	stem :	MPC8	3560AD	S Eva	aluat	tion Bo	bard							
ID	Proc :	PVR=	=8020 1	BUS=	3ns	(13333)	OkHz)						
Proces	ssor :	MPC8	3540 V	1.0 0	@ 80() MHz,	266	MHz	ССВ, 1	.33 MHz	memoi	ry, 66	5 MHz	PCI
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EDINK[I	MPC854)] {1	L} >>											

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6 Default Program Settings

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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"

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Supported Commands

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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