AT91RM9200DK U-Boot Flash Programming Solutions

Introduction

The AT91RM9200DK Development Board is provided with a default boot program in its external Flash memory. This boot program, called U-Boot, is used by the AT91RM9200DK to boot after reset. The U-Boot performs initialization of the AT91RM9200DK, provides user interface via the Serial Debug Port and allows application download through the Serial Debug Port or Ethernet.

This Application Note aims at providing solutions when the U-Boot program contained in the external Flash of AT91RM9200DK Development Board has been deleted. Two ways of reprogramming the Flash memory are described in this Application Note; the method selected depends on whether the user has a Slingshot™ JTAG/ICE interface. If this interface is not being used, then the external Flash is reprogrammed using the internal BootROM (embedded on the AT91RM9200 version 58A07F).

AT91 ARM® Thumb® Microcontrollers

Application Note

6041A–ATARM–01/04

U-Boot Software

Features

The main features of the U-Boot software embedded in the AT91RM9200DK Development Kit are:

- Standalone primary bootstrap
- Small footprint
- OS-independent
- Auto-boot and interactive modes
- Command line interface
- Non-volatile environment variables
- Flash programming capability
- DataFlash programming capability (only available in latest Open Source download)
- Download through serial interface (Kermit protocol)
- Download through Ethernet (tftp)
- Integrated bootp
- Scripting capability

Organization

To optimize the use of resources, U-Boot is made up of three parts:

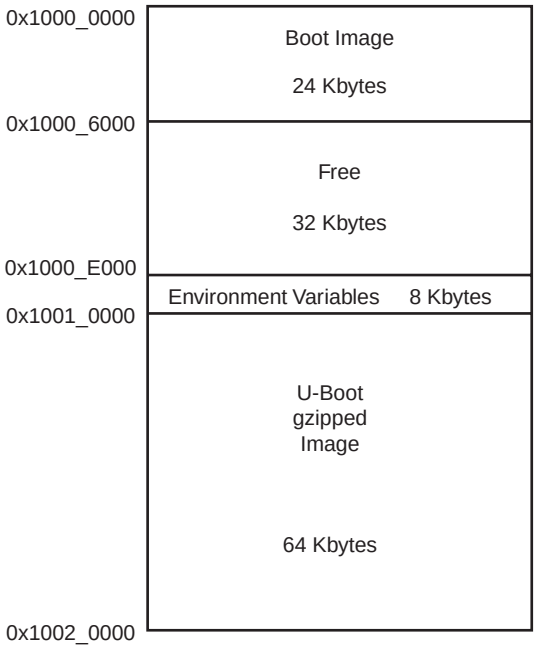
- A primary bootstrap
- A de-compression executable
- A gzip-compressed binary executable called the U-Boot Image

The primary bootstrap is concatenated to the de-compression executable into one single file called the boot image and must reside in the AT91RM9200DK Flash on NCS0 at address 0x1000_0000.

The primary bootstrap is a simple assembly code routine that sets up the system and puts it into an operational state. More specifically, it starts the high-speed clocks of the CPU and programs the on-chip memory controller to define the memory layout. When these steps are completed, the primary bootstrap gives control to the de-compression executable.

The de-compression executable is an optimized version of the gunzip program. It decompresses the gzip-compressed image of U-Boot into RAM, and jumps to it. The location of the binary executable in RAM is defined at link time.

Figure 1. Flash Mapping



Reprogramming the External Flash on the AT91RM9200DK Development Board

For Users of Slingshot JTAG/ICE Interface and MULTI®2000

The procedure for reprogramming the Flash described here is applicable to users of the AT91RM9200DK Development Board who have the Green Hills® Slingshot JTAG/ICE interface and MULTI2000.

Hardware and Software Requirements

- UBootFlashProgramming.zip file provided with this Application Note
- Green Hills Slingshot JTAG/ICE interface
- Green Hills MULTI2000 (V3.6.1 or higher) running on your PC
- A serial cable (null modem)
- HyperTerminal running on your PC application (1115200, 8, N, 1)

Connecting the AT91RM9200DK to the Host PC

1. Connect the AT91RM9200DK to the Host PC using the serial cable through the Serial Debug Port on the AT91RM9200DK and the serial COM port on the Host PC. Open a HyperTerminal session with the following configuration: 115200 bit rate, 8-bit data length, No parity bit, 1 stop bit and No flux control.
2. Connect the Slingshot JTAG/ICE Interface to the AT91RM9200DK through the JTAG/ICE Interface connector and to the PC through the USB Port.

Launching the MULTI2000

3. Extract the AT91RM9200 Getting Started Software Package file called **AT91RM9200-GettingStarted-GHS3_6-1_1.exe**, available in the UBootFlash-Programming.zip file provided with this Application Note.
4. Launch the MULTI2000 Project Manager and open the project **Getting-Started.bld.** This is available in the software package, extracted to the following directory path C:\UBootFlashProgramming\AT91RM9200-GettingStarted-GHS3_6-1_1\AT91RM9200-GettingStarted\compil.
5. Select the project basic_flash.bld by double-clicking on it. Build it and check if build was succesful.
6. Power-up and reset the AT91RM9200DK Development Board.

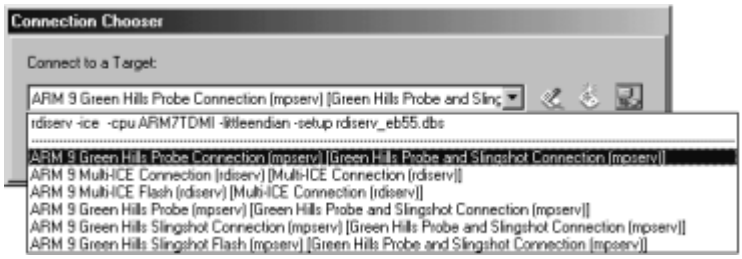
Configuring the Connection to the AT91RM9200DK

This is one of the most important steps in the procedure. As the Flash has been completely erased, a standard initialization that would normally configure the External Bus Interface, the Remap and the PLLs is not performed on the AT91RM9200DK. To carry out the initialization correctly, a Target Setup Script file (extension .dbs) must be used. The file, named mpserv_dk9200_PLL.dbs, is provided with this Application Note. You are strongly advised to use it.

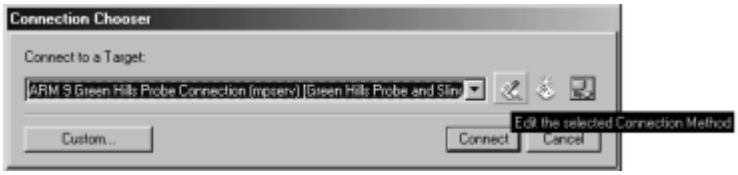
To proceed:

7. Click on the Connect button to open the Connection Chooser window:

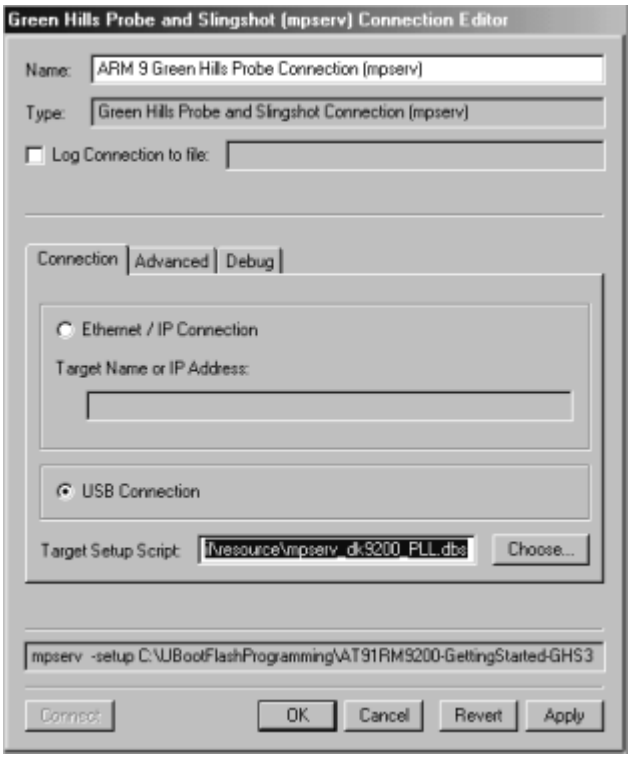
8. In the Connection Chooser window, select the ARM®9 Green Hills Probe™ Connection (mpserv):



9. Edit the selected Connection Method:



10. In the Slingshot Connection Editor window, select the Target Setup Script file that initializes the AT91RM9200DK correctly. It is very important to use the file mpserv_dk9200_PLL.dbs provided with this Application Note:

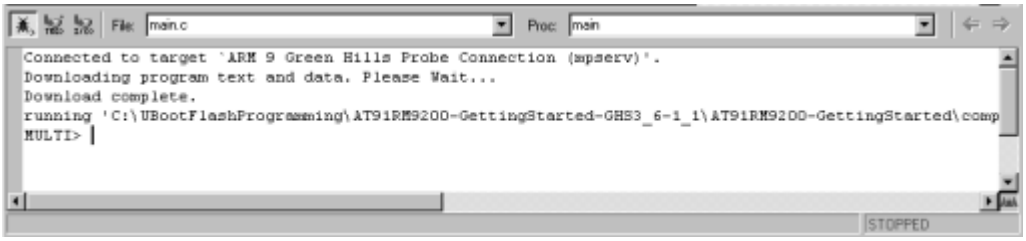


Launching the Debugger

11. Click on the Debug button to run the debugger:

12. In the debugger environment, click on the Step button to download the basic_flash project:

13. In the debugger environment, switch to the command pane:



Loading the Loader Application

The next step is to download the **loader.bin** application. This application is used to download a binary file from a HyperTerminal session through the Serial Debug Port using the Xmodem protocol. The loader.bin file to download is available in the the software package extracted at the beginning of the procedure and available in the directory C:\UBootFlashProgramming\AT91RM9200-GettingStarted-GHS3_6-1_1\AT91RM9200-GettingStarted\Flash. See “Launching the MULTI2000” on page 4.

14. Download the loader.bin application in the internal RAM at address 0x200000 by writing the following command in the command pane window (prompt MULTI>):

```
MULTI> memload raw C:\UBootFlashProgramming\AT91RM9200-
GettingStarted-GHS3_6-1_1\AT91RM9200-GettingStarted\Flash\loader.bin
0x200000
```

15. Set the Program Counter (pc) at the beginning of the downloaded loader.bin application and run from here:

```
MULTI> target reg pc 0x200000
MULTI> target run
```

Loading U-Boot

The loader application is now running on the AT91RM9200DK and is ready to download a binary application file through the Serial Debug Port using the Xmodem protocol on a HyperTerminal session.

16. Download the **u_boot.bin** binary file using the Xmodem protocol. This file is available in the UBootFlashProgramming.zip file provided with this Application Note under the directory path C:\UBootFlashProgramming\binary.

In the HyperTerminal session, send the file u_boot.bin using the Xmodem protocol. At the end of the Xmodem transfer, a new prompt is displayed in the HyperTerminal window:

```
Uboot>
```

The U-Boot is now running on the AT91RM9200DK.

This Boot program can now be used to download files to the SDRAM through the Serial Debug Port using the Kermit protocol with a HyperTerminal session. It is then copied to the Flash.

Downloading U-Boot Binary Files

The last step is to download the primary bootstrap, boot.bin, and the gzip-compressed U-Boot image, u-boot.gz. These two files are available in the UBootFlashProgramming.zip file provided with this Application Note in the directory C:\UBootFlashProgramming\binary.

17. The first file to load is the boot image "**boot.bin**".

```
Uboot> loadb 20000000
## Ready for binary (Kermit) download …
## Start Addr =0x20000000
```

The boot image is now loaded in SDRAM. The following command copies the SDRAM (0x20000000) to Flash(0x10000000):

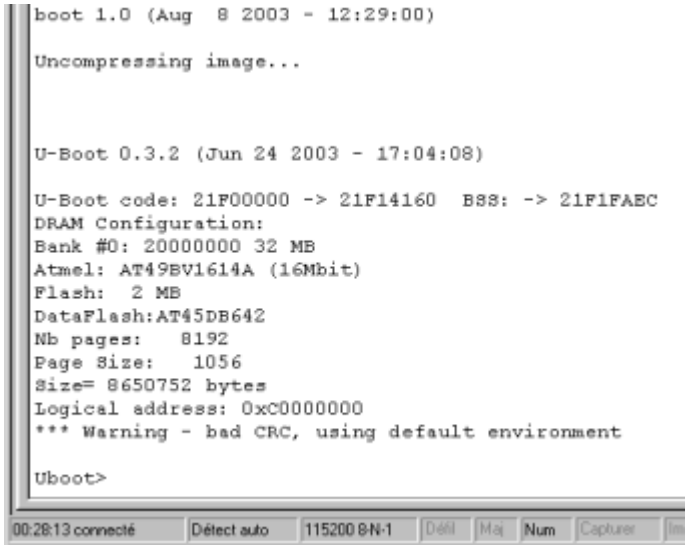
```
Uboot> protect off 10000000 10005fff
Unprotect 3 sectors
Uboot> erase 10000000 10005fff
Erase Flash from 0x10000000 to 0x10005fff...
Erasing sector 0 ... ok.
Erasing sector 1 ... ok.
Erasing sector 2 ... ok.
done.
Erased 3 sectors.
Uboot> cp.b 20000000 10000000 5FFF
Copy to flash… done.
Uboot> protect on 10000000 10005FFF
Protected 3 sectors
Uboot>
```

18. Once the primary bootstrap has been loaded, the U-Boot gzipped image can be copied into Flash. The file to load is the uboot gzipped image "**u-boot.gz**":

```
Uboot> loadb 20000000
## Ready for binary (Kermit) download …
## Start Addr =0x20000000
Uboot> protect off 10010000 1001ffff
Unprotect 1 sectors
Uboot> erase 10010000 1001ffff
Erase Flash from 0x10010000 to 0x1001ffff...
```

```
Erasing sector 8 ... ok.
done.
Erased 1 sectors.
Uboot> cp.b 20000000 10010000 FFFF
Copy to flash… done.
Uboot> protect on 10010000 1001FFFF
Protected 1 sectors
Uboot>
```

19. The U-Boot has been upgraded. Reboot your board.



Using the Internal BootROM

The procedure for reprogramming the Flash described here is applicable to users of the AT91RM9200DK Development Board who do not have a Green Hills Slingshot JTAG/ICE Interface. The solution presented here uses the Internal BootROM of the AT91RM9200.

After reset, the AT91RM9200DK boots from the external Flash memory by default (BMS high during reset). To boot using the embedded Boot ROM program (on-chip boot mode with BMS low during reset), it is mandatory to remove the R159 resistor from the AT91RM9200DK development board temporarily.

Hardware and Software Requirements

- UBootFlashProgramming.zip file available with this Application Note
- A serial cable (Null modem)
- HyperTerminal running on your PC application (1115200,8,N,1)

Connecting the AT91RM9200DK to the Host PC

1. Connect the AT91RM9200DK to the Host PC using the serial cable through the Serial Debug Port on the AT91RM9200DK and the serial COM port on the Host PC. Open a HyperTerminal session with the following configuration, 115200 bit rate, 8-bit data length, No parity bit, 1 stop bit and No flux control.

Loading the Loader Application

2. Download the **loader.bin** application. This application is used to download a binary file from a HyperTerminal session through the Serial Debug Port using the Xmodem protocol.
3. Extract the AT91RM9200 Getting Started Software Package file called **AT91RM9200-GettingStarted-GHS3_6-1_1.exe**, available on the UBootFlash-Programming.zip file provided with this Application Note. The loader.bin file to download is available in the software package extracted to the following directory path C:\UBootFlashProgramming\AT91RM9200-GettingStarted-GHS3_6-1_1\AT91RM9200-GettingStarted\Flash.
4. Power-up and reset the AT91RM9200DK Development Board.

   The Internal Boot Program runs and waits for downloading an application code into the internal SRAM via Xmodem protocol through the Serial Debug Port (DBGU). It then branches to the application entry point at the first address of the SRAM.
5. On the HyperTerminal session, send the file loader.bin using Xmodem protocol.

Loading U-Boot

The loader application is now running on the AT91RM9200DK and is ready to download a binary application file through the Serial Debug Port using the Xmodem protocol on a HyperTerminal session.

6. Download the **u_boot.bin** binary file using the Xmodem protocol. This file is available available in the UBootFlashProgramming.zip file provided with this Application Note under the following directory path C:\UBootFlashProgramming\binary.

   In the HyperTerminal session, send the file u_boot.bin using Xmodem protocol. At the end of the Xmodem transfer, a new prompt is displayed in the HyperTerminal window:

   ```
   Uboot>
   ```

   The UBoot is now running on the AT91RM9200DK.

   This Boot program can be used to download files to the SDRAM through the Serial Debug Port using the Kermit protocol with a HyperTerminal session. It is then copied to the Flash.

Downloading U-Boot Binary Files

The last step is to download the primary bootstrap, boot.bin, and the gzip-compressed U-Boot image, u-boot.gz. These two files are also available in the UBootFlashProgramming.zip file provided with this Application Note in the directory C:\UBootFlashProgramming\binary.

7. The first file to load is the boot image "**boot.bin**".

```
Uboot> loadb 20000000
## Ready for binary (Kermit) download …
## Start Addr =0x20000000
```

The boot image is now loaded in SDRAM. The following command copies the SDRAM (0x20000000) to Flash(0x10000000).

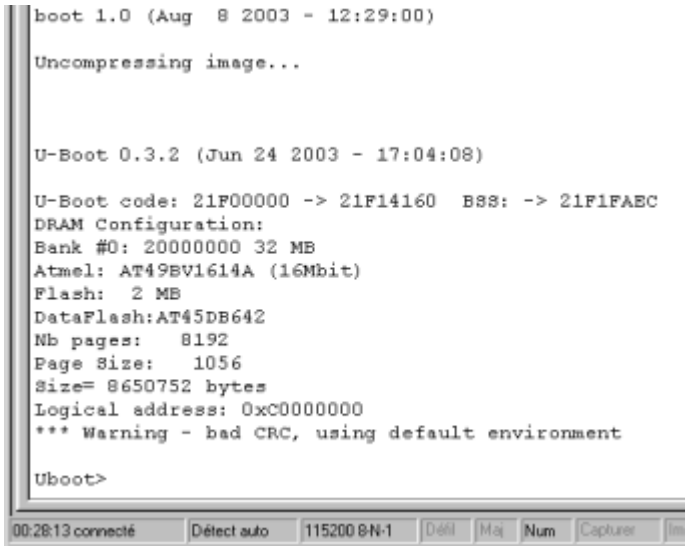
```
Uboot> protect off 10000000 10005fff
Unprotect 3 sectors
Uboot> erase 10000000 10005fff
Erase Flash from 0x10000000 to 0x10005fff...
Erasing sector 0 ... ok.
Erasing sector 1 ... ok.
Erasing sector 2 ... ok.
done.
Erased 3 sectors.
Uboot> cp.b 20000000 10000000 5FFF
Copy to flash… done.
Uboot> protect on 10000000 10005FFF
Protected 3 sectors
Uboot>
```

8. Once the primary bootstrap has been loaded, the U-Boot gzipped image can be copied into Flash. The file to load is the uboot gzipped image "**u-boot.gz**":

```
Uboot> loadb 20000000
## Ready for binary (Kermit) download …
## Start Addr =0x20000000
Uboot> protect off 10010000 1001ffff
Unprotect 1 sectors
Uboot> erase 10010000 1001ffff
Erase Flash from 0x10010000 to 0x1001ffff...
Erasing sector 8 ... ok.
done.
Erased 1 sectors.
Uboot> cp.b 20000000 10010000 FFFF
Copy to flash… done.
Uboot> protect on 10010000 1001FFFF
Protected 1 sectors
Uboot>
```

The U-Boot has been upgraded.

9. Set the R159 resistor on the AT91RM9200DK to boot from the external Flash memory. Reboot your board.



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