ADENEO

WINDOWS CE PORT ON AT91SAM9263EK BOARD

APPLICATION NOTE: USING THE WINDOWS CE BINARY BSP

HISTORY

BSP Version	Revision	Date	Update History
V 0.1.0	A	06/12/2006	Creation
V 0.9.0	A	28/06/2007	PreRelease
V 1.0.0	A	11/07/2007	Official Release

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1. Document presentation

1.1 Abbreviations used

BSP	Board Support Package
OAL	OEM Adaptation Layer
PB	Platform Builder
WinCE	Windows CE

AT91SAM9263EK Atmel evaluation kit for AT91SAM9263 product

%_TARGETPLATROOT%: this environment variable is set by platform builder to contain the BSP directory when building a Windows CE image. We use the same abbreviation in this document to refer to the BSP directory for AT91SAM9263EK board.

1.2 Document Purpose

This document provides information on how to use the demo Windows CE image for AT91SAM9263EK target device.

This document addresses users of the AT91SAM9263EK BSP:

- System developers who are generating CE image for AT91SAM9263EK targets, or willing to evaluate Windows CE 5.0 on an AT91SAM9263 based target
- Applicative developers who are developing applications that aim AT91SAM9263EK target.

2. Contents of the BSP

The AT91SAM9263EK BSP contains the following components

- OAL for AT91SAM9263 processor
- Eboot : bootloader for AT91SAM9263EK boards
- Serial Driver: Serial driver for AT91SAM9263EK boards
- USB Function Bus Driver : USB Device driver for AT91SAM9263EK boards
- USB HOST : USB Host driver for AT91SAM9263EK boards
- Ethernet : Ethernet driver for AT91SAM9263EK boards
- SPI Driver : SPi driver for AT91SAM9263EK boards
- I2C Driver : I2C driver for AT91SAM9263EK boards
- PWM Driver : PWM driver for AT91SAM9263EK boards
- LCDC Driver : LCDC driver for AT91SAM9263EK boards
- Touchscreen driver : Touchscreen driver for AT91SAM9263EK boards
- Atapi driver : Hard Disk driver for AT91SAM9263EK boards
- SD Memory driver : SD memory driver for AT91SAM9263EK boards
- EEPROM driver : EEPROM driver for AT91SAM9263EK boards
- Nandflash driver : Nandflash driver for AT91SAM9263EK boards
- Audio driver: Audio driver for AT91SAM9263EK boards

3. Tutorial on using AT91SAM9263EK BSP

AT91SAM9263EK BSP is designed to be used with Platform Builder 5.0. It might be delivered in two forms:

- A source form which allows all types of modifications in the components included in the BSP
- A binary form which allows only drivers addition on image generation for AT91SAM9263EK target

This tutorial gives a global approach of how to use the AT91SAM9263EK BSP. For specific technical points (such as updating the bootloader, performing kernel debugging, developing with AT91SAM9263EK platforms, copying CE image for the first time in SPI Data Flash, etc.), please refer to "How to" section.

3.1 Requirements

To perform this tutorial, the following resources are required:

- A workstation with SAM-BA v2.3 to v2.5, ActiveSync 3.7 at least. The PC should have at least:
  - A Serial link available
  - An Ethernet connection
  - A USB port
- The AT91SAM9263EK BSP in its binary form.

3.2 Step-by-step tutorial

3.2.1 Step 1: BSP installation on development workstation

Install the MSI file AT91SAM9263EK_BIN. This will install the binary BSP in Platform Builder and register the BSP in PB Catalog. The BSP is fully included in the AT91SAM9263EK_BIN directory.

The AT91SAM9263EK_BIN BSP should now be available in Platform Builder Catalog, under third party entry.

3.2.2 Step 2: CE Image creation based on AT91SAM9263EK_BIN BSP

The creation of a CE image is similar for AT91SAM9263EK target as for any other target. Under platform builder, create a new platform selecting *File→New Platform*. Then, follow the indications below for each step of the New Platform Wizard:

- Step 2: For the name, type AT91SAM9263EK_Tutorial,
- Step 3: Select AT91SAM9263EK_BIN,
- Step 4: Select "Custom Device",
- Step 5: Select C Libraries and Runtimes,
- Step 6: Select ActiveSync→File Sync,
- Step 7: Select USB Host support,
- Step 8:
  - Select Networking – Local Area Network (LAN) → Wired Loacal Area Network
  - Select Networking – Wide Area Networking→ RAS/PPP→Autodial,

- Select Networking – Wide Area Networking →TAPI→Unimodem,

- Step 9: Select none,
- Step 10:
  - Select Storage Manager → FAT file system,
  - Select Storage Manager → Storage Manager Control Panel Applet
  - Select Storage Manager → Partition Driver
- Step 11: Select none,
- Step 12: Select none,
- Step 13: Select none,
- Step 14: Select none,
- Step 15: Select none,
- Step 16:
  - Select Shell→Graphical Shell→Standard shell,
  - Select User Interface→Network user interface,
  - Select User Interface→Software Input Panel →Software-based Input Panel Driver,
  - Select User Interface→Software Input Panel →SIP→ SIP for small Screens,
- Step 17: Select none,
- Step 18: Select none,
- Step 19: Click Next,
- Step 20: Click Finish.

Once the image is created, you have to add manually drivers from the catalog.

Right-click on the following components and click “Add to OS design”.

- Drivers from the catalog :

  Catalog→Device Drivers→USB Function→USB Function Clients→Serial

- Drivers from the AT91SAM9263EK_BIN catalog :

  Catalog→Third Party→BSPs→AT91SAM9263EK_BIN

  - Boot Mode → Boot from SPI DataFlash
  - Storage Drivers → NandFlash

  Catalog→Third Party→BSPs→AT91SAM9263EK_BIN→Device Drivers

  - USB Function → USB Function Bus Driver → USB Function Driver
  - SPI Driver
  - Touchscreen

Now, the image can be generated: select “AT91SAM9263EK_Release” configuration (combo box in command bar) and “Menu Build OS→Sysgen”.

Note: The Binary BSP package also contains a sample Windows CE image in AT91SAM9263EK_DEMOBIN.ZIP. You can use this image by unzipping this file under %_WINCEROOT%\ PBWorkspaces\ AT91SAM9263EK_DEMOBIN, and opening the pbpxml file with PB 5.0.

3.2.3 Step 3: Preparing AT91SAM9263EK board for WindowsCE support

To check if there is already a bootloader in the SPI DataFlash, boot the board. You may have the following log on DBGU Serial output (configuration 115200, 8, n, 1):

> *RomBOOT*
> *>*
> *INFO : Low Level Init : OK*
> *Init Data flash*
> *Starting eboot ...*
> *kMaster Clock is 49921225 Hz*
> *Debug serial initialized .....OK*
>
> *Microsoft Windows CE Ethernet Bootloader Common Library Version 1.1 Built Jul 4 2007 18:17:29*
> *Microsoft Windows CE 5.0 Ethernet Bootloader for the AT91SAM926xEK board*
> *Adaptation performed by ADENEO (c) 2007*
>
> *Master Clock is 49921225 Hz*
> *Master Clock is 49921225 Hz*
> *WARNING : LoadEBootCFG: No valid Eboot configuration found.*
> *INFO : Loading default bootloader settings*
>
> *Press [ENTER] to download now or [SPACE] to cancel.*
> *Initiating image download in 5 seconds*

In this case, you can jump directly to step 3.2.4 in order to copy and boot a Windows CE image in NandFlash. Otherwise, follow the next steps.

3.2.3.1 Windows CE Boot process on EK board

When booted the AT91SAM9263 ROMBoot tries to load from a bootable device a binary in SRAM and have it executed. If no executable binary is available, it will start SAM-BA. In any case, the size of this code has to be less than internal SRAM size.

As the standard Windows CE bootloader (Eboot) is too big, the Windows CE BSP for AT91SAM9263EK board uses a boot process in 2 steps.

- First, a loader (FirstBoot) is loaded from SPI Data Flash, and executed in SRAM. It initializes AT91SAM9263EK SDRAM, downloads Eboot from SPI DataFlash in SDRAM and jumps to the startup function of Eboot.

- Next, Eboot initializes the hardware necessary to load a Windows CE image. Then it actually loads the image either from the NandFlash or from Ethernet in SDRAM and jumps to the startup function of the image.

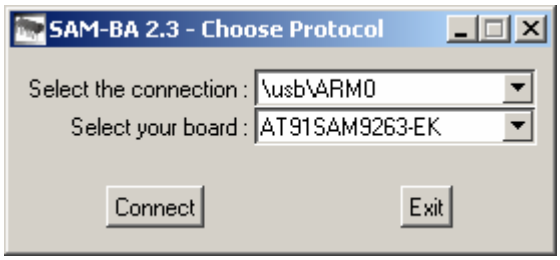
This way of working is dedicated to the EK board. For specific designs it can be adapted, according to the storage devices available on the custom board (NOR Flash, NAND, etc.)

3.2.3.2 Step 3.1: Downloading Atmel loader to SPI DataFlash:

Atmel provides software (SAM-BA) to download the bootloader in the AT91SAM9263EK board.

To download the bootloader, follow the next instructions:

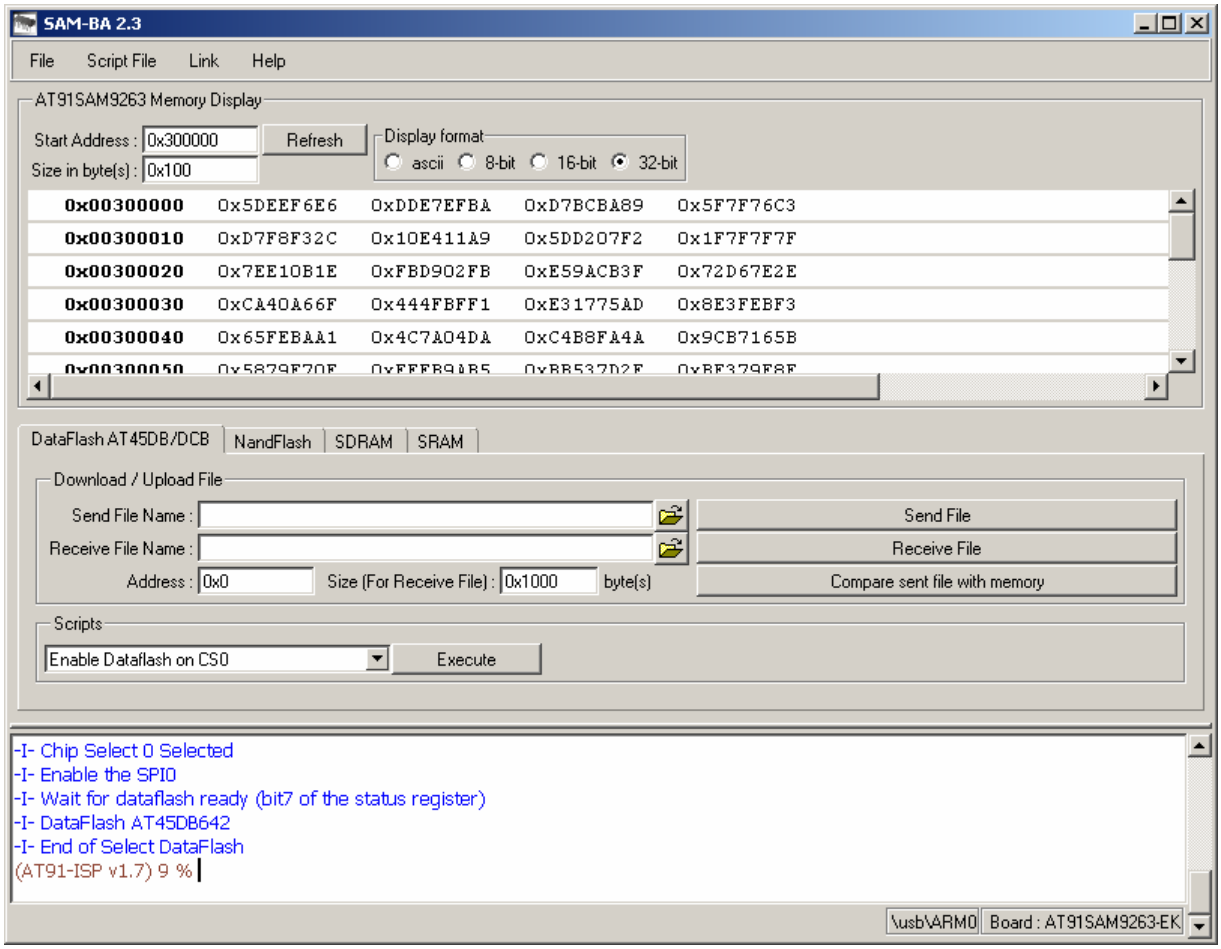
- Install the software SAM-BA v2.3, v2.4 or v2.5 (v2.6 and newer not supported!).
- Connect a USB cable between the Workstation and the AT91SAM9263EK board (using the USB Device port).
- The workstation will detect the board. Install the board's driver delivered with SAM-BA.
- Launch SAM-BA. You must obtain the following screen:



If this connection is not available, try to remove the DataFlash Card from its slot and reboot.

- Choose the board AT91SAM9263EK, and select "Connect".

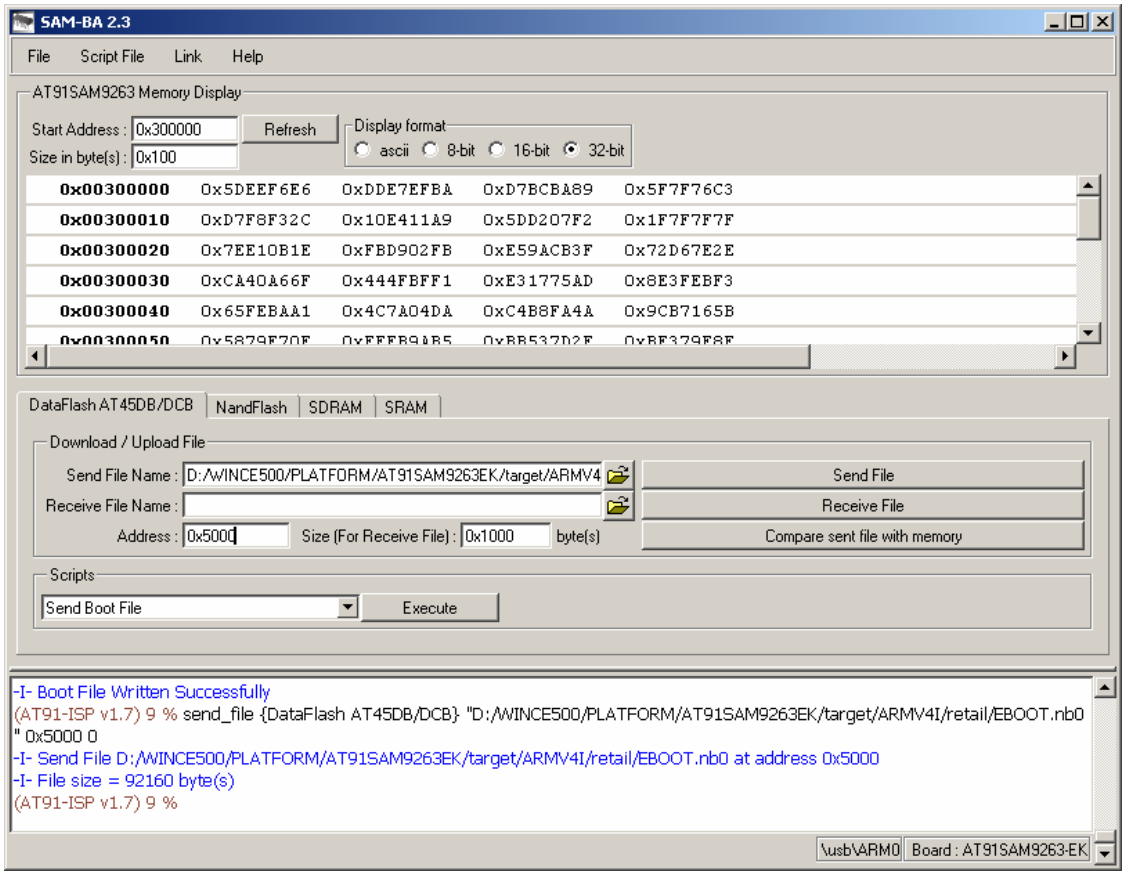
- In the main window of SAM-BA, select the tab "DataFlash AT45DB/DCB"
- In the "Scripts" list box, select "Enable DataFlash on CS0" and press "Execute". You will obtain this screen:



- In the “Scripts” list box, select “Send BOOT File” and press “Execute”.
- You will have to select the **Firstboot.nb0** file.

At this time, FirstBoot is downloaded into the DataFlash. To finish, you have to download Eboot.

- In the “Send File Name:” text box, select the **eboot.nb0** file from BSP CD.
- In the “Internal Address:” field, enter the address **0x5000** and press the button “Send File”. You will obtain the following screen:



The bootloader is now loaded in the SPI DataFlash. Close SAM-BA.

3.2.4 Step 4: Download an image through Ethernet with Platform Builder

- Reboot the board. You should have the following log messages:

> *RomBOOT*
>
> *>*
>
> *INFO : Low Level Init : OK*
>
> *Init Data flash*
>
> *Starting eboot ...*
>
> *kMaster Clock is 49921225 Hz*
>
> *Debug serial initialized .....OK*
>
> *Microsoft Windows CE Ethernet Bootloader Common Library Version 1.1 Built Jul 4 2007 18:17:29*
>
> *Microsoft Windows CE 5.0 Ethernet Bootloader for the AT91SAM926xEK board*
>
> *Adaptation performed by ADENEO (c) 2007*
>
> *Master Clock is 49921225 Hz*
>
> *Master Clock is 49921225 Hz*
>
> *WARNING : LoadEBootCFG: No valid Eboot configuration found.*
>
> *INFO : Loading default bootloader settings*

*Press [ENTER] to download now or **[SPACE]** to cancel.*

Initiating image download in 5 seconds

Ethernet Boot Loader Configuration :

0) Mac address ..... (00:12:72:72:20:20)

1) Ip address ..... (192.168.111.115)

2) Subnet Mask address .. (255.255.255.0)

3) DHCP ..... (Enabled)

4) Boot delay (seconds).. (5)

5) Frequency settings ... (core at 200, bus divider 4)

6) Download image to SDRAM

7) Download new image at startup

l) Launch flash resident image now

d) Download from ethernet now

s) Save configuration now

r) Restore default configuration and save now

n) Image flash menu

>System ready!

In this menu, you can configure the Ethernet connection between the board and your network, for instance changing the Mac and IP addresses. When using static IP (if there is no DHCP server on the network), AT91SAM9263EK target and workstation should be on the same subnetwork.

- To download the Windows CE image in SDRAM, press the key 6 until “Download image to SDRAM” appears and press the key 7 until “Download new image at startup” appears.
- Select the key D (or d) to download the image, the bootloader should display on HyperTerminal « Sending BOOTME to 255.255.255.255 ».

Once Eboot is reconfigured, follow these steps to update the CE image:

- Under Platform Builder, enter download settings (*Target→Connectivity Options).* Select Ethernet for both Download and Kernel Transport. Enter the configuration dialog. You should see in the list SAM9263_xxxx, where xxxx depends on the last bytes of MAC address. Select the SAM9263_xxx target.
- Start the download using *Target→Attach Device*. The CE image should be downloaded.

Once the image has booted, the Windows CE desktop is displayed on the screen (optionally after the touch calibration screen).

3.2.5 Step 5: ActiveSync connection

To perform ActiveSync connection, configure ActiveSync on Workstation to accept USB connections. Then, connect AT91SAM9263EK *USB Device* port to Workstation USB port. The CE target automatically tries to connect to ActiveSync, and on the workstation, ActiveSync shows as “Connecting”.

When connection is established, try copying a file from and to the CE target under the Workstation explorer.

3.2.6 Step 6: Applicative development and debugging for AT91SAM9263EK target

Firstly, the SDK of the image must be exported. This is performed through *Platform→*SDK*→New SDK.*

In “Product name”, enter “AT91SAM9263EK Tutorial”. In “Manufacturer Name”, enter “Adeneo SAS”.

Next, check eVC++ 4.0 support and Finish.

Next, generate the SDK using *Platform→*SDK*→Build SDK …*

Once SDK is built, install it by launching “AT91SAM9263EK_Tutorial_SDK.msi” located in SDK subdirectory of AT91SAM9263EK_Tutorial directory. Select “complete” installation.

Once installation is performed, reboot your workstation and launch eVC++. Create a new application supporting ARMV4I microprocessor called AT91SAM9263EK_TestAppli. In the WCE Configuration, select AT91SAM9263EK_Tutorial_SDK.

Configure Platform Manager to use ActiveSync as transport and server (through *Tools→Configure Platform Manager*, select AT91SAM9263EK_Tutorial).

Put a breakpoint in the InitInstance function. Build the application. Once build is performed, eVC++ will try to connect to target to download the application. Then launch it in debug mode. The application should stop on breakpoint. Stop debugging and exit eVC++.

4. Tips and tricks on using the BSP

This chapter gives technical information on some advanced features of the AT91SAM9263EK BSP.

4.1 How to customize and build a Windows CE image based on AT91SAM9263EK BSP?

- From the catalog window (on the right of PB workspace), choose the features to add (right click on feature + *Add To OS Design*). Features of the Windows CE OS are located in CoreOS directory of the catalog. Features of the AT91SAM9263EK_BIN BSP are located in the “Third Party\BSPs”.
- From the Workspace window, choose the features to remove (right-click on feature + *Delete*). Some features can’t be removed if they are required by others features.
- To build the image, select the type of build (Debug or Release) and use *Build OS→Build and Sysgen Current BSP*.
- Sometimes the build fails :

Error: This build configuration has not been sysgen'ed
Error adding sysgen'ed headers and libs
Error rolling toolkit-specific files

To solve this issue, edit <*workspace_root*>*Makesdk**platform.ini*, look for “*sysgen=”*(2

occurrences, one for debug and one for release). If there is *sysgen=0*, modify it in *sysgen=1* and rebuild the SDK by executing:

makesdk.exe /inifile:"<workspace_root>\Makesdk\platform.ini"

4.2 How to configure Platform Builder to allow image downloading through Ethernet?

- Connect a serial link between DBGU AT91SAM9263EK board connector and Development workstation. Launch a terminal session on development workstation
- Under PB, configure the Ethernet connection (*Target→Connectivity Options*): select Ethernet for both services (Download & Debug), and click on the *Configure* button
- Reboot AT91SAM9263EK board
- When terminal displays “Press any key to break into configuration menu”, enter a key to configure bootloader
- From bootloader main menu under the terminal, change the settings of Ethernet connection (MAC address, IP address, DHCP...)
- From bootloader main menu under the terminal, press 6 to select “Download image to SDRAM”
- From bootloader main menu under the terminal, press 7 to select “Download new image at startup”
- From bootloader main menu under the terminal, select “Download image now”
- Under PB, in the Ethernet configuration window, select the SAM9263_xxx board that should appears when bootloader executes

4.3 How to download an image through Ethernet from Platform builder?

- Under PB, launch target downloading (*Target→Attach Device)*
- Reboot AT91SAM9263EK board
- When the bootloader executes, Platform Builder should perform the Windows CE image downloading
- Once downloading is finished, the Windows CE image should start. Platform builder waits for kernel debugging connection and the CE image connects to debugger. Traces are displayed in Platform builder debug Window

4.4 How to copy and boot a Windows CE image in Nand Flash?

- Connect a serial link between DBGU AT91SAM9263EK board connector and Development workstation. Launch a terminal session on development workstation.
- Under PB, configure the Ethernet connection (*Target→Connectivity Options*): select Ethernet for both services (Download & Debug), and click on the *Configure* button.
- Reboot AT91SAM9263EK board
- When terminal displays “Press [ENTER] to download now or [SPACE] to cancel.”, press SPACE key to configure bootloader
- From bootloader main menu under the terminal, select Network Menu. If the network settings don’t fit with Ethernet link between AT91SAM9263EK board and development workstation, change the network settings

- From bootloader main menu under the terminal, press 6 to select "Download image to Flash"
- From bootloader main menu under the terminal, press 7 to select "Launch existing flash resident image at startup"
- From bootloader main menu under the terminal, select "Download image now"
- Under PB, in the Ethernet configuration window, select the AT91SAM9263EK board that should appear when bootloader executes
- Under PB, launch target downloading (*Target→Attach Device)*
- When the bootloader executes, Platform Builder should perform the Windows CE image downloading and copy to Nand flash,
- Once downloading is finished, the target reboots and the local image Nand flash is booted. The CE image doesn't connect to kernel debugger, as Ethernet debugging is not started. The debug traces are sent to DBGU instead (displayed on HyperTerminal).

4.5 How to upload a CE image without using Platform Builder?

4.5.1 With a TFTP client:

For uploading a CE image, you need a tftp client which can send a file and which can change its port value. These steps replace steps using PB but CE image must not be built with KITL support since KITL needs PB.

- Change port setting in tftp client from 69 (which is the TFTP standard) to 980.
- Reboot AT91SAM9263EK board, choose the correct bootmode, and then exit eboot.
- When eboot displays the following message on the terminal: "Sent BOOTME to 255.255.255.255", send nk.bin to the AT91SAM9263EK target.
- The transfer should be running without trouble.

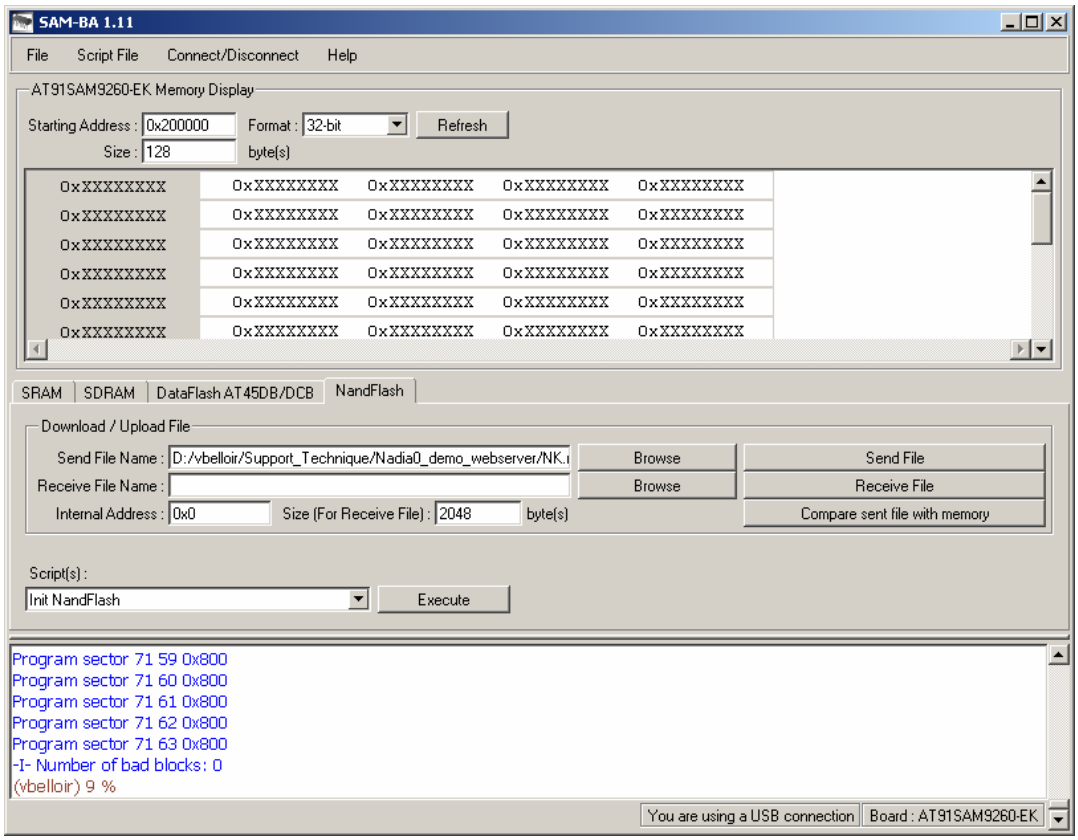
You can use pumpkin from http://www.klever.net/kin/pumpkin.html which allows changing the port setting.

4.5.2 With SAM-BA:

- Connect a serial link between DBGU AT91SAM9263EK board connector and Development workstation. Launch a terminal session on development workstation,
- Reboot AT91SAM9263EK board,
- When terminal displays "Press [ENTER] to download now or [SPACE] to cancel.", press SPACE key to configure bootloader,
- From bootloader main menu under the terminal, press 6 to select "Download image to Flash"
- From bootloader main menu under the terminal, press 7 to select "Launch existing flash resident image at startup"
- Press "N" to enter in the NandFlash Menu, and then press "2" to configure NandFlash settings. The NandFlash settings are given in Platform Builder, at the end of a "Make A run time image". They are:

- Physical Start address,
- Starting IP,
- Total Rom Size.

- Open SAM-BA, choose the at91sam9263ek board like in step *Step 3.1: downloading Atmel loader to SPI DataFlash.*
- In the main window of SAM-BA, select the “NandFlash” tab
- In the “Script(s) :” list box, select “Init NandFlash” and press “Execute”,
- Then, in the “Send File Name:” box, select the **nk.nb0** file, and press “Send File” button. It takes a few times. You will get the following screen:



Once downloading is finished, the target must be rebooted and the local image NandFlash is launched.

4.6 How to work simultaneously with many targets on the same network?

The targets are identified through the name displayed in the *Target→Connectivity Options* dialog box. This name is SAM923_xxx. The xxxx value reflects the last two bytes of the MAC address of the target.

These two bytes can be set through bootloader configuration menu, in the network settings. Consequently, when working with many AT91SAM9263EK targets on the same network, set different values for these bytes to allow there identification.

Next, when Eboot is trying to connect to Platform Builder, it displays on the DBGU the name used for identification. Selecting this name in the *Target→Connectivity Options* menu of Platform Builder will ensure that it will connect to this target when downloading the image.

4.7 Why does the device reset every hour?

A time Bomb is inserted in the evaluation BSP. By default, it makes the device reset every hour. This time bomb can be removed buying the full release of the BSP.

4.8 Why does SAMBA v2.5 doesn't work properly with the platform?

A bug appeared in the version 2.5 of the software SAM-BA, it isn't possible to establish a connection with the platform AT91SAM9263EK. An error message appears at startup. To fix this problem, you can use the previous version of the software (SAMBA 2.3), or you can edit the file DATAFLASH.tcl located in /SAM-BA v2.5/lib/AT91SAM9263-EK/.

In the function *EraseAllDataFlash* please do the following modifications:

```
proc DATAFLASH::EraseAllDataFlash {  } {
    variable deviceAT45
    variable AT91C_DATAFLASH_TIMEOUT
+   global commandLineMode                    Insert this declaration.

    # Wait window for erasing
-   if {$commandLineMode == 0= {              Overwrite this line with the one below.
+   if {$commandLineMode == 0} {
      waitWindows::createWindow "Erasing whole DataFlash" "erase.gif"
      tkwait visibility .topWaitWindow
    }
```

END OF DOCUMENT

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