JANUS REMOTE COMMUNICATIONS

Application Note 105

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400AP Application Note
Uploading Firmware Images to NAND Flash

Overview

This document describes the process of uploading the required firmware images into NAND flash memory of the Terminus 400AP. These instructions are based on a Linux PC running the Atmel SAM-BA application. The following images are required to run the Linux OS on the 400AP:

Bootstrap
U-Boot
Linux Kernel
UBI filesystem

The 400AP comes with these images pre-loaded in NAND flash during production. If these images have been erased from NAND flash memory, replacement images are located on the Janus website under 400AP downloads.

http://www.janus-rc.com/400ap_downloads.html

The Linux Kernel and UBI filesystem images are generated from the Buildroot toolchain. Please reference the following document for configuring the Buildroot toolchain for use with the 400AP.

400AP Application Note - Configuring the Buildroot toolchain for the 400AP

Atmel's SAM-BA application is used to write firmware images to flash memory of the 400AP. Please reference the following document for configuring the SAM-BA application for use with the 400AP.

400AP Application Note - Atmel SAM-BA Application Modifications

Terminal Emulator for use with the 400AP Console Serial Port:

A Terminal Emulator is needed in order to communicate with the 400AP console serial port (Front Panel DB9 Connector). The following instructions are for Minicom, but you can use a Terminal Emulator you are comfortable with.

Step 1. Open a Linux Terminal window with user privileges that allow access to serial ports.

Step 2. Connect 400AP Console serial port to a PC serial port using a standard serial cable.

Step 3. Issue the following: minicom –s.

Follow the on screen menus to configure the following parameters:

Serial Device:	/dev/ttyS0 (System Dependant)
Bps/Par/Bits:	115200 8N1
Hardware Flow Control:	No
Software Flow Control:	No

Save setup as DF1 before exiting.

Step 4. Issue the following to launch Minicom Terminal Emulator: minicom –o

Configuring 400AP RomBOOT Mode:

The following instructions assume the custom version of AT91bootstrap for the 400AP is loaded into NAND flash. This version of AT91bootstrap evaluates the state of the Mode button and vectors to RomBOOT if the Mode button is pressed for some time during boot.

If no bootable code is found after the 400AP is powered or reset, RomBOOT mode will be entered automatically. Under this condition the only indication of RomBOOT mode is that "RomBOOT" is transmitted from the 400AP console port.

Step 1. Power the 400AP.

Step 2. Press and hold the Mode button.

Step 3. Press and release the Reset button while continuing to press the Mode button.

Step 4. Release Mode button after green LED illuminates.

Step 5. The 400AP will be in RomBOOT mode when the green LED illuminates.

The following will be displayed from the Console port if you are in RomBOOT mode.

RomBOOT

Note 1: Under some circumstances the proceeding instructions can fail depending on the state of the following files: Bootstrap, U-Boot. If RomBOOT is not displayed follow these alternate instructions.

Alt. 1.) Press and hold the Mode button.

Alt. 2.) Power cycle the 400AP.

Alt. 3.) Release Mode button after green LED illuminates.

*Note 2: If the 400AP vectors to code in the NAND flash during boot and the code is corrupt or needs to be overridden the only way to get into RomBOOT mode is via the 20-pin JTAG port. Please refer to NAND Flash recovery on the following s*ection of this guide.

Configuring 400AP RomBOOT Mode continued:

Step 6. Connect a USB cable to the USB device port of the 400AP. The other end of the USB cable connects to a USB host port of your PC running the SAM-BA application.

The following should display in the terminal emulator: ">"

The ">" prompt indicates that the 400AP is in RomBOOT mode and the driver has been initialized by the host PC.

If the ">" prompt doesn't display when the USB cable is connected to the host PC then please check the following.

1. Has the Kernel been compiled with support for the RomBOOT driver?

   Note: Linux Kernel 2.6.37 or higher is required for SAM-BA application to work with 400AP USB device port driver. Linux Kernel must be compiled with SAM-BA driver support.

   Kernel Settings (make menuconfig):

   Device Drivers --->

   [*] USB Support --->

   <M> USB Serial Converter support --->

   <M> USB Atmel SAM Boot Assistant (SAM-BA) driver

2. Is another driver detecting the USB connection and configuring the USB device as something other then the required ttyUSB0 device?

   Open a console window and run 'dmesg ' after plugging in the USB cable to a 400AP in RomBOOT mode. The following test is an example of a properly setup system.

   user@localhost ~ $ dmesg

   usb 4-2: new full speed USB device number 2 using uhci_hcd
   usb 4-2: New USB device found, idVendor=03eb, idProduct=6124
   usb 4-2: New USB device strings: Mfr=0, Product=0, SerialNumber=0
   usbcore: registered new interface driver usbserial
   usbserial: USB Serial Driver core
   USB Serial support registered for sam-ba
   sam-ba 4-2:1.1: sam-ba converter detected
   usb 4-2: sam-ba converter now attached to ttyUSB0
   usbcore: registered new interface driver sam-ba
   sam_ba: v1.0: Atmel SAM Boot Assistant (SAM-BA) driver

3. If sam-ba converter comes up as ttyACM0 interface you will need to create the following symbolic link

   ln -s /dev/ttyACM0 /dev/ttyUSB0

   More SAM-BA set-up information at: http://www.at91.com/linux4sam/bin/view/Linux4SAM/SoftwareTools

NAND Flash Recovery

The Atmel ARM9 is configured on boot to execute its RomBOOT code. This RomBOOT code interrogates connected memory to detect an application to execute. If no application is detected the RomBOOT code enters RomBOOT mode and allows the Atmel SAM-BA application to access connected memory in order to upload firmware images. The 400AP has all application code stored in the NAND flash. The first location in Flash has a custom Bootstrap application that controls low-level hardware initialization. After Bootstrap has initialized the ARM9 hardware it detects the state of the external Mode button of the 400AP. If during this check the Mode button is pressed the green LED will illuminate and Bootstrap will vector to RomBOOT mode. If for any reason Bootstrap becomes corrupt the Mode button will not be able to interrupt the boot process and RomBOOT mode will not be entered. In this bricked condition firmware can only be reloaded with use of Atmel SAM-ICE emulator pod and the SAM-BA software.

The following directions are based on the Windows version of the Atmel SAM-BA application. The following emulator pod is required during the NAND flash recovery instructions.

Atmel Part: AT91SAM-ICE

User Guide: http://www.atmel.com/dyn/resources/prod_documents/doc6206.pdf

Follow the SAM-ICE user guide for how to install the Windows drivers.

Once the drivers are installed follow these directions to erase NAND flash contents.

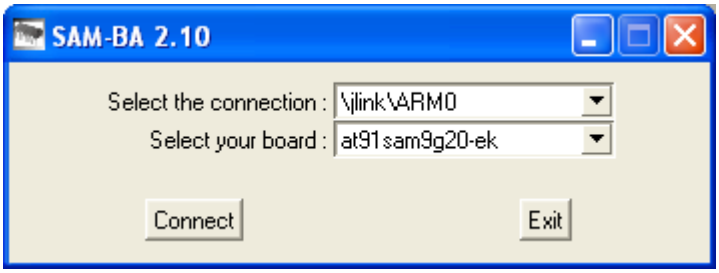
Step 1.) Connect the SAM-ICE emulator pod to your PC and the 20-pin ribbon cable to the 400AP JTAG port (P5).

Step 2.) Power the 400AP.

Step 3.) Run SAM-BA v2.10 application.

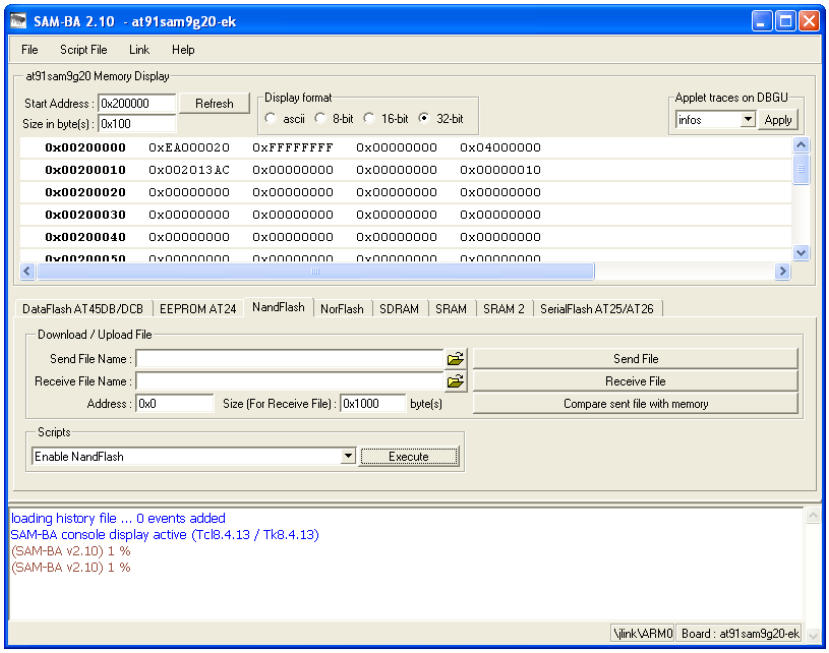
Note: Do not run the SAM-BA v2.10_cdc version.

Step 4.) When prompted make the following settings and select Connect.



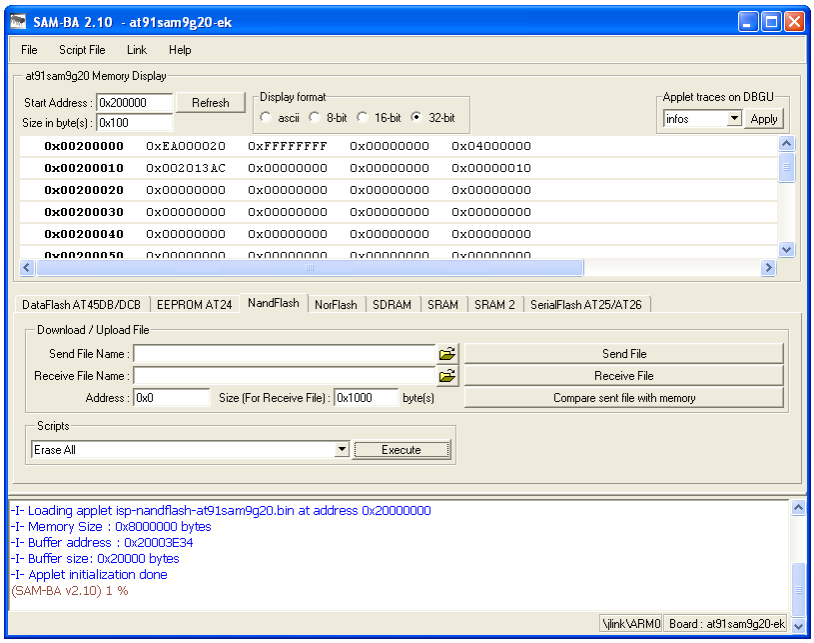
NAND Flash Recovery continued

Step 5.) Select Enable NandFlash script and select Execute



Step 6.) Select Erase All script and select Execute.

Note: Do not select Scrub NandFlash script.



Step 7.) Remove power from 400AP then disconnect the SAM-ICE pod from 400AP.

At this point you will need to follow the directions in this application note to restore the following firmware.

Bootstrap U-Boot Linux Kernel UBI filesystem

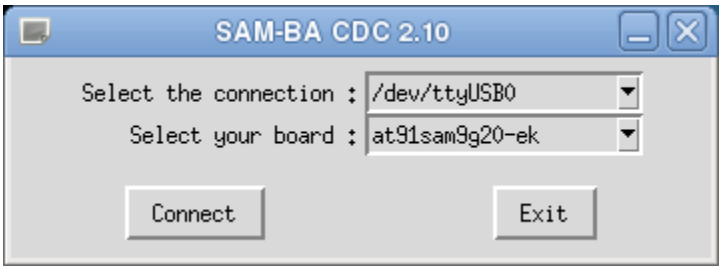
Launching SAM-BA Application:

Step 1. Configure 400AP for RomBOOT mode.

*Note: Refer to **Configuring 400AP RomBOOT Mode** section of this user guide.*

Step 2. Launch SAM-BA application.

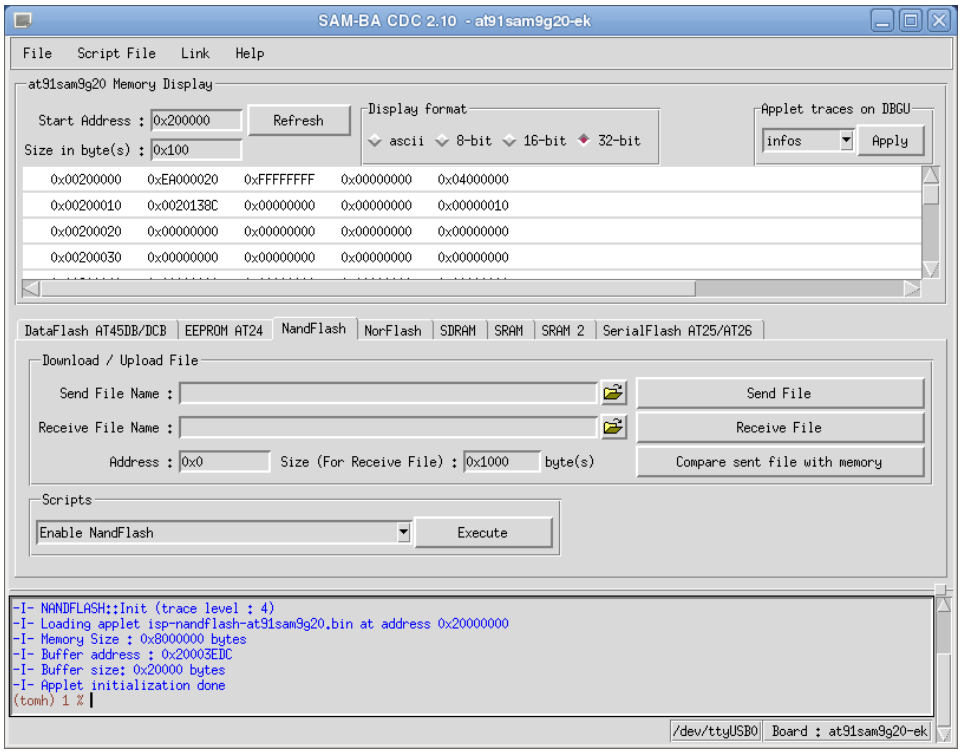
Step 3. When prompted configure the following options and then select Connect.



Step 4. To program the Flash memory you need to select Enable NandFlash.

To enable flash select the **Execute** button.

Note: NAND Flash needs to be enabled every time you launch the SAM-BA application.



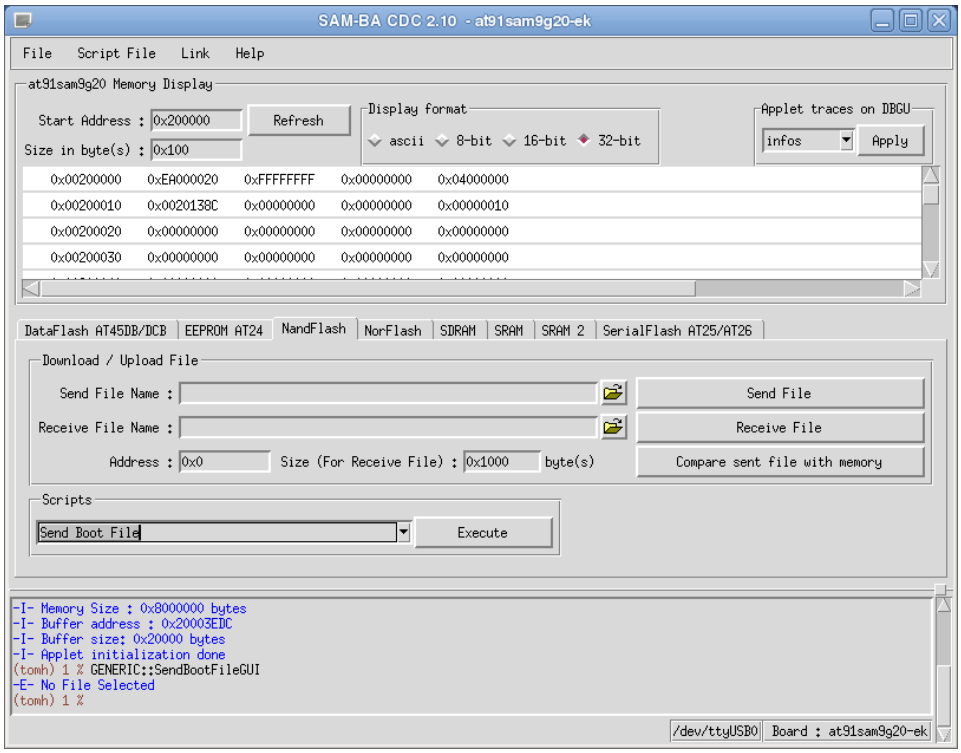
Writing Bootstrap Image to NAND Flash Memory:

Step 1. Launch SAM-BA application.

*Note: Refer to **Launching SAM-BA Application** section in this user guide.*

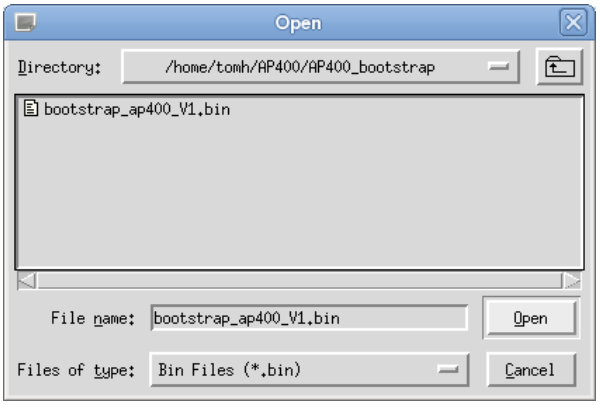
Step 2. To program to 400AP Bootstrap image you need to select **Send Boot File.**

Select the **Execute** button.



When prompted select the Bootstrap image.

Select **Open** button to write the Bootstrap image to flash memory.



Writing U-Boot Image to NAND Flash Memory:

Step 1. Launch SAM-BA application.

Note: Refer to Launching SAM-BA Application section in this user guide.

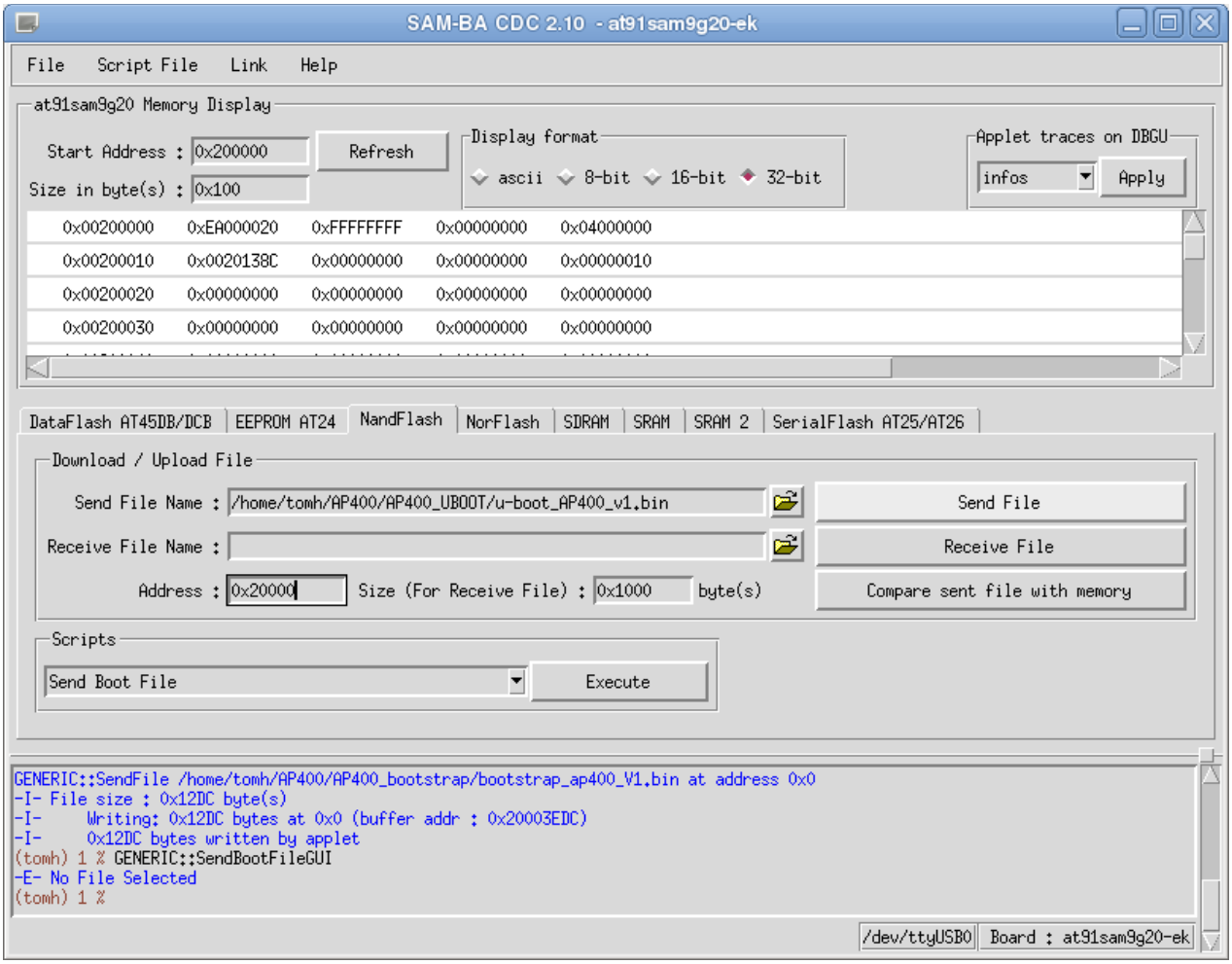
Step 2. Enter 0x20000 in the Address field.

Click the  Icon next to the **Send File Name** field.

When prompted select the U-boot image and select **Open**.

To write the U-boot image to flash select **Send File**.

Verify image has been written correctly by selecting **Compare sent file with memory**.



Writing U-Boot Image to NAND Flash Memory continued

Step 3. After writing the U-Boot image to flash memory you will need to update the boot arguments. Open a Terminal Emulator application and reset 400AP.

Note: Refer to **Terminal Emulator for use with the 400AP** *section in this user guide.*

Step 4. Exit out of SAM-BA application.

Step 5. When prompted by U-Boot, exit out of autoboot.

Hit any key to stop autoboot:

The following prompt should be displayed:

U-Boot>

Step 6. The following commands are for the 400AP using a UBI File System image.

At the U-Boot prompt enter the following U-Boot commands:

setenv bootcmd nand read 0x22000000 0x00200000 0x00200000\; bootm 0x22000000

setenv bootargs mem=64M console=ttyS0,115200 ubi.mtd=1 root=ubi0:rootfs rw rootfstype=ubifs

setenv ethaddr xx:xx:xx:xx:xx:xx

saveenv

boot

Note: xx:xx:xx:xx:xx:xx should be substituted with the MAC address listed on the 400AP product label.

Writing Linux Kernel Image to NAND Flash Memory:

Step 1. If the flash memory location where the Linux Kernel is to be written is blank proceed to Step 4.

You will need to erase the flash memory location where the Linux Kernel is going to be written. Open a Terminal Emulator application and reset 400AP.

*Note: Refer to **Terminal Emulator for use with the 400AP** section in this user guide.*

Step 2. When prompted by U-Boot, exit out of autoboot.

Hit any key to stop autoboot:

The following prompt should be displayed:

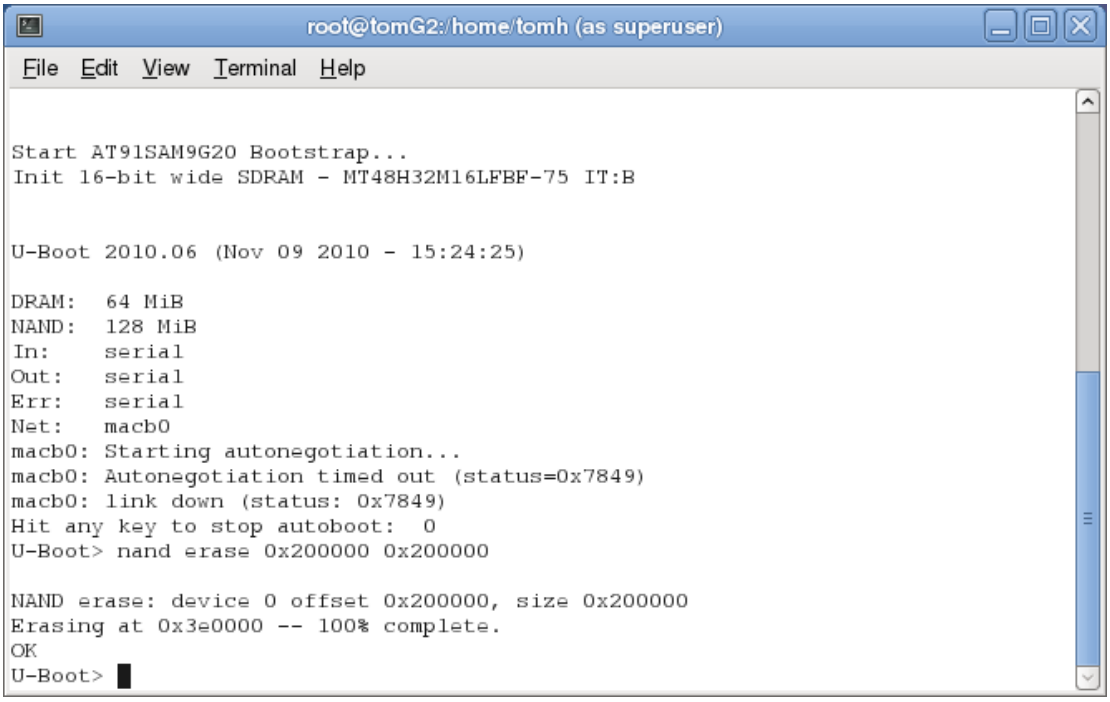
U-Boot>

Step 3. At the U-Boot prompt enter the following command.

nand erase 0x200000 0x200000

Note: If you are also going to write the File System image then issue the following command to erase memory for Kernel and File System at once.

nand erase 0x200000



Writing Linux Kernel Image to NAND Flash Memory continued:

Step 4. Launch the SAM-BA application.

*Note: Refer to **Launching SAM-BA Application** section in this user guide.*

Step 5. Enter 0x200000 in the Address field.

Click the  Icon next to the **Send File Name** field.

When prompted select Linux Kernel image and select **Open**.

*Note: If using the Buildroot toolchain as configured for the 400AP the Kernel image will be named, **uImage**. You will not be able select this image from within SAM-BA application without renaming the file with a file extension.*

Example: Rename file to **uImage.bin**

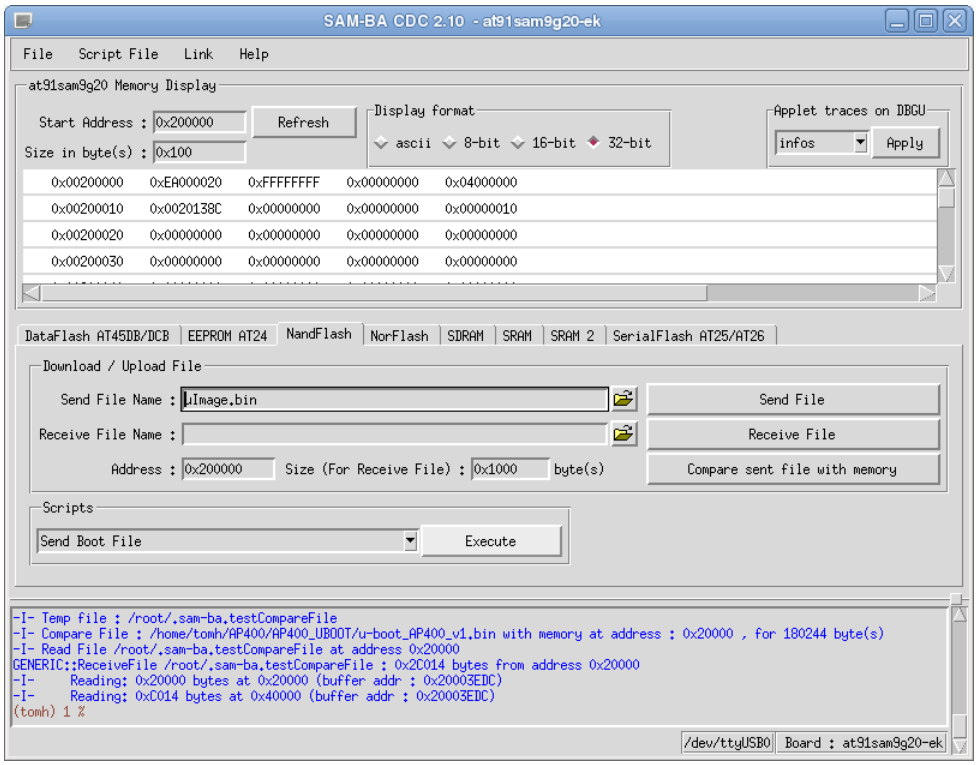
Another option is to create a symbolic link for uImage.bin that references uImage.

Example: ~/buildroot/output/images $ ln –s uImage uImage.bin

To write Linux Kernel to flash select **Send File**.

Verify image has been written correctly by selecting

Compare sent file with memory.



Writing File System Image to NAND Flash Memory:

Step 1. If the flash memory location where the File System is to be written is blank proceed to Step 4.

You will need to erase the flash memory location where the File System is going to be written. Open a Terminal Emulator application and reset 400AP.

*Note: Refer to **Terminal Emulator for use with the 400AP** section in this user guide.*

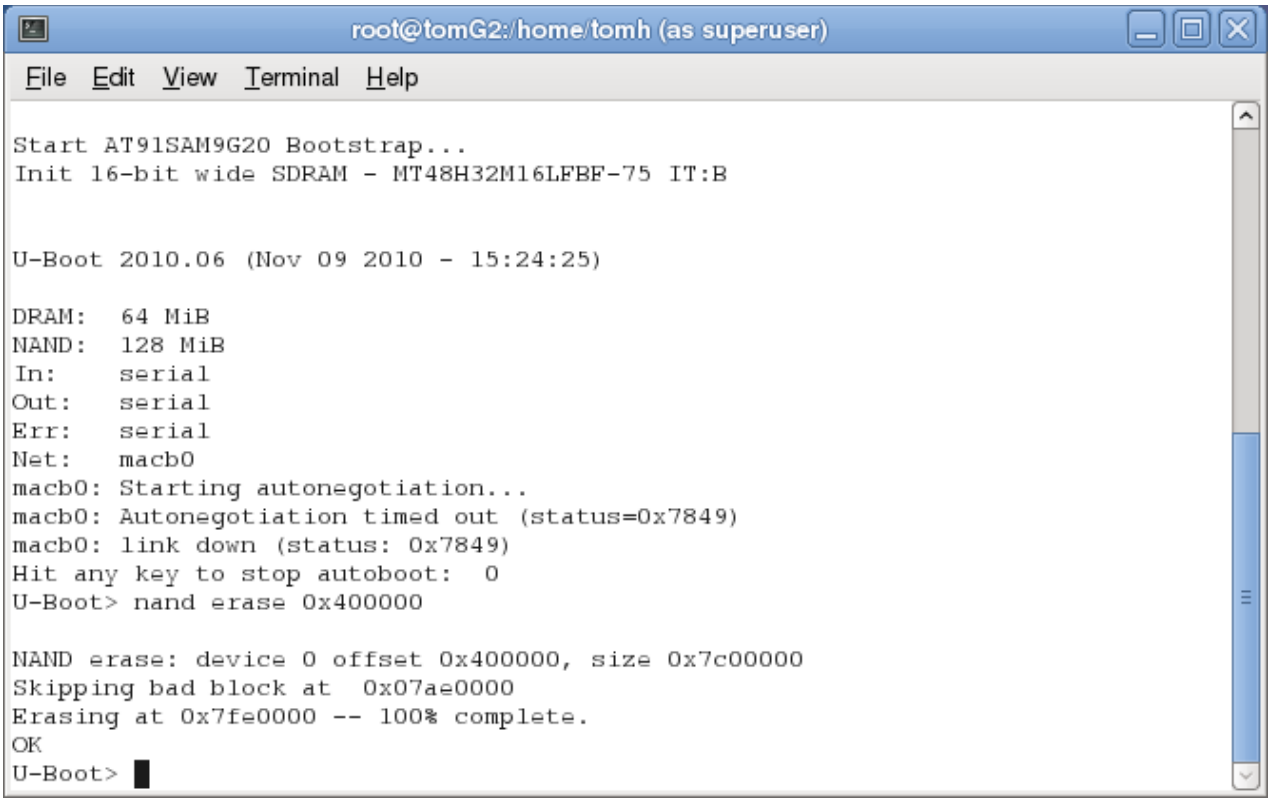
Step 2. When prompted by U-Boot, exit out of autoboot.

Hit any key to stop autoboot:

The following prompt should be displayed:
U-Boot>

Step 3. At the U-Boot prompt enter the following command.

nand erase 0x400000



Writing File System Image to NAND Flash Memory continued:

Step 4. Launch the SAM-BA application.

*Note: Refer to **Launching SAM-BA Application** section in this user guide.*

Step 5. Enter 0x400000 in the Address field.

Click the  Icon next to the **Send File Name** field.

When prompted select File System image and select **Open**.

*Note: If using the Buildroot toolchain as configured for the 400AP the filesystem will be named, **rootfs.ubi**.*

To write the File System to flash select **Send File**.

Verify image has been written correctly by selecting
Compare sent file with memory.