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400AP Application Note Uploading Firmware Images to 400AP NAND Flash Models

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Overview

This document describes the process of uploading the required firmware images to NAND flash of the 400AP. These instructions should be followed if you are uploading new firmware into the 400AP.

Requirements:

Linux Development PC:

Instructions contained in this application note are based on the Ubuntu distribution of Linux. If you are using another distribution of Linux the instructions might need to be altered to match the Linux distribution you are using.

Software Applications:

The following applications are used in this application note. These applications run on the Development PC.

Atmel's SAM-BA

minicom Terminal Emulator

400AP (NAND flash models):

The following serial numbers use NAND flash as non-volatile memory.

Serial numbers are listed on product label.

ARXXXXX

DEMO-??-ARXXXXX

??-ARXXXXX

X   = Numeric value (0 to 9)

??   = Numeric value (00 and 10), Example "07-AR99999"

Firmware Images:

Firmware images required to run the Linux OS on the 400AP.

These images are stored in NAND flash.

AT91Bootstrap

U-Boot

Linux Kernel

UBI filesystem

Firmware Images:

The 400AP comes with firmware pre-loaded in NAND flash during production. If the images have been erased from NAND flash, replacement images are located on the Janus website under 400AP downloads. Look for the firmware archive that matches the serial number on your product label.

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

The Linux Kernel and UBI filesystem images are generated from the Buildroot toolchain. If you would like to customize your own Kernel and filesystem you will need to setup the Buildroot toolchain. Please reference the following document for configuring the Buildroot toolchain for use with the 400AP.

400AP Application Note - Buildroot Toolchain Installation for the 400AP

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Terminal Emulator:

A Terminal Emulator on your development PC is needed in order to communicate with the 400AP console serial port (Front Panel DB9 Connector). The serial console port exposes the 400AP Linux Command Line Interface(CLI). The following instructions are for minicom, but you can use any Terminal Emulator you are comfortable with.

⚠️ The following instructions assume you are a normal Linux user (not root) without privileges to access serial ports. The instructions are based on the use of the sudo package. All commands referenced below will be issued at the PC's Linux CLI

Step 1. Opening a terminal on your PC in order to access the PC's Linux CLI.

For default Unity Desktop of Ubuntu 11.04 or later.

Dash → More Apps → Accessories → Terminal

For default Gnome Desktop of releases earlier than Ubuntu 11.04.

Applications menu → Accessories → Terminal

Step 2. Making required 400AP hardware connections.

Connect 400AP Console serial port (Front Panel DB9 Connector) to your PC's serial port using a standard serial cable.

Apply power to 400AP.

Step 3. Configuring minicom serial port parameters.

Type the following command at Linux PC's CLI: sudo minicom –s

Enter your Linux user password if prompted.

Follow the on screen menus to configure the following parameters:

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

Save setup as DF1 before exiting.

Step 4. Starting minicom Serial Communication Program.

Type the following command at Linux PC's CLI: `sudo minicom –o`

At this point you have a connection to the 400AP console port.

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RomBOOT Mode:

RomBOOT mode is an operational state that allows firmware upload into NAND flash via Atmel's SAM-BA application. If firmware has been erased the 400AP will automatically boot into RomBOOT mode. Under this condition the red and green LED's will not illuminate and the only indication that RomBOOT mode has been entered is that "RomBOOT" will be displayed via the 400AP console port.

The 400AP is shipped from the factory with a production image that includes a low level bootloader. The bootloader is a modified version of Atmel's AT91bootstrap. On boot the 400AP runs AT91bootstrap and RomBOOT mode is not entered.

The following instructions assume the custom version of AT91bootstrap is loaded into NAND flash. Follow these instructions to bypass AT91bootstrap and boot into RomBOOT mode.

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.
       RomBOOT will be displayed via the 400AP console port after the 400AP boots into RomBOOT mode.

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.

SAM-BA:

Atmel's SAM-BA application is used to write firmware images to flash memory of the 400AP. Janus has customized the SAM-BA installation for use with the 400AP. The instructions in this application note reference this customized version of SAM-BA. Please reference the following document for configuring SAM-BA for use with the 400AP.
       400AP Application Note - Atmel SAM-BA Installation for Janus 400AP Products

Step 1. Entering RomBOOT mode.

 Refer to RomBOOT Mode section of this application note.

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SAM-BA continued:

Step 2. Starting SAM-BA application – continued.

Open a terminal on your PC in order to access the PC's Linux CLI.

For default Unity Desktop of Ubuntu 11.04 or later.

Dash → More Apps → Accessories → Terminal

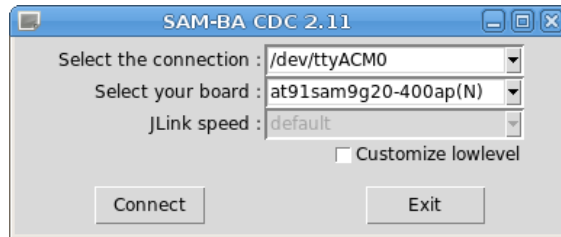For default Gnome Desktop of releases earlier than Ubuntu 11.04.

Applications menu → Accessories → Terminal

Type the following command at Linux PC's CLI:

sudo ~/sam-ba_janus/sam-ba

Enter your Linux user password if prompted.

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

Step 4. To program NAND Flash it must first be enabled.

Select the Enable NandFlash script from the drop down menu and click the Execute button.

⚠ NAND Flash needs to be enabled every time you start SAM-BA.

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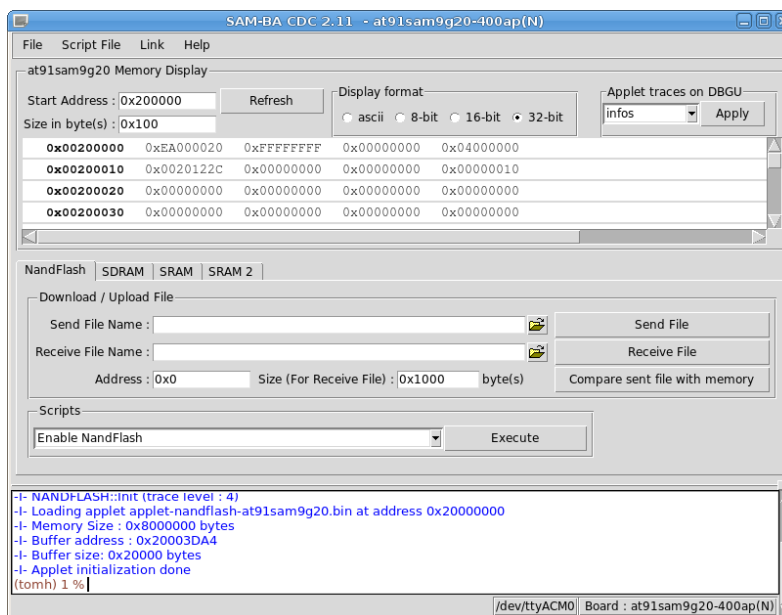
Uploading Firmware Images to Flash:

The following section describe how to load each of the required firmware images into NAND flash. The following diagram defines where each image is located in NAND flash.
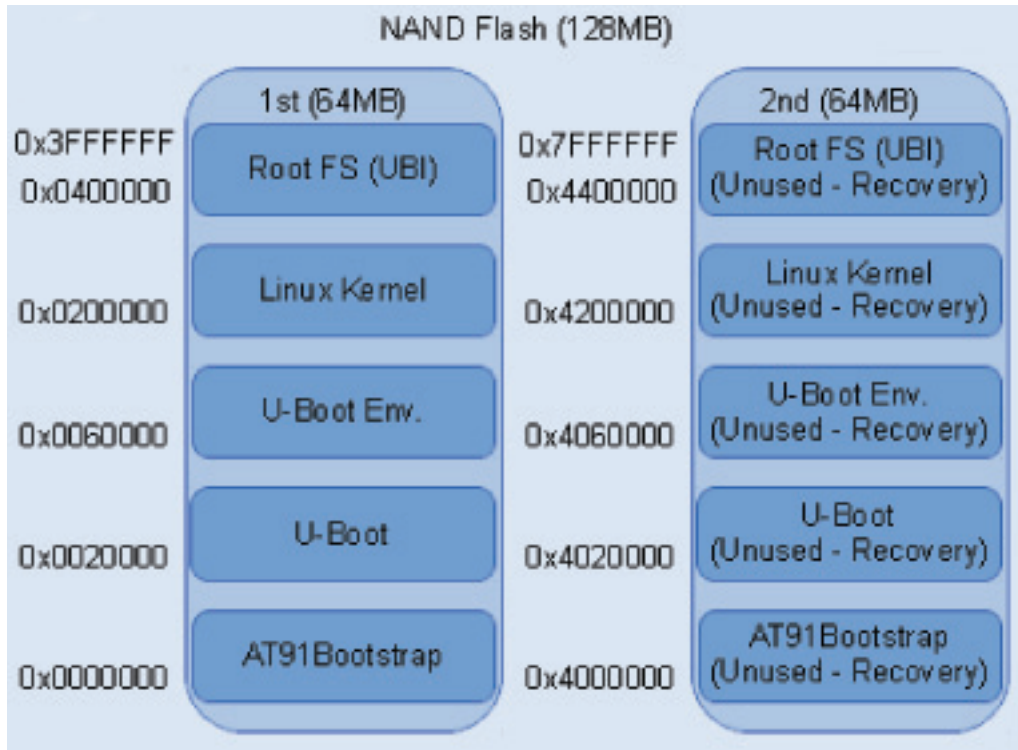
The following sections are written with the assumption that you are only writing one image at a time. If you are writing all images at the same time you will only need to enter RomBOOT mode and launch SAM-BA one time.

If you have setup the Buildroot toolchain and have built your own Kernel and filesystem you don't need to reload Bootstrap and U-Boot when uploading the Kernel and filesystem.

Janus supplies a single image file that contains the Full Production image to allow you to restore the 400AP to original factory settings. Follow the Upload Full Production Image section to restore factory default setting.

Uploading Bootstrap Image:

Step 1. Starting SAM-BA application.

Refer to SAM-BA section of this application note.

Don't forget to Enable NAND Flash!

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Uploading Bootstrap Image continued:

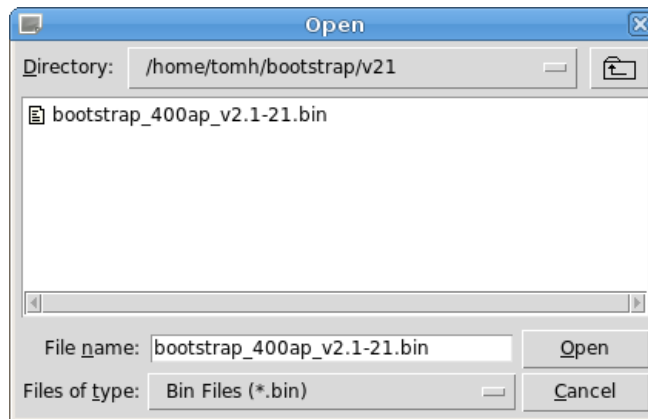**Step 2. Uploading Bootstrap image.**

Select the Send Boot Image script from the drop down menu.

Click the Execute button.
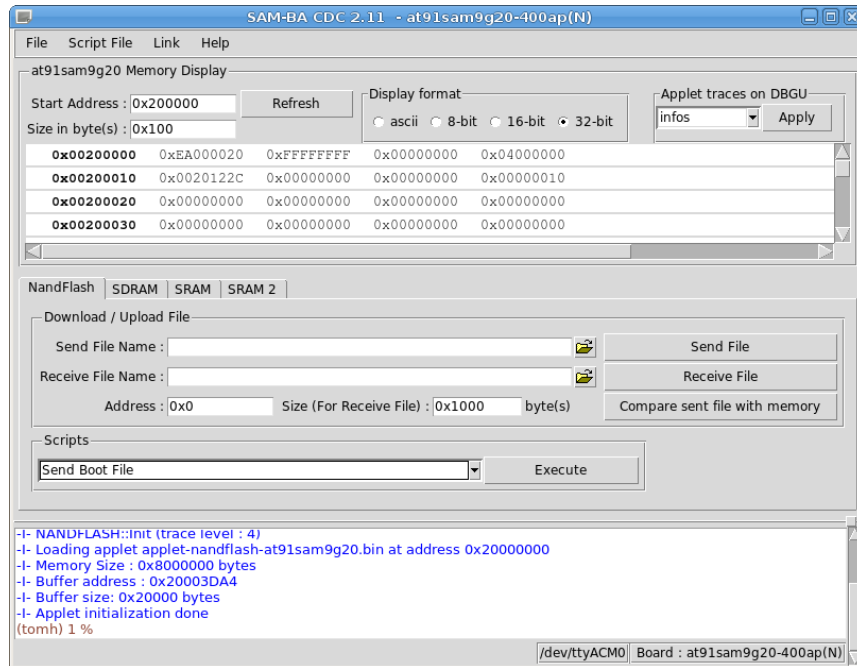
When prompted navigate to and select the Bootstrap image.

Click Open button to write the Bootstrap image to NAND flash.

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Uploading U-Boot Image:

Step 1. Starting SAM-BA application.
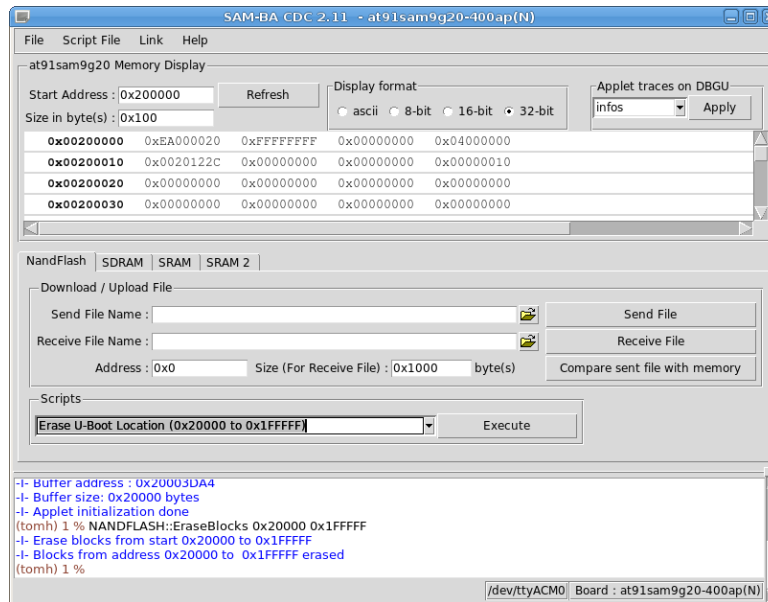
Refer to SAM-BA section of this application note.

Don't forget to Enable NAND Flash!

Step 2. Erasing U-Boot NAND flash location.

Select the Erase U-Boot Location script from the drop down menu.

Click the Execute button to erase flash.

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Uploading U-Boot Image continued:

Step 3. Uploading U-Boot image to NAND flash.

Enter 0x20000 in the Address field.

Click the icon next to the Send File Name field.

When prompted navigate to and select the U-Boot image.

Click Open button.

Click Send File to upload image.

After the image has finished uploading, verify image has been written correctly by clicking Compare sent file with memory.
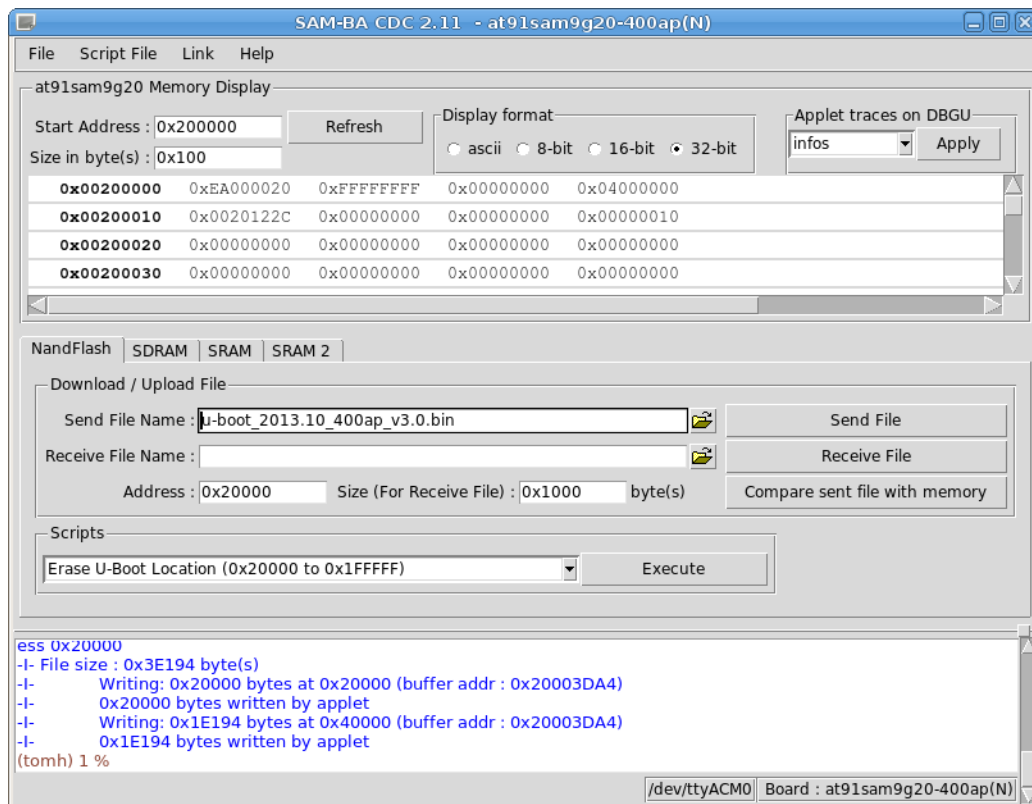
⚠️ U-Boot environmental variables have been erased. The environmental variables need to be rewritten before you can boot the 400AP. Please refer to U-Boot Environmental Variables section of this application note. This can wait until you exit SAM-BA and reboot.

Uploading Kernel Image:

Step 1. Starting SAM-BA application.

Refer to SAM-BA section of this application note.

Don't forget to Enable NAND Flash!

Step 2. Erasing Kernel NAND flash location.

Select the Erase Kernel Location script from the drop down menu.

Click the Execute button to erase flash.

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Uploading Kernel Image continued:

Step 3. Uploading Kernel image to NAND flash.

Enter 0x200000 in the Address field.

Click the [icon] icon next to the Send File Name field.

When prompted navigate to and select the Kernel image.

Click Open button.

⚠ 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 uImage 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

Click Send File to upload image.

After the image has finished uploading, verify image has been written correctly by clicking Compare sent file with memory.

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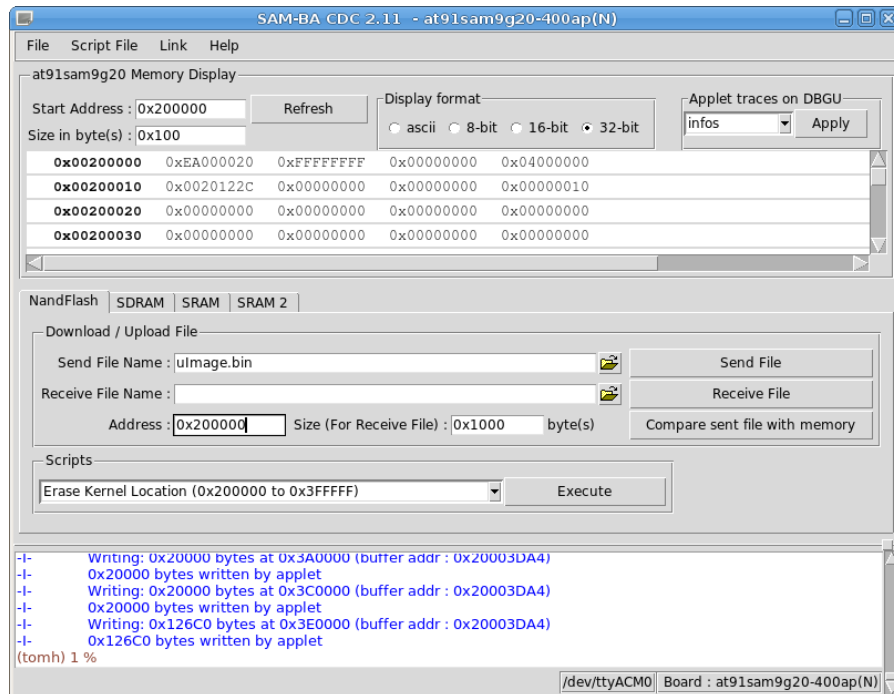
Uploading Filesystem Image:

Step 1. Starting SAM-BA application.

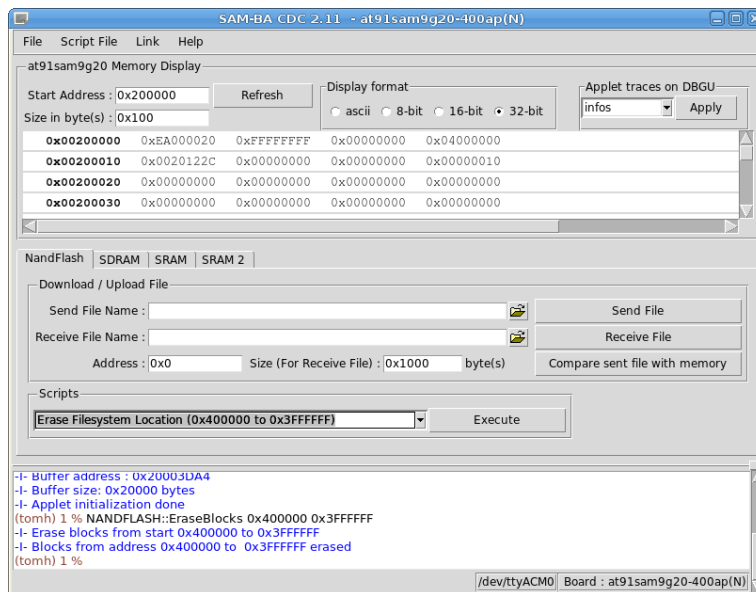Refer to SAM-BA section of this application note.

Don't forget to Enable NAND Flash!

Step 2. Erasing Filesystem NAND flash location.

Select the Erase Filesystem Location script from the drop down menu.

Click the Execute button to erase flash.

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Uploading Filesystem Image continued:

Step 3. Uploading Filesystem image to NAND flash.

Enter 0x400000 in the Address field.

Click the [icon] icon next to the Send File Name field.

When prompted navigate to and select the Filesystem image.
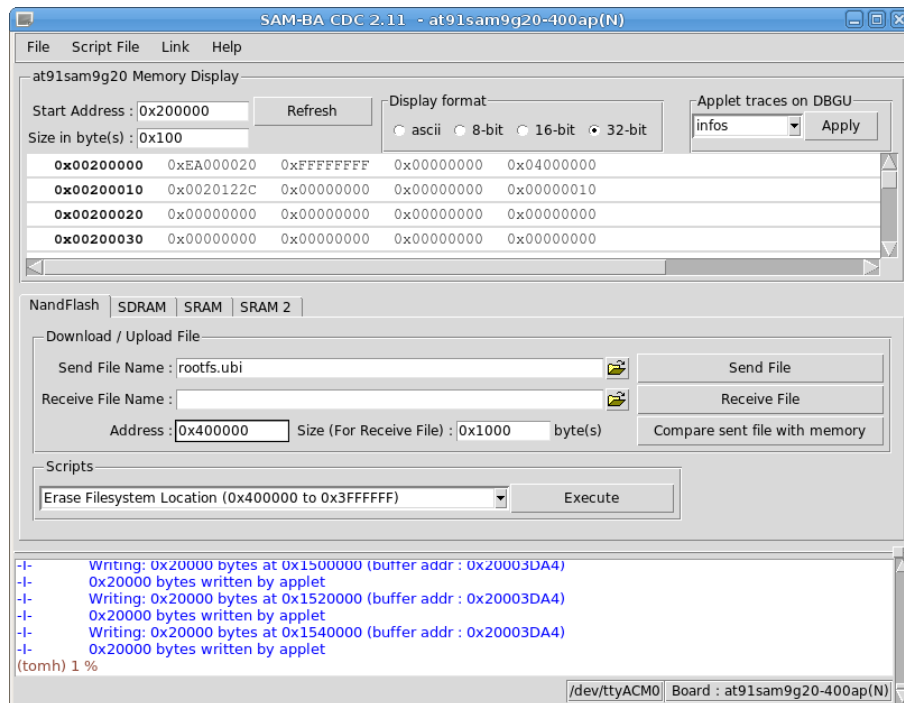
Click Open button.

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

~/buildroot/output/images/rootfs.ubi

Click Send File to upload image.

After the image has finished uploading, verify image has been written correctly by clicking Compare sent file with memory.

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Uploading Full Production Image:

Step 1. Starting SAM-BA application.

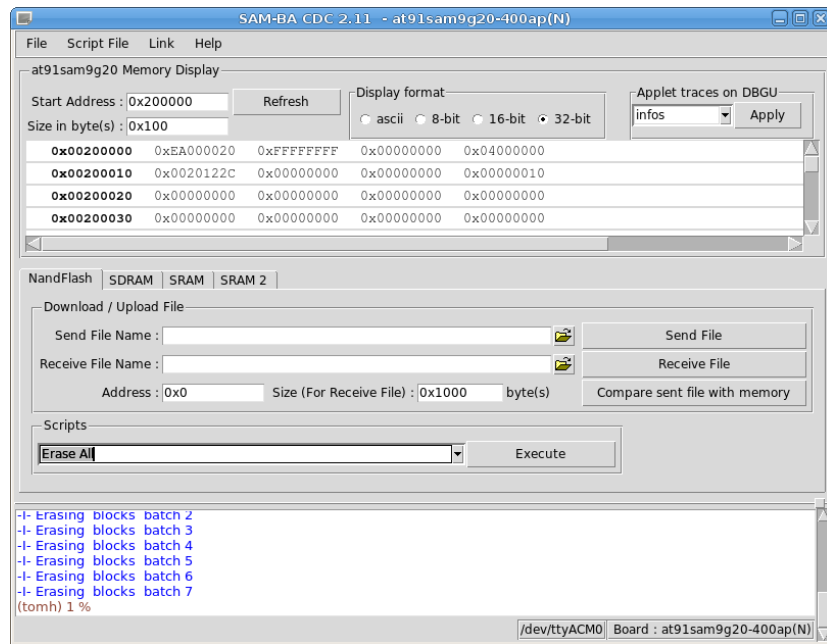Refer to SAM-BA section of this application note.

Don't forget to Enable NAND Flash!

Step 2. Erasing NAND flash.

Select the Erase All script from the drop down menu.

Click the Execute button to erase flash.

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Uploading Full Production Image continued:

Step 3. Uploading Full Production image to NAND flash.

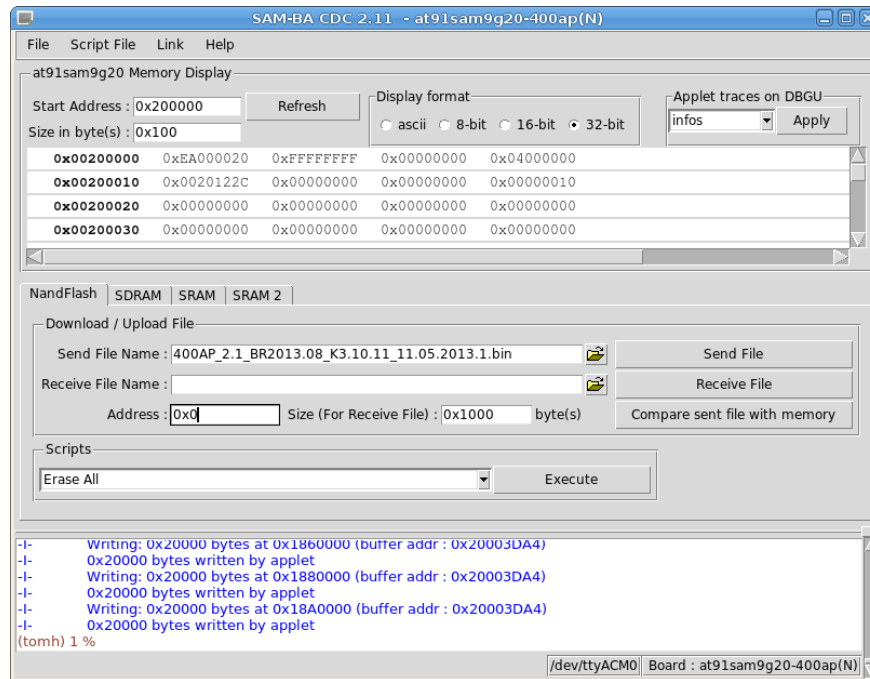Enter 0x0 in the Address field.

Click the ⊡ icon next to the Send File Name field.

When prompted navigate to and select the Full Production image.

Click Open button.

Click Send File to upload image.

After the image has finished uploading, verify image has been written correctly by clicking Compare sent file with memory.

The Full Production image supplied by Janus does not contain the 400AP Ethernet port MAC address. Please refer to U-Boot Environmental Variables section of this application note. You will only need to enter the setenv ethaddr command as the bootcmd and bootargs are stored in the Full Production image.

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U-Boot Environmental Variables:

If you have erased U-boot environmental variables you will need to rewrite them in order to boot the 400AP into Linux. Follow these instructions to restore U-boot environmental variables.

Step 1. Resetting the 400AP

Press the Reset button on front panel of the 400AP.

Step 2. Entering the U-Boot environment during boot.

When prompted by U-Boot, hit any key to stop autoboot:

The following prompt should be displayed:

U-Boot>

Step 3. Setting U-Boot environmental variables.

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

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

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

Step 4. Verifying U-boot environmental variables have been saved

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

printenv

Expected response:

bootdelay=3

baudrate=115200

ethact=macb0

bootcmd=nand read 0x22000000 0x00200000 0x00200000; bootm 0x22000000

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

stdin=serial

stdout=serial

stderr=serial

ethaddr=xx:xx:xx:xx:xx:xx

Environment size: 262/131067 bytes

Step 5. Exiting the U-Boot environment.

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

reset

This command will cause the 400AP to exit U-boot and boot into Linux.

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