Release Notes for the QNX Neutrino 6.4.0 BSP for Atmel AT91SAM9263-EK Board#

System requirements#

Target system#

- QNX Neutrino RTOS 6.4.0
- Board: Atmel at91sam9263-EK Evaluation Board
- Data-Flash: AT45DCB008D (8 MB) CARD
- SDRAM: 16-bit Micron MT48LC16M16A2 (64 MB) SDRAM
- NAND Flash: Micron MT29F2G08AAC (256 MB) NAND Flash

Host development system#

- QNX Momentics 6.4.0, one of the following host systems:
  - QNX Neutrino 6.4.0
  - Microsoft Windows Vista, XP SP2 or SP3, 2000 SP4
  - Linux Red Hat 8 or 9, Linux Red Hat Enterprise Workstation 3 or 4, Red Hat Fedora Core 3 or 4, or SUSE 10
- Terminal emulation program (Qtalk, Momentics IDE Terminal, tip, HyperTerminal, etc.)
- Windows Machine required SAM-BA appication to download the image on Data-Flash.
- RS-232 serial port
- NULL-modem serial cable
- USB cable to connect board with windows Machine

Getting Started#

Step 1: Connect your hardware#

Connect the DEBUG port of the AT91SAM9263 board to the first serial port of your windows machine. Install the SAM-BA application provided by Atmel. Connect the board with Windows Machine using USB Cable.

Step 2: Build the BSP#

You can build an OS image from the source code or the binary components contained in a BSP package.
For instructions about building an OS image, please refer to the chapter Working with a BSP in the Building Embedded Systems manual. After Building the BSP three bin files will be created in images directory.
*ifs-at91sam9263.bin
*ipl-at91sam9263.bin
*ipl-ifs-at91sam9263.bin

```
mkflashimage script creates a combined IPL/IFS image as ipl-ifs-at91sam9263.bin
The mkflashimage script:

#!/bin/sh
# script to build a binary IPL and boot image for ATMEL AT91SAM9263 Evaluation Kit board.
# NOTE the image (ipl-ifs-at91sam9263.bin) must be built as binary, i.e. [virtual=armle,binary] in the buildfile
set -v

#       Convert IPL into BINARY format
${QNX_HOST}/usr/bin/ntoarm-objcopy --input-format=elf32-littlearm --output-format=binary -R.data ../install/armle/boot/sys/
```

```
#       Pad BINARY IPL
mkrec -s16k -ffull -r ipl-tmp-at91sam9263.bin > ipl-at91sam9263.bin

#       Combine the BINARY IPL with the BINARY OS Image
cat ./ipl-at91sam9263.bin ./ifs-at91sam9263.bin > ipl-ifs-at91sam9263.bin

#       Cleaning up temporary files
rm -f *tmp*
```

Step 3A: Download the Bootable IFS image.#

The Boot Program integrates different programs that manage download and/or upload into the different memories of the product. First, it initializes the Debug Unit serial port (DBGU) and the USB High Speed Device Port.

- Then NAND Flash Boot program is executed. The NAND Flash Boot program searches for a valid application in the NAND Flash memory. If a valid application is found, this application is loaded into internal SRAM and executed by branching at address 0x0000_0000 after remap.
- If no NAND Flash Boot program is found, the Data-Flash Boot program is then executed. It looks for a sequence of seven valid ARM exception vectors in a Data-Flash connected to the SPI. All these vectors must be B-branch or LDR load register instructions except for the sixth vector. This vector is used to store the size of the image to download. If a valid sequence is found, code is downloaded into the internal SRAM. This is followed by a remap and a jump to the first address of the SRAM.If no valid ARM vector sequence is found, SAM-BA Boot is then executed. It waits for transactions either on the USB device, or on the DBGU serial port.

Install and setup SAM-BA#

1. Install "AT91-ISP v1.12.exe" .

2. Intall "ActiveTcl8.5.5.0.287690-win32-ix86-threaded.exe" i.e.TCL environment which is used by SAM-BA (any other TCL environment can also be used) .

3. Connect serial cable with windows machine, and use any serial port application such as teraterm or hyperterminal, and attach it with COM device, with baud rate set as 115200. Make sure the Atmel Data-Flash card is not pluged in the socket A.

4. Restart the board, hyperterminal will be showing following message .

```
RomBOOT
>
```

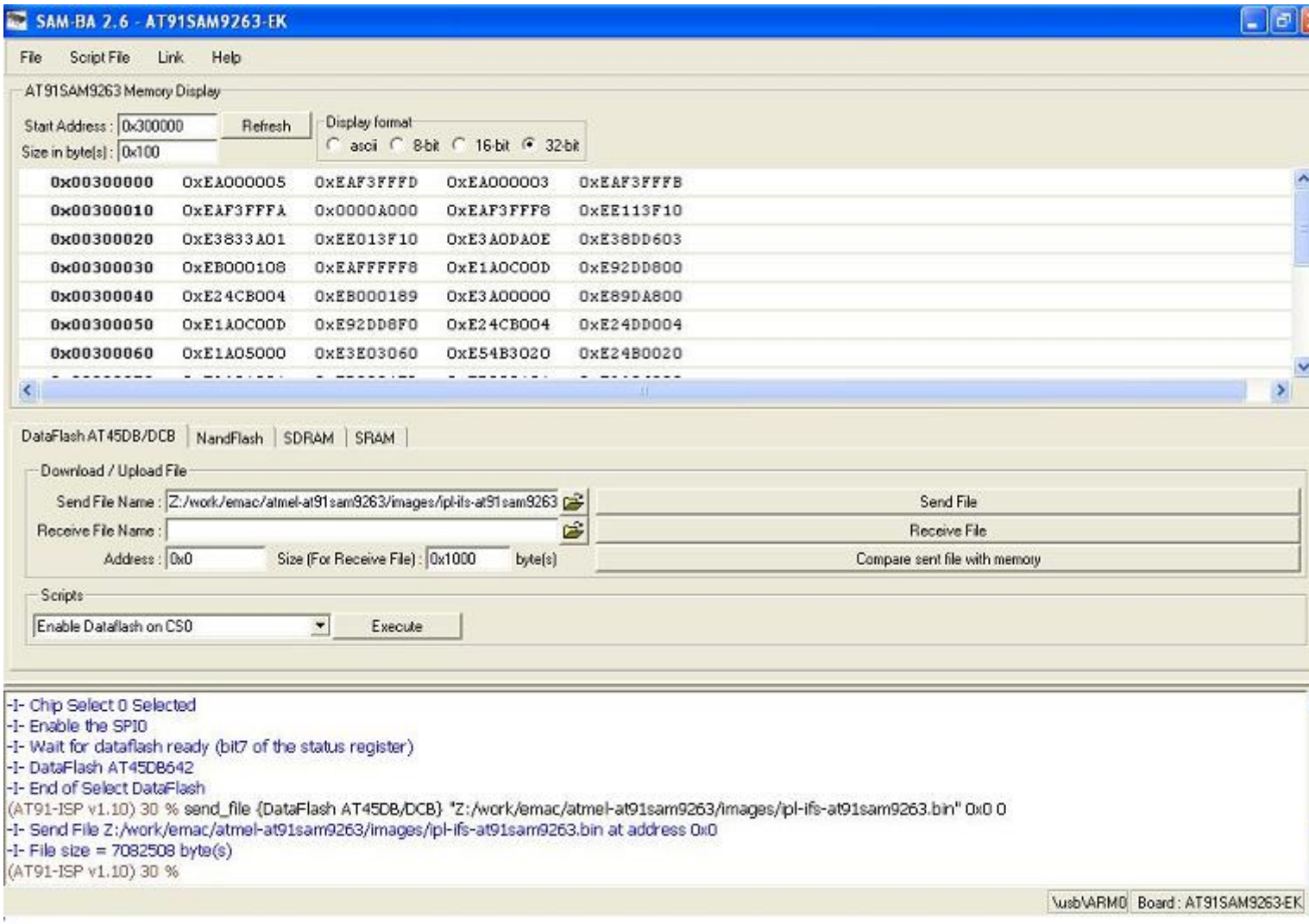
5. Connect usb cable with windows machine, It will prompt with a new usb hardware found message, and will try to install the corresponding driver.

6. Check device has enumerated properly by looking into device manager .

7. Start SAM-BA 2.6 with \usb\ARM0 as connection.

Loading the IFS image using SAM-BA#

- Plug the Atmel Data-Flash card into the socket A.
- Select the Data-Flash AT45DB/DCB tab in SAM-BA Application. Execute the Enable Data-flash on CS0 script.
- Select the ipl-ifs-at91sam9263.bin file to be sent to the target, and then press Send File. Depending on the size of your file, it will take a few seconds up to a minute.



Press the reset button, now on your terminal you will see output as follows:

```
RomBOOT
>

QNX Neutrino Initial Program Loader for ATMEL AT91SAM9263-EK
Commands:
Press 'D' to download an OS image from serial port, using sendnto utility
Press 'F' to Boot an OS image from SPI/SERIAL flash
ATMEL AT45DB642D/AT45DCB008D SPI Flash detected.

QNX IFS image detected on page: 00000010 Offset: 00000220 Size: 0057E240
############################################################Done
found image, calling image setup...
image_setup OK, calling image start...


PIO init : DBGU, USART, Audio(AC97), NAND: TO DO,
CPU0: Dcache: 512x32 WB
CPU0: Icache: 512x32
CPU0: 41069265: arm926 rev 5 100MHz
elf_map: 1M va=fe000000 pa=20100000 sz=00100000
elf_map: 1M va=fe000000 pa=20100000 sz=00100000
Header size=0x0000009c, Total Size=0x000004e0, #Cpu=1, Type=4
Section:system_private offset:0x000001f0 size:0x00000068
 syspage ptr user:fc404000 kernel:fc404000
 cpupage ptr user:fc4047e0 kernel:fc4047e0 spacing:84
 kdebug info:00000000 callback:00000000
 boot pgms: idx=0
```

```
   0) base paddr:20110000 start addr:fe03d838
  ramsize:00000000 pagesize:00001000
Section:qtime offset:0x00000148 size:0x00000060
  boot:00000000 CPS:00000000002faf08 rate/scale:320000000/-15 intr:1
Section:callout offset:0x000000a0 size:0x00000048
  reboot:fc404658 power:fc404678
  timer_load:fc40468c reload:fc4046b4 value:fc4046e0
  0) display:fc404700 poll:fc404724 break:fc404748
  1) display:00000000 poll:00000000 break:00000000
Section:cpuinfo offset:0x000001a8 size:0x00000020
  0) cpu:41069265 flags:40000000 speed:00000064 cache i/d:1/0 name:53
Section:cacheattr offset:0x000004a0 size:0x00000040
  0) flags:32 size:0020 #lines:0200 control:fc4044e0 next:255
  1) flags:11 size:0020 #lines:0200 control:fc404534 next:255
Section:meminfo offset:0x000004e0 size:0x00000000
Section:asinfo offset:0x00000320 size:0x00000140
  0000) 0000000000000000-00000000ffffffff o:ffff a:0010 p:100 c:00000000 n:21
  0020) 0000000020000000-0000000023ffffff o:0000 a:0017 p:100 c:00000000 n:28
  0040) 0000000000000000-00000000ffffffff o:ffff a:0010 p:100 c:00000000 n:21
  0060) 0000000020000000-0000000023ffffff o:0040 a:0007 p:100 c:00000000 n:32
  0080) 000000002010e108-000000002067e23f o:0000 a:0005 p:100 c:00000000 n:60
  00a0) 0000000020100000-000000002010e107 o:0000 a:0007 p:100 c:00000000 n:68
  00c0) 000000002010e108-000000002067e23f o:0000 a:0007 p:100 c:00000000 n:76
  00e0) 0000000020000000-0000000020007fff o:0020 a:0007 p:100 c:00000000 n:84
  0100) 0000000020010834-00000000200fffff o:0020 a:0007 p:100 c:00000000 n:84
  0120) 000000002067e240-0000000023ffffff o:0020 a:0007 p:100 c:00000000 n:84
Section:hwinfo offset:0x000002d8 size:0x00000048
  0) size:3 tag:3 isize:3, iname:0, owner:65535, kids:1
  12) size:3 tag:17 isize:3, iname:9, owner:0, kids:1
  24) size:3 tag:3 isize:3, iname:37, owner:12, kids:1
  36) size:4 tag:46 isize:4, iname:41, owner:24, kids:0
    00 00 00 00
Section:typed_strings offset:0x00000258 size:0x00000020
  off:0 type:5 string:'UNKNOWN'
  off:12 type:2 string:'localhost'
Section:strings offset:0x00000278 size:0x00000060
  [0]'hw' [3]'Group' [9]'unknown' [17]'Bus' [21]'memory' [28]'ram' [32]'1to1'
  [37]'rtc' [41]'NONE' [46]'Device' [53]'arm926' [60]'imagefs' [68]'startup'
  [76]'bootram' [84]'sysram'
Section:intrinfo offset:0x00000460 size:0x00000040
  0) vector_base:00000000, #vectors:32, cascade_vector:7fffffff
     cpu_intr_base:00000000, cpu_intr_stride:0, flags:0000
      id => flags:8000, size:002c, rtn:fc4045a0
     eoi => flags:9000, size:0028, rtn:fc4045cc
     mask:fc4045f4, unmask:fc404618, config:00000000
Section:smp offset:0x000004e0 size:0x00000000
Section:pminfo offset:0x000004e0 size:0x00000000
Section:mdriver offset:0x000004e0 size:0x00000000
Section:boxinfo offset:0x000001c8 size:0x00000028
  hw_flags:00000000
Section:cpu offset:0x00000128 size:0x00000020
  page_flush:fc404564 page_flush_deferred:fc40459c
  upte_ro:00000aae upte_rw:00000ffe
  kpte_ro:0000000e kpte_rw:0000055e
  mask_nc:0000000c
  mmu_cr1:00051078 set:0000317f clr:00000000 -> 0005317f

System page at phys:20010000 user:fc404000 kern:fc404000
Starting next program at vfe03d838
```

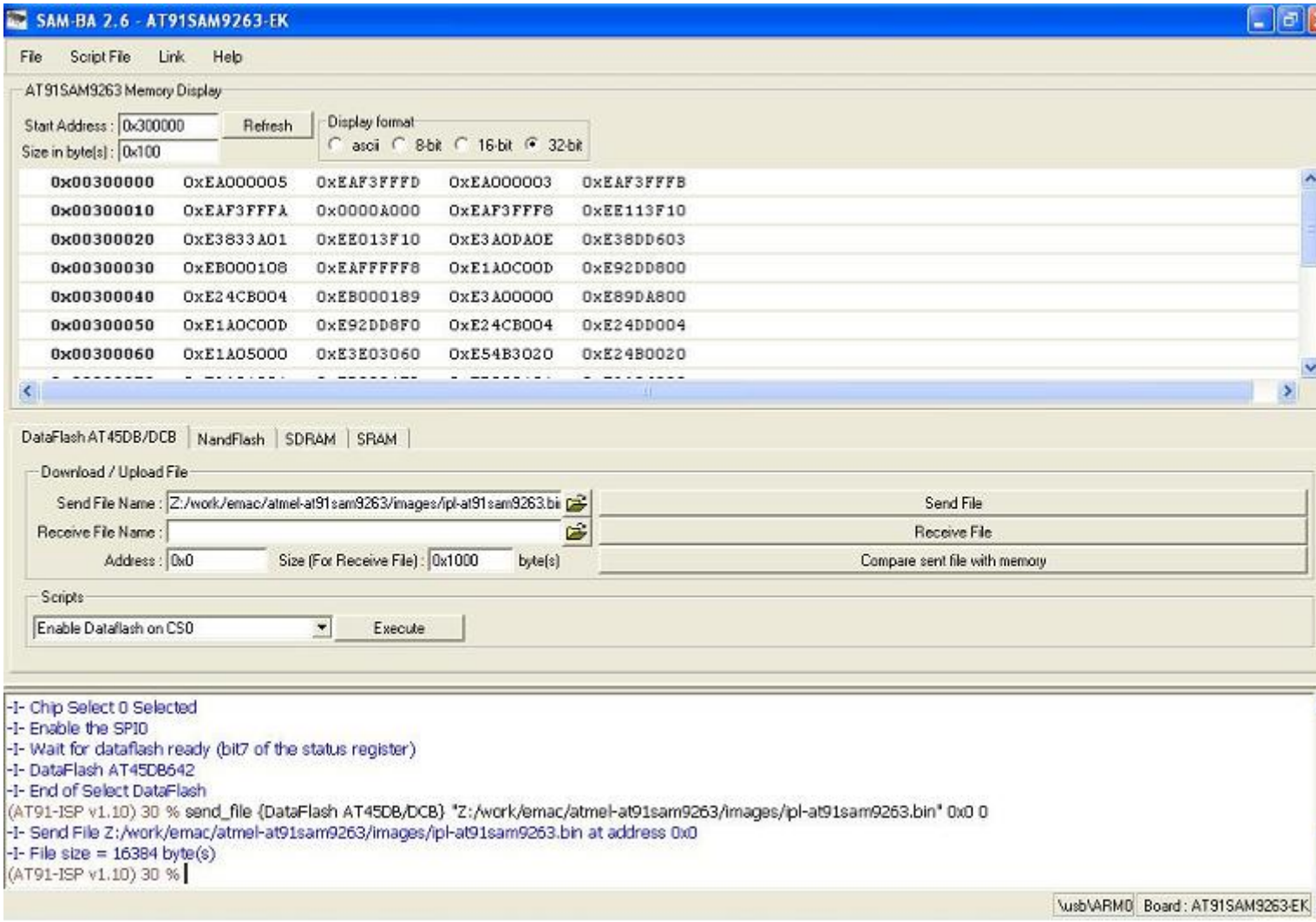
```
cpu_startnext: cpu0 -> fe03d838
Welcome to QNX Neutrino 6.4 on the Atmel AT91SAM9263 Board
Starting DBGU driver...
Starting Serial USART 1 driver ...
Starting SPI driver...
Starting Audio driver...
Starting Graphics driver...
Starting NAND driver...
#
```

You can test the OS simply by executing any shell builtin command or any command residing within the OS image (e.g. ls).

Step 3B: Reprogram the IPL.#

In case if Board is new or IPL gets corrupted, We can reprogram IPL using SAM-BA application.

- Select the Data-Flash AT45DB/DCB tab in SAM-BA application window, . Execute the Enable Data-flash on CS0 script.
- Select the ipl-at91sam9263.bin file to be sent to the target, and then press Send File. It will take a few seconds up to a minute.
- Snapshot is as follows:



Summary of driver commands#

The driver command lines below are specific to the Atmel AT91SAM9263 board. See the online docs for each driver for additional command-line options and other details.

Note: Some of the following drivers are commented out in the default buildfile. To use the drivers in the target hardware, you'll need to uncomment them in your buildfile, rebuild the image, and load the image into the board.

Startup:#

Command:

```
startup-at91sam9263 -r 0x23d00000,0x200000,1 -vvvvvvv
```

Serial:#

Command:

```
devc-serusart -F -S -u2 -b115200 -c50000000 0xfff8c000^2,7
```

Required binaries:

- devc-serusart

Command:

```
devc-serdebug -e -F -S -b115200 -c50000000 0xffffee00,1
```

Required binaries:

- devc-serdebug

SPI:#

Command:

```
spi-master -u0 -d at91sam9xx base=0xFFFA4000,irq=14,clock=50000000

spi-master -u1 -d at91sam9xx base=0xFFFA8000,irq=15,clock=50000000
```

Required binaries:

- spi-master
- spi-at91sam9xx.so

Network:#

Command:

```
io-pkt-v4 -dat91sam9xx syspage
```

Required binaries:

- devnp-at91sam9xx.so
- io-pkt-v4

Audio:#

Command:

```
io-audio -d at91sam9xx_ac97 ioport=0xfffa0000,irq=18
```

Required binaries:

- io-audio
- libasound.so
- deva-mixer-ac97.so
- deva-ctrl-at91sam9xx_ac97.so

MMC SD:#

Command:

```
devb-mmcsd-at91sam9xx mmcsd ioport=0xFFF80000,irq=10
```

Required binaries:

- libcam.so
- fs-dos.so
- fs-qnx4.so
- fs-ext2.so
- cam-disk.so
- io-blk.so

I2C#

Command:

```
i2c-at91sam9xx -p0xfff88000 -i13 -v
```

Required binaries:

- i2c-at91sam9xx

Libraries:

- libi2c-master.a

DMA:#

Required library:

- libdma-at91sam9263.so

ETFS NAND flash#

Command:

```
fs-etfs-at91sam9xx -D addr=0x40000000,board_id=at91sam9263-ek -m /fs/etfs
```

Required binaries:

- fs-etfs-at91sam9xx
- etfsctl

Note: For more information about these commands, see the Neutrino Utilities Reference.

Graphics#

Command:

```
Photon &
waitfor /dev/photon
io-display -dvid=0x0,did=0x0
io-graphics
pwm &
pterm -x10 -y10 -h250 -w200 -t"QNX 6.4.0" -K 03 &
devc-pty &
```

Required binaries:

- devg-at91sam9xx.so
- libph.so
- libAp.so
- libphexlib.so
- libphrender.so
- libffb.so
- libdisputil.so
- libimg.so.1
- ttfFFcore.so
- PHFcore.so
- FCcore.so
- libFF-T2K.so
- libblkcache.so
- libFF-T2K-fm.so
- libFF-T2K-cache.so
- phfont.so
- libfontutils.so
- libfont.so

Required configuration files:

- /usr/photon/config/at91sam9263.conf=${PWD}/../src/hardware/devg/atl91sam9xx/at91sam9263.conf
- /etc/system/config/display.conf=${PWD}/../src/hardware/devg/atl91sam9xx/display.conf

About graphics#

This driver currently supports the AT91SAM9263 integrated LCD controller . It was developed on the Atmel AT91SAM9263 Evaluation Board. This is the GF graphics driver is loaded by io-display.

LCD Displays#

- By default the driver sets up the Hitachi TX09D71VM1CCA TFT with the AT91SAM9263 reference board.

HW Format	QNX Format	Notes
16-bit	15-bit	QNX framework format is ARGB1555, but MSB is not actually used because the hardware uses only 15 bits

Reserving Memory / Memory Restrictions#

The Atmel AT91SMA9263 is a UMA system (Unified Memory Architecture). This means there is no dedicated video memory in the system. Surfaces displayed by the LCD controller, and rendered by the CPU, reside in system memory

- To ensure there is enough memory available for graphics, we recommend that memory be reserved at startup by using the -r option to startup.

For example to reserve 2 MB of memory:

startup-at91sam9263 -r 0x23d00000,0x200000,1 -vvvvvvv

where 0x23d00000 is the physical base address of memory (1MB aligned), and 0x200000 is the size of memory reserved in bytes.

For a list of options available to the driver please see the at91sam9263.conf file.

2DGC#

The Atmel 2DGC has a restriction that the base address of a memory surface be aligned on a 1 MB boundary. There is also a restriction that sizes that the stride of memory can be. (256, 512, 1024, 2048) , the display is 240 pixels wide. The LCD controller for the AT91SAM9263 expects colors to be in the format of BGR. The QNX graphics framework and the 2DGC specify the colorformat as RGB. The graphics driver is providing the color swapping before programming the 2DGC.

Known Issues for This BSP#

- Network driver drops packet due to transmitter under run. A known HW limitation with the Ethernet transmitter and usage of slow SDRAM memory will cause the transmitter to generate under run and flush all packets/fragments in the transmitter queue. For more details about this problem refer to the Atmel AT91SAM9263 reference manual "MACB Errata" for more details.
- Due to a hardware limitation of I2C controller (the SCLK line cannot be hold by the controller in the middle of transmission), the I2C driver drops data in the high baud rate and large data transfer. Workaround: lower down the baud rate, increase the priority of the driver, and verify the read/write data by software.