i.MX53 SABRE TABLET Linux
User's Guide

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Contents

About This Book

This document explains how to build and install the Freescale Linux BSP on the i.MX53 SABRE Tablet board. All steps needed to get the i.MX53 SABRE Tablet board running are detailed, including board dip switch settings, steps to download an OS image through the manufacturing (MFG) tool, and instructions on configuring and using the u-Boot bootloader.

Audience

This document is intended for software, hardware, and system engineers who are planning to use the product and for anyone who wants to understand more about the product.

References

1. i.MX Family Linux Software Development Kit Reference Manual

1. Introduction

The i.MX53 SABRE Tablet Linux BSP is a collection of binary, source code, and support files that can be used to create a Linux kernel image and a root file system for i.MX53 SABRE Tablet board. This document is only for the general Linux platform. For the steps on how to run and configure a new Ubuntu rootfs please read the Ubuntu 10.04 Startup Guide for the i.MX5X board.

Please note that the i.MX53 SABRE Tablet board was formerly named i.MX53 SMD board. This name change has not been completely propagated through the build environment, so instances of the name "SMD" will still be seen throughout this document. This is an older name for the SABRE Tablet board.

1.1 Boot Loader

The i.MX53 SABRE Tablet Linux delivery package contains the following U-Boot bootloader binary:

```
<Version>_images_MX5X/u-boot-mx53-smd.bin
```

This bootloader supports SPI-NOR, SD, eMMC4.4, SATA boot for MX53 SABRE Tablet board.

1.2 Linux Kernel image

This Freescale i.MX BSP contains a pre-built kernel image based on the 2.6.35.3 version of the Linux kernel. The i.MX53 SABRE Tablet kernel image is found at the following location:

```
<Version>_images_MX5X/uImage
```

1.3 Ubuntu demo rootfs

An Ubuntu demo rootfs (lucid version) with demo applications is provided for demo purpose.

2. Building the Linux Platform

This chapter explains how to set up the build environment, install and build LTIB, set the rootfs for NFS, and set up the host environment. Please note that not all of the steps are required for every boot mode, the only strictly required steps are in sections 2.1 and 2.2

2.1 Setting Up the Linux Host

See "`ltib_build_host_setup.pdf`" to setup the Linux host server.

2.2 Installing and Building LTIB

To install and build LTIB, follow the steps below:

NOTE

In some Linux systems, the following procedure must be done with **root** permissions. However, these instructions are for performing the procedure "not as root".

To run LTIB, some host packages are needed. If any error related to a host package is raised, install the host package.

1. Remove all previously-installed packages in `/opt/freescale/pkgs/`.
2. Install the LTIB package not as root:

```
tar zxf <ltib_release>.tar.gz
./<ltib_release>/install
```

This command installs LTIB to your directory.

3. Build LTIB:

```
cd <LTIB directory>
./ltib -m config
```

4. Select platform to **Freescale iMX reference boards** and exit, saving the changes. At the next menu, select platform type as **imx5x** and package profile. Exit and save changes. Please note that only the profiles of **Min profile**, **FSL gnome release packages** and **mfg firmware profile** pass build tests.

5. To build U-Boot for MX53 START board, select “Choose your board for u-boot” as “mx53_smd”. Please note this option is only for U-Boot. For kernel image, current default kernel configuration can build the same images for all i.MX5x parts boards.

```
|--- Choose your board                                                    |
                  |
  | |    board (mx53_smd)  --->
```

6. Run the following command:

```
./ltib
```

When this procedure is completed, the kernel image and the U-boot images are located at:

```
rootfs/boot/
```

7. Input the following command to get LTIB command help:

```
./ltib -help
/* Get the source code of one package */
./ltib -m prep -p <package name>
/* Build one package */
./ltib -m scbuild -p <package name>
/* Install one package to rootfs */
./ltib -m scdeploy -p <package name>
```

2.3 Setting rootfs for NFS

There are two ways to set up the `rootfs` for NFS on this package.

- Using the `ext2` format `rootfs` package provided in the distribution
- Using the `rootfs` that is created after making the build of the kernel

Use the following commands to set the `rootfs` directory for NFS using the `rootfs.ext2.gz` package already included in the distribution (you must be the root user for this operation):

```
mkdir /mnt/rootfs
cp imx5x/rootfs.ext2.gz  /tools
cd /tools
gunzip rootfs.ext2.gz
mount -o loop -t ext2 rootfs.ext2 /mnt/rootfs
cp -r /mnt/rootfs .
export ROOTFS_DIR=/tools/rootfs
```

NOTE

In some Linux distributions (such as Fedora), the user needs to make sure that the contents inside `/tools/rootfs` have the proper permission for user access. Since the mount command is made as root, the content shows as restricted access after the command `cp -r /mnt/rootfs`, which may prevent the NFS mount from working correctly.

To use the root file system created in the LTIB directory after the kernel build, use the command:

```
%export ROOTFS_DIR=/<LTIB directory>/rootfs
```

2.4 Copying images to TFTP server

To use tftp server to download the image, copy the kernel image in the release package or LTIB to the tftp directory. For example:

```
cp imx5x/uImage /tftpboot
```

or

```
cp /<LTIB directory>/rootfs/boot/uImage /tftpboot
```

2.5 How to generate no-padding U-Boot

To generate no-padding U-Boot, run:

```
sudo dd if=u-boot-mx53-smd.bin of=u-boot-mx53-smd-no-padding.bin
              bs=512 skip=2
```

2.6 How to Generate uImage from a zImage

To generate a uImage with ltib, in the kernel source code, change the build target from “zImage” to “uImage”.

If you want to generate a uImage from a zImage you built, you can generate a “uImage," based on the above zImage as below:

- Build u-boot package to get “mkimage” tool under `rpm/BUILD/u-boot-<version>/tools/mkimage`.
- Copy `mkimage to /usr/bin/`
- Run the below command:

  ```
  mkimage -A arm -O linux -T kernel -C none -a 0x70008000 -e 0x70008000 -n
  "Linux-<kernel_version>" -d zImage uImage
  ```

  Note: Replace kernel_version with the appropriate kernel version for your image. For example, 2.6.35-151-xxxx.

2.7 How to Build U-Boot and Kernel in Standalone Environment

To build U-Boot in a standalone environment, do the following in the root folder of U-Boot sources:

```
make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-
4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-
gnueabi/bin/arm-none-linux-gnueabi- distclean

make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-
4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-
gnueabi/bin/arm-none-linux-gnueabi- mx53_smd_config

make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-
4.4.4-glibc-2.11.1-multilib-1.0/arm-fsl-linux-
gnueabi/bin/arm-none-linux-gnueabi-
```

To build the kernel in the standalone environment, do as the following:

```
make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-
multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi- imx5_defconfig

make ARCH=arm CROSS_COMPILE=/opt/freescale/usr/local/gcc-4.4.4-glibc-2.11.1-
multilib-1.0/arm-fsl-linux-gnueabi/bin/arm-none-linux-gnueabi- uImage
```

2.8 Build Manufacturing Firmware

Please setup LTIB environment and then configure Firmware build profile.

```
./ltib --selectype
```

Choose correct item as below:

```
--- Choose the platform type

        Selection (imx5x)  --->

--- Choose the packages profile

        Selection (mfg firmware profile)--->
```

In “Freescale iMX5x Based Boards” section, choose the board information as the following:

```
--- Choose your board for u-boot

       board (mx53_smd)  --->
```

After `ltib` has completed the build, **initramfs.cpio.gz.uboot** is generated under the ltib root folder. The **u-boot.bin** and **uImage** for MFG tool are generated under `rootfs/boot/`.

3. How to Boot the SABRE Tablet Board

The boot modes of the i.MX53 SABRE Tablet board are controlled by the boot configuration DIP switches on the board. To locate the boot configuration switches refer to the i.MX53 SABRE Tablet Hardware User's Guide. The following sections just list basic boot setup configurations.

3.1 How to Enter Serial Download Mode for MFG Tool

Table 3.1 shows the boot switch settings to enter serial download mode for MFG tool. Meanwhile, ensure SW19 is connected to dip 1 which is used to set GPIO7 as HIGH to keep the system ON.

Table 3.1 the boot switch setup for MFG tool

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW26	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
SW28	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF

3.2 How to Boot From SD Card

Table 3.2 shows the boot switch settings to boot from SD card in J13

Table 3.2 the boot switch setup for SD boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW26	ON/OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
SW28	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Dip 1 of SW26 indicates the bus width of the SD. ON: 4-Bit; OFF: 1-bit.

3.3 How to Boot From eMMC4.4

Table 3.3 shows the boot switch settings to boot from eMMC4.4 with fast boot mode connected with SDHC3

Table 3.3 the boot switch setup for eMMC4.4 boot with fast boot mode

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW26	OFF	ON	OFF	OFF	ON	ON	ON	OFF
SW28	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

Tablet 3.4 shows the boot switch settings to boot from eMMC4.4 with normal boot, 8-bit DDR mode:

Table 3.3 the boot switch setup for eMMC4.4 boot with normal boot mode

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW26	OFF	ON	ON	OFF	OFF	ON	ON	OFF
SW28	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

3.4 How to Boot From SATA

Table 3.5 shows the boot switch settings to boot from SATA

Table 3.4 the boot switch setup for SATA boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW26	OFF	OFF	OFF	ON	OFF	ON	OFF	OFF
SW28	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

To boot from SATA with internal clock, ensure the fuse “SATA_ALT_CLK_REF” is blown. The following U-Boot command can blown SATA internal boot fuse:

```
iim blow 4 3 4
```

3.5 How to Boot From SPI-NOR

Table 3.5 shows the boot switch settings to boot from SPI-NOR

Table 3.5 the boot switch setup for SPI-NOR boot

Switch	D1	D2	D3	D4	D5	D6	D7	D8
SW26	ON	OFF	OFF	ON	ON	ON	OFF	OFF
SW28	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF

4. Flash Memory Map

This chapter describes the software layout in MMC/SD cards. This information may be useful for understanding later sections about image download.

4.1 MMC/SD/SATA Memory Map

The MMC/SD/SATA scheme is different from the NAND and NOR flash which are deployed in the BSP software. The MMC/SD/SATA must keep the first sector (512 bytes) as the MBR (Master Boot Record) in order to use MMC/SD as the rootfs.

Upon boot up, the MBR is executed to look up the partition table to determine which partition to use for booting. The bootloader should be at the end of MBR. The kernel image and `rootfs` may be stored at any address after bootloader.

The MBR can be generated through the `fdisk` command when creating partitions in MMC/SD cards on a Linux Host server.

5. Downloading Images Using MFG Tool

This chapter describes the procedure for using the MFG tool to download images to the different devices.

5.1 Installing the MFG Tools

Unzip `Mfgtools-Rel-<version>_MX53_UPDATER.tar.gz`

5.2 Usage

Read the MFG tool documentation in the "Document" folder, before using the MFG tool. The MFG tool follows the instructions into "`Profiles\MX53 Linux Update\OS Firmware\ucl.xml`" to execute program operations. The user must read and update ucl.xml to understand the operations before using the MFG tool.

Follow these instructions to use the MX53 SABRE Tablet MFG tool:

- Connect a USB cable from a PC to the USB OTG port (J34) on the board.
- Connect UART to PC for console output. Open a Terminal emulator program.
- Set SW28 dip 3, 4 as ON, other dips are off, Set SW19 connected to dip 1, press the SW5 key and ensure USB device is found.
- The default profile of the manufacturing tool assumes your file system to be packed and compressed using `bzip2` algorithm. To create this file, you can run the following commands as a root user. You can also modify profile to support other formats.
    - `>cd your_rootfs_dir`
    - `>tar -cjf rootfs.tar.bz2 *`
- You can specify your images in two ways: The first is by editing "`Profiles\MX53 Linux Update\OS Firmware\ucl.xml`" to modify the file path or flash operations according to your usage. Note that "MX53SMD-xxx" lists are the example codes for MX53 SABRE Tablet. You can modify them for MX53 SABRE Tablet programming. After the modification is completed, save the changes and exit. Another way is by copying your files in "`Profiles\MX53 Linux Update\OS Firmware\files`" directory. You can replace the files inside this folder. Note that you will find `u-boot-mx53-smd.bin` and `uImage` binaries in "`Profiles\MX53 Linux Update\OS Firmware`" folder. These files should not be replaced. They are different from your image files and serve another purpose.

- Execute "`MfgTool.exe`". Select the "Options -> Configuration" menu. If this is the first time connecting an i.MX53 board with the MFG tool, install a USB driver under "`Drivers\iMX_BulkIO_Driver`".
- Select the appropriate USB port in the sheet "USB Ports".
- Select the appropriate profile in the sheet "Profiles." Type the item in "Operations." Right-click and select "Edit." (Note that the default profiles are used as examples. They should be modified according to the user's programming operations.)
  - Select "MX53SMD-SD" to program images to SD.
  - Select "MX53SMD-eMMC4.4" to program images to eMMC4.4 for fast boot mode. Since the block number of eMMC4.4 in ucl.xml is assumed as 0, need to unplug SD card to use the default profile to program eMMC4.4.
  - Select "MX53SMD-SATA" to program images to SATA.
  - Select "MX53SMD-SPI_NOR" to program images to SPI-NOR.
- Insert SD card.
- Start the downloading process by pressing the green, **Start,** button. You will see the progress bar as well as the current task in the notification bar as shown in Figure 5-5. When you see "Update Complete" in the notification bar, press the red, **Stop,** button to finish.
- The manufacturing tool may sometimes report an error message when it is downloading the file system in an SD card. This can be caused by insufficient space in the SD card due to a small partition size. To fix this, unzip the file "`Profiles\MX53 Linux Update\OS Firmware\mksdcard.sh.tar`" and then modify the script to increase the size of the partition and create more partitions according to your file system requirements. After the modification is done, tar the script again.

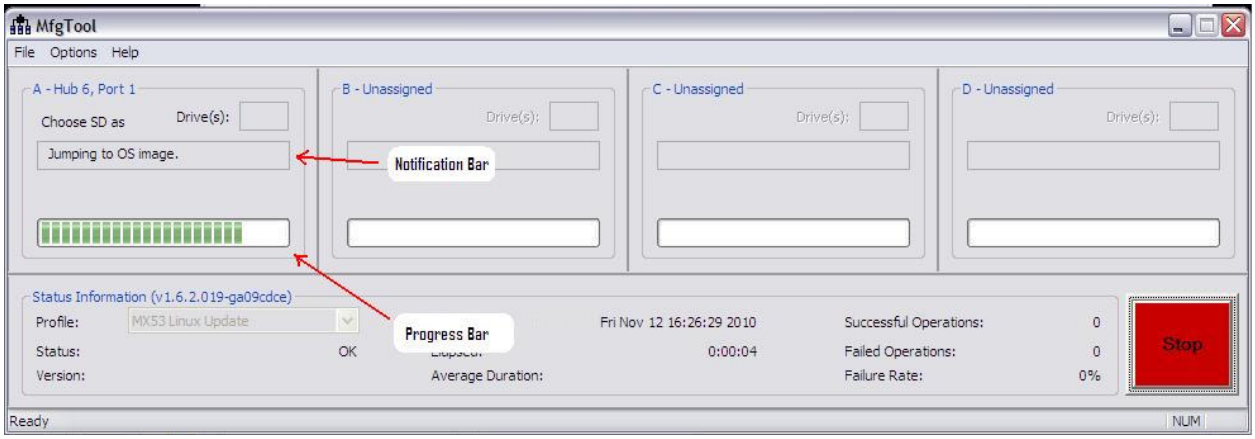

Figure 5-1 Programming SD With Manufacturing Tool.

6. Download Images by Bootloader or NFS

6.1 Setup Terminal

The i.MX53 SABRE Tablet board can communicate with a host server (Windows or Linux) using the serial cable. Common serial communication programs such as HyperTerminal, Tera Term or PuTTY can be used. The example below describes the serial terminal setup using HyperTerminal on a Windows host:

1. Connect the target and the Windows PC using a serial cable.
2. Open HyperTerminal on the Windows PC, and select the settings as shown in Figure 6-1.

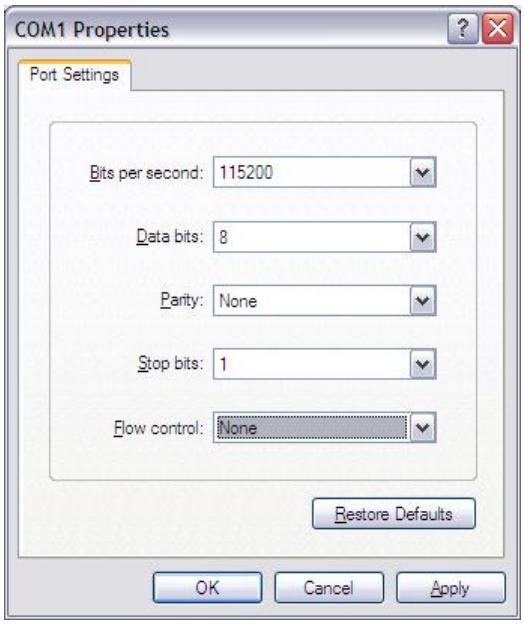

Figure 6 -1 HyperTerminal Settings for Terminal Setup

3. After the bootloader is programmed on SD card, press SW5 key to power up the board. The bootloader prompt is displayed on the terminal screen.

6.2 Download by U-Boot

6.2.1 MMC/SD on SDHC1

1. To clean up the environments stored on MMC/SD, do as the following in U-Boot console:

```
MX53-SMD U-Boot > mmc write 0 0x70100000 0x600 0x10
```

2. Set SW26 dip 7 as ON. Others are OFF. Power up the board and set the U-Boot environment variables as needed. For example,

```
MX53-SMD U-Boot > setenv bootargs console=ttymxc0,115200
MX53-SMD U-Boot > setenv loadaddr 0x70800000
MX53-SMD U-Boot > setenv serverip 10.192.225.216
MX53-SMD U-Boot > setenv bootfile uImage
### The user can set fake MAC address vi ethaddr environment if need
MX53-SMD U-Boot > setenv ethaddr 00:01:02:03:04:05
MX53-SMD U-Boot > saveenv
```

3. Copy uImage to `tftp` server. Then download it to RAM:

```
MX53-SMD U-Boot > dhcp
```

4. Query the information about MMC/SD card.

```
MX53-SMD U-Boot > mmcinfo 0
Device: FSL_ESDHC
Manufacturer ID: 3
OEM: 5344
Name: SD04G
Tran Speed: 25000000
Rd Block Len: 512
SD version 2.0
High Capacity: Yes
Capacity: 3965190144
Bus Width: 4-bit
Boot Partition Size: No boot partition available
```

5. Check the usage of "`mmc`" command. The "`blk#`" is equal to "`<the offset of read/write>/<block length of the card>`". The "`cnt`" is equal to "`<the size of read/write>/<block length of the card>`".

```
MX53-SMD U-Boot > help mmc
mmc - MMC sub system

Usage:
mmc mmc read <device num> addr blk# cnt [partition]
mmc write <device num> addr blk# cnt [partition]
mmc rescan <device num>
mmc list - lists available devices
```

6. Program the kernel uImage into MMC/SD. For example, the below command writes the image with the size 0x300000 from `${loadaddr}` to the offset 0x100000 of the MMC/SD card. Here 0x800 =0x100000/512, 0x1800=0x300000/512. The block size of this card is 512. This example assumes the kernel image is less than 0x300000 bytes. If the kernel image exceeds 0x300000, enlarge the image length.

```
MX53-SMD U-Boot > mmc write 0 ${loadaddr} 0x800 0x1800

MMC write: dev # 0, block # 2048, count 6144, partition # 0 ...
6144 blocks written: OK
```

7. Boot up the system through RFS in SD card via HannStar LVDS:

```
MX53-SMD U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/mmcblk0p1 rootwait rw
              video=mxcdi1fb:RGB666,XGA di1_primary ldb=di1 ip=dhcp'
MX53-SMD U-Boot > setenv bootcmd_mmc 'run bootargs_base bootargs_mmc;mmc
              read 0 ${loadaddr} 0x800 0x1800;bootm'
MX53-SMD U-Boot > setenv bootcmd 'run bootcmd_mmc'
MX53-SMD U-Boot > saveenv
```

8. Boot up the system through RFS in SD card via CLAA WVGA panel:

```
MX53-SMD U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/mmcblk0p1 rootwait rw
              video=mxcdi0fb:RGB565,CLAA-WVGA di0_parimary ip=dhcp'
```

9. Boot up the system through RFS in SD card via HDMI:

```
MX53-SMD U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/mmcblk0p1 rootwait rw
              video=mxcdi0fb:RGB24,1024x768M@60 hdmi di0_primary
              ip=dhcp'
```

10. To program the rootfs to MMC/SD, See Section 6.3 “Use i.MX53 as Host Server to Create rootfs” or section “Using a Linux Host to Set Up an SD/MMC card”.

6.2.2 eMMC4.4 on SDHC3

1. To clean up the environments stored on eMMC4.4, do as the following in U-Boot console:

```
MX53-SMD U-Boot > mmc write 1 0x70100000 0x600 0x10
```

2. Set SW26 dip 2, 5,6,7 ON, SW28 dip 8 ON. Others are Off. Power up the board and set the U-Boot environment variables as needed. For example,

```
MX53-SMD U-Boot > setenv bootargs console=ttymxc0,115200
MX53-SMD U-Boot > setenv loadaddr 0x70800000
MX53-SMD U-Boot > setenv serverip 10.192.225.216
MX53-SMD U-Boot > setenv bootfile uImage
### The user can set fake MAC address vi ethaddr environment if need
MX53-SMD U-Boot > setenv ethaddr 00:01:02:03:04:05
MX53-SMD U-Boot > saveenv
```

3. Copy uImage to `tftp` server. Then download it to RAM:

```
MX53-SMD U-Boot > dhcp
```

4. Query the information about MMC/SD card.

```
MX53-SMD U-Boot > mmcinfo 1
Device: FSL_ESDHC
Manufacturer ID: 45
OEM: 100
Name: SEM08
Tran Speed: 25000000
Rd Block Len: 512
MMC version 4.0
High Capacity: Yes
Capacity: 7944011776
Bus Width: 8-bit
Boot Partition Size:  1024KB
Current Partition for boot: Boot partition 1
```

5. Check the usage of "`mmc`" command. The "`blk#`" is equal to "`<the offset of read/write>/<block length of the card>`". The "`cnt`" is equal to "`<the size of read/write>/<block length of the card>`".

```
MX53-SMD U-Boot > help mmc
mmc - MMC sub system

Usage:
mmc mmc read <device num> addr blk# cnt [partition]
mmc write <device num> addr blk# cnt [partition]
mmc rescan <device num>
mmc list - lists available devices
```

6. Program the kernel uImage into eMMC4.4. For example, the below command writes the image with the size 0x300000 from `${loadaddr}` to the offset 0x100000 of the MMC/SD card. Here 0x800 =0x100000/512, 0x1800=0x300000/512. The block size of this card is 512. This example assumes the kernel image is less than 0x300000 bytes. If the kernel image exceeds 0x300000, enlarge the image length.

```
MX53-SMD U-Boot > mmc write 1 ${loadaddr} 0x800 0x1800

MMC write: dev # 1, block # 2048, count 6144, partition # 0 ...
6144 blocks written: OK
```

7. Boot up the system through RFS in eMMC4.4 via HannStar LVDS:

```
MX53-SMD U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/mmcblk0p1 rootwait rw
              video=mxcdi1fb:RGB666,XGA di1_primary ldb=di1 ip=dhcp'
MX53-SMD U-Boot > setenv bootcmd_mmc 'run bootargs_base bootargs_mmc;mmc
              read 1 ${loadaddr} 0x800 0x1800;bootm'
MX53-SMD U-Boot > setenv bootcmd 'run bootcmd_mmc'
MX53-SMD U-Boot > saveenv
```

8. Boot up the system through RFS in eMMC4.4 via CLAA WVGA panel:

```
MX53-SMD U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/mmcblk0p1 rootwait rw
              video=mxcdi0fb:RGB565,CLAA-WVGA di0_primary ip=dhcp'
```

9. Boot up the system through RFS in eMMC4.4 via HDMI:

```
MX53-SMD U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/mmcblk0p1 rootwait rw
              video=mxcdi0fb:RGB24,1024x768M@60 hdmi di0_primary
              ip=dhcp'
```

10. To program the rootfs to MMC/SD, See Section 6.3 “Use i.MX53 as Host Server to Create rootfs” or section “Using a Linux Host to Set Up an SD/MMC card”.

6.2.3 SATA

1. Connect a SATA device to J5. Ensure
2. Ensure the fuse “SATA_ALT_CLK_REF” is blown
3. The default environment setting for SABRE Tablet board is the SD card. To store the environment on the SATA, do as the followings:

   a. Modify U-Boot source code and apply the following patch:

```
diff --git a/include/configs/mx53_smd.h
b/include/configs/mx53_smd.h

index 81bdc48..9a69f46 100644

--- a/include/configs/mx53_smd.h

+++ b/include/configs/mx53_smd.h

@@ -266,8 +266,8 @@

 #define CONFIG_SYS_NO_FLASH


 /* Monitor at beginning of flash */

-/* #define CONFIG_FSL_ENV_IN_SATA */

-#define CONFIG_FSL_ENV_IN_MMC

+#define CONFIG_FSL_ENV_IN_SATA

+//#define CONFIG_FSL_ENV_IN_MMC


 #define CONFIG_ENV_SECT_SIZE    (128 * 1024)

#define CONFIG_ENV_SIZE         CONFIG_ENV_SECT_SIZE
```

   b. Rebuild U-Boot and flash new bootloader to SATA device.

4. Set SW26 dip 4, 6 ON. Others are OFF. Power up the board and set the U-Boot environment variables as needed. The following examples assume the environment variables are stored into SATA device.

```
MX53-SMD U-Boot > setenv bootargs console=ttymxc0,115200
MX53-SMD U-Boot > setenv loadaddr 0x70800000
MX53-SMD U-Boot > setenv serverip 10.192.225.216
MX53-SMD U-Boot > setenv bootfile uImage
### The user can set fake MAC address vi ethaddr environment if need
MX53-SMD U-Boot > setenv ethaddr 00:01:02:03:04:05
MX53-SMD U-Boot > saveenv
```

5. Copy uImage to tftp server. Then download it to RAM:

```
MX53-SMD U-Boot > dhcp
```

6. Query SATA information:

```
MX53-SMD U-Boot > sata info


SATA device 0: Model: SanDisk SSD P4 32GB Firm: SSD 8.00 Ser#:
104550300093

            Type: Hard Disk

            Supports 48-bit addressing

                     Capacity: 30533.8 MB = 29.8 GB (62533296 x 512)
```

7. Program the kernel uImage into SATA. For example, the below command writes the image with the size 0x300000 from ${loadaddr} to the offset 0x100000 of the SATA. Here 0x800 =0x100000/512, 0x1800=0x300000/512. The block size of this card is 512. This example assumes the kernel image is less than 0x300000 bytes. If the kernel image exceeds 0x300000, enlarge the image length.

```
MX53-SMD U-Boot > sata write ${loadaddr} 0x800 0x1800


   SATA write: device 0 block # 2048, count 6144 ... 6144 blocks written:
OK
```

8. Boot up the system through RFS in SATA:

```
MX53-SMD U-Boot > setenv bootargs_sata 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/sda1 rootwait rw
              video=mxcdi1fb:RGB666,XGA di1_primary ldb=di1 ip=dhcp'
MX53-SMD U-Boot > setenv bootcmd_sata 'run bootargs_base
              bootargs_sata;sata read  ${loadaddr} 0x800 0x1800;bootm'
MX53-SMD U-Boot > setenv bootcmd 'run bootcmd_sata'
MX53-SMD U-Boot > saveenv
```

6.2.4 SPI-NOR

1. The default environment setting for SABRE Tablet board is the SD card. To store the environment on the SPI-NOR, do as the followings:

   a. Modify U-Boot source code and apply the following patch:

```
diff --git a/include/configs/mx53_smd.h
b/include/configs/mx53_smd.h

index 81bdc48..9a69f46 100644

--- a/include/configs/mx53_smd.h

+++ b/include/configs/mx53_smd.h

@@ -266,8 +266,8 @@

 #define CONFIG_SYS_NO_FLASH


 /* Monitor at beginning of flash */

-/* #define CONFIG_FSL_ENV_IN_SATA */

-#define CONFIG_FSL_ENV_IN_MMC

+#define CONFIG_FSL_ENV_IN_SF

+/* #define CONFIG_FSL_ENV_IN_MMC */


 #define CONFIG_ENV_SECT_SIZE    (128 * 1024)

#define CONFIG_ENV_SIZE         CONFIG_ENV_SECT_SIZE
```

   b. Rebuild U-Boot and flash new bootloader to SPI-NOR device.

2. Set SW26 dip 1, 4, 5, 6 ON, SW28 dip 5 ON. Others are OFF. Power up the board and set the U-Boot environment variables as needed. The following examples assume the environment variables are stored into SPI-NOR device.

```
MX53-SMD U-Boot > setenv bootargs console=ttymxc0,115200
MX53-SMD U-Boot > setenv loadaddr 0x70800000
MX53-SMD U-Boot > setenv serverip 10.192.225.216
MX53-SMD U-Boot > setenv bootfile uImage
### The user can set fake MAC address vi ethaddr environment if need
MX53-SMD U-Boot > setenv ethaddr 00:01:02:03:04:05
MX53-SMD U-Boot > saveenv
```

3. Copy uImage to tftp server. Then download it to RAM:

```
MX53-SMD U-Boot > dhcp
```

4. Query SPI-NOR information:

```
MX53-SMD U-Boot > sf probe 1
```

5. Program the kernel uImage intoSPI-NOR. For example, the below command writes the image with the size 0x300000 from ${loadaddr} to the offset 0x100000 of theSPI-NOR. This example assumes the kernel image is less than 0x300000 bytes. If the kernel image exceeds 0x300000, enlarge the image length.

```
MX53-SMD U-Boot > sf probe 1

……

MX53-SMD U-Boot > sf write ${loadaddr} 0x100000 0x300000

……
```

6.2.5 U-Boot Configurations

The U-Boot “print” command can be used to check environment variable values. The “setenv” command can be used to set environment variable values. See the U-Boot user guide for details.

6.3 Use i.MX53 as Host Server to Create rootfs

Linux provides multiple methods to program images to the storage device. This section describes how to use the i.MX53 SABRE Tablet as Linux Host server to create the rootfs on MMC/SD card or SATA device.

1. Boot from NFS or other storage. Check partitions information:

```
root@freescale ~$ cat /proc/partitions
```

2. To create a partition in MMC/SD Slot 0, use the `fdisk` command in the Linux console:

```
root@freescale ~$ fdisk /dev/mmcblk0
Device contains neither a valid DOS partition table, nor Sun, SGI or OSF
disklabel
Building a new DOS disklabel. Changes will remain in memory only,
until you decide to write them. After that the previous content
won't be recoverable.

The number of cylinders for this disk is set to 124368.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
1) software that runs at boot time (e.g., old versions of LILO)
2) booting and partitioning software from other OSs
   (e.g., DOS FDISK, OS/2 FDISK)

Command (m for help): p

Disk /dev/mmcblk0: 4075 MB, 4075290624 bytes
```

```
4 heads, 16 sectors/track, 124368 cylinders
Units = cylinders of 64 * 512 = 32768 bytes

        Device Boot      Start         End      Blocks   Id System
```

3. If creating a partition on a SATA device, the command can be changed to "`fdisk /dev/sda`"

4. As described in Chapter 4, the rootfs partition should be located after kernel image; the first 0x800000 bytes can be reserved for MBR, bootloader, and kernel sections.

   From the above log, the `Units` of current MMC/SD card is 32768 bytes. The beginning cylinder of the first partition can be set as "0x300000/32768 = 96." The last cylinder can be set according to the `rootfs` size. Create a new partition by typing:

```
Command (m for help): n
Command action
   e   extended
   p   primary partition (1-4)
p
Partition number (1-4): 1
First cylinder (1-124368, default 1): 96
Last cylinder or +size or +sizeM or +sizeK (96-124368, default 124368):
Using default value 124368

Command (m for help): w
The partition table has been altered!

Calling ioctl() to re-r mmcblk0:ead partition table
 p1
```

5. Format the MMC/SD partitions as types `ext3` or `ext4` type. For example, to use `ext3`:

```
root@freescale ~$ mkfs.ext3 /dev/mmcblk0p1
mke2fs 1.41.4 (27-Jan-2009)
Filesystem label=
OS type: Linux
Block size=4096 (log=2)
Fragment size=4096 (log=2)
248992 inodes, 994184 blocks
49709 blocks (5.00%) reserved for the super user
First data block=0
Maximum filesystem blocks=1019215872
31 block groups
32768 blocks per group, 32768 fragments per group
8032 inodes per group
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736

Writing inode tables: done
Creating journal (16384 blocks): done
```

```
Writing superblocks and filesystem accounting information: done

This filesystem will be automatically checked every 20 mounts or
180 days, whichever comes first.  Use tune2fs -c or -i to override.
```

6. Copy the `rootfs` contents to the MMC/SD card (copy the `rootfs.ext2` to NFS `rootfs`)

```
mount -t ext2 -o loop /rootfs.ext2 /mnt/cdrom
cd /mnt
mkdir mmcblk0p1
mount -t ext3 /dev/mmcblk0p1 /mnt/mmcblk0p1/
cp -rf /mnt/cdrom/* /mnt/mmcblk0p1/
umount /mnt/mmcblk0p1
umount /mnt/cdrom
```

7. Type `sync` to write the contents to MMC/SD.
8. Type `poweroff` to power down the system. Follow the instructions in Chapter 7 to boot the image from MMC/SD card.

7. Using a Linux Host to Set Up an SD/MMC Card

This chapter describes the steps to prepare an SD/MMC card to boot off an i.MX53 SABRE Tablet.

7.1.1 Requirements

An SD/MMC card reader, like a USB card reader, is required. It will be used to transfer the boot loader and kernel images to initialize the partition table and copy the root file system. To simplify the instructions, it is assumed that a 4GB SD/MMC card is used.

Any Linux distribution can be used for the following procedure. It is recommended to use a Linux distribution that LTIB has been tested against (like Fedora, or Ubuntu).

The Linux kernel running on the Linux host will assign a device node to the SD/MMC card reader. The kernel might decide the device node name or udev rules might be used. In the following instructions, it is assumed that udev is not used.

To identify the device node assigned to the SD/MMC card, enter the command:

```
$ cat /proc/partitions

major minor  #blocks  name

   8     0   78125000 sda

   8     1   75095811 sda1

   8     2          1 sda2

   8     5    3028221 sda5

   8    32  488386584 sdc

   8    33  488386552 sdc1

   8    16    3921920 sdb

   8    18    3905535 sdb1
```

In this example, the device node assigned is `/dev/sdb` (a block is 1kB large).

7.1.2 Copying the Boot Loader Image

Enter the following command to copy the U-Boot image to the SD/MMC card (note that this operation will delete the partition table present on the media):

```
$ sudo dd if=u-boot-mx53-smd.bin of=/dev/sdb bs=512 && sync && sync
```

To update U-Boot to another version, run the following command:

```
$ sudo dd if= u-boot-mx53-smd.bin  of=/dev/sdb bs=512 seek=2 skip=2&& sync &&
sync
```

The first 1 KB, that includes the partition table, will be preserved.

7.1.3 Copying the Kernel Image

The following command will copy the kernel image to the SD/MMC card:

```
$ sudo dd if= uImage of=/dev/sdb bs=512 seek=2048 && sync && sync
```

This will copy the `uImage` to the media at offset 1 MB.

7.1.4 Copying the File System (rootfs)

A partition table must be first created. If a partition already exists and it is big enough for the file system you want to deploy, then you can skip this step.

To create a partition, at offset 8192 (in sectors of 512 bytes) enter the following command:

```
$ sudo fdisk /dev/sdb
```

Type the following parameters (each followed by **<ENTER>**):

```
u       [switch the unit to sectors instead of cylinders]
d       [repeat this until no partition is reported by the ‘p’ command ]
n       [create a new partition]
p       [create a primary partition]
1       [the first partition]
8192    [starting at offset sector #8192, i.e. 4MB, which leaves enough space
for the kernel, the boot loader and its configuration data]
<enter> [using the default value will create a partition that spans to the
last sector of the medium]
w       [ this writes the partition table to the medium and fdisk exits]
```

The file system format `ext3` or `ext4` is a good option for removable media due to the built-in journaling. Run the following command to format the partition:

```
$ sudo mkfs.ext3 /dev/sdb1
```

Or

```
$ sudo mkfs.ext4 /dev/sdb1
```

Copy the target file system to the partition:

```
$ mkdir /home/user/mountpoint
$ sudo mount /dev/sdb1 /home/user/mountpoint
```

Assume that the root file system files are located in `/home/user/rootfs`:

```
$ cd /home/user/rootfs
$ sudo cp –rpa [A–z]* /home/user/mountpoint
$ sudo umount /home/user/mountpoint
```

The file system content is now on the media.

8. Running the Image on the Target

This chapter explains how to run an image on the target from downloaded device and NFS. These instructions assume that you have downloaded the kernel image using the instructions in Chapter 5 or Chapter 6 or Chapter 7. If you have not setup your Serial Terminal yet, please refer to Section 6.1 Setup Terminal.

8.1 Run the image from NFS

To boot from NFS, do as follows (attention must be paid to the items marked in blue color. You need to modify them as per your environment or HW information):

1. Press SW5 key to power up the board.
2. Enter the following commands in the U-Boot prompt:

```
MX53-SMD U-Boot > setenv serverip 10.192.225.216

MX53-SMD U-Boot > setenv bootfile uImage

MX53-SMD U-Boot > setenv nfsroot
10.192.225.216:/data/rootfs_home/rootfs_mx53
### The user can set fake MAC address vi ethaddr environment if need
MX53-SMD U-Boot > setenv ethaddr 00:01:02:03:04:05

MX53-SMD U-Boot > setenv bootargs_base 'setenv bootargs
console=ttymxc0,115200'

### LVDS

MX53-SMD U-Boot > setenv bootargs_nfs 'setenv bootargs ${bootargs}
root=/dev/nfs ip=dhcp nfsroot=${nfsroot},v3,tcp video=mxcdi1fb:RGB666,XGA
di1_primary ldb=di1'

### HDMI

MX53-SMD U-Boot > setenv bootargs_nfs 'setenv bootargs ${bootargs}
root=/dev/nfs ip=dhcp nfsroot=${nfsroot},v3,tcp
video=mxcdi0fb:RGB24,1024x768M@60 hdmi di0_primary ip=dhcp'

MX53-SMD U-Boot > setenv bootcmd_net 'run bootargs_base bootargs_nfs;bootm'

MX53-SMD U-Boot > setenv bootcmd 'dhcp; run bootcmd_net'

MX53-SMD U-Boot > saveenv
```

8.2 Run the Image from MMC/SD

To boot the system from MMC/SD flash follow the steps bellow (attention must be paid to the items marked in blue color. You need to modify them as per your environment or HW information):

1. Press the SW5 key to power up the board.
2. Assume the kernel image start from the address 0x100000 byte (the block start address is 0x800). The kernel image size is less than 0x300000 byte. The `rootfs` is located into `/dev/mmcblk0p1` partition. Enter the following commands in the U-Boot prompt:

```
MX53-SMD U-Boot > setenv loadaddr 0x70800000

MX53-SMD U-Boot > setenv bootargs_base 'setenv bootargs
console=ttymxc0,115200'

MX53-SMD U-Boot > setenv bootargs_mmc 'setenv bootargs ${bootargs}
root=/dev/mmcblk0p1 rootwait rw video=mxcdi1fb:RGB666,XGA di1_primary
ldb=di1 ip=dhcp'

MX53-SMD U-Boot > setenv bootcmd_mmc 'run bootargs_base
bootargs_mmc;mmc read 0 ${loadaddr} 0x800 0x1800;bootm'

MX53-SMD U-Boot > setenv bootcmd 'run bootcmd_mmc'

MX53-SMD U-Boot > saveenv

MX53-SMD U-Boot > run bootcmd
```

To read kernel image from eMMC4.4, please update the command line as:

```
MX53-SMD U-Boot > setenv bootcmd_mmc 'run bootargs_base bootargs_mmc;mmc
read 1 ${loadaddr} 0x800 0x1800;bootm'
```

8.3 Run the Image from SATA

The following steps may be used to boot the system from SATA:

1. Press the SW5 key to power up the board.
2. Assume the kernel image starts from the address 0x100000 byte (the block start address is 0x800). The kernel image size is less than 0x300000 byte. The `rootfs` is located in `/dev/sda1`. Enter the following commands in the U-Boot prompt:

```
MX53-SMD U-Boot > setenv loadaddr 0x70800000
MX53-SMD U-Boot > setenv bootargs_base 'setenv bootargs
              console=ttymxc0,115200'
MX53-SMD U-Boot > setenv bootargs_sata 'setenv bootargs ${bootargs}
              console=tty1 root=/dev/sda1 rootwait rw
              video=mxcdi1fb:RGB666,XGA di1_primary ldb=di1 ip=dhcp'
MX53-SMD U-Boot > setenv bootcmd_sata 'run bootargs_base
              bootargs_sata;sata read  ${loadaddr} 0x800 0x1800;bootm'
MX53-SMD U-Boot > setenv bootcmd 'run bootcmd_sata'
```

```
MX53-SMD U-Boot > run bootcmd
```

8.4 Run the Image from SPI-NOR

The following steps may be used to boot the system from SPI-NOR flash:

3. Press the SW5 key to power up the board.
4. Assume the kernel image starts from the address 0x100000 byte (the block start address is 0x800). The kernel image size is less than 0x300000 byte. The `rootfs` is located in `NFS`. Enter the following commands in the U-Boot prompt:

```
MX53-SMD U-Boot > setenv serverip 10.192.225.216

MX53-SMD U-Boot > setenv loadaddr 0x70800000

MX53-SMD U-Boot > setenv nfsroot
10.192.225.216:/data/rootfs_home/rootfs_mx53

MX53-SMD U-Boot > setenv bootargs_base 'setenv bootargs
              console=ttymxc0,115200'
MX53-SMD U-Boot > setenv bootargs_sf 'root=/dev/nfs ip=dhcp
              nfsroot=${nfsroot},v3,tcp
              video=mxcdi0fb:RGB24,1024x768M@60 hdmi di0_primary
              ip=dhcp'
MX53-SMD U-Boot > setenv bootcmd_sata 'run bootargs_base bootargs_sf;sf
              probe 1;sf read ${loadaddr} 0x100000 0x300000;bootm'
MX53-SMD U-Boot > setenv bootcmd 'run bootcmd_sata'
MX53-SMD U-Boot > run bootcmd
```