Learning how to configure, boot-up and test the i.MX6 platform …

IMX6QSDB platform board

Bruno Castelucci

Introduction

- This webinar will provide a walk through of the i.MX 6Quad SABRE Board for Smart Devices (SDB).

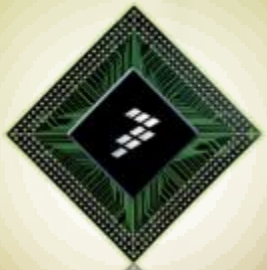
- During this session it will be covered the basics of this HW platform, what we deliver with our BSPs and how to use some of the basics.

- After completing this session you:
  - will be able to deploy images in the i.MX6 SABRE Board for Smart Devices (SDB)
  - Completely capable to understand the deployment process for any i.MX platform

Tools to be used in this Training Session

- i.MX 6Quad SABRE Board for Smart Devices
  - Power supply
  - 2 Micro USB cables
- LVDS Display
- Host PC
- Software:
  - Freescale Ubuntu image
  - Freescale demo images
  - Freescale Manufacturing Tool (MFG_Tool)

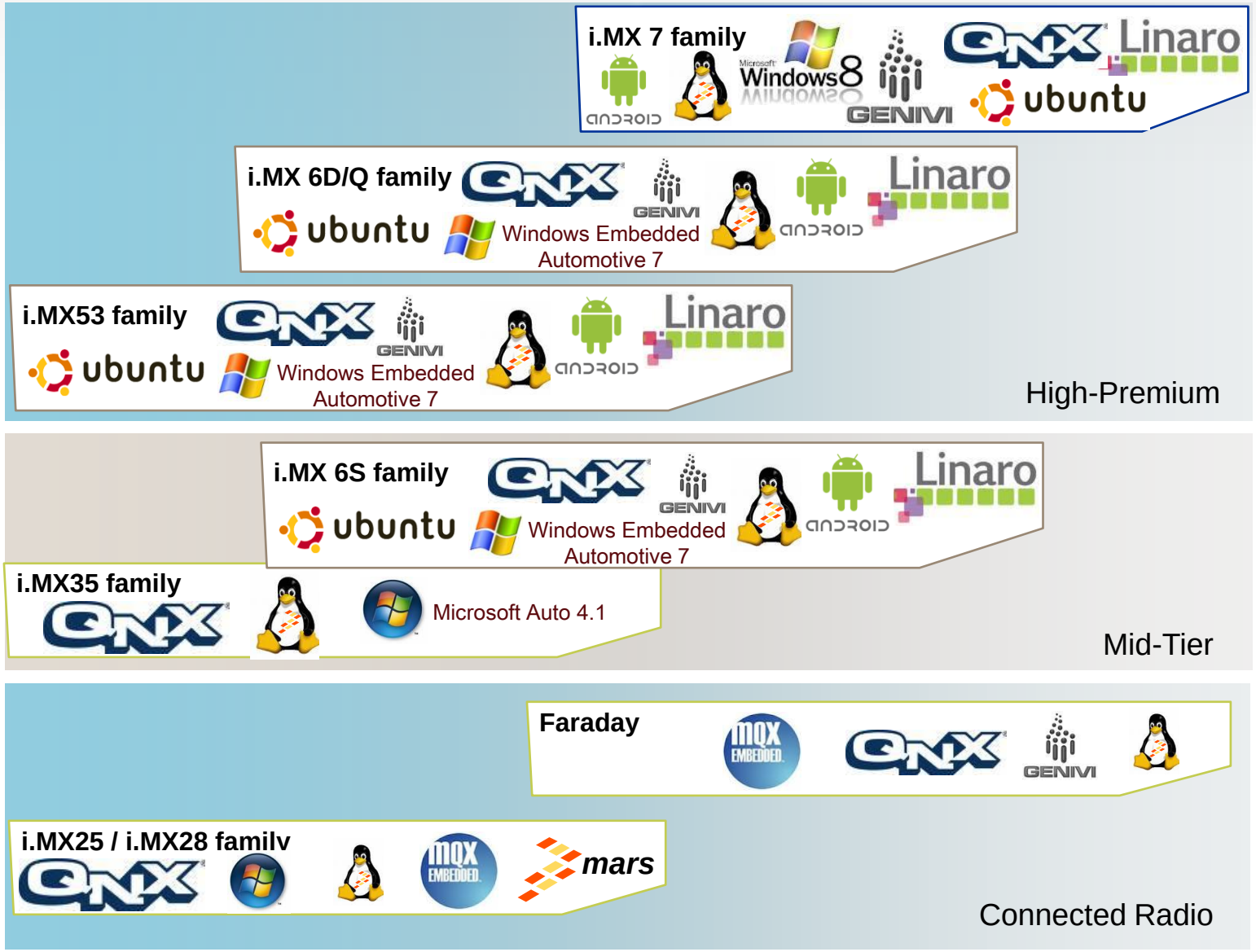
i.MX
Your Interface to the World



i.MX families offer the most versatile platforms for multimedia and display applications, bringing personality and interactivity to a whole new world of products

freescale™

Infotainment Platform Roadmap



High-End
Navigation
Natural Language
HD Video Decode
Multiple Displays

Entry-Mid-Tier Nav
Advanced Audio
Entry Speech Rec
Sophisticated GUI

Audio Connectivity
GUI Support
Segment -TFT LCD
PDIMs

Freescale i.MX Application Processors

i.MX 6Quad

i.MX53

High Performance Tablet

Media Box

Luxury Infotainment

Advanced HMI

i.MX 6Dual
i.MX 6DualLite NEW

i.MX51, i.MX50

Color eReader

Business Tablet

Mainstream Infotainment

Medical

i.MX 6Solo
i.MX 6SoloLite NEW

i.MX28, i.MX233, i.MX25, i.MX27, i.MX31, i.MX35

Monochrome eReader

Single Function Tablet

Connected Radio

Smart Energy Meter

Performance/ Multimedia Capability

Content Creation, Technology Driver

Good, Better, Best Differentiation

freescale™

i.MX 6: One Platform, Differentiated Products

Saves **development costs** and **improves time to market**.
Scalability with multiple cores is **key** to implement this strategy.

Smart Device Design

Quad Core

High-End (6Quad)

IPTV
High Performance Tablet
Auto Infotainment

Dual Core

High-End (6Dual)

Low-End (6DualLite)

Smart Monitor
Business Tablet
Media Tablet
IP Phone
Tablets for Kids
Mainstream Infotainment
Color eReaders

Single Core

High-End (6Solo)

Low-End (6SoloLite)

Smart Energy
eReaders
Entry Auto Infotainment

i.MX 6 Series Overview

Scalable series of five ARM Cortex A9-based SoC families

i.MX 6SoloLite

- 1x 1GHz
- x32 400MHz DDR3
- No HW video accel.
- 2D graphics (2 GPUs)
- LCD, EPD

i.MX 6Solo

- 1x 1GHz
- x32 400MHz DDR3
- **HD1080p video**
- 2D+**3D** (2 GPUs), 53Mtri/s
- LCD, EPD

i.MX 6DualLite

- **2x** 1GHz
- **x64** 400MHz DDR3
- HD1080p video
- 2D+3D (2 GPUs), 53Mtri/s
- LCD, EPD

i.MX 6Dual

- 2x 1/**1.2GHz**
- x64 **533MHz** DDR3
- **Dual** HD1080p video
- 2D+3D (3 GPUs), **176 Mtri/s**
- LCD

i.MX 6Quad

- **4x** 1/1.2GHz
- x64 533MHz DDR3
- Dual HD1080p video
- 2D+3D (3 GPUs), 176 Mtri/s
- LCD

Pin-to-pin Compatible

Software Compatible

freescale™

i.MX 6 Series At a Glance

Red indicates change from column to the left

i.MX 6SoloLite

- Single ARM® Cortex™-A9 at 1.0GHz
- 256KB L2 cache, Neon, VFPvd16, Trustzone
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller

i.MX 6Solo

- Single ARM Cortex-A9 at 1.0GHz
- **512KB** L2 cache, Neon, VFPvd16, Trustzone
- **3D graphics** with 1 shader
- 2D graphics
- 32-bit DDR3 and LPDDR2 at 400MHz
- Integrated EPD controller

i.MX 6DualLite

- **Dual** ARM Cortex-A9 at 1.0GHz
- 512KB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 1 shader
- 2D graphics
- **64-bit** DDR3 and 2-channel 32-bit LPDDR2 at 400MHz
- Integrated EPD controller

i.MX 6Dual

- **Dual** ARM Cortex-A9 at 1/**1.2GHz**
- **1 MB** L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with **4 shaders**
- **Two** 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at **533MHz**
- Integrated **SATA-II**

i.MX 6Quad

- **Quad** ARM Cortex-A9 at 1.2GHz
- 1 MB L2 cache, Neon, VFPvd16, Trustzone
- 3D graphics with 4 shaders
- Two 2D graphics engines
- 64-bit DDR3 and 2-channel 32-bit LPDDR2 at 533MHz
- Integrated SATA-II

i.MX 6 Series Highlights

- ARM Cortex-A9 based solutions ranging up to 1.2GHz
- HD 1080p encode and decode (except 6SL)
- 3D video playback in High definition (except 6SL)
- Low power 1080p playback at 350mW Integrated IO's that include HDMI v1.4, MIPI and LVDS display ports, MIPI camera, Gigabit Ethernet, multiple USB 2.0 and PCI-Express
- SW support: Google Android™, Windows® Embedded CE, Ubuntu, Linux®, Skype™

Features vary by product family

freescale™

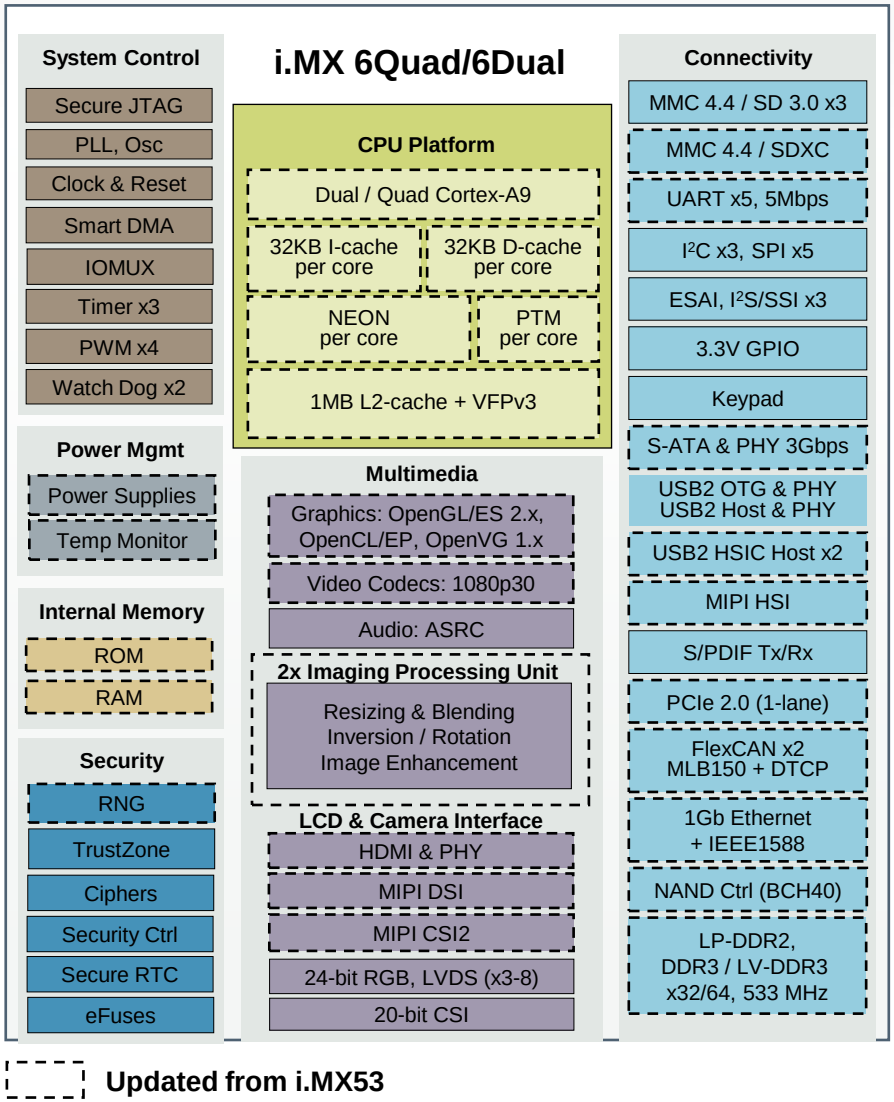
i.MX 6Quad/6Dual Applications Processor

Specifications

- **CPU:** i.MX 6Quad 4x Cortex-A9 @1.2 GHz, 12000 DMIPS
  - i.MX 6Dual 2x Cortex-A9 @1.2 GHz, 6000 DMIPS
- **Process:** 40nm
- **Core Voltage:** 1.1V
- **Package:** 21x21 0.8mm Flip-chip BGA
  - 12x12 PoP (LP-DDR2, NAND)

Key Features and Advantages

- Multi-core architecture for high performance, 1MB L2 cache
- 64-bit LP-DDR2, DDR3 and raw / managed NAND
- S-ATA 3Gbps interface (SSD / HDD)
- Delivers rich graphics and UI in HW
  - OpenGL/ES 2.x 3D accelerator with OpenCL EP support and OpenVG 1.1 acceleration
- Drives high resolution video in HW
  - Multi-format HD1080 video decode and encode
  - 1080p60 decode, 720p60 encode
  - High quality video processing (resizing, de-interlacing, etc.)
- Flexible display support
  - Four simultaneous: 2x Parallel, 2x LVDS, MIPI-DSI, or HDMI
  - Dual display up to WUXGA (1920x1200) and HD1080
- MIPI-CSI2 and HSI
- Increased analog integration simplifies system design and reduces BOM
  - DC-DC converters and linear regulators supply cores and all internal logic
  - Temperature monitor for smart performance control
- Expansion port support via PCIe 2.0
- Car network: 2xCAN, MLB150 with DTCP, 1Gb Ethernet with IEEE1588



Updated from i.MX53

Intelligent Integration of Multi-Media

i.MX 6Dual/6Quad VPU

-H.264 MVC1080p60 decode
-H.264 MVC 720p60 encode
- 350mW power consumption for single video!

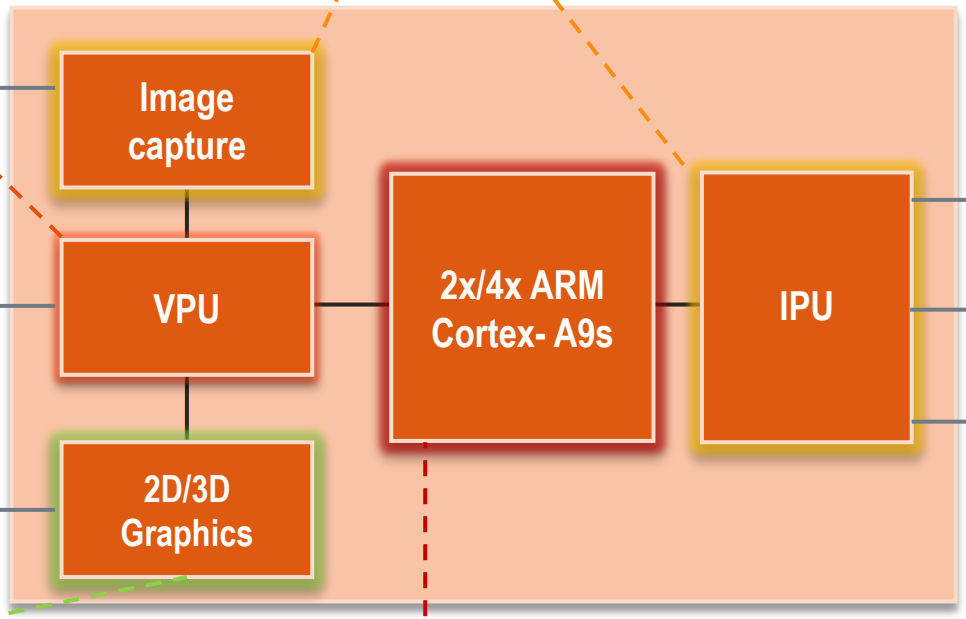
i.MX 6Dual/6Quad IPU

- Four Display support (2x MIPI-DSI, Parallel, HDMI v1.4a)
- Stereoscopic camera input
- Color adjustments and gamut mapping
- Gamma correction and contrast stretching
- Compensation for low-light conditions & backlight reduction

Recording Video

Movie Content

Game Content



3D LCD

Publish

3D Television

i.MX 6Dual/6Quad Triple-Play Graphics

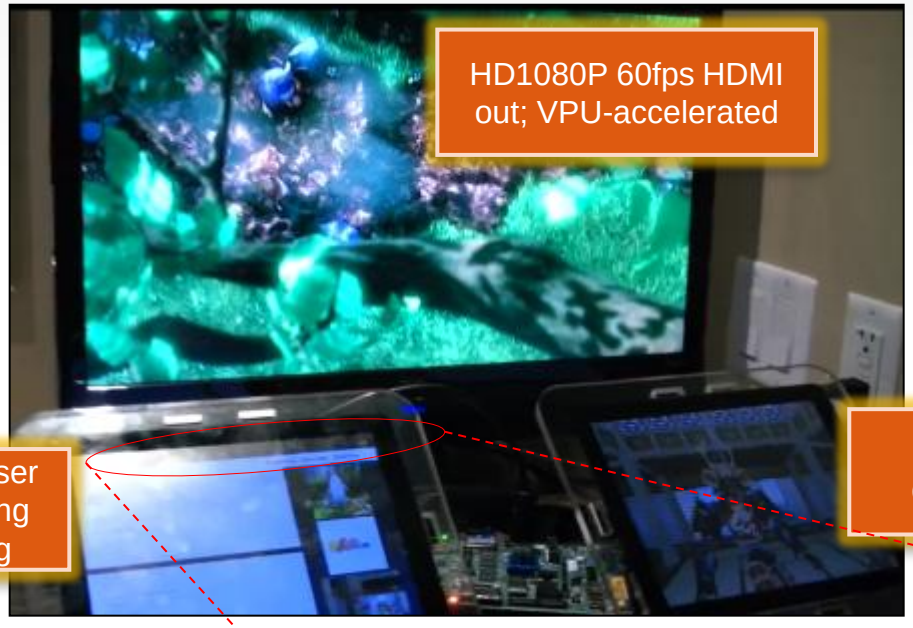
- 3 engines: 3D, OpenVG and BLT
- 200 MT/s, 4 shaders, 3 separate engines
- High quality 3D games optimized for mobile
- Augmented reality views (real world + 3D objects)
- Advanced 3D video formats (source/depth format)

i.MX 6Dual/6Quad– 2x/4x cores

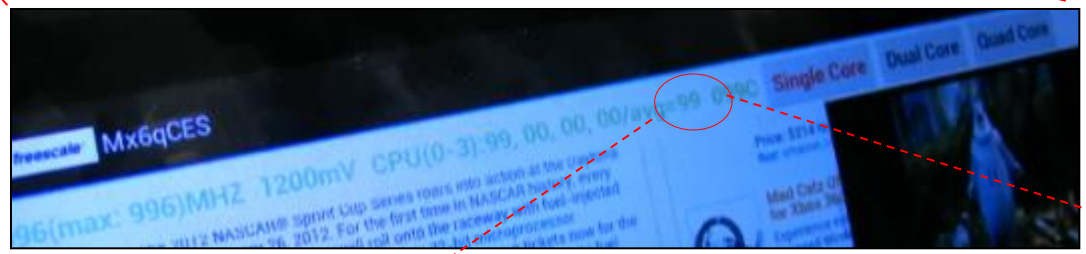
- Create, transform, enhance, & publish multimedia fast!
- Intuitive User Interfaces for content viewing
- Scalability for 'the next big use case'

freescale™

Quad core enables lower power than Dual core



Jan 2012 Android Ice Cream Sandwich



	1 Core	2 Core	4 Core
CPU utilization	**99%**	**~55-67%**	**~33%**

Watch it live!
http://www.youtube.com/watch?v=dE5TIzOz9NI&list#t=7m07

SABRE Board for Smart Devices (SDB)

i.MX 6Quad 1Ghz Cortex-A9 Processor
- Can be configured as i.MX 6Dual
- Freescale MMPF0100 PMIC
- 1 GB DDR3 memory (non terminated)
- 3” x 7” 8-layer PCB

Part Numbers: MCIMX6Q-SDB ($399)

Display (9.7”): MCIMX-LVDS1 ($499)
Display (4.3”): MCIMX28LCD ($199)

Connectivity
- Full-size SD/MMC card slot
- 7-pin SATA data connector
- 10/100/1000 Ethernet port
- 1x high-speed USB host port
- PCI-e connector

Display connectors
- 2x LVDS connectors
- Connector for 24 bit 4.3” 800x480 WVGA with 4-wire touch screen
- HDMI Connector

Debug
- JTAG connector
- Serial to USB connector

Additional Features
- 3-axis Freescale accel
- Power supply- USB plug
- No battery charger

Audio
- Wolfson Audio Codec
- Microphone and headphone jacks

OS Support
- Linux and Android IceCream Sandwich from Freescale;
- Others: support by 3rd parties

Expansion Connector
- Camera CSI port signals
- I2C, SSI, SPI signals

Tools Support
- Lauterbach, ARM (DS-5), Macraigor debug/IDE tool chain

The i.MX Linux BSP

The i.MX 6 Linux BSP

What we deliver with the BSP

- Linux BSP Source Code
- Linux BSP Documentation package
- Linux BSP Demo Image package
  - U-boot image
  - Linux Kernel image
  - Root File System
- Linux Multimedia Codecs binary files
- Linux Multimedia Codecs Documentation
- Manufacturing Tool (MFG tool) package

…where do I get those?

www.freescale.com/imx6

L3.0.35_1.1.0_DEMO_IMAGE : Linux Binary Demo Files for i.MX 6Quad and i.MX 6Dual Linux BSP.
Size (K): 346308 **Format:** gz **Rev #:** L3.0.35_1.1.0 **Modified:** 1/15/2013

IMX_6DQ_MFG_TOOL : Tool and documentation for downloading OS images to the i.MX 6Quad and i.MX6Dual.
Size (K): 57732 **Format:** gz **Rev #:** L3.0.35_1.1.0 **Modified:** 1/18/2013

L3.0.35_1.1.0_UBUNTU_RFS : File System for the Ubuntu Images for i.MX 6Quad and i.MX 6Dual Linux BSP.
Size (K): 771115 **Format:** tgz **Rev #:** L3.0.35_1.1.0 **Modified:** 1/22/2013

Demo Image Deployment

Demo image deployment

1. Decompress the Linux demo image
   L3.0.35_12.09.01.01_GA_images_MX6Q.tar.gz

2. Decompress the Manufacturing Tool downloaded file
   Mfgtools-Rel-L3.0.35_1.0.1_MX6Q_UPDATER.tar.gz

Manufacturing Tool setup

- Go to the path where you decompressed the "*DEMO_IMAGES*"

…/L3.0.35_12.09.01_GA\L3.0.35_12.09.01_GA_images_MX6Q

- Copy the following files:
  - *u-boot-mx6q-sabresd.bin*
  - *uImage*

Manufacturing Tool setup

- Go to the path where the MFGTool was decompressed

…\Mfgtools-Rel-L3.0.35_1.0.1_MX6Q_UPDATER\Profiles\MX6Q Linux Update\OS Firmware\files

- Paste the previously copied files in this folder…

- Get the Ubuntu image (*12_09_01_oneiric.tgz*) and paste it in the same folder

Manufacturing Tool setup

- Go back one folder

…Mfgtools-Rel-L3.0.35_1.0.1_MX6Q_UPDATER\Profiles\MX6Q Linux Update\OS Firmware

- Open the ***ucl2.xml*** file

- Go to this profile:

```
<LIST name="ubuntu-SabreSD-eMMC" desc="Choose eMMC as media">
```

- Change the line containing the name "*oneiric.tgz*"

```
<CMD state="Updater" type="push" body="pipe tar --numeric-owner -zxv -C /mnt/mmcblk0p1" file="files/oneiric.tgz">Sending and writting rootfs</CM
```

…by "*12_09_01_oneiric.tgz*"

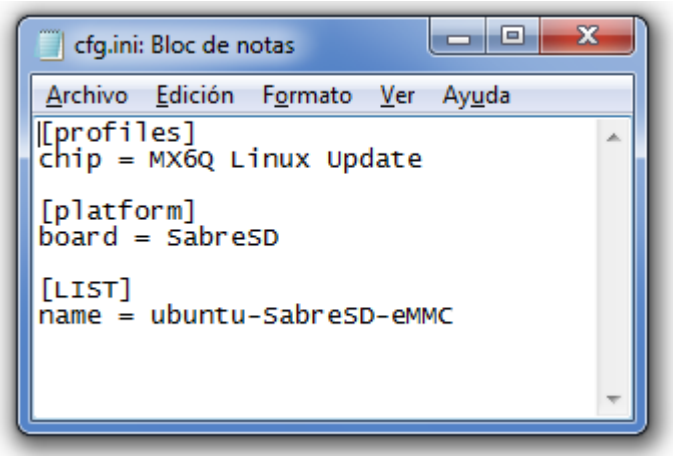
```
<CMD state="Updater" type="push" body="pipe tar --numeric-owner -zxv -C /mnt/mmcblk0p1" file="files/12_09_01_oneiric.tgz">Sending and writting ro
```

Manufacturing Tool setup

- Go back in the same folder to the very beginning

…Mfgtools-Rel-L3.0.35_1.0.1_MX6Q_UPDATER

- Open the ***cfg.ini*** file



Demo image deployment – Board setup

A. Connect the UBS OTG port

(J505, bottom, middle connector) from the SABRE SD to the computer.

B. Connect the USB to SERIAL port

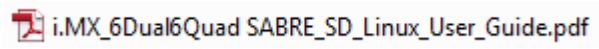
(J509, bottom, left connector) from the SABRE SD to the computer.

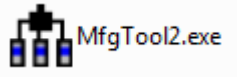
C. Open a Terminal on the Host PC

Bits per second:	115200
Port:	USB

Demo image deployment – Board setup

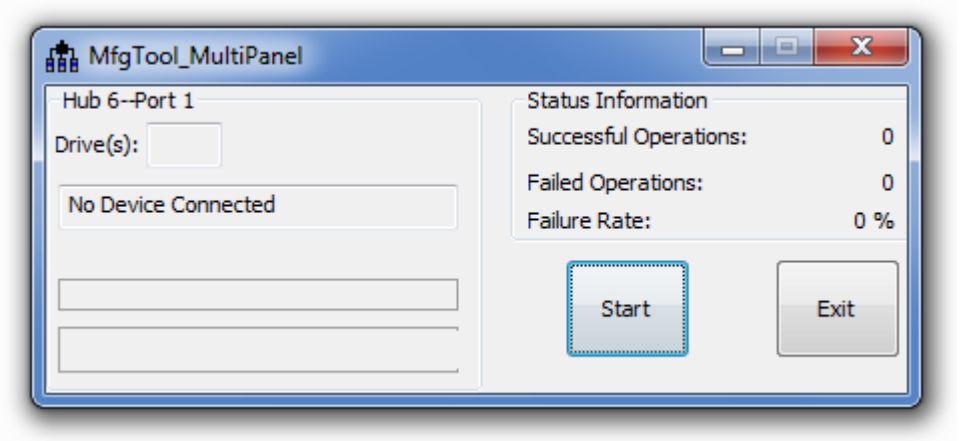
D. Set the board to the serial download mode, change Boot Switch (**SW6**) to **00001100** *(from 1-8 bit)*.



E. Start the MFGTool by clicking the executable icon 

Demo image deployment – Board setup

The user interface of this tool should look like:



F. Plug in the Power supply to the board and then the device field shall update as "**HID-compliant device**".

Demo image deployment

G. Wait until the download process is done, the MFG tool will display the Operation Complete message when is done.

…what is MFGTool doing?

- If we take a look at the ucl2.xml file we used before, we will find out the Manufacturing Tool is doing the same process we should be doing in Linux step by step:

…what is MFGTool doing?

- It will first of all, identify the device node assigned on the cfg.ini file (SD, eMMC, etc)

```
$ 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
```

…what is MFGTool doing?

- Then it will begin copying the boot loader image (***u-boot.bin***) into the device assigned
- Creating the first partition with its proper size

```
$ sudo dd if=u-boot.bin  of=/dev/sdb bs=512 seek=2 skip=2 conv=fsync
```

…what is MFGTool doing?

- After the u-boot is loaded into the memory, the kernel image will be copied (***uImage***)
- Creating the second partition at offset 1MB (bs x seek = 512 x 2048 = 1MB)

```
$ sudo dd if=uImage of=/dev/sdb bs=512 seek=2048 conv=fsync
```

…what is MFGTool doing?

- Then a partition table must be created

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

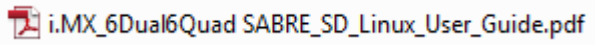
…with the following parameters:

```
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]
16384    [starting at offset sector #16384, i.e. 8MB, 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]
```

…what is MFGTool doing?

- Then the media must be formated with a specific format (ext3 or ext4) …and the target file system will be copied to the partition created.
- This copy may take several minutes.

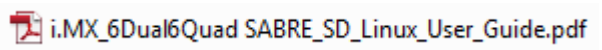
- Now… the file system is in the media.



Demo image deployment

H. Click **Stop** and then **Exit**.

I. Change Boot Switch (SW6) to **11100110** to switch the board back to eMMC boot mode.



J. Power down the board and connect the LVDS cable to the LVDS0 port

K. Power up the board to start the boot process.

Booting up the board

- Stop the boot process to modify the boot arguments (*bootargs*)

- Enter the following sequence:

i.MX_6Dual6Quad SABRE_SD_Linux_User_Guide.pdf

```
$setenv bootargs_mmc 'setenv bootargs ${bootargs} root=/dev/mmcblk0p1
  rootwait rw video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666
  video=mxcfb1:dev=hdmi,1440x900M@60,if=RGB24'
$setenv bootcmd 'run bootcmd_mmc'
$saveenv
$boot
```

Booting up the board

- After the boot process begins, you will be able to see the penguins

GStreamer

for video tests

GStreamer

- Now that the board is running Ubuntu
- Open a Terminal window and do the following:

  $ gst-launch -v <gst elements>

GStreamer

- For a video source test:

  $ gst-launch videotestsrc ! mfw_v4lsink device=/dev/video17

GStreamer

- For an image display:

  $ VSALPHA=1 gst-launch filesrc location=sample.jpeg ! jpegdec ! imagefreeze ! mfw_isink

GStreamer

- For video rendering:

  $ gst-launch videotestsrc ! mfw_v4lsink

- For audio rendering:

  $ gst-launch audiotestsrc ! alsasink

GStreamer

- For multi-overlay:

```
$ export VSALPHA=1
$ SAMPLE1=sample1.avi; SAMPLE2=sample2.avi;
SAMPLE3=sample3.avi; SAMPLE4=sample4.avi;
$ WIDTH=320; HEIGHT=240; SEP=20

$ gst-launch \ playbin2 uri=file://`pwd`/$SAMPLE1 video-
sink="mfw_isink axis-top=0 axis-left=0   disp-width=$WIDTH disp-
height=$HEIGHT" \ playbin2 uri=file://`pwd`/$SAMPLE2 video-
sink="mfw_isink axis-top=0 axis-left=`expr
```

i.MX Community | Freesca

https://community.freescale.com/community/imx

freescale community

Home | Activity | Inbox | Actions | Browse

Welcome, Gue

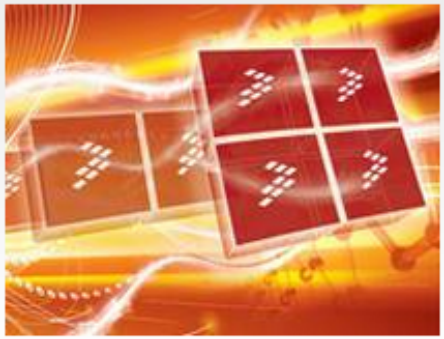
Sea

i.MX Community

Log in to follow, share, and participate in this community. Not a member? Join Now!

Overview | Content | People | Subspaces and Projects | Calendar

Welcome to the i.MX Community



This is an open community of i.MX developers and users with the common interest of transforming i.MX applications processors into practically anything imaginable — be it a tablet, eReader, smart appliance, smart medical device, or even infotainment in your car. The i.MX Community is a place to share knowledge, development tips and code. Here you can find technical information and learn from your peers and from the Freescale product experts to take your designs to a new level.

We would like to encourage you to first search the community before asking a question, you might find someone has already solved your particular problem. If it hasn't been solved please ask the community...

Search for an answer... Submit

Partner Contri

Content tagge

i.MX6 ROM A Documentati

Hardware As for Windows Compact 7

Qt 4.8.x QW

Yocto with E

First to releas i.MX6 Develo

Partner Video

Content tagge

GIT Branch for Patch Submissions

freescale™

freescale™