GTA04 Boot with Device Tree

A migration Concept

Requirements

- we need 3 different image types
  - Production Image (PI) (2 partitions with MLO to flash Xloader and U-Boot)
  - Single/Standard Image (SI) image kernel + some rootfs (standard case)
  - pure rootfs Image (RI) for NAND partition

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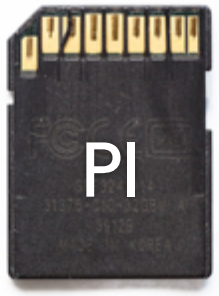
Production (PI), Standard (SI) and ROOTFS Images (RI)

production
unbricking
upgrading



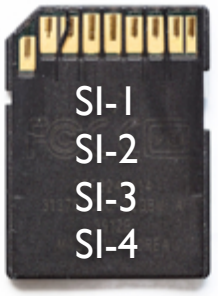
MLO / X-Loader
U-Boot
Boot-Splash
boot.scr

NAND: X-Loader
U-Boot+Boot-Splash
boot.scr
kernel
ubifs

daily use

(Single Partition)

(Multipartition)



kernel + booatargs.scr
Debian
QtMoko
Replicant
QuantumSTEP
...

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Requirements

- upgrade must be possible without RS232 cable and U-Boot console commands
- downgrade to older boot loader should be possible

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Requirements

- same Standard Image SD card must boot on L2804, L3704, L7004, ... (swap your system image and important files between devices)

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The SI must be „universal“

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Needs dynamic configuration to device

	MLO	U-Boot	Kernel	Rootfs
L2804				
L3704				
L7004				
Neo900				

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What must be configured dynamic?

- Display (U-Boot, Kernel, rootfs)
- Touch parameters (Kernel, rootfs)
- Bootslpash images (U-Boot)
- LEDs (U-Boot, Kernel)
- interfaces (variety of GPIO assignment, e.g. for TRF7970, display)

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U-Boot

- U-Boot is flashed to NAND (and only stored on PI)
- we have multiple versions - one for each device variant
- you should never flash the wrong PI :)
- can setup different pinmux, gpios, display for boot menu

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Kernel

- Kernel is either flashed to NAND or in /uImage or /boot/uImage
- should be the same for any device!
- currently our U-Boot passes a mux= parameter to the kernel and the board file can then modify the display etc.
- example: mux=GTA04A3, mux=GTA04b2

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rootfs

- the preferred method to probe for device variations is that user space checks if the kernel provides some APIs
- every measure must be taken to avoid to ask for the device model or version
- the optimal portable rootfs has NO dependencies (not even on screen sizes/ resolutions)

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rootfs exceptions

- xorg.conf - hard codes physical screen dimensions (in mm)
- touch screen - rotation, precalibration (could be moved to TSC driver i.e. DT parameters)
- wwan on/off GPIO (we could better hide the real GPIO by adding some rfkill driver to the kernel)
- is currently done by checking /proc/cmdline for the mux= value

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Device Tree

http://events.linuxfoundation.org/sites/events/files/slides/petazzoni-device-tree-dummies.pdf

- replaces (potentially dynamic) board file by a (statically compiled) device tree
- can be loaded by boot loader
- or can be appended to the kernel zImage

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Device Tree

what is the problem?

- DT is not dynamic - we can‘t check for the mux= variable!
- we need a different DT file (e.g. omap3-gta04+b2.dtb) for each device, i.e. we can‘t append to an universal kernel
- Therefore U-Boot must load the right one
  - either from NAND (where it could be appended since NAND is a RI with separate kernel)
  - or choose one (of several) from the SI SD card
- we must ensure that SD card provides *all* relevant device tree binaries for some kernel for an SI

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solutions: booting

- U-Boot knows the device it is running on (because we have device specific variants in NAND or on PI)
- U-Boot already provides the mux= variable - but that is „old style“
- we can initialize another environment variable:
  e.g. devicetree=omap3-gta04+b2
- the boot script can try to
  - locate and load some uImage and ${devicetree}.dtb file
  - or if no kernel is found, use the device tree in NAND for the kernel in NAND

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solutions: flashing

- can we simply append the relevant DT by the flash-nand script?
- Yes, it could be possible if we have the mkimage tool on the production SD
- and we can extract the zImage by a script: http://buffalo.nas-central.org/wiki/How_to_Extract_an_uImage
  - `dd if="${UIMAGE}" of="${TMPFILE}" ibs=64 skip=1 (header)`
  - `dd if="${TMPFILE}" of="${zImage}" ibs=8 skip=1 (ARM Mach type header)`
- So it is possible for a kernel booted from SD to flash itself into NAND and append the required DT

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solutions: distributing kernels

- we must provide all potential .dtb files in the boot directory
- so that they are available to boot a SI on all devices that are supported
- (minor) problem: growth of the number of files if we support more and more devices in the future

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Migration plan

- U-Boot: provide devicetree= variable
- boot.scr: load ${devicetree}.dtb from the same location where uImage was found
- boot.scr: use device tree from NAND if NAND kernel is booted
- kernel: provide ${devicetree}.dts files for *all* device variants we have
  - we may need to use .dtsi file(s) to organize common parts
  - file names must match constants compiled into U-Boot variants
- kernel build script: copy *all* relevant .dtb files to .../unstable
- kernel build script: add *all* relevant .dtb files to the .deb packages
- flash-nand: find a way to append the currently used device tree file to the currently used uImage when flashing to NAND
  - or (big change!): add a new device-tree MTD partition to U-Boot and Kernel
- makesd (PI): install all relevant device trees in /boot
- rootfs: replace check for mux= in /proc/cmdline with /proc/device-tree/model
- what else?

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Migration Phases

- Phase 1: compile kernel with DT
- Phase 2: make U-Boot and boot.scr locate and load the correct DT
- Phase 3: make DT kernel boot
- Phase 4: adapt scripts for NAND flashing and configs

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