Booting Linux with U-boot

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June 7, 2010

Archived at:
http://beagleboard.org/esc

The five (5) boot phases

1. ROM loads x-load (MLO)
2. X-load loads u-boot
3. U-boot reads commands
4. Commands load kernel
5. Kernel reads root file system

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(1) ROM loads x-load (MLO)

http://www.ti.com/litv/pdf/sprufd6a

- ROM attempts to load boot image
  - Sequence of attempts depends if USER button pressed
- For MMC/SD boot
  - Must have 255 heads and 63 sectors/track
  - First partition is FAT and bootable
  - Must have “MLO” as first file and directory entry
    - “MLO” is x-load.bin.ift renamed
  - Use mkcard.sh
- X-load image must be “signed”
  - signGP app is open source
- There are utilities for USB and serial boot
  - http://beagleboard.org/project/OMAP+U-Boot+Utils/

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(2) X-load loads u-boot

http://gitorious.org/beagleboard-validation/x-load

- X-load is a utility derived from u-boot
  - Small enough to fit in internal RAM
  - Configures external RAM
    - Could otherwise be done in configuration header, but doesn't allow for multiple memory types
- Looks first on MMC/SD
  - If it finds u-boot.bin, loads and runs it

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(3) U-boot reads commands

http://gitorious.org/beagleboard-validation/u-boot

- U-boot version allows interaction over the serial and USB ports
  - Serial cable provided in case you have a laptop
  - USB driver looks like a USB-to-serial converter device
  - Use gserial.inf to install a driver in Windows
- U-boot environment variables read from flash
  - Stored in the third flash partition (mtd2)
  - 'bootcmd' variable stores the commands to execute
  - 'bootdelay' is number of seconds to allow interruption of the boot
- Default 'bootcmd' reads 'boot.scr' auto-script

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(4) Commands load kernel

- U-boot loads kernel and passes it 'bootargs'
  - Default environment is used when variables haven't been stored in flash
    - Rev C boards are shipped without variables stored in flash
  - Console can be used to interrupt the boot process and modify variables
    - The Rev B u-boot only supported the console over the serial port
    - The Rev C u-boot adds support for the console over the USB OTG port
    - Future modifications may support USB keyboard/mouse and DVI-D monitor
  - Fourth flash partition (mtd3) is reserved for the kernel
- bootm <RAM addr> – executes kernel from RAM

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Default bootcmd for Rev C

http://gitorious.org/projects/beagleboard-default-u-boot/repos/jason-clone/blobs/for-khasim-rebase/include/configs/omap3_beagle.h

- bootcmd=
```
if mmcinit; then
  if run loadbootscript; then
   run bootscript;
  else
   if run loaduimage; then
    if run loadramdisk; then
     run ramboot;
    else
     run mmcboot;
    fi;
   else run nandboot;
   fi;
  fi;
else run nandboot;
fi
```

Default bootcmd for xM Rev A

http://gitorious.org/beagleboard-validation/u-boot/blobs/xm-jason-patches/include/configs/omap3_beagle.h

```
if mmc init ${mmcdev}; then
 if userbutton; then
  setenv bootscr boot.scr;
 else
  setenv bootscr user.scr;
 fi
 if run loadbootscript; then
  run bootscript;
 else
  if run loaduimage; then
   if run loadramdisk; then
    run ramboot;
   else
    run mmcboot;
   fi;
   else run nandboot;
  fi;
 fi;
else run nandboot; fi
```

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U-boot command summary

http://www.denx.de/wiki/DULG/Manual

- Basic commands
  - help – provide the list of commands (varies by build)
  - printenv – lists the contents of the current environment
  - saveenv – writes the current environment to the flash
  - setenv <variable> 'string' – sets environment variable
  - autoscr <RAM addr> – run script from RAM
- MMC/SD
  - mmcinit – initializes the MMC/SD card
  - fatls mmc 0 – reads FAT directory on the first partition
  - fatload mmc 0 <RAM addr> <filename> – load a file into RAM
- NAND
  - nand unlock – enables writing to the NAND
  - nandecc <sw|hw> – configures ECC mode (OMAP3 specific)
  - nand erase <start> <length> – erases portion of NAND flash
  - nand read <RAM addr> <start> <length> – reads into RAM
  - nand write <RAM addr> <start> <length> – writes from RAM
- Serial
  - loadb <RAM addr> – reads into RAM via kermit file send

(5) Kernel reads root file system

- Kernel mounts root file system based on 'bootargs'
  - NAND (JFFS2): root=/dev/mtdblock4 rw rootfstype=jffs2
  - RAMDISK: root=/dev/ram0 rw ramdisk_size=32768 initrd=0x81600000,32M
  - MMC/SD: root=/dev/mmcblk0p2 rw rootwait
  - NFS: root=/dev/nfs rw nfsroot=192.168.123.1:/data/target ip=192.168.123.2::255.255.255.0 nolock,rsize=1024,wsize=1024 rootdelay=2

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Configuring the display

http://groups.google.com/group/beagleboard/msg/4c64b2c614622053

- video=omapfb
- vram=10M
- omap-dss.def_disp=lcd
- omapfb.vram=4M,3M,3M
- omapfb.video_mode=1024x768MR-16@60

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Other bootargs

- nohz=off
  - Power management (dynamic tick)
- mem=88M
  - Reserve memory

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Writing our own boot script

Build u-boot and mkimage

- cd ~/u-boot-omap3
- make omap3_beagle_config
- make

```
For the xM demo image, look in
/usr/share/esc-training/u-boot
```

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Build my.scr

- cd ~/u-boot-omap3
- cp /media/mmcblk0p1/menu/kridner.script my.script
- nano my.script
- ./tools/mkimage -A arm -T script -C none -d my.script my.scr
- Be very careful before executing the next step
  - cp my.scr /media/mmcblk0p1/boot.scr
  - If unsure, run /switchboot now
  - boot

These instructions are not for the xM demo image, instead look at /boot/u-boot-scripts

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Edit environment in flash

- make env
- nano /etc/fw_env.config
  - /dev/mtd2 0 0x20000 0x20000
- ./tools/env/fw_printenv
- ln -s tools/env/fw_printenv fw_setenv
- ./fw_setenv usbtty 'cdc_acm'
- ./fw_setenv stdout 'serial,usbtty'
- ./fw_setenv stdin 'serial,usbtty'
- ./fw_setenv stderr 'serial,usbtty'
- ./tools/env/fw_printenv

These instructions are not for the xM

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Trying usbtty

- cp ~/gserial.inf /media/mmcblk0p1/
- halt
- Remove power and SD card
- Copy gserial.inf from SD to PC
- Plug USB from Beagle to your PC
  - Select driver
- Start Hyperterminal
  - Newest serial port, max baud, n81, no flow
- Optional
  - nand erase 0x260000 0x20000

These instructions are not for the xM

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Creating a ramdisk.gz

- dd if=/dev/zero of=ramdisk bs=1k count=32768
- mkfs.ext2 ramdisk
- mount -o loop ramdisk /mnt
- tar -xvjf fs.tar.bz2 -C /mnt
  - Other methods to copy may be fine
- umount /mnt
- gzip ramdisk

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