The Embedded Linux Quick Start Guide

Using the LPC3250-Stick

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Overview

- Description of the hardware
- Installing the tool chain
- Compiling the kernel
- Configuring the U-Boot environment
- Booting up
- What to do next
The LPC3250-Stick

- ARM926EJS, 266 MHz
- 32 MiB SDRAM
- 128 MiB NAND flash
- Ethernet
- USB 2.0 host and device
  - serial and JGAG over USB
- LCD controller
The COM board

- Connectors and interface logic for
  - RS-232
  - Ethernet
  - USB host and device
  - Mini-SD card
Connections

Laptop USB (ttyS0 serial console and power)

Optional serial ttyTX0

Laptop Ethernet
Tool chain: Ångström

• ARM926EJS implements arm v5 instructions including thumb (16-bit)
• So, we need an armv5t tool chain
• Pre-built tool chains available from
  • http://www.angstrom-distribution.org/toolchains/
• Or, build one from source following these instructions
  • http://www.angstrom-distribution.org/building-angstrom
  • Set machine to any ARM926EJS core, e.g. at91sam926ek
What goes where?

Base directory:
/usr/local/angstrom/arm

Binaries (cross compiler)
/usr/local/angstrom/arm/bin

Headers
/usr/local/angstrom/arm/arm-angstrom-linux-gnueabi/usr/include

Libraries (development and run-time)
/usr/local/angstrom/arm/arm-angstrom-linux-gnueabi/lib
/usr/local/angstrom/arm/arm-angstrom-linux-gnueabi/usr/lib
Trying it out

The Hello World program

```c
#include <stdio.h>
int main(void) {
    printf("Hello, ARM\n");
    return 0;
}
```

$ export PATH=/usr/local/angstrom/arm/bin:$PATH
$ arm-angstrom-linux-gnueabi-gcc hello-arm.c -o hello-arm

$ file hello-arm
hello-arm: ELF 32-bit LSB executable, ARM, version 1 (SYSV),
  dynamically linked (uses shared libs), for GNU/Linux 2.6.16, not stripped
Serial devices

• The LPC3250-stick uses the usb-ftdi serial chip with non-standard vendor and product ID

• So, first load the driver like so
  • sudo modprobe ftdi_sio vendor=0x0640 product=0x0026

• Then plug in the USB cable
  • /dev/ttyUSB0 (JTAG) and /dev/ttyUSB1 (RS-232) are created
  • and they will disappear when unplugged...
Bootloader: U-Boot

- U-Boot version 2009.03
- Serial console over USB-serial adapter
  - 115200 8n1
- Minicom (terminal emulator) settings

```
A - Serial Device : /dev/ttyUSB1
B - Lockfile Location : /var/lock
C - Callin Program :
D - Callout Program :
E - Bps/Par/Bits : 115200 8N1
F - Hardware Flow Control : No
G - Software Flow Control : No

Change which setting?
```
Flash memory layout

- 128 MiB NAND flash
- 128 KiB erase block
- 1024 erase blocks total
Kernel: 2.6.34

- Need vanilla 2.6.34 plus LPC3250-stick BSP (a patch)
- Known to work
  - UARTs
  - Ethernet
  - NAND flash
- Not tested/known not to work
  - USB host/gadget
  - Mini SD
  - RTC
Root file system: Ångström

- Generated using on-line builder
  - http://www.angstrom-distribution.org/narcissus/
  - Machine at91sam926ek
  - Console-only image
  - 39 MiB when uncompressed
- Could be built from source, as with toolchain
Configuring the network

Network configuration in:  /etc/network/interfaces

Bring interface up with:  ifup [interface | -a]

Take down with:  ifdown [interface | -a]

Example /etc/interfaces:

```
auto lo
iface lo inet loopback

auto eth0
iface eth0 inet dhcp

iface eth1 inet static
  address 192.168.0.202
  netmask 255.255.255.0
  network 192.168.0.0
  gateway 192.168.0.200
```
Ångström package manager: opkg

• Ångström has > 1000 packages
• Installing packages is less error prone than “roll-your-own”
• Handles dependencies and version numbering
• But, takes up storage space (~ 10 MiB) and less flexible than RYO
**opkg examples**

Update local database of packages from feeds (see `/etc/opkg`)

```
opkg update
```

List all packages available
```
opkg list
```

List packages installed
```
opkg list_installed
```

Install a package (e.g. procps)
```
opkg install procps
```

Install a specific package file (bypassing the feeds)
```
opkg install /ipk/procps_3.2.8-r9.1.5_armv5te.ipk
```
TFTP and NFS

U-Boot downloads uImage from TFTP server on host

Laptop

Target

/var/lib/tftpboot/uImage

~/rootdir/bin
/dev
/etc
/lib
...

Kernel mounts root file system via NFS
Hands-on

• Get lab notes from
  • http://www.embedded-linux.co.uk/downloads/elce-2010/linux-quick-start-lab-notes.pdf

• Just follow the instructions...
Further reading

• “Inner Penguin”
  • http://www.embedded-linux.co.uk/

• Embedded Linux Wiki
  • http://elinux.org/Main_Page

• Embedded Linux Primer
  • Christopher Hallinan, Prentice Hall

• Building Embedded Linux Systems, 2nd Edition
  • Karim Yaghmour et al, O'Reilly & Associates
Thank you for listening

Happy hacking*

(*) RFC 1392 "Internet Users' Glossary"

hacker
A person who delights in having an intimate understanding of the internal workings of a system, computers and computer networks in particular. The term is often misused in a pejorative context, where "cracker" would be the correct term. See also: cracker.