Session #6: Configuring and Building the Linux Kernel
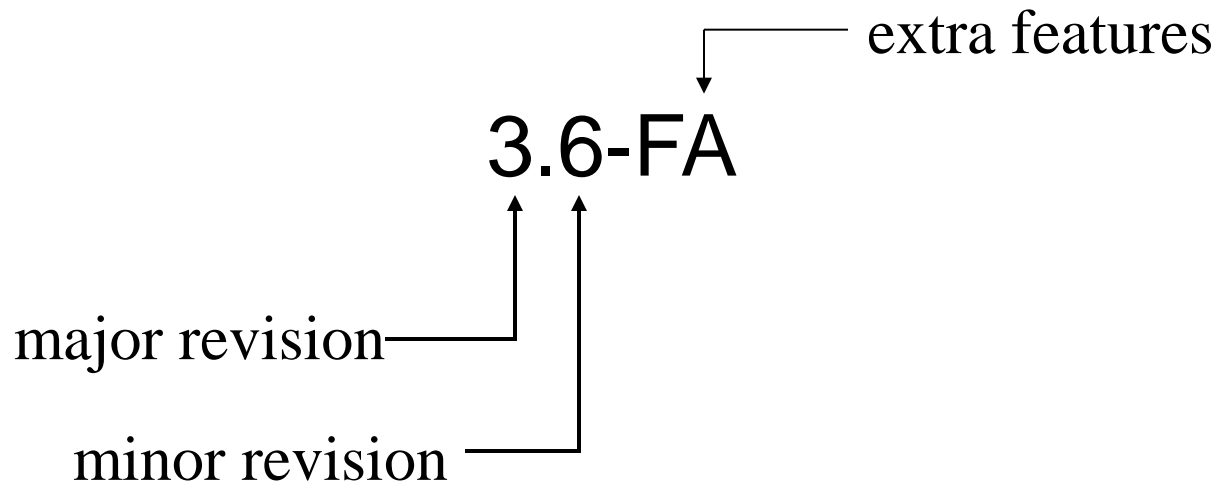
It's easier than you might think

Why Rebuild the Kernel

- Because you can!
- Reduce bloat of unneeded features
- Add features not in default kernel
  - Alternate filesystems – DOS, JFFS
  - Non-standard peripherals
- Build for non-x86 embedded target

Version numbering

extra features

3.6-FA

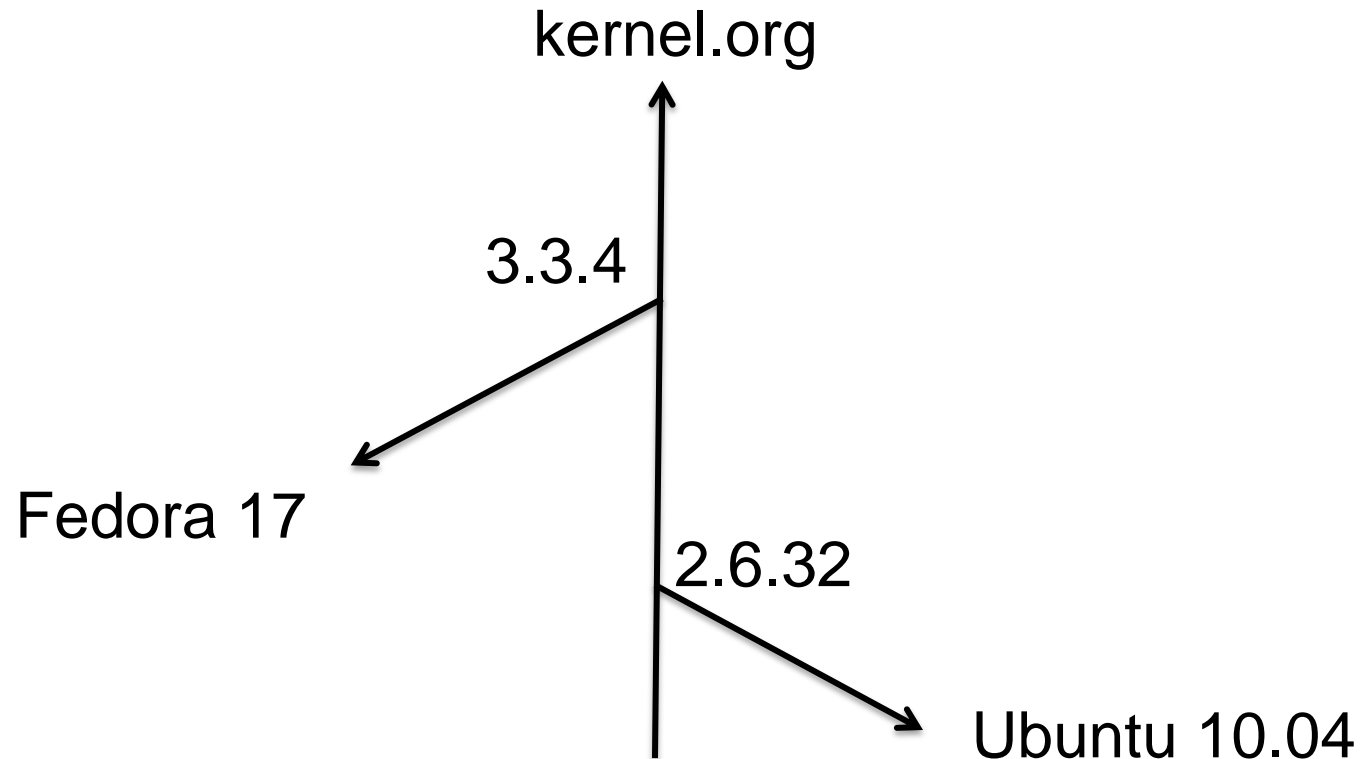major revision

minor revision

Source tree stored in:
  /usr/src/arm/linux-3.6-FA

Symbolic link /usr/src/arm/linux points to:

uname –a   Shell command to list version of running kernel

"Upstream" vs. "Downstream" kernel

kernel.org

3.3.4

Fedora 17

2.6.32

Ubuntu 10.04

What version to use?

- The kernel is a moving target
  - It changes daily
- Stay away from the bleeding edge
  - Development kernels are identified as "-rc*n*"
- Pick a stable kernel that meets your needs
  - Supports required functionality
  - Our kernel is currently 3.6
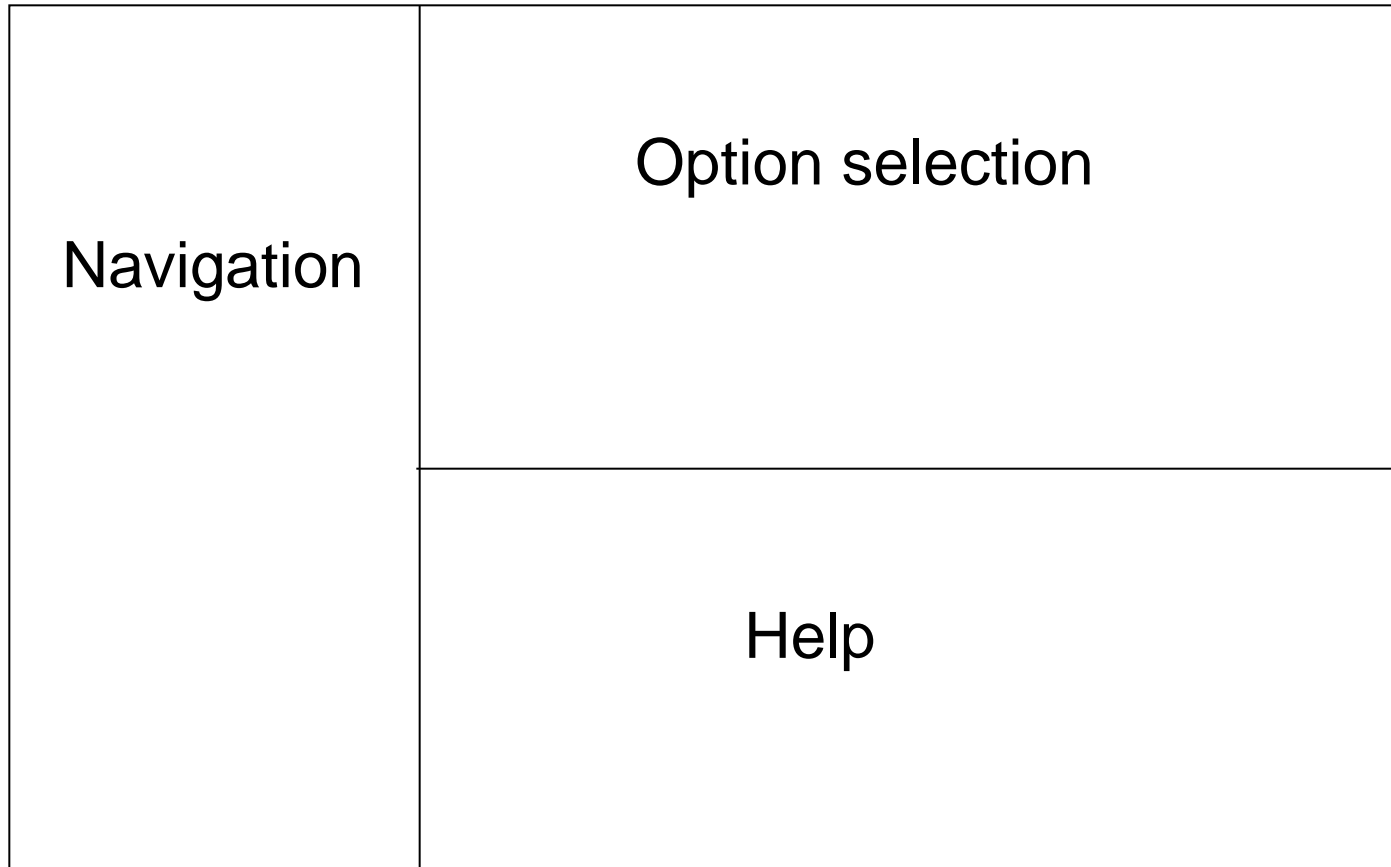
Kernel Source Tree

usr/src/arm/linux

- Documentation
- arch
- crypto
- drivers
- fs
- include
- init
- ipc
- kernel
- lib
- mm
- net
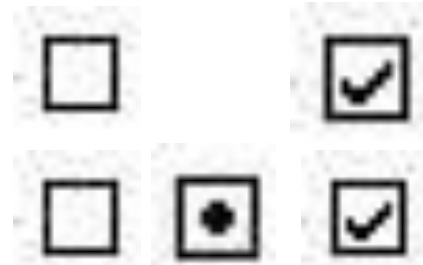- scripts
- security
- sound

Building the Kernel

- cd /usr/src/arm/linux
- Edit makefile   (line 195)
  - ARCH   ?= arm
- make help
- Copy mini2451_linux_config to .config
- make xconfig

Xconfig menu

Navigation	Option selection
	Help

Configuration option types

- Boolean
- Tri-state
- Number   (double-click to enter)
- Text   (double-click to enter)
- Radio button (pick one and only one)

Xconfig options

- Show Name
- Show Range
- Show Data
- Radio buttons
  - Show Normal Options
  - Show All Options
  - Show Prompt Options

.config File

```
#
# Automatically generated make config: don't edit
# Linux kernel version: 2.6.32.2
# Tue Jul 20 12:35:52 2010
#
CONFIG_ARM=y
CONFIG_HAVE_PWM=y
CONFIG_SYS_SUPPORTS_APM_EMULATION=y
CONFIG_GENERIC_GPIO=y
CONFIG_NO_IOPORT=y
CONFIG_GENERIC_HARDIRQS=y
CONFIG_STACKTRACE_SUPPORT=y
CONFIG_HAVE_LATENCYTOP_SUPPORT=y
CONFIG_LOCKDEP_SUPPORT=y
CONFIG_TRACE_IRQFLAGS_SUPPORT=y
CONFIG_HARDIRQS_SW_RESEND=y
CONFIG_GENERIC_IRQ_PROBE=y
CONFIG_RWSEM_GENERIC_SPINLOCK=y
CONFIG_ARCH_HAS_CPUFREQ=y
```

Other Config Targets

- **make menuconfig**
  - Predecessor to xconfig. Pseudo graphic interface
- **make oldconfig**
  - Creates new configuration using the existing .config file as a starting point
  - Prompts for new options
- **make defconfig**
  - Creates a configuration with all options set to default values

Build the kernel

- **make clean** (not necessary the first time)
- **make**
  - Builds Image and zImage in arch/arm/boot
 - **make** is <u>recursive</u>
  - Takes a long time

Kconfig language

- Xconfig menu data comes from kconfig files

- Top level kconfig file is in arch/arm/
  - Have a look

- source is equivalent to #include in C

- Defined in Documentation/kbuild/kconfig-language.txt

SD-Flasher

- Windows Utility
  - Formats SD for booting Mini2451
  - A way to load images into NAND flash
- Unzip SD-Flasher.zip in a Windows machine
  - One file: SD-Flasher.exe
- Insert SD card
- Right-click SD-Flasher.exe
  - Run as administrator

SD-Flasher menu
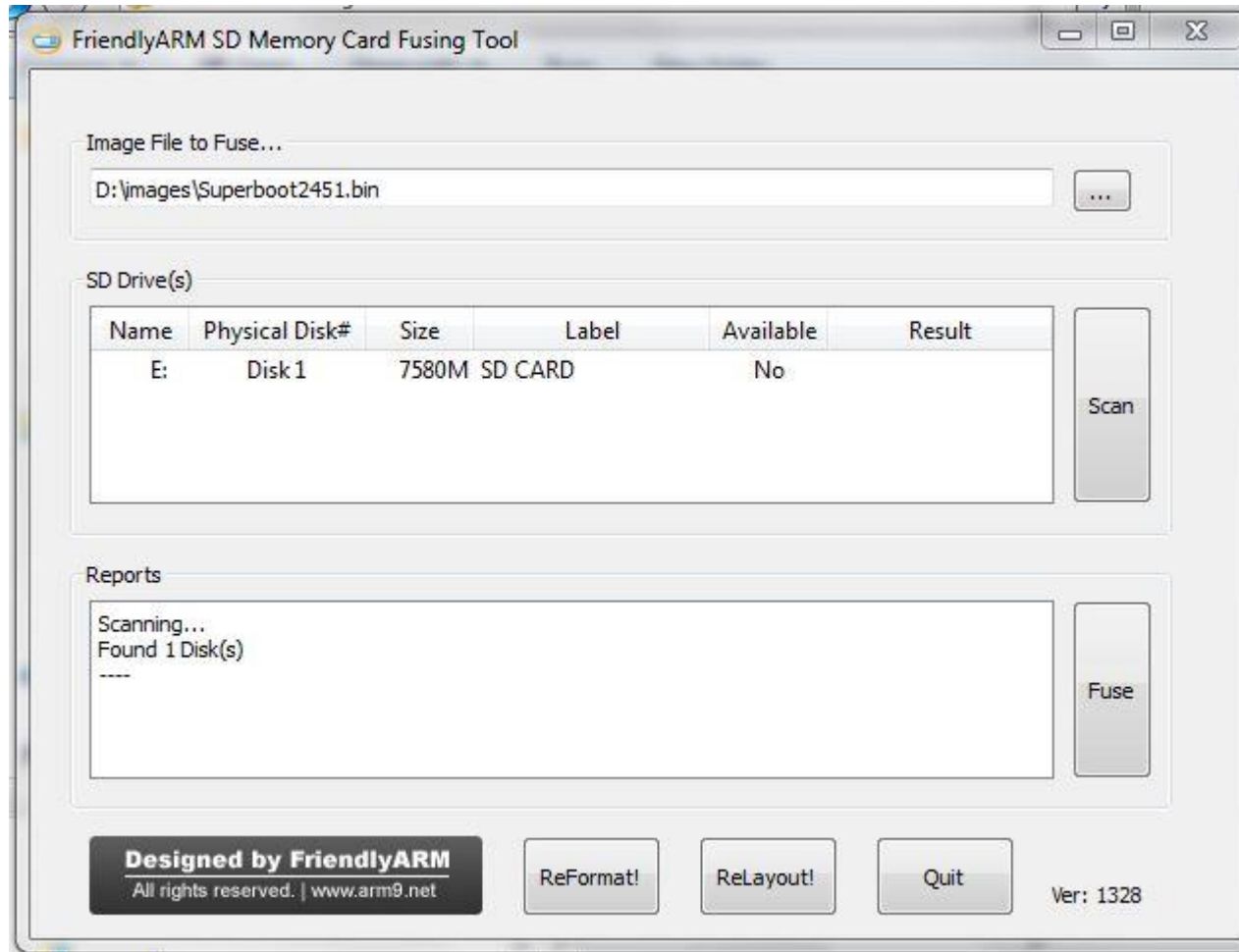
FriendlyARM.ini

- Edit images/FriendlyARM.ini
  - Comment out lines:
    - Linux-BootLoader
    - Linux-RootFs-InstallImage
- Copy linux/arch/arm/boot/zImage to /images/linux

On the target

- Insert SD card

- Move boot selector toward card edge

- Power up or reset
  - zImage is loaded in NAND

- Move boot selector switch back

- Power up or reset
  - uname -a

BusyBox

- "multi-call" binary
- Single executable can implement over 300 Linux utilities
- Standard commands are links to /bin/busybox
- Highly configurable

Configure Busybox

- cd ~/busybox-1.20.2

- cp ../factory_images/bb_config .config

- make xconfig
  - Busybox Settings
    - Build Options > Cross Compiler Prefix
    - Installation options > Busy Box installation prefix

Build Busybox

- make

- make install or…

- make install CONFIG_PREFIX = ../target_fs

Review

- Linux kernel source tree
  - Kernel version numbering
  - *Upstream* vs *downstream* kernels
- Configuring and building the kernel
  - make xconfig
  - make clean
  - make
- Booting new kernel using "Superboot"
- Busybox