

**IT'S ALIVE!**

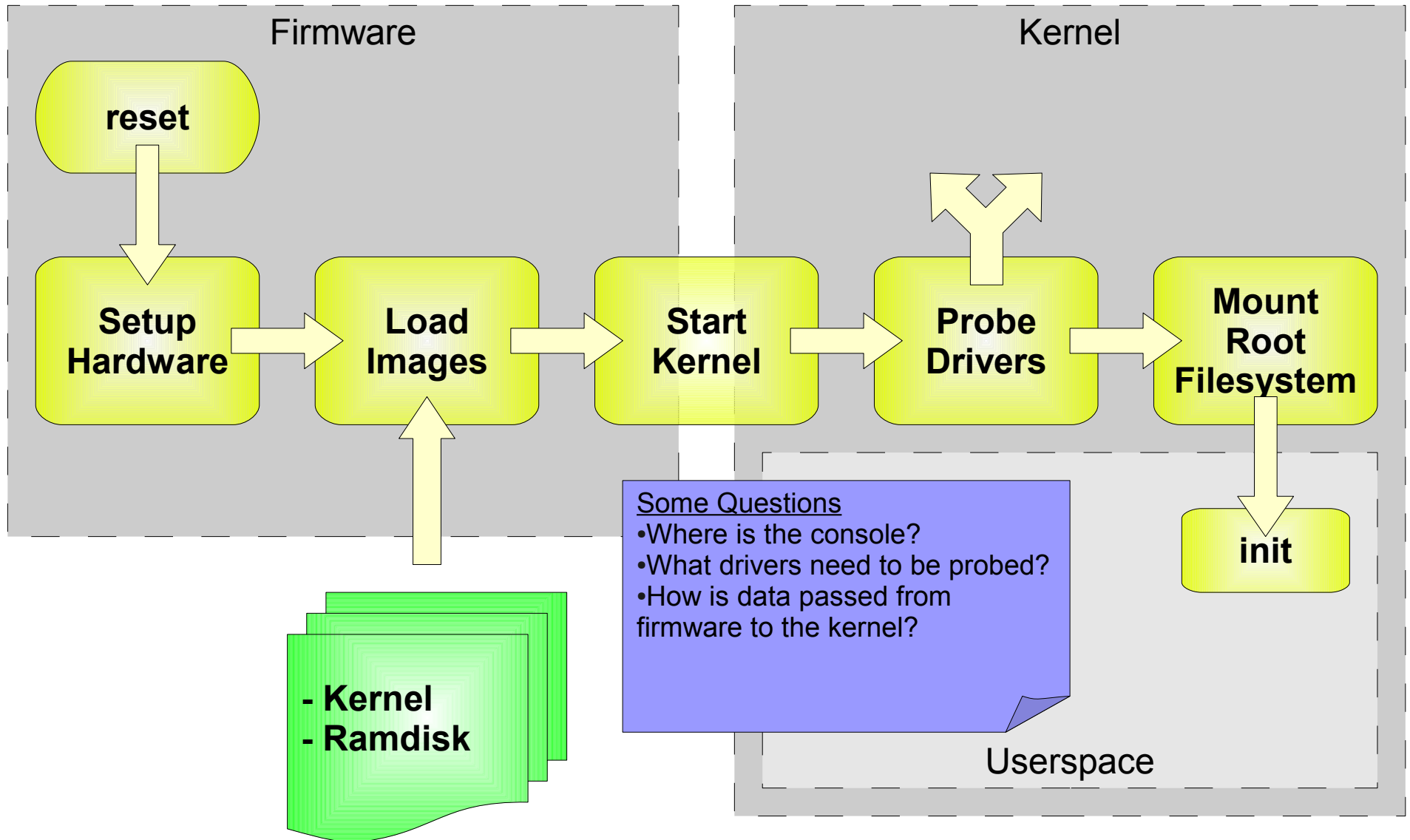
Linux on PowerPC Porting Guide

Grant Likely  
Secret Lab Technologies Ltd.

Embedded Linux Conference  
April 7, 2009  
San Francisco, CA



# What it takes to boot Linux



# What needs to be prepared

Firmware  
Image

Executed on  
reset

Kernel  
Image

(ulmage for  
U-Boot)

Flattened  
Device Tree  
Blob

(DTB)

Root Filesystem

Could be anywhere:  
NFS, ramdisk, Flash, USB, etc

# Toolchain



ELDK

Crosstool-ng

PowerPC distros: Fedora, Debian, etc

Just a few of the options!

# Concerning U-Boot

- `git://git.denx.de/u-boot`
- Files to add/modify
  - Makefile
  - `boards/<boardname>/*`
  - `include/configs/<boardname>.h`
- Clone an existing board port

# Building U-Boot

```
~$ git clone git://git.denx.de/u-boot
~$ cd u-boot
~/u-boot$ [... add your board support! ...]
~/u-boot$ export PATH=/home/opt/eldk-4.1/bin:/home/opt/eldk-4.1/usr/bin:$PATH
~/u-boot$ export CROSS_COMPILE=ppc_4xx-
~/u-boot$ export ARCH=powerpc
~/u-boot$ make clobber
~/u-boot$ make ml507_elc2009_config      # <==== Configure for your board
~/u-boot$ make
                                     [... Make does lots of stuff ...]
~/u-boot$ cp u-boot /path/to/install/directory      # ELF image
~/u-boot$ cp u-boot.bin /path/to/install/directory  # Binary image
```

# Concerning the kernel...

- What files to add/change?

(Nothing to see here!)

- Instead Flattened Device Tree (fdt) describes hardware.



# The OF Device Tree

- Describes the hardware
- Originally from Open Firmware



# Building the Kernel and DTB image

```
~$ git clone git://git.kernel.org/pub/scm/linux/kernel/git/torvalds/linux-2.6.git
~$ cd linux-2.6
~/linux-2.6$ [... add your board support! ...]
~/linux-2.6$ export PATH=/home/opt/eldk-4.1/bin:/home/opt/eldk-4.1/usr/bin:$PATH
~/linux-2.6$ export CROSS_COMPILE=ppc_4xx-
~/linux-2.6$ export ARCH=powerpc
~/linux-2.6$ make mrproper
~/linux-2.6$ make 44x/virtex5_defconfig      # <==== Configure the kernel
~/linux-2.6$ make menuconfig
                [... add/remove features ...]
                [... add "virtex440-ml507-elc2009.dtb" to CONFIG_EXTRA_TARGETS ...]
~/linux-2.6$ make
                [... Make does lots of stuff ...]
~/linux-2.6$ cp arch/powerpc/boot/uImage /path/to/install/directory
~/linux-2.6$ cp arch/powerpc/boot/*.dtb /path/to/install/directory
```

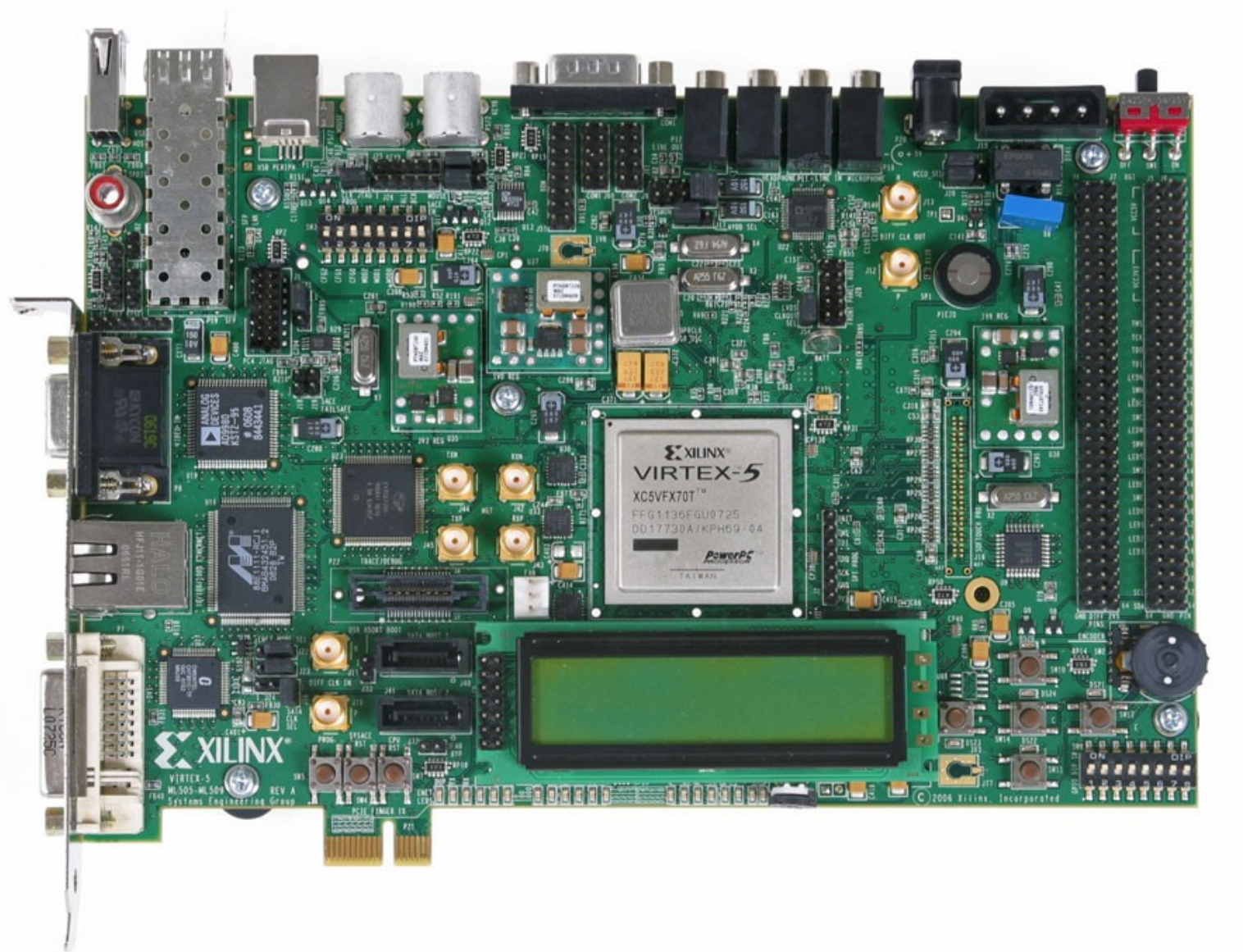
# Concerning the root filesystem...

- Options:
  - Roll your own
  - Use a Tool
    - Buildroot, LTIB, PTXdist, Gentoo Embedded, Open Embedded, etc.
  - Use a Distribution:
    - Debian, Ubuntu, Red Hat, etc.
    - MontaVista, ELDK, etc.

# Concerning Device Drivers...

- Core devices attached to processor
  - Local bus attached
  - Board description
  - Do I use **platform\_bus**? ... Use **of\_platform\_bus**!
- Does probing work?
  - PCI, USB
  - Existing drivers correctly probed.
- Is probing broken/unreliable/none-existent?
  - MDIO, I2C, SPI
  - Helper functions in drivers/of/\* to populate bus

# Demo time...





# Additional Resources:

## U-Boot

[\\_http://www.denx.de/wiki/U-Boot](http://www.denx.de/wiki/U-Boot)

[\\_u-boot@lists.denx.de](mailto:u-boot@lists.denx.de) mailing list

## Kernel

[\\_linuxppc-dev@ozlabs.org](mailto:linuxppc-dev@ozlabs.org) mailing list

## Device Tree

[\\_IEEE1275-1994 \(OpenFirmware\) Specs](#)

[. http://playground.sun.com/1275/](http://playground.sun.com/1275/)

[. http://www.complang.tuwien.ac.at/forth/1275.ps.gz](http://www.complang.tuwien.ac.at/forth/1275.ps.gz)

[\\_http://ols.fedoraproject.org/OLS/Reprints-2008/likely2-reprint.pdf](http://ols.fedoraproject.org/OLS/Reprints-2008/likely2-reprint.pdf)

[\\_linux-2.6/Documentation/powerpc/booting-without-of.txt](#)

•Also see [linux-2.6/Documentation/powerpc/dts-bindings/\\*](#)

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## Root Filesystem

[\\_Thomas Petazzoni's Buildroot talk, Osaka Room, 4:40 \(right now!\)](#)

[\\_Klass van Gend's BitBake talk, Yesterday, watch video online](#)

[\\_Thomas Petazzoni's Build tools BoF, Osaka Room, Wednesday 1:00](#)

# Acknowledgements

- IBM, Xilinx and Freescale who provide cool platforms to hack on
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## Goals:

- Step through the porting process
- Give overview of the structure
- How to find additional information
- Where to get help

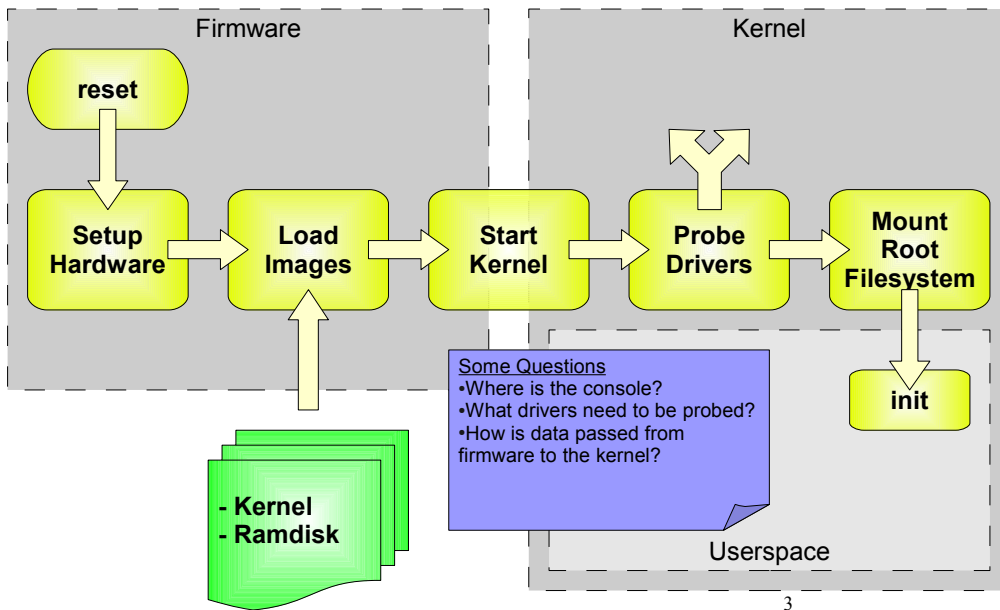
This will be a informal talk. Please ask questions, ask for clarification if anything doesn't make sense. I've got lots of technical details that I can talk about, more than enough to fill this hour, so if there is any aspect that you're interested in please let me know.

I'm going to start with a high level overview of the porting process and then drill down into the technical details. I'm also going to show off a 'canned' demo of porting Linux to a new PowerPC platform.

· Click f



# What it takes to boot Linux



Very flexible

- Linux doesn't care how it is loaded into RAM
- doesn't care about rootfs location

# What needs to be prepared

Firmware Image  
Executed on reset

Kernel Image  
(ulmage for U-Boot)

Flattened Device Tree Blob  
(DTB)

Root Filesystem  
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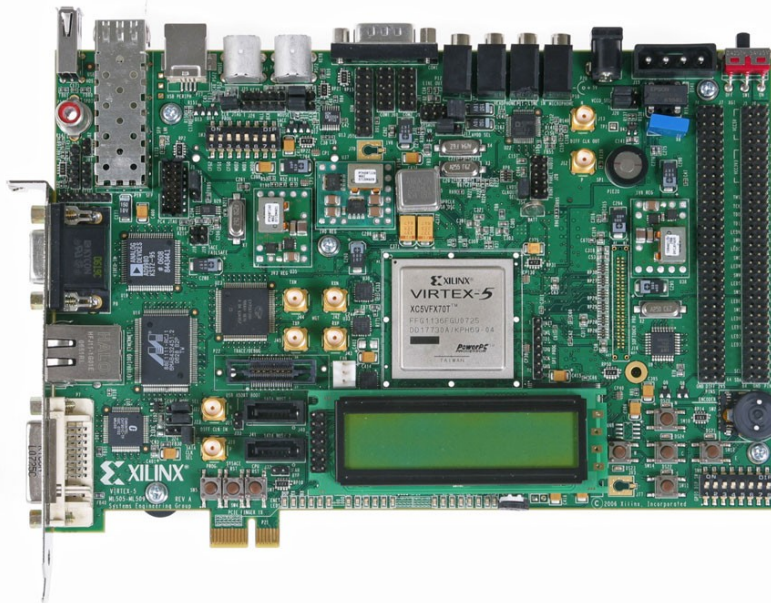
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Demo time...



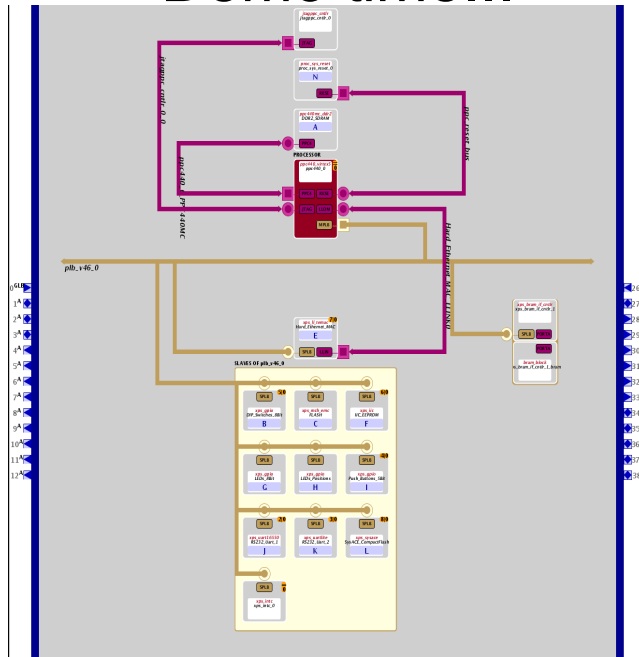
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What I have here is an ML507 board from Xilinx. If you were in Dr. John William's talk yesterday you will already know a little bit about FPGAs.

In this case, I'm not actually interested in demonstrating FPGA technologies, but it happens to be a convenient platform. I've got a sample bitstream on this CF card turns this board into a PowerPC platform with a serial port, an Ethernet port and some other devices.

# Demo time...



# Additional Resources:

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- [u-boot@lists.denx.de](mailto:u-boot@lists.denx.de) mailing list

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  - Also see [linux-2.6/Documentation/powerpc/dts-bindings/](http://linux-2.6/Documentation/powerpc/dts-bindings/)\*
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