



# Linux on Power and the IBM Linux Technology Centre

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# Introductions & Agenda

» Who am I ?

» Agenda

- About the IBM Linux Technology Centre (LTC)
- Linux on Power History & Status
- LTC Development areas for Power
- Overview of Device Trees
- Overview of ePAPR
- Future Directions for Linux on Power

# IBM Linux Technology Centre (LTC)

- » Main Linux development group within IBM
- » Part of Systems & Technology Group
  - Close links with both Server and Microelectronics development teams
  - Gives Linux unique level of influence into products
- » ~600+ Staff, 40+ Cities, 7+ Countries
- » Work closely with, indeed as part of, Open Source Community
  - Code accepted/rejected on technical merit
  - Work in both *Spirit* and *Letter* of Open Source Community norms
- » Team includes some very well known OSS developers

# IBM Linux Technology Centre (LTC) (cont'd)

## » Simple Mission Statement

- Make Linux Better
  - Test, Security, Standards, RAS
- Expand Linux's Reach
  - Telcos, Realtime, Embedded
- Bring IBM products to Linux
  - Hardware, Software, Services
- Customer Collaboration
  - Exploring variety of areas

# Linux on Power – a brief history

- » One of the earlier non-x86 architecture ports
  - November 1995 in kernel 1.3.45
- » 32 Bit PowerPC first
  - Apple PowerMacs, IBM RS/6000 & Embedded boards
  - arch/ppc
- » 64 Bit PowerPC c. 2001
  - IBM pSeries/iSeries, Apple G5 & Embedded boards
  - arch/ppc64
- » Decision to consolidate 32 & 64 bit to single architecture tree c. 2005
  - arch/powerpc
  - x86 & x86-64 followed just recently...

# Linux on Power – a brief history (continued)

- » 64 bit kernels handle 32 bit userspace with no overhead
  - Useful code size advantages
- » Lot of common code
  - Across Server, Embedded and CELL microprocessors
  - Across Platforms / Vendors
- » OzLabs/LTC team members involved from earliest days
- » LoP credited with help keeping broader codebase endian and word-size independent
- » Along with System Z (Mainframe) port, helped drive virtualisation support in kernel

# Linux on Power – current status

- » Kernel port is actively maintained
  - Mixture of corporate and community contributors
    - Freescale, AMCC, PASEmi & IBM all involved
    - Over 25 full time contributors
    - More than 30 part time contributors
  - Remains very well regarded by broader kernel community
    - A “model” port
      - e.g. Microblaze port closely modelled on Power
  - Consolidation to arch/powerpc nearly complete
    - Strongly encourage new ports to be under arch/powerpc
- » Compiler/Toolchain actively developed

# Linux on Power – current status (continued)

- » Community outside corporates remains vibrant
  - Slight decline in numbers since Apple moved to Intel
  - Increase in embedded developers
- » power.org addressing lack of commodity workstation with 4 Way 970MP based “Developer Toolkit”
- » linuxppc-dev mailing list
  - Average 400 messages/week
  - <https://ozlabs.org/mailman/listinfo/linuxppc-dev>
- » #mklinux and #ppc64 IRC channels
  - On freenode.net

# LTC Development areas for Power

## » Kernel

- Enabling Linux on IBM Servers, Blades
- Enabling embedded SoC
- Combination gives coverage large system to small
  - All systems benefit from enterprise class testing regime
- Arguing Power viewpoint in the community
  - Overall Linux on Power “Maintainer” is an IBMer
    - Thus works directly w/Linus Torvalds, Andrew Morton etc.

# LTC Development areas for Power (continued)

## » Compiler/Toolchain/Libraries

- Developing/maintaining gcc for Power
- Linker and other toolchain applications
- Some library work
  - Including some specialised libraries for SoC

## » Virtualisation

- Mature virtualisation support atop server hypervisor
- Xen & kvm support

# Overview of Device Trees

- » Provide a (mostly!) consistent way of representing hardware properties to OS at boot time
- » Origins in Open Firmware
- » Typically passed from firmware to bootloader as a binary “blob”
- » Support by Linux on Power from early days
- » Work by Gibson et. al. to create Device Tree Compiler and associated tools
  - Allows device tree creation from high level text representation
  - Library allows boot loader, kernel and/or firmware to get properties in consistent manner
- » <http://www.jdl.com/software>

# Overview of Device Trees (continued)

## » Example CPU entry

```
cpus {
    PowerPC,440GX@0 {
        device-type = "cpu";
        clock-frequency = <800000000>; // 800MHz
        timebase-frequency = <0>; // Filled in by boot code
        i-cache-line-size = <32>;
        d-cache-line-size = <32>;
        i-cache-size = <0x8000>; /* 32 kB */
        d-cache-size = <0x8000>; /* 32 kB */
        dcr-controller;
        dcr-access-method = "native";
    };
};
```

# Overview of Device Trees (continued)

## » Example of accessing Device Tree properties

```
/* From arch/powerpc/boot/devtree.c */

void dt_fixup_cpu_clocks(u32 cpu, u32 tb, u32 bus)
{
    void *devp = NULL;

    /* ... */

    while ((devp = find_node_by_devtype(devp, "cpu"))) {
        setprop_val(devp, "clock-frequency", cpu);
        setprop_val(devp, "timebase-frequency", tb);
        if (bus > 0)
            setprop_val(devp, "bus-frequency", bus);
    }

    /* ... */
}
```

# Overview of ePAPR

- » Simplified version of the Power Architecture Platform Reference targeted at embedded applications
- » Created under the auspices of power.org with Freescale & IBM being major contributors
- » Provides formal definitions of
  - Device tree
  - Binary image formats
  - Passing of control from firmware to OS (“Application”)
- » First draft being ratified at present
  - No RTAS definitions, may include in later revisions
  - SMT/Hyperthreaded CPUs may need definition

# Linux on Power – The Future

- » LoP will remain key part of IBM's Linux strategy
  - Investment and expertise will remain strong too
- » Contributions of LoP community will remain key part of broader Linux kernel ecosystem
- » For people working on Linux on Power
  - Thankyou!
  - Please work with arch/powerpc whenever you can
    - arch/ppc will go away by end of year
  - Maintainers happy to help
- » Expect influence/use of Device Trees & ePAPR to grow

# Close

- » Questions
- » Thankyou :)

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