Status of Embedded Linux
October 2014

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LF CE Workgroup
Outline

Kernel Versions
Technology Areas
CE Workgroup Projects
Other Stuff
Resources
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Kernel Versions

- Linux v3.12 – 3 Nov 2013 – 62 days
- Linux v3.13 – 19 Jan 2014 – 77 days
- Linux v3.14 – 30 Mar 2014 – 70 days
- Linux v3.15 – 8 Jun 2014 – 70 days
- Linux v3.16 – 3 Aug 2014 – 57 days
- Linux v3.17 – 5 Oct 2014 – 63 days
- Linux v3.18-rc1
Linux v3.16

- Power-aware scheduling
- decode_stacktrace.sh
  - Converts offsets in a stack trace to filenames and line numbers
- F2FS large volume support
Linux v3.17

• Lots of ARM hardware support
  • Newly enabled ARM hardware
    • Rockchip RK3288 SoC
    • Allwinner A23 SoC
    • Allwinner A31 Hummingbird
    • Tegra30 Apalis board support
    • Gumstix Pepper AM335x
    • AM437x TI evaluation board
  • Other ARM boards with existing support also saw improvements with Linux 3.17
  • Rework of "config-bisect" mode in ktest
Things to watch

- Android patches in staging
  - More about this later…
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Bootup Time

- Deferred initcalls patch
  - Resurrected for a mainline attempt
  - See http://www.spinics.net/lists/linux-embedded/msg03955.html

- Presentations at ELCE:
  - 12 Lessons Learnt in Boot Time Reduction
    - By Andrew Murray
  - Fast Boot: Profiling Analysis Methods and Tool
    - By Christopher Hallinan
Graphics

- <Nothing to report here this time>
- OK – have heard vague reports about continuing improvements to Open Source drivers for popular GPUs
- Don’t know of any shipping in products yet
File Systems

- Lots of high-end magnetic media switching to Shingled Magnetic Recording (SMR)
  - Has similarities to flash storage, with regions handled similar to erase blocks
  - Emphasis on writing large blocks in a single pass, and not-rewriting small units
  - Similar to some SSD, but with high seek latencies
Power Management

• At ELCE
  • Power management measurement devices

• At Plumbers
  • Energy management vs. power management
    • Performance vs. battery life
    • Want performance hinting from apps
    • Pinning some things to the “little” processor (in big.LITTLE)
Power Management (cont.)

- Energy-aware Scheduling
- Predicting wakeup with IO latency tracking
  - Permits better choice of idle state
- Tools to measure and analyze energy efficiency
  - Slowly evolving – no great breakthroughs
- CPUFREQ – continuing integration into scheduler
- This is still a long-term effort
  - (Frank Rowand thinks more than 5 years)
Real Time

• RT-preempt patch set is now a hobbyist project
  • There are now officially no commercial supporters of the project
• Still have Xenomai (using Cobalt RT core)
• Very good overview of existing RT solutions, and presentation of new alternative at ELCE
  • rtmux: A thin multiplexer to provide hard realtime applications for Linux
    • By Jim Huang
System Size

• Renewed kernel size reduction project
  • Leader is Josh Triplett of Intel
  • See kernel summit coverage at: http://lwn.net/Articles/608945/
  • Talk at ELCE:
    • Linux kernel tinification
      • By Josh Triplett
  • BOF at ELCE as well

• Renewed emphasis due to:
  • Interest in IOT
  • New higher-end 32-bit microcontrollers coming on market (with 512K to 1024K of static RAM)
Toolchains

• LLVM being used for more and more
  • Including Linux kernel
    • ELCE talk by Behan Webster with latest update
  • Building Android with Clang (next slide)
Building Android with Clang

- Nexus 7 and 10 are booting and can run many apps
- Nexus 4 and 5 still problematic
- 112 patches submitted
  - 74 accepted
  - 34 waiting
- GCC performance is slightly better
- Clang is finding real bugs
Testing

- New kernel sub-system: kselftest
  - Makefile target: ‘make kselftest’
  - Currently supports host-mode selftest
  - Now being worked on for cross-build
  - Want short tests
  - Want standardized test output
  - See http://lwn.net/Articles/608959/
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CEWG Contract Work 2014

- Compressed printk messages
- Device-tree documentation
- LTSI test framework
- ARM RO text and data overwrite detection
- Android boot time reduction
- CPU Shielding capability
- Config_numa support for ARM
- More robust UBIFS support
Compressed printk messages

• Size reduction while retaining messages
• Contractor: Wolfrom Sang
• Status: Reported at LinuxCon North America and ELCE
• See final report at:
  http://elinux.org/Compressed_printk_messages_-_Results
• Summary:
  • Mainlining existing system is difficult
  • Some techniques were discovered for reducing printk message overhead in some situations (e.g. using common prefixes)
Device-tree documentation

- Better docs needed for developers, sub-system maintainers, and binding reviewers
- Contractor: Frank Rowand
- Status: started
  - Research work done, and presented as talks at LinuxCon and ELCE
  - Written report to follow
LTSI test framework

• Enhance Cogent test framework, in Jenkins, for use with LTSI kernel
• Support board-independent deployment and control system
• Contractor: Cogent
• Status: started
  • Report given at LinuxCon NA
  • Not sure about download status
    • beta available?
Others

• Overwrite detection for kernel text and read-only data
  • Something similar mainlined in 3.14
  • Is no longer needed
• Android boot time improvements
  • Work to bring up side stack (such as back-up camera) before rest of Android initializes
  • Contractor: Cogent
  • Status: not started
New CEWG Projects

- New projects for CE Workgroup, with focused areas
- Based on Steering Committee meetings in May
- New project areas:
  • Internet of Things
  • Standard Embedded Distribution
  • Linux in Social Infrastructure
  • Device Mainlining
CE Workgroup Sessions

• CEWG presentations and BOFS in Germany
  • Goal to inform people about new projects and solicit input and participation
• Overcoming Obstacles to Mainlining – survey results, and best practices
  • Device Mainlining BOF
• Linux in Infrastructure systems
• IOT BOF
  • Size Bof
• Standard Embedded Distribution BOF
• Linux in Infrastructure presentation and BOF
CEWG project next steps

- Looking at Collaboration Summit and ELC for next meetings and action steps
- Looking for companies interested in these projects
Other Projects

- Long Term Support Initiative (LTSI)
- eLinux wiki
Long Term Support Kernel for Industry

- LTSI 3.14 is latest kernel
- Many presentations available on status
  - ELC 2014 presentation by Hisao Munakata
  - ELCE 2014 presentation by Tsugikazu Shibata and Hisao Munakata
- Latest project push is testing facility
- Also, considering slower releases, or mechanism to support additions after merge window
eLinux wiki

• http://elinux.org
  • Web site dedicated to information for embedded Linux developers
    • The wikipedia of embedded linux!

• Hundreds of pages covering numerous topic areas: bootup time, realtime, security, power management, flash filesystem, toolchain, editors

• Working on new wiki projects:
  • Video transcription project
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• Events
• ELCE Announcements
• Distros
Events

- Embedded Linux Conference Europe 2014
  - October 13-15, 2014 – Düsseldorf, Germany
- Embedded Linux Conference 2015
  - March 23-25, 2015 – San Jose
ELCE announcements

• Allseen Alliance – Peer-to-peer ad-hoc networking
  • http://allseenalliance.org
  • Sony is now a premier member
    • https://allseenalliance.org/announcement/allseen-alliance-announce-sony-premier-member
  • AllJoyn is the name of the implementation
• PRPL Foundation – Multi-company MIPS non-profit
  • Like Linaro, but for MIPS
  • Projects: PRPL OpenWRT, MIPS QEMU
• DroneCode – Open source UAV software group
  • http://www.dronecode.org/
  • Andrew Tridgel is lead engineer (very good sign)
  • “Using linux throughout the complete UAV stack”
    • By Koen Kooi
Distros

- **Android**
  - Stuff moving from staging
  - Lots of stuff already merged
  - <show Android mainline status slides here>

- **Tizen**
  - Doing lots of security work with SMACK
  - Have proposed it for easy use with Yocto Project
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- LWN.net
  - http://lwn.net/
  - If you are not subscribed, please do so
- Kernel Newbies
  - http://kernelnewbies.org/Linux_3.?
- eLinux wiki - http://elinux.org/
  - Especially http://elinux.org/Events for slides
- Celinux-dev mailing list
Thanks!