CE Workgroup

Status of Embedded Linux
December 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 v3.13 – 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 – 7 Dec 2014 – 63 days
- Linux v3-19 (in merge window, no RC yet)
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
Linux v3.18

- OverlayFS introduced
- Support for madvise() and fadvise() can be configured out (tinification patch)
- More LLVM support
- New SOC support:
  - Hisilicon HiP04
  - Amlogic Meson6 (8726MX)
  - Renesas R-Car E2 (R8A77940)
  - Broadcom BCM63xx DSL
  - Atmel SAMA5D4
Linux v3.19

- F2FS now has a "fastboot" option
- Device tree overlay support
  - Useful for boards that have daughterboards (e.g. capes or shields) that need DTS changes at boot time.
  - See http://lwn.net/Articles/616859/
- squashfs supports LZ4 compression
- Android "binder" code has been moved from the staging tree
Things to watch

- Android patches in staging
  - More about this later…
- Kdbus
- Kernel tinification!
- Systemd in embedded
Kernel notes

- Contributions by different companies

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Bootup Time

- F2FS filesystem has a new "fastboot" option
  - Skips some boot-time checks
Graphics

• <Nothing to report here this time>
File Systems

- SquashFS supports LZ4 compression
- OverlayFS
  - Support for read/write filesystem over the top of a read-only filesystem
  - Most common use-case is live CDs, but it can be useful for some embedded scenarios
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
- Idle time prediction
  - Permits better choice of idle state
  - http://lwn.net/Articles/618074/
- Tools to measure and analyze energy efficiency
  - Slowly evolving – no great breakthroughs
- CPUFREQ – continuing integration into scheduler
Real Time

• RT-preempt patch set is now a hobbyist project
  • There are now officially no commercial supporters of the project
  • See http://lwn.net/Articles/617140/

• Still have Xenomai (using Cobalt RT core)

• Good overview of existing RT solutions, and a 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
  • See kernel summit coverage at: http://lwn.net/Articles/608945/
  • Talk at ELCE: “Linux kernel tinification”
  • Project page: https://tiny.wiki.kernel.org/projects

• Syscall elimination
  • Splice and friends - See http://lwn.net/Articles/624258
  • Madvise and fadvise()
  • Discussion about how modular to make the kernel
    • Slippery slope to make things conditional? – if, so we’ve been doing it for years

• “make tinyconfig” (mainlined in 3.17)
Toolchains

• LLVM being used for more and more
  • Including Linux kernel
    • ELCE talk by Behan Webster with latest update
  • More fixes for LLVM support in 3.18
  • 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/
- New size test:
  - "make TARGETS=size kselftest"
    - Really needs cross-build and deploy-to-target support
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CEWG Contract Work

- Stopping “Open Project Proposal”
  - Have historically asked community for projects
  - Projects were useful, but disjointed
    - Projects not big enough to rally around as an industry
  - We’re not doing that anymore

- Going to model where project requirements drive contract projects
  - E.g. if IOT finds a requirement that can be met by funding a contractor, CEWG will do that
CEWG Projects

- New projects for CE Workgroup, with focused areas
- Project areas:
  - Internet of Things
  - Standard Embedded Distribution
  - Linux in Social Infrastructure
  - Device Mainlining
Device Mainlining

- Did research on “obstacles to mainlining”
  - Did survey of developers
  - Presented results at ELCE
  - Also had good discussions at ELCE BOF and “hallway track”
- Have continued work, researching current SOC status
  - Collected many source trees for commercial products
  - Analyzed for patterns of materials missing from mainline
Device Mainlining (cont.)

- Plan to write “Mainlining Best Practices” white paper
- Lots of problem uncovered while researching Linux trees
  - Deciding on whether to publish problem reports
- Plan to write tools to help companies find patches that are good candidates for upstreaming
- Find areas where Linux upstream frameworks are lacking
  - USB OTG is one area – no support upstream for charging interfaces
CEWG project next steps

• Hold project meetings at ELC
  • Planning meetings on IOT, Device Mainlining, and Infrastructure
• IOT meeting will focus on requirements
Other Projects

- Long Term Support Initiative (LTSD)
- 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](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
- Projects and Consortia
- Distros
Events

• **Embedded Linux Conference 2015**
  • March 23-25, 2015 – San Jose
  • Theme: Drones, Things and Automobiles
    • Tracks on Drones, IOT and Automotive
  • Co-located with Android Builder Summit
  • Proposals are due January 9

• **Embedded Linux Conference Europe 2015**
  • October 5-7, 2015 - Dublin, Ireland
Projects and Consortia

• Allseen Alliance – Peer-to-peer ad-hoc networking
  • http://allseenalliance.org
  • AllJoyn is the name of the implementation

• PRPL Foundation – Multi-company MIPS non-profit
  • Projects: PRPL OpenWRT, MIPS QEMU

• DroneCode – Open source UAV software group
  • http://www.dronecode.org/
  • First Linux Drone summit at ELC
  • Andrew Tridgell on ELC program committee
Distros

- Android
  - Lollipop now shipping
  - Lots of changes in upper portions of stack
    - Some kernel level (e.g. no longer uses logger)

- Tizen
  - Doing lots of security work with SMACK
  - Have proposed it for easy use with Yocto Project
  - Some small-system (Tizen micro) work
    - https://lwn.net/Articles/617555/
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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!