



CE Workgroup

Status of Embedded Linux

December 2014

Tim Bird

Architecture Group Chair

LF CE Workgroup



CE Workgroup

Outline

Kernel Versions
Technology Areas
CE Workgroup Projects
Other Stuff
Resources



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Kernel Versions

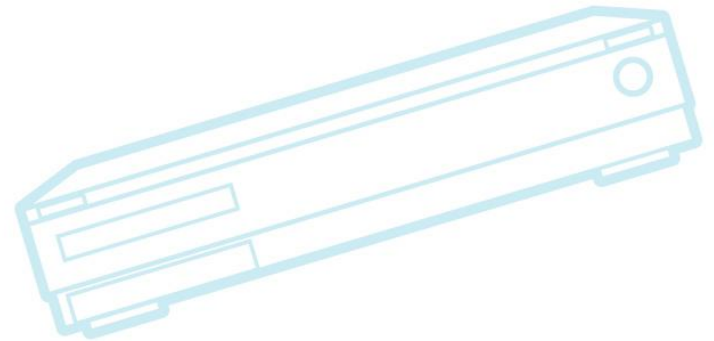
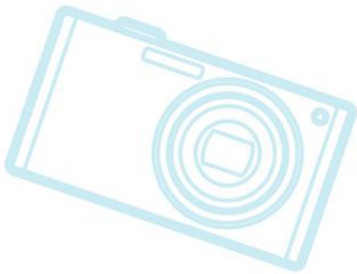
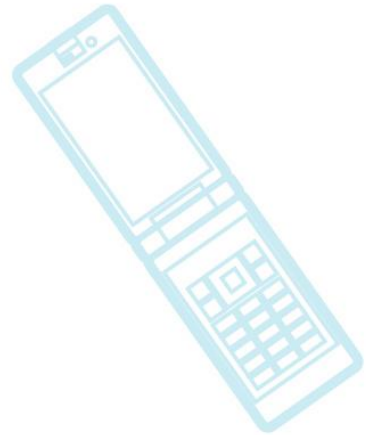
- Linux v3.13 – 19 Jan 2014 – 77 days
- Linux v3.14 – 30 Mar 2014 – 70 days
- Linux v3.15 – 8 Jun 2014 – 70 days
- Linux v3.16 – 3 Aug 2014 – 57 days
- Linux v3.17 – 5 Oct 2014 – 63 days
- Linux v3.18 – 7 Dec 2014 – 63 days
- Linux v3-19 (in merge window, no RC yet)



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Linux v3.16

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





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Linux v3.17

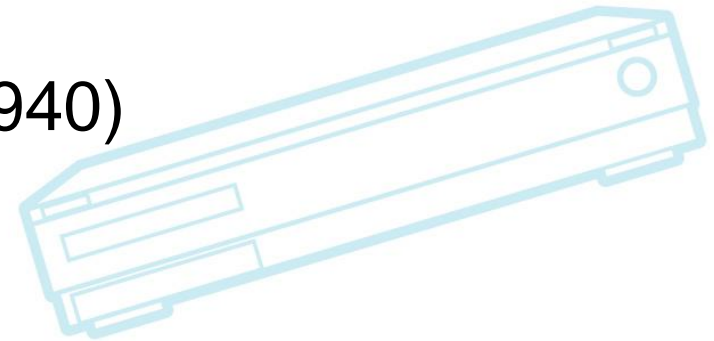
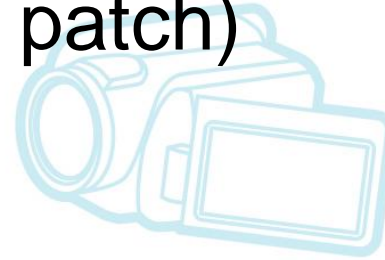
- Lots of ARM hardware support
 - Newly enabled ARM hardware
 - Rockchip RK3288 SoC
 - Allwinner A23 SoC
 - Allwinner A31 Hummingbird
 - Tegra30 Apalis board support
 - Gumstix Pepper AM335x
 - AM437x TI evaluation board
 - Other ARM boards with existing support also saw improvements with Linux 3.17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



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Linux v3.18

- OverlayFS introduced
- Support for `madvise()` and `fadvice()` 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





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Linux v3.19

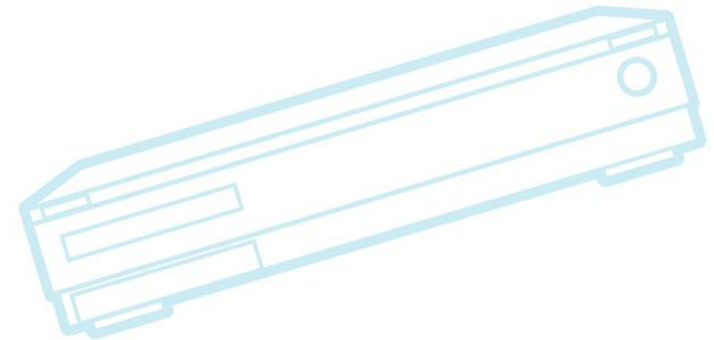
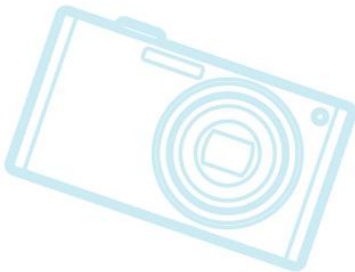
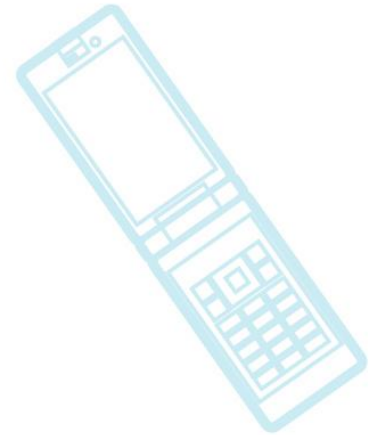
- F2FS now has a "fastboot" option
- Device tree overlay support
 - Useful for boards that have daughterboards (e.g. capes or shields) that need DTS changes at boot time.
 - See <http://lwn.net/Articles/616859/>
- squashfs supports LZ4 compression
- Android "binder" code has been moved from the staging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



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Things to watch

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





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Kernel notes

- Contributions by different companies

Author email domain	commits	Committers (since 3.4)
Sony[me]	43	14
Lge.com	583	11
Huawei	1141	65
Qualcomm Codeaurora	2249	89
Moto	2559	15
Samsung	8672	151
Intel	32177	438



CE Workgroup

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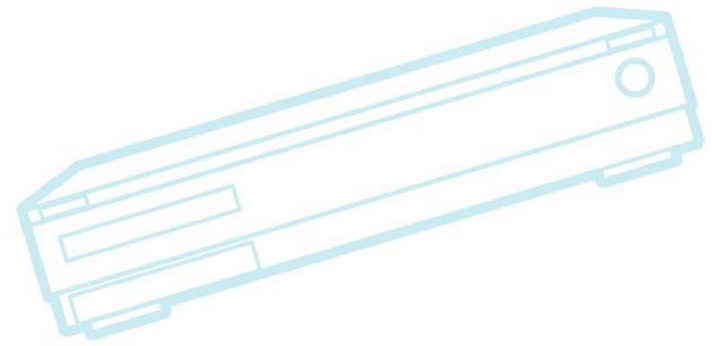
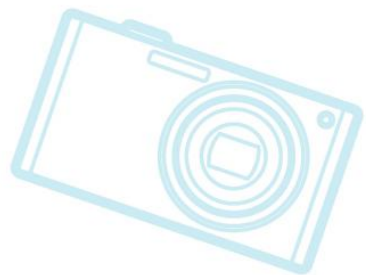
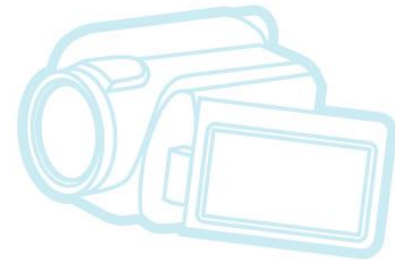
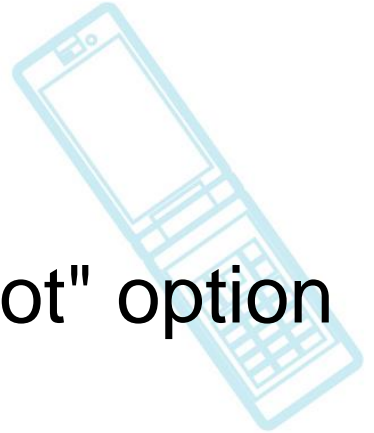
Resources



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Bootup Time

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

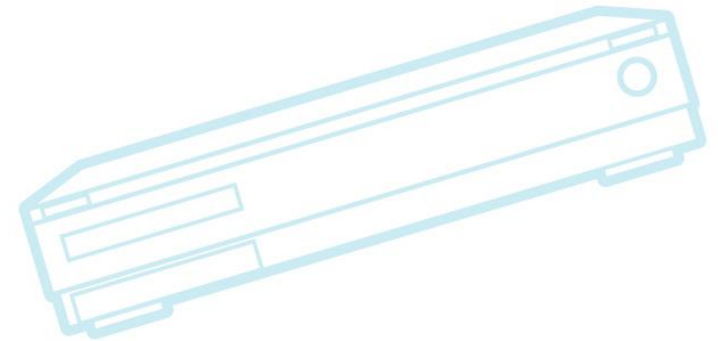
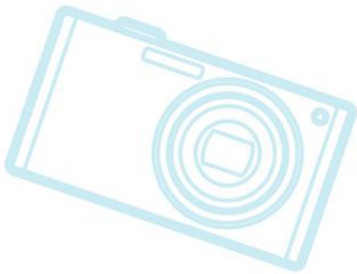
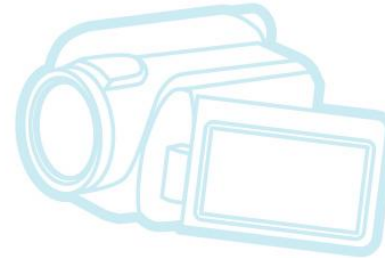
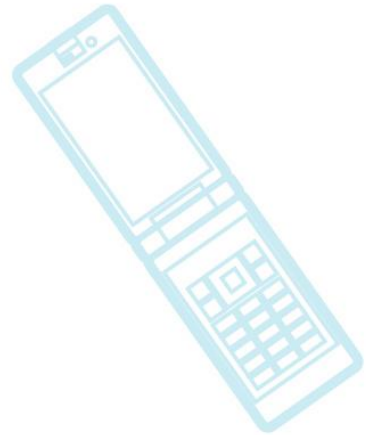




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Graphics

- <Nothing to report here this time>

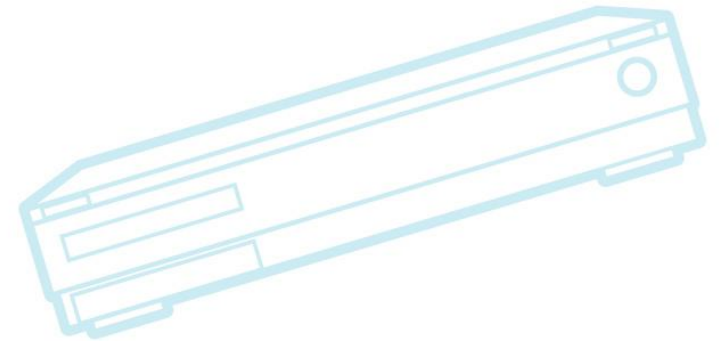
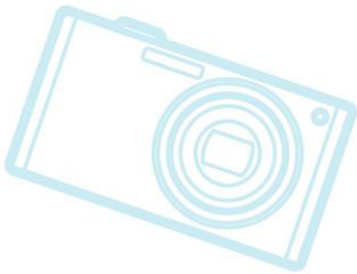




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File Systems

- 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





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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)



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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



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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



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System Size

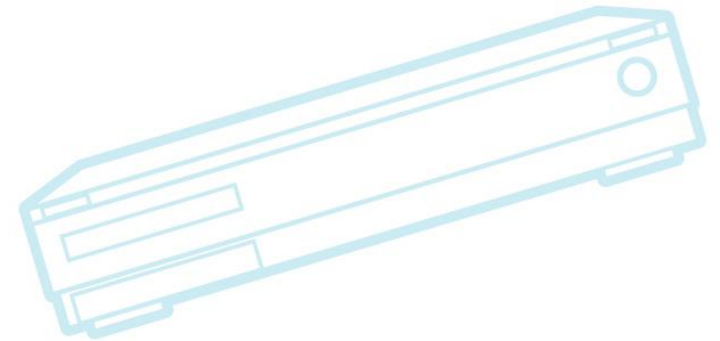
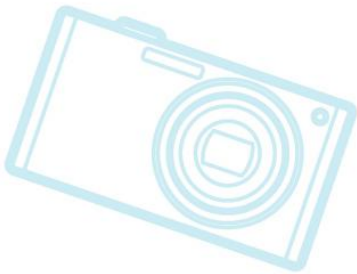
- Renewed kernel size reduction project
 - See kernel summit coverage at: <http://lwn.net/Articles/608945/>
 - Talk at ELCE: “Linux kernel tinification”
 - Project page: <https://tiny.wiki.kernel.org/projects>
- Syscall elimination
 - Splice and friends - See <http://lwn.net/Articles/624258>
 - Madvise 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)



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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)





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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



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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

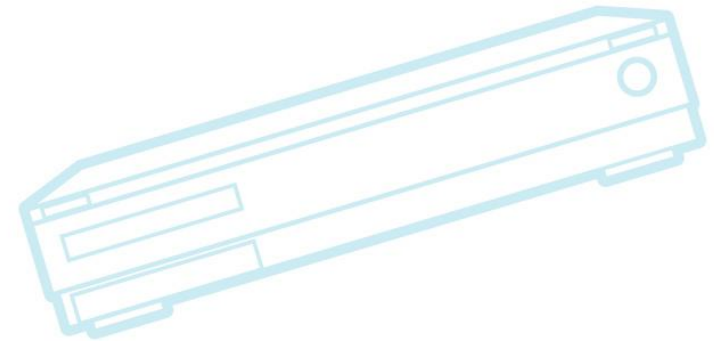
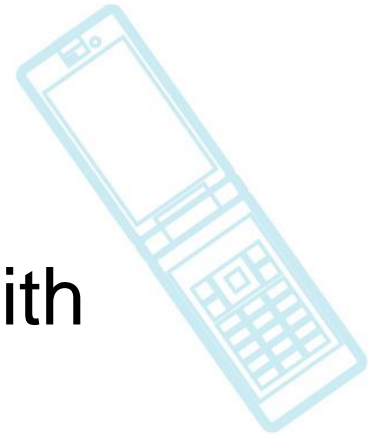
- Stopping “Open Project Proposal”
 - Have historically asked community for projects
 - Projects were useful, but disjointed
 - Projects not big enough to rally around as an industry
 - We’re not doing that anymore
- Going to model where project requirements drive contract projects
 - E.g. if IOT finds a requirement that can be met by funding a contractor, CEWG will do that



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CEWG Projects

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





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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



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Device Mainlining (cont.)

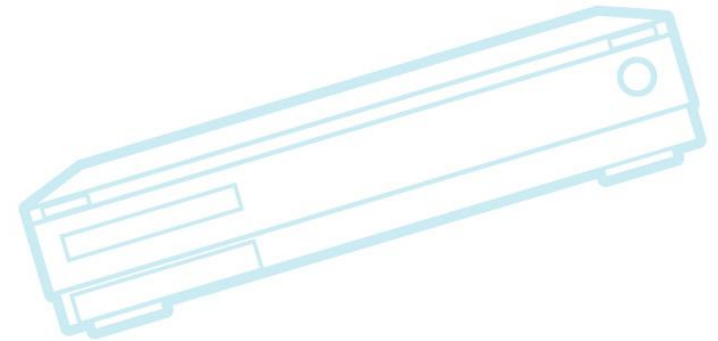
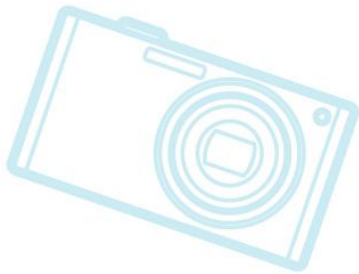
- Plan to write “Mainlining Best Practices” white paper
- Lots of problem uncovered while researching Linux trees
 - Deciding on whether to publish problem reports
- Plan to write tools to help companies find patches that are good candidates for upstreaming
- Find areas where Linux upstream frameworks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



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CEWG project next steps

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

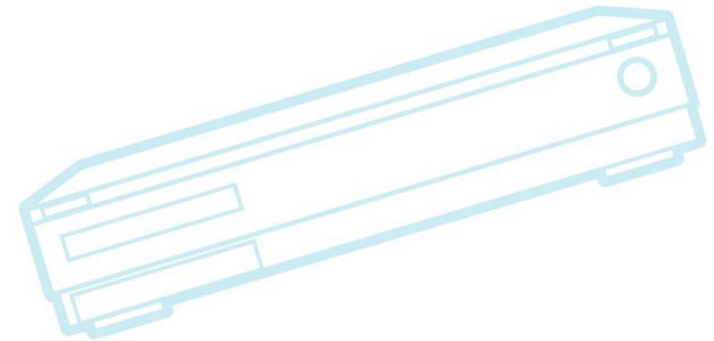
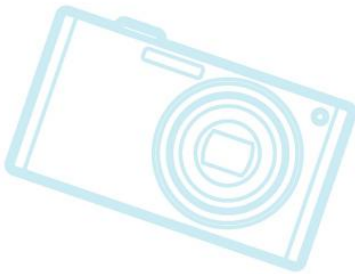
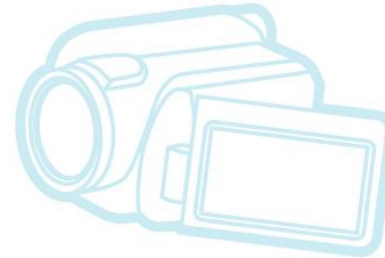
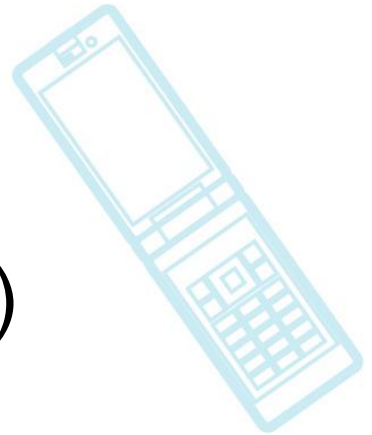




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Other Projects

- Long Term Support Initiative (LTSI)
- eLinux wiki





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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



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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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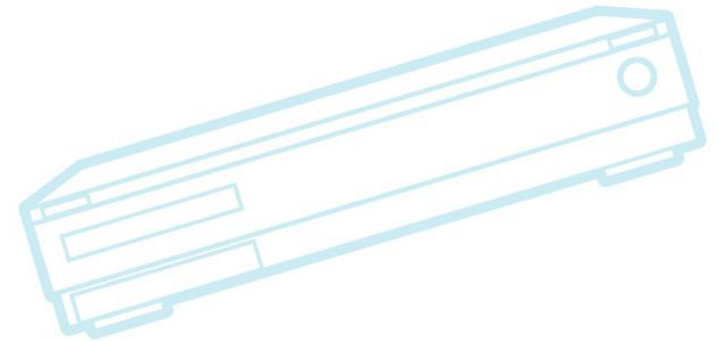
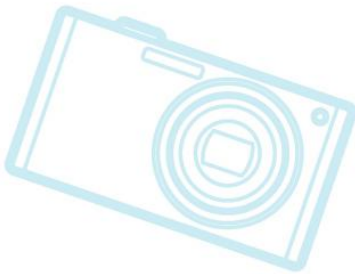
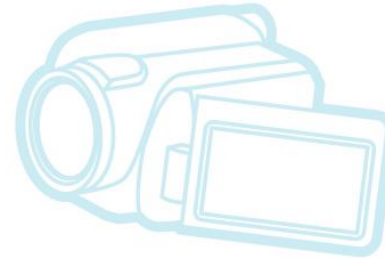
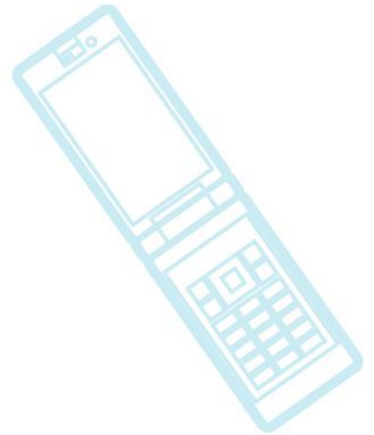
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Other Stuff

- Events
- Projects and Consortia
- Distros





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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



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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



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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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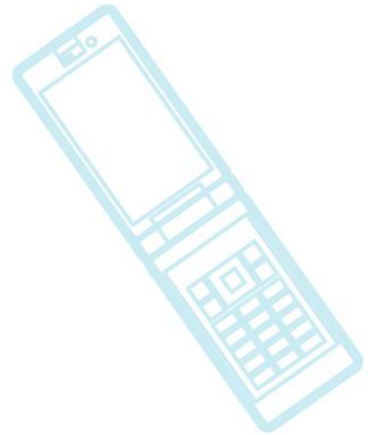
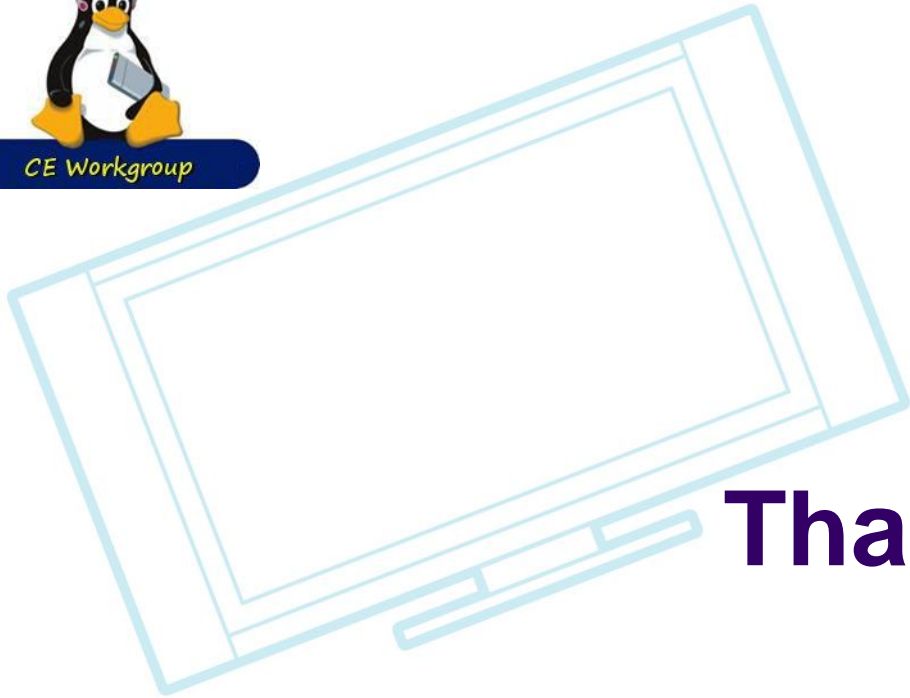
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- LWN.net
 - <http://lwn.net/>
 - If you are not subscribed, please do so
- Kernel Newbies
 - http://kernelnewbies.org/Linux_3.?.?
- eLinux wiki - <http://elinux.org/>
 - Especially <http://elinux.org/Events> for slides
- Celinux-dev mailing list



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Thanks!

