



CE Workgroup

Status of Embedded Linux

October 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

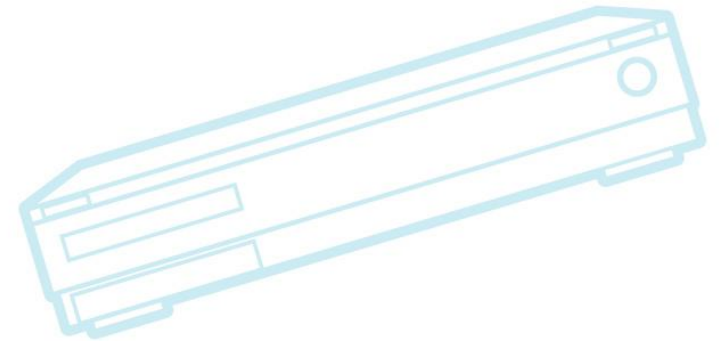
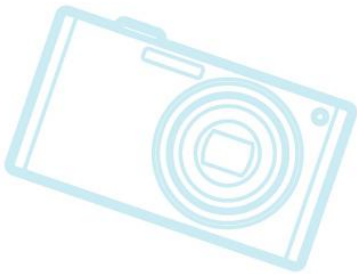
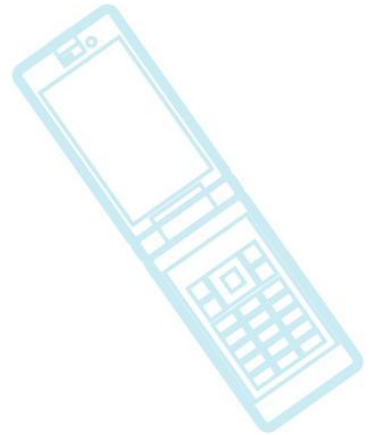
- Linux v3.12 – 3 Nov 2013 – 62 days
- Linux v3.13 – 19 Jan 2014 – 77 days
- Linux v3.14 – 30 Mar 2014 – 70 days
- Linux v3.15 – 8 Jun 2014 – 70 days
- Linux v3.16 – 3 Aug 2014 – 57 days
- Linux v3.17 – 5 Oct 2014 – 63 days
- Linux v3.18-rc1



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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

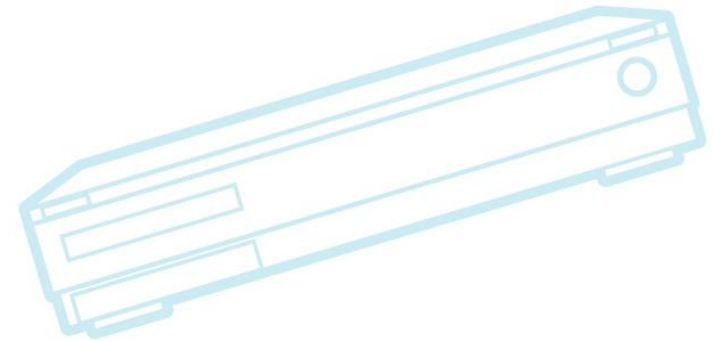
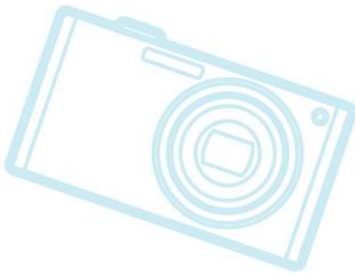
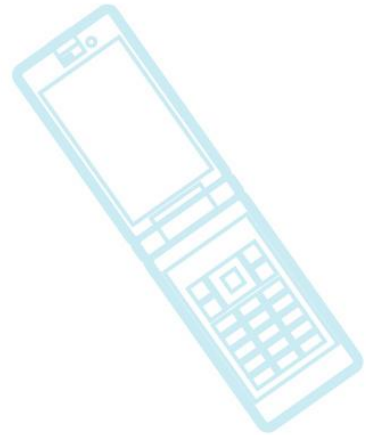
- Lots of ARM hardware support
 - Newly enabled ARM hardware
 - Rockchip RK3288 SoC
 - Allwinner A23 SoC
 - Allwinner A31 Hummingbird
 - Tegra30 Apalis board support
 - Gumstix Pepper AM335x
 - AM437x TI evaluation board
 - Other ARM boards with existing support also saw improvements with Linux 3.17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



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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



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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



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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



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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
- 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)



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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
- 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

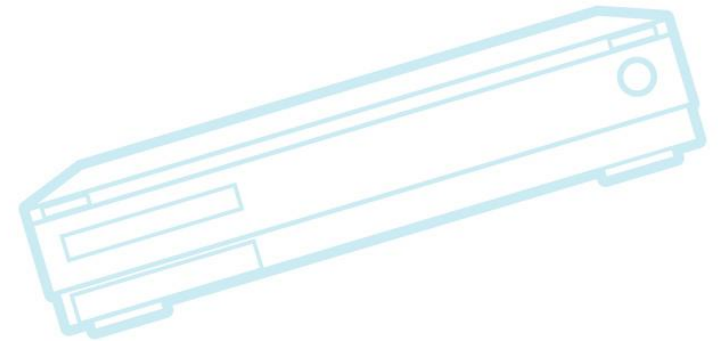
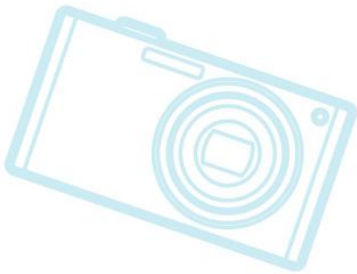
- Renewed kernel size reduction project
 - Leader is Josh Triplett of Intel
 - See kernel summit coverage at: <http://lwn.net/Articles/608945/>
 - Talk at ELCE:
 - Linux kernel tinification
 - By Josh Triplett
 - BOF at ELCE as well
- Renewed emphasis due to:
 - Interest in IOT
 - New higher-end 32-bit microcontrollers coming on market (with 512K to 1024K of static RAM)



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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)





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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/>



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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



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Compressed printk messages

- Size reduction while retaining messages
- Contractor: Wolfram Sang
- Status: Reported at LinuxCon North America and ELCE
- See final report at:

http://elinux.org/Compressed_printk_messages_-_Results

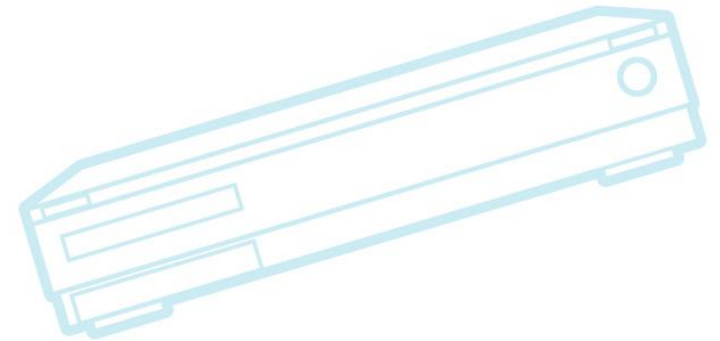
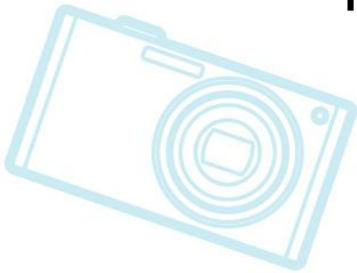
- **Summary:**
 - Mainlining existing system is difficult
 - Some techniques were discovered for reducing printk message overhead in some situations (e.g. using common prefixes)



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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





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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?



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Others

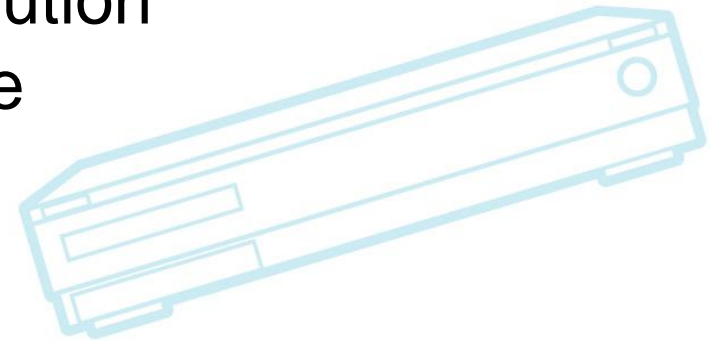
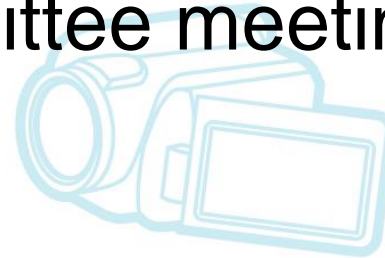
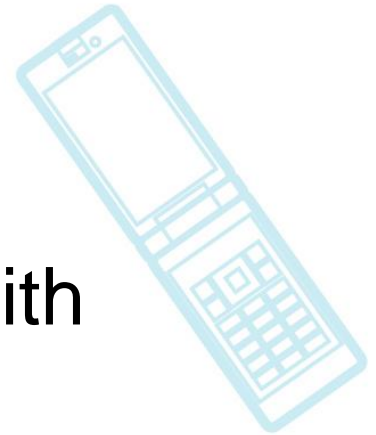
- Overwrite detection for kernel text and read-only data
 - Something similar mainlined in 3.14
 - Is no longer needed
- Android boot time improvements
 - Work to bring up side stack (such as back-up camera) before rest of Android initializes
 - Contractor: Cogent
 - Status: not started



CE Workgroup

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





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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



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CEWG project next steps

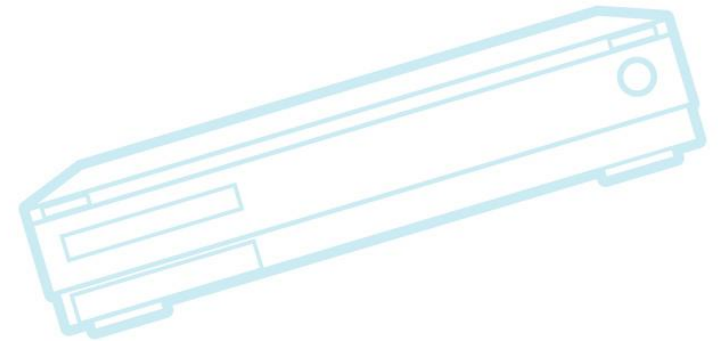
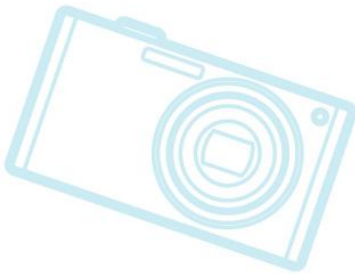
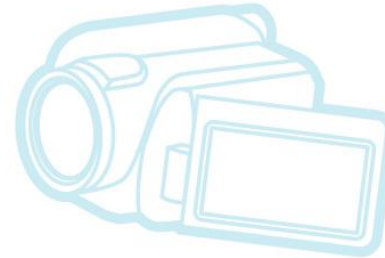
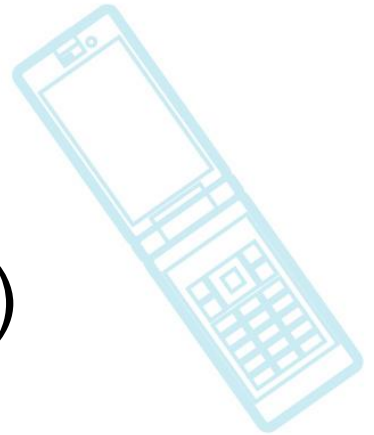
- Looking at Collaboration Summit and ELC for next meetings and action steps
 - Looking for companies interested in these projects



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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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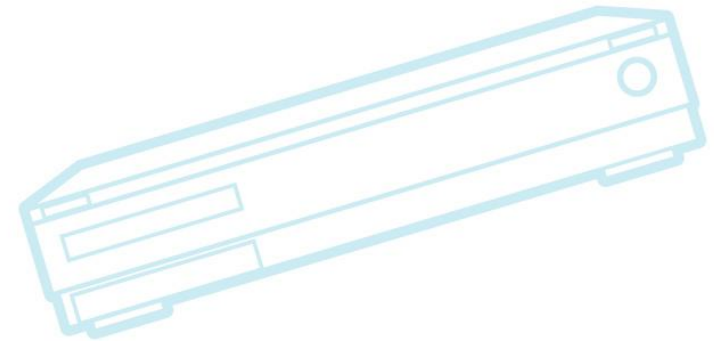
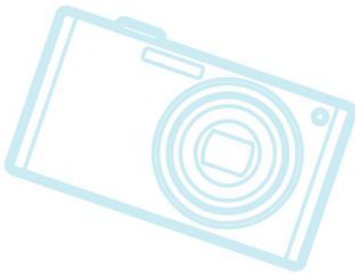
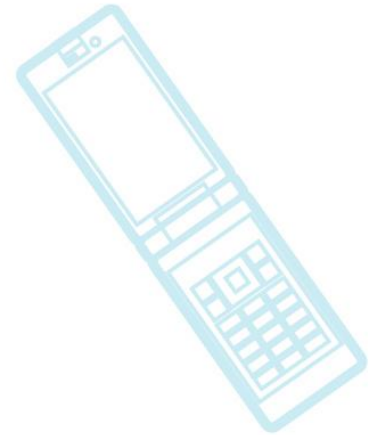
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Other Stuff

- Events
- ELCE Announcements
- Distros

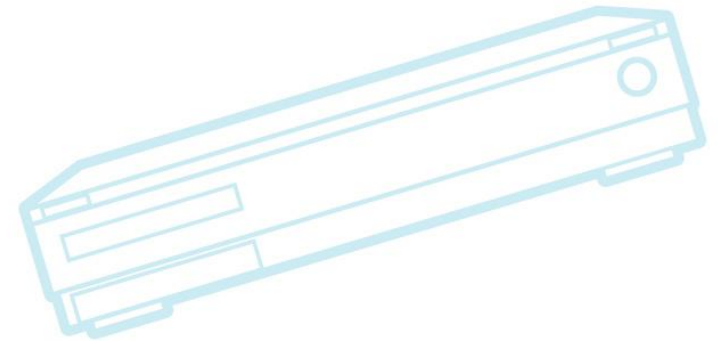
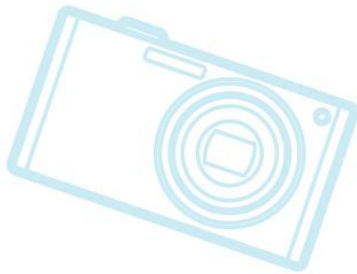




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Events

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





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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



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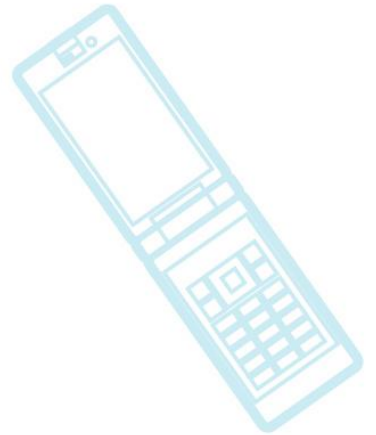
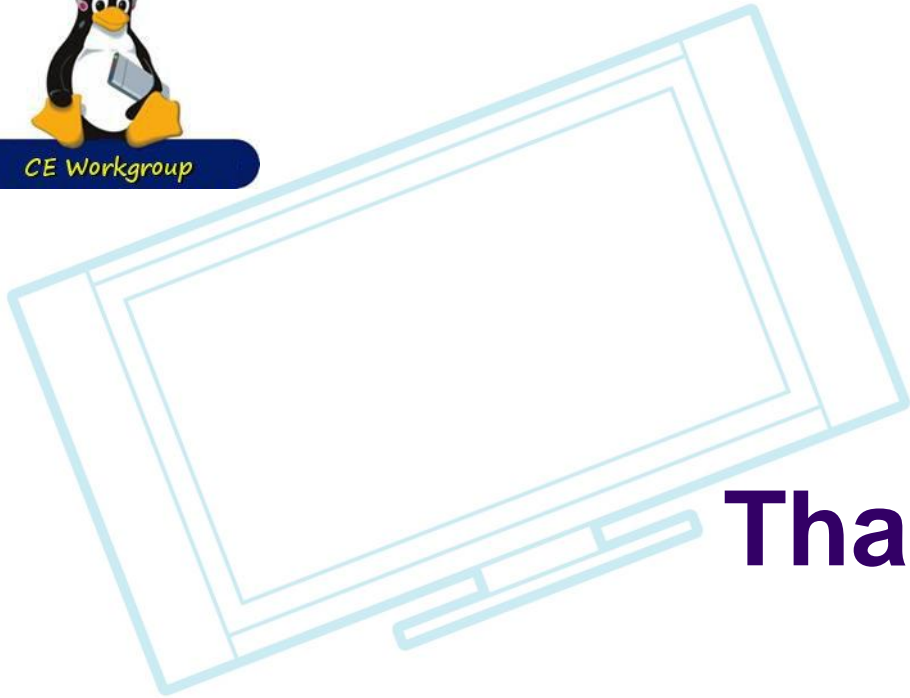
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- LWN.net
 - <http://lwn.net/>
 - If you are not subscribed, please do so
- Kernel Newbies
 - http://kernelnewbies.org/Linux_3.?.
- eLinux wiki - <http://elinux.org/>
 - Especially <http://elinux.org/Events> for slides
- Celinux-dev mailing list



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Thanks!

