Real-Time Linux
State of the union

Thomas Gleixner

RT-Summit 2017, Prague
Mission
- RT Mainlining
- Documentation
- Establishing community
- Long term maintenance
Funding

- Funding for 2017 is secured
- 1 Platinum member
- 5 Gold members
- 4 Silver members
Staffing

- 5 developers working on the project
Tasks accomplished

- CPU hotplug rework
- CPU hotplug locking rework
CPU hotplug

What’s wrong?
- Known to be fragile
- Duct taped to death
- Completely fell apart with RT
CPU hotplug

First steps
- First attempt of redesign in 2012
- Conversion to a symmetric state machine
CPU hotplug

First steps
- Ran out of spare time
- Some $corp promised to pick it up
CPU hotplug

First steps

- Ran out of spare time
- Some $corp promised to pick it up
- ... applied more duct tape instead
CPU hotplug

This time for real
- Revisited in 2015
- Finished in 2017
CPU hotplug

**Groundwork**

- Analyzing all notifiers
- Documenting ordering requirements
- Fixing several dozens of existing bugs
CPU hotplug

Grumpwork

- One by one conversion of notifiers to states
- Gradual removal of old infrastructure
CPU hotplug

The locking nightmares

- Rework of hotplug locking
- Lockdep coverage unearthed yet another pile of bugs
- Curing is mostly finished by now
CPU hotplug

Lessons learned

- If you unearth existing bugs, you are expected to fix them
- The amount of crap you find is immense
- Don’t assume you saw the worst already
- Don’t give up if you have to rewrite stuff all over the place
- Never expect that corporates keep their promises
CPU hotplug

Lessons learned

- Estimation of effort is hard
- Total timespan off by factor 2
- Total work hours off by factor 3
CPU hotplug

Lessons learned

- Took 2 years time
- About 2 man years effort
- About 1.2 patches per work day
Tasks accomplished

- CPU hotplug rework
- CPU hotplug locking rework
- Timer wheel rework
- HRTimer rework
- Futex/RTmutex overhaul
- Separation of pagefault and preemption
- Cleanup of task affinity abuse
- Extending debug facilities
Tasks accomplished

- About 700 patches merged or queued for 4.15
- About 50 patches still under review
- Fixed 40 real and 80 latent bugs

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Long term stable versions

- Linux 3.2 - EOL: May. 2018, rarely updated
- Linux 3.16 - EOL: Apr. 2020, rarely updated
- Linux 4.1 - EOL: May. 2018
- Linux 4.4 - EOL: Feb. 2022
- Linux 4.9 - EOL: Jan. 2019
- Linux 4.14 - EOL: TBD
Development version

- Linux 4.13
- Will be abandoned in favour of 4.14 (LTS)
Most complex development tasks

- dcache locking
- softirq modifications
- memory management interaction
- local locks and annotations
dcache locking

- Trylock loops
- Safe in mainline
- Lifelock prone in RT
- The most challenging issue right now
You want to help?

- Testing
- Documentation
- Task list in the RT wiki
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Roadmap

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