KernelCI: a new dawn

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Kernel testing landscape

- Developers: contributors to upstream, maintainers
  → Only run tests on their workstations / dev boards
Kernel testing landscape

- Developers: contributors to upstream, maintainers
  → Only run tests on their workstations / dev boards

- Users: distros, OEMs, SoC/CPU vendors
  → Only run tests on their own hardware
  → Don’t necessarily send fixes upstream
Kernel testing landscape

- Intel 0-Day and Linux Kernel Performance[1]
  → Only run tests on Intel x86

[1] https://01.org/lkp
Kernel testing landscape

- Intel 0-Day and Linux Kernel Performance[^1]
  → Only run tests on Intel x86

- Linaro Kernel Functional Tests[^2]
  → Only run tests on Linaro member platforms

[^1]: https://01.org/lkp
[^2]: https://lkft.linaro.org/
Total test coverage

= 

On the beaten tracks
KernelCI: off-road testing

- Run on all CPU architectures
- Test coverage aiming to grow over the whole kernel
- Run all tests on a wide range of hardware platforms
KernelCI: a ghost project?

- Initiated by Linaro in 2014
- Targeting ARM ecosystem
- Only did boot testing
- Limited community
- Needs a new home
KernelCI: a new dawn

• KernelCI now becoming part of the Linux Foundation
• Collabora to be a Premier member
• Filling gaps in kernel test coverage
• Big companies are investing
  - Google and Microsoft sponsored servers
• Funding, structure, maintenance, sustainability...
kernelci.org
Where are we now?
The KernelCI loop

- **Git**
- **Commit**
- **Build**
- **Test**
- **Report**

Developer

- AWS
- GCE
- Azure dedicated

- Jenkins
- LAVA
- custom labs

- results
- regressions
- bisections

- Emails
- Dashboard

Open First
KernelCI in numbers

1 build every 24 seconds

1 boot every 40 seconds

76 device types

Baylibre

Theobroma

Collabora

Linaro

Mhart

Arm

Arm64

X86

Mips

Arc

Riscv
Automated boot bisection

• For all boot regressions found on:
  - mainline
  - stable branches
  - linux-next
  - some subsystems’ and maintainers’ trees

• A few noteworthy results:
  - QEMU x86 boot failure on linux-4.14.y
    https://lists.linaro.org/pipermail/kernel-build-reports/2018-January/thread.html#27424
  - Peach Pi Chromebook deadlock on v4.15-rc3
    https://lists.linaro.org/pipermail/kernel-build-reports/2017-December/thread.html#26688
  - Big-endian arm64 preempt count bug on next-20181210
    https://git.kernel.org/pub/scm/linux/kernel/git/next/linux-next.git/commit/?h=akpm&id=7faa313f05cad184e8b17750f0cbe5216ac6debb
Functional tests

- Graphics: IGT (DRM/KMS)
  → Subset run on a handful of devices, gradually expanding

- Media: v4l2-compliance
  → Full test suite run on hardware and QEMU (vivid driver)

- Power: suspend / resume
  → Run on many boards, finding issues regularly

- USB: smoke test
  → Check that the USB subsystem is initialised
kernelci.org

What’s next?
Joining the Linux Foundation

- Membership scheme
- Sustainable funding
- KernelCI as a service
- Premier members:
  - Collabora
  - ...waiting for official project launch
More build power

- Microsoft Azure builders
- Google Compute Engine builders
- Linux Foundation membership can help too
- Adding more trees: subsystems, stable “autosel”
- Adding multiple compiler support (LLVM/Clang...)
Horizontal / Vertical testing

- KernelCI with boot testing
- LKFT with LTP

- long tests on few configurations
- short tests on many configurations
Horizontal / Vertical testing

- Long tests on few configurations
- Short tests on many configurations

LKFT and KernelCI starting to join forces
Mapping test areas of the kernel

• Drawing a map of all the kernel surface to test
• Gradually expanding coverage
  – Adding source trees for each part of the kernel
  – Adding test suites to target each specific part
  – Adding hardware to test architectures and drivers
• Digging out issues found in “terra incognita”
Case Study

The media subsystem
Media subsystem as a pilot

- Building media subsystem master branch
- Expanding v4l2 test plan
- Enabling QEMU with virtual video (vivid driver)
- Working with the developers to get feedback
- Improving test results
- Tracking regressions
- Improving email reports
Issues found with UVC driver

- The USB Video Class driver is for standard webcams
- Has been in mainline since v2.6.26
- Enabled testing on rk3399-gru-kevin Chromebook
- Found out that it fails v4l2-compliance:
  Total: 48, Succeeded: 44, Failed: 4, Warnings: 9
- Full details:
  https://lava.collabora.co.uk/scheduler/job/1328514
  https://lava.collabora.co.uk/results/1328514/0_v4l2?search=&length=50#table
Showing failures prompts developers to fix them
Thank you!
Any questions?
Photo credits

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