Growing a Lab for Upstream Testing

Requirements

- Diverse ecosystem of devices
- Software for test automation
- Monitoring system
- Recovery strategies
CI Loop
LAVA

- Linaro Automation and Validation Architecture: https://www.lavasoftware.org/
  - Functional testing on real HW
  - Automates power control and serial access
  - Scalable scheduler
  - Results available in different formats
LAVA

CI LOOP

- COMMIT
- BUILD ARTIFACTS
- REPORT RESULTS
- ANALYZE RESULTS
- RUN TEST JOB
- LAVA

I just wrote the most beautiful code of my life.
Devices in LAVA

- **Requirements**
  - Ability to be turned on/off remotely
  - Ability to access a reliable console remotely
  - Ability to boot arbitrary Kernel+(DTB)+System remotely

- **Configuration (jinja2, YAML)**
  - Device type template
  - Device dictionary
  - Health check
Collabora Lab

https://lava.collabora.dev/

- 16 racks
- 217 devices of 38 different types
- 16 LAVA dispatchers
- Network switches, debug interfaces, USB hubs, power supplies, tons of cables
Collabora Lab Stats

Arch Distribution January 2023

- x86_64: 113
- arm64: 75
- arm: 15
- qemu: 12
- x86: 2

Device Distribution January 2023

- Chromebook: 157
- Embedded SBC: 46
- Qemu: 12
- Server: 2
HW for Automation

- Embedded SBCs
  - Ethernet relay (e.g. Devantech ETH008, ETH8020, ETH484)
  - Ethernet power switch (e.g. Aviosys IP9850, Energenie EGPMS)
- Chromebooks
  - SuzyQable + USB Eth adapter
  - ServoV4
- Servers
  - IPMI
- All devices
  - USB regular/switchable HUB (e.g. Ykush)
  - USB cables
SW for Automation

- Power+serial control
  - PDUDaemon [https://github.com/pdudaemon/pdudaemon](https://github.com/pdudaemon/pdudaemon)
  - Conserver [https://www.conserver.com](https://www.conserver.com)
  - Hdctools [https://chromium.googlesource.com/chromiumos/third_party/hdctools/](https://chromium.googlesource.com/chromiumos/third_party/hdctools/)

- Interaction w/ LAVA
  - Lavacli [https://docs.lavasoftware.org/lava/lavacli.html](https://docs.lavasoftware.org/lava/lavacli.html)
  - LAVA Gitlab Runner [https://github.com/collabora/lava-gitlab-runner](https://github.com/collabora/lava-gitlab-runner)
KernelCI

- Linux Kernel continuous testing [https://kernelci.org/](https://kernelci.org/)
  - Baseline tests (e.g. bootrr, dmesg)
  - Boot tests (e.g. boot-nfs, boot-fastboot)
  - Subsystem tests (e.g. igt, v4l2-compliance)
  - Userspace tests (e.g. chromeos tast)
- Post-merge testing
  - Build reports
  - Regression reports
MesaCl

- Mesa conformance testing and performance tracking
  https://gitlab.freedesktop.org/mesa/mesa/-/pipelines
  - API
    - OpenGL, OpenGL ES, VA-API, Vulkan
  - Drivers
    - Iris, ANV, RadeonSI, RADV, Panfrost, Panvk, Freedreno, Turnip, LLVMPipe, Lavapipe, Softpipe, Etnaviv, Lima, v3d, v4c, Dozen, Virgl, Venus, Nouveau, Crocus
  - Test suites
    - dEQP, Khronos GL and VK CTS, Piglit, trace replaying for OpenGL, Vulkan and Direct3D, Skqp, va-utils

- Pre-merge conformance tests
- Post-merge performance tests
Collabora Lab Stats

# KernelCI Jobs January 2023
314956 Jobs, 16944 Hours

- x86_64: 154257
- arm64: 54595
- arm: 57913
- qemu: 48191

# MesaCI Jobs January 2023
66288 Jobs, 11154 Hours

- x86_64: 47069
- arm64: 80
- arm: 19139
Upstream Testing

- Pre-merge tests
  - User’s MR blocked until all tests succeed
  - Risk of pipeline starvation
  - Risk of wrongly rejecting MR

- Post-merge tests
  - Rely on job results to report regressions
  - Risk of detecting false regressions
Common Issues

- **HW degradation**
  - Faulty cables, dead battery/power supply, dead SD card
- **Network**
  - Connectivity issues, IP address mismatches
- **Rack setup**
  - Cable positioning, lid angle, overheating
- **FW bugs**
Pitfalls

● Serial console silence
  - Hard to determine the cause after the kernel has booted
Pitfalls

- Serial connection shared between kernel and test shell
  - Possible interference between LAVA signals, kernel and test output

Unknown test uuid. The STARTRUN signal for this test action was not received correctly.

Invalid TESTCASE signal
Pitfalls

- Network drop during bootloader phase
  - Needs to be marked as infrastructure error

Waiting for the transfer...

R8152: Bulk read error 0x00000000
Receive failed.
R8152: Bulk read error 0xffffffff
Receive failed.
R8152: Bulk read error 0xffffffff

matched a bootloader error message: '(Bulk read error(.*)\{3\}\{9\)'
end: 2.2.4 bootloader-commands (duration 08:00:06) [common]

Case: bootloader-commands
case_id: 363465122
definition: lava
duration: 6.01
extra: ...
level: 2.2.4
namespace: common
result: fail
depthcharge-retry failed: 1 of 3 attempts. 'matched a bootloader error message: '(Bulk read error(.*)\{3\}\{9\)'
Pitfalls

- Network drop during test phase
  - Critical on tests that rely on a NFS rootfs
Best Practices

- Write robust health checks
  - Ensure faulty devices are taken down automatically
- Monitor LAVA Infrastructure Error exceptions
  - Spot issues with specific racks or device types
- Ensure device redundancy
  - Monitor the device’s health and job queue
- Isolate test shell output and kernel messages when possible
  - e.g. docker container + SSH connection to the DUT
Next Steps

- Keep adding new devices
  - Increase lab capacity + cover variety of platforms from different vendors
- Keep improving the infrastructure and our monitoring tools
- Increase the coverage of test suites
Thank you!

We are hiring - col.la/careers