Android Common Kernel Testing at Google
September 14, 2017

Presentation by Marissa Wall <marissaw@google.com>
Presubmit Testing

- Obtain a target that can run unmodified Android Common Kernels
  - Supports all currently maintained Android Common Kernels (3.18, 4.4 and 4.9)
  - Easy switching of the kernel on a running instance
- Decide which test cases to run on each new patch
- Integrate the target with existing presubmit testing infrastructure
- Publicly publish the testing results on each patch uploaded to gerrit
New Emulator

- Focused on kernel and framework developers
- Kernel changes confined to device drivers and upstreamed
- Supports Android common kernels 3.18, 4.4 and 4.9
- Runs on Linux server pool
  - Supports up to 64 cores per device
  - Runs on up to 100s of virtual devices
- Implements lower-level interfaces like USB, WiFi, and Bluetooth
- Security model on Android fully intact
- Tentatively scheduled to be open sourced with Oreo Maintenance Release 1
New Emulator versus Goldfish

- Engineered to run on Linux server pool
- Prioritize fidelity over performance
- No framework changes
  - e.g. no property based code paths in the framework code
- No attempt at ARM emulation
- Linux support only
New Emulator

End-to-End tests
Framework
adbd OpenGL stub Treble Adapters
Common HALs
VSoC Guest Kernel Driver
UDC, sync, glpipe, gralloc, futex, shm
Android Common Kernel
VMM (currently QEMU)

Debian image
cloud-android*.deb
Boot image
Vendor image
System image

Iptables
NAT
adb
Client
SwiftShader
PCI shared memory window with eventfd interrupts
Tap Driver
vhci_hcd

GPU Server
Virtual Hardware Implementations

Streaming (Framebuffer & HALs)

Host Kernel
Server
Test cases

- **VTS**
  - Kernel / System / kselftest / LTP
  - HALs / HIDL
  - Security
  - Performance
  - Fuzz

- **CTS**

- **Suggestions?**
Sources

- **VTS**

- **CTS**
  - [https://source.android.com/compatibility/cts/](https://source.android.com/compatibility/cts/)
Thanks!
Linux Kernel Functional Testing Efforts at Linaro
Linux Kernel Functional Testing at Linaro

- Project initiated by Google
  - To improve -stable and Android common kernel testing
  - Benefits downstream SoC vendor kernels
Existing Community Build/Boot Testing Efforts

0-day kernel tester: https://01.org/lkp

- Really efficient multi-arch build testing
- Pre-acceptance testing (developer git trees, lkml patches)
- Limited (virtualized x86 only) boot, functional and performance testing

KernelCI.org: https://kernelci.org/

- Build testing many kernels (mainline, -stable, -next, android-common) for handful of arm/arm64/mips/x86 platforms
- Boot testing on many platforms in many separate labs
Linux Kernel Functional Testing at Linaro

- **Build + Boot + Functional testing on ..**
  - Platforms: HiKey, x86, Beagle x15 (In Progress), db410c, Qemu (In Progress)
  - Kernels: Mainline, LTS (stable and rc for 4.4, 4.9), -next and android-common kernels
  - Userland: AOSP, OpenEmbedded

- **Currently Running ..**
  - LTP-syscall, kselftests, hugetlbfs (OpenEmbedded), Android CTS/VTS (AOSP)

- **Hoping to grow and add more test as things settle down**
  - LTP-$(sub-testsuite), xfstest, lkp, piglit and others…
  - Suggestions welcome
Build, Test & Reporting Infrastructure

- Test setup built around Jenkins and LAVA v2
- Builds at https://ci.linaro.org/
- Test/QA reporting
  - Dashboard https://qa-reports.linaro.org/lkft/
  - Email notifications (Beta)
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<thead>
<tr>
<th>Project</th>
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<th>Tests</th>
<th>Metrics</th>
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**Test run #22005** Environment: hi6220-hikey Status: Complete

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<th>Suite</th>
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**Test run #22003** Environment: hi6220-hikey Status: Complete

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### Test run #22660
Environment: x86 Status: Complete

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Environment: hifi20-hikey Status: Complete

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### Test run #22655
Environment: x86 Status: Complete

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Testing Pain Points

- Modes of managing and testing mobile (AOSP) and classic linux clients (OpenEmbedded) are very different
  - Mobile: fastboot, adb, USB-gadget
  - Classic: tftp boot/install, ssh, ethernet

- Fastboot scaling issues
  - Fastboot flashing pin cpus, so flashing more boards than cpus at once run into errors
  - Have potential fix, but environment was reworked to avoid issue.

- Ghost bugs which are hard to reproduce outside of lab
  - Bad cables or potentially a few bad boards
  - Host BIOS tweaks for xHCI
Hikey (Primary test device)

- **Mobile focussed Kirin620 SoC**
  - Mostly upstream, supported in AOSP

- **Single USB controller**
  - Can be exclusively a gadget or a host, not both at once.

- **UEFI bootloader doesn’t support USB eth devices**
  - No tftp booting

- **Flashing via fastboot then requires gadget mode**
  - No usb eth at runtime
Feedback / Questions / Want to join/help?

- Suggestion welcome on how to handle such mode of testing more reliably and efficiently?
- How to involve community as we scale up ..?
  - Reaching out to maintainers and test authors for help
  - Helping triage and fixing bugs found in the limited test run so far
  - UEFI support for usb eth devices on HiKey
  - adbd gadget support in OE/classic linux distros
  - Fixing/expanding test infrastructure (LAVA)
Thank You

For further information: www.linaro.org