Continuously Integrating the Upstream Linux Kernel on Hardware

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Who is Anders ?

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Employed Linaro engineer
10+ years in Embedded
Involved with the kernel for 6+ years
Testing 9+ years
Prefer sausages, cheese and beer.

Linaro

Who are Linaro?

- Linaro brings together industry and the open source community to work on projects and provide common software foundations for all
- Top 5 company contributor to Linux and Zephyr kernels
- Contributor to >70 open source projects; many maintained by Linaro engineers

	Company	4.8-4.13 Changesets	%
1	Intel	10,833	13.1%
2	Red Hat	5,965	7.2%
3	Linaro	4,636	5.6%

Source: 2017 Linux Kernel Development Report, Linux Foundation

Selected projects Linaro contributes to

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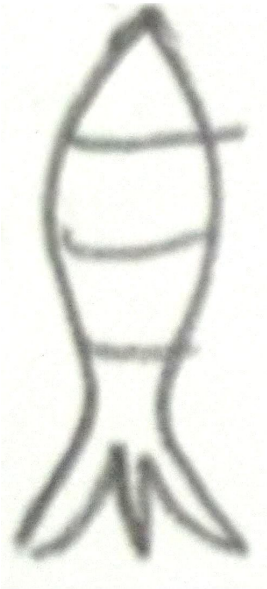
What is Linux Kernel Functional Testing (LKFT)

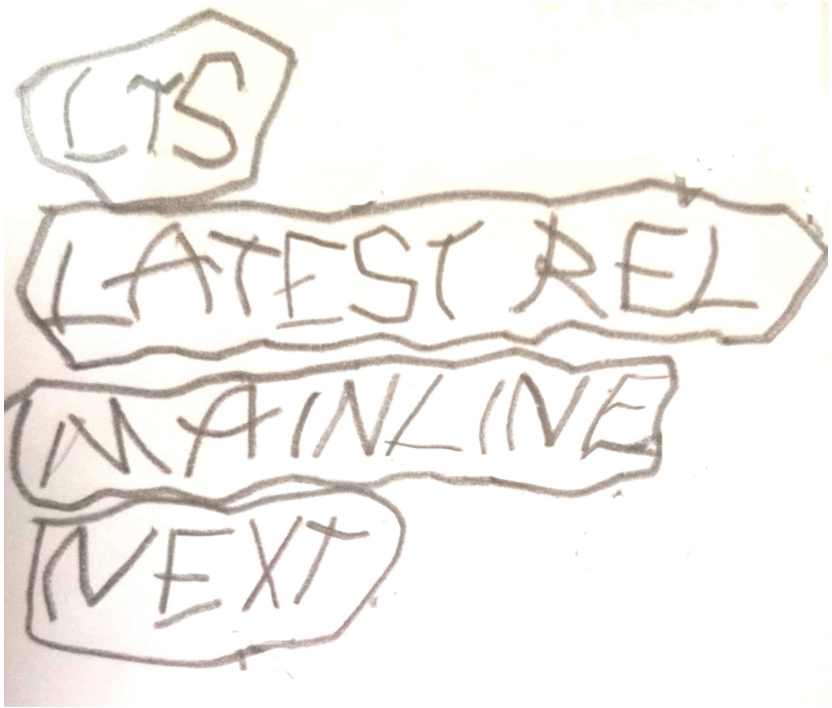
Over 10 million tests so far in 2019

- A lot of data
- Find actual problems ?



Linux Kernels that LKFT tests

- Longterm stable (LTS) kernels
  - 4.4 EOL 2022,
  - 4.9 EOL 2023,
  - 4.14 EOL 2020,
  - 4.19 EOL 2020,
- Released kernel(s)
  - 5.0 EOL when next stable release is released
- Others
  - linux-next is tagged



https://www.kernel.org/category/releases.html

https://lkft.linaro.org/branches/

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LKFT’s software stack

Dashboard

Email reporting

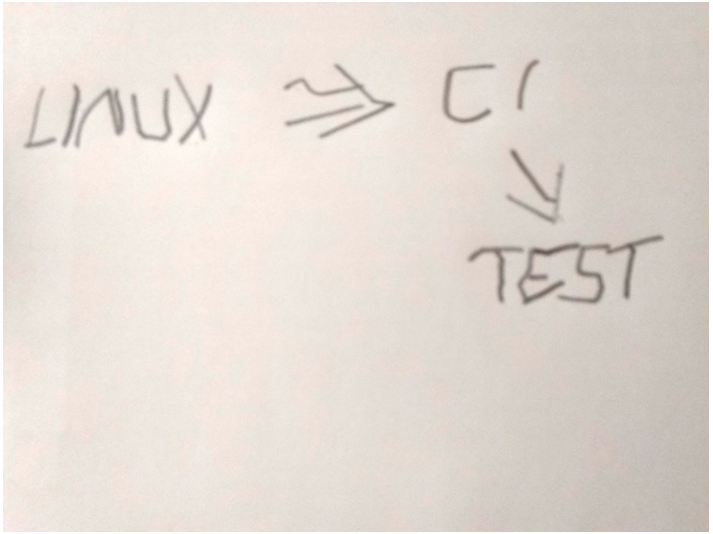
LAVA

SQUAD

Jenkins

Bugzilla

When do LKFT run tests ?



When a new Linux Kernel gets pushed (commits or tags), LKFT builds an OE image with the Kernel + rootfs and run it in LAVA on real hardware

Hardware in the LKFT lab

- Hardware
  - arm64: Hikey, dragonboard, juno
  - arm: x15
  - x86 to run both x86_64 server, running both 64bit and 32 bit mode
  - Qemu:
    - x86_64 server: x86 64bit and 32bit
    - Synquacer: arm 64bit and 32bit

https://lkft.linaro.org/boards/

LKFT Email reporting

Screencap of email report

```
└─<[master@origin]>─(0) $ ./bin/generate_next_kselftest_report.py
SUBJECT: next-20190306 kselftest results

Summary
---------------------------------------------------------------------
kernel: 5.0.0
git repo: https://git.kernel.org/pub/scm/linux/kernel/git/next/linux-next.git
git branch: master
git commit: cf08baa29613dd899954089e7cc7dba1d478b365
git describe: next-20190306
Test details: https://qa-reports.linaro.org/lkft/linux-next-oe/build/next-20190306

Regressions (compared to build next-20190305)
---------------------------------------------------------------------
```

Ref:

https://github.com/Linaro/squad.git

https://github.com/Linaro/lkft-tools.git

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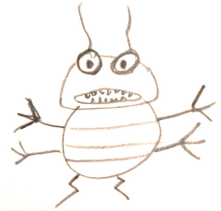
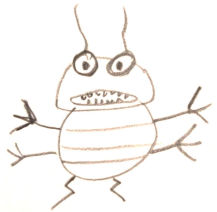
LKFT Dashboard

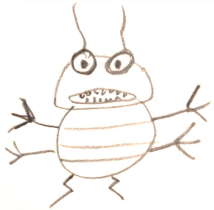


From QA-reports to report the issue or submit a patch to test the proposed fix

Latest builds

next-20190327	118 test runs · 118 completed	16059 tests · 14388 pass · 1442 skip · 197 fail · 32 xfail · 37.115	an hour ago · March 27, 2019, 6:28 a.m.
next-20190326	150 test runs · 150 completed	23057 tests · 20897 pass · 1876 skip · 230 fail · 54 xfail · 36.815	3 hours ago · March 27, 2019, 4:29 a.m.
next-20190325	140 test runs · 140 completed	20191 tests · 18116 pass · 1776 skip · 246 fail · 53 xfail · 31.026	2 days ago · March 25, 2019, 8:04 a.m.
next-20190322	140 test runs · 140 completed	23796 tests · 21454 pass · 1946 skip · 338 fail · 58 xfail · 32.905	4 days, 6 hours ago · March 23, 2019, 2:03 a.m.
next-20190321	145 test runs · 145 completed	23523 tests · 21260 pass · 1916 skip · 291 fail · 56 xfail · 29.035	5 days, 19 hours ago · March 21, 2019, 12:44 p.m.





qa-reports.linaro.org/lkft/mainline/v5.0...

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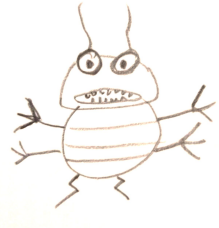
LKFT Dashboard

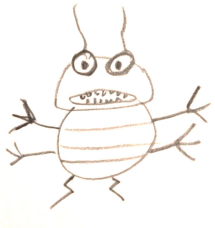


From QA-reports to report the issue or submit a patch to test the proposed fix

Test results

Filter results ...

Suite	x15 - arm	qemu_arm	qemu_i386	qemu_arm64	x86_64	qemu_x86_64	i386	hi6220-hikey - arm64	dragonboard-410c - arm64	juno-r2 - arm6
kselftest	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
kselftest-vsyscall-mode-native					✖					
kselftest-vsyscall-mode-none					✖					
spectre-meltdown-checker-test	✖	✔	✔	✔	✱	✔	✱	✔	✔	✱
boot	✔	✔	✔	✔	✔	✔	✖	✔	✔	✔
ltp-syscalls-tests	✖	✖	✖	✖	✖	✖	✖	✖	✖	✖
build		✔	✔	✔		✔				
install-android-platform-tools-r2600	✔							✔	✔	



qa-reports.linaro.org/lkft/mainline/v5.0...

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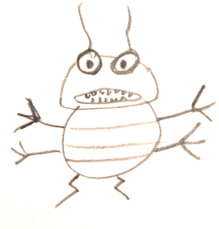
LKFT Dashboard



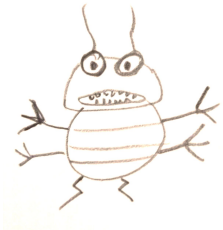
From QA-reports to report the issue or submit a patch to test the proposed fix

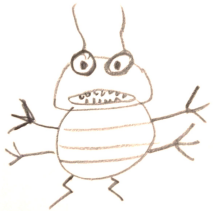
Test results

Filter results ...

Suite	qemu_arm	qemu_i386	x15 - arm	qemu_arm64	hi6220-hikey - arm64	juno-r2 - arm64	i386	x86_64	qemu_x86_64	dragonboard-410c - arm64
kselftest	✖	✖	✖	✖	✖	✖	✖	✖	✖	

Test Run	Environment	Test Results
645966	qemu_arm	163 tests 96 pass 19 skip 48 fail
645912	qemu_i386	181 tests 121 pass 13 skip 47 fail
645952	x15 - arm	157 tests 96 pass 17 skip 44 fail
645938	qemu_arm64	165 tests 108 pass 20 skip 37 fail
645925	hi6220-hikey - arm64	125 tests 81 pass 13 skip 31 fail
645980	juno-r2 - arm64	144 tests 98 pass 18 skip 28 fail
645898	i386	85 tests 48 pass 11 skip 26 fail
645857	x86_64	150 tests 108 pass 22 skip 20 fail
	qemu_x86_64	149 tests 105 pass 25 skip 19 fail





qa-reports.linaro.org/lkft/mainline/v5.0...

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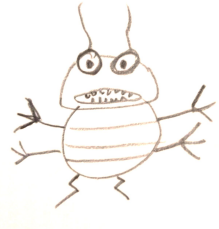
LKFT Homepage



Test Results

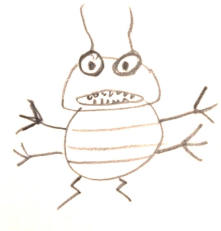
linux-stable-rc-4.4-oe pass: 18110, fail: 45, xfail: 613, skip: 1621
linux-stable-rc-4.9-oe pass: 22723, fail: 3, xfail: 709, skip: 2273
linux-stable-rc-4.14-oe pass: 23251, fail: 34, xfail: 677, skip: 2158
linux-stable-rc-4.19-oe pass: 22345, fail: 16, xfail: 407, skip: 1968
linux-stable-rc-5.0-oe pass: 23473, fail: 49, xfail: 340, skip: 2098
linux-mainline-oe pass: 22668, fail: 96, xfail: 283, skip: 2145
linux-next-oe pass: 20923, fail: 267, xfail: 55, skip: 1891

Build and test results from Jenkins and QA reports

LKFT Build Status

The LKFT build uses OpenEmbedded to build a userspace image, along with the kernel, for each board and branch combination under test.

Board	4.4	4.9	4.14	4.19	5.0	mainline	linux-next
Hikey arm64	build passing	build passing	build passing	build passing	build passing	build passing	build passing
X15 arm32	build passing	build passing	build passing	build passing	build passing	build passing	build passing
Juno arm64	build passing	build passing	build passing	build passing	build passing	build passing	build passing
DragonBoard 410c arm64	Not supported	build passing	build passing	build passing	build passing	build passing	build passing
Intel Server i386	build passing	build passing	build passing	build passing	build passing	build passing	build passing
Intel Server x86_64	build passing	build passing	build passing	build passing	build passing	build passing	build passing



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LKFT Triage Process: Bug Classification

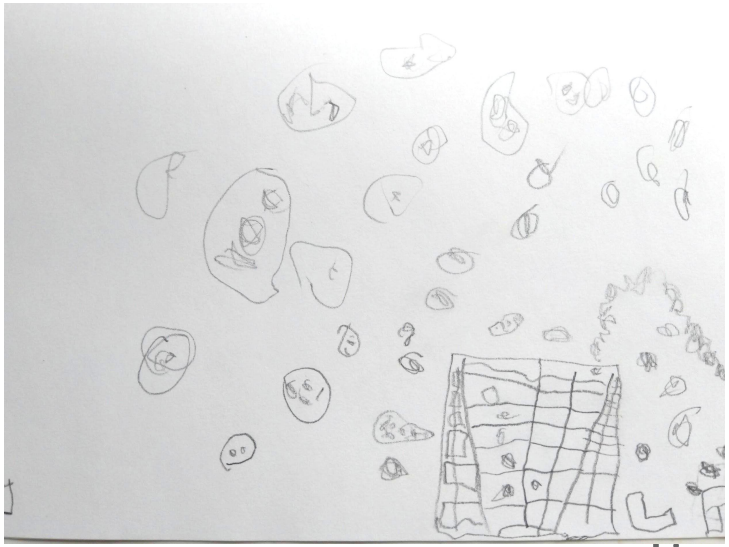
Components:

- **Kernel** - Actual kernel issues, excluding issues under tools/testing/selftests/ (kselftest).
- **General** - Bugs that don't fit any other component. Examples include build issues, root filesystem issues, etc.
- **kselftest** - Issues that need to be fixed in kselftest.
- **Linux Test Project (LTP)** - Issues that need to be fixed in LTP.

bugs.linaro.org - Product "Kernel Functinal Testing"

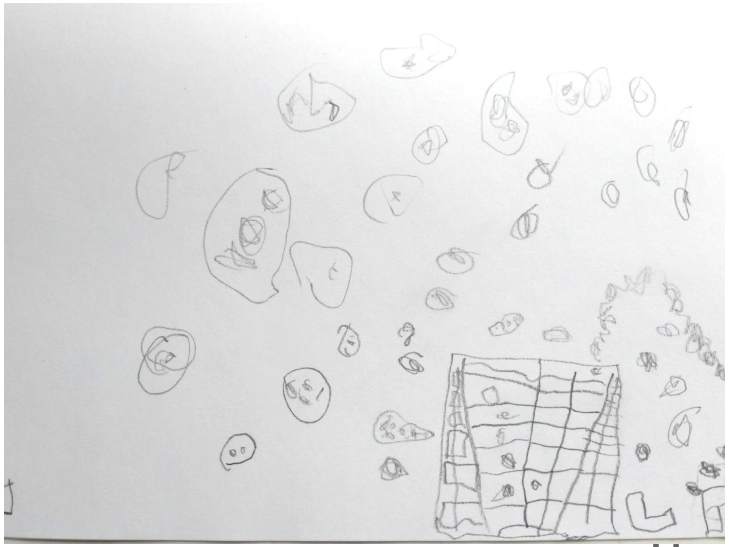
LKFT Triage Process: First approach

- Try to run everything.
  - Consequence: Boards crash; tests hang and cause timeouts.



LKFT Triage Process: Second approach

- Try to run everything, but skip tests that cause the test run to fail.
  - Consequence: Lots of failures to wade through.



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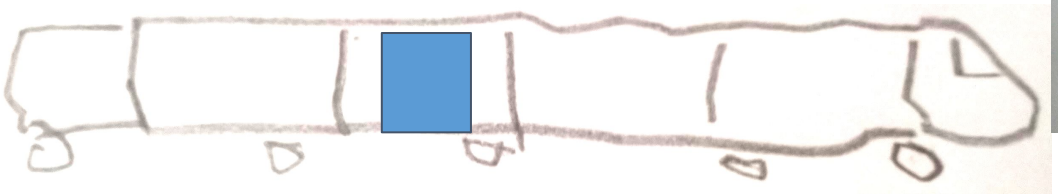
LKFT Triage Process: Third approach

- Compare previous run to current and detect ‘regressions’ and ‘fixes’.
  - Consequence: Lots of tests fail intermittently. Lack of good baselines.



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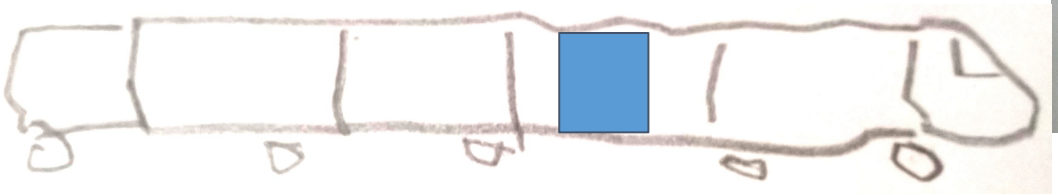
LKFT Triage Process: Fourth approach

- Skip failing tests to make the data clearer.
  - Consequence: No more ‘fixes’. Hiding too much data.



LKFT Triage Process: Fourth approach (current)

- Triage and annotate failures
  - Cons: High touch, not automated
  - Pros:
    - Any known failure that passes is a ‘fix’ (unless ‘intermittent’)
    - Any new failure is a ‘regression’ (unless ‘ intermittent’)

Thank you

Ref:
https://lkft.linaro.org/
https://github.com/Linaro/squad
https://qa-reports.linaro.org/lkft/
https://github.com/Linaro/lkft-tools
https://lkft.validation.linaro.org/
https://lkft.linaro.org/boards/

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