KernelCI e ELK

Charles Oliveira

Introdução - Linaro

- Foco no desenvolvimento do ambiente ARM para Linux
- Desenvolvedores de Kernel
- Desenvolvedores do LAVA (Linaro Automated Validation Architecture)
  - Automação de testes
    - Abrange tanto VM quanto sistemas embarcados
    - Foco em testes de Kernel (incluindo Android)
  - Em Python
- Mantém um laboratório com placas como RaspberryPi, DragonBoard, entre outras
  - https://www.youtube.com/watch?v=6jwYymfauik
- Desenvolvedores de ferramentas de apoio
  - **SQUAD - Software QUAlity Dashboard**
  - LKFT - Linux Kernel Functional Testing
  - Entre outras iniciativas internas
- Iniciou o KernelCI

Introdução - KernelCI

- O que é is KernelCI?
  - Monitora Trees/Branches, e.g., *stable/linux-5.0.y*
  - Builds distribuidas
    - Matriz de builds: Kernels x Defconfigs x Compiladores
  - Laboratórios LAVA e não-LAVA
    - Matriz de boots: Labs x Placas
  - Emails
  - Bissecções *novo*
  - Testes *novo*
  - **Frontend**
- Números (a cada duas semanas)
  - **30+** kernel trees monitoradas
  - **40k+** builds
  - **20k+** boots

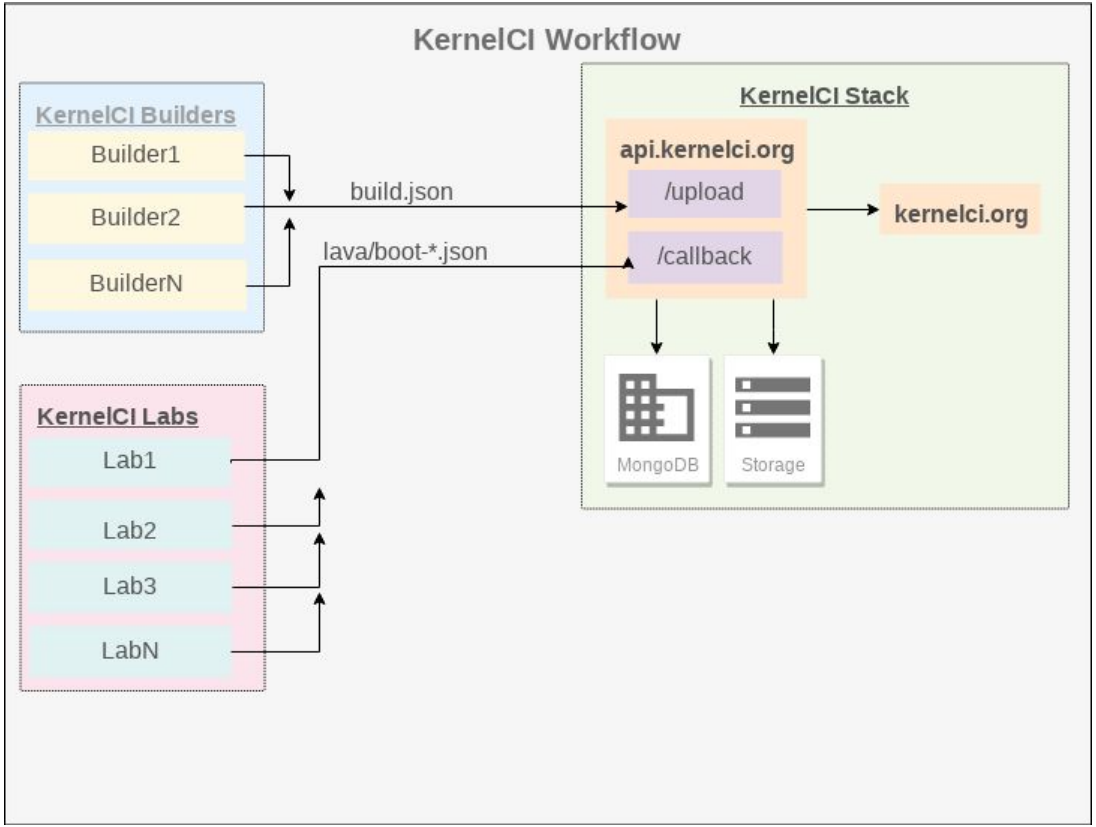
Lado que precisa melhorar do KernelCI

- Frontend do KernelCI é escrito em Javascript e HTML, as vezes complexo
- Diferentes comunidades necessitam diferentes visualizações
- Adicionar novas funcionalidades no frontend é complicado

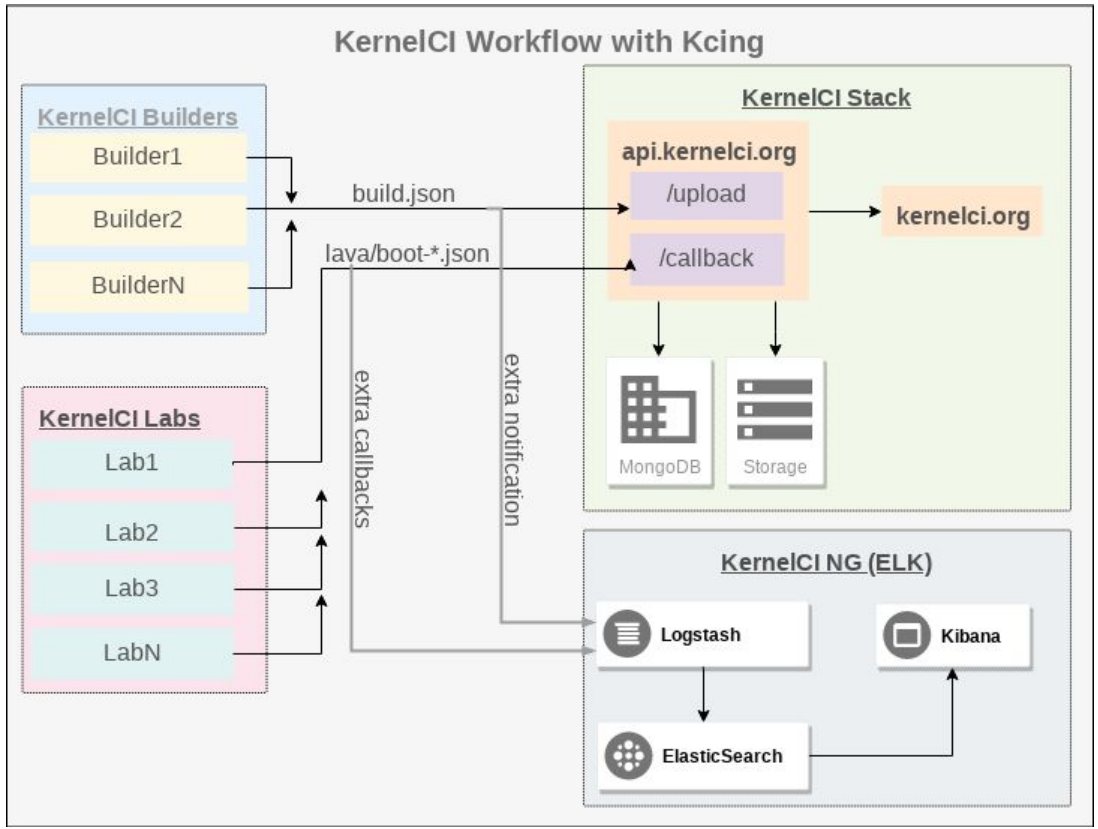
Solução proposta - ELK

- Existem ferramentas open source como Elasticsearch e agregadores de log como Logstash e Greylog. Iniciamos uma pesquisa para investigar como isso ajudaria a dar uma cara nova ao KernelCI.
- Um protótipo foi feito utilizando o stack ELK (Elasticseach, Logstash, e Kibana) para indexar dados vindos do KernelCI e apresentá-los em uma interface web.

Overview do KernelCI



Overview do KernelCI + ELK

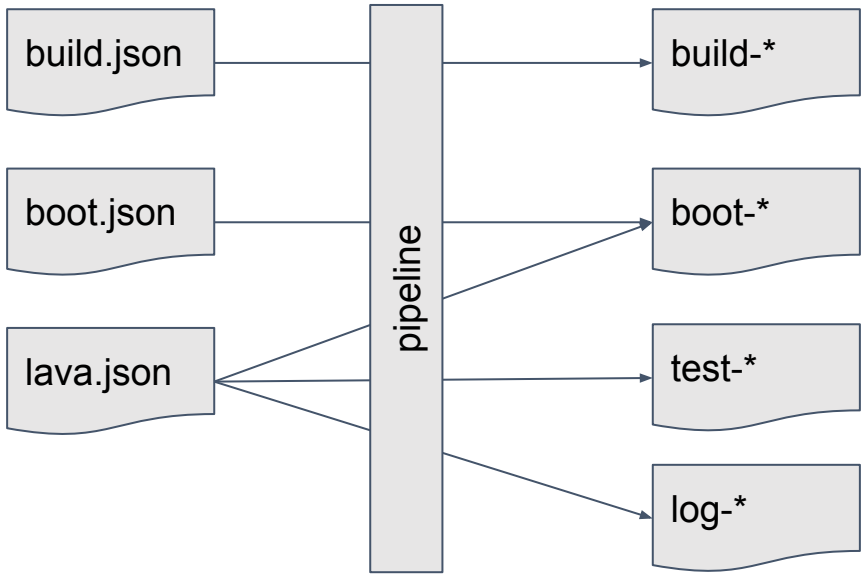


Abordagem

O ELK é composto de componentes bastante especializados, que trabalham em harmonia (todos são mantidos pela Elastic).

- Logstash
    - Coletor de dados/logs
    - Pipeline: processa **logs**, **boots** e **builds** e envia para o Elasticsearch.
- Elasticsearch
    - Indexa documentos JSON
    - É rápido, escalável e a documentação é bem atualizada; a comunidade é ativa, perguntas sempre solucionadas no próprio fórum da ferramenta
    - Não é um banco relacional, deve-se rever os conceitos de normalização de dados
- Kibana
    - WYSIWYG dashboard builder
    - Transforma consultas do ElasticSearch em dashboards
    - Diversos widgets embutidos: table, pie, heatmap...
    - Amigável à plugins

Logstash



ElasticSearch

- Vários experimentos foram feitos com índices simples ou relacionados contendo dados de **boot**, **log** e **test**
  - Arrays são bem-vindos no Elasticsearch, mas não são muito úteis para dashboards no Kibana
- Para a busca de logs funcionar, cada linha de log foi considerada um documento único no ES, e para isso houve muita duplicidade de dados:
  - tree, branch, kernel, defconfig, arch, mach, compiler, lab, board
- Documentos são indexados diariamente:
  - log-YYYY.MM.DD, test-YYYY.MM.DD, boot-YYYY.MM.DD, build-YYYY.MM.DD
- Indexação diária facilita deleção de dados antigos e ajuda na escalabilidade

ElasticSearch (amostra)

index	docs.count	store.size
boot-2019.03.26	3126	1.4mb
boot-2019.03.27	1390	619kb
build-2019.03.26	6879	4.4mb
build-2019.03.27	2634	2.1mb
log-2019.03.26	1678096	383.8mb
log-2019.03.27	1004088	226.5mb
test-2019.03.26	25288	7.4mb
test-2019.03.27	14881	4.3mb

Kibana

- Trabalha com padrão de nome de índices
  - **log-*** aponta para os índices log-2019.03.01, log-2019.03.02, etc
  - **test-*** aponta para os índices test-2019.03.01, test-2019.03.02, etc
  - O mesmo para **build-*** e **boot-***
- Uso de chaves estrangeiras é proibitivo (aumenta latência)
- *Scripted fields* + URLs personalizáveis
  - Navegação entre dashboards
- Criamos dashboards que:
  - Dão uma visão de alto nível do trabalho desempenhado pelo KernelCI
  - Auxiliam usuários e desenvolvedores a encontrar bugs

Demo time!

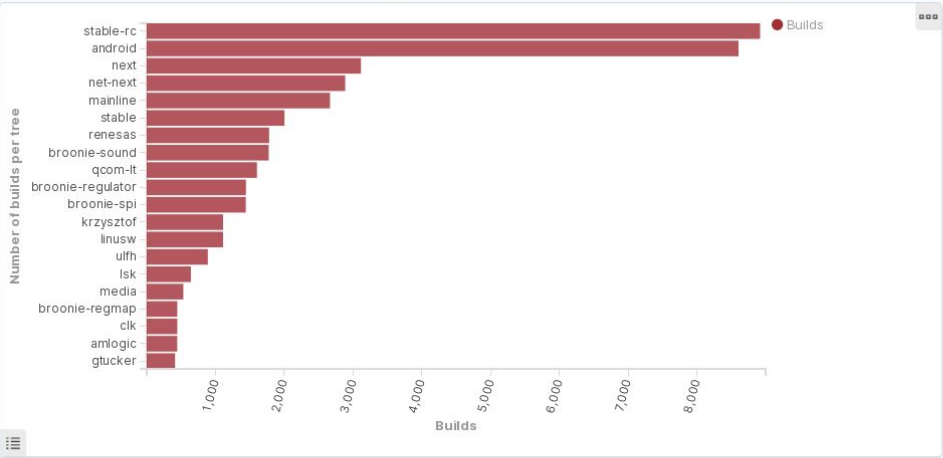
- Home
- Boots
  - Compare different boards
- Tests
  - Compare different boards
- Logs
  - Search for specific word
  - View boot that originated that log
  - View tests
  - View build

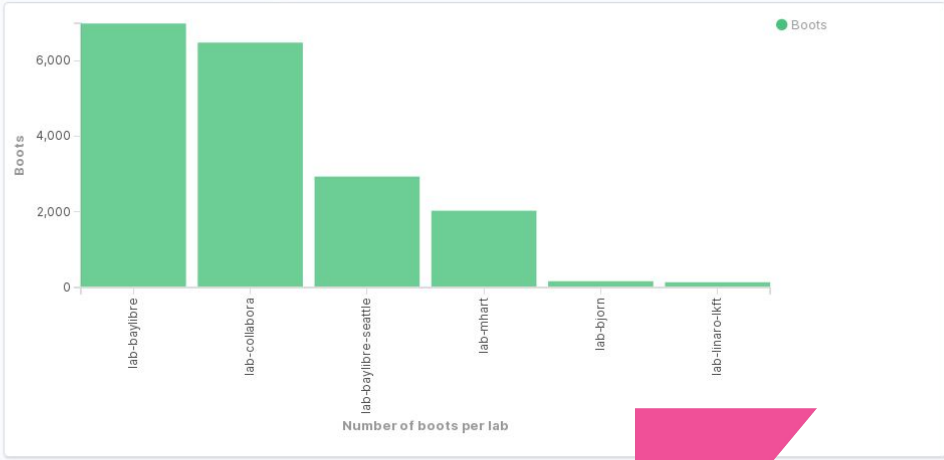
18,761
Number of Boots

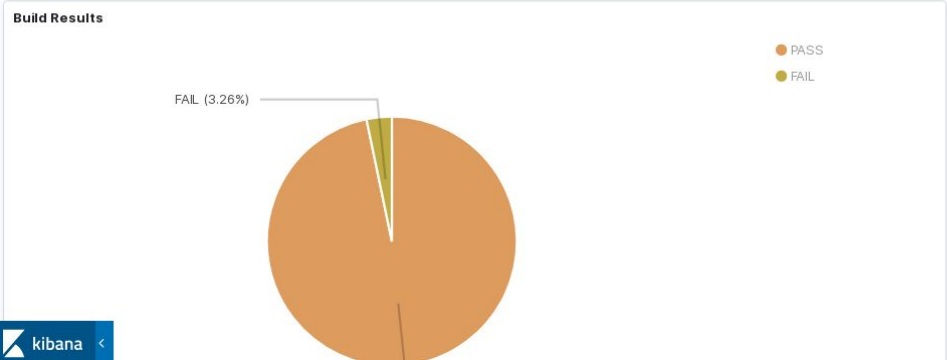
43,584
Number of Builds

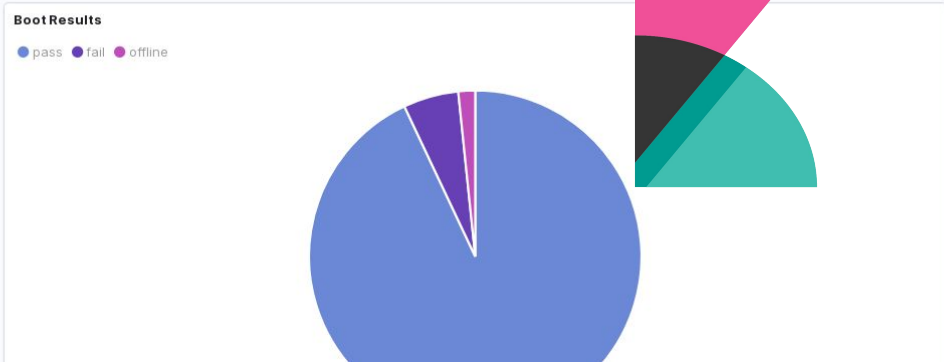
203,382
Tests

13,141,579
Log Lines









kibana

Tree
Select...

Branch
Select...

Lab
Select...

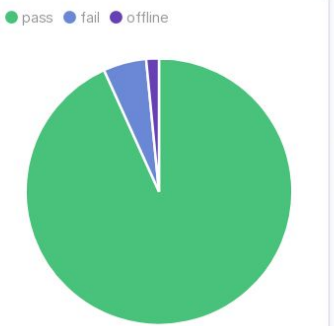
Kernel
Select...

Defconfig
Select...

Board
Select...

Arch
Select...

Build Environment
Select...



20,151
Number of Boots

Passed Boots

Tree	Branch	Kernel	Defconfig	Arch	Build Environment	Lab	Board	Passed	Compare	Build	Count
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre-seattle	alpine-db	pass	other boards	view	1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre-seattle	am335x-boneblack	pass	other boards	view	1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre-seattle	armada-xp-openblocks-ax3-4	pass	other boards	view	1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre-seattle	at91-sama5d4_xplained	offline	other bo		1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre-seattle	at91-sama5d4ek	offline	other bo		1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-collabora	bcm2836-rpi-2-b	fail	other bo	w	1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-collabora	beaglebone-black	pass	other bo	w	1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-collabora	imx6q-sabrelite	pass	other bo		1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-collabora	jetson-tk1	pass	other bo		1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-collabora	odroid-xu3	fail	other bo		1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre	beagle-xm	pass	other boards	view	1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre	meson8b-odroidc1	pass	other boards	view	1
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	lab-baylibre	odroid-xu3	pass	other boards	view	1

Back to boots

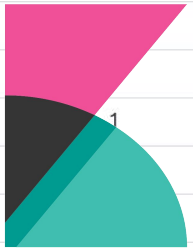
Build

Tree	Branch	Kernel	Defconfig	Arch	Build Environment	Git	Log	Kernel config	Count
mainline	master	v5.1-rc2	multi_v7_defconfig	arm	gcc-7	git://git.kernel.org/pub/scm/linux/kernel/git/torvalds/linux.git	View Log	kernel.config	1

Export: Raw Formatted

Comparing same build that booted across different boards

Lab	Board	Result	Log	Boot	Count
lab-baylibre-seattle	alpine-db	pass	view log	view	
lab-baylibre-seattle	am335x-boneblack	pass	view log	view	
lab-baylibre-seattle	armada-xp-openblocks-ax3-4	pass	view log	view	1
lab-baylibre-seattle	at91-sama5d4_xplained	offline	view log	view	
lab-baylibre-seattle	at91-sama5d4ek	offline	view log	view	
lab-collabora	bcm2836-rpi-2-b	fail	view log	view	1
lab-baylibre	beagle-xm	pass	view log	view	1
lab-collabora	beaglebone-black	pass	view log	view	1



Home | Boots | Builds | Tests | Logs

Test results

Test Suite

Select...

Test Name

Select...

25,014
Tests

Tree

Select...

Branch

Select...

Kernel

Select...

Defconfig

Select...

Lab	Job id	Test Suite	Test	Result	Lava log	Compare	Count
lab-collabora	1544417	0_igt	@basic	pass	view log	other boards	1
lab-collabora	1544417	0_igt	@basic	pass	view log	other boards	1
lab-collabora	1544417	0_igt	@basic	pass	view log	other boards	1
lab-collabora	1544417	0_igt	@invalid-get-prop-any	pass	view log	other boards	1
lab-collabora	1544417	0_igt	@invalid-get-prop-any	pass	view log	other boards	1
lab-collabora	1544417	0_igt	@addfb25-X-tiled	fail	view log	other boards	1
lab-collabora	1544417	0_igt	@addfb25-X-tiled-mismatch	fail	view log	other boards	1
lab-collabora	1544417	0_igt	@addfb25-Y-tiled	pass	view log	other boards	1
lab-collabora	1550786	0_igt	@basic	pass	view log	other boa	
lab-collabora	1550786	0_igt	@basic	pass	view log	other boa	
lab-collabora	1550786	0_igt	@basic	pass	view log	other boa	
lab-collabora	1550786	0_igt	@invalid-get-prop	pass	view log	other boa	
lab-collabora	1550786	0_igt	@invalid-get-prop	pass	view log	other boa	
lab-collabora	1550786	0_igt	@invalid-get-prop-any	pass	view log	other boards	1
lab-collabora	1550786	0_igt	@invalid-get-prop-any	pass	view log	other boards	1
lab-collabora	1550786	0_igt	@invalid-set-prop-any	pass	view log	other boards	1

Filters | >_ msg:panic AND lvl.keyword:target | Options | Last 7 days | Show dates | Refresh

+ Add filter

Home | Boots | Builds | Tests | Logs

Tip: go to the beginning of the **search field** above and type:

```
msg: your-desired-search  |  msg: (a-word OR other-word)  |  msg: (a-word AND other-word)
```

For a complete reference, click here

1–50 of 864

dt	lvl	msg	sc_boot_link
26-03-2019 17:00:14.765	target	[110.769626] Kernel panic - not syncing: VFS: Unable to mount root fs on unknown-block(2,0)	view boot
26-03-2019 17:00:14.807	target	[110.804845] [<c0e27b60>] (dump_stack) from [<c0346294>] (panic+0xf0/0x274)	view boot
26-03-2019 17:00:14.807	target	[110.811700] [<c0346294>] (panic) from [<c1401550>] (mount_block_root+0x1b0/0x298)	
26-03-2019 17:00:14.990	target	[110.996502] ---[end Kernel panic - not syncing: VFS: Unable to mount root fs on unknown-block(2,0)]---	
26-03-2019 14:38:21.091	target	[9.475937] Kernel panic - not syncing: VFS: Unable to mount root fs on unknown-block(1,0)	
26-03-2019 14:38:21.122	target	[9.508718] [<c0e8401c>] (dump_stack) from [<c0347108>] (panic+0x110/0x2e4)	
26-03-2019 14:38:21.130	target	[9.515676] [<c0347108>] (panic) from [<c15015f0>] (mount_block_root+0x240/0x2a8)	
26-03-2019 17:11:58.108	target	[110.768187] Kernel panic - not syncing: VFS: Unable to mount root fs on unknown-block(2,0)	view boot
26-03-2019 17:11:58.150	target	[110.803434] [<c0e2616c>] (dump_stack) from [<c03462f0>] (panic+0x110/0x294)	view boot

Next steps

- Mais dashboards
  - Top 20 testes, placas e defconfigs que mais falham
- ElastAlert
  - Alerta quando alguma placa parece estar offline
  - Alerta quando um commit específico quebrou uma build

Perguntas?

Referências

- Linaro: https://linaro.org
- LAVA: https://lavasoftware.org/
- KernelCI: https://kernelci.org
- Elastic/Logstash/Kibana: https://www.elastic.co/
- SQUAD: https://squad.readthedocs.io/en/latest/
  - Instância do SQUAD: https://qa-reports.linaro.org
- LKFT: https://lkft.validation.linaro.org
- Contato: charles.oliveira@linaro.org

Obrigado!