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shaping tomorrow with you

Establish an automated testing lab for AGL

Jun 21, 2018

Automotive Linux Summit, Tokyo

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Self Introduction

FUJITSU

- Liu Wenlong(liuwl.fnst@cn.fujitsu.com)
- Linux Software Engineer (2015 ~)
- AGL CIAT Member (2017 ~)
  - focus on CIAT for AGL
  - Drivers test, LTP, Fuego and LAVA

Agenda

- Preface
- LAVA Quickstart
- Fuego Quickstart
- Fuego&LAVA solution
- LAVA tests in Fuego
- Future Work

Preface

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CIAT(Continuous integration automated testing)

Existing tools,

- Autotest
  https://autotest.github.io/
- BuildStream
  https://wiki.gnome.org/Projects/BuildStream/
- **LAVA**
  http://validation.linaro.org
- **Fuego**
  http://fuegotest.org/
- KernelCI
  https://kernelci.org/

Preface

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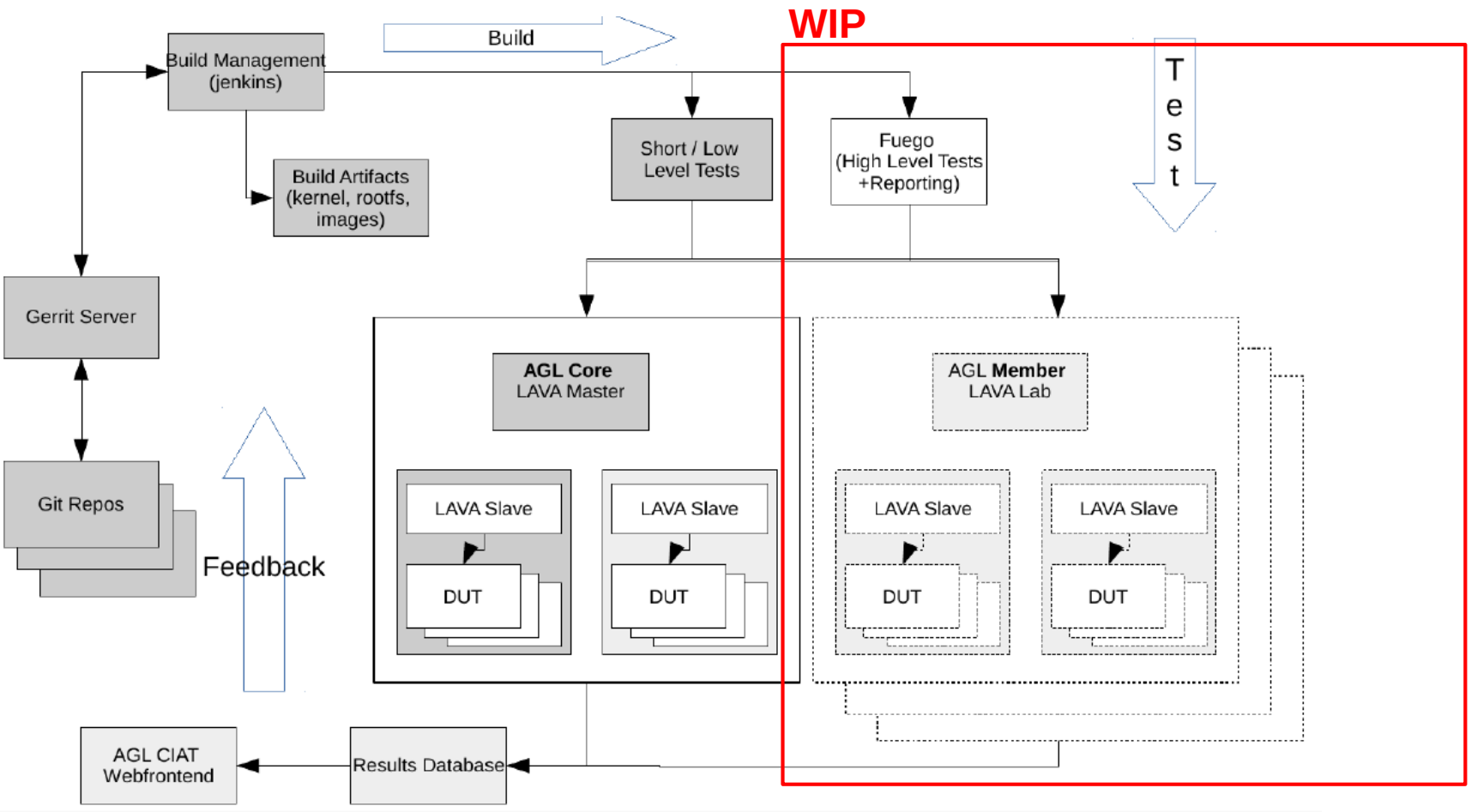
Test tools comparison,

	LAVA	Fuego
Build farm	**No**	**Can be**
Pre-packaged tests	**No**	**Yes**
Jobs management	**No**	**Yes**
Reporting(Results parser)	**Yes**	**Strong**
Distributed lab support	**Yes**	**No**
Board management	**Strong**	**Yes**
System deployment(auto boot)	**Yes**	**No**
Web interface	Yes	Yes
Easy to extend	No	Yes
Easy to install	No	Yes

Fuego+LAVA will be a good solution for our testing lab and AGL CIAT framework.

Preface

AGL testing lab(CIAT loop)



Let's see how to establish an automated testing lab.

Refer to: https://schd.ws/hosted_files/aglammeu17/5c/jsmoeller_How_to_Write_Tests_for_the_AGL_HW_Test_Infra.pdf

LAVA Quickstart

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LAVA installation and configurations,

- LAVA installation,

  https://www.validation.linaro.org/static/docs/v2/installing_on_debian.html

  Or install with docker https://github.com/kernelci/lava-docker (2018.4)

- LAVA configurations,

  - Add new devices

    https://www.validation.linaro.org/static/docs/v2/first-devices.html

  - Devices control(ser2net/PDU)
    https://www.validation.linaro.org/static/docs/v2/first-installation.html

- Do LAVA tests,

  - Write lava tests

  https://www.validation.linaro.org/static/docs/v2/developing-tests.html

  - Submit lava tests with “lava-tool”

  https://www.validation.linaro.org/static/docs/v2/lava-tool.html

Let’s have a look at the LAVA test definition to lay the groundwork for the later parts.

LAVA Quickstart

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LAVA test definition (YAML file),

```
metadata:
  git.branch: agl-branch
  image.type: AGL
  ......

device_type: r8a7796-m3ulcb
......
actions:
- deploy:
    to: nbd
    os: oe
    kernel:
      url: http://xxx/Image
    ......

- boot:
    timeout:
      minutes: 10
    method: u-boot
    ......
```

Meta section

Action section

Boot section

```
- test:
    definitions:
    - repository: https://git_qa_repo[1]
      from: git
      path: test-suites/yocto-ptest.yaml
      name: yocto-ptest

- test:
    definitions:
    - repository:
        ......
        run:
          steps:
          - lava-test-set start set-pass
          ......
          - lava-test-set stop set-fail
      from: inline
      name: health-test
      path: inline/health-test.yaml
```

Test section

We can easily to do different tests on different HWs by customizing different sections.

[1] https://git.automotivelinux.org/src/qa-testdefinitions

For details, refer to: [https://www.validation.linaro.org/static/docs/v2/dispatcher-actions.html]

About those “sections” above, refer to:

[https://schd.ws/hosted_files/aglammeu17/5c/jsmoeller_How_to_Write_Tests_for_the_AGL_HW_Test_Infra.pdf]

LAVA Quickstart

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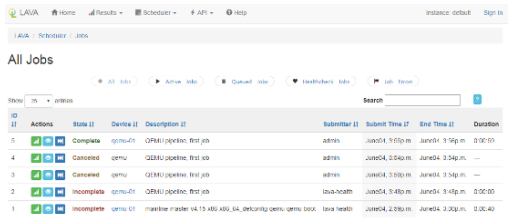
LAVA connections,

Tester/developer side:

LAVA Web interface



- Write/Submit lava tests
- Check test results
- Boards management
- …

LAVA HOST:

LAVA master
LAVA worker
…

Services:
dhcpd/tftpd/nbd/nfs/…

Power Management

Serial management

Board farm:

Board Power Supply

Relay /PDU

serial/network

serial

serial

serial

DUT 01

DUT 02

……

WAN …

LAN …

We can use LAVA in our auto-testing lab now.

LAVA Quickstart

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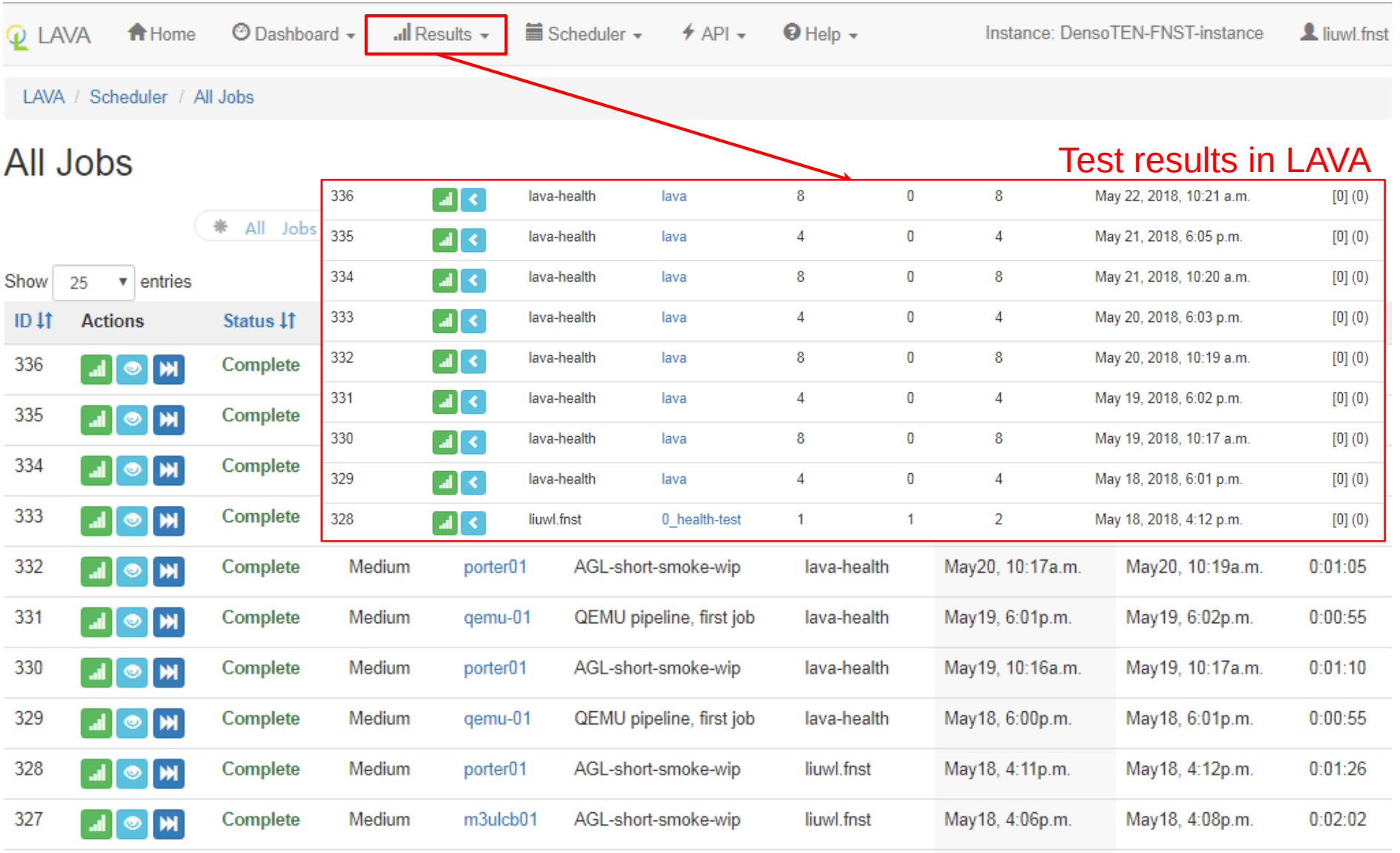
LAVA test results,



LAVA Quickstart

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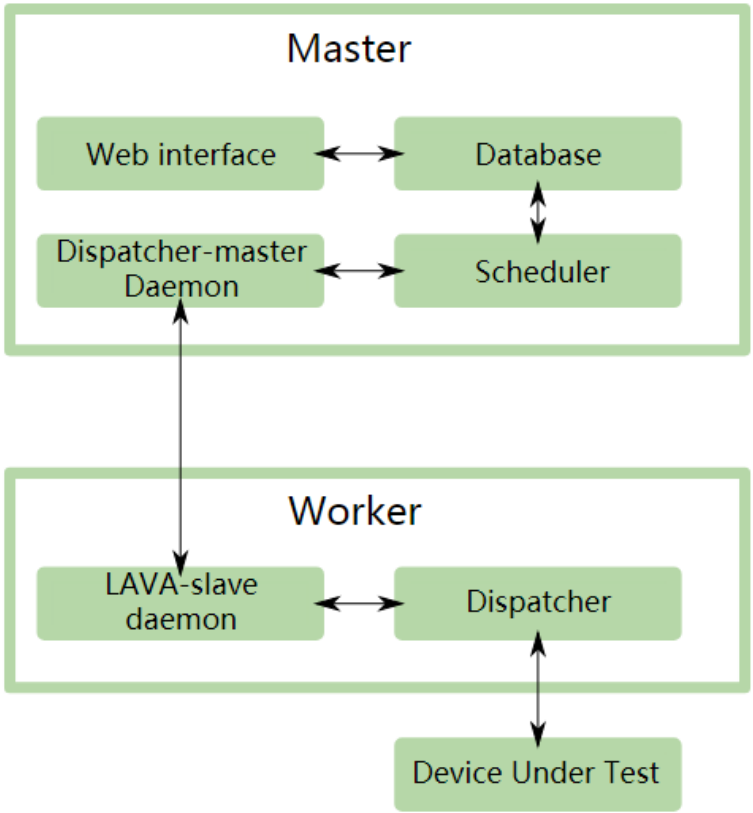
LAVA features and diagram,

- Testing changes on multi-HW
- Boot testing, bootloader testing and system level testing
- Not a test lab
- Not a build farm
- Not a complete CI solution
- Not a set of tests
- Distributed test lab
- Support various bootloader



Source from https://www.validation.linaro.org/static/docs/v2/first-installation.html

For details, please refer to,
[https://www.validation.linaro.org/static/docs/v2/contents.html]

Fuego Quickstart

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Fuego installation and configurations,

- Fuego installation steps
  http://fuegotest.org/wiki/Fuego_Quickstart_Guide
- Add a board
  http://fuegotest.org/wiki/Adding_a_board
- Add a toolchain
  http://fuegotest.org/wiki/Adding_a_toolchain
- Add a test
  http://fuegotest.org/wiki/Adding_a_test
- How to write good tests?
  http://fuegotest.org/wiki/Presentations

Fuego Quickstart

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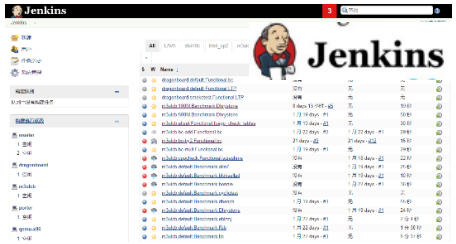
Fuego connections,

Tester/developer side:

Jenkins web interface



Users can,
- Job management
- Run tests
- Check test results

Fuego Server:

Jenkins:
- job management
- job trigger
- test results display
- etc

File server:
- share test logs
- documents
- etc

Fuego Framework
- test tarball management
- test scripts (build/run/analysis)
- boards/toolchain configuration
...

SSH/...

SSH/...

SSH/...

Board farm:

Board 01

Board 02

……

Board Power Supply

WAN …

LAN …

We can use Fuego in our auto-testing LAB now.

Fuego Quickstart

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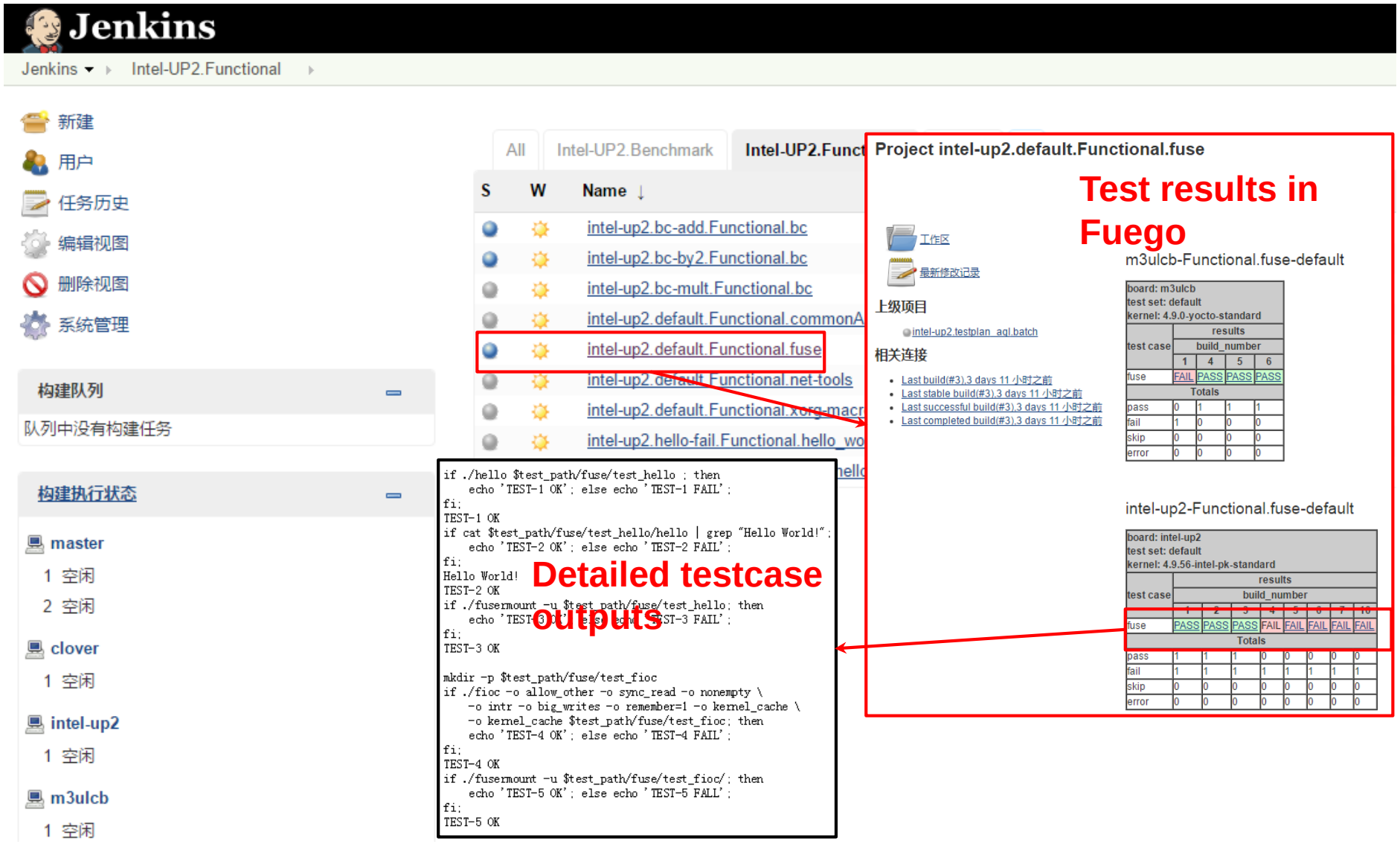
Fuego test results(report),



Fuego Quickstart

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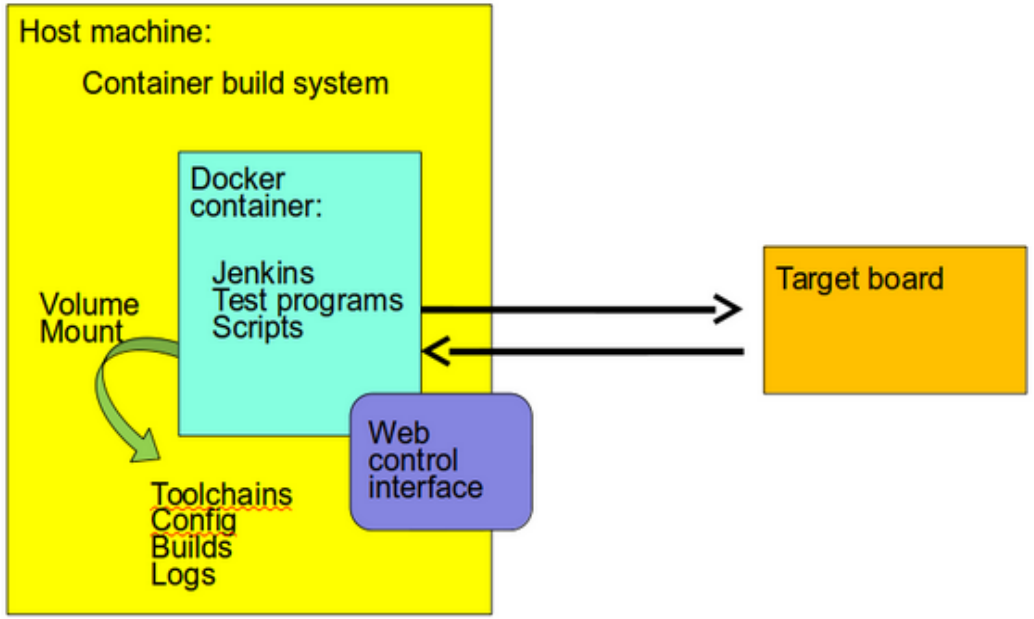
Fuego features and diagram,

- Highly customizable
- Unified test outputs
- Flexible test configuration
- Running tests in batches
- Pre-packaged tests
- Jenkins based
- Do tests with command lines
- Board setup is simple & flexible



Source from http://fuegotest.org/wiki/Architecture

For details, please refer to, http://fuegotest.org/wiki/Architecture

Fuego&LAVA solution

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To do more with LAVA and Fuego,

- If we want to do LAVA+Fuego test, how?
  - Use LAVA as a board handler layer (existing feature)
    - Do LAVA job submit within Fuego
    - Enhanced board management for Fuego
    - LAVA board lab can be used in Fuego
    - Fuego has the ability to do OS upgrade
  - Use Fuego as LAVA test wrapper and build farm (new)
    - Do specified OS deployment/upgrades on real hardware automatically
    - With the help of Fuego, LAVA has the ability to make test results meaningful
    - Over 100+ Fuego pre-packaged tests can be used in LAVA
    - Fuego has the ability to do tests with remote board lab

Let's see the existing "Fuego+LAVA" solution first.

Fuego&LAVA solution

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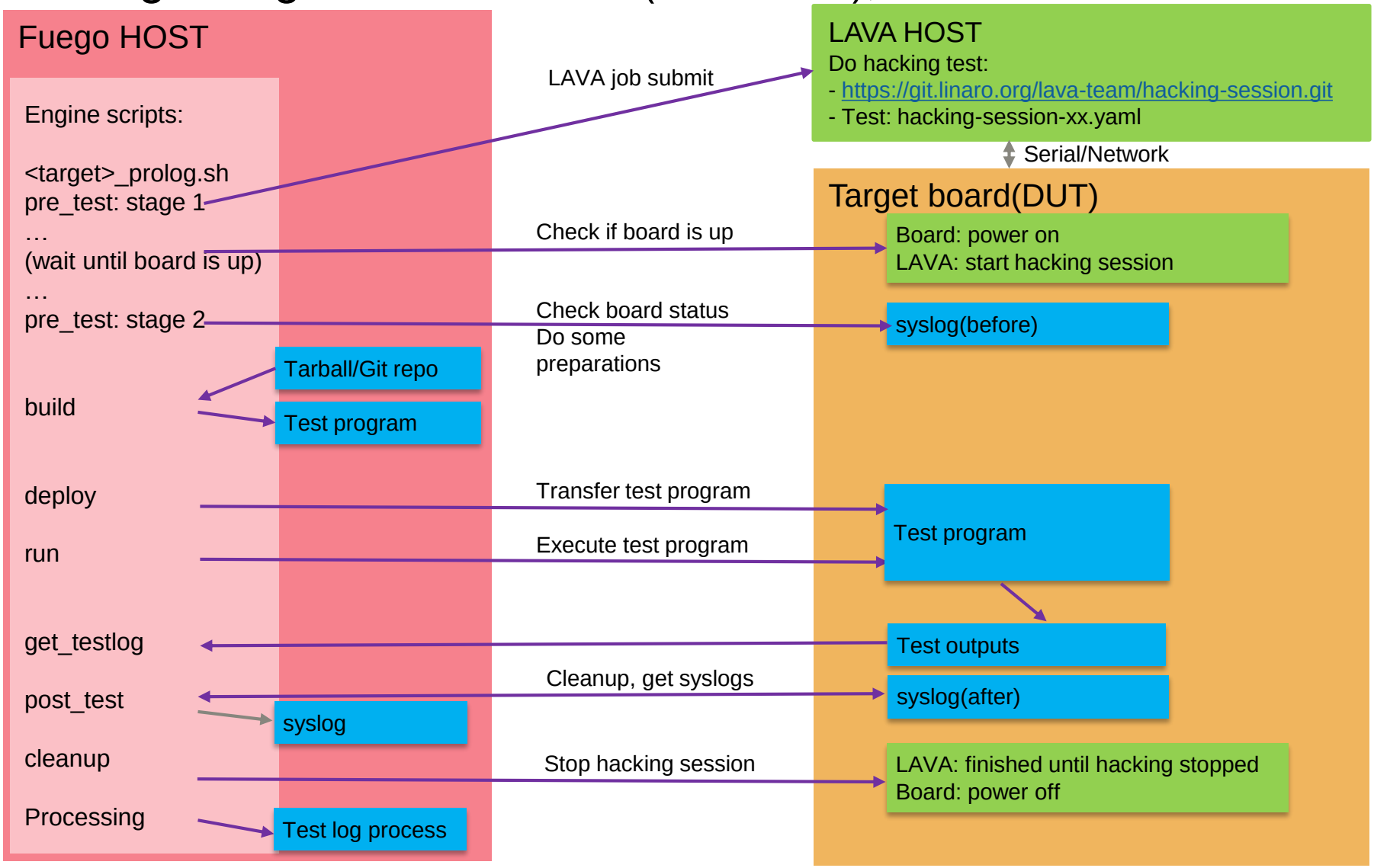
Existing “Fuego+LAVA” feature(work flow),



Refer to, http://fuegotest.org/wiki/Architecture#fuego_test_phases

Fuego&LAVA solution

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Existing “Fuego+LAVA” feature(quickstart), (example with “Intel UP2” board)

- Enable the following variables in board file:
  - TARGET_SETUP_LINK="fuego-lava-target-setup"
    TARGET_TEARDOWN_LINK="fuego-lava-target-teardown"

- Add a “upsquared.lava” and a “upsquared.lava.yaml”:
  - file “upsquared.lava” holds env variables
    credentials and values for KERNEL,ROOTFS, LAVA_HOST, etc
  - file “upsquared.lava.yaml” holds a template for the lava test job

We can do Fuego+LAVA tests on Intel UP2 board with those steps above.

Refer to: https://bitbucket.org/tbird20d/fuego/commits/7d6a953455ada9b79d8a3a7ede523cd79647de5c

Fuego&LAVA solution

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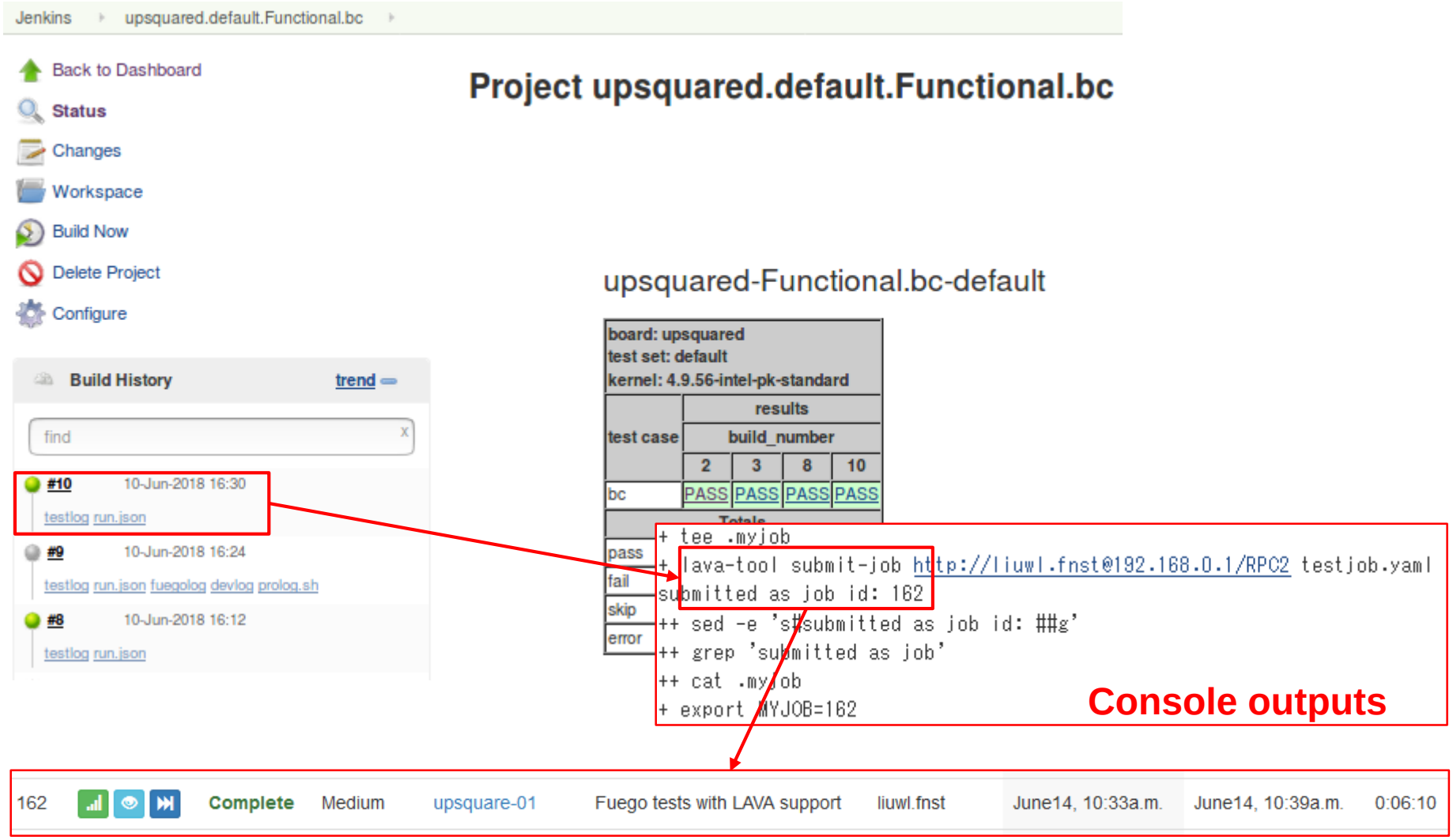
Existing “Fuego+LAVA” feature(test results),
(example, “Functinal.bc” test on Intel UP2 board)



Fuego&LAVA solution

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New “Fuego+LAVA” feature,

About the current “Fuego+LAVA” solution, it CANNOT,

- Not support remote board lab
- Cannot save test duration
- Cannot customize LAVA tests

We have those demands above, so how?

- Add a new job to generate yaml test files to support remote board lab
  - To use AGL “releng-scripts”[1] will be a nice choice
- LAVA tests customization(do multi-tests at one DUT boot)
  - add new tests in AGL qa-testdefinitions repo[2] to yaml test files

Let’s have a look at the new feature next.

[1] https://git.automotivelinux.org/AGL/releng-scripts
[2] https://git.automotivelinux.org/src/qa-testdefinitions

Fuego&LAVA solution

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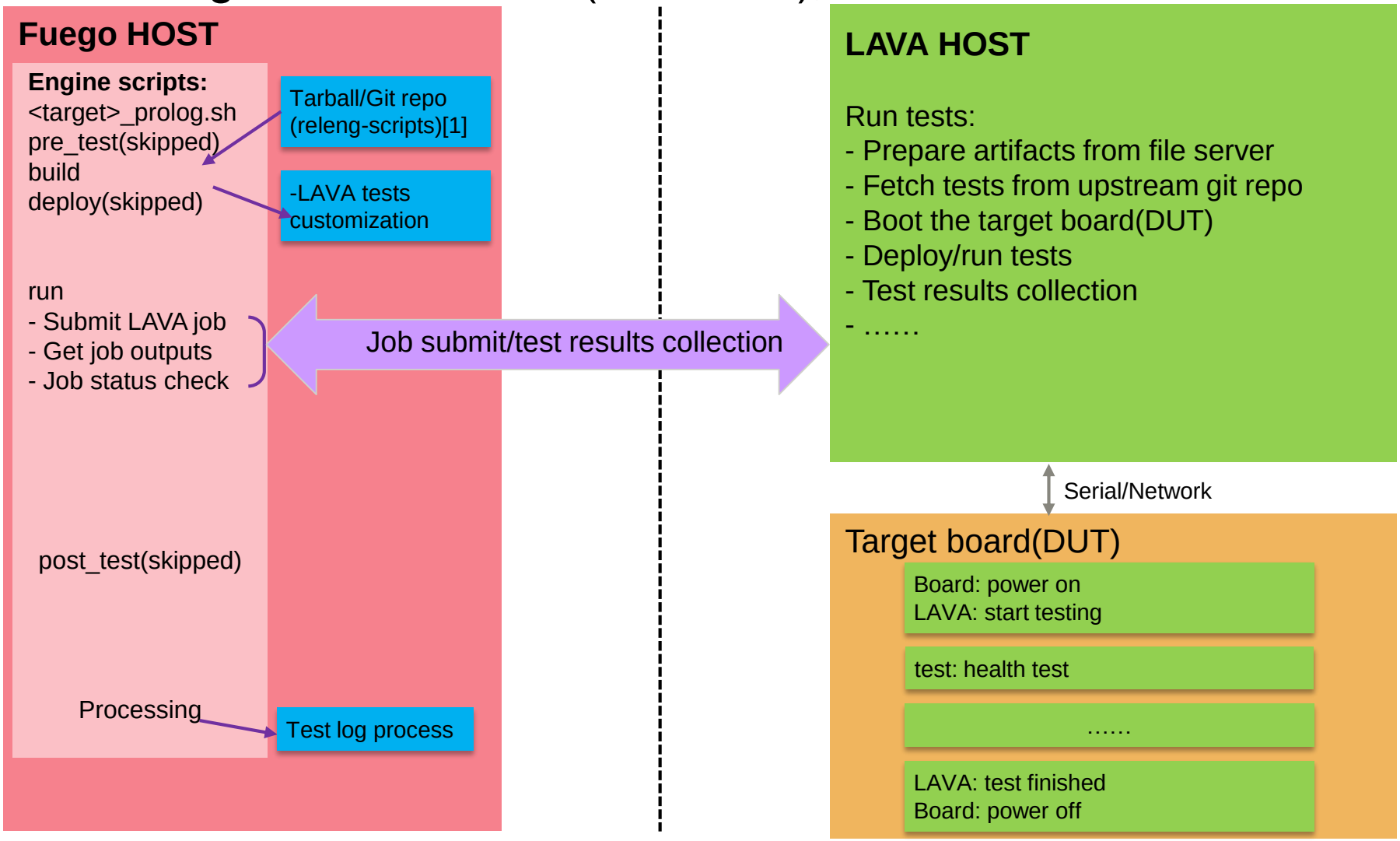
New “Fuego+LAVA” feature(work flow),



[1] https://git.automotivelinux.org/AGL/releng-scripts/

Refer to, http://fuegotest.org/wiki/Architecture#fuego_test_phases

Fuego&LAVA solution

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New feature: add a new test to generate yaml test files,

- Add a new test, (named “Functional.lava” in this example)
  - Download the releng-scripts[1] to “Functional.lava/releng-scripts.tar.gz”

- LAVA tests generation and customization,

```
$ cat /fuego-core/engine/tests/Functional.lava/fuego_test.sh
tarball=releng-scripts.tar.gz

……

function test_build {
    # generate lava yaml test file.
    ./utils/create-jobs.py --machine $NODE_NAME --test ${FUNCTIONAL_LAVA_TESTS} ¥
            --boot ${FUNCTIONAL_LAVA_BOOT_TYPE} ¥
                    --url ${FUNCTIONAL_LAVA_FETCH_URL} > test.yaml

    ……
}
```

Those test specified here will be added to yaml test file.

Now, AGL only support health-test, smoke,yocto-ptest in upstream repo[1].
But we can specify whatever other tests from github or somewhere and add it to yaml test file.

[1] https://git.automotivelinux.org/AGL/releng-scripts/tree/templates/tests

Fuego&LAVA solution

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New feature: jobs submit and results reporting,

- Job submit with lava-tool,

```
$ lava-tool submit-job https://${LAVA_USER}@${LAVA_HOST} test.yaml
# lava-tool can also be used to check the job status and get test outputs from LAVA.
```

- LAVA outputs analysis,

LAVA outputs


```
- {"dt": "2018-05-07T10:50:41.001315", "lvl": "debug", "msg": "Received signal: <TESTSET> START set-pass"}
- {"dt": "2018-05-07T10:50:41.001630", "lvl": "info", "msg": "Starting test_set set-pass"}
- {"dt": "2018-05-07T10:50:41.062658", "lvl": "target", "msg": "<LAVA_SIGNAL_STARTTC always-pass>"}
- {"dt": "2018-05-07T10:50:41.063024", "lvl": "target", "msg": "<LAVA_SIGNAL_ENDTC always-pass>"}
- {"dt": "2018-05-07T10:50:41.063352", "lvl": "target", "msg": "<LAVA_SIGNAL_TESTCASE TEST_CASE_ID=always-pass RESULT=pass>"}
- {"dt": "2018-05-07T10:50:41.063636", "lvl": "target", "msg": "+ lava-test-set stop set-pass"}
- {"dt": "2018-05-07T10:50:41.063917", "lvl": "target", "msg": "<LAVA_SIGNAL_TESTSET STOP>"}
- {"dt": "2018-05-07T10:50:41.064194", "lvl": "target", "msg": "+ lava-test-set start set-fail"}
- {"dt": "2018-05-07T10:50:41.064466", "lvl": "target", "msg": "<LAVA_SIGNAL_TESTSET START set-fail>"}
- {"dt": "2018-05-07T10:50:41.065469", "lvl": "debug", "msg": "Received signal: <STARTTC> always-pass"}
- {"dt": "2018-05-07T10:50:41.066349", "lvl": "debug", "msg": "Received signal: <ENDTC> always-pass"}
- {"dt": "2018-05-07T10:50:41.067118", "lvl": "debug", "msg": "Received signal: <TESTCASE> TEST_CASE_ID=always-pass RESULT=pass"}
- {"dt": "2018-05-07T10:50:41.067514", "lvl": "results", "msg": {"case": "always-pass", "definition": "0_health-test", "result": "pass", "set": "set-pass"}}
```


Easy to analyse and split the test outputs from LAVA.

Test name and result can be easily generated by the following key-value in the test outputs,

- “case”: testcase
- “result”: result
- “set”: testset

Fuego&LAVA solution

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Test results with new “Fuego+LAVA” feature(Fuego side),

Jenkins

Jenkins ▸ m3ulcb.default.Functional.lava ▸

返回面板
状态
修改记录
工作空间
立即构建
删除 Project
配置

Build History 构建历史

find

#30 2018-6-13 下午4:39
testlog run.json

#29 2018-6-13 下午3:20

Project m3ulcb.default.Functional.lava

工作区
最新修改记录

相关连接

- Last build(#30),1 小时 33 分之前
- Last stable build(#30),1 小时 33 分之前
- Last successful build(#30),1 小时 33 分之前
- Last failed build(#25),3 小时 43 分之前
- Last unsuccessful build(#27),3 小时 15 分之前

```
Received signal: <TESTSET> STOP
Closing test_set set-pass
Received signal: <TESTSET> START set-fail
Starting test_set set-fail
+ lava-test-case always-fail --shell false
<LAVA_SIGNAL_STARTTC always-fail>
<LAVA_SIGNAL_ENDTC always-fail>
<LAVA_SIGNAL_TESTCASE TEST_CASE_ID=always-fail RESULT=fail>
+ lava-test-set stop set-fail
<LAVA_SIGNAL_TESTSET STOP>
+ set +x
Received signal: <STARTTC> always-fail
Received signal: <ENDTC> always-fail
Received signal: <TESTCASE> TEST_CASE_ID=always-fail RESULT=fail
```

Test case outputs in detail

m3ulcb-Functional.lava-lava

board: m
test set:
kernel: u

test case	8	9	10	11	12	13	14	15	16	17
0_health-test	PASS	PASS	PASS	PASS	PASS	-	PASS	PASS	-	PASS
1_bc-test	PASS	PASS	PASS	PASS	PASS	-	PASS	PASS	-	PASS
auto-login-action	PASS	PASS	PASS	PASS	PASS	-	PASS	PASS	-	PASS
bootloader-overlay	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
http-download	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS
http-download-1	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS	PASS

LAVA tests can be triggered and its testcases can also be parsed and displayed in Fuego.

Fuego&LAVA solution

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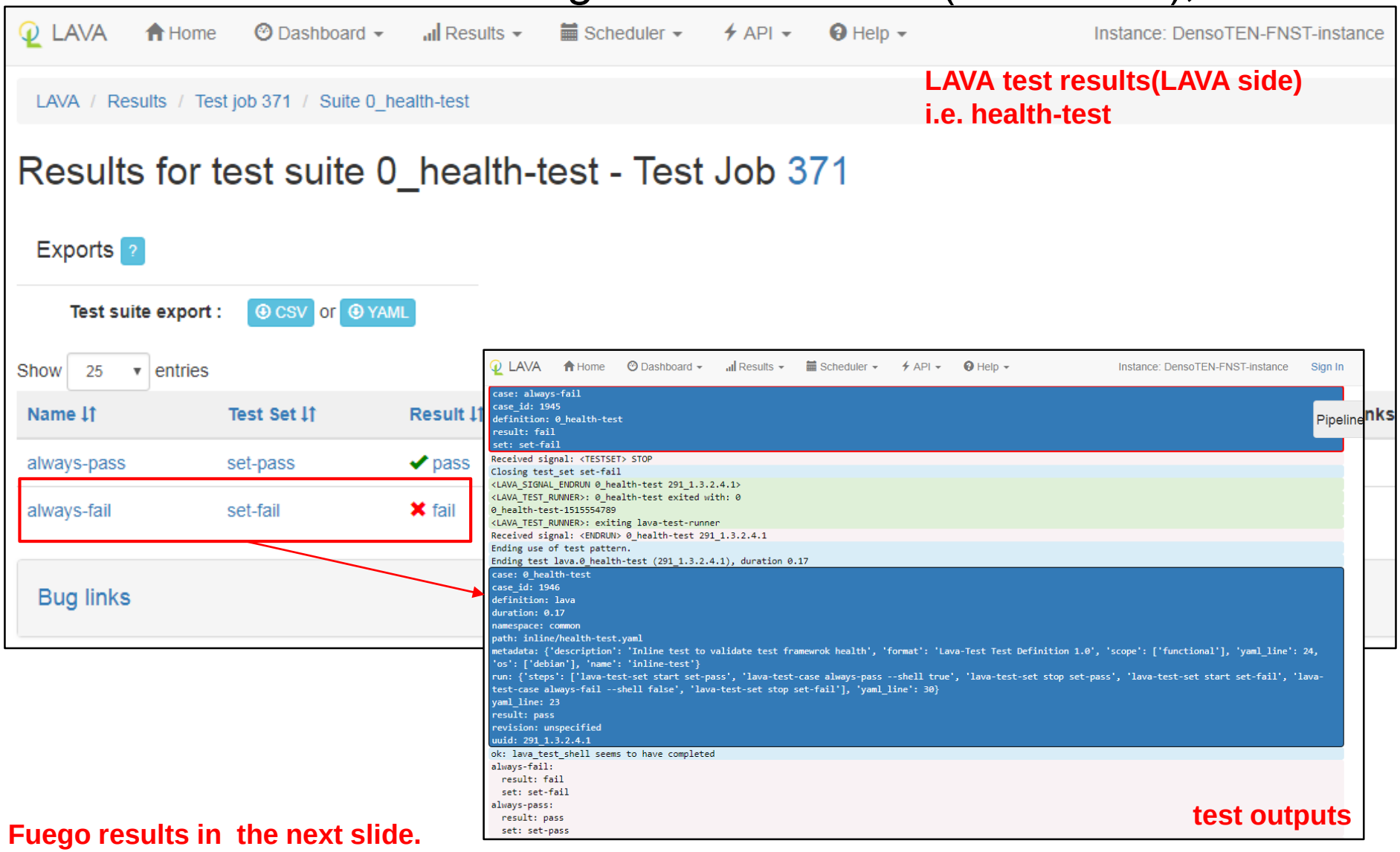
Test results with new “Fuego+LAVA” feature(LAVA side),



Fuego results in the next slide.

LAVA tests in Fuego

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What is LAVA test,

The generic lava tests,

- Usually hosted in git repo[1]
  - yaml file describing the (set of) test(s) and scripts to execute the test(s)[2]
- Tests from,
  - from inline/git

How can we do Functional/Benchmark tests with LAVA? i.e. Functional.LTP.

- Scenario 1: Pre-installed LTP on DUT (i.e. agl-demo-platform-qa)
- Scenario 2: LTP not installed on the DUT (i.e. agl-demo-platform)

Different solution will be used for different scenarios.
Let talk about this in the next slide.

[1] https://git.automotivelinux.org/src/qa-testdefinitions
[2] https://schd.ws/hosted_files/aglammeu17/5c/jsmoeller_How_to_Write_Tests_for_the_AGL_HW_Test_Infra.pdf

LAVA tests in Fuego

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Functional/Benchmark tests for LAVA. (Example, Functional.LTP)

- About scenarios 1 & 2, yaml test files from git/inline can be as below[1],

```
……
params:
   TESTS: math
   ……

run:
   steps:
   - if [ ! -e /opt/ltp ]; then wget FUEGO_BUILD_SERVER/TARBALL && tar --strip-components=1 -xzf TARBALL; else
cd /opt/ltp; fi
   - ……
```

Download built binaries from Fuego.

The TARBALL above is the pre-built LTP binaries(built in Fuego with ftc tool).

- About scenarios 2,
  - test from tar will be a better solution,
    BUT, LAVA said “Support is planned for tar and url”[2].

  - LAVA transport support will also be a good solution(more Fuego style)
    (WIP)

[1] https://git.linaro.org/qa/test-definitions.git/tree/automated/linux/ltp
[2] https://www.validation.linaro.org/static/docs/v2/actions-test.html#from

LAVA tests in Fuego

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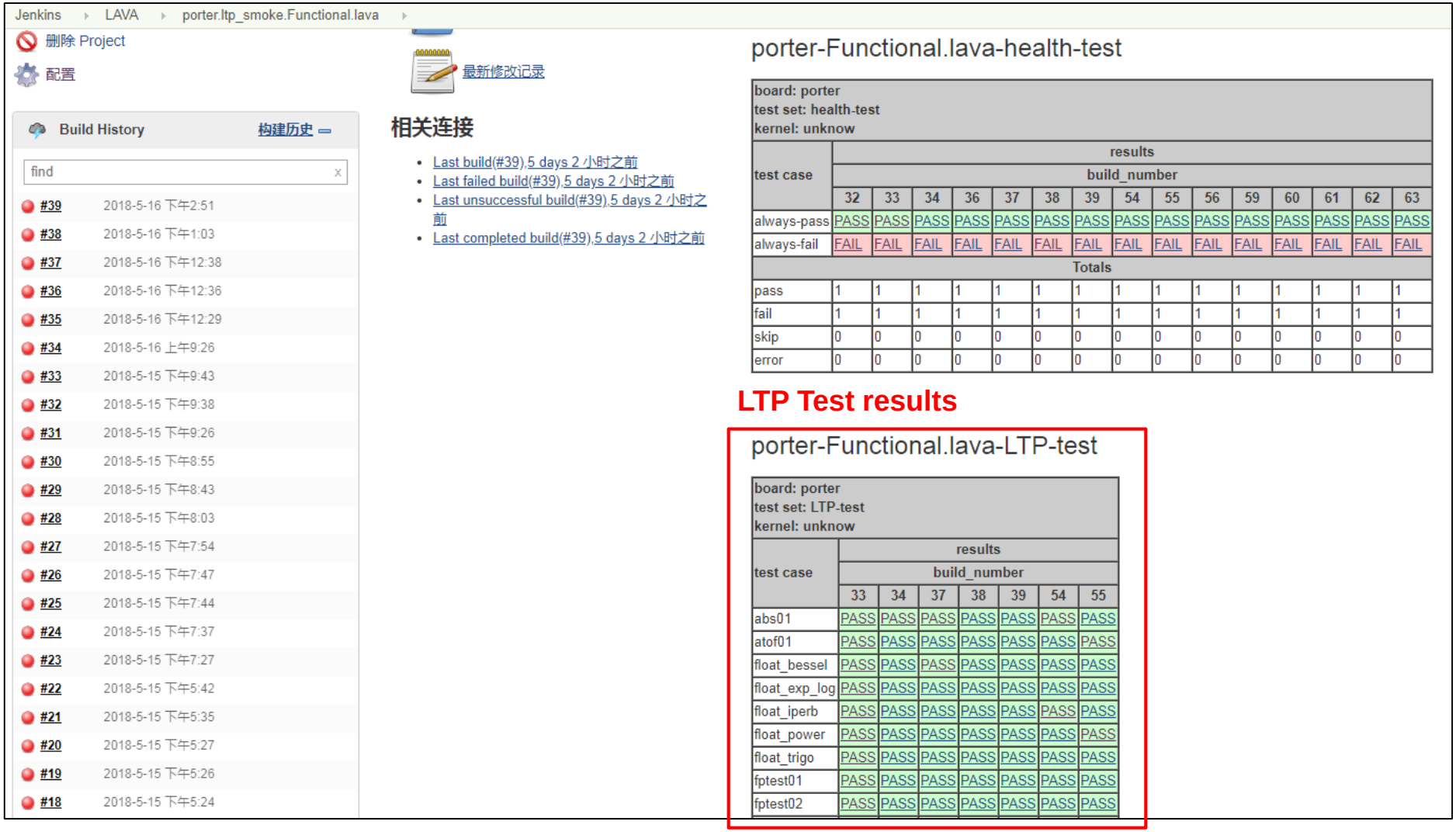
LTP test with “Fuego+LAVA” solution(Fuego side),



LAVA tests in Fuego

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LTP test with “Fuego+LAVA” solution(LAVA side),

LAVA Home Dashboard Results Scheduler API Help Instance: DensoTEN-FNST-instance

Results for test suite 1_LTP-test - Test Job 291

Exports ?

Test suite export : CSV or YAML

Show 25 entries

Name	Test Set	Result	Measurement	Units	Logged	Bug Links
abs01	—	pass	—		05/16/2018 2:56 p.m.	[0]
atof01	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
float_bessel	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
float_exp_log	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
float_iperb	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
float_power	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
float_trigo	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
fptest01	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
fptest02	—	pass	—	—	05/16/2018 2:56 p.m.	[0]
nextafter01	—	pass	—	—	05/16/2018 2:56 p.m.	[0]

LTP test results

Future Work

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About LAVA+Fuego:

- Run build phase separately and make tar for built artifacts
- Avoid false positive for test outputs from LAVA
- Watch the new features about LAVA.
- Take part in “LAVA Transport Support” related works
  (Tim Bird/Daniel Sangorrin/Jan-Simon are working on this)

OTHERS:

- New tests for AGL qa-testdefinition
- Benchmark test results displayed in html table
- Fuego failed tests investigation for R-Car M3 and Intel UP2
- Kernel LTSI test(BSP tests, drivers tests, OSS tests)

Introduction of Demo showcase

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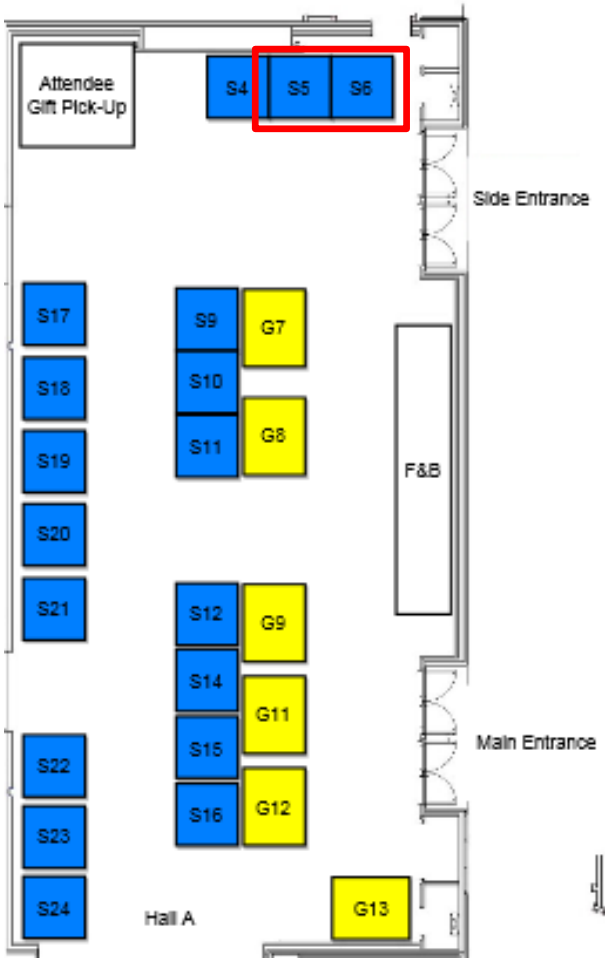
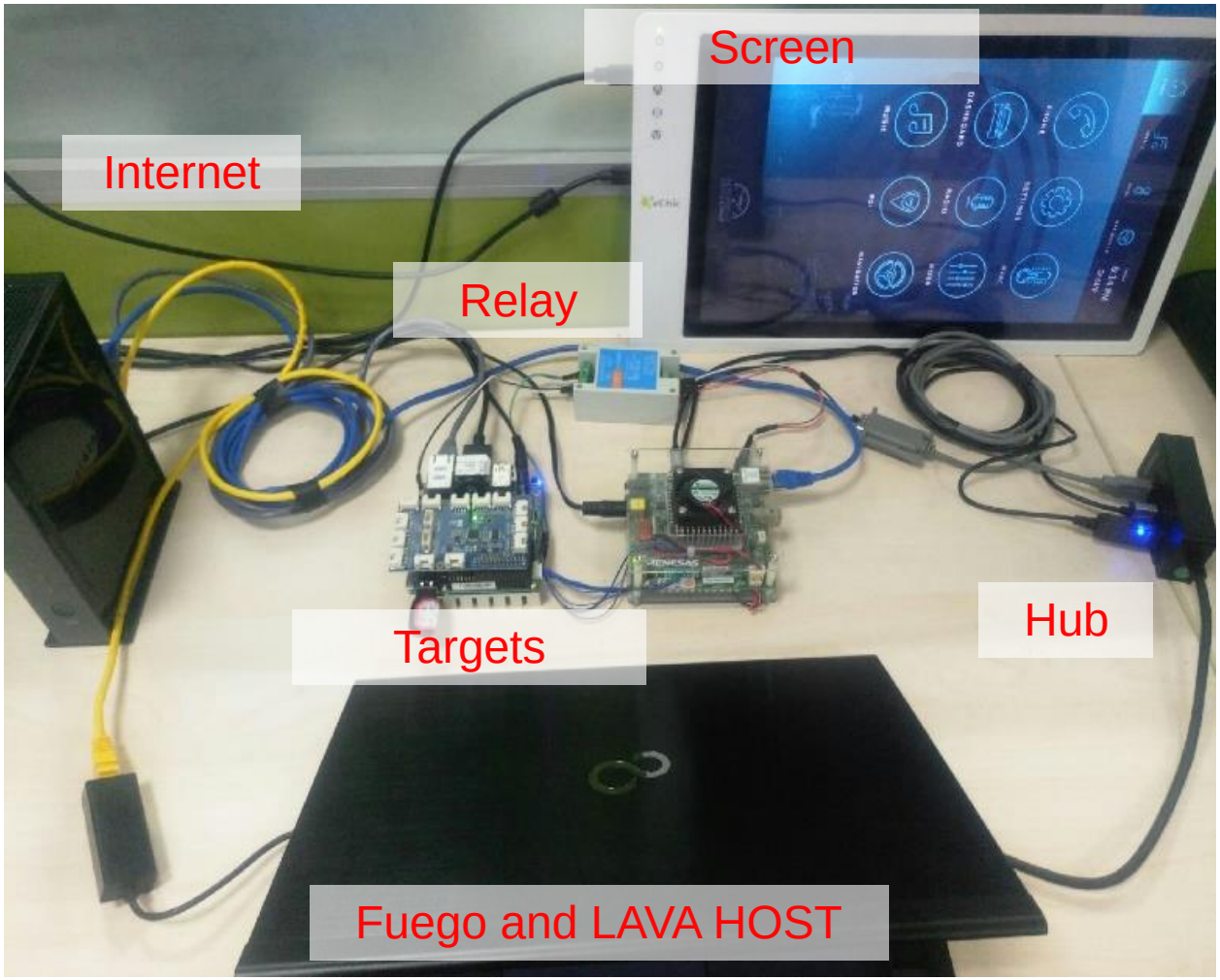
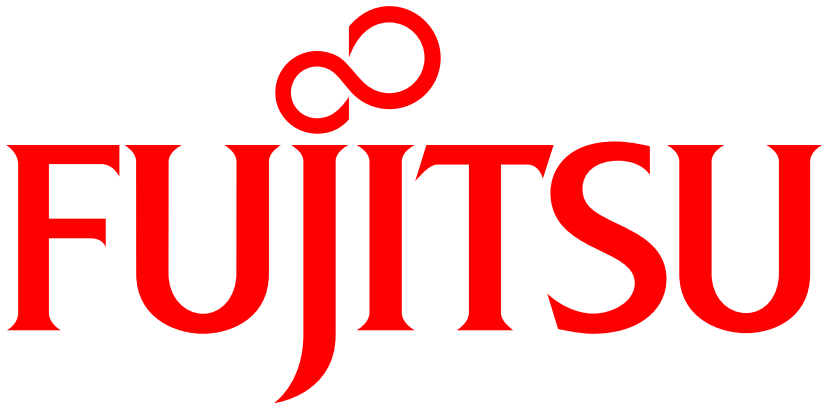
Welcome to our Demo Showcase…





Thank you!

liuwl.fnst@cn.fujitsu.com



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