



arm

Testing TF-A with QEMU in OpenCI

Harrison Mutai

15/12/2022

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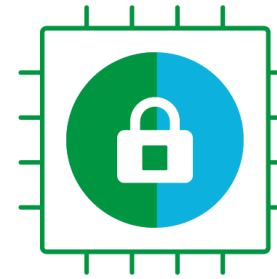
- Navigating the Jenkins UI
- Navigating the test results

+ Running local QEMU tests

+ Changes in TF-A CI Scripts

- Overview of the CI architecture
- Changes to build and run packages

+ Final Comments and Conclusions



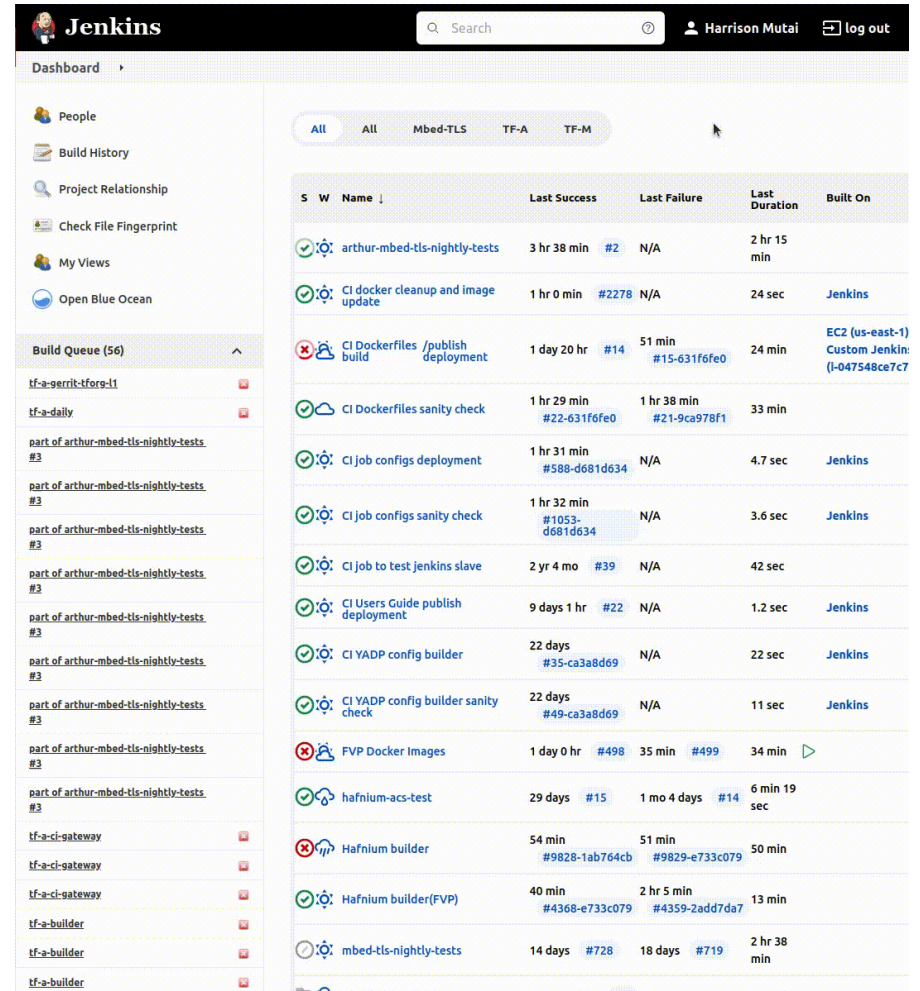
arm

Running QEMU tests in OpenCI

Running QEMU tests in OpenCI

Navigating the Jenkins UI

- + Open the **tf-a-ci-gateway** job console in Jenkins:
<https://ci.trustedfirmware.org/job/tf-a-ci-gateway>
- + Select *Build with Parameters* from the left menu
- + Enter **qemu-boot-tests** into the **TEST_GROUPS** input
- + Hit build!



The screenshot shows the Jenkins dashboard with a search bar at the top right and a user profile for Harrison Mutai. The main content area displays a table of build jobs. The table has columns for status (S), name (Name), last success, last failure, last duration, and built on. The jobs listed include:

S	Name	Last Success	Last Failure	Last Duration	Built On
✓	arthur-mbed-tls-nightly-tests	3 hr 38 min #2	N/A	2 hr 15 min	
✓	CI docker cleanup and image update	1 hr 0 min #2278	N/A	24 sec	Jenkins
✗	CI Dockerfiles /publish build	1 day 20 hr #14	51 min #15-631f6fe0	24 min	EC2 (us-east-1) Custom Jenkins (I-047548ce7c7)
✓	CI Dockerfiles sanity check	1 hr 29 min #22-631f6fe0	1 hr 38 min #21-9ca978f1	33 min	
✓	CI job configs deployment	1 hr 31 min #588-d681d634	N/A	4.7 sec	Jenkins
✓	CI job configs sanity check	1 hr 32 min #1053-d681d634	N/A	3.6 sec	Jenkins
✓	CI job to test jenkins slave	2 yr 4 mo #39	N/A	42 sec	
✓	CI Users Guide publish deployment	9 days 1 hr #22	N/A	1.2 sec	Jenkins
✓	CI YADP config builder	22 days #35-ca3a8d69	N/A	22 sec	Jenkins
✓	CI YADP config builder sanity check	22 days #49-ca3a8d69	N/A	11 sec	Jenkins
✗	FVP Docker Images	1 day 0 hr #498	35 min #499	34 min	
✓	hafnium-acs-test	29 days #15	1 mo 4 days #14	6 min 19 sec	
✗	Hafnium builder	54 min #9828-1ab764cb	51 min #9829-e733c079	50 min	
✓	Hafnium builder(FVP)	40 min #4368-e733c079	2 hr 5 min #4359-2add7da7	13 min	
○	mbed-tls-nightly-tests	14 days #728	18 days #719	2 hr 38 min	

Running QEMU tests in OpenCI

Navigating the Jenkins UI

- + Open the **tf-a-ci-gateway** job console in Jenkins:
<https://ci.trustedfirmware.org/job/tf-a-ci-gateway>
- + Select *Build with Parameters* from the left menu
- + Enter **qemu-boot-tests** into the **TEST_GROUPS** input
- + Hit build!

The screenshot shows the Jenkins web interface for the 'tf-a-ci-gateway' job. The breadcrumb navigation at the top reads 'Dashboard > TF-A > tf-a-ci-gateway'. The left sidebar contains a menu with options: 'Back to Dashboard', 'Status', 'Changes', 'Workspace', 'Build with Parameters', 'Rebuild Last', 'Favorite', and 'Open Blue Ocean'. The main content area is titled 'Project tf-a-ci-gateway' and includes a description: 'Main job entry point for a Trusted Firmware A (TF-A) CI.' Below this, there are sections for 'Last Successful Artifacts' (listing merge.json, report.html, and report.json), 'Recent Changes', 'Subprojects' (with a 'Static' sub-section listing 'tf-a-builder(blocking)'), 'Upstream Projects' (listing various gerrit and static-checks jobs), and 'Downstream Projects' (listing 'tf-a-builder'). A 'Permalinks' section at the bottom provides links to the last build, last stable build, last successful build, last failed build, last unsuccessful build, and last completed build.

Running QEMU tests in OpenCI

Navigating the test results

- + An interactive GUI is produced by the `tf-a-ci-gateway` job
- + Provides summary of individual test results
- + Results also provided in a JSON-format file
- + Specific test cases can be re-run directly from this console

Build #24569 (Dec 11, 2022, 7:55:46 PM)

Build Artifacts

[report.html](#) 15.32 KB [view](#)
[report.json](#) 598 B [view](#)



No changes.



Started by upstream project [tf-a-main](#) build number [464](#) originally caused by:

- Started by upstream project [tf-a-daily](#) build number [379](#) originally caused by:
 - Started by timer



This run spent:

- 15 sec waiting;
- 5 min 14 sec build duration;
- 5 min 29 sec total from scheduled to completion.



Test Group	TF Build Config	Run Config	Status
qemu boot tests	qemu default	qemu linux.rootfs.fip.uefi.virt	SUCCESS <input type="checkbox"/>
		qemu linux.rootfs.fip.uefi.virt.debug	SUCCESS <input type="checkbox"/>
	qemu tbb	qemu linux.rootfs.fip.uefi.virt.debug	SUCCESS <input type="checkbox"/>

Select tests by result: None | SUCCESS | UNSTABLE | FAILURE

Select build configurations, and click the button to re-trigger builds. Use **Shift+Click** to alter parameters when re-triggering.

Local commands

```
workspace=/tmp/workspace test_run=1 test_groups=qemu-boot-tests/qemu-default:qemu-linux.rootfs.fip.uefi-virt script/run_local_ci.sh
```

```
{
  "job": "tf-a-builder",
  "build_job": "tf-a-builder",
  "jenkins_url": "http://ci.trustedfirmware.org",
  "child_build_numbers": [
    "1531625",
    "1531618",
    "1531628"
  ],
  "test_files": [
    "0000qemu-boot-testsqemu-default,nil,nil,nil;qemu-linux.rootfs.fip.uefi-virt.test",
    "0001qemu-boot-testsqemu-default,nil,nil,nil;qemu-linux.rootfs.fip.uefi-virt.debug.test",
    "0002qemu-boot-testsqemu-tbb,nil,nil,nil;qemu-linux.rootfs.fip.uefi-virt.debug.test"
  ],
  "test_results": {
    "1531625": "SUCCESS",
    "1531618": "SUCCESS",
    "1531628": "SUCCESS"
  }
}
```



Running QEMU tests in OpenCI

Navigating the test results

- + The result in the status column is a link to the `tf-a-builder` that run the test
- + Provides access to artefacts from the test and all logs
- + Terminal symbol links to the console log of that job
- + Results are retained for up to 15 days

Build #24569 (Dec 11, 2022, 7:55:46 PM)



Build Artifacts

[report.html](#) 15.32 KB [view](#)
[report.json](#) 598 B [view](#)



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This run spent:

- 15 sec waiting;
- 5 min 14 sec build duration;
- 5 min 29 sec total from scheduled to completion.



Test Group	TF Build Config	Run Config	Status
qemu boot tests	qemu default	qemu linux.rootfs fip.uefi virt	SUCCESS
		qemu linux.rootfs fip.uefi virt debug	SUCCESS
	qemu tbb	qemu linux.rootfs fip.uefi virt debug	SUCCESS

Select tests by result: None | SUCCESS | UNSTABLE | FAILURE

Select build configurations, and click the button to re-trigger builds.
Use **Shift+Click** to alter parameters when re-triggering.

Rebuild selected configs

Rebuild this job

Local commands

```
workspace=/tmp/workspace test_run=1 test_groups=qemu-boot-tests/qemu-default:qemu-linux.rootfs-fip.uefi-virt script/run_local_ci.sh
```

Build #1531625 (Dec 11, 2022, 7:56:17 PM)

Test Job id: [11268048](#)
LAVA log: [lava.log](#)
Build [tf-a-daily](#) #379



Build Artifacts

No changes.



Started by upstream project [tf-a-ci-gateway](#) build number [24569](#)
originally caused by:

- Started by upstream project [tf-a-main](#) build number [464](#)
originally caused by:
 - Started by upstream project [tf-a-daily](#) build number [379](#)
originally caused by:
 - Started by timer



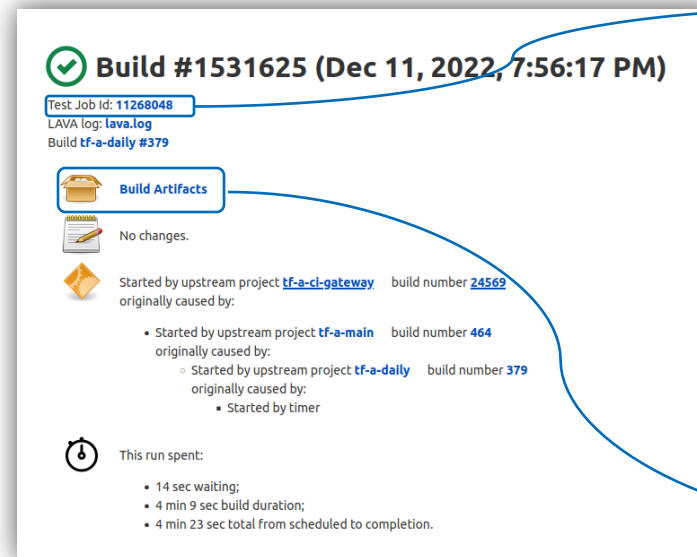
This run spent:

- 14 sec waiting;
- 4 min 9 sec build duration;
- 4 min 23 sec total from scheduled to completion.

Running QEMU tests in OpenCI

Navigating the test results

- + LAVA populates results live; the plain logs can be downloaded after the run.
- + The interactive LAVA console is available as soon as the tf-a-builder submits the job to LAVA



Build #1531625 (Dec 11, 2022, 7:56:17 PM)

Test Job ID: 11268048
LAVA log: lava.log
Build tf-a-daily #379

Build Artifacts

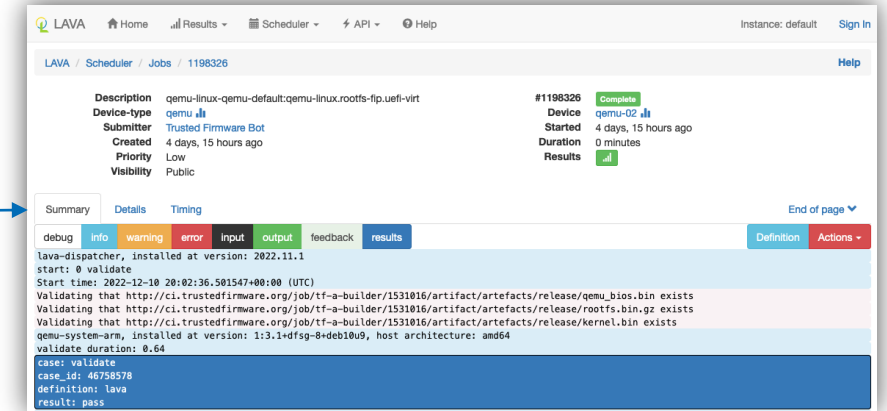
No changes.

Started by upstream project [tf-a-ci-gateway](#) build number [24569](#) originally caused by:

- Started by upstream project [tf-a-main](#) build number [464](#) originally caused by:
 - Started by upstream project [tf-a-daily](#) build number [379](#) originally caused by:
 - Started by timer

This run spent:

- 14 sec waiting;
- 4 min 9 sec build duration;
- 4 min 23 sec total from scheduled to completion.



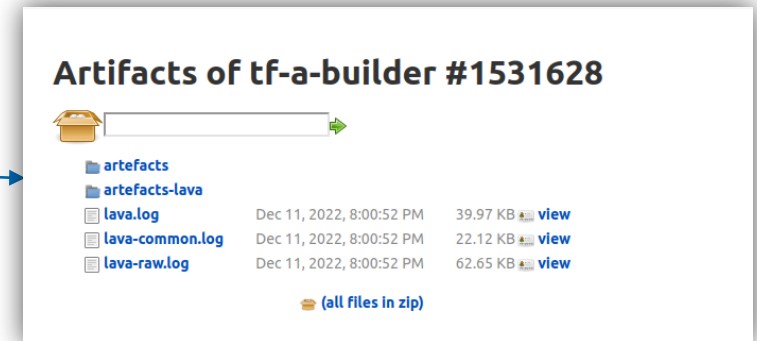
LAVA / Scheduler / Jobs / 1198326

Description	qemu-linux-qemu-default:qemu-linux.rootfs-ftp.uefi-virt	#1198326	Complete
Device-type	qemu	Device	qemu-02
Submitter	Trusted Firmware Bot	Started	4 days, 15 hours ago
Created	4 days, 15 hours ago	Duration	0 minutes
Priority	Low	Results	
Visibility	Public		

Summary Details Timing

debug info warning error input output feedback results

```
lava-dispatcher, installed at version: 2022.11.1
start: 0 validate
Start time: 2022-12-10 20:02:36.501547+00:00 (UTC)
Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531016/artifact/artefacts/release/qemu_bios.bin exists
Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531016/artifact/artefacts/release/rootfs.bin.gz exists
Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531016/artifact/artefacts/release/kernel.bin exists
qemu-system-arm, installed at version: 1:3.1+dfsg-8+deb10u9, host architecture: amd64
validate duration: 0.64
Case: validate
Case_id: 46758578
definition: lava
result: pass
```



Artifacts of tf-a-builder #1531628

artefacts

- artefacts-lava
 - lava.log Dec 11, 2022, 8:00:52 PM 39.97 KB [view](#)
 - lava-common.log Dec 11, 2022, 8:00:52 PM 22.12 KB [view](#)
 - lava-raw.log Dec 11, 2022, 8:00:52 PM 62.65 KB [view](#)

[\(all files in zip\)](#)

Running QEMU tests in OpenCI

Navigating the test results

Artifacts of tf-a-builder #1531628



artefacts			
artefacts-lava			
lava.log	Dec 11, 2022, 8:00:52 PM	39.97 KB	view
lava-common.log	Dec 11, 2022, 8:00:52 PM	22.12 KB	view
lava-raw.log	Dec 11, 2022, 8:00:52 PM	62.65 KB	view

(all files in zip)

```
2022-12-11T19:59:42 lava-dispatcher, installed at version: 2022.11.1
2022-12-11T19:59:42 start: 0 validate
2022-12-11T19:59:42 Start time: 2022-12-11 19:59:42.927638+00:00 (UTC)
2022-12-11T19:59:42 Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/qemu_bios.bin exists
2022-12-11T19:59:43 Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/rootfs.bin.gz exists
2022-12-11T19:59:43 Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/kernel.bin exists
2022-12-11T19:59:43 qemu-system-arm, installed at version: 1:3.1+dfsg-8+deb10u9, host architecture: amd64
2022-12-11T19:59:43 validate duration: 0.58
2022-12-11T19:59:43 {'case': 'validate', 'definition': 'lava', 'result': 'pass'}
2022-12-11T19:59:43 start: 1 deployimages (timeout 00:00:30) [common]
2022-12-11T19:59:43 start: 1.1 download-retry (timeout 00:00:30) [common]
2022-12-11T19:59:43 start: 1.1.1 http-download (timeout 00:00:30) [common]
2022-12-11T19:59:43 downloading http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/qemu_bios.bin
2022-12-11T19:59:43 saving as /var/lib/lava/dispatcher/tmp/1201023/deployimages-uazuur2d/bios/qemu_bios.bin
2022-12-11T19:59:43 total size: 2495245 (2MB)
2022-12-11T19:59:43 No compression specified
2022-12-11T19:59:43 progress 1% (0MB)
2022-12-11T19:59:43 progress 6% (0MB)
```

```
NOTICE: Booting Trusted Firmware
NOTICE: BL1: v2.8(debug):v2.8-82-g25eb64726
NOTICE: BL1: Built : 19:58:01, Dec 11 2022
INFO: BL1: RAM 0xe00e000 - 0xe0f8000
WARNING: BL1: cortex_a57: CPU workaround for 813419 was missing!
WARNING: BL1: cortex_a57: CPU workaround for 817169 was missing!
INFO: BL1: cortex_a57: CPU workaround for disable_ldnp_overread was applied
WARNING: BL1: cortex_a57: CPU workaround for 826974 was missing!
WARNING: BL1: cortex_a57: CPU workaround for 826977 was missing!
WARNING: BL1: cortex_a57: CPU workaround for 828024 was missing!
WARNING: BL1: cortex_a57: CPU workaround for 829520 was missing!
WARNING: BL1: cortex_a57: CPU workaround for 833471 was missing!
WARNING: BL1: cortex_a57: CPU workaround for 859072 was missing!
WARNING: BL1: cortex_a57: CPU workaround for 1319537 was missing!
INFO: BL1: cortex_a57: CPU workaround for cve_2017_5715 was applied
INFO: BL1: cortex_a57: CPU workaround for cve_2018_3639 was applied
INFO: BL1: cortex_a57: CPU workaround for cve_2022_23960 was applied
INFO: Using crypto library 'mbed TLS'
INFO: BL1: Loading BL2
INFO: Loading image id=6 at address 0xe06b000
```

```
{
  "dt": "2022-12-11T19:59:42.927092",
  "lvl": "info",
  "msg": "lava-dispatcher, installed at version: 2022.11.1"
},
{
  "dt": "2022-12-11T19:59:42.927436",
  "lvl": "info",
  "msg": "start: 0 validate"
},
{
  "dt": "2022-12-11T19:59:42.927653",
  "lvl": "info",
  "msg": "Start time: 2022-12-11 19:59:42.927638+00:00 (UTC)"
},
{
  "dt": "2022-12-11T19:59:42.927891",
  "lvl": "debug",
  "msg": "Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/qemu_bios.bin exists"
},
{
  "dt": "2022-12-11T19:59:43.116222",
  "lvl": "debug",
  "msg": "Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/rootfs.bin.gz exists"
},
{
  "dt": "2022-12-11T19:59:43.283045",
  "lvl": "debug",
  "msg": "Validating that http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/kernel.bin exists"
},
{
  "dt": "2022-12-11T19:59:43.504057",
  "lvl": "info",
  "msg": "qemu-system-arm, installed at version: 1:3.1+dfsg-8+deb10u9, host architecture: amd64"
},
{
  "dt": "2022-12-11T19:59:43.506511",
  "lvl": "info",
  "msg": "validate duration: 0.58"
},
{
  "dt": "2022-12-11T19:59:43.507002",
  "lvl": "results",
  "msg": "{ 'case': 'validate', 'definition': 'lava', 'result': 'pass' }"
},
{
  "dt": "2022-12-11T19:59:43.507835",
  "lvl": "info",
  "msg": "start: 1 deployimages (timeout 00:00:30) [common]"
},
{
  "dt": "2022-12-11T19:59:43.508349",
  "lvl": "debug",
  "msg": "start: 1.1 download-retry (timeout 00:00:30) [common]"
},
{
  "dt": "2022-12-11T19:59:43.508841",
  "lvl": "debug",
  "msg": "start: 1.1.1 http-download (timeout 00:00:30) [common]"
},
{
  "dt": "2022-12-11T19:59:43.509546",
  "lvl": "info",
  "msg": "downloading http://ci.trustedfirmware.org/job/tf-a-builder/1531628/artifact/artefacts/debug/qemu_bios.bin"
},
{
  "dt": "2022-12-11T19:59:43.509970",
  "lvl": "debug",
  "msg": "saving as /var/lib/lava/dispatcher/tmp/1201023/deployimages-uazuur2d/bios/qemu_bios.bin"
},
{
  "dt": "2022-12-11T19:59:43.510327",
  "lvl": "debug",
  "msg": "total size: 2495245 (2MB)"
},
{
  "dt": "2022-12-11T19:59:43.510461",
  "lvl": "debug",
  "msg": "No compression specified"
},
{
  "dt": "2022-12-11T19:59:43.690483",
  "lvl": "debug",
  "msg": "progress 1% (0MB)"
},
{
  "dt": "2022-12-11T19:59:43.717830",
  "lvl": "debug",
  "msg": "progress 6% (0MB)"
}
```

arm

Running local QEMU tests

Running local QEMU tests

- + Trust Firmware A and CI repository sources (v2.7 onwards).
- + For existing tests, TFTF isn't strictly necessary (pass dummy value).
- + System QEMU for Aarch64 (> v4.2.1).

```
test_run=1 \  
workspace=$(mktemp -d) \  
tfa_downloads="https://downloads.trustedfirmware.org/tf-a" \  
nfs=$workspace \  
tf_root="/path/to/trusted-firmware-a/" \  
tftf_root="/path/to/tf-a-tests/" \  
test_groups=qemu-boot-tests/qemu-default:qemu-linux.rootfs-fip.uefi-virt \  
    bash $ci_root/script/run_local_ci.sh
```

Running local QEMU tests

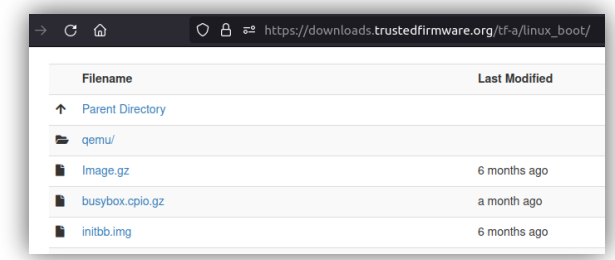
```
test_run=1 \
workspace=$(mktemp -d) \
tfa_downloads="https://downloads.trustedfirmware.org/tf-a" \
nfs=$workspace \
tf_root="/path/to/trusted-firmware-a/" \
tftf_root="/path/to/tf-a-tests/" \
test_groups=qemu-boot-tests/qemu-default:qemu-linux.rootfs-fip.uefi-virt \
  bash $ci_root/script/run_local_ci.sh
```

Do not spawn expect instances to track serial output!

Directory to build and run test from.

OpenCI parameter - scratch & tool area

Individual test we would like to run.



Running local QEMU tests

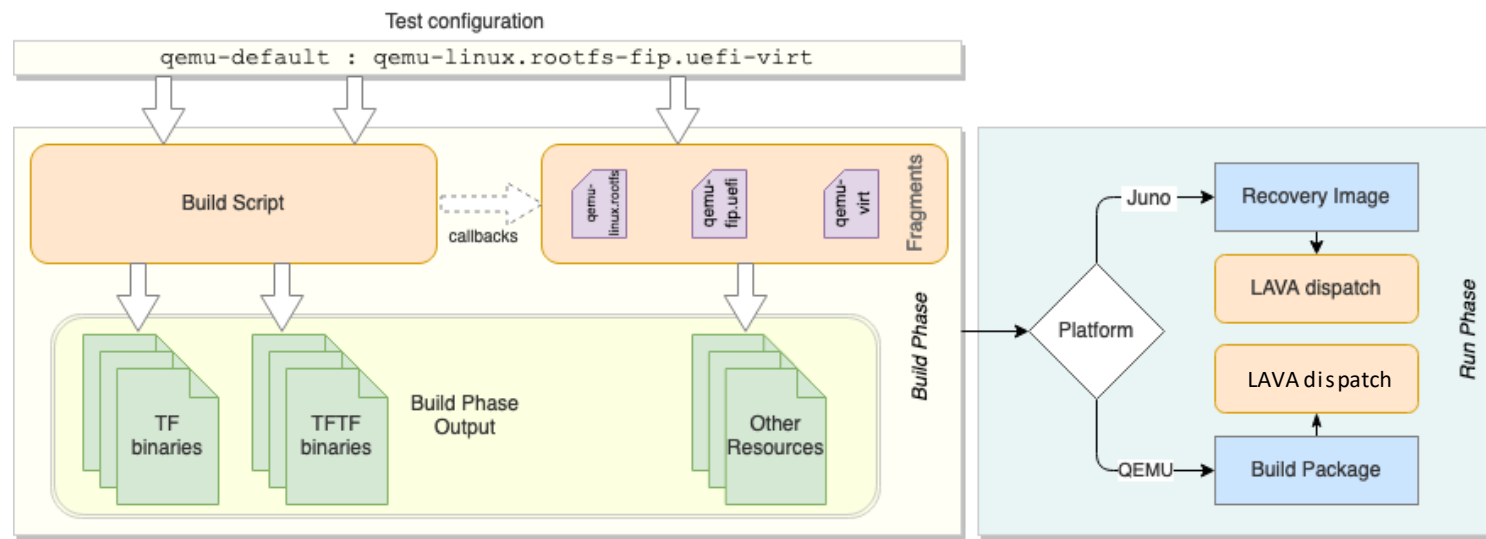
```
harmut01 at e125160 in ~/projects/tf-a-projects/platform-ci on remotes/origin/HEAD [?]  
$
```

arm

Changes in TF-A CI Scripts

Changes in TF-A CI Scripts

Overview of the CI architecture



- + Consists of a build and run phase.
- + Build phase downloads and generates all the resources required to run the test.
- + The run phase executes the output of the build phase.
- + Information about the build phase is encoded in the test configuration.

Changes in TF-A CI Scripts

Overview of the CI architecture

```
1 CROSS_COMPILE=aarch64-none-elf-  
2 PLAT=qemu
```

platform-ci/tf_config/qemu-default

`{tf-build-config | nil}[,tftf-build-config]:{run-config | nil}`

Build configuration – plain text files in `tf_config` or `tftf_config` containing build parameters for TF-A and or TFTF.

```
platform-ci/tf_config/  
— qemu-aarch32-clang-opteed  
— qemu-aarch32-opteed  
— qemu-default  
— qemu-gicv3  
— qemu-mb_hash256  
— qemu-opteed-tbb-enc  
— qemu_sbsa-default  
— qemu_sbsa-stack-protector  
— qemu_sbsa-stack-protector-rndcanary  
— qemu-tbb
```


Changes in TF-A CI Scripts

Overview of the CI architecture

```
{tf-build-config | nil}[ ,tftf-build-config]:{run-config | nil}
```

Run configuration – specifies the steps necessary to setup the test environment i.e., choosing a non-secure payload.

```
platform-ci/run_config/  
├─ qemu-fip.uefi  
├─ qemu-linux.rootfs  
└─ qemu-virt
```

Changes in TF-A CI Scripts

Overview of the CI architecture

- + Test configurations of a similar nature are collected as a group.
- + See the **group** subdirectory in the CI repository for already existing groups.
- + Providing a group name to the CI scripts executes all tests thereunder i.e. `qemu-boot-tests` runs all QEMU tests under `group/qemu-boot-tests`

```
platform-ci/group/tftf-l1-fvp
├── fvp-aarch64-only,fvp-default:fvp-tftf-fip.tftf-foundationv8
├── fvp-bl31-separate-nobits,fvp-default:fvp-tftf-fip.tftf-aemv8a
├── fvp-default,fvp-default:fvp-tftf-fip.tftf-aemv8a
├── fvp-default,fvp-default:fvp-tftf-fip.tftf-aemv8a.assymmetric
├── fvp-default,fvp-default:fvp-tftf-fip.tftf-aemv8a.singlecore
├── fvp-default,fvp-default:fvp-tftf-fip.tftf-aemva
├── fvp-tspd-aarch64-only,fvp-default:fvp-tftf-fip.tftf-foundationv8-tspd
├── fvp-tspd,fvp-default:fvp-tftf-fip.tftf-aemv8a.assymmetric-tspd
├── fvp-tspd,fvp-default:fvp-tftf-fip.tftf-aemv8a.singlecore-tspd
├── fvp-tspd,fvp-default:fvp-tftf-fip.tftf-aemv8a-tspd
├── fvp-tspd,fvp-default:fvp-tftf-fip.tftf-aemva-tspd
platform-ci/group/tftf-l1-juno
├── juno-aarch32-el3-runtime,juno-aarch32-default:juno-tftf+aarch32-rt32
├── juno-aarch32-el3-runtime,juno-aarch32-reboot:juno-tftf+aarch32-rt32
├── juno-default,juno-default:juno-tftf
├── juno-default,juno-reboot:juno-tftf
├── juno-sdei,juno-default:juno-tftf
├── juno-trng,juno-trng:juno-tftf
├── juno-tspd-tbb-mbedtls,juno-default:juno-tftf
```

Changes in TF-A CI Scripts

Changes to build and run packages

- 1. Boot QEMU from TF-A to the Linux shell on a local machine**
2. Automate build steps and fetching of pre-built resources
3. Setup reproducible test environment in CI
4. Automate job submission

Changes in TF-A CI Scripts

Changes to build and run packages

- + There are two ways to launch QEMU guests: firmware based and kernel shortcut.
- + **-kernel** in addition to **-bios** means that QEMU loads the kernel into DRAM and puts the kernel info into the **fw_cfg** device
- + Bios is responsible for providing the kernel with the device tree
- + A binary consisting of BL1 and the FIP are used as the BootROM. Bootloader built into the FIP image as BL33

```
$ qemu-system-aarch64 \
  -machine 'secure=on,virtualization=on,gic-version=2' -cpu max \
  -nographic -display none -d unimp \
  -m 4G -M virt -smp 4 \
  -append 'console=ttyAMA0,115200n8 root=/dev/vda earlycon' \
  -bios qemu_bios.bin -initrd rootfs.bin -kernel kernel.bin
```



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Changes in TF-A CI Scripts

Changes to build and run packages

- + What parts do we need?
 - Kernel
 - EDK II
 - Root filesystem
 - Boot image (bl1.bin + fip.bin)
- + Some parts not possible to build at runtime ie kernel and EDK II
- + Must build TF-A from source!

```
$ qemu-system-aarch64 \
  -machine 'secure=on,virtualization=on,gic-version=2' -cpu max \
  -nographic -display none -d unimp \
  -m 4G -M virt -smp 4 \
  -append 'console=ttyAMA0,115200n8 root=/dev/vda earlycon' \
  -bios qemu_bios.bin -initrd rootfs.bin -kernel kernel.bin
```

Kernel

EDK II

BL2

BL1

Changes in TF-A CI Scripts

Changes to build and run packages

- + Introduced three fragments:
 - run_config/qemu-linux.rootfs
 - run_config/qemu-fip.uefi
 - run_config/qemu-virt
- + Fetch and archive kernel, and root filesystem
- + Fetch EDK II and build the FIP with it as BL33
- + Generate the BootROM that is provided with the **-bios** option

```
14 post_tf_archive(){
15     image="qemu_bios.bin" bl1_path="$archive/bl1.bin" \
16     fip_path="$archive/fip.bin" gen_qemu_image
17 }
```

run_config/qemu_fip.uefi

```
72 gen_qemu_image(){
73     local image=${image:?}
74     local bl1_path=${bl1_path:?}
75     local fip_path=${fip_path:?}
76
77     # Cocatenate bl1 and fip images to create a single BIOS consumed by QEMU.
78     cp $bl1_path "$image"
79     dd if=$fip_path of="$image" bs=64k seek=4
80
81     archive_file "$image"
82 }
```

qemu_utils.sh

Changes in TF-A CI Scripts

Changes to build and run packages

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Changes in TF-A CI Scripts

Changes to build and run packages

LAVA / Scheduler / Device Types

Device types

Show entries

Name	Idle ↓↑	Maintenance ↓↑	Offline ↓↑	Busy ↓↑	Queue
cy8ckit-064s0s2-4343w	3				
juno	9				
lpcpresso55s69	3				
mps		1		3	104
mt8192-asurada-rev1	3				
musca-b				4	55
qemu	4				
sc7180-trogdor-lazor-limozeen		2		1	
stm32l562e-dk	3				
stm32mp157c-dk2		1			

Changes in TF-A CI Scripts

Changes to build and run packages

- + Each test job has a list of actions [1]:
 - Boot – boot the device and check prompts to see whether device has booted correctly
 - Deploy – download files to boot the device and prepare an overlay of files to run the test action
 - Test – clone and run tests for this job
- + For boot action, it constructs the correct pipeline from a specified set
- + User provides prompt to expect when system boots successfully... LAVA fails if it doesn't find this.

```
Matched prompt #10: root@tf-busyboot:/root#
case: kernel-messages
case_id: 46758583
definition: lava
duration: 3.31
extra: ...
level: 2.2.1
namespace: common
result: pass
Setting prompt string to ['root@tf-busyboot:/root#']
end: 2.2.1 login-action (duration 00:00:03) [common]
case: login-action
case_id: 46758584
definition: lava
duration: 3.32
extra: ...
level: 2.2.1
namespace: common
result: pass
```

Boot action prompt check in LAVA UI

Changes in TF-A CI Scripts

Changes to build and run packages

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Changes in TF-A CI Scripts

Changes to build and run packages

- + Jobs may be submitted to LAVA in one of three ways:
 1. Using the lavacli program
 2. XML-RPC API [2]
 3. Its web UI [3].
- + LAVA jobs are defined in YAML files
- + A job defines what software should be deployed on the device under test (DUT) and what actions should be performed there.
- + Created a template job configuration for boot tests.

```
1  device_type: qemu
2  job_name: qemu-linux- $\{\text{test\_config}\}$ 
3  priority: medium
4  visibility: public
5
6  metadata:
7    test_config:  $\{\text{test\_config}\}$ 
8    build_url:  $\{\text{BUILD\_URL}\}$ 
9    emulator:  $\{\text{model}\}$ 
10
11   $\{\text{if [ -n " $\{\text{gerrit\_url}\}$ " ]}; then$ 
12    cat <<-YAML
13    gerrit_url: " $\{\text{gerrit\_url}\}$ "
14   $\}$ 
15   $\}$ 
16
17  context:
18    arch: aarch64
19    machine:  $\{\text{machine:-virt}\}$ 
20    cpu:  $\{\text{cpu:-max}\}$ 
21    extra_options:
22   $\{\text{for boot argument in " $\{\text{boot\_arguments}[\text{@}]:?\}$ "; do$ 
23    cat <<-YAML
24    | -  $\{\text{boot\_argument}\}$ 
25     $\}$ 
26   $\}$ 
done)
```

script/lava-templates/qemu-linux.yaml

Changes in TF-A CI Scripts

Changes to build and run packages

```
1 device_type: qemu
2 job_name: qemu-linux-${test_config}
3 priority: medium
4 visibility: public
5
6 metadata:
7   test_config: ${test_config}
8   build_url: ${BUILD_URL}
9   emulator: ${model}
10
11 $(if [ -n "${gerrit_url}" ]; then
12   cat <<-YAML
13   gerrit_url: "${gerrit_url}"
14   YAML
15 fi)
16
17 context:
18   arch: aarch64
19   machine: ${machine:-virt}
20   cpu: ${cpu:-max}
21   extra_options:
22 $(for boot_argument in "${boot_arguments[@]:?}"; do
23   cat <<-YAML
24     - ${boot_argument}
25   YAML
26 done)
```

```
12 generate_lava_job(){
13     local model="qemu-virt"
14
15     model="$model" gen_model_params
16     model="$model" gen_qemu_yaml
17 }
```

```
gen_qemu_yaml(){
    model="${model:?}"
    model_bin="${model_bin:qemu-system-aarch64}"

    yaml_template_file="$workspace/qemu_template.yaml"
    yaml_file="$workspace/qemu.yaml"
    yaml_job_file="$workspace/job.yaml"
    lava_model_params="$workspace/lava_model_params"

    # this function expects a template, quit if it is not present
```

```
1 device_type: qemu
2 job_name: qemu-linux-qemu-default:qemu-linux.rootfs-fip.uefi-virt
3 priority: medium
4 visibility: public
5
6 metadata:
7   test_config: qemu-default:qemu-linux.rootfs-fip.uefi-virt
8   build_url:
9   emulator: qemu-virt
10
11 context:
12   arch: aarch64
13   machine: virt
14   cpu: max
15   extra_options:
16     - -machine 'secure=on,virtualization=on,gic-version=2'
17     - -smp 4
18     - -m 4G
19     - -nographic -display none -d unimp
20     - -append 'console=ttyAMA0,115200n8 root=/dev/vda earlycon'
```

Conclusion

- + To get started running tests, you might need to be added to this group:
 - <https://github.com/orgs/trusted-firmware-ci/teams/trusted-firmware-a-openci-users/>
 - Get in touch via the mailing list or directly to Joanna Farley to get added.
- + Currently QEMU tests do not gate patch submission, long term strategy is to add them to L1/L2 tests once we are confident they are stable
- + There are still quite a few gaps that need to be filled
 - Expect script support
 - Measured Boot
 - OPTEE
 - U-Boot
- + Interested, or keen to make it better? Contributions are welcome!
- + We are also looking for some help maintaining the infrastructure – if this is of interest, please do get in touch!

arm

Thank You

Danke

Gracias

Grazie

谢谢

ありがとう

Asante

Merci

감사합니다

धन्यवाद

Kiitos

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תודה

Resources

1. https://validation.linaro.org/static/docs/v2/explain_first_job.html
2. <https://tf.validation.linaro.org/static/docs/v2/data-export.html#xml-rpc>
3. <https://tf.validation.linaro.org/static/docs/v2/first-job.html#web-ui-submit>



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