

# How to build up an ecosystem for open-source firmware testing



**9ELEMENTS**  
Cyber Security

# Agenda

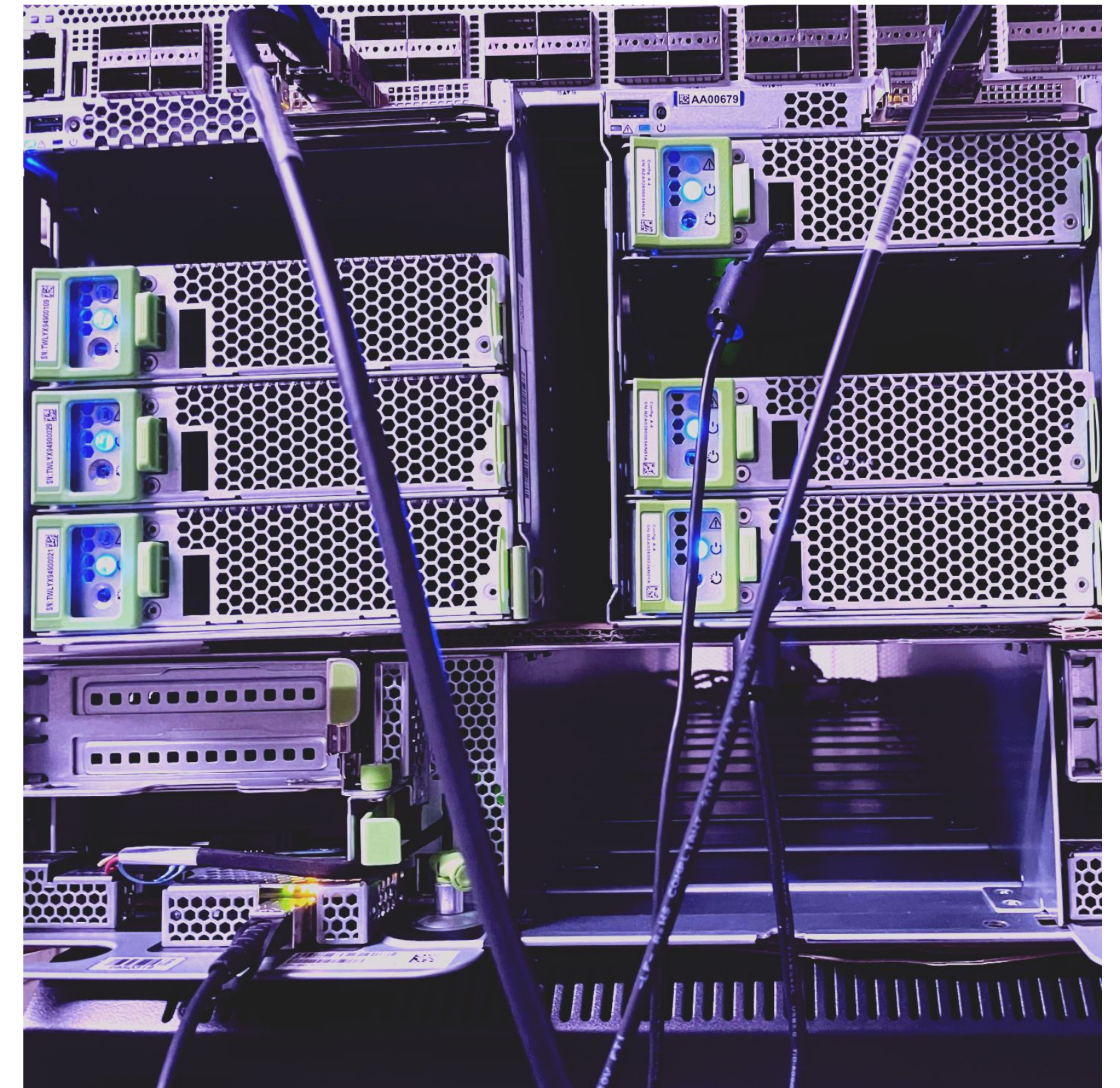
- . Open-Source Firmware Testing
- . Our Idea
- . Our Solutions
- . Get Involved





# Open-Source Firmware Testing

- Firmware runs directly on the hardware
- Firmware behaves differently on different architectures, SoC's or Boards
- Firmware Testing is hard
- No unified approach
- Quite complex to set up
- No centralized entity for Firmware Testing

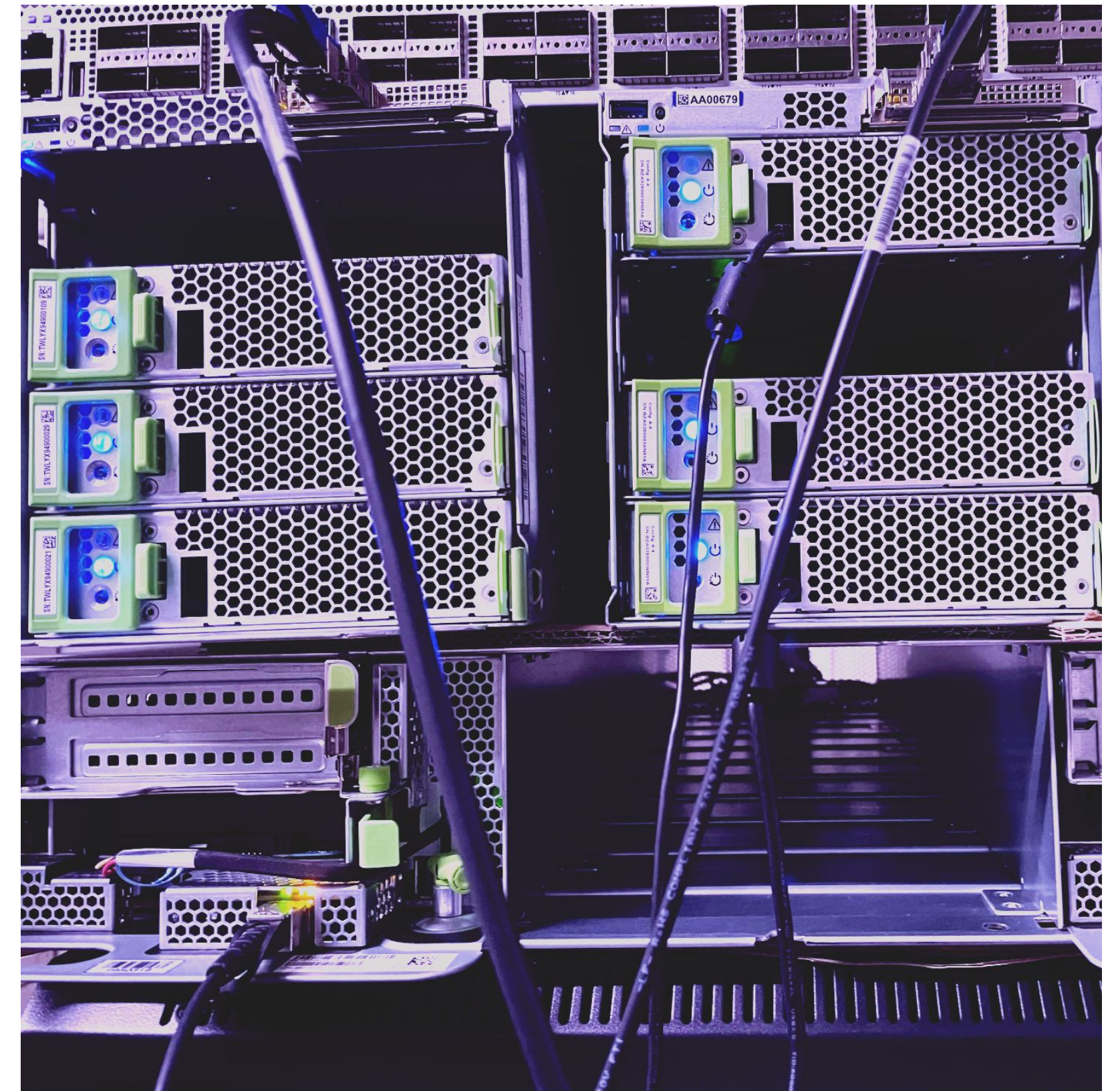


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# Current State

- Diverse open-source firmware ecosystem
- Diverse continuous integration
- Loose Build Testing
- No/Little Testing on real hardware

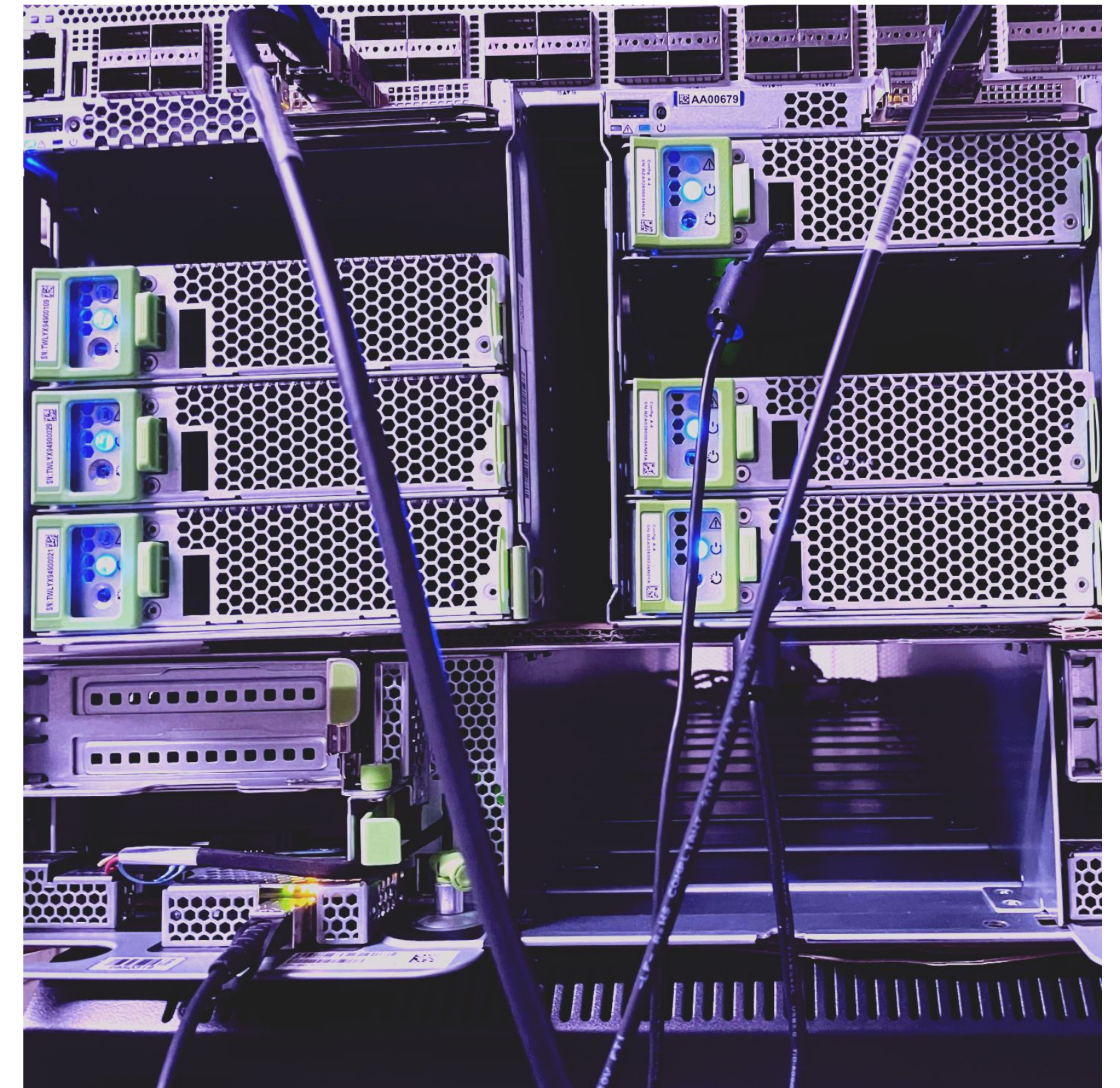


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# Current State

- Nearly every project does build-testing
  - Easy to set-up
  - Minimal amount of confidence
    - At least the code builds
  - But there's more..
    - Unit Testing
    - Functional Testing
    - Performance Testing
    - ...



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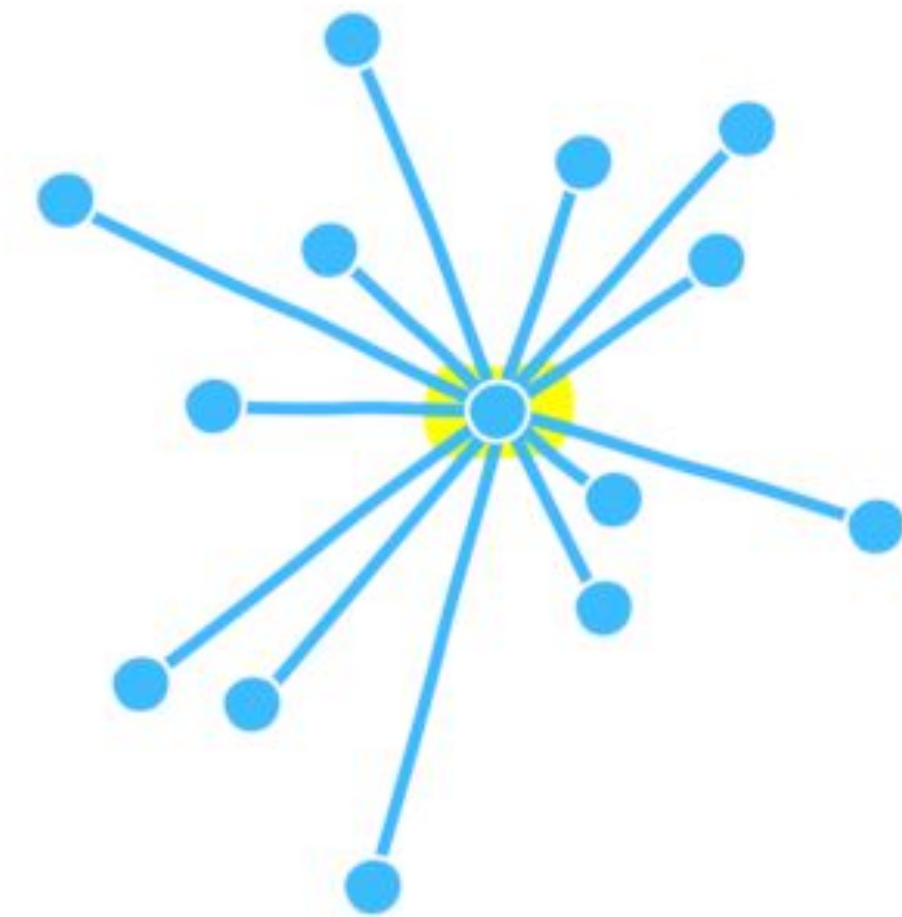
# Current State

- . Firmware is the most privileged code running on your system
  - . Security implications
- 
- More OSF Testing
  - Make OSF Testing more accessible
  - Results more usable across the community



# An open ecosystem

- Centralized Reporting Infrastructure
  - Result should be gather centralized
  - Results are shared with everyone
  - Build your own solution on top of this
- Decentralized Testing Infrastructure
  - Run your own Infra
  - Run your own code
  - Share results with others
  - Everyone can submit boards to the QA



# An open ecosystem

- Pros

- Better Test Coverage
- Measure Impact of Changes
- Catch regressions
- Keep unmaintained boards in the tree
- Combining multiple efforts

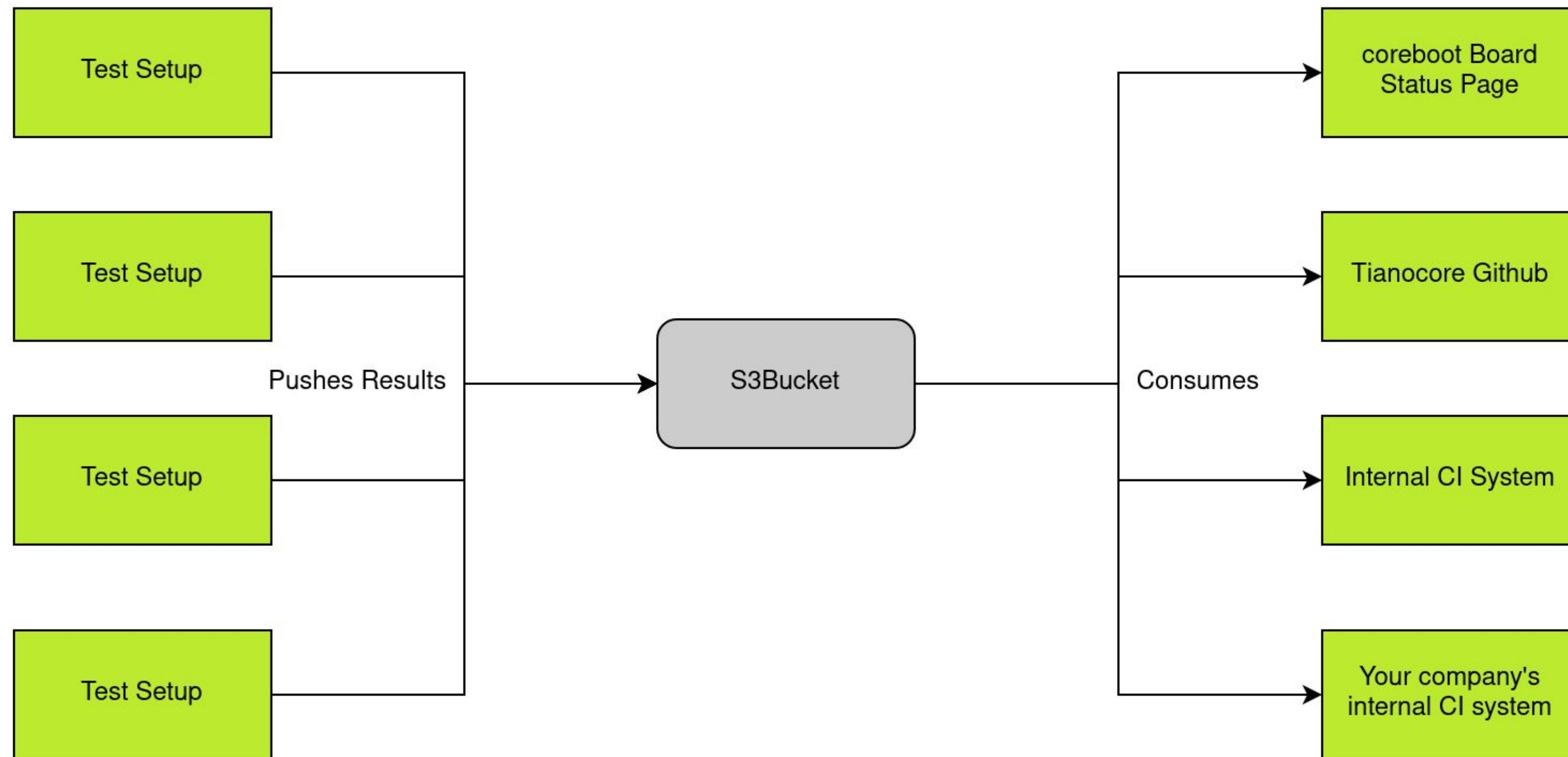
- Cons

- A Common Test Interface / Specification (is needed)
- Integration Work
- More Fragmentation on the short term

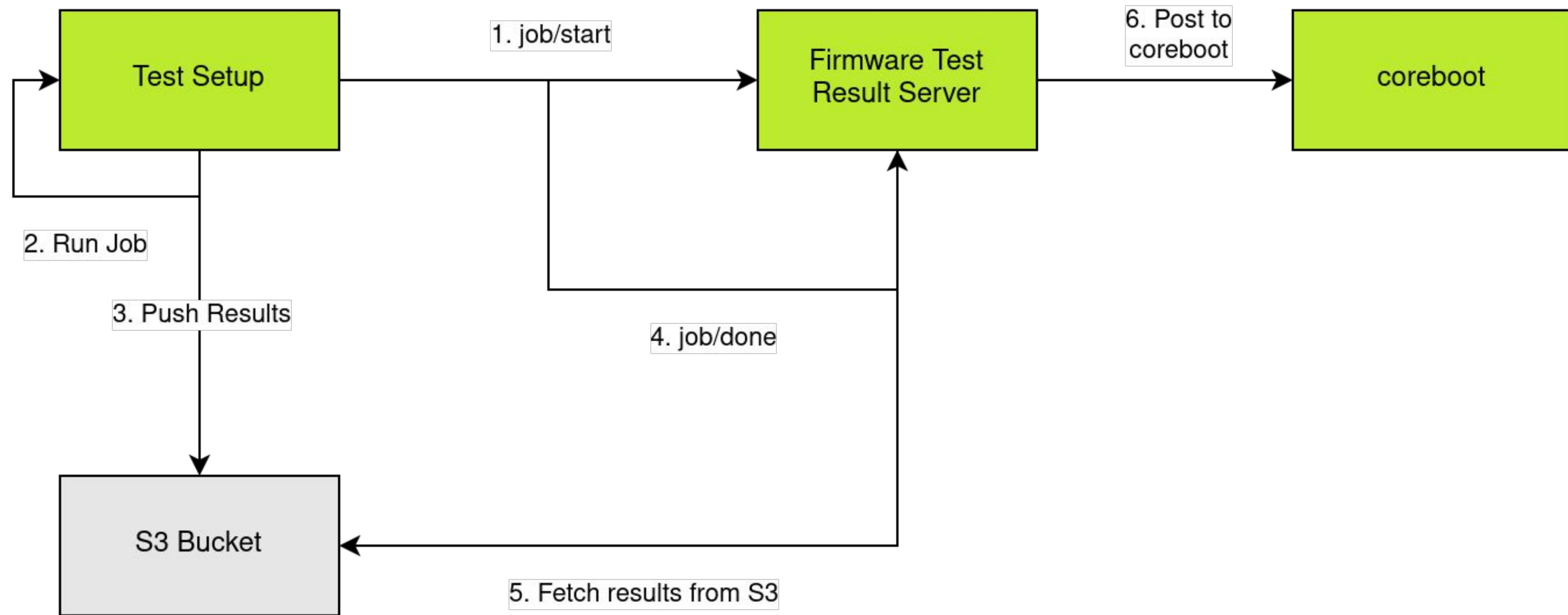




# An open ecosystem



# Use-Case coreboot





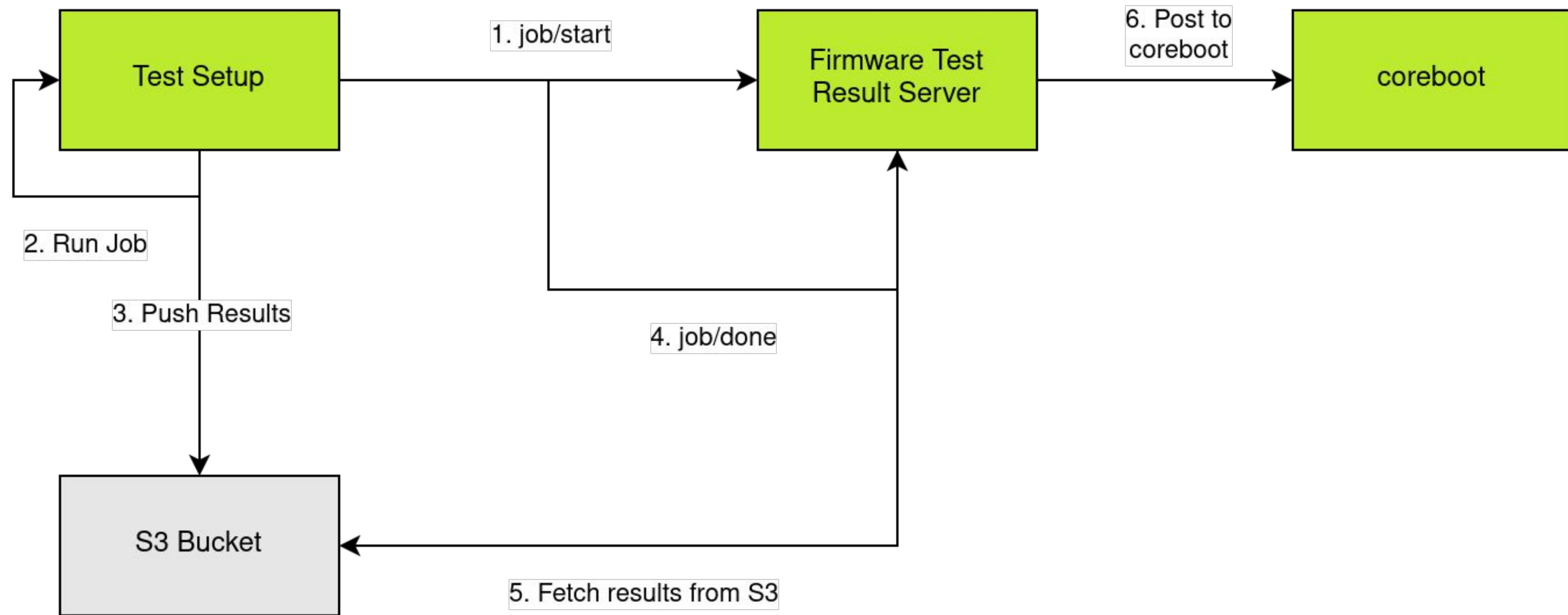
# An open ecosystem

- Endpoint: job/start

```
{  
  "workerID": "2",  
  "projectID": "1",  
  "hash": "aded1d7fd04a60c59dca0ff83dd428387e110ef4",  
  "timeout": 240,  
  "description": "OCP TiogaPass SPX-SP Boot Test (LinuxBoot)"  
}
```



# Use-Case coreboot





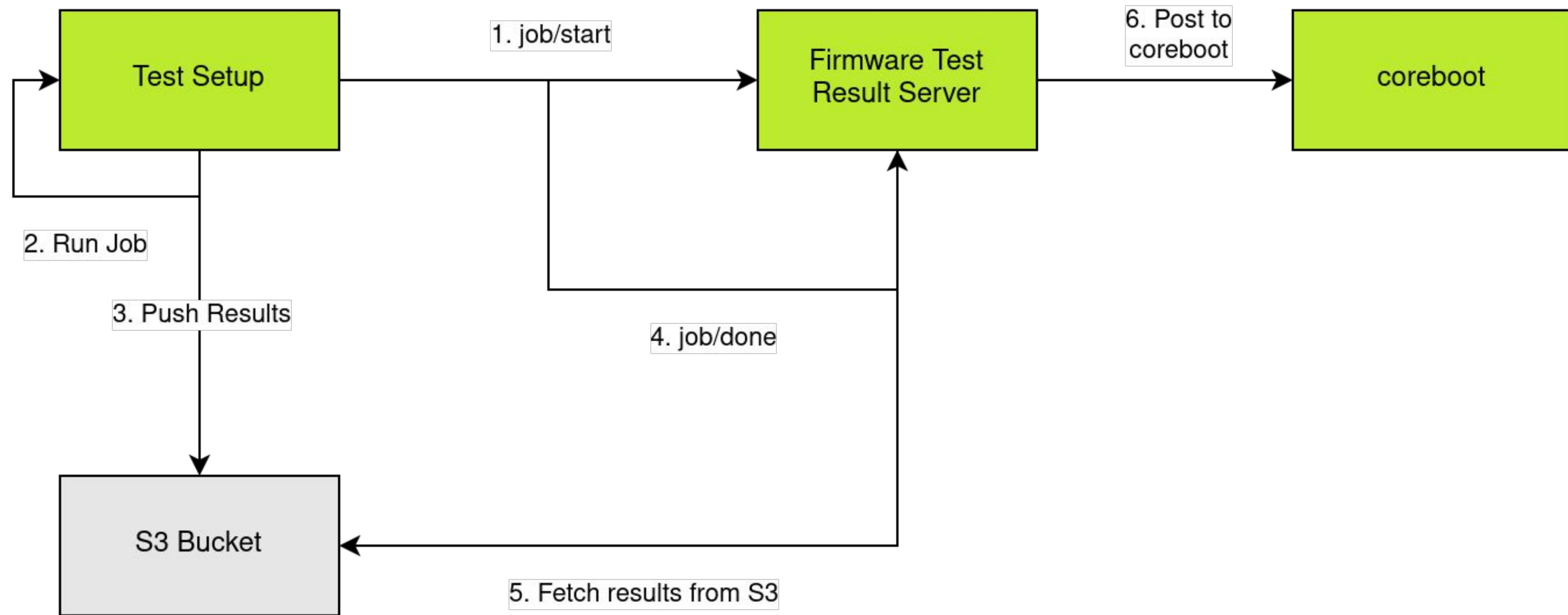
# An open ecosystem

- Endpoint: job/done

```
{  
  "workerID": "2",  
  "projectID": "1",  
  "hash": "aded1d7fd04a60c59dca0ff83dd428387e110ef4",  
  "success": 1,  
  "reportLink": "https://www.firmwaretesting.io/234"  
}
```

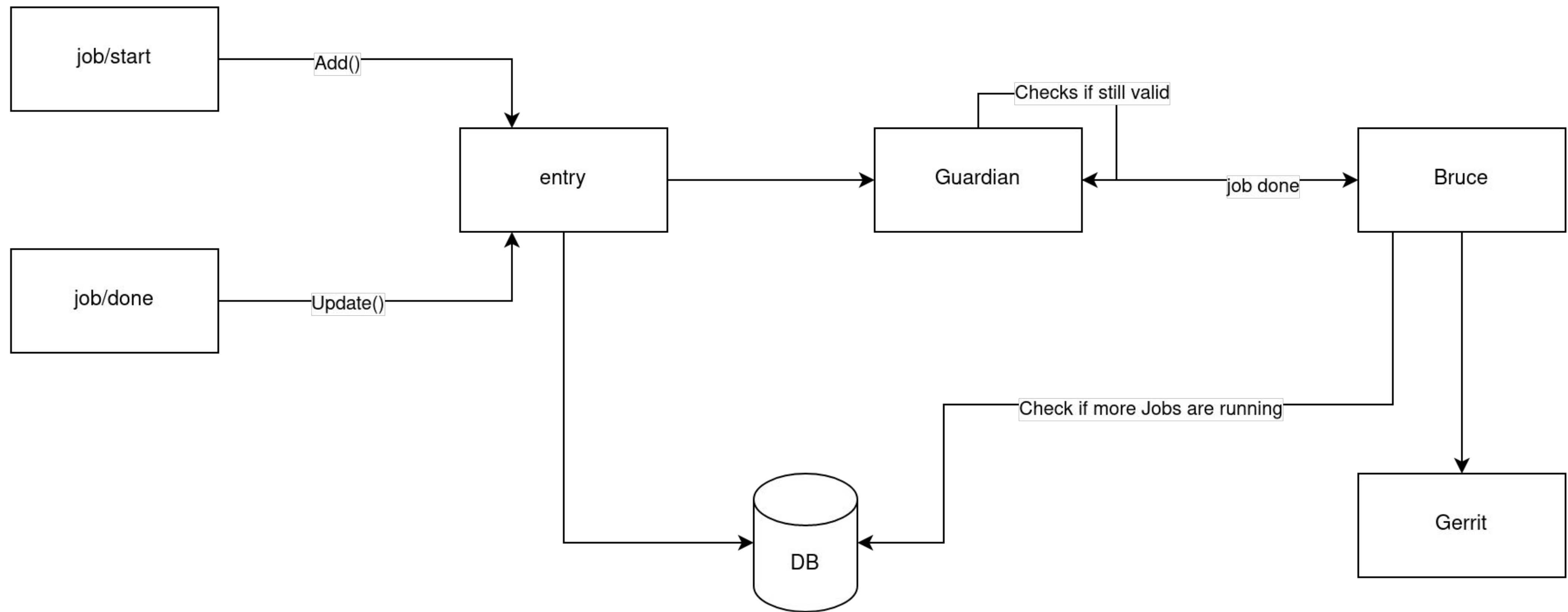


# Use-Case coreboot





# Use-Case coreboot



# coreboot Lava QA

- . Current Hardware QA System for coreboot  
(Available to the public)
- . Tests every submitted commit
- . Different Hardware
  - T500
  - HP Z550
  - QEmu Targets
  - ..
- . Quite complex set up
- . Only reports directly to Gerrit (currently)





# coreboot Lava QA

Show 

25

 entries

Search  ?

ID <span>↑↓</span>	Actions	State	Device <span>↑↓</span>	Device type <span>↑↓</span>	Description <span>↑↓</span>	Submitter <span>↑↓</span>	Submit Time <span>↑↓</span>	End Time <span>↑↓</span>	Duration
39589	<div><div></div><div></div><div></div></div>	Running	qemu_q35	BOARD_EMULATION_QEMU_X86_Q35	QEMU health test	lava-health	Jan.28, 9:07p.m.	—	—
39588	<div><div></div><div></div><div></div></div>	Complete	t500	BOARD_LENOVO_T500	"ThinkPad T500" (x86_32) using payload SeaBIOS	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:08p.m.	0:12:07
39587	<div><div></div><div></div><div></div></div>	Complete	z220	BOARD_HP_Z220_SFF_WORKSTATION	"HP Z220 SFF Workstation" (x86_32) using payload LinuxBoot_BusyBox_kexec	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:03p.m.	0:07:52
39586	<div><div></div><div></div><div></div></div>	Complete	hp8200_2	BOARD_HP_COMPAQ_8200_ELITE_SFF_PC	"HP Compaq 8200 Elite SFF PC" (x86_32) using payload TianoCore	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:06p.m.	0:10:32
39585	<div><div></div><div></div><div></div></div>	Complete	hp8200	BOARD_HP_COMPAQ_8200_ELITE_SFF_PC	"HP Compaq 8200 Elite SFF PC" (x86_32) using payload SeaBIOS	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:07p.m.	0:11:45
39584	<div><div></div><div></div><div></div></div>	Incomplete	qemu_q35	BOARD_EMULATION_QEMU_X86_Q35	"QEMU x86 q35/ich9" (x86_32) using payload TianoCore	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:06p.m.	0:07:07
39583	<div><div></div><div></div><div></div></div>	Complete	qemu_q35	BOARD_EMULATION_QEMU_X86_Q35	"QEMU x86 q35/ich9" (x86_32) using payload SeaBIOS	gerrit	Jan.28, 8:55p.m.	Jan.28, 8:59p.m.	0:03:23
39582	<div><div></div><div></div><div></div></div>	Complete	qemu_i440fx	BOARD_EMULATION_QEMU_X86_I440FX	"QEMU x86 i440fx/piix4" (x86_64) using payload SeaBIOS	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:03p.m.	0:03:12
39581	<div><div></div><div></div><div></div></div>	Complete	qemu_i440fx	BOARD_EMULATION_QEMU_X86_I440FX	"QEMU x86 i440fx/piix4" (x86_32) using payload SeaBIOS	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:00p.m.	0:04:09
39580	<div><div></div><div></div><div></div></div>	Complete	qemu_aarch64	BOARD_EMULATION_QEMU_AARCH64	"QEMU AArch64" using payload LinuxBoot_u-root_kexec	gerrit	Jan.28, 8:55p.m.	Jan.28, 9:03p.m.	0:07:29
39579	<div><div></div><div></div><div></div></div>	Complete	qemu_q35	BOARD_EMULATION_QEMU_X86_Q35	QEMU health test	lava-health	Jan.28, 8:36p.m.	Jan.28, 8:38p.m.	0:02:06

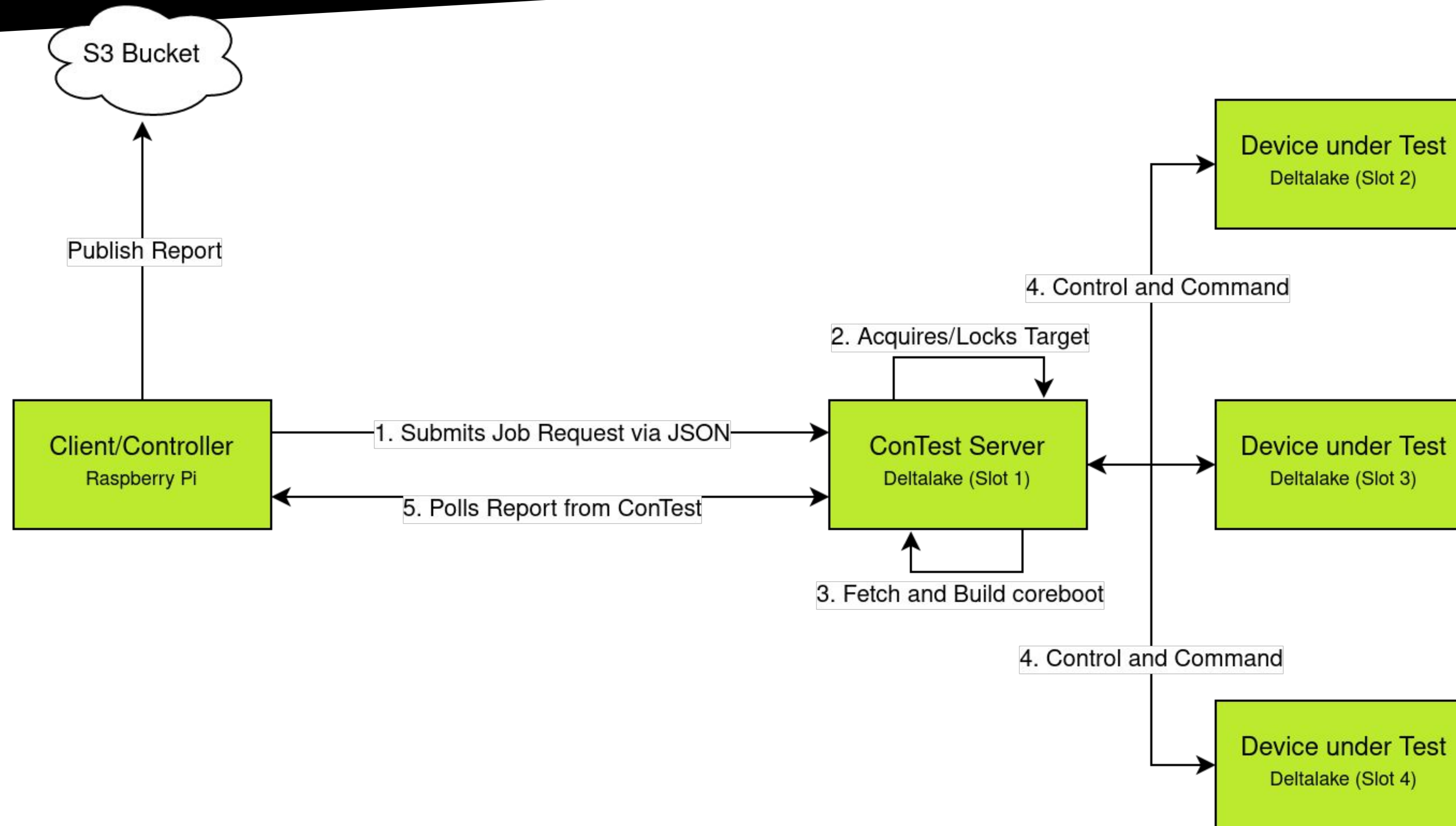


# coreboot ConTest QA

- . **Open-source:** obviously :-)
- . **General-purpose:** not just for firmware
- . **Modular:** specialized behaviours can be plugged
- . **Validating:** to minimize run-time errors
- . **Configuration-based:** a job is described as text config
- . **On-device:** run tests directly on the DUT
- . **Orchestrated:** not everything can run directly on the DUT







# coreboot ConTest QA





# coreboot ConTest QA

 Patrick Georgi	Change has been successfully cherry-picked as 416b828f47655b6306d3f1ae49e3c3227a1296dd by Patrick Georgi	Patchset 5	Dec 07 3:06 PM	▼
 build bot (Jenkins)	Build Successful <a href="https://qa.coreboot.org/job/coreboot/18100/">https://qa.coreboot.org/job/coreboot/18100/</a> : SUCCESS	Patchset 5	Dec 07 3:23 PM	▼
 9elements QA	Added to cc:  9elements QA	Patchset 5	Dec 07 3:44 PM	▼
 9elements QA	<p>Automatic boot test returned (PASS/FAIL/TOTAL): 6/0/6</p> <p>"HP Z220 SFF Workstation" (x86_32) using payload LinuxBoot_BusyBox_kexec : SUCCESS : <a href="https://lava.9esec.io/r/30884">https://lava.9esec.io/r/30884</a></p> <p>"HP Compaq 8200 Elite SFF PC" (x86_32) using payload TianoCore : SUCCESS : <a href="https://lava.9esec.io/r/30883">https://lava.9esec.io/r/30883</a></p> <p>"HP Compaq 8200 Elite SFF PC" (x86_32) using payload SeaBIOS : SUCCESS : <a href="https://lava.9esec.io/r/30882">https://lava.9esec.io/r/30882</a></p> <p>"QEMU x86 q35/ich9" (x86_32) using payload TianoCore : SUCCESS : <a href="https://lava.9esec.io/r/30881">https://lava.9esec.io/r/30881</a></p> <p>"QEMU x86 q35/ich9" (x86_32) using payload SeaBIOS : SUCCESS : <a href="https://lava.9esec.io/r/30880">https://lava.9esec.io/r/30880</a></p> <p>"QEMU AArch64" using payload LinuxBoot_u-root_kexec : SUCCESS : <a href="https://lava.9esec.io/r/30879">https://lava.9esec.io/r/30879</a></p> <p>Please note: This test is under development and might not be accurate at all!</p>	Patchset 5	Dec 07 3:44 PM	▲



# Get involved!

- . ConTest
  - <https://github.com/facebookincubator/contest>
  - #contest on OSFW Slack (osfw.slack.com)  
Invite @ <https://slack.osfw.dev/>
- . Twitter: @nablahero



# Get involved!

- . ConTest
  - <https://github.com/facebookincubator/contest>
- . Firmware Test Result Server
  - <https://github.com/walterchris/FirmwareResultServer>
- . Lava QA
  - <https://lava.9esec.io>
- . Twitter: @nablahero

