presented by

CANONICAL

Firmware Test Suite - Uses, Development, Contribution and GPL

Fall 2017 UEFI Plugfest

October 30 – November 3, 2017

Presented by Alex Hung (Canonical, Ltd)

Agenda

- Introduction
- Installation & Uses
- Adding New Tests
- Contributing Patches
- GPLv2 & FWTS
- FWTS Community

Introduction

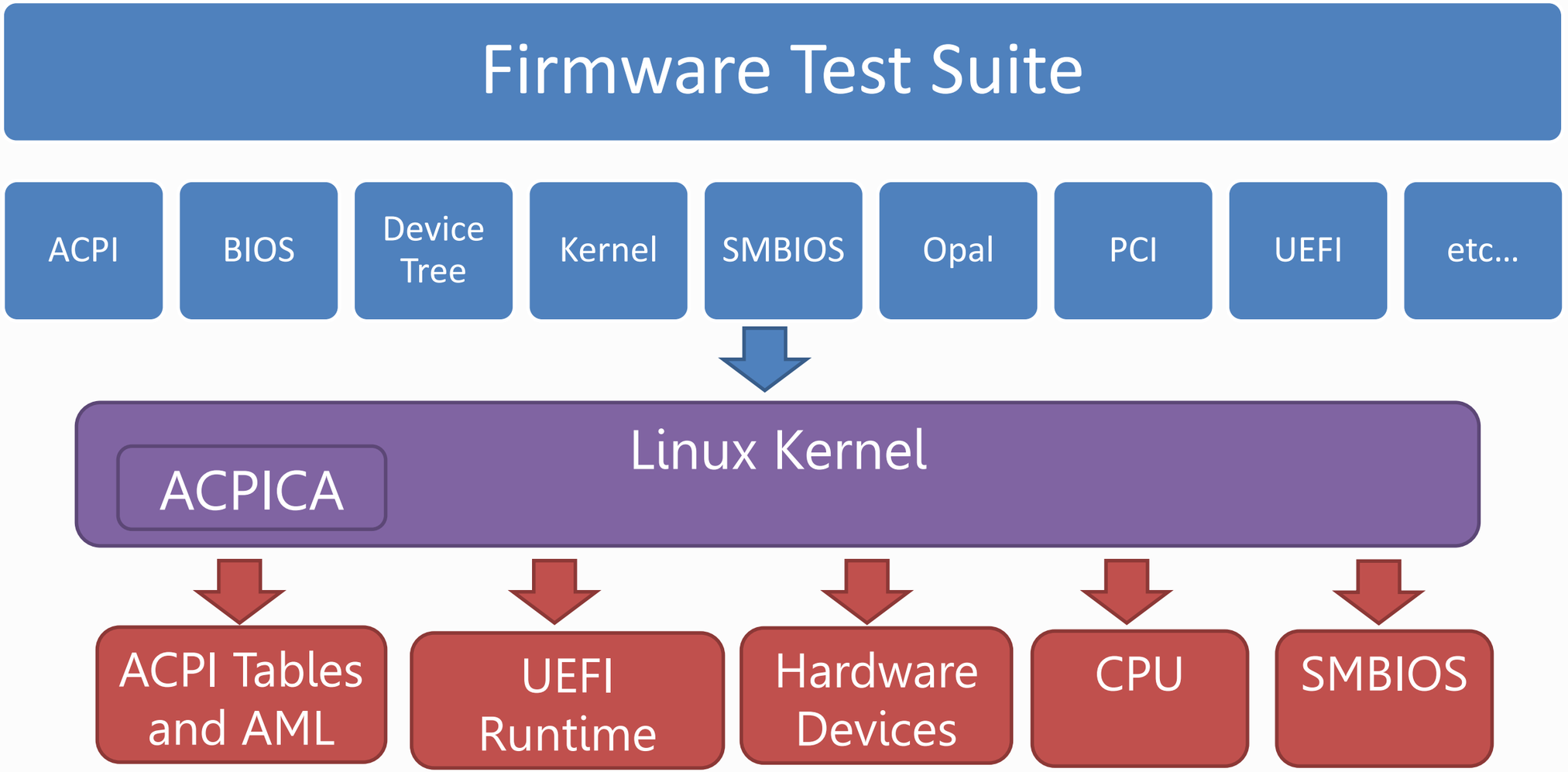
What is Firmware Test Suite (FWTS)?

- The recommended ACPI SCT
- Open-source Linux tool that automates firmware checking
- Detect bugs and advise firmware engineers
  - Test interactions between Linux & firmware
  - Gather firmware data for debug

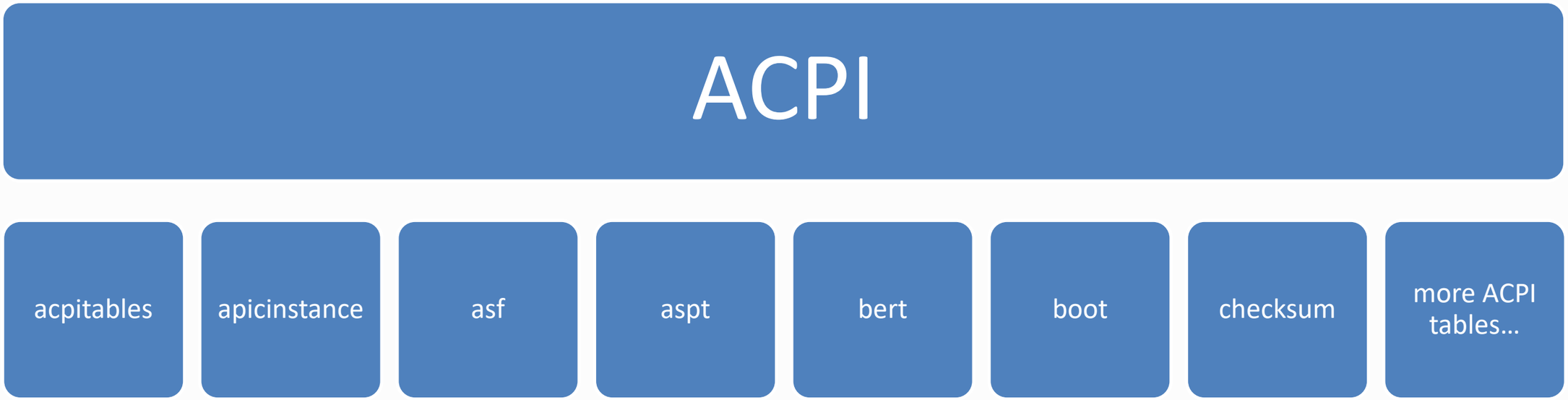
What is Firmware Test Suite (FWTS)?

- A good choice if one wants to implement new tests for specific features
  - Device Tree (an alternative for ACPI)
  - SBBR (a requirement for ARM server)
  - OPAL (for IBM PowerPC)

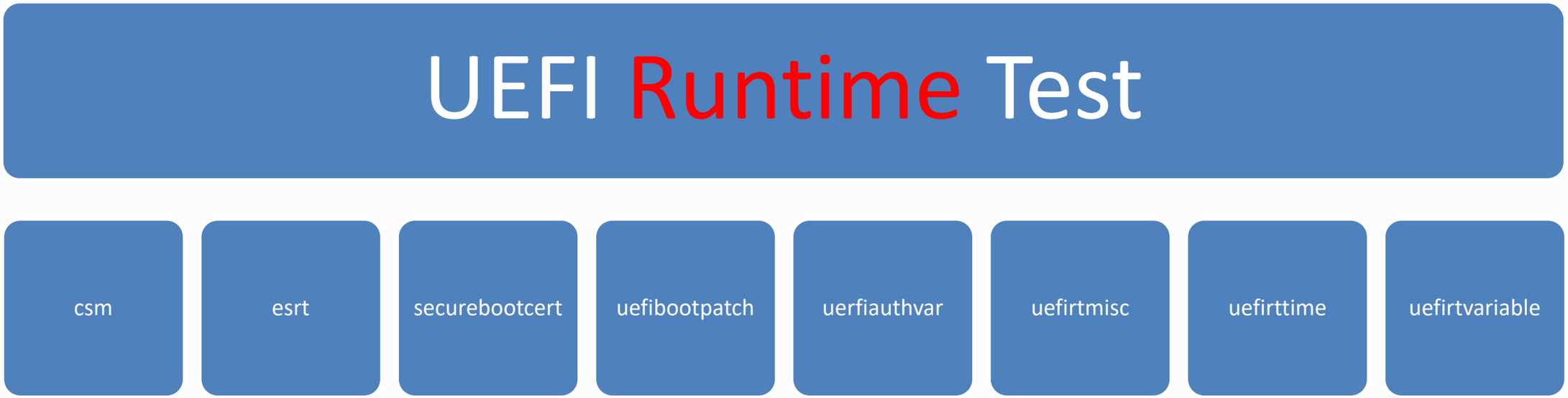
FWTS Framework & Tests



FWTS Architecture – ACPI



FWTS Architecture – UEFI



Installation & Uses

Getting FWTS-LIVE

- Download - http://fwts.ubuntu.com/fwts-live/
- Make bootable fwts-live USB disk
  - **Linux**:
    - Identify USB disk: *dmesg | tail -10 | grep Attached*
    - Copy image: *sudo dd if=fwts-live-17.08.00.img of=/dev/sdb ; sync*
  - **Windows**: Use "Win32 Disk Imager"

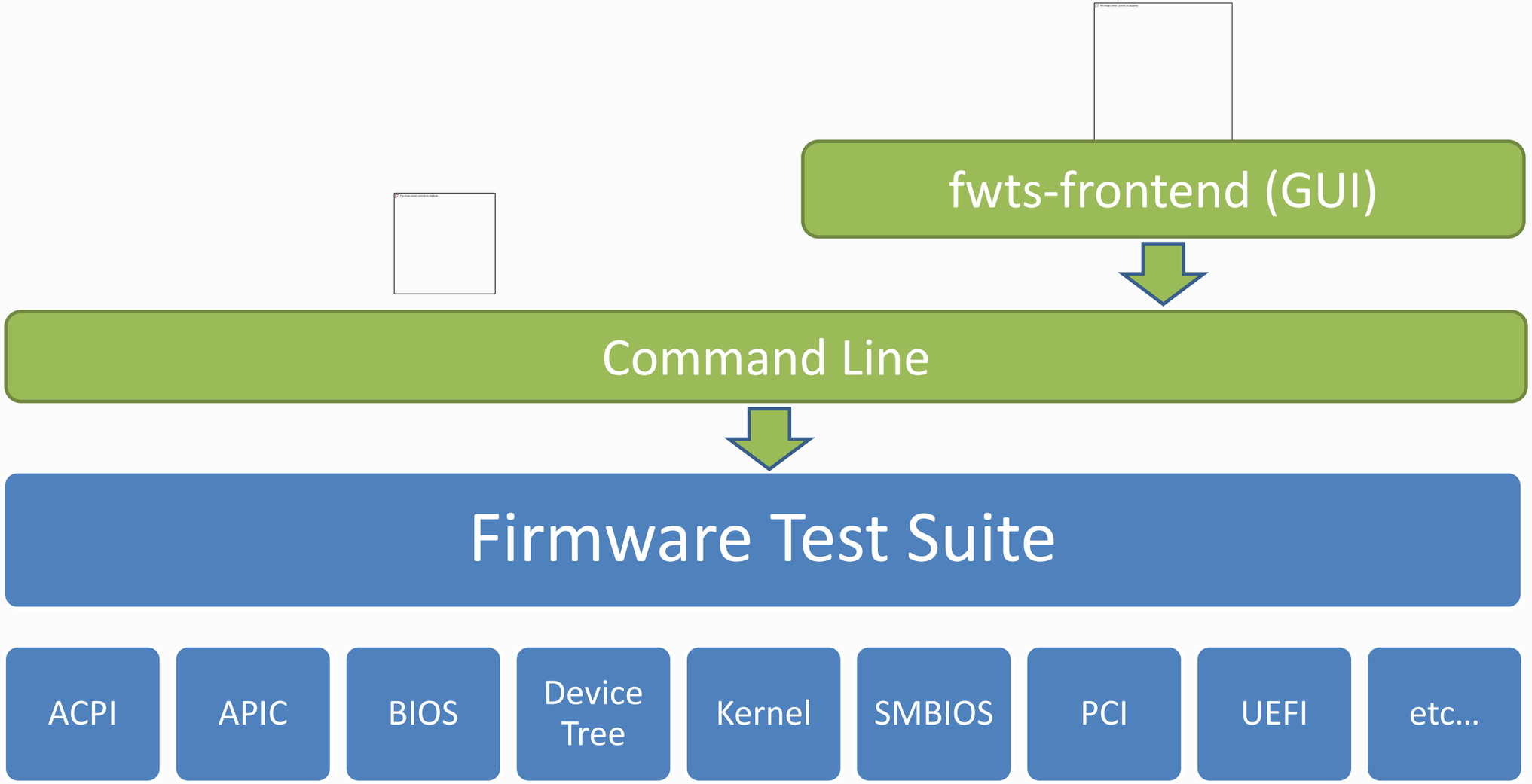
Installing FWTS in Ubuntu

- Add apt-repository for latest release
  - *sudo add-apt-repository ppa:firmware-testing-team/ppa-fwts-stable*
- Install fwts
  - *sudo apt update*
  - *sudo apt install fwts fwts-frontend*

Installing from Source Code

- Download source code
  - *git clone git://kernel.ubuntu.com/hwe/fwts.git*
  - *git clone https://github.com/ColinIanKing/fwts*
- Setup build environment & configure
  - *sudo apt-get build-dep fwts*
  - *autoreconf -ivf && ./configure*
- Compile and install
  - *make clean && make -j4* (= 4 threads)
  - *sudo make install*

FWTS User Interfaces



Using FWTS [Demo]

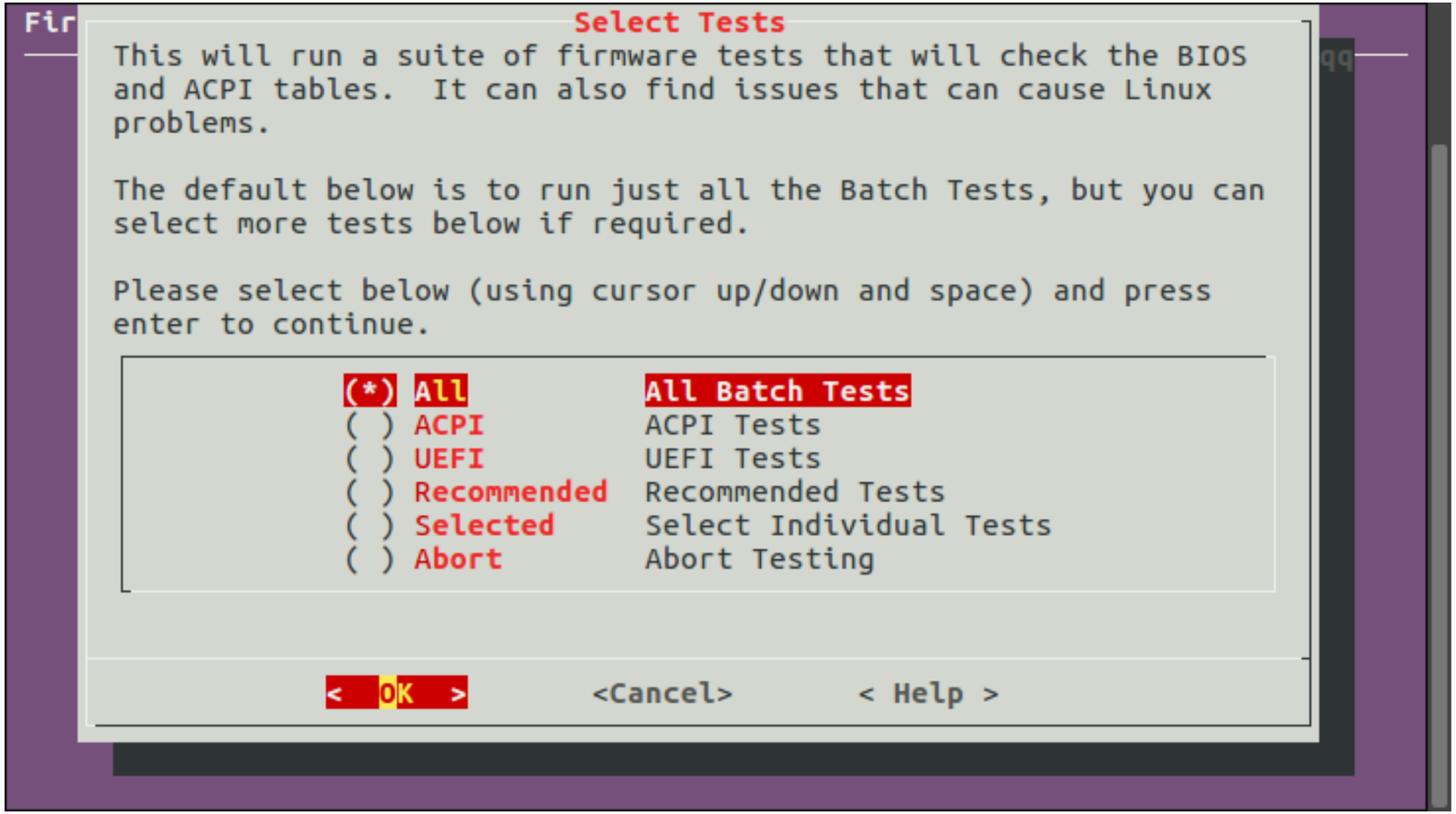
Using FWTS – Command Line

- Run a single test, ex. C states
  - *sudo fwts cpufreq*
- Run multiple tests, ex. C states + PCIe ASPM
  - *sudo fwts cpufreq aspm*
- Run all ACPI tests + all UEFI tests
  - *sudo fwts --acpitests --uefitests*
- View all tests
  - *fwts --show-tests-full*

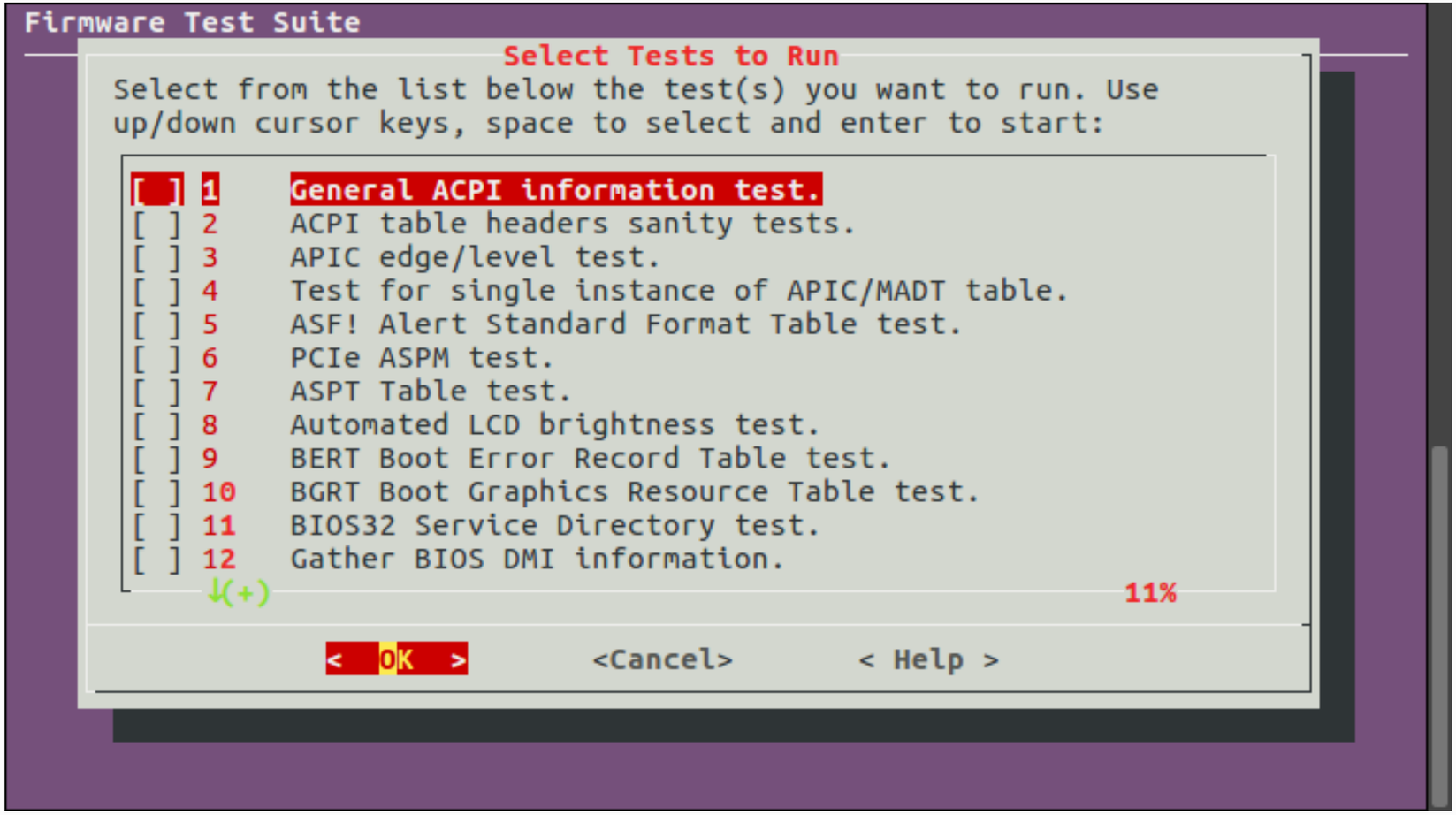
Using FWTS – Command Line

```
alexhung@moon:~$ sudo fwts cpufreq aspm
Running 2 tests, results appended to results.log
Test: CPU frequency scaling tests.
  CPU frequency table consistency                    1 passed
  CPU frequency table duplicates                     1 passed
  CPU frequency firmware limits                      1 passed
  CPU frequency claimed maximum                      1 passed
  CPU frequency SW_ANY control                       1 skipped
  CPU frequency SW_ALL control                       1 skipped
  CPU frequency performance tests.                   1 skipped
Test: PCIe ASPM test.
  PCIe ASPM ACPI test.
  PCIe ASPM registers test.                          1 passed, 2 warnings
alexhung@moon:~$
```

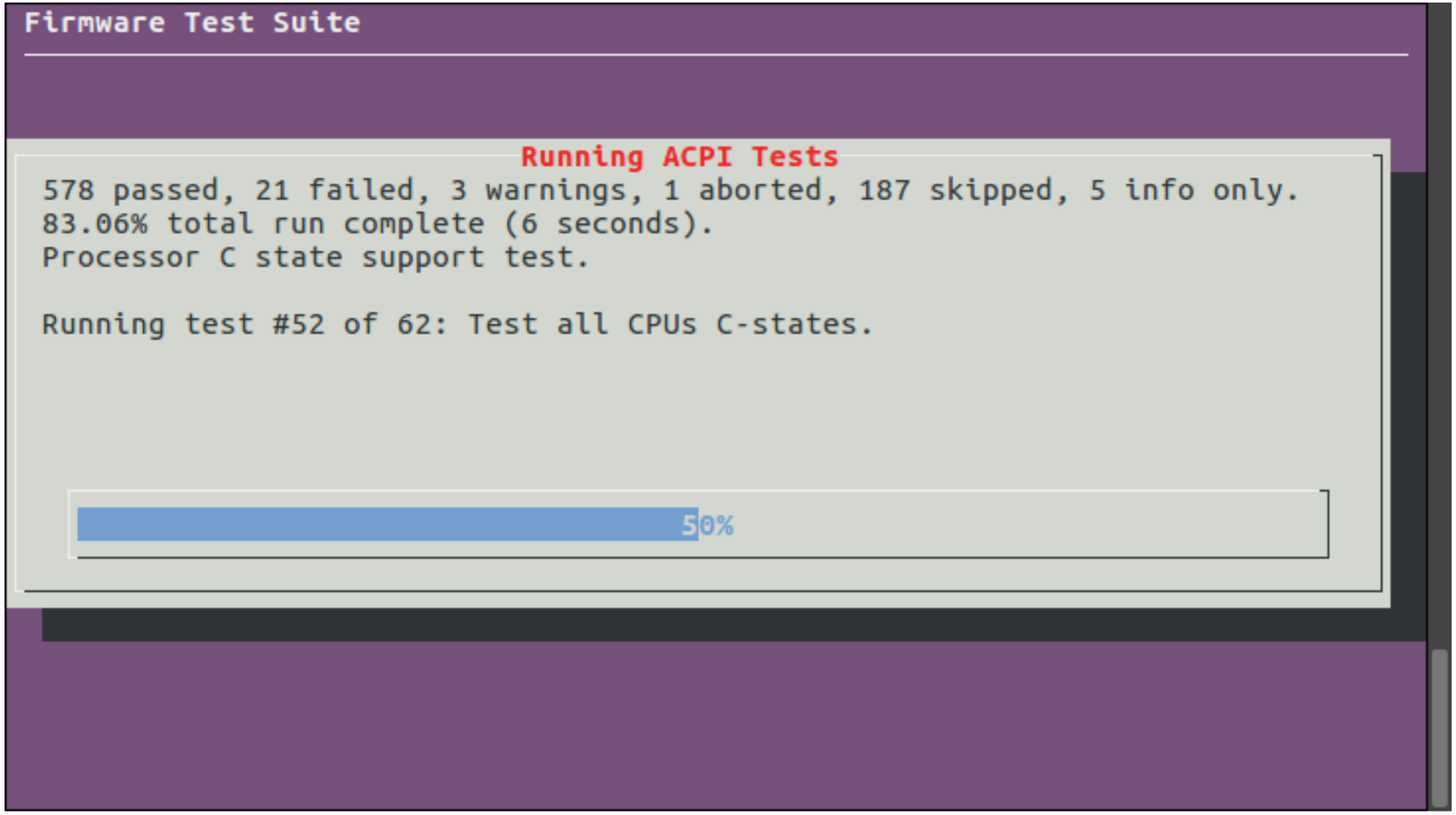
Using FWTS – fwts-frontend-text



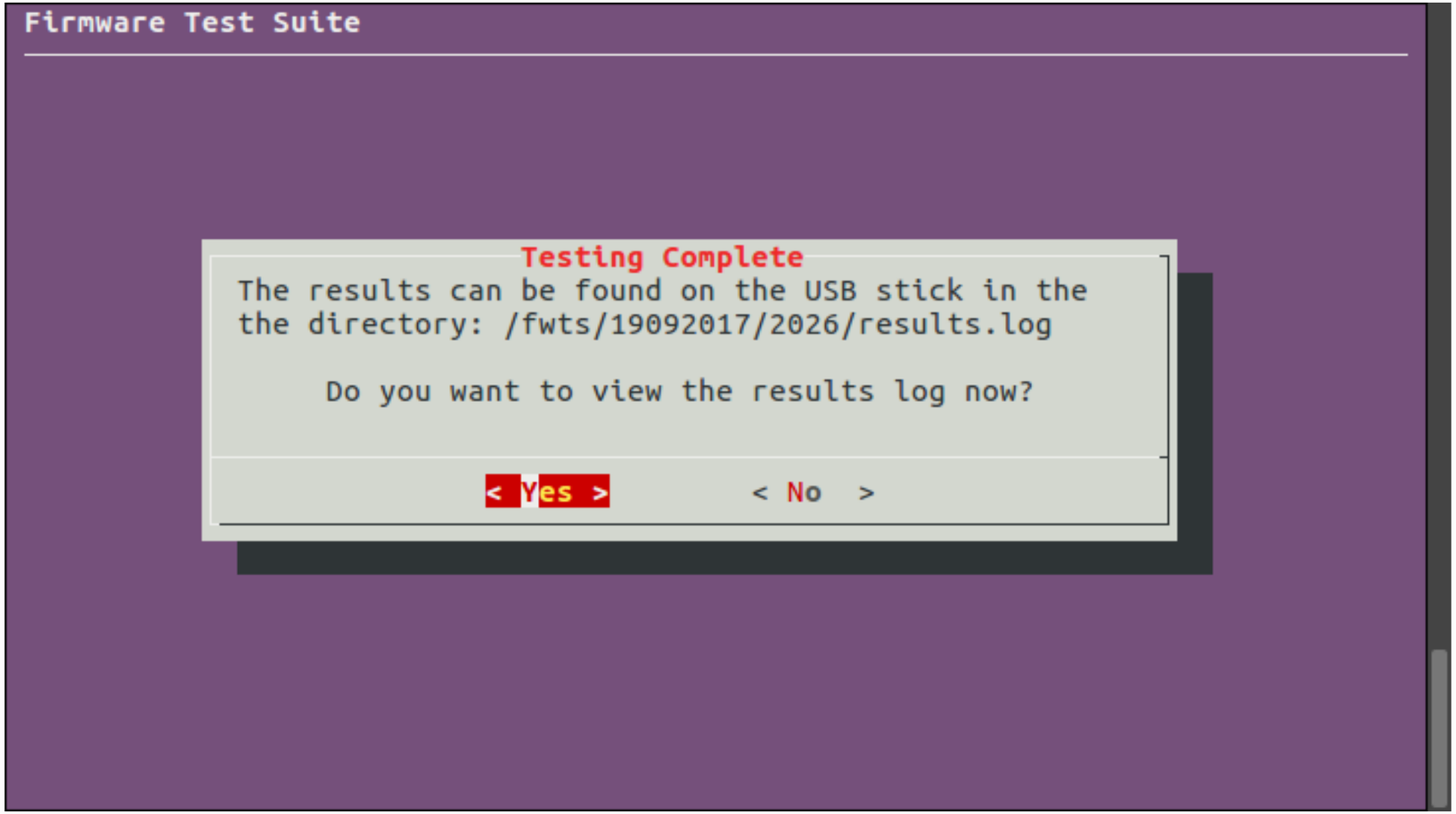
Using FWTS – fwts-frontend-text



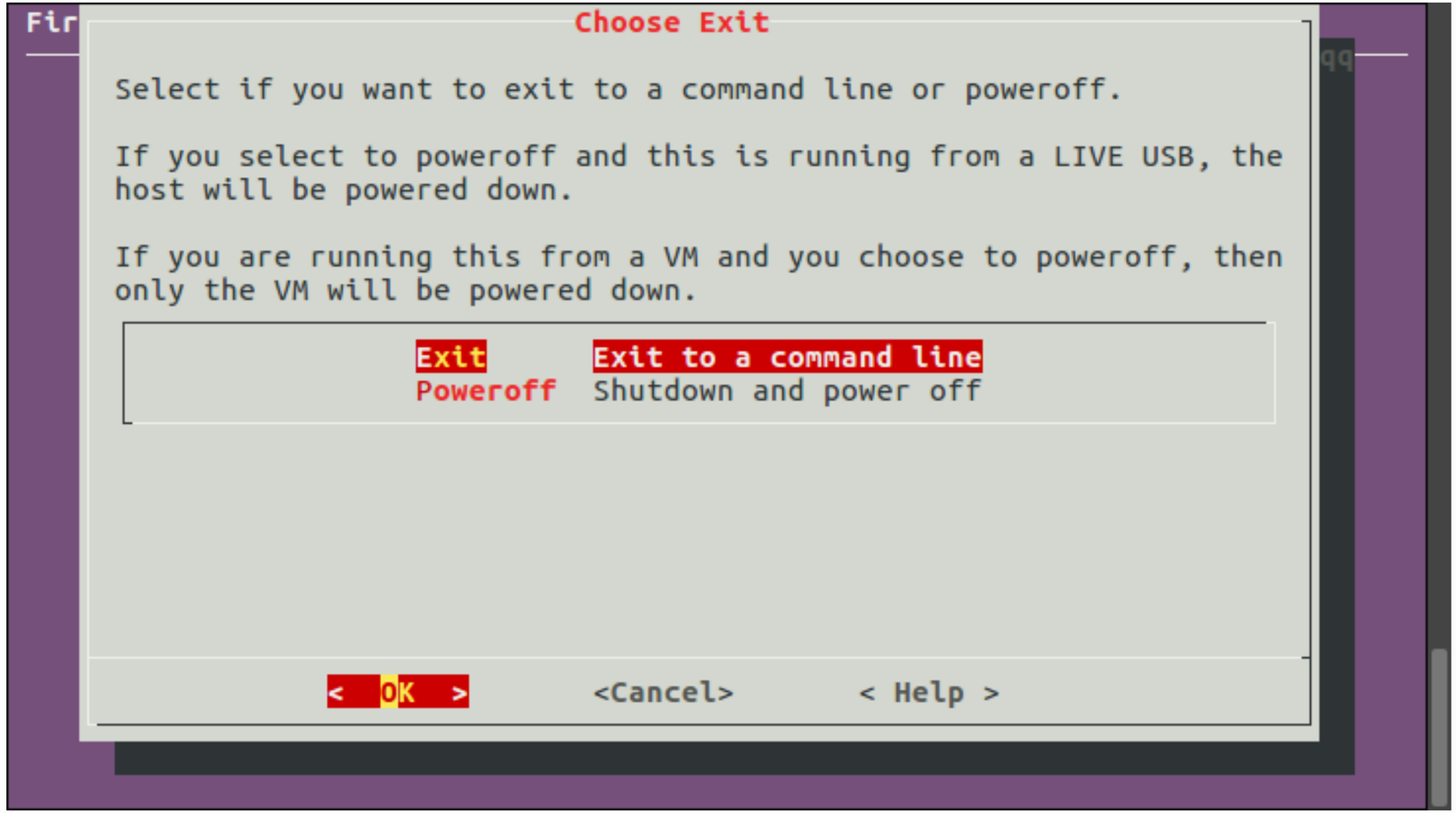
Using FWTS – fwts-frontend-text



Using FWTS – fwts-frontend-text



Using FWTS – fwts-frontend-text



Results.log

```
Results generated by fwts: Version V17.08.00 (2017-08-30 06:30:53).

Some of this work - Copyright (c) 1999 - 2017, Intel Corp. All rights reserved.
Some of this work - Copyright (c) 2010 - 2017, Canonical.
Some of this work - Copyright (c) 2016 - 2017, IBM.
Some of this work - Copyright (c) 2017, ARM Ltd.

This test run on 19/09/17 at 21:04:24 on host Linux moon 4.10.0-33-generic
#37~16.04.1-Ubuntu SMP Fri Aug 11 14:07:24 UTC 2017 x86_64.

Command: "fwts cpufreq aspm".
Running tests: cpufreq aspm.

cpufreq: CPU frequency scaling tests.
-------------------------------------------------------------------------------
WARNING: Test 1, Cannot set CPU 0 governor to userspace.
Failed to initialize cpufreq to set CPU speed
Test 1 of 7: CPU frequency table consistency
PASSED: Test 1, CPU frequency tables are consistent

Test 2 of 7: CPU frequency table duplicates
PASSED: Test 2, No duplicates in CPU frequency table

                                                              18,1          Top
```

Results.log – Tests

```
cpufreq: CPU frequency scaling tests.
-------------------------------------------------------------------------------
WARNING: Test 1, Cannot set CPU 0 governor to userspace.
Failed to initialize cpufreq to set CPU speed
Test 1 of 7: CPU frequency table consistency
PASSED: Test 1, CPU frequency tables are consistent

Test 2 of 7: CPU frequency table duplicates
PASSED: Test 2, No duplicates in CPU frequency table

Test 3 of 7: CPU frequency firmware limits
PASSED: Test 3, No BIOS limits imposed

Test 4 of 7: CPU frequency claimed maximum
PASSED: Test 4, No max frequencies present

Test 5 of 7: CPU frequency SW_ANY control
SKIPPED: Test 5, Can't set CPU frequencies

Test 6 of 7: CPU frequency SW_ALL control
SKIPPED: Test 6, Can't set CPU frequencies

Test 7 of 7: CPU frequency performance tests.
                                                          31,1          20%
```

Results.log – Summary

```
5 passed, 0 failed, 2 warnings, 0 aborted, 3 skipped, 0 info only.

Test Failure Summary
================================================================================

Critical failures: NONE

High failures: NONE

Medium failures: NONE

Low failures: NONE

Other failures: NONE

Test           |Pass |Fail |Abort|Warn |Skip |Info |
---------------+-----+-----+-----+-----+-----+-----+
aspm           |    1|     |     |    2|     |     |
cpufreq        |    4|     |     |     |    3|     |
---------------+-----+-----+-----+-----+-----+-----+
Total:         |    5|    0|    0|    2|    3|    0|
---------------+-----+-----+-----+-----+-----+-----+
                                                70,0-1        Bot
```

Adding New Tests

FWTS Directories

Firmware Test Suite

ACPI	BIOS	Device Tree	Kernel	SMBIOS	Opal	PCI	UEFI	etc…

```
alexhung@moon:~/src/fwts$ tree src -L 1 -d
src
├── acpi
├── acpica
├── apic
├── bios
├── cmos
├── cpu
├── devicetree
├── dmi
├── example
├── hotkey
├── ipmi
├── kernel
├── lib
├── opal
├── pci
├── sbbr
├── uefi
└── utilities
```

```
alexhung@moon:~/src/fwts$ tree src/acpi -L 1 -d
src/acpi
├── ac_adapter
├── acpidevices
├── acpidump
├── acpiinfo
├── acpitables
├── apicinstance
├── asf
├── aspt
├── battery
├── bert
├── bgrt
├── boot
├── brightness
├── checksum
├── cpep
├── crsdump
├── csrt
├── cstates
└── dbg2
```

Adding an ACPI Table Test

- [DEMO] adding DPPT table as an example
  - Add to FWTS
  - Use iasl & fwts — dumpfile to test the new table
- [DEMO] adding a new test group such as — acpitests

Contributing Patches

Contributors

```
 2896  Colin Ian King <colin.king@canonical.com>
  319  Alex Hung <alex.hung@canonical.com>
  189  Ivan Hu <ivan.hu@canonical.com>
  120  Keng-Yu Lin <kengyu@canonical.com>
   86  IvanHu <ivan.hu@canonical.com>
   47  Al Stone <al.stone@linaro.org>
   35  Jeremy Kerr <jk@ozlabs.org>
   26  Deb McLemore <debmc@linux.vnet.ibm.com>
   24  Jeffrey Hugo <jhugo@codeaurora.org>
   16  Alberto Milone <alberto.milone@canonical.com>
   15  Prarit Bhargava <prarit@redhat.com>
   14  Chris Van Hoof <vanhoof@canonical.com>
   14  Ricardo Neri <ricardo.neri-calderon@linux.intel.com>
   11  Matt Fleming <matt.fleming@intel.com>
    6  Erico Nunes <ernunes@redhat.com>
    4  Heyi Guo <heyi.guo@linaro.org>
    4  Mahesh Bireddy <mahesh.reddybireddy@arm.com>
    4  Yang Kun (YK) <kun.yang@canonical.com>
    3  Anthony Wong <anthony.wong@canonical.com>
    3  Fu Wei <fu.wei@linaro.org>
    3  Kamal Mostafa <kamal@canonical.com>
    3  Rajat Goyal <Rajat.Goyal@arm.com>
    3  Sakar Arora <Sakar.Arora@arm.com>
:
```

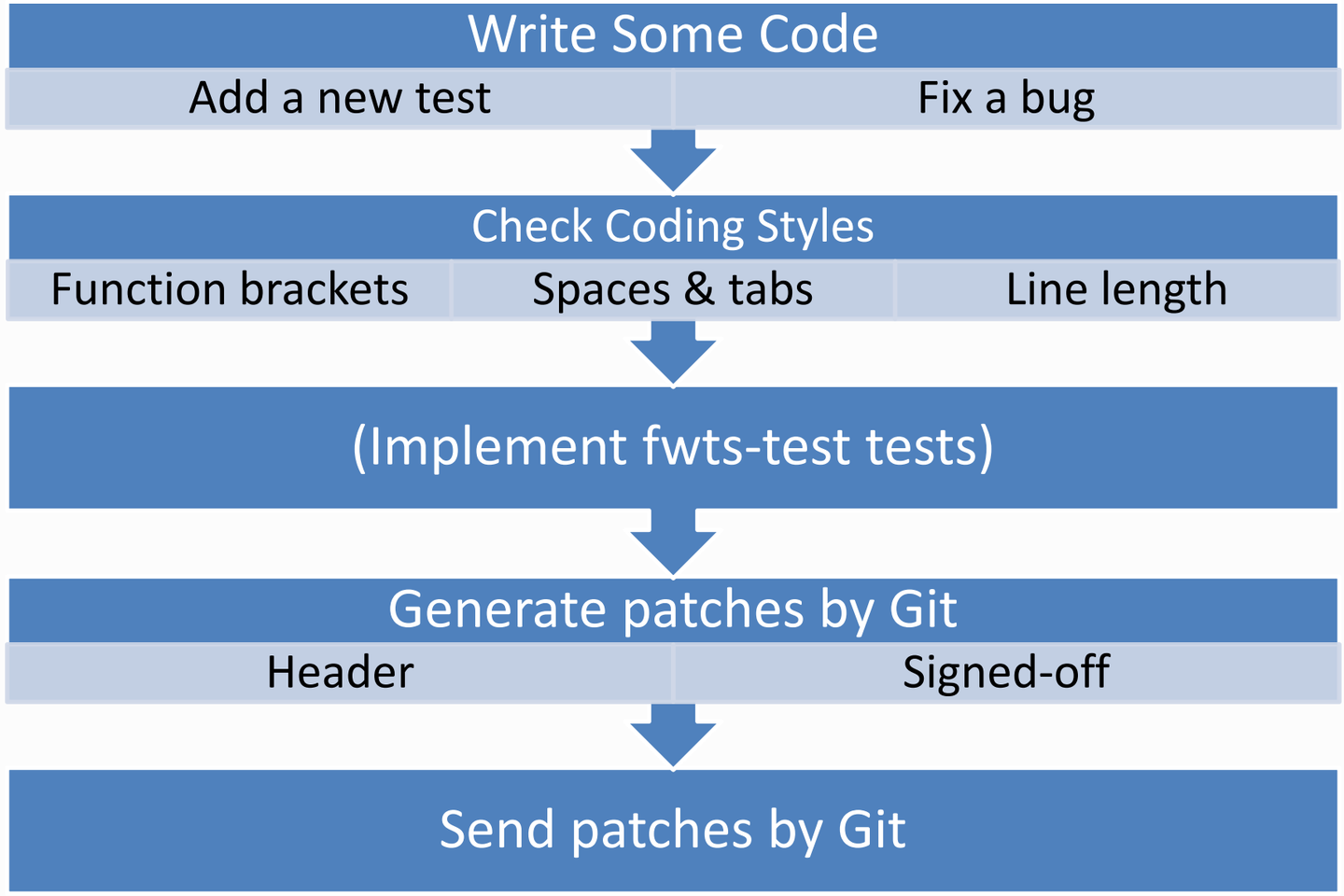
Why do People Contribute?

- My manager asks me to
- A bug annoys me
- My name will show up in Google
- I can list this in LinkedIn
- I can get a free ticket to COSCUP
- All of the above

Why do Companies Contribute?

- Same reasons for any other open source projects
  - Framework is easy to add new features, ex. Device Tree
  - Existing code is available, ex. ARM's Server Base Boot Requirements (SBBR)
  - Example: Linux-Only-Spec (imaginary) that must exclude all Windows features
    - No DBGP, DBG2, MSDM, and SLIC etc…

Submitting Patches



Check Patch Formats

- Following Linux source code convention
  - Not as restricted
- Signed-off
- Common format errors
  - Examples

FWTS-TEST

- A test for testing FWTS implementation
  - Check it
- Needed when adding new tests
- Ask us how to do it
  - We can help! (sometimes)

GPLv2 & FWTS

GPLv2

- FWTS uses GPLv2
- GPL is a “Copy-Left” license
- Can-do & can’t-do
- Implication
  - Contribute or not
  - Public & private PPA

Should I Upstream Patches?

- It depends
- But the answer is usually YES

Must I Release My Patches?

- It depends
- But the answer is usually NO
- Problems
  - Maintenance gets more and more difficult as FWTS grows

Are You 100% Certain?

- No
- Open source license is a complex topic
- Please consult professional lawyers

FWTS Community

Contact FWTS Community

- Email List (subscribe)
  - fwts-devel@lists.ubuntu.com
- Social media (FaceBook, Google+ & Twitter)
- Launchpad
- UEFI Plugfest!!!

Official URL

https://wiki.ubuntu.com/FirmwareTestSuite

Q&A

Thanks for attending the Fall 2017
UEFI Plugfest

For more information on the Unified EFI Forum and UEFI Specifications, visit http://www.uefi.org

presented by

CANONICAL