AUTOMATED GRAPHICAL TESTING ON REAL HARDWARE:
ADVENTURES WITH OPENQA

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XDC 2023
HELLO

I am

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2 UNIT TESTS

NO INTEGRATION TESTS
OpenQA

Automated end-to-end testing of...

- Desktop operating systems
- Phone operating systems
- Car operating systems
- ...basically anything with a screen
THE PROJECT

- Open source (GPL-2.0-or-later)
- Community-driven development
- Paid maintainer team (funded by SUSE)
- "Continuous release" model (no "stable" version)
THE TOOL

• Strong support for **screenshot testing**
  ▪ Fuzzy region matching (using openCV)
  ▪ Graphical UI for updating screenshots

• Multiple **backends** for virtual and physical hardware

• Hackable Perl codebase!
EXAMPLE: GNOME OS TESTS

Let's try and run them locally...

```
rm -r ./out; env ssam_openqa run --tests-path .
   --hdd-path ./gnome_os_disk.latest.20230831.img
   --iso-path ./gnome_os_installer_525758.iso
   -o ./out
```
ssam_openqa is a CLI helper tool. It wraps long Podman commands:

```
podman run --name ssam_openqa_gnome_apps 
   --privileged --detach 
   --volume=$(pwd)/gnome_os_disk.latest.20230831.img:/disk.img 
   --volume=$(pwd):/tests 
   --volume=$(pwd)/out/gnome_apps:/shared 
   --entrypoint isotovideo 
   --publish 5990 
   --publish 20013 
   --workdir=/shared 
   registry.opensuse.org/devel/openqa/containers15.4/openqa_worker:latest 
   --workdir=/shared ARCH=x86_64 
   ASSETDIR=/var/lib/openqa/share/factory/ 
   BACKEND=qemu 
   ...
```

os-autoinst is also packaged in distros - but beware "rolling release" versioning.
HOW IT WORKS

**Assets**: OS image, … **Tests** and **needles**
HOW IT WORKS

Assets: OS image, ...

Tests and needles

Test runner: isotovideo
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Hardware control

Machine: QEMU, hardware, ...

Machine state
HOW IT WORKS

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Input

Console: virtio, serial, VNC, ...

Screenshots
HOW IT WORKS

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Screenshots

Test results
INTEGRATING INTO CI

Two options:

• Permanent workers, managed by openQA server
• Transient workers, e.g. on a Gitlab CI runner

openSUSE use openQA to manage workers.

GNOME uses transient runners on Gitlab CI.
THE OPENQA WEB UI

Let's see this online!
Screenshot tests will always have false positives.

openQA deals with this in 4 ways:

1. Search within the screen
2. Similarity threshold (90-100%)
3. Exclude zones
4. Web UI for needle updates.
"Permenant worker" and "transient worker" approaches are possible.
KERNEL TESTING AT CODETHINK
EXAMPLE OF LAVA + OPENQA

See: http://openqa.qa.codethink.co.uk/
Testing on automotive hardware

How do you remote control a car IVI system?

- virtio-devices
- VNC
- Q.A.D.: lightweight "remote control" daemon
HARDWARE TOOLS

USB-C switcher with computer control

For tests involving phones & USB media

Open hardware, see: https://gitlab.com/CodethinkLabs/usb-switch
HARDWARE TOOLS

What to do about the mess??
HARDWARE TOOLS

Testing in a Box

Hardware: Host PC, serial, CAN emulator, USB Switch + Hub, Bluetooth/WiFi, HID emulation, ...

Software: Gitlab + Gitlab CI, openQA worker, ...

Open hardware, see: https://gitlab.com/CodethinkLabs/testing-in-a-box
CODETHINK IS HIRING

openQA: https://openqa.qa/

 GNOME tests: https://gitlab.gnome.org/gnome/openqa-tests/

Codethink projects:

• Code: https://gitlab.com/CodethinkLabs/
• Chat: #codethinklabs:matrix.org

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