Building and testing an automotive platform - how Automotive Grade Linux is built and tested

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AGL - what?

- Automotive Grade Linux is a Linux Distribution
- It is based on the Yocto Project/Openembedded
- Platform for multiple device profiles (IVI, telematics, ... )
AGL - what?

- Open Source and Code First
- Multiple Architectures:
  - x86 (e.g. Intel Minnowboard)
  - ARM 32 (e.g. Renesas Porter, TI Vayu, RaspberryPI)
  - ARM 64 (e.g. Qualcomm dragonboard 410c, rpi3?)
This talk ...

- why ? ... we do this
- what ? ... tools we use
- how ? ... we combine them
- what ? ... we want to achieve
Why?
... we do this
Why?

AGL development ...

- AGL development is done in a distributed way
- Developers around the globe contribute
- Code review
Why?

- Does it build?
- Does it work?
  - on board/arch A?
  - on board/arch B?
  - on board/arch C?
  - ...
  - on board/arch <n>?
Why?

- This must be a common problem!
  - just see how many talks during ELCE we have ;)
  - multiple solutions – good!
  - different use-cases

- Here is what we use! (Well, we think it does the trick – ideas/feedback welcome! Curious to hear your ideas !)
What?
... tools we use
What? ... tools we use

- **SCM + Review**: Gerrit (sorry, Greg)
- **CI Builds**: Jenkins
- **Tests on HW**: 
  a) AGL-JTA (Fuego)
  b) LAVA
- **Data-Postproc** ... ???
SCM/Code-Review - Gerrit

- https://git.automotivelinux.org
- AGL-related projects in AGL/*
- if we are upstream → /src/*
- to try out code → /staging/*
- we use "repo" to pull down the git repositories
SCM/Code-Review - Gerrit

• All code that goes into AGL/* needs to work on all reference and community platforms

→ Test matrix:
  – Renesas Porter
  – Intel Minnowboard
  – Qemux86-64 (emulator)
  – DragonBoard
  – TI Vayu
  – NXP Wandboard, Sabre
  – RPI 2/3
  – ...

LINUX FOUNDATION
CI Builds - Jenkins

- https://jenkins-new.automotivelinux.org
  - Standard Jenkins
    + gerrit-trigger plugin (to poll git.automotivelinux.org)
    + openstack cloud plugin (to start jenkins slaves/minions)
      + slaves run off identical base-images
  - CI-jobs created with Jenkins-Job-Builder (yaml)
CI Builds - Jenkins

- A successful build will vote "Verified +1"
- A failed build will vote "Verified -1" in Gerrit
- You need to define the success/failure criteria
  - Starts with "it builds" (yay!)
  - Ends with "it boots, runs, passes all tests, updates cleanly, communicates with X and shuts-down properly"
Tests on HW

Tests on HW are hard !?

- You need the HW
- You need it on your desk/in your lab
- You need to deploy firmware/filesystems
- You need to reboot the board
- You need to initiate the test
- You need to collect the results
- You need to interpret the results

... rinse & repeat
Lab setups ... (from ELCE slides)
Documenting our Lab setup

- Doc for AGL-JTA/Fuego: https://git.automotivelinux.org/gerrit/gitweb?p=AGL-JTA.git;a=tree;f=docs
- Wiki page in AGL wiki:
  - https://wiki.automotivelinux.org/agl-testframework
Tests and frameworks ...

- AGL-JTA (modified/patched Fuego)
  - https://git.automotivelinux.org/gerrit/gitweb?p=AGL-JTA.git
  - jta.automotivelinux.org (Live instance - WIP)
  - runs tests on target boards and collects results
    - results end up right now in a git repo

😊 large set of Tests, postproc capabilities

😢 Installation, modification, board local (pwr/ssh)
## Test Automation Framework

### Latest tests runs

<table>
<thead>
<tr>
<th>Job</th>
<th>Build</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIAT:java-done</td>
<td>P6</td>
<td>Oct 5, 2016 7:51:17 PM</td>
</tr>
<tr>
<td>CIAT:upload_result</td>
<td>F12</td>
<td>Oct 5, 2016 7:51:17 PM</td>
</tr>
<tr>
<td>CIAT:porter1</td>
<td>P6</td>
<td>Oct 5, 2016 7:51:05 PM</td>
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<tr>
<td>CIAT:common1</td>
<td>P8</td>
<td>Oct 5, 2016 7:50:57 PM</td>
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<tr>
<td>CIAT:porter2</td>
<td>P8</td>
<td>Oct 5, 2016 7:50:47 PM</td>
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<tr>
<td>CIAT:releases-porter</td>
<td>P8</td>
<td>Oct 5, 2016 7:50:34 PM</td>
</tr>
<tr>
<td>CIAT:java_deploy</td>
<td>P8</td>
<td>Oct 5, 2016 7:40:04 PM</td>
</tr>
<tr>
<td>CIAT:test</td>
<td>P5</td>
<td>Oct 5, 2016 7:40:04 PM</td>
</tr>
<tr>
<td>CIAT:java-done</td>
<td>P5</td>
<td>Oct 5, 2016 4:21:34 PM</td>
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<tr>
<td>CIAT:upload_result</td>
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<tr>
<td>CIAT:porter1</td>
<td>F7</td>
<td>Oct 5, 2016 4:21:21 PM</td>
</tr>
<tr>
<td>CIAT:common1</td>
<td>F7</td>
<td>Oct 5, 2016 4:21:12 PM</td>
</tr>
<tr>
<td>CIAT:porter2</td>
<td>F7</td>
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<td>CIAT:releases-porter</td>
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<td>CIAT:porter1</td>
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<tr>
<td>CIAT:common1</td>
<td>P8</td>
<td>Oct 5, 2016 2:48:12 PM</td>
</tr>
</tbody>
</table>

### Test Run statistics
Tests and frameworks ...

- LAVA
  - https://validation.linaro.org
  - https://porter.automotivelinux.org/scheduler/alljobs
  - board farm management + test executor
  - grabs board from pool, pwr & boot & test
    - ☺ multiple boards per type, remote lab (WIP),
    - ☺ runs even on RPI2/3 with PiFACE ! (2 DUT)
    - ☹ first setup little hard, doc for satellite labs
<table>
<thead>
<tr>
<th>ID</th>
<th>Status</th>
<th>Priority</th>
<th>Device</th>
<th>Description</th>
<th>Submitter</th>
<th>Submit Time</th>
<th>End Time</th>
<th>Duration</th>
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<tr>
<td>163</td>
<td>Complete</td>
<td>Medium</td>
<td>porter-01</td>
<td>lava-boot job for jta-agl</td>
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<td>Canceled</td>
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</tbody>
</table>
Documenting our Lab setup

- WIP document for LAVA:
- Doc for AGL-JTA/Fuego:
  https://git.automotivelinux.org/gerrit/gitweb?p=AGL-JTA.git;a=tree;f=docs
- Wiki page in AGL wiki:
  - https://wiki.automotivelinux.org/agl-testframework
BOM $\leq 100$ €

HOST
(Lava, tftp, ser2net)

DUT

USB2SERIAL

USB2Ethernet

Power (via relay)

Network

Relay board

Images: commons:User:Lucasbosch, commons:User:HandySmart, Element14
Data-Postproc ... ???

- Investigating
  - In fuego (AGL-JTA) ??
  - Other mechanism ??
  - What data to track at all ??

→ You need to define your key indicators
Feedback to Developers

- In our case – right in gerrit:

  - Code Review (human)
  - Verified (CI complete)
  - CI-Image-Build ("It builds")
  - CI-Image-Boot-Test ("It boots on HW")
  - CI-Image-LTSI-Test ("The tests pass")
  - CI-Image-UI-Test ("The UI tests pass")
How ? ... we combine them
Plan (short/mid)

- Gerrit
- Jenkins (Build)
- SPDX
- AGL-JTA (jta)
- Lava (lava)
- Remote Lab
  - Extended tests, customized tests
What? ... we want to achieve
What? ... we want to achieve (Vision)

- Stable and tested platform to build-upon
  - wide range of devices
- Fast development through 'instant' feedback
  - developers work remotely, not all boards available
- Easy development through direct test on hw
  - remote testing capabilities in combination with SDK
Q/A ?!
THANK YOU