ENHANCE FUEGO TEST EFFICIENCY BY APPLYING ADDITIONAL SOFTWARE AND HARDWARE SOLUTIONS

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AGENDA

- Self introduction
- Fuego as a test automation solution
  - Why Fuego
  - Known efforts of applying Fuego
- A FUNCTIONAL automation test solution based on Fuego
- Feedback to Fuego upstream
- Future work
SELF INTRODUCTION
Renesas Design Vietnam Co., Ltd. (RVC) was founded in October 2004, as one of the main design centers in Renesas group.

- Business line: Design of semiconductor for both hardware and software.
WHO AM I?

- Name: Khiem Trong. Nguyen (KHIEM Nguyen - キム グエン)
- Company: Renesas Design Vietnam

- Career: 09 years experiences in embedded software development
  - Development and verification for Mobile software platform
  - Development and verification for In-vehicle software platform
  - Develop and apply test automation solutions to In-vehicle software platform
FUEGO

AS A TEST AUTOMATION SOLUTION
There are 3 important milestones so far.
And there are more expectations on upcoming releases as Fuego get more attentions from community.
FUEGO AS A TEST AUTOMATION SOLUTION
ABOUT FUEGO [2/2]

2014
- LTSI Test project (JTA)
  - 1st release by May 2014
  - Adopted by AGL and community
  - Run on Docker from 2015

2016
- Fuego v1.0 release
  - Released by Nov. 2016
  - More engagement from community
  - Function enhancement from community
  - Wiki, Mailing list discussion

2017
- Fuego v1.1 “Blaze” release
  - Released by April 2017
  - Upgrade to Jenkins 2.32.1
  - Change Fuego directories layout
  - Change Fuego script system
  - New transport for board communication

- Fuego next
  - LAVA integration
  - etc
FUEGO AS A TEST AUTOMATION SOLUTION
PITFALLS OF SOFTWARE TEST ACTIVITIES

- Unstable test result among testers
- Much human efforts due to manual tests and test cycle repetition
- Hard to modify un-unified & close-source test solutions
- Hard to port test cases from one solution to another

There’s a common need to find a software test framework which can address above issues.
FUEGO AS A TEST AUTOMATION SOLUTION

Why Fuego?

Jenkins-based open source test solution

- Easy expand the supported features, utilizing the Jenkins plugins
- Portable by running Fuego on top of Docker
- Able to utilize the existed features to optimize test execution
- Easy to add more test cases individually or in groups
FUEGO AS A TEST AUTOMATION SOLUTION
THE KNOWN EFFORT OF APPLYING FUEGO [1/2]

- There are more community contribution to Fuego from the time.
  - Adding more test cases
    - 2014, Fujitsu engineer contributes new ethtool test cases.
  - Use system to perform kernel build and test
    - 2015, Mitsubishi engineer showed how to run LTP efficiently with LTSI test project.
  - Apply Fuego into AGL test automation framework.
    - 2015, AGL engineers deployed it as official AGL CIAT solution.
  - Improve Fuego functionalities
    - 2016, Toshiba engineer proposed improvement on Post-processing tool to summarize LTP test result.
According to the report in 2016 [1], Renesas has also put many efforts to apply Fuego into test automation solutions.

- Building up automation test for R-Car System, select to execute all test cases without manually connect/disconnect the external hardware.
- Summarized the test result (logs) automatically and output them as a report (excel file).

A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

WHAT IS A FUNCTIONAL AUTOMATION TEST SOLUTION?

- Requirements for a functional automation test solution.
  - Able to perform the test automatically as submitted schedule.
  - Able to complete the test case without human intervention.
  - Automatically notify status of test execution to testers.
  - Offer the options to trigger the test automatically based on source code update (CIAT).
  - Easy the device management.
  - Ease the test case management, test result management and test report creation.
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

WHAT IS A FUNCTIONAL AUTOMATION TEST SOLUTION?

- Able to complete the test case without human intervention.
  - Need hardware solution to support board control automatically (change boot mode, cold boot, warm boot, resume from deep sleep, USB/SDcard/HDMI hotplug).
- Automatically notify status of test execution to testers.
  - Email notification to testers
- Offer the options to trigger the test automatically based on source code update (CIAT)
  - Hook git repository update event or Gerrit review system update.
- Easy the device management
  - Local and remote board management
- Ease the test case management, test result management and test report creation.
  - Scalable and Flexible test result database
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
INTEGRATING SOFTWARE SOLUTION WITH FUEGO

- Testlink as Fuego’s “test case and test result database” facility.
  - Strong open-source solution for test case management.
    - Manage test specification.
    - Manage test plan -> execution.
    - Generate test execution matrix report.
  - Import/export
- Jenkins plugin is available.
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
INTEGRATING SOFTWARE SOLUTION WITH FUEGO

- Lava as Fuego’s “board management” facility.
  - Strong open-source solution for board management.
    - Local boards and remote boards
    - Support interface to extend board management capabilities, like power supply ON/OFF, etc
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
INTEGRATING SOFTWARE SOLUTION WITH FUEGO

- Gerrit as Fuego’s “test event trigger” facility.
- Strong open-source solution for source code review and source code management.
- Well-known combination to realize CI infrastructure.
What features hardware solutions can support?

- Power supply control
- Boot from power-on-reset (cool boot) or hardware reset (warm boot)
- Firmware update with switch changing
- Suspend-to-RAM resume as a wakeup factor
- External connection hotplug
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
INTEGRATING HARDWARE SOLUTION WITH FUEGO

- Power supply control
- Boot from power-on-reset (cool boot) or hardware reset (warm boot)

RSTMODE_SW=L
EX_PWRONn=H/L
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
INTEGRATING HARDWARE SOLUTION WITH FUEGO

- Firmware update with switch changing
  - With GPIO control, able to perform firmware update, hyperflash boot and QSPI boot.
- Suspend-to-RAM resume as a wakeup factor
  - GPIO as a wakeup factor
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
INTEGRATING HARDWARE SOLUTION WITH FUEGO

- Firmware update with switch changing
  - Show the image of switch for Hyperflash boot and QSPI boot.
  - Show how to use GPIO control to support that work automatically.
- Suspend-to-RAM resume as a wakeup factor
  - GPIO as a wakeup factor
  - Special wakeup factor for deep System Suspend-to-RAM
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
INTEGRATING HARDWARE SOLUTION WITH FUEGO

SD Card

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Pin name</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>DAT3</td>
</tr>
<tr>
<td>2</td>
<td>CMD I/O</td>
</tr>
<tr>
<td>3</td>
<td>VSS</td>
</tr>
<tr>
<td>4</td>
<td>VDD</td>
</tr>
<tr>
<td>5</td>
<td>CLK</td>
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<td>6</td>
<td>VSS</td>
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<td>7</td>
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</tr>
<tr>
<td>8</td>
<td>DAT1</td>
</tr>
<tr>
<td>9</td>
<td>DAT2</td>
</tr>
</tbody>
</table>

Control VDD pin to hotplug SD Card

Control Vbus pin to hotplug USB

HDMI hotplug

Control pin19 to hotplug HDMI
A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO
FUEGO INTEGRATED SYSTEM

Host/TFTP PC

Database

Email Notification

Network

User_A

User_B

User_C

User_D

Fuego PC

Serial Connection

Adruino

Board A

Board B

Gerrit
Demonstration Video
for referenced Fuego integrated solution
FEEDBACK TO FUEGO UPSTREAM
FEEDBACK TO FUEGO UPSTREAM

- To realize the functional test automation solutions, need to offer the reference implementation which integrating other software solution to expand Fuego capability.
- Need reference design showing the integration.
- Considering to add more features as Fuego own features.
FEEDBACK TO FUEGO UPSTREAM

- Via this presentation, Renesas shows the possibility to integrating additional hardware solution and software solutions with Fuego to enhance test efficiency.
  - To make the integration smoothly, Fuego should have standardized interfaces for the features.
    - E.g test result database management, Gerrit integration, email notification
FUTURE WORK

- Via the Fuego practice, Renesas will contribute ideas/feedback to current Fuego development features as well as planning features for Fuego next releases.
- Renesas will continue using Fuego as test automation solution and explore more ways to improve test efficiency with Fuego.
  - Migrate all implemented features into latest Fuego release and continue enhancing the operation.
- One of the next challenges is to introduce audio test automation and video test automation to Fuego.