

# ENHANCE FUEGO TEST EFFICIENCY BY APPLYING ADDITIONAL SOFTWARE AND HARDWARE SOLUTIONS

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BIG IDEAS  
FOR EVERY SPACE

# AGENDA

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- Fuego as a test automation solution **Page 06**
  - Why Fuego
  - Known efforts of applying Fuego
- A FUNCTIONAL automation test solution based on Fuego **Page 13**
- Feedback to Fuego upstream **Page 26**
- Future work **Page 29**

# SELF INTRODUCTION

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# ABOUT RENESAS AND RENESAS DESIGN VIETNAM

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## Sales Companies

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Renesas Electronics America  
Renesas Electronics Canada  
Renesas Electronics Brasil-Servicos  
Renesas Electronics Europe (UK)  
Renesas Electronics Europe (Germany)  
Renesas Electronics (China)  
Renesas Electronics (Shanghai)  
Renesas Electronics Hong Kong  
Renesas Electronics Taiwan  
Renesas Electronics Singapore  
Renesas Electronics Malaysia  
Renesas Electronics India  
Renesas Electronics Korea

## Manufacturing and Engineering Service Companies

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Renesas Semiconductor Manufacturing  
Renesas Semiconductor Package & Test Solutions  
Renesas Semiconductor (Beijing)  
Renesas Semiconductor (Suzhou)  
Renesas Semiconductor (Malaysia)  
Renesas Semiconductor (Kedah)  
Renesas Semiconductor Technology (Malaysia)  
Renesas Semiconductor KL

## Design and Application Technologies Companies

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Renesas System Design  
Renesas Engineering Services  
**Renesas Design Vietnam**  
Renesas Semiconductor Design (Beijing)  
Renesas Semiconductor Design (Malaysia)

## Business Corporation

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Intersil Corporation

- 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?

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- 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

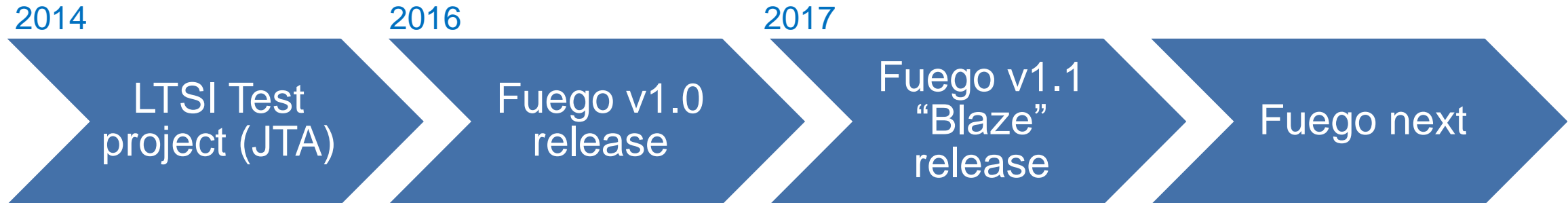
# AS A TEST AUTOMATION SOLUTION

AS  
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# FUEGO AS A TEST AUTOMATION SOLUTION

## ABOUT FUEGO [1/2]

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**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]

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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

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**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 ?

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**Jenkins-based open source test solution**



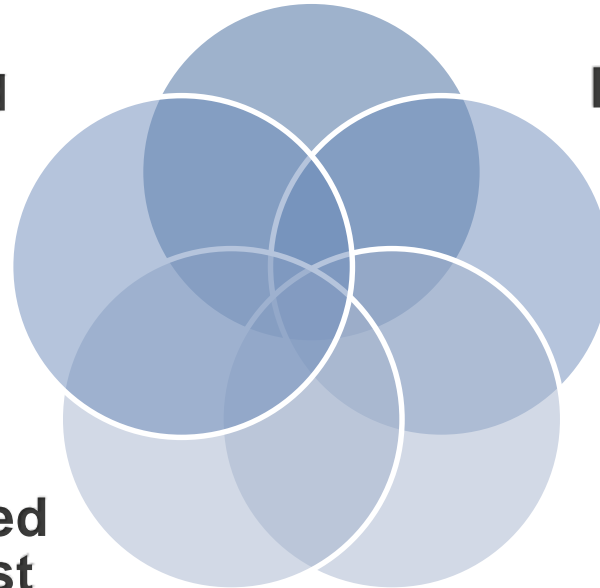
**Easy expand the supported features, utilizing the Jenkins plugins**

**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]

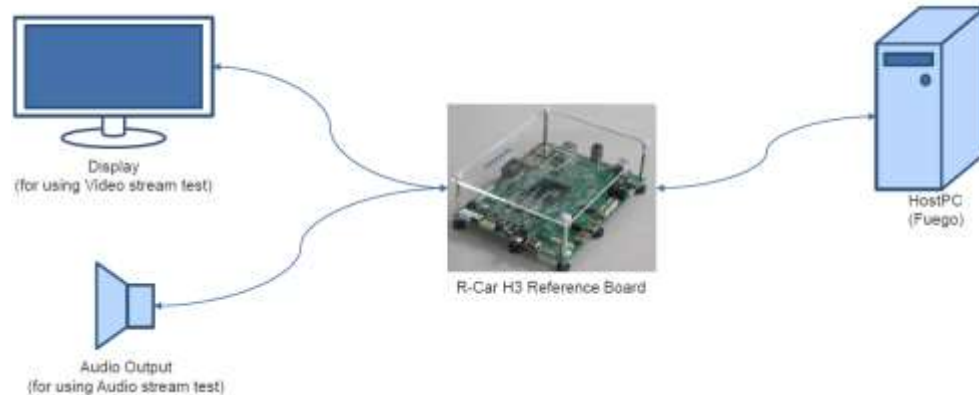
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- There are more community contribution to Fuego from the time.
  - Adding more test cases
    - 2014, Fujitsu engineer contributes new ethtool test cases.
  - Use system to perform kernel build and test
    - 2015, Mitsubishi engineer showed how to 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.

# FUEGO AS A TEST AUTOMATION SOLUTION

## THE KNOWN EFFORT OF APPLYING FUEGO [2/2]

- 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).



■ **Template Sample**

- PC report info: Utsutsu
- Environment: Linux
- Target board: R-Car
- Note:

Test name	Result	Duration	Details-Comments
Test Case #01	passed		
Test Case #02	passed		

[1] [http://elinux.org/images/1/12/The\\_Test\\_Activities\\_In\\_Renesas\\_Using\\_Fuego.pdf](http://elinux.org/images/1/12/The_Test_Activities_In_Renesas_Using_Fuego.pdf)

# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO



# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

## WHAT IS A FUNCTIONAL AUTOMATION TEST SOLUTION ?

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- 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 ?

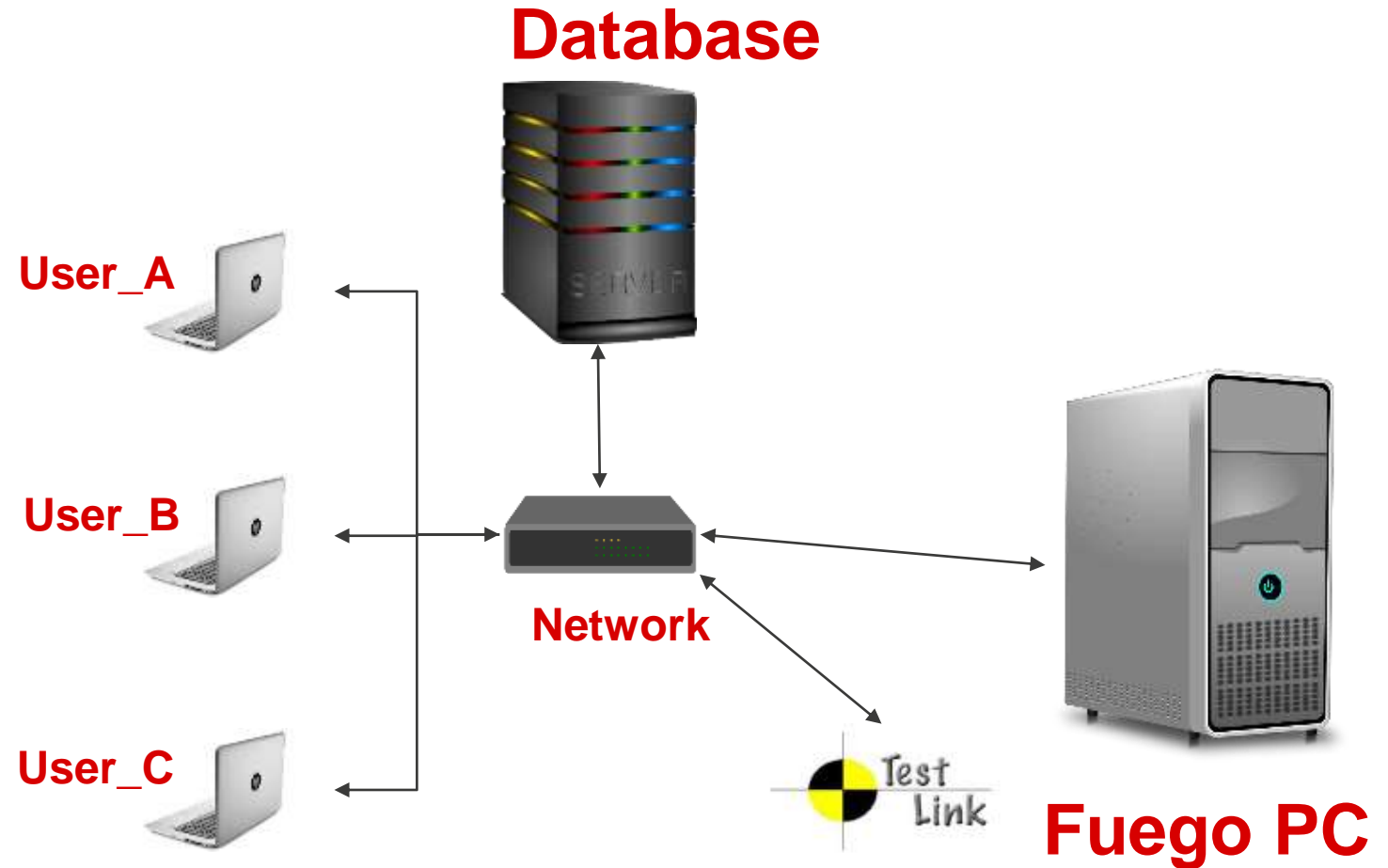
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- Able to complete the test case without human intervention.
  - Need hardware solution to support board control automatically (change boot mode, cold boot, warm boot, resume from deep sleep, USB/SDcard/HDMI hotplug).
- Automatically notify status 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.

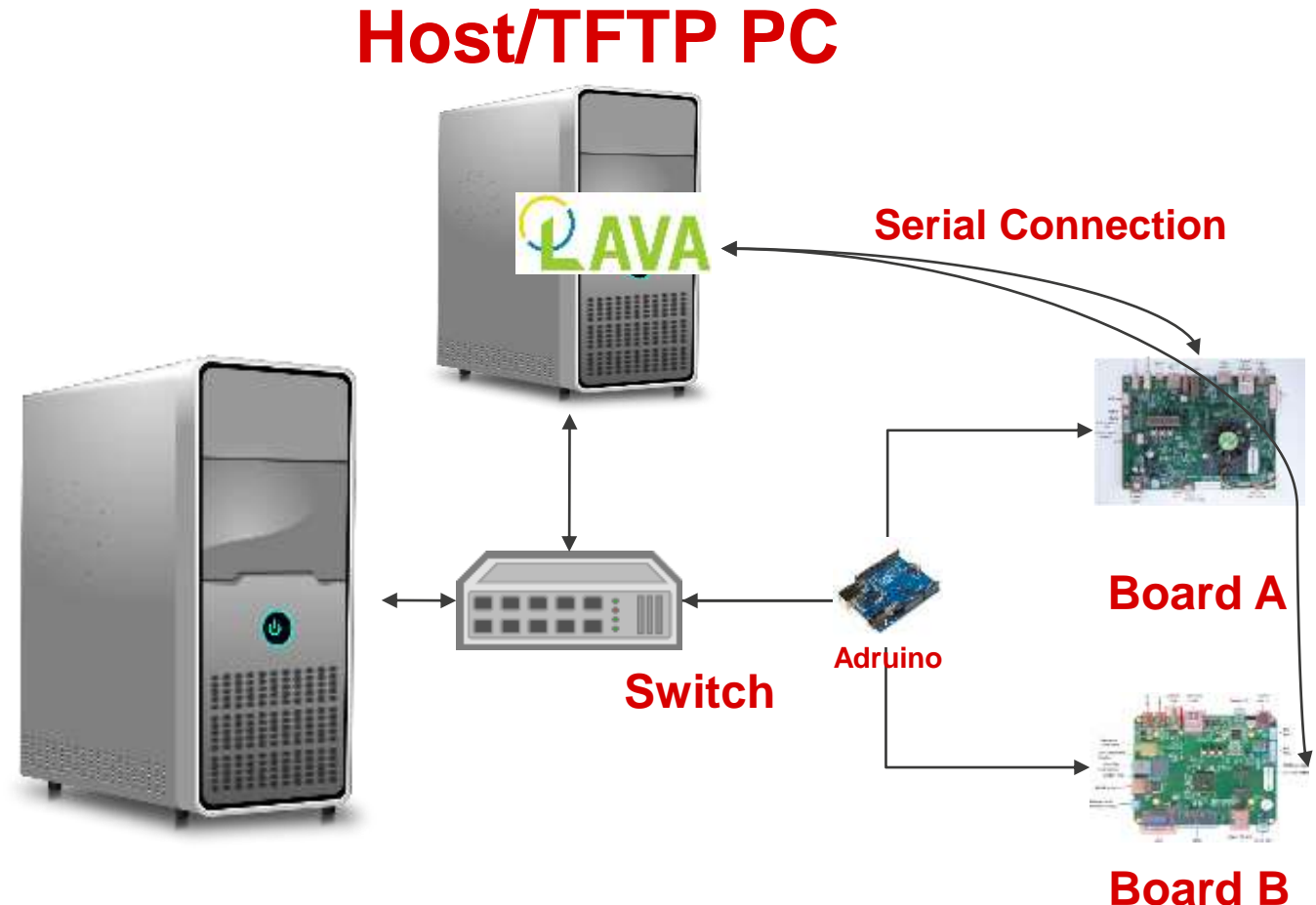




# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

## INTEGRATING SOFTWARE SOLUTION WITH FUEGO

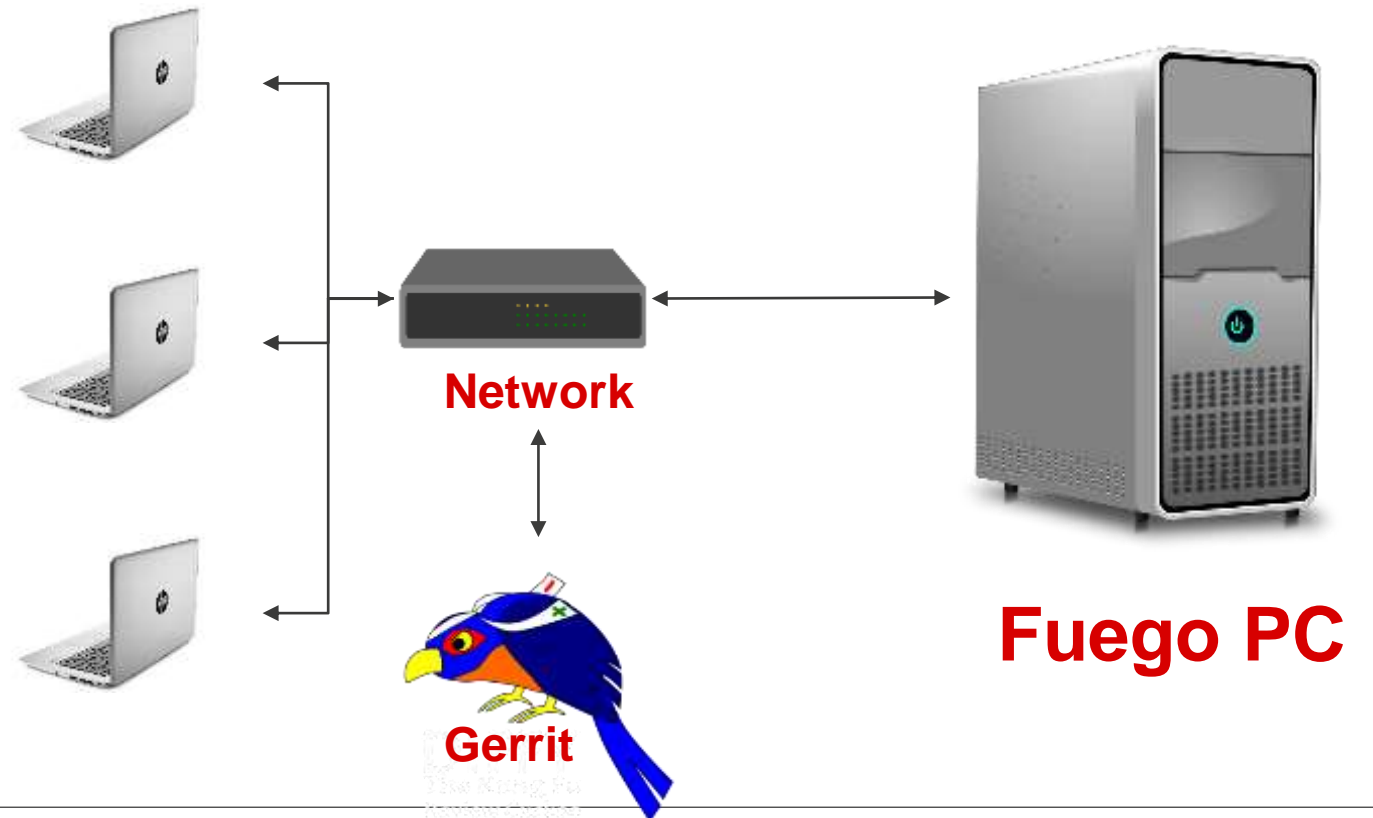
- Lava as Fuego's "board management" facility.
- Strong open-source solution for board management.
  - Local boards and remote boards
  - Support interface to extend board management capabilities, like power supply ON/OFF, etc



# 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.

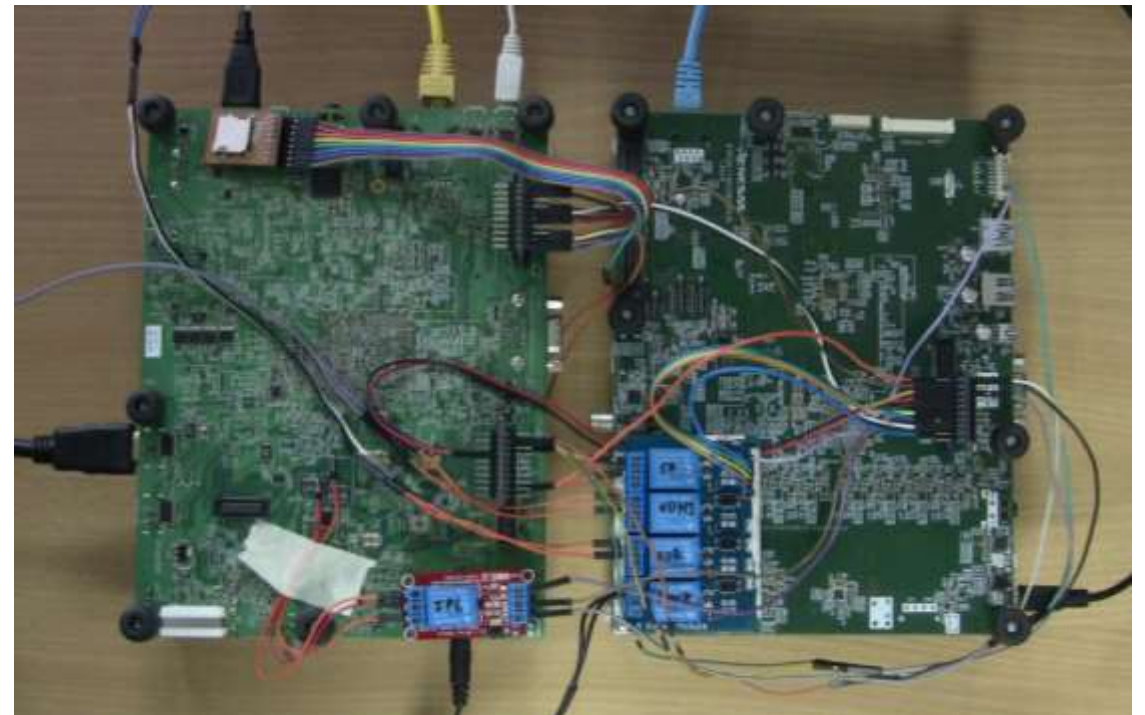


# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

## INTEGRATING HARDWARE SOLUTION WITH FUEGO

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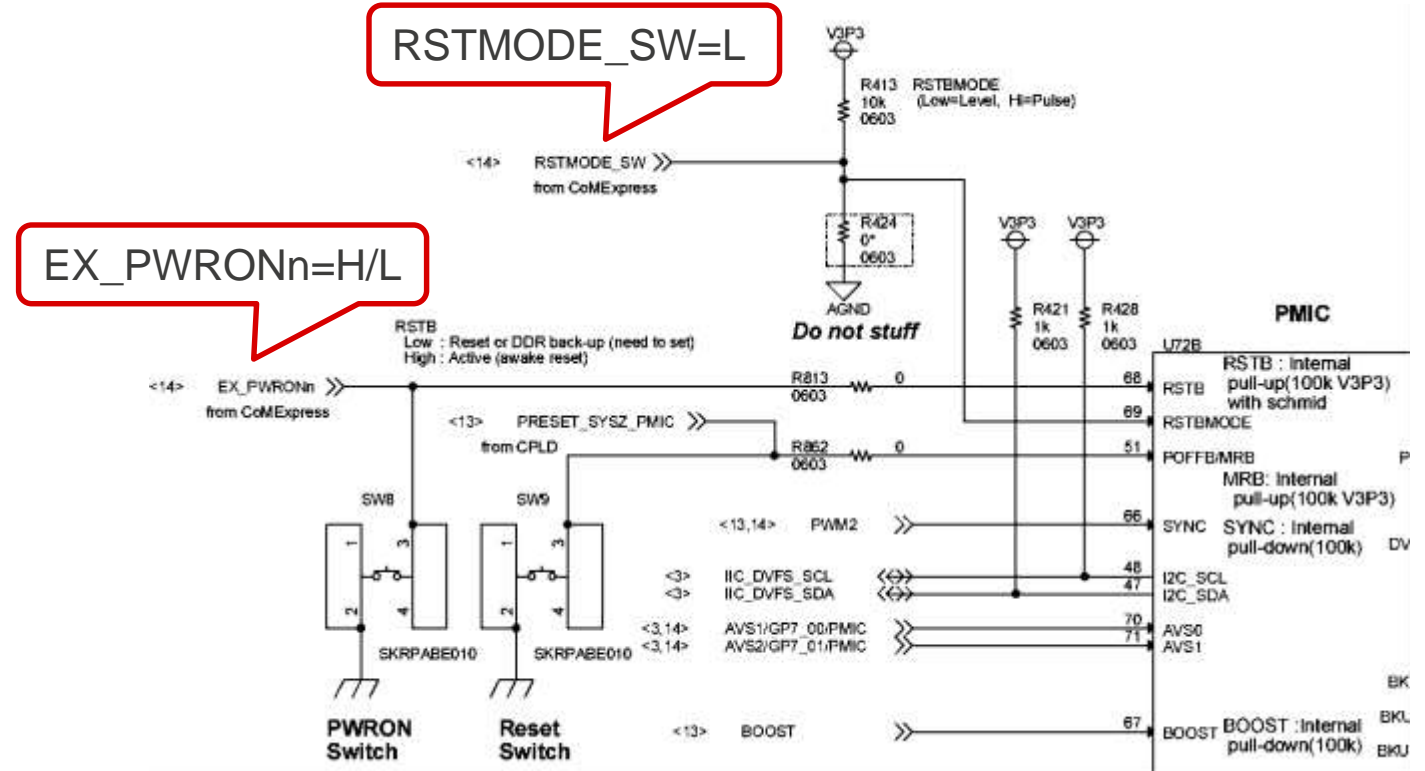
- What features hardware solutions can support ?
  - Power supply control
  - Boot from power-on-reset (cool boot) or hardware reset (warm boot)
  - Firmware update with switch changing
  - Suspend-to-RAM resume as a wakeup factor
  - External connection hotplug



# 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)



# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

## INTEGRATING HARDWARE SOLUTION WITH FUEGO

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- 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

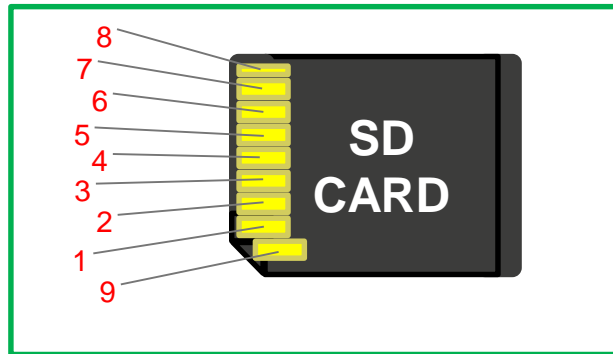
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- Firmware update with switch changing
  - Show the image of switch for Hyperflash boot and QSPI boot.
  - Show how to use GPIO control to support that work automatically.
- Suspend-to-RAM resume as a wakeup factor
  - GPIO as a wakeup factor
  - Special wakeup factor for deep System Suspend-to-RAM

# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

## INTEGRATING HARDWARE SOLUTION WITH FUEGO

### SDCard hotplug



Pin number	Pin name
1	DAT3
2	CMD I/O
3	VSS
4	VDD
5	CLK
6	VSS
7	DAT0
8	DAT1
9	DAT2

Control VDD pin to hotplug SDCard

### USB hotplug

**Pin out**

Standard A

4 3 2 1

Standard B

4 3

The type-A plug (left) and type-B plug (right)

Pin 1	<span style="color: red;">■</span> VBus (+5 V)
Pin 2	<span style="color: white;">□</span> Data-
Pin 3	<span style="color: green;">■</span> Data+
Pin 4	<span style="color: black;">■</span> Ground

Control Vbus pin to hotplug USB

### HDMI hotplug

**Pin out**

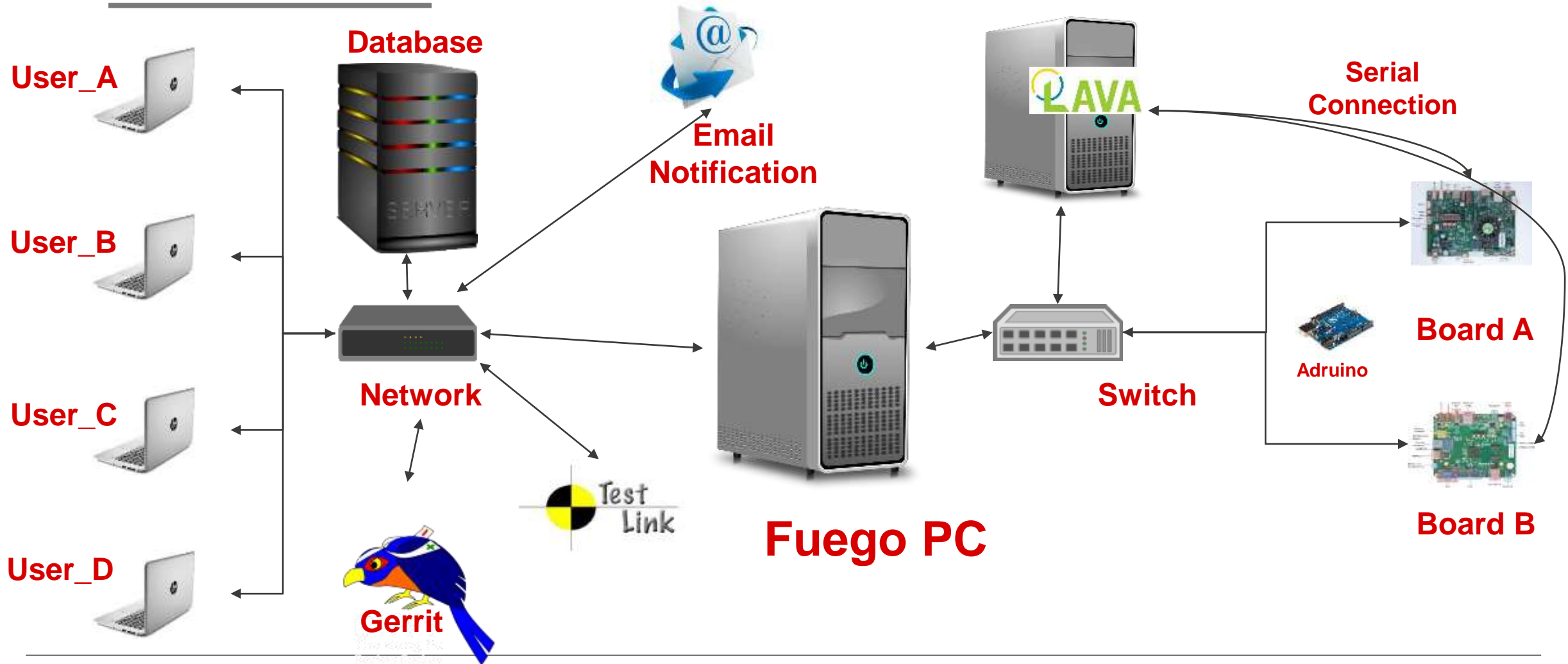
HDMI type A receptacle (female)

Pin 1	TMDS Data2+
Pin 2	TMDS Data2 Shield
Pin 3	TMDS Data2-
Pin 4	TMDS Data1+
Pin 5	TMDS Data1 Shield
Pin 6	TMDS Data1-
Pin 7	TMDS Data0+
Pin 8	TMDS Data0 Shield
Pin 9	TMDS Data0-
Pin 10	TMDS Clock+
Pin 11	TMDS Clock Shield
Pin 12	TMDS Clock-
Pin 13	CEC
Pin 14	Reserved (HDMI 1.0-1.3c) Utility/HEAC+ (HDMI 1.4+, optional, <a href="#">HDMI Ethernet Channel</a> and <a href="#">Audio Return Channel</a> )
Pin 15	SCL (I <sup>2</sup> C serial clock for DDC)
Pin 16	SDA (I <sup>2</sup> C serial data for DDC)
Pin 17	Ground (for DDC, CEC, ARC, and HEC)
Pin 18	+5 V (min. 0.055 A) <sup>[3]</sup>
Pin 19	Hot Plug Detect (all versions) HEAC- (HDMI 1.4+, optional, <a href="#">HDMI Ethernet Channel</a> and <a href="#">Audio Return Channel</a> )

Control pin19 to hotplug HDMI

# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

FUEGO INTEGRATED SYSTEM





# A FUNCTIONAL AUTOMATION TEST SOLUTION BASED ON FUEGO

FUEGO INTEGRATED SYSTEM

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Demonstration Video  
for referenced Fuego integrated solution

**FEEDBACK TO FUEGO UPSTREAM**

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# FEEDBACK TO FUEGO UPSTREAM

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- 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

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- 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

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# FUTURE WORK

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- 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.

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BIG IDEAS FOR EVERY SPACE

[Renesas.com](http://Renesas.com)