

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

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BIG IDEAS  
FOR EVERY SPACE

# AGENDA

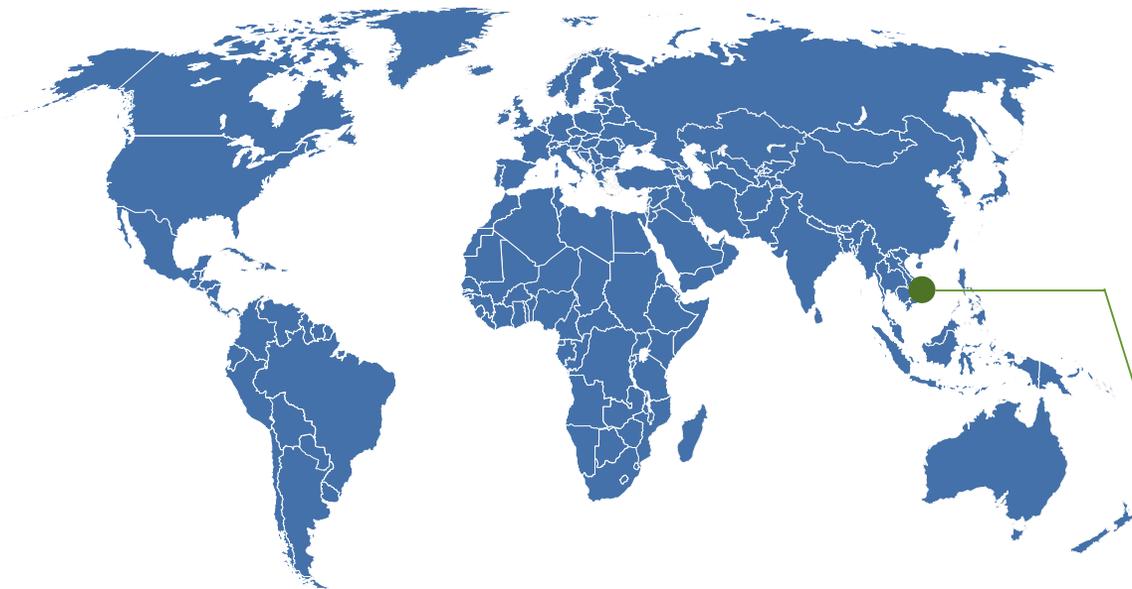
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- Self introduction **Page 03**
- Fuego as a test automation solution **Page 06**
  - Why Fuego
  - Known efforts of applying Fuego
- A FUNCTIONAL automation test solution based on Fuego **Page 13**
- Feedback to Fuego upstream **Page 24**
- Future work **Page 27**

# SELF INTRODUCTION

# ABOUT RENESAS AND RENESAS DESIGN VIETNAM

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## Sales Companies

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

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

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

- 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.

## Business Corporation

Intersil Corporation

# 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
  - Development for test automation solutions of In-vehicle software platform
  
- Email: [khiem.nguyen.xt@renesas.com](mailto:khiem.nguyen.xt@renesas.com)

# FUEGO

# AS A TEST AUTOMATION SOLUTION

## ABOUT FUEGO [1/2]

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There have been **3 important milestones** so far.

And there are more expectations on upcoming releases as Fuego gets more attentions from community.

# ABOUT FUEGO [2/2]



- 1st release by May 2014
- **Adopted by AGL** and community
- **Run on Docker** from 2015

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

- Released by April 2017
- **Upgraded to Jenkins 2.32.1**
- New Fuego directories layout
- New Fuego script system
- New transport for board communication

- LAVA integration
- etc

# PITFALLS OF SOFTWARE TEST ACTIVITIES

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P1

**Unstable  
test results**  
among  
testers

P2

**Much human  
effort** due to  
manual tests  
& repetitive  
test cycle

P3

**Hard to  
modify**  
un-unified &  
close-source  
test solution

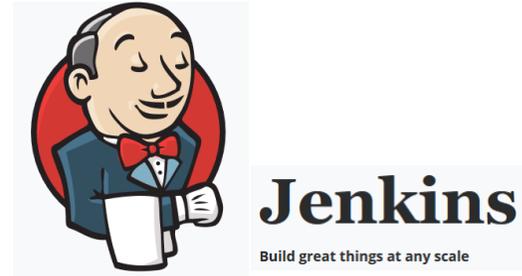
P4

**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.

# SOLVE PITFALLS - WHY FUEGO ?

Jenkins-based **open source** test automation solution



Can Solved P1 P3

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



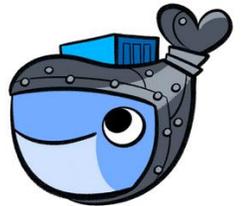
Can solved P2 P3

Able to utilize the **existed features to optimize test execution**

Can solved P1

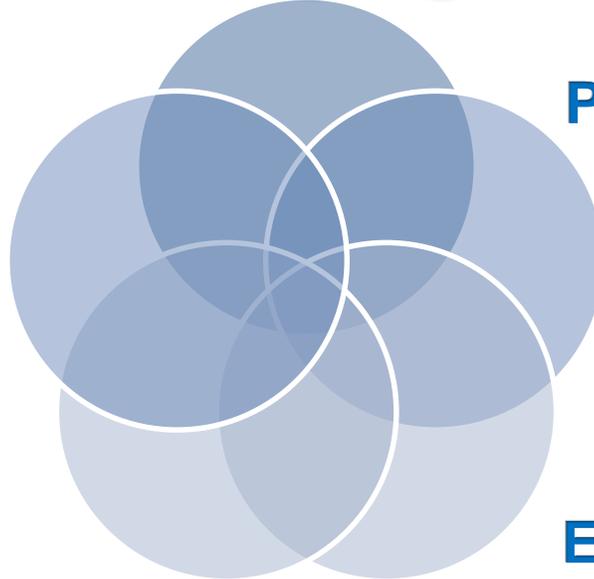
**Portable** by running Fuego on top of **Docker**

Can solved P3 P4



**Easily add more test cases individually or in groups**

Can solved P4



# USE FUEGO - THE KNOWN EFFORT [1/2]

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2014

- Fujitsu **contributed** new ethtool test cases.

2015

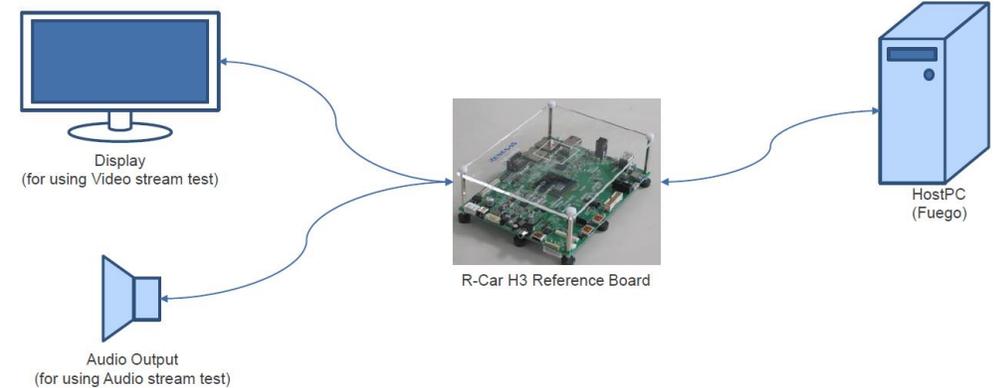
- Mitsubishi showed how to **run LTP efficiently** with LTSI test project.
- AGL deployed it as official **AGL CIAT solution**.

2016

- Toshiba proposed improvement on **Post-processing tool** to **summarize LTP test result**.

# USE FUEGO - THE KNOWN EFFORT [2/2]

- Renesas has also put many efforts to apply Fuego into test automation solutions.
- **Building up automation test for R-Car platform** which could execute selected test cases without external hardware's hotplug operation.
- **Summarize the test results (logs)** automatically and output them **as a report (excel file)**.



## ■ Template Sample

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

Test name	Results	Durations	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

# WHAT IS A FUNCTIONAL AUTOMATION TEST SOLUTION ?

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- Typical requirements for a functional automation test solution:

R1

Able to **perform the tests automatically** as submitted schedule

R4

Automatically **notify status of test execution** to testers

R2

Have efficient solution for **device management**

R5

Able to **automatically trigger the test** based on source code update (CIAT)

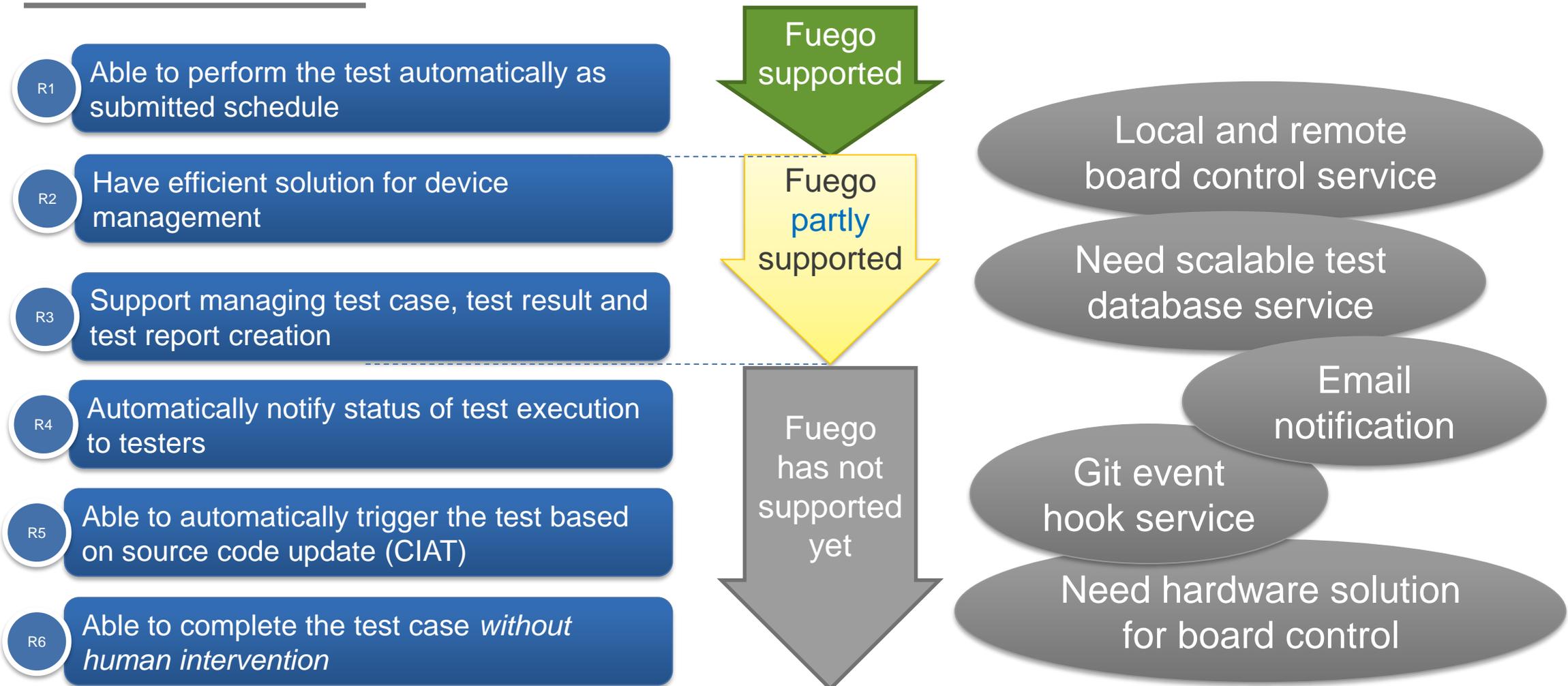
R3

Support **managing test cases**, test results and test report creation

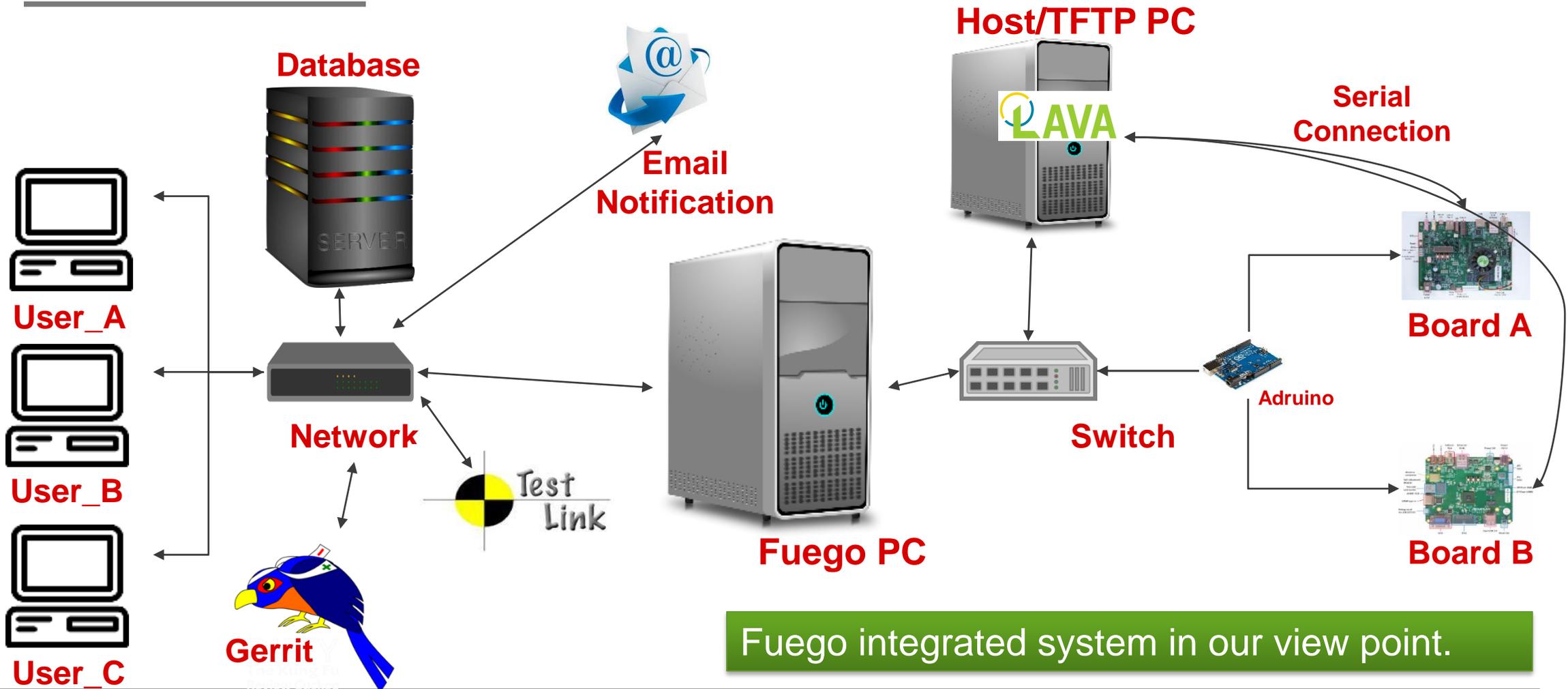
R6

Able to complete the test case **without human intervention**

# FUEGO VS FUNCTIONAL AUTOMATION TEST SOLUTION



# BRIEF IMAGE ABOUT FUEGO INTEGRATED SYSTEM

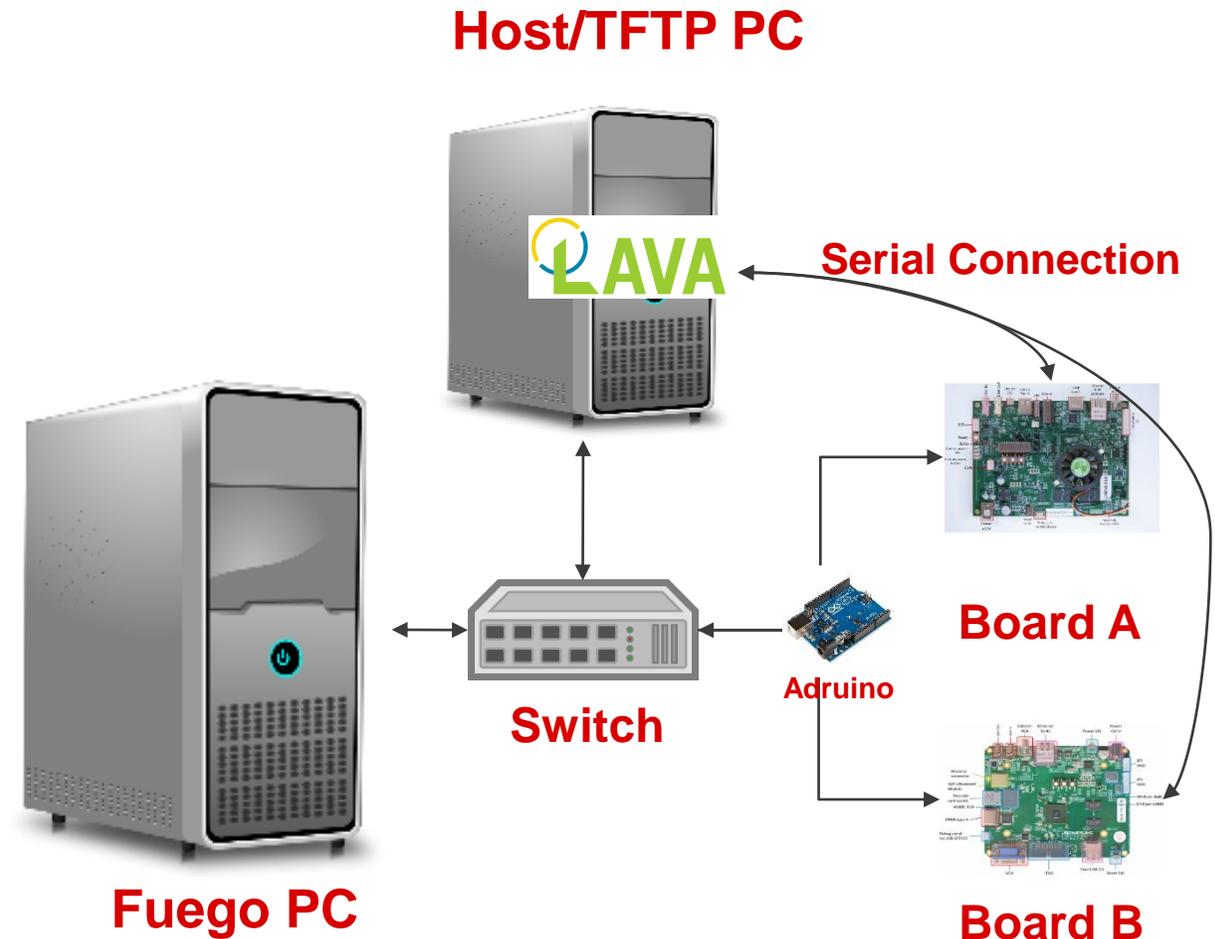


Fuego integrated system in our view point.

# REALIZE FUEGO INTEGRATED SYSTEM

## INTEGRATING SOFTWARE SOLUTIONS

- 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

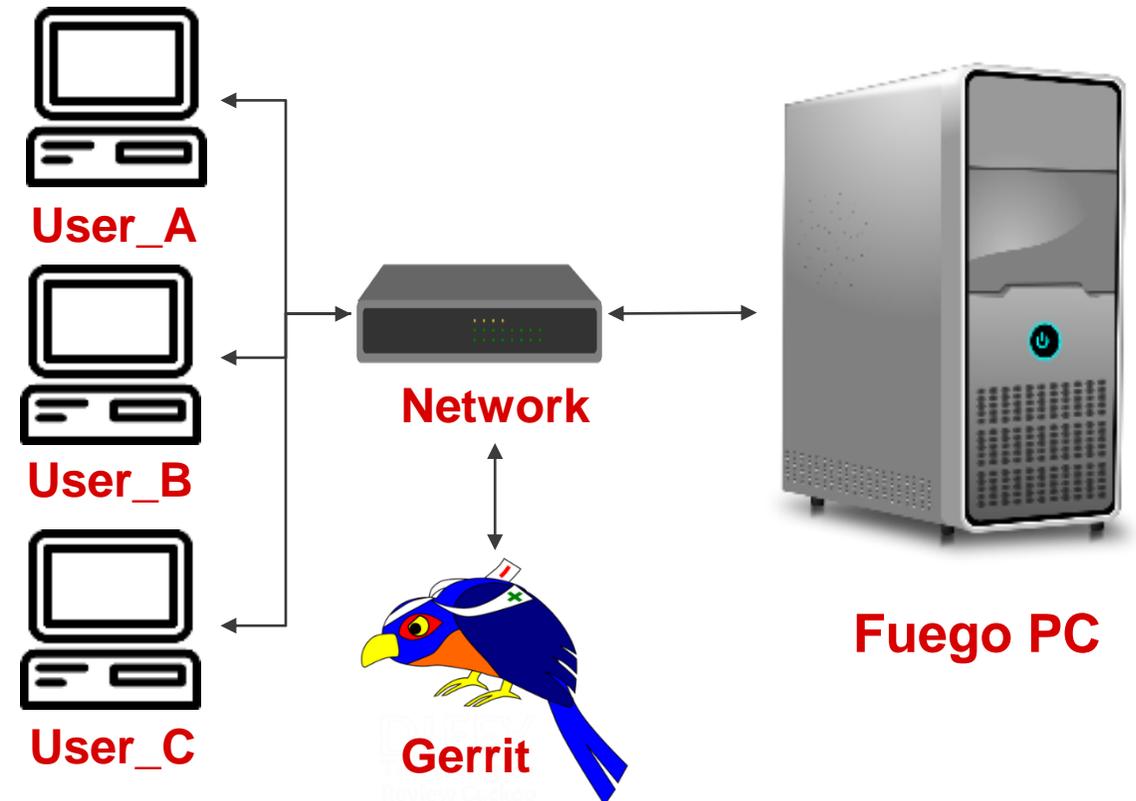


# REALIZE FUEGO INTEGRATED SYSTEM

## INTEGRATING SOFTWARE SOLUTIONS

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- 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.

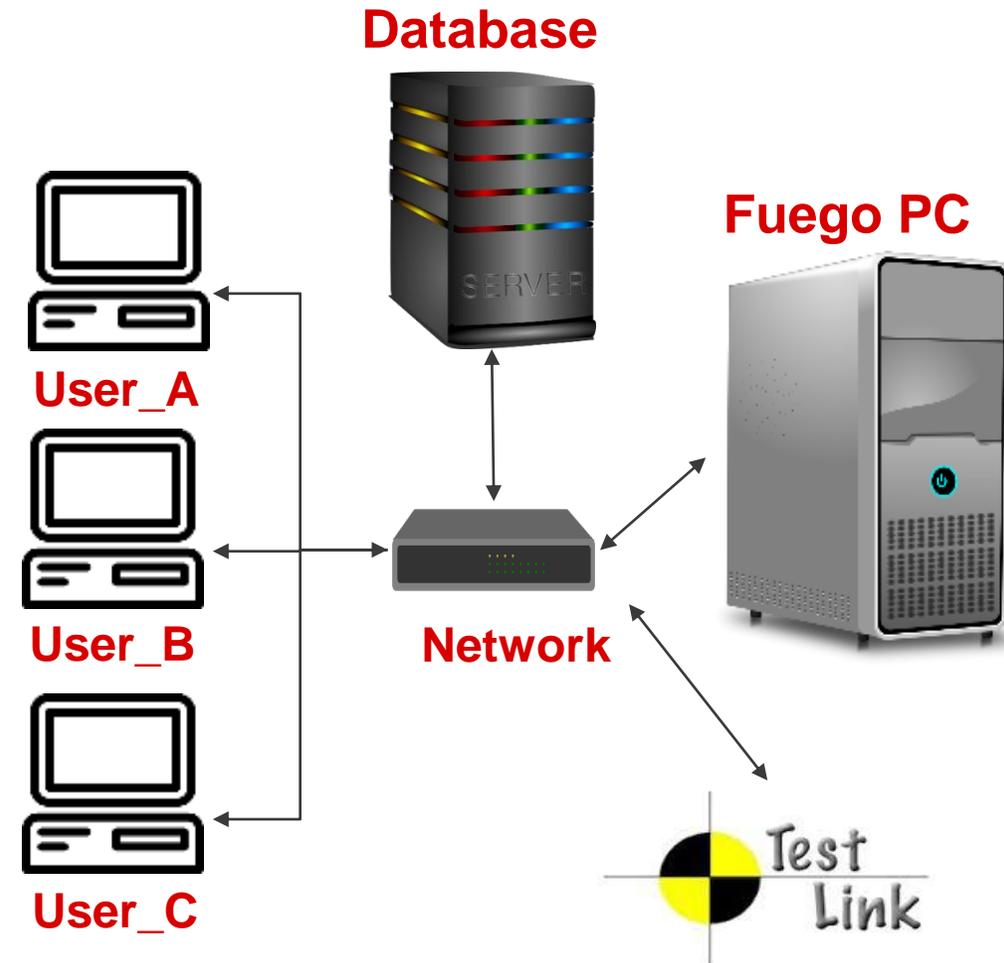


# REALIZE FUEGO INTEGRATED SYSTEM

## INTEGRATING SOFTWARE SOLUTIONS

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- 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.

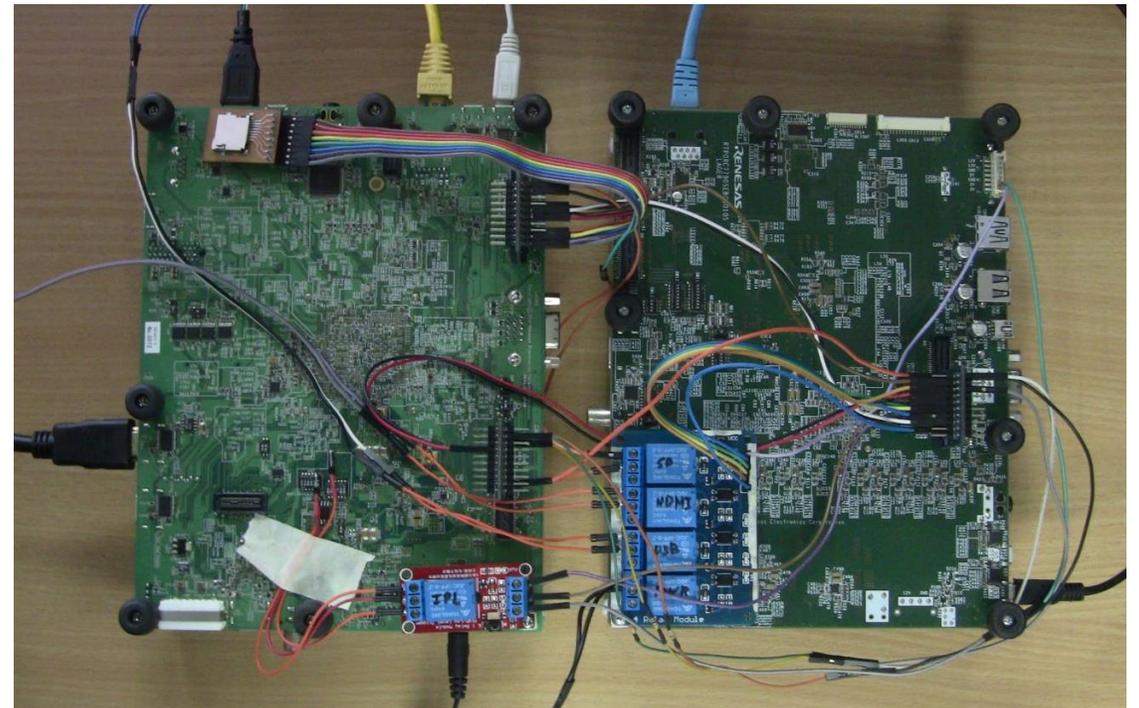


# REALIZE FUEGO INTEGRATED SYSTEM

## INTEGRATING HARDWARE SOLUTIONS

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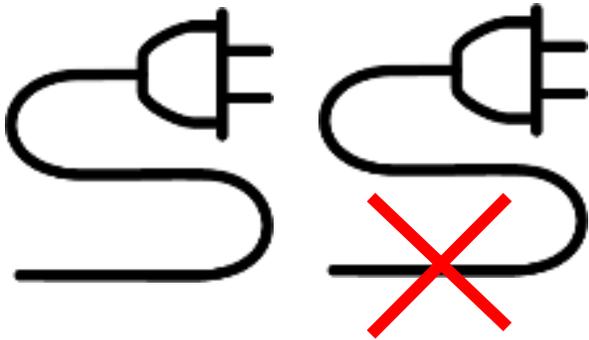
- What features hardware solutions can support ?
  - Power supply control
  - Boot from power-on-reset (cool boot) or from hardware reset (warm boot)
  - Firmware update
  - Suspend-to-RAM's resume trigger
  - External connections' hotplug



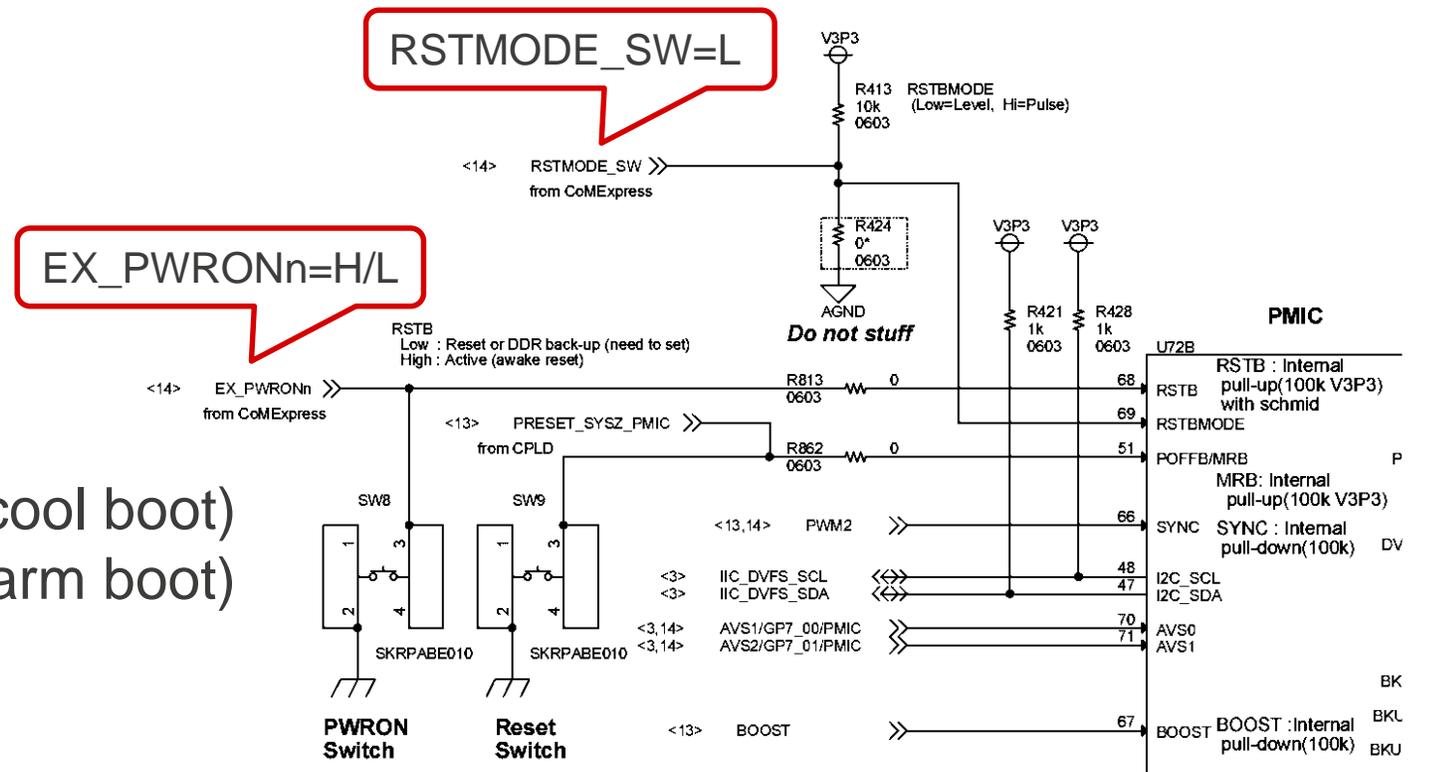
# REALIZE FUEGO INTEGRATED SYSTEM

## INTEGRATING HARDWARE SOLUTIONS

Power supply control



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

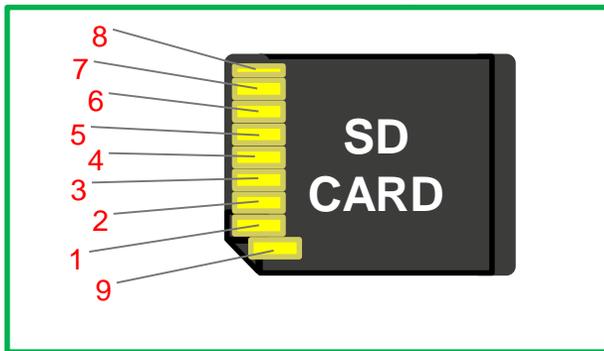


From schematics of R-Car Starter Kit Pro

# REALIZE FUEGO INTEGRATED SYSTEM

## INTEGRATING HARDWARE SOLUTIONS

### 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)

<b>Pin 1</b>	<span style="color: red;">■</span> VBus (+5 V)
<b>Pin 2</b>	<span style="border: 1px solid black; display: inline-block; width: 10px; height: 10px;"></span> Data-
<b>Pin 3</b>	<span style="background-color: green; display: inline-block; width: 10px; height: 10px;"></span> Data+
<b>Pin 4</b>	<span style="background-color: black; display: inline-block; width: 10px; height: 10px;"></span> Ground

Control Vbus pin to hotplug USB

Maintain the quality of GPIO signal is crucial for the hot-plug feature.

### HDMI hotplug

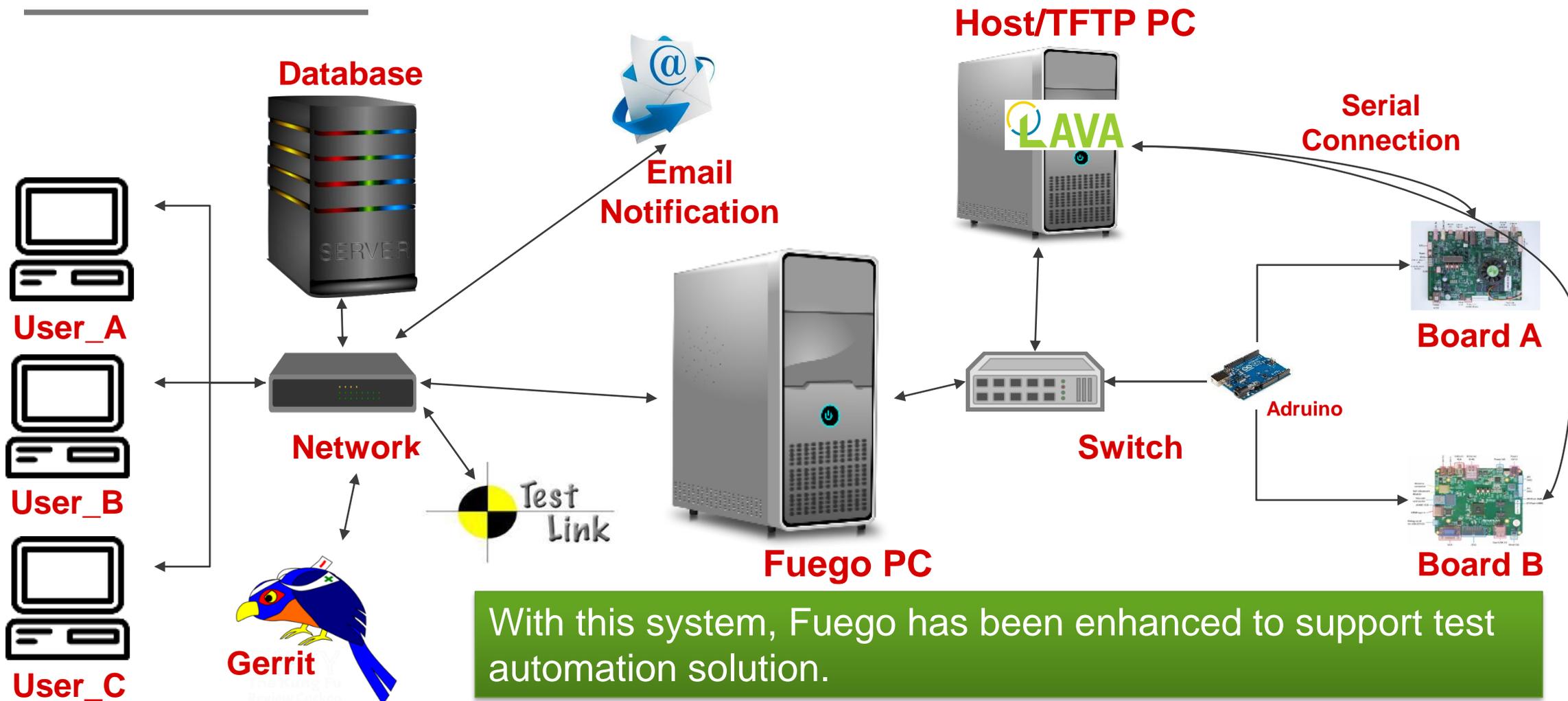
**Pin out**

HDMI type A receptacle (female)

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

Control pin19 to hotplug HDMI

# IMAGE ABOUT FUEGO INTEGRATED SYSTEM



# FEEDBACK TO FUEGO UPSTREAM

# FEEDBACK TO FUEGO UPSTREAM [1/2]

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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 [2/2]

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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

# FUTURE WORK

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- Renesas will continue contributing feedback to Fuego current development features as well as planning features for next releases.
- Renesas will continue using Fuego as test automation solution and explore more ways to improve test efficiency with Fuego.
- 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)**