

INTRODUCTION TO R-CAR S4 STARTER KIT AND R-CAR S4 WHITEBOX SDK

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AYUMI NAKAMICHI
RENESAS ELECTRONICS

INTRODUCTION TO WHO I AM

- 中道安祐未 / Ayumi Nakamichi
 - 入社4年目 / 4 years at Renesas Electronics Corporation
 - Product Marketing Specialist
 - 主にプロモーション活動 / mainly involved in promotional activities
 - 趣味はゲーム / My hobby is game.
最近、マインクラフトとパルワールド / In particular, I have been playing a lot lately with Minecraft and Palworld.

This is my first presentation outside the company, so please be gentle.

TODAY'S AGENDA

1. Automotive trend and Consortium's contribution
2. Proposal for accelerating consortium's development
3. Detail components of proposal and expected use-case
 1. R-Car S4 Starter Kit
 2. R-Car S4 Whitebox SDK
 3. Case study

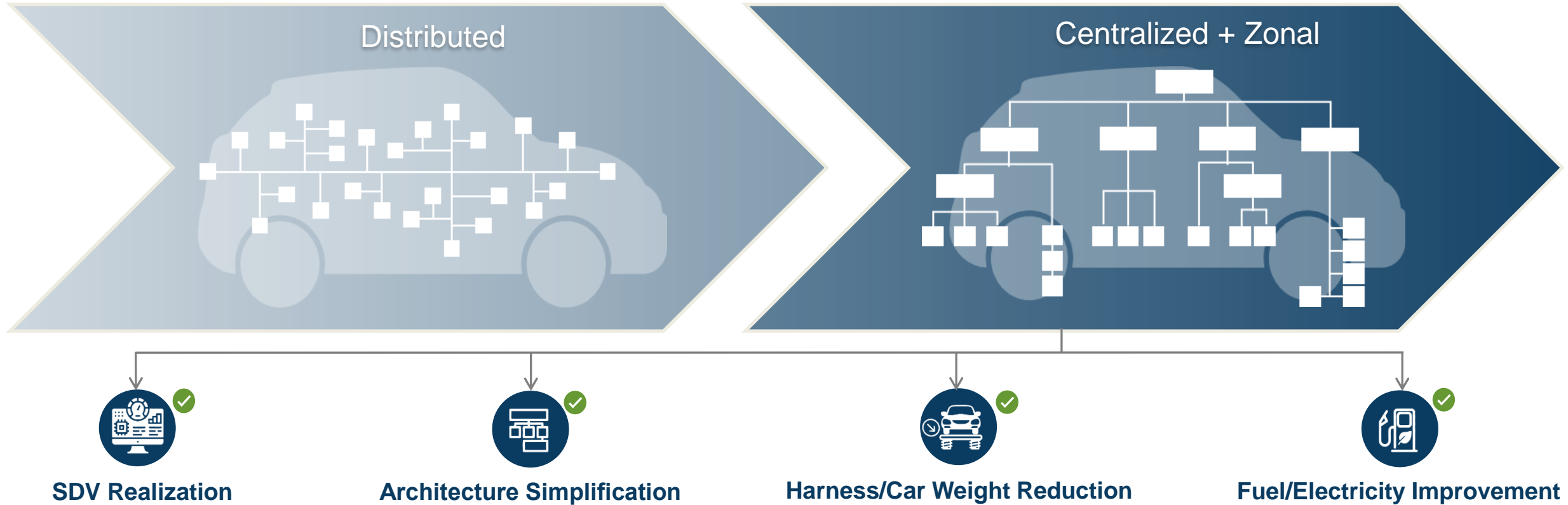


Note: Consortium includes OSS community

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THE EVOLUTION OF E/E ARCHITECTURE

From distributed architecture to centralized and zonal architecture



System is more complex, and software development cost is increasing.

CONSORTIUM'S CONTRIBUTION

1. Automotive trend and Consortium's contribution
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Motivation

For reduction of software development cost :

- Non-competitive areas should be commonized
- Common specification to across different OEM and different Tier1 is needed
- Many consortium were organized to make common or new architecture

Investment

Automotive Industry Consortium



Others...

Contribution



Consortium contributes car products with using its asset and effort

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PROPOSAL WITH SYNERGY B/W HW AND SW

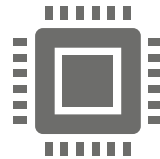
Renesas proposes new solution that has highly accessibility for consortium

Blocking factor

HW

Lack of reference HW variation

- Few low-cost board dedicated for GW
- Difficult for consortium engineers to purchase



SW

Lack of RTOS for vehicle control

- Few AUTOSAR compliant OSS-based Realtime OS
- Difficult for consortium engineers to develop



Proposal

R-Car S4 Starter Kit

- Lowest priced board for gateway
- Integrated MCU and SoC into one



👍 High accessibility

- Anyone can start with low-cost soon
- Useful for both MCU & SoC engineers

R-Car S4 Whitebox SDK

- All software is Free of Charge
- All in one package (AP/RT/MCU)



We believe this can accelerate consortium's development!

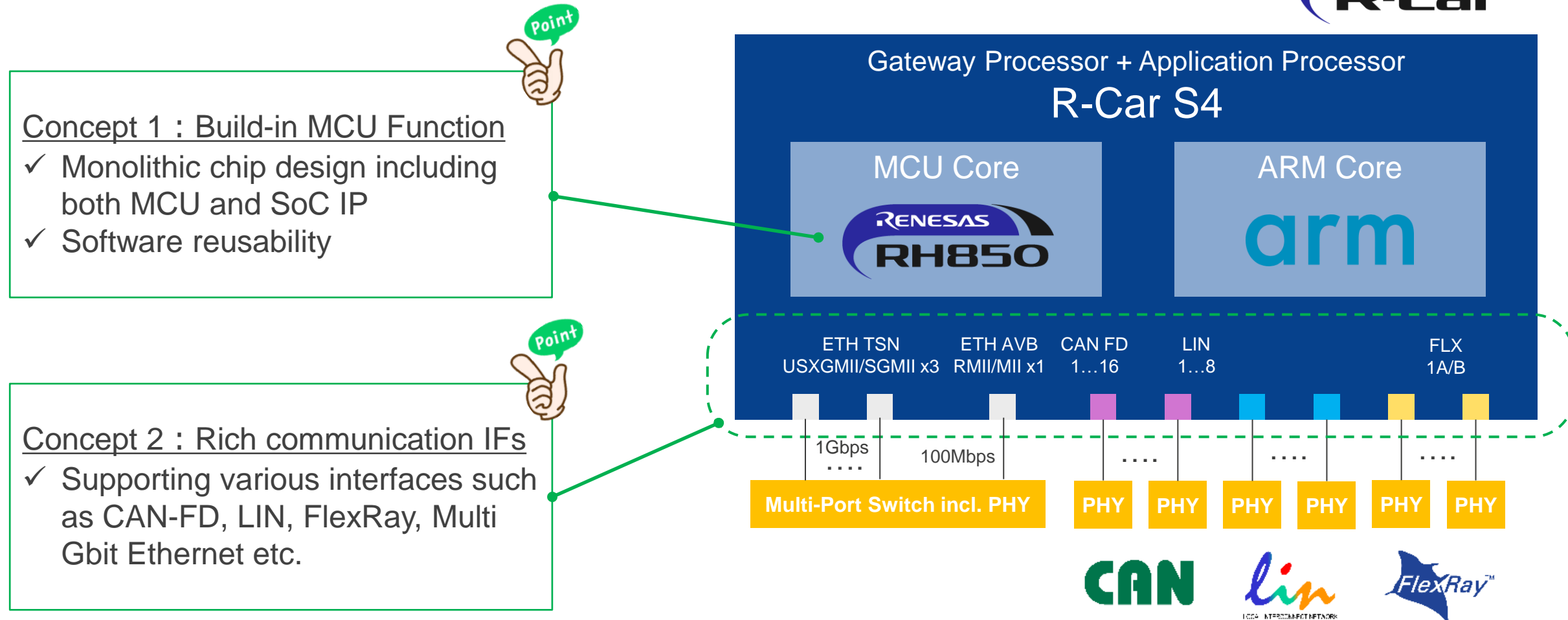
R-CAR S4 STARTER KIT

(HARDWARE PART)



R-CAR S4 SOC PRODUCT CONCEPT

1. Automotive trend and Consortium's contribution
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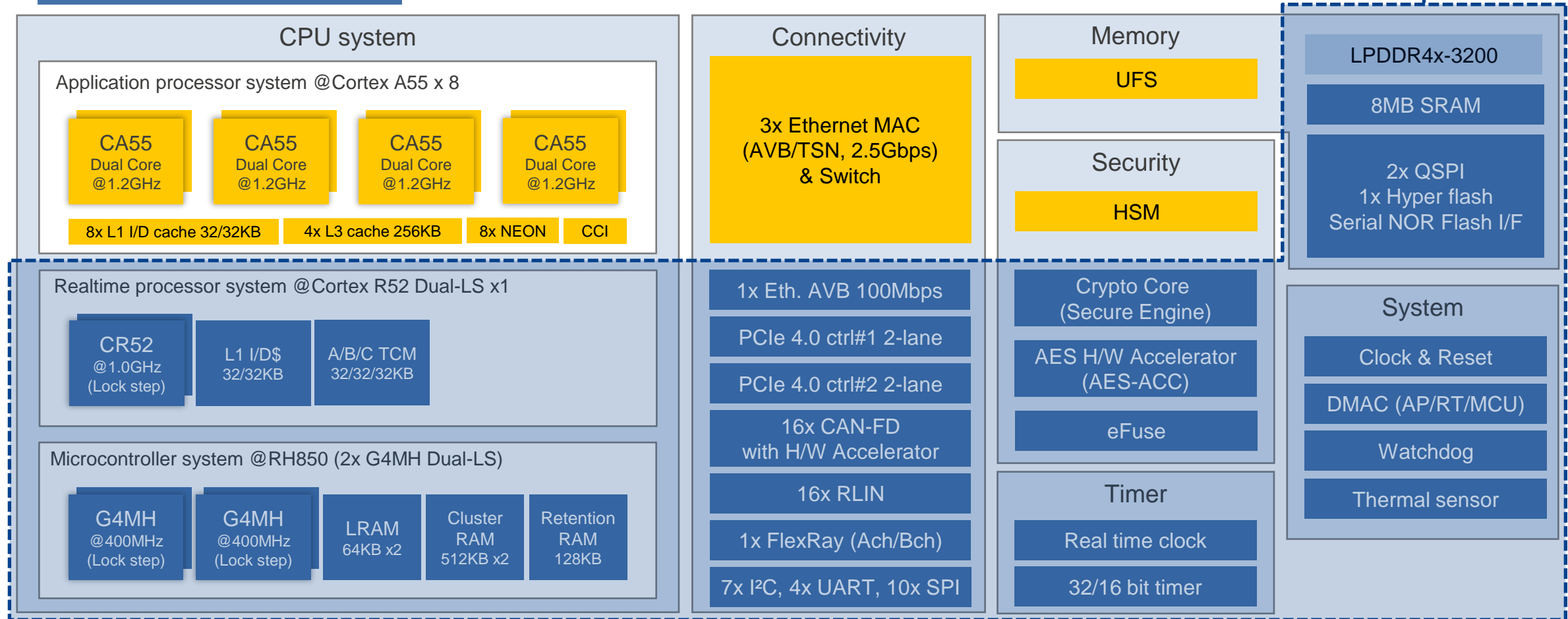
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R-CAR S4 SOC BLOCK DIAGRAM

New IPs (enhanced from Gen3)

IPs reuse from Gen3 or RH850

Software reusability 88%



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R-CAR S4 STARTER KIT

R-Car S4 Starter Kit enables rapid development of Automotive Gateway Systems



Easy to buy

Anyone can buy from Global Distributor

Accessible board and competitively priced

Easy to use

Anyone can download SW and Doc

No need any contract, easy trial for R-Car S4

Easy to evaluate

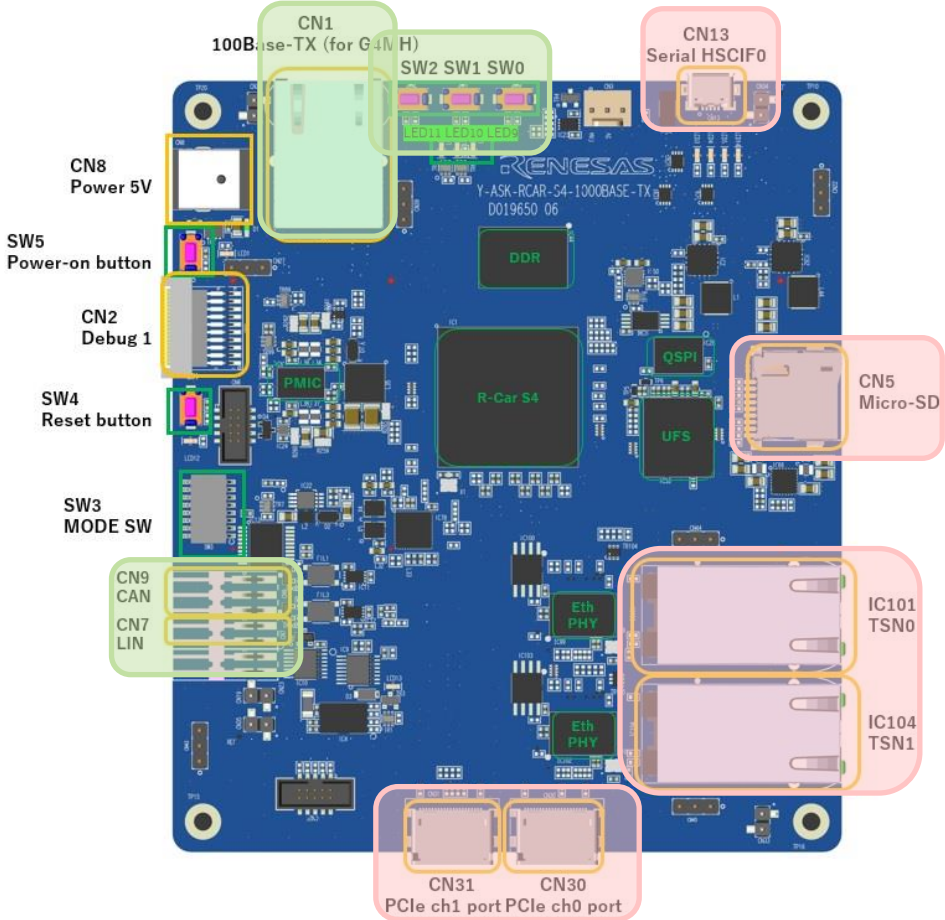
Anyone can evaluate immediately

A lot of supported OSS SW PKGs

SPECIFICATION OF R-CAR S4 STARTER KIT

- 1. Automotive trend and Consortium's contribution
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Function	R-Car S4 Starter Kit	Supported CPU core (default setting)
SOC	R-Car S4	-
DRAM	4GB LPDDR4	CA55 / CR52
Flash memory	64MB QSPI 128GB UFS	CA55 / CR52
Removal media	1ch (MicroSD)	CA55 / CR52
Ethernet TSN	2ch (Rswitch2 with 1Gbps)	CA55 / CR52
Ethernet AVB	1ch	G4MH
Debug Serial	2 port (one connector)	CA55 / CR52
PCIe	2ch (RC and EP) [2lane x2]	CA55 / CR52
CAN-FD	2ch	G4MH
LIN	1ch	G4MH
User LED	LED9, LED10, LED11	G4MH
User SW	SW0, SW1, SW2	G4MH



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LINKS : R-CAR S4 STARTER KIT

All information about R-Car S4 Starter Kit is available from **eLinux wiki** and **Renesas R-Car S4 Starter Kit product page**.

	Release packages	Links
 eLinux wiki (elinix.org)	Board information	https://elinix.org/R-Car/Boards/S4SK
	Yocto Linux	https://elinix.org/R-Car/Boards/S4SK/Yocto-Linux
	Hypervisor (Xen)	https://elinix.org/R-Car/Boards/S4SK/Xen-Hypervisor
	Zephyr	https://elinix.org/R-Car/Boards/S4SK/Zephyr
 R-Car S4 Starter Kit Product page (renesas.com)	Board Manual (inc. Schematic)	https://www.renesas.com/products/automotive-products/automotive-system-chips-socs/y-ask-rcar-s4-1000base-t-r-car-s4-starter-kit#documents
	R-Car S4 Starter Kit Configuration Tool	https://www.renesas.com/products/automotive-products/automotive-system-chips-socs/y-ask-rcar-s4-1000base-t-r-car-s4-starter-kit#design_development
	ICUMX Loader (click through)	

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HISTORY OF R-CAR STARTER KIT

[*] AGL: [Automotive Grade Linux \(automotivelinux.org\)](https://www.automotivelinux.org)

- ✓ The R-Car Starter Kit series was launched in 2014.
- ✓ R-Car Gen2 (Porter) and Gen3 (Pro/Premier) Starter Kit has adopted as reference platform for AGL[*].
- ✓ Renesas is aiming for the R-Car S4 Starter Kit to be adopted as a reference platform for AGL.

Porter (R-Car M2)



2014

2016



R-Car Starter Kit Pro/Premier

2017



Kingfisher

R-Car S4 Starter Kit



2023

WHERE TO BUY

- SHIMAFUJI ELECTRIC INCORPORATED
 - <http://www.shimafuji.co.jp/products/2856> (Jp)
 - <http://www.shimafuji.co.jp/en/products/2120> (En)

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Support

eLinux Site

R-Car S4 Starter Kit board information and Yocto Linux BSP/Hypervisor Xen BSP are available from the eLinux site. See Resources and Software & Tools section.

Buy or Sample

- Shimafuji

SHIMAFUJI

Products Service Project Company Recruits Contact Us

Products

Top > products > R-Car S4 Starter Kit

R-Car Products

R-Car S4 Starter Kit

SBEV-RCAR-CCPF-SK (Connected car platform evaluation board)

R-Car H3e-2G Starter Kit + SBEV-RCAR-KF-M06 (Advanced Model) SET

SBEV-RCAR-KF-M06 (Advanced Model)

SBEV-RCAR-KF-GMSL02 (GMSL Camera Board)

SBEV-RCAR-KF-

R-Car S4 Starter Kit

R-Car S4 Starter Kit

The R-Car S4 Starter Kit is a low-cost, readily available development board for building software using the Renesas R-Car S4 system on chip (SoC). The SoC delivers high computing performance and an array of communication features for both cloud communication and safe vehicle control. Engineers can take advantage of the new kit to easily start their initial evaluation of car servers, connected gateways, connectivity modules and more, for rapid application development.

CPU

1.2GHz Cortex A55 cores	:	8
1.0GHz Cortex R52 cores (lock-step)	:	1
400MHz RH850 G4MH cores (lock-step)	:	2

Inventory products

Contact/Quotation

R-CAR S4 WHITEBOX SDK

(SOFTWARE PART)



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WHAT'S R-CAR S4 WHITEBOX SDK?



Accessible

All software is published on github and there are no license fee.

Customizable

No binary and No proprietary software, all of source code can be modified.

Extensible

Any packages can be added since SDK is developed based on yocto project.

Flexible

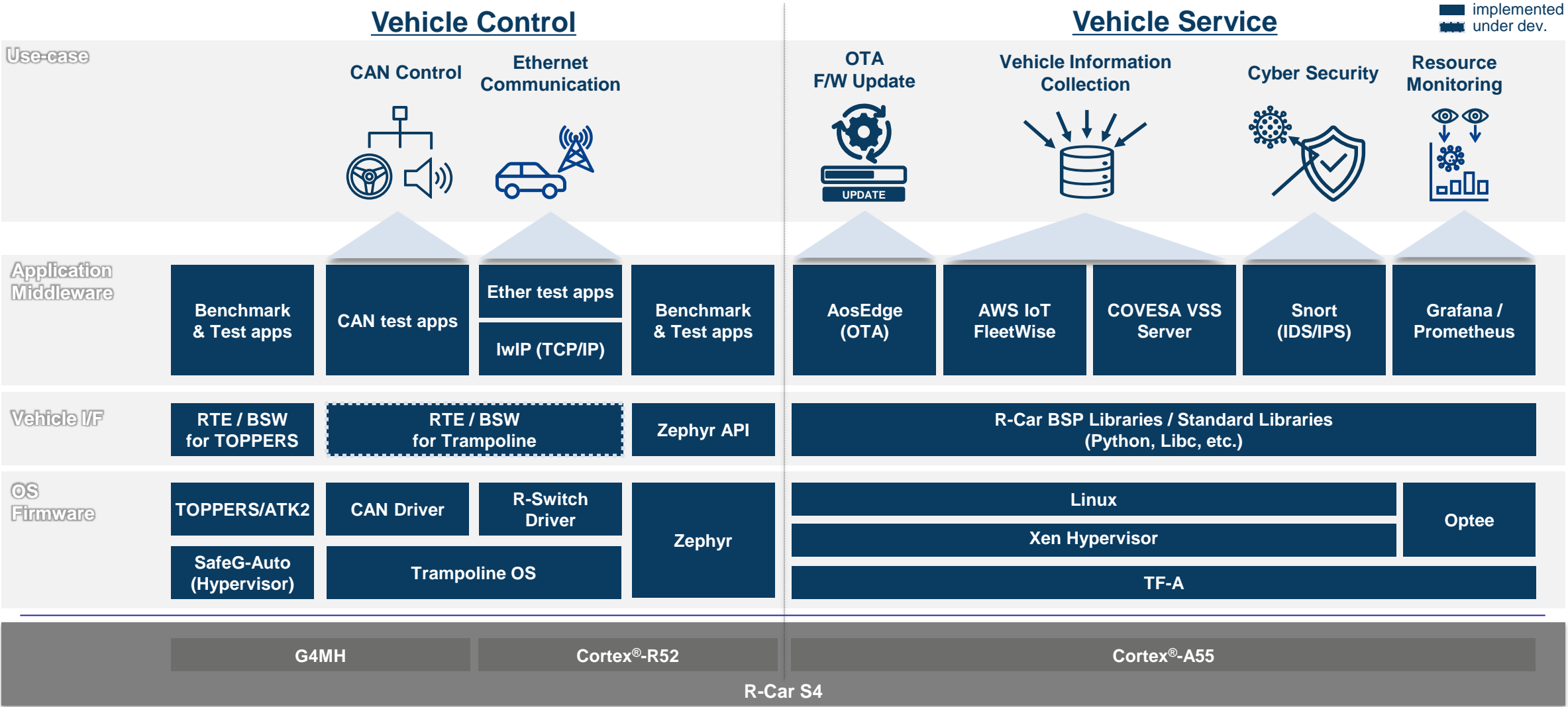
Three real time OSs (Toppers ATK2, Trampoline, Zephyr) are supported.

Use-case oriented

Multiple apps (OTA, IDS/IPS, etc) are pre-implemented along gateway use-case.

SOFTWARE STRUCTURE

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R-Car S4

■ implemented

▤ under dev.

GITHUB – R-CAR S4 WHITEBOX SDK

<https://github.com/renesas-rcar/whitebox-sdk>

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renesas-rcar / whitebox-sdk

<> Code Issues Pull requests Actions Projects Wiki Security Insights

whitebox-sdk Public

Watch Fork Star

v5.x

Go to file Add file Code About

Branches Tags

Whitebox SDK: Upgrade to v5.0 18 hours ago 144

application_cpu

ca55: yaml: Fix error with latest moulin 18 hours ago

mcu

cr52/g4mh: s4sk: Add can disable proj... 2 weeks ago

realtime_cpu

cr52: trampoline Fix typo 20 hours ago

tool

tool: repo_init: Change to release versi... 20 hours ago

.gitignore

Add feature to preparing IPL/Firmware... 2 weeks ago

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Create whitebox-sdk 9 months ago

MAINTAINERS

Create whitebox-sdk 9 months ago

README.md

Whitebox SDK: Upgrade to v5.0 18 hours ago

build_whitebox_v...

Whitebox SDK: Upgrade to v5.0 18 hours ago

README.md

What is Whitebox SDK?

The R-Car S4 Whitebox SDK is an integrated development platform that accelerates the development of connected services applications.

All software is provided as an all-in-one package under a Free of Charge (FoC) license, which facilitates testing and can be widely used in advanced development. In addition, since the software is mainly open source, users are free to modify the source code as they wish.

Please refer to the official webpage:

<https://www.renesas.com/whitebox-sdk>

Table of contents

Setup

Tool setup

Build

LICENSE

Documentation

Support

FAQ

Community Q&A forum

Top directory of repository

v5.x 13 branches 8 tags

Whitebox SDK: Upgrade to v5.0

application_cpu

← for Cortex-A55

ca55: yaml: Fix error with latest moulin

mcu

← for G4MH

cr52/g4mh: s4sk: Add can disable projec

realtime_cpu

← for Cortex-R52

cr52: trampoline Fix typo

tool

← Script files

tool: repo_init: Change to release version

.gitignore

Add feature to preparing IPL/Firmware a

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Create whitebox-sdk

MAINTAINERS

Create whitebox-sdk

README.md

Whitebox SDK: Upgrade to v5.0

build_whitebox_v5.0.sh

Whitebox SDK: Upgrade to v5.0

Branch info

Switch branches/tags

Find or create a branch...

Branches

Tags

✓ v5.x

← Latest

default

demo_v1

demo_v2

demo-dev

demo-dev-s4sk-wip

demo-dev-s4sk-wip2

v1.x

v2.x

v3.x

v4.x

Renesas website

RENESAS

Products Applications Design Resources Sales & Support About

Design Resources > Software - Middleware, Drivers, OS > R-Car S4 Whitebox SDK - Integrated Development Platform for Connected Services and Gateway Application

R-Car S4 Whitebox SDK - Integrated Development Platform for Connected Services and Gateway Application

Software Package

Download Manual SW

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HOW TO DOWNLOAD AND BUILD

<https://github.com/renesas-rcar/whitebox-sdk>

README.md

Download repository

Execute the following command:

```
bash -c "$(wget -O- https://raw.githubusercontent.com/renesas-rcar/whitebox-sdk/v5.0/tool/repo_init.sh)"
```

Required packages

1. ICUMX loader and Flash Writer package
 - o This is not used for building, but it requires for executing Whitebox SDK.
 - o Please download "ICUMX_Loader_and_Flashwriter_Package_for_R-Car_S4_Starter_Kit_SDKv3.16.1" or later from following:
 - <https://www.renesas.com/products/automotive-products/automotive-system-chips-socs/y-ask-r-car-s4-1000base-t-r-car-s4-starter-kit#download>
2. CC-RH compiler
 - o This is used for building G4MH software.
 - o Please download "RH850 Compiler CC-RH V2.05.00 for e2 studio" from following:
 - <https://www.renesas.com/us/en/software-tool/c-compiler-package-rh850-family#download>

Please copy above files under the tool directory:

```
cd whitebox-sdk/tool
cp <download directry>/CC-RH_V20500_setup-doc.zip .
cp <download directry>/ICUMX_Loader_and_Flashwriter_Package_*.zip
```

Tool setup

Since GUI operation is required during installation, it must be run on an Ubuntu PC.

```
cd whitebox-sdk/tool
./setup_whitebox.sh
```

Build

Execute the following command:

```
cd whitebox-sdk
./build_whitebox_v5.0.sh <BOARD>
```

Download

```
bash -c "$(wget -O- https://raw.githubusercontent.com/renesas-rcar/whitebox-sdk/v5.1/tool/repo_init.sh)"
```

Install packages

```
cd whitebox-sdk/tool
cp <download directry>/CC-RH_V20500_setup-doc.zip .
cp <download directry>/ICUMX_Loader_and_Flashwriter_Package_*.zip .
```

Setup environment

```
cd whitebox-sdk/tool
./setup_whitebox.sh
```

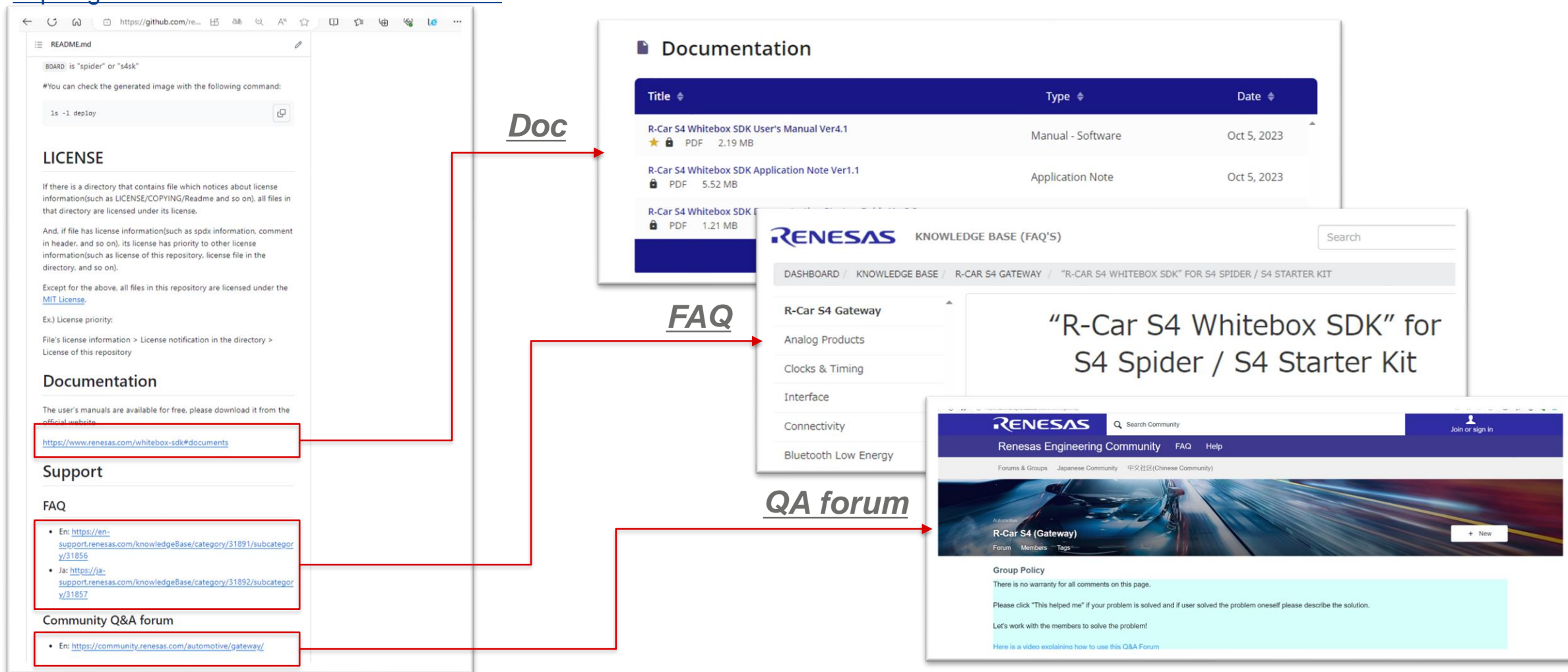
Build

```
cd whitebox-sdk
./build_whitebox_v5.1.sh s4sk
```


DOCUMENTATION AND SUPPORT

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<https://github.com/renesas-rcar/whitebox-sdk>



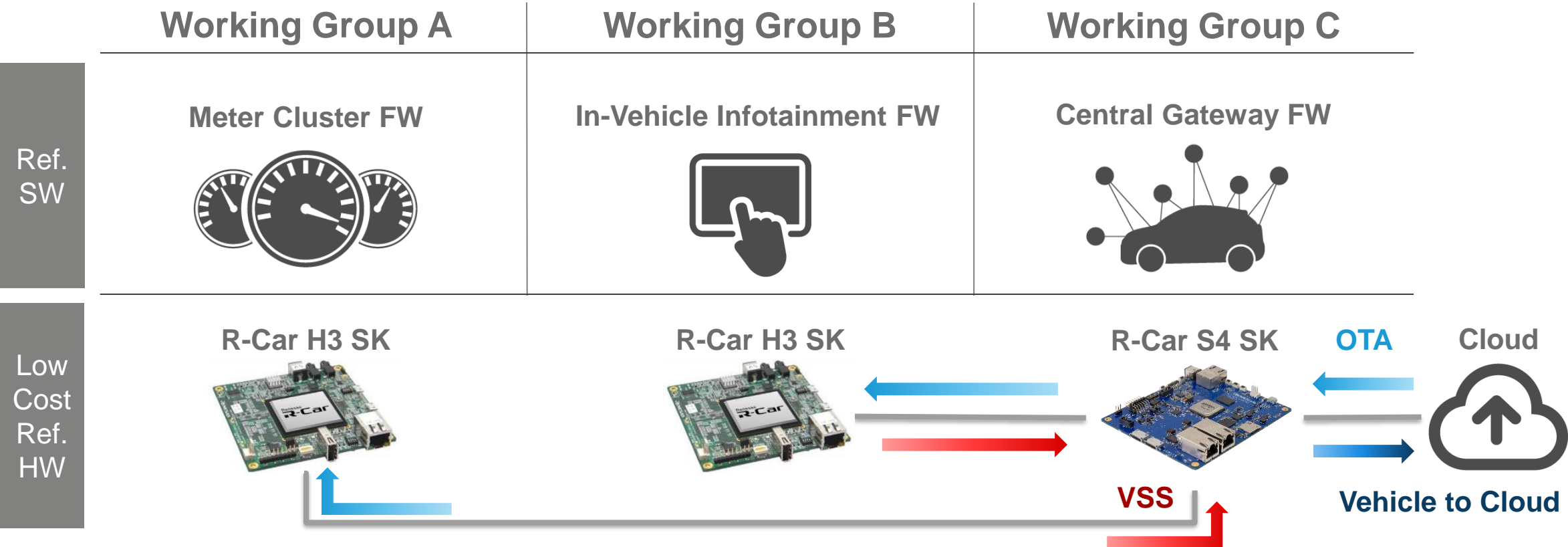
CASE STUDY



EXPECTED USE-CASE

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Automotive Industry Consortium

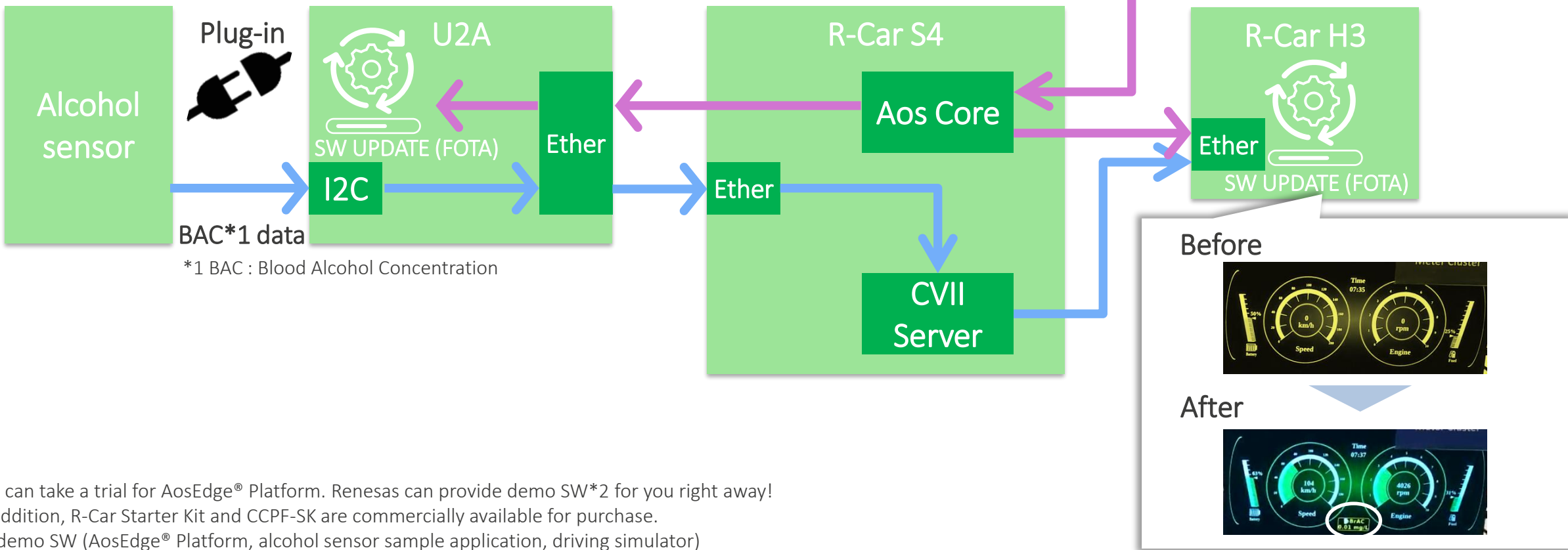


Let's start the use-case of new architecture across multiple ECUs

MULTIPLE FOTA

Apeal points:

- Required software get download by OTA mechanism along with hardware plug-in



You can take a trial for AosEdge® Platform. Renesas can provide demo SW*2 for you right away!
In addition, R-Car Starter Kit and CCPF-SK are commercially available for purchase.
*2 demo SW (AosEdge® Platform, alcohol sensor sample application, driving simulator)

CONCLUSION

1. I introduced automotive industry trends and the contributions of the consortium and explained that the consortium's activities are expanding at the non-competitive domain of the car.
2. For accelerating consortium activities, Renesas proposed the combination of R-Car S4 Starter Kit and R-Car S4 Whitebox SDK.
3. I explained overview of R-Car S4 Starter Kit and R-Car S4 Whitebox SDK and introduced use cases with demonstrations.

[Renesas.com](https://www.renesas.com)