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

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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.
    最近は、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

THE EVOLUTION OF E/E ARCHITECTURE

From distributed architecture to centralized and zonal architecture

- SDV Realization
- Architecture Simplification
- Harness/Car Weight Reduction
- Fuel/Electricity Improvement

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

CONSORTIUM'S CONTRIBUTION

Motivation → Investment → Contribution

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

Automotive Industry Consortium

- AUTOMOTIVE GRADE LINUX
- COVESA
- SDV Eclipse Software Defined Vehicle
- SOAFEE
- AVC CONSORTIUM
- THE AUTOWARE FOUNDATION
- AECC AUTOMOTIVE EDGE COMPUTING CONSORTIUM
- Others…

Consortium contributes car products with using its asset and effort

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

Point

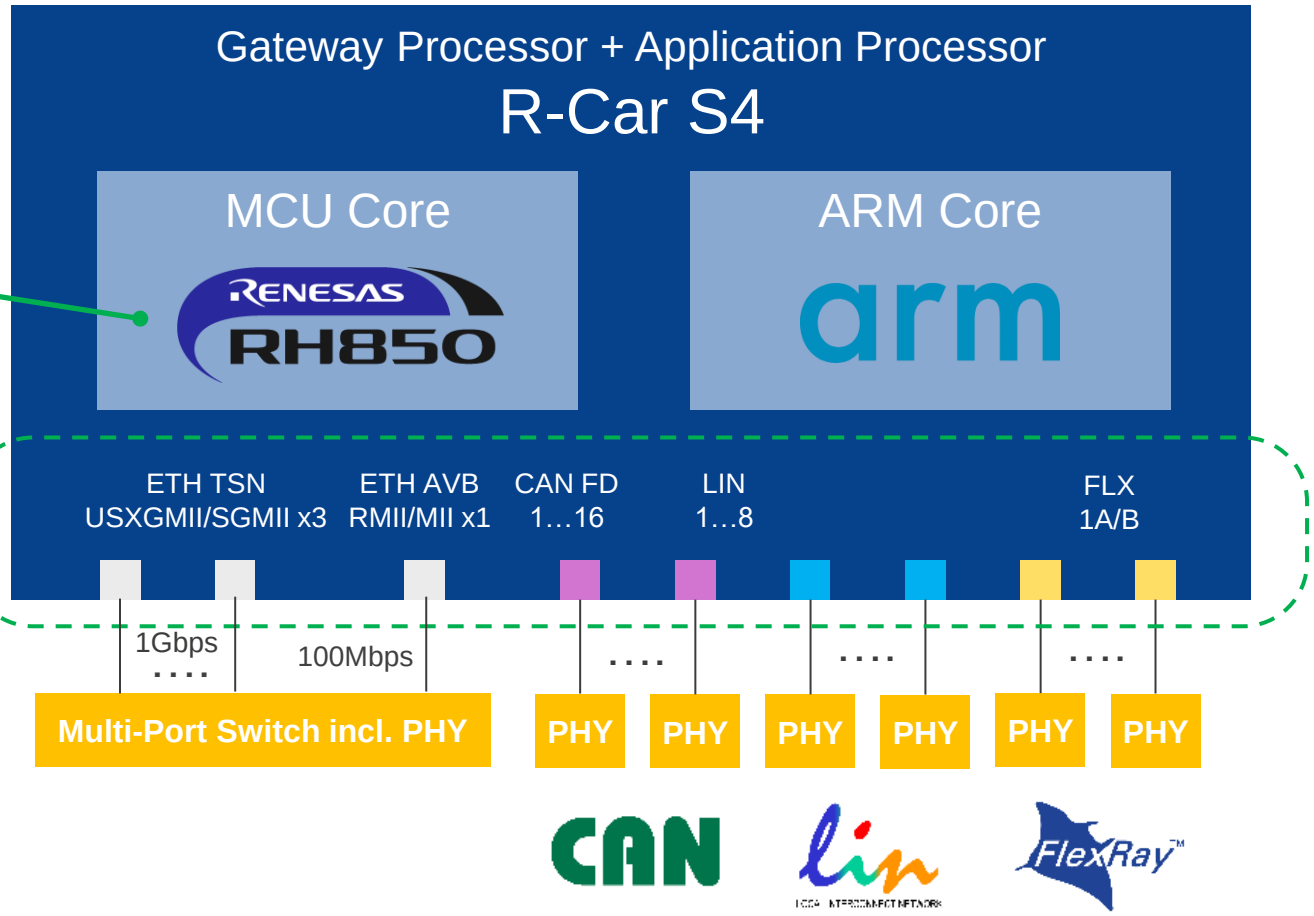
Concept 1：Build-in MCU Function

- ✓ Monolithic chip design including both MCU and SoC IP
- ✓ Software reusability

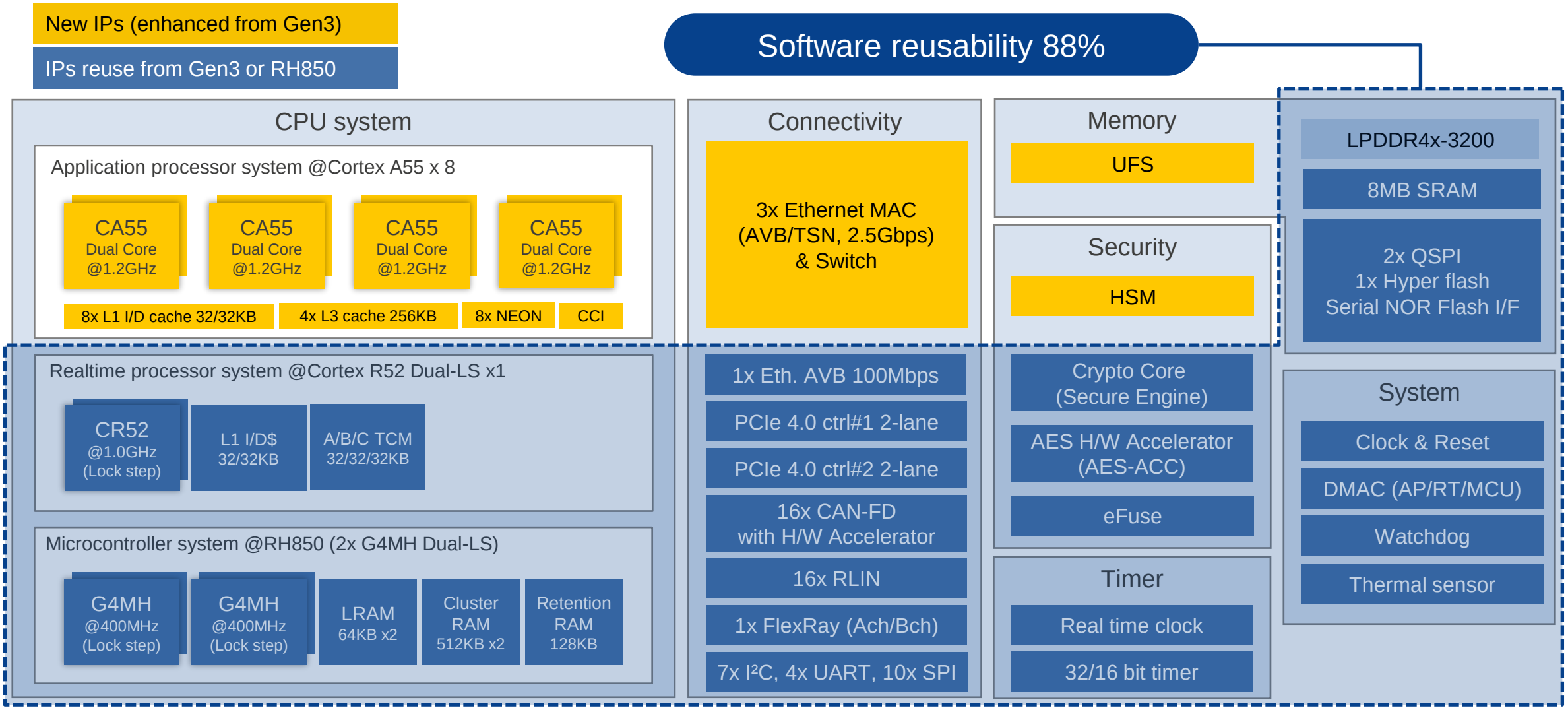
Point

Concept 2：Rich communication IFs

- ✓ Supporting various interfaces such as CAN-FD, LIN, FlexRay, Multi Gbit Ethernet etc.



R-CAR S4 SOC BLOCK DIAGRAM



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

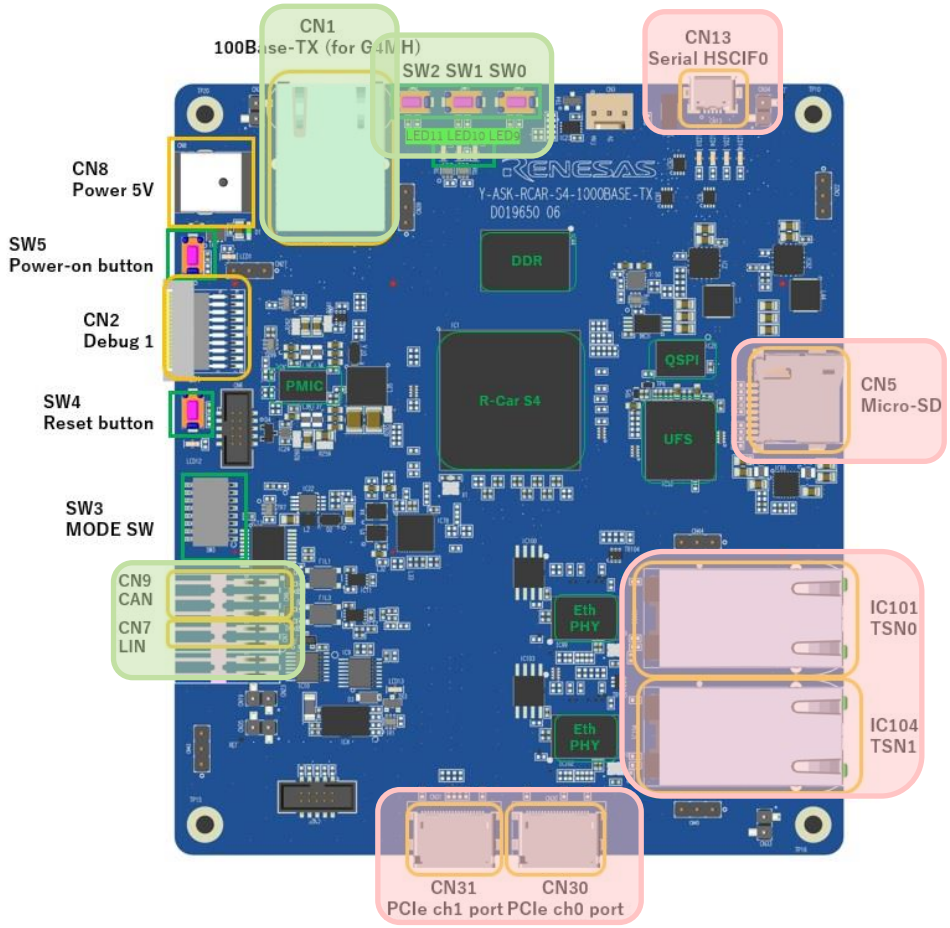
Anyone can download SW and Doc
No need any contract, easy trial for R-Car S4

Easy to evaluate

Anyone can evaluate immediately
A lot of supported OSS SW PKGs

SPECIFICATION OF R-CAR S4 STARTER KIT

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



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 (elinux.org)	Board information	https://elinux.org/R-Car/Boards/S4SK
	Yocto Linux	https://elinux.org/R-Car/Boards/S4SK/Yocto-Linux
	Hypervisor (Xen)	https://elinux.org/R-Car/Boards/S4SK/Xen-Hypervisor
	Zephyr	https://elinux.org/R-Car/Boards/S4SK/Zephyr
RENESAS 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)	

HISTORY OF R-CAR STARTER KIT

[*] AGL: Automotive Grade Linux (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

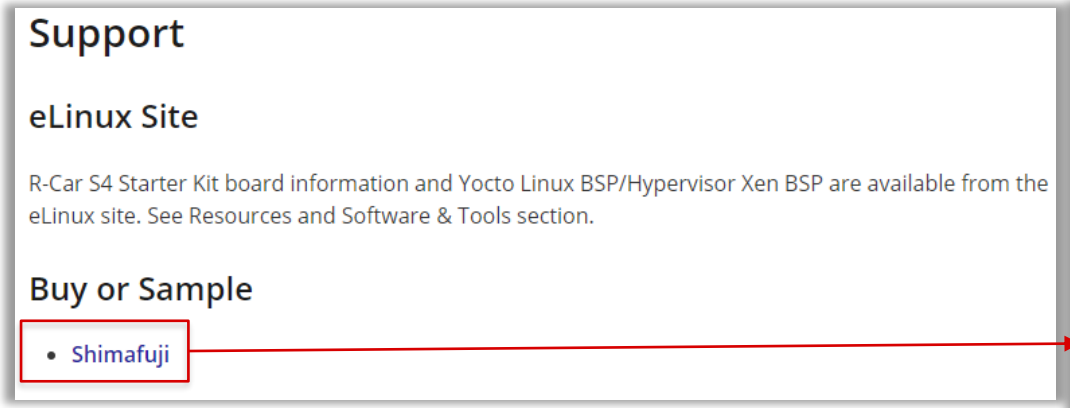
Kingfisher

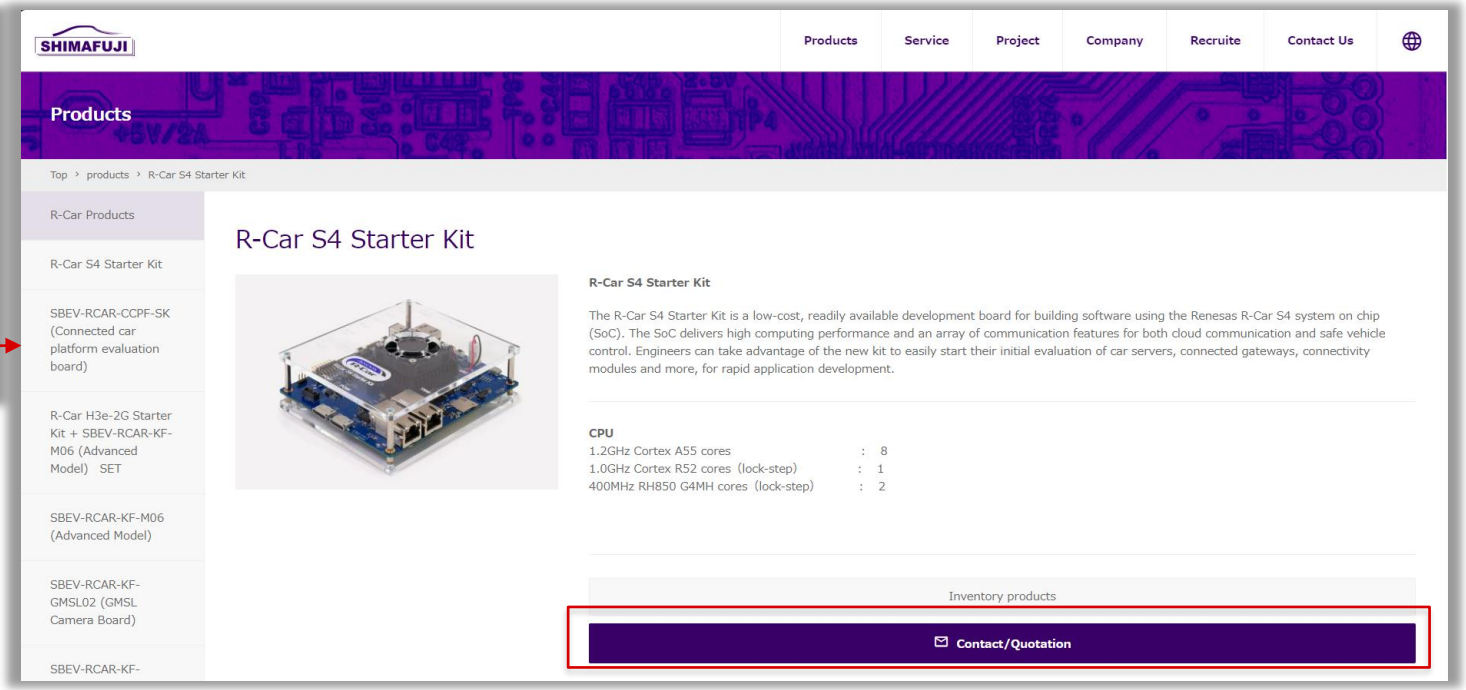
R-Car S4 Starter Kit

2023

WHERE TO BUY

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





R-CAR S4 WHITEBOX SDK

(SOFTWARE PART)

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.

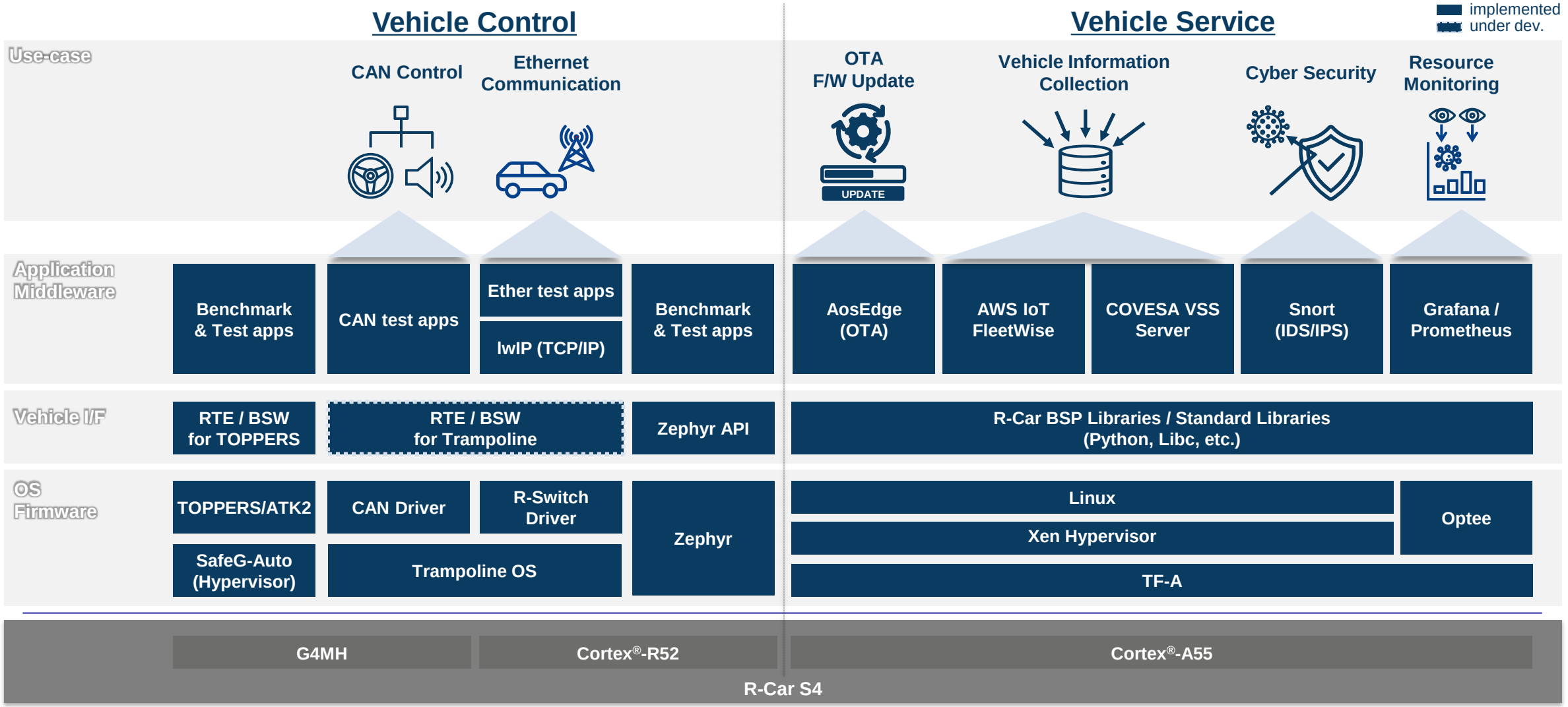
Flexible

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

Use-case oriented

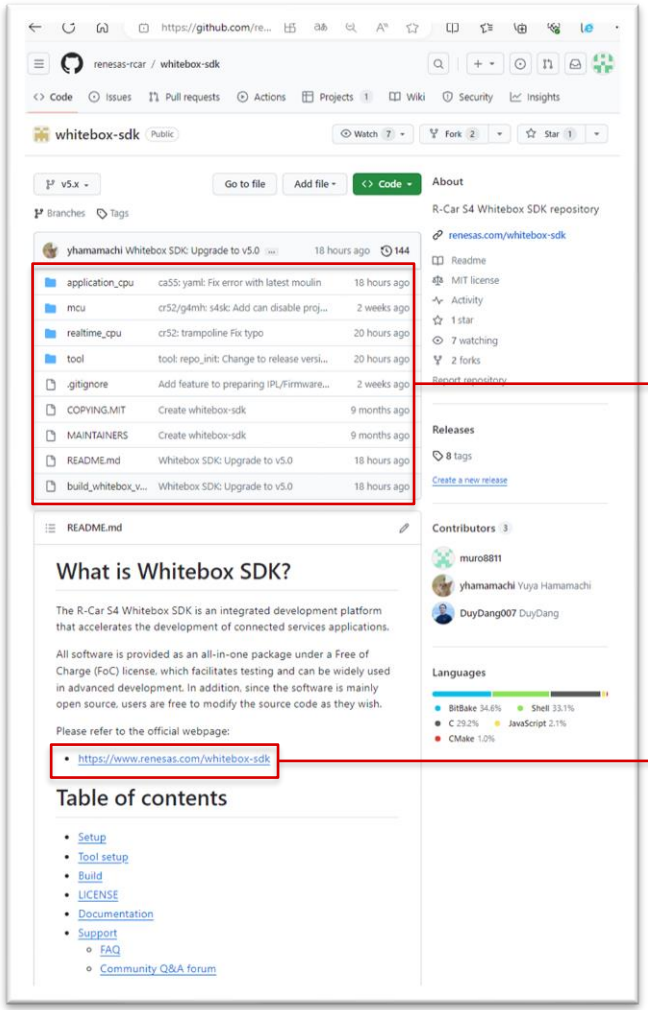
Multiple apps (OTA, IDS/IPS, etc) are pre-implemented along gateway use-case.

SOFTWARE STRUCTURE

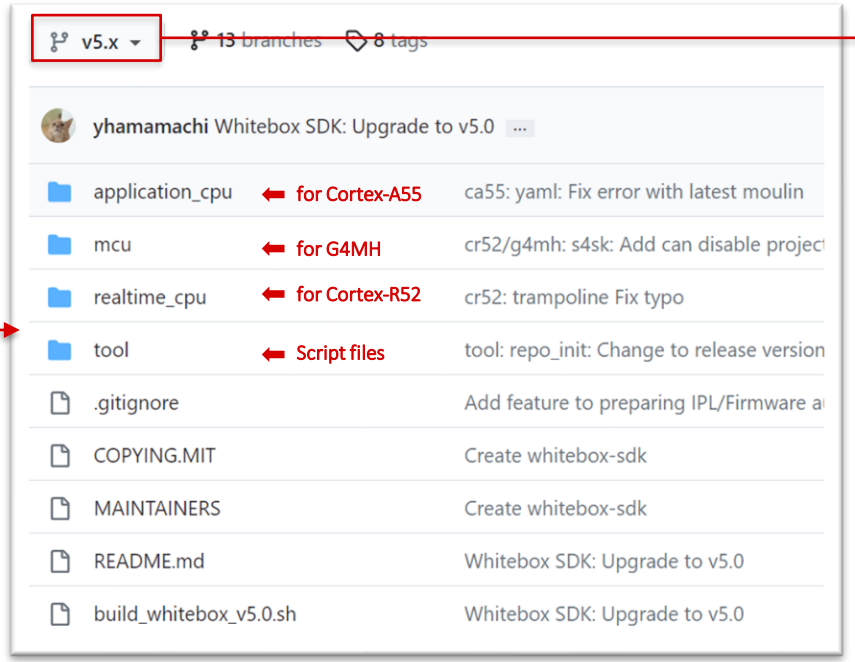


GITHUB – R-CAR S4 WHITEBOX SDK

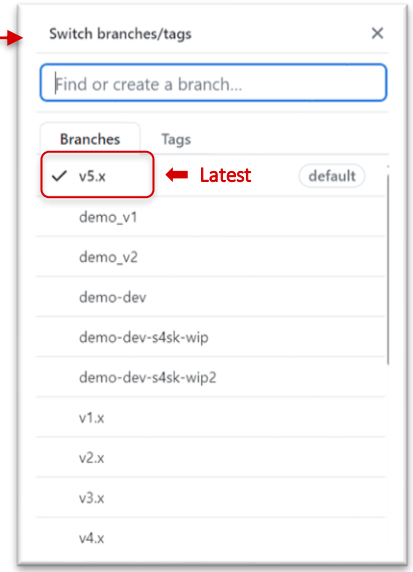
https://github.com/renesas-rcar/whitebox-sdk



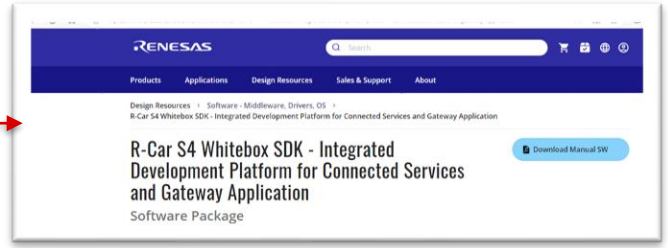
Top directory of repository



Branch info

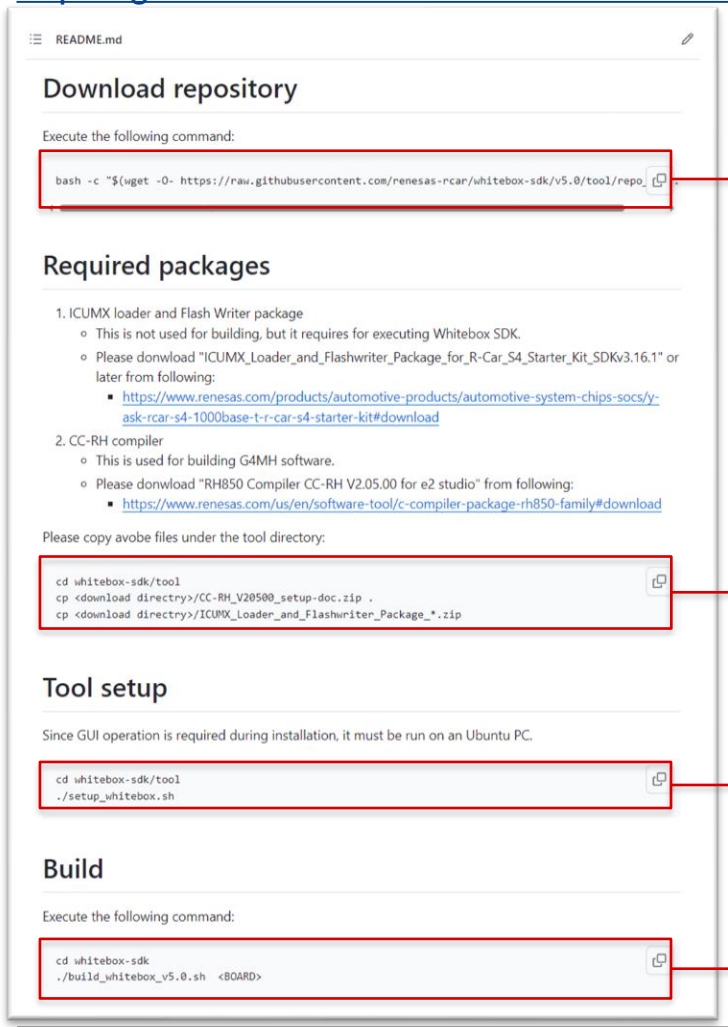


Renesas website



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_
```

Required packages

1. ICUMX loader and Flash Writer package
   - This is not used for building, but it requires for executing Whitebox SDK.
   - Please donwload "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-rcar-s4-1000base-t-r-car-s4-starter-kit#download
2. CC-RH compiler
   - This is used for building G4MH software.
   - Please donwload "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 avobe 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

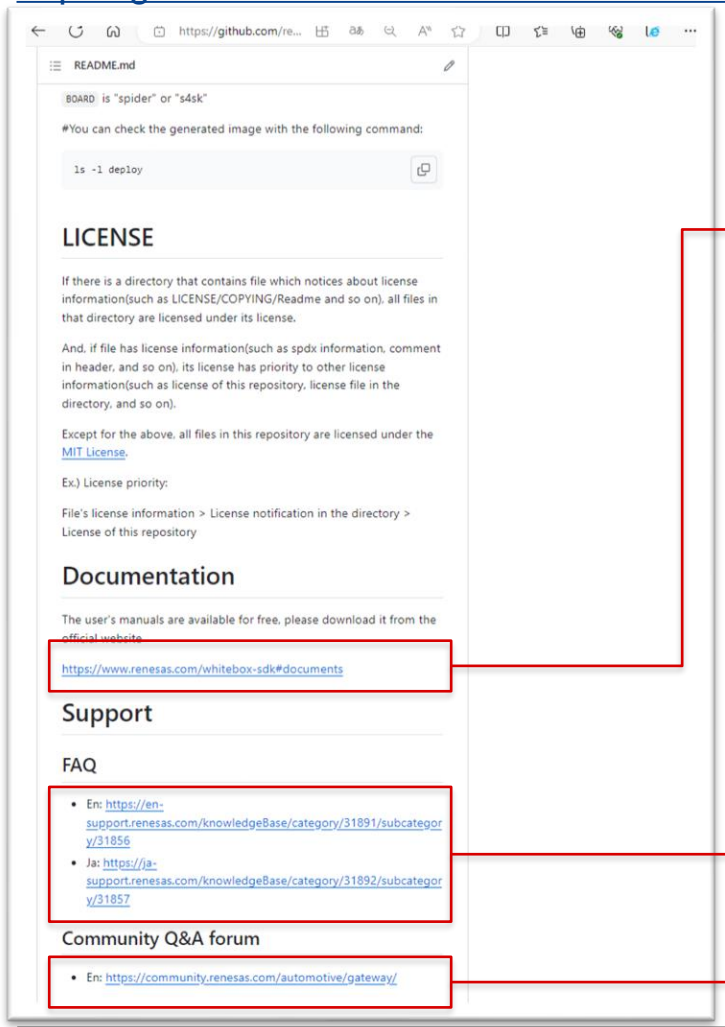
```
cd whitebox-sdk/tool
./setup_whitebox.sh
```

Build

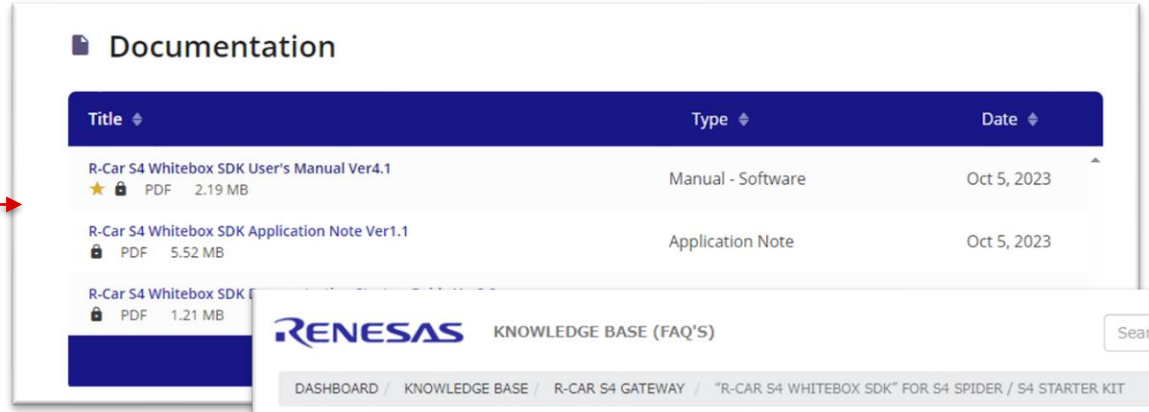
```
cd whitebox-sdk
./build_whitebox_v5.1.sh  s4sk
```

DOCUMENTATION AND SUPPORT

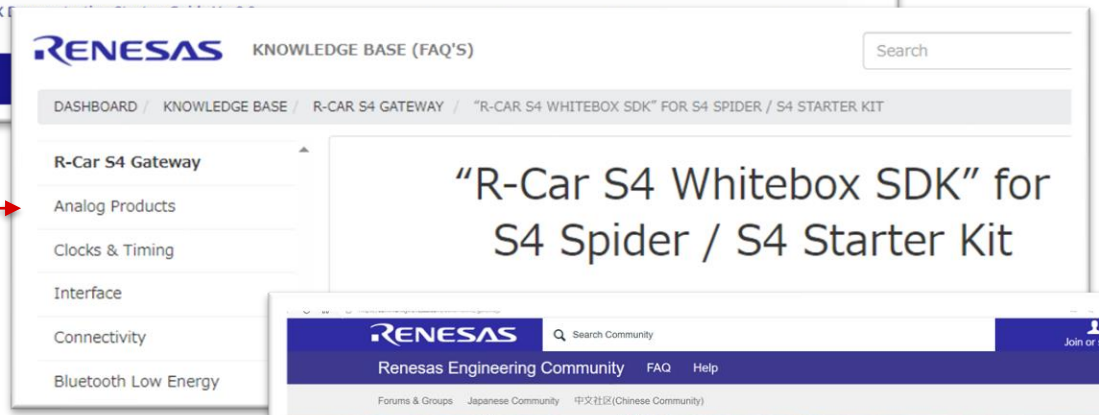
https://github.com/renesas-rcar/whitebox-sdk



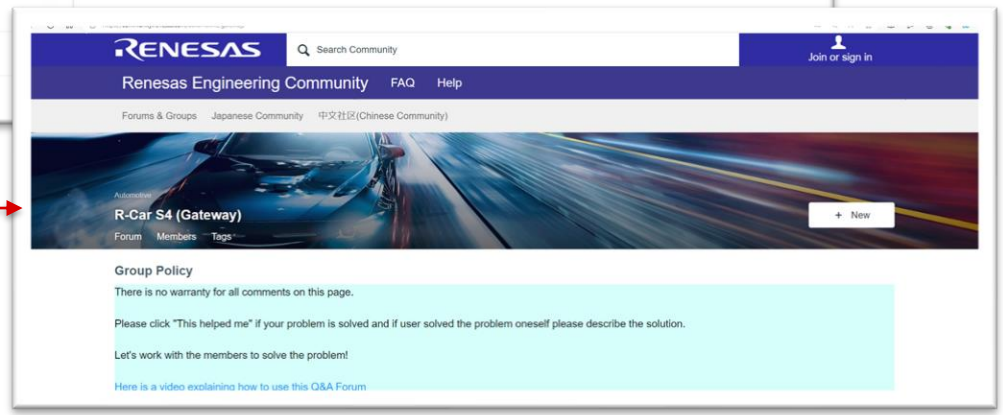
Doc



FAQ



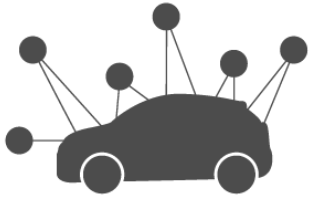
QA forum

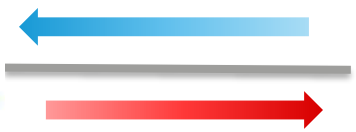


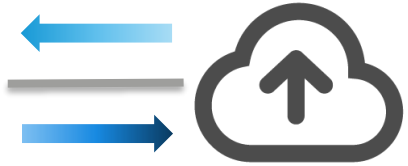
CASE STUDY

EXPECTED USE-CASE

Automotive Industry Consortium

	Working Group A	Working Group B	Working Group C
Ref. SW	Meter Cluster FW 	In-Vehicle Infotainment FW 	Central Gateway FW 
Low Cost Ref. HW	R-Car H3 SK 	R-Car H3 SK 	R-Car S4 SK 





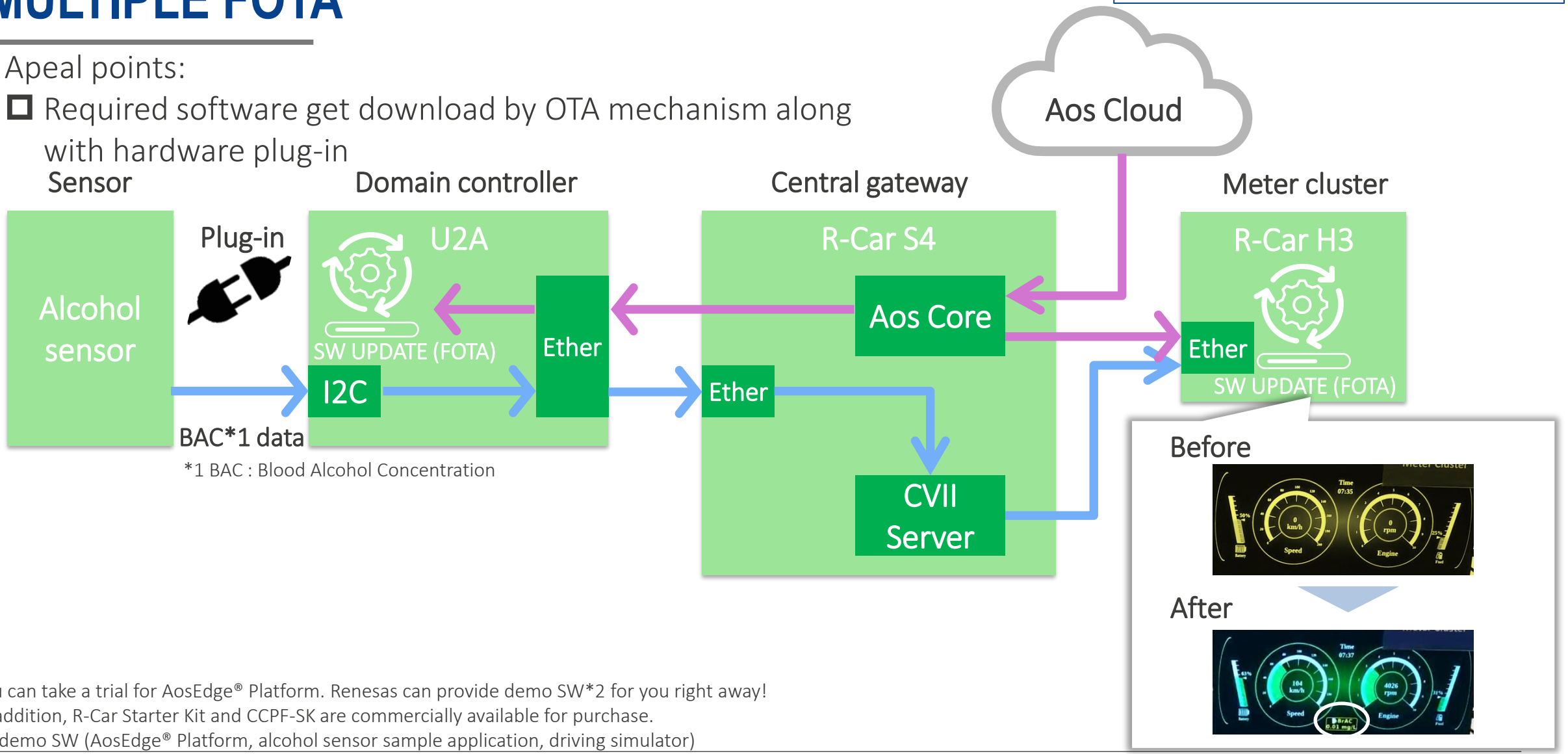
Vehicle to Cloud

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