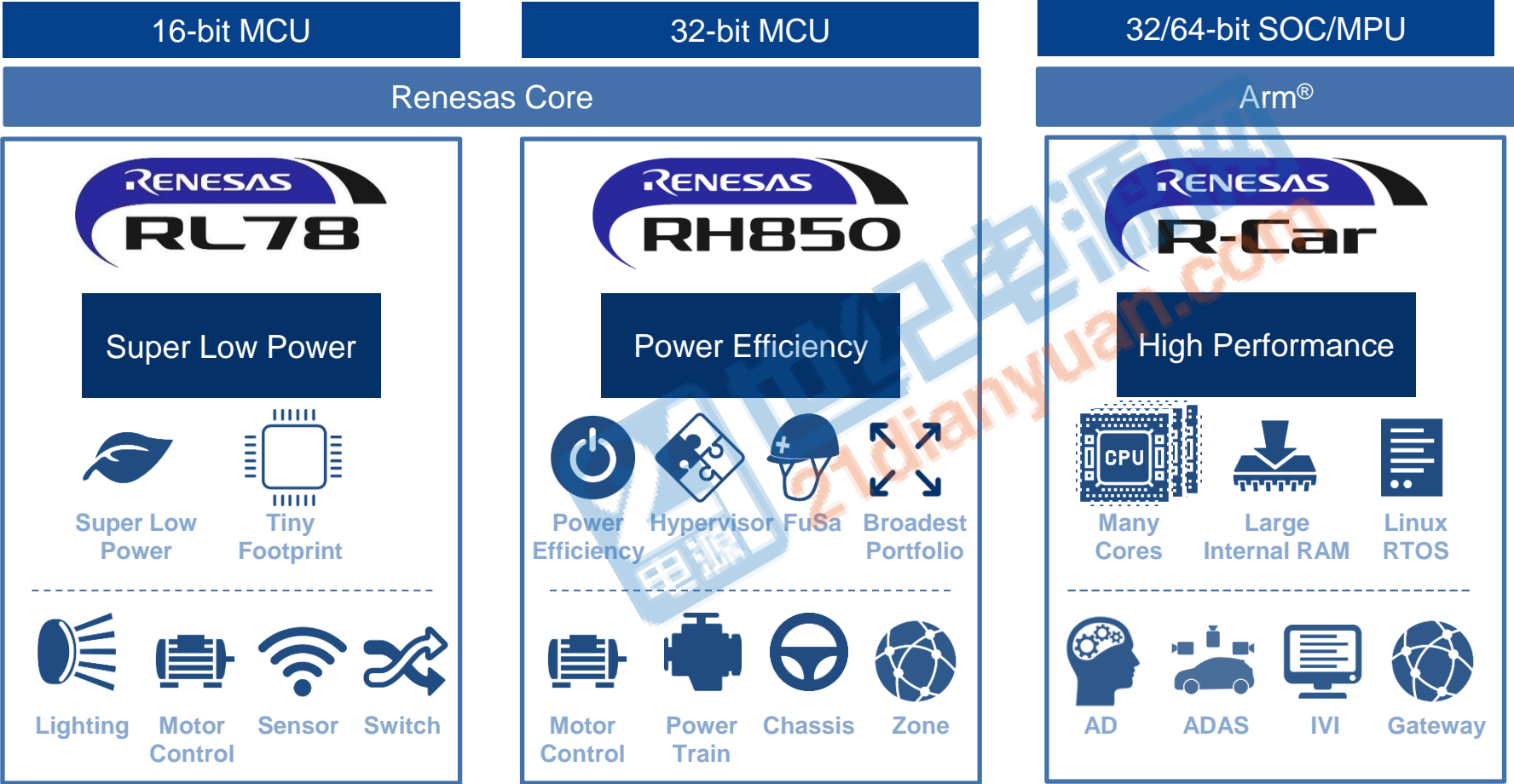# MCU SOLUTIONS FOR DOMAIN CONTROLLER

MAR. 2024
BETTY GUO
GLOBAL DISTRIBUTION MARKETING
RENESAS ELECTRONICS CORPORATION
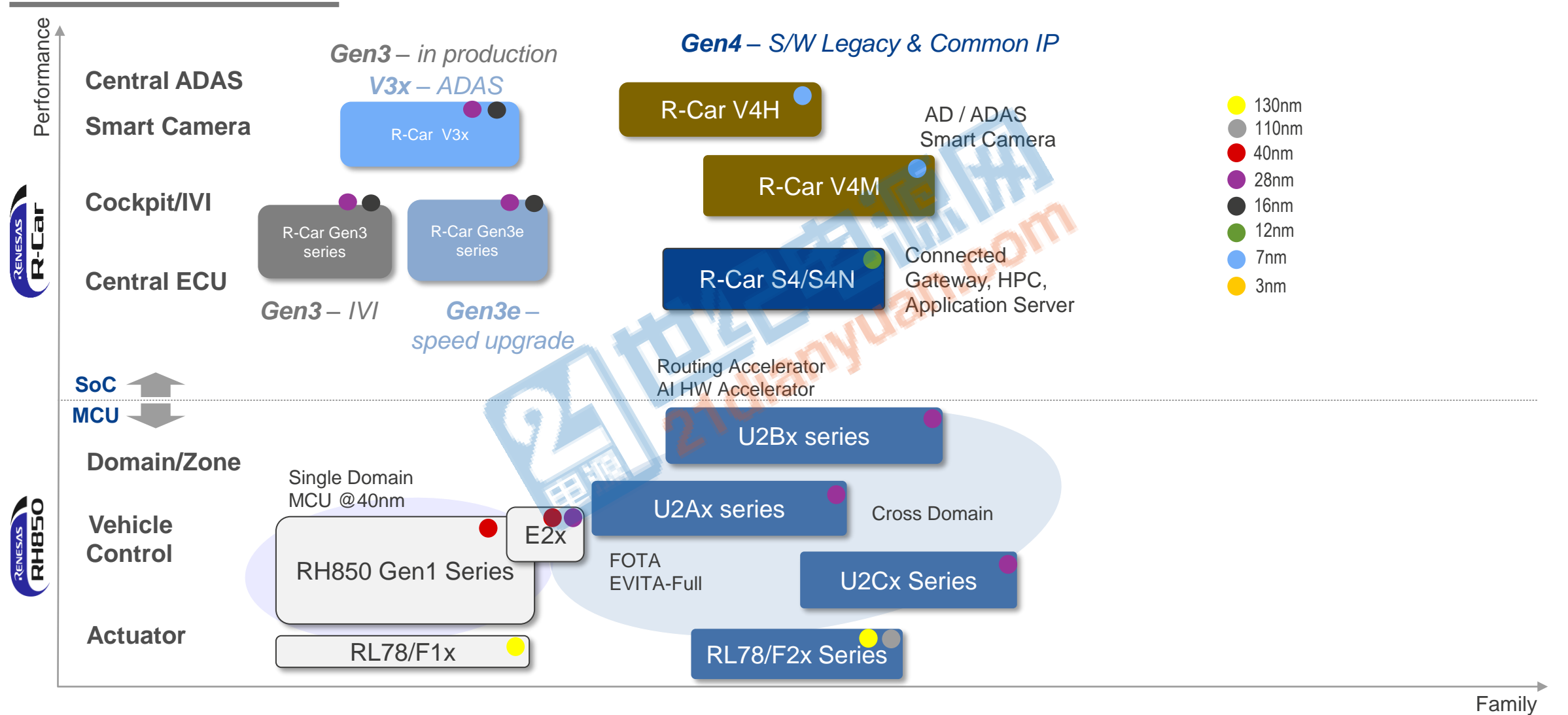
RENESAS

RENESAS AUTOMOTIVE MCU AND SOC/MPU

Renesas provides for the various needs of our customers with a rich lineup of automotive MCUs and MPUs.

16-bit MCU	32-bit MCU	32/64-bit SOC/MPU
Renesas Core	Renesas Core	Arm®

RL78
Super Low Power

- Super Low Power
- Tiny Footprint

- Lighting
- Motor Control
- Sensor
- Switch

RH850
Power Efficiency

- Power Efficiency
- Hypervisor
- FuSa
- Broadest Portfolio

- Motor Control
- Power Train
- Chassis
- Zone

R-Car
High Performance

- Many Cores
- Large Internal RAM
- Linux RTOS

- AD
- ADAS
- IVI
- Gateway

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AUTOMOTIVE DIGITAL PRODUCTS ROAD MAP
S/W REUSABILITY AMONG SEGMENT AND GENERATION

Performance

R-Car

RH850

SoC
MCU

Central ADAS
Smart Camera
Cockpit/IVI
Central ECU

Domain/Zone
Vehicle Control
Actuator

Gen3 – in production
V3x – ADAS

R-Car V3x

Gen4 – S/W Legacy & Common IP

R-Car V4H

AD / ADAS
Smart Camera

R-Car V4M

R-Car Gen3 series
R-Car Gen3e series

R-Car S4/S4N

Connected Gateway, HPC, Application Server

Gen3 – IVI
Gen3e – speed upgrade

Routing Accelerator
AI HW Accelerator

U2Bx series

Single Domain MCU @40nm

E2x

U2Ax series

Cross Domain

RH850 Gen1 Series

FOTA
EVITA-Full

U2Cx Series

RL78/F1x

RL78/F2x Series

Family

🟡	130nm
⚪	110nm
🔴	40nm
🟣	28nm
⚫	16nm
🟢	12nm
🔵	7nm
🟠	3nm

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CPU CORE ROADMAP

RH850/U2A,B

New CPU (Under Consideration)

G4MH2
・G4MH1+Hypervisor

RH850/E2x

G4MH1
・400MHz
・Out-of-Order
・FP-SIMD

RH850/E1M-S2

G3MH
・8-stage
・320MHz
・Low power

**RH850/P1M,
RH850 P1x-C**

G3M/G3MA
・7-stage
・320MHz
・Multi-Core

V850E2x
・7-stage
・Dual-issue
・FPU

V850E1x
・5-stage

V850 Architecture

SH2A

SH2 **SH Architecture**

Lockstep

Low Power

G4KH
・5-stage
・up to 320MHz

RH850/U2C

G3KH
・5-stage
・up to 240MHz

RH850/F1x

G3K
・5-stage
・Small

Core Name	G4MH2	G4KH	G3MA	G3M	G3KH
Product	RH850/ U2A,B	RH850/ U2C	RH850/ P1x-C	RH850/ P1x	RH850/ F1Kx
Frequency	400MHz	320MHz	240MHz	320MHz	240MHz
DMIPS/ MHz	4.2	2.3	3.2	3.2	2.3
I-Cash	Up to 32KB	Up to 16KB	Up to 16KB	Up to 8KB	n/a
FPU[*1]	S/D/SI	S/D/-	←	←	S/-/-
LRAM	Up to 32KB	Up to 512KB	←	←	←
Virtualization	Support	n/a	←	←	←
Register Banking	Support	←	n/a	n/a	←

*1: S=Single, D=Double, SI=FP-SIMD

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RH850/U2X

RH850/U2X FAMILY

Market requirement

New E/E Architecture

Higher dev. efficiency by common parts

Software reusability

Support for Application Integration

One U2 Family from low to high

Common IP / Software
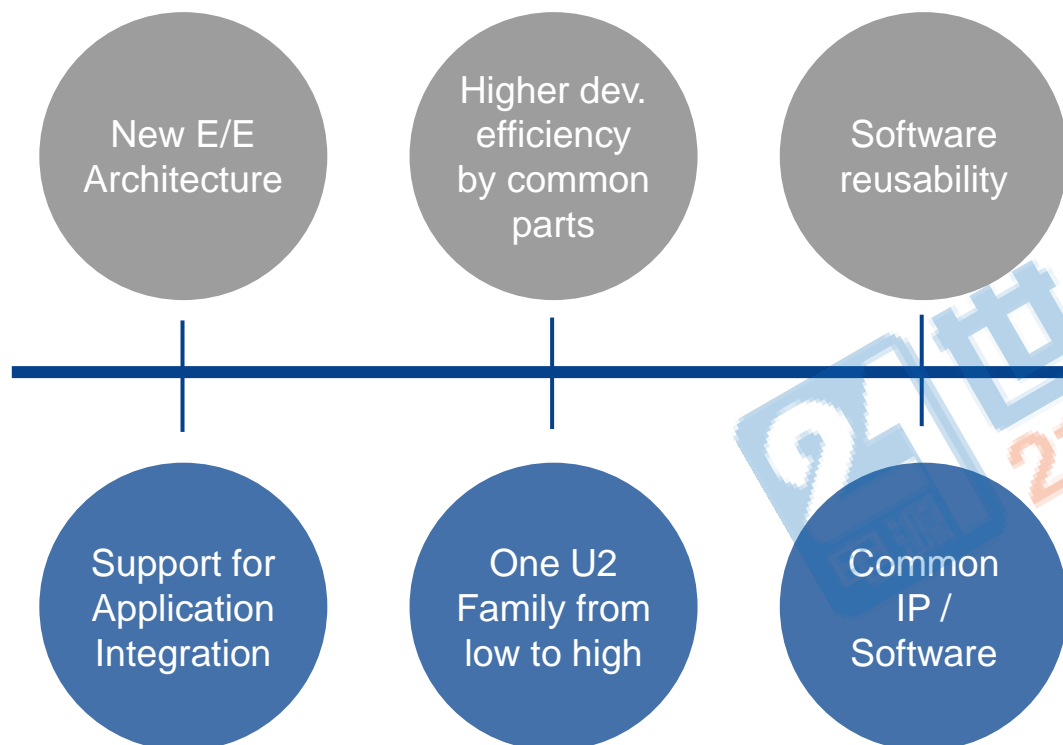
Renesas' platform strategy

U2Bx
High Performance

ROM: up to 26MB
CPU: 400MHz
x (2+2) ~ (6+4)

U2Ax
General Purpose for High

ROM: up to 16MB
CPU: 400MHz
x (2+2) ~ (4+4)

U2Cx
General Purpose For Mid/Low

ROM: up to 8MB
CPU: up to 320MHz
x (1+1) ~ (2+2)
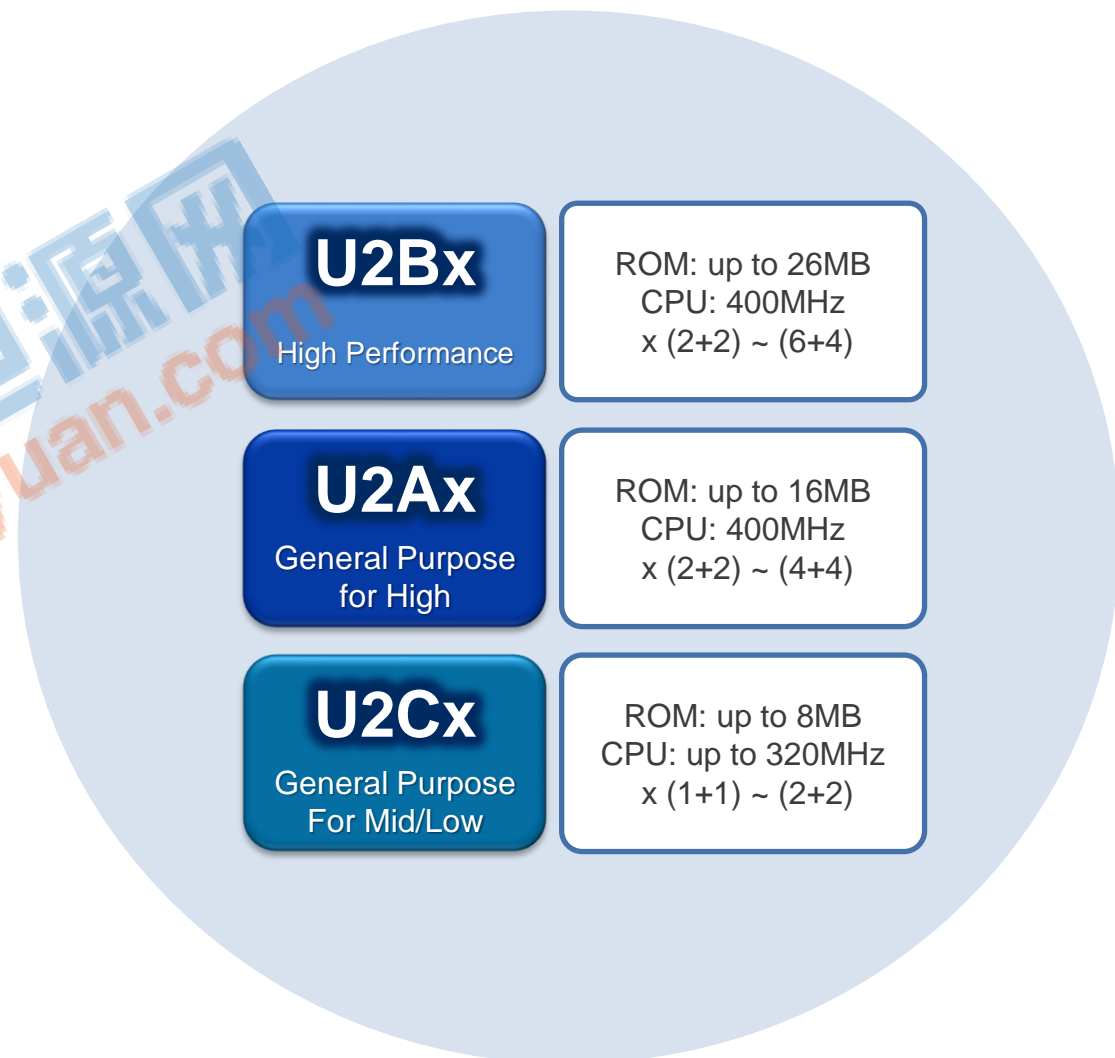
RH850 PRODUCT COVERAGE

☐ **Wide line-up to cover various applications and systems**

Powertrain

xEV

Energy Management

DCU / Zone / Gateway

Chassis & Safety

Body Control / Actuator

E2x Series

C1x Series

P1x Series

F1x Series

RL78 Series

Energy Management: DC-DC converter, BMS, OBC

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RH850/U2X SERIES COVERS E/E ARCHITECTURE CHANGES

The RH850/U2x series covers Zone/DCU where MCU requirements are diversified
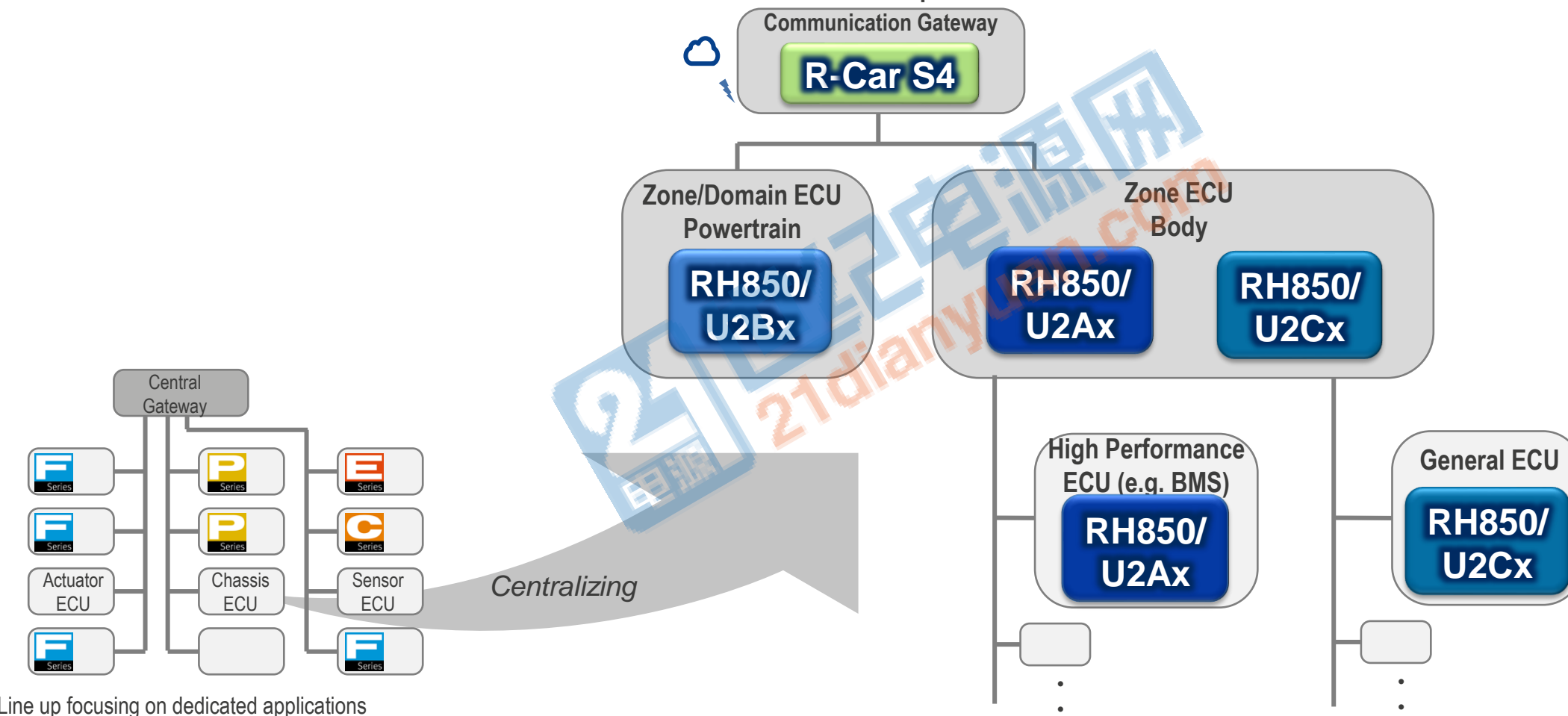
Line up focusing on dedicated applications

Centralizing

RH850/U2X FAMILY - POSITIONING

Powertrain	Accelerator for Model-Based Design & AI	
xEV	RDC for high frequency carrier, Multiphase control	
DCU / Zone / Gateway	**Powertrain** → QoS, Hardware Accelerator High performance CPU	
	Body → Hypervisor Low power consumption	
Chassis & Safety	Small package, Multi Core	
Energy Management	Low Standby Power	
Body Control / Actuator	Low Power & Wide Line-up incl. ASIL B&D	

U2B
High Performance
(Zone / PT / xEV)

ROM: up to 26MB
CPU: 400MHz
x (2+2) ~ (6+4)

3~10 KDMIPS

U2A
General Purpose
(High)

ROM: up to 16MB
CPU: 400MHz
x (2+2) ~ (4+4)

3~6 KDMIPS

U2C
General Purpose
(Mid / Low)

ROM: up to 8MB
CPU: up to 320MHz
x (1+1) ~ (2+2)

0.7~1.3 KDMIPS

Software Reusability

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HIGH SOFTWARE REUSABILITY WITH RENESAS CROSS DOMAIN 28NM MCU PLATFORM

Software First – Renesas Platform Approach

40nm

	Within Application	Across Application
Domain/Zone	95%	
Powertrain/xEV	95%	
Chassis & Safety	95%	70%
Energy Mgmt	95%	
Body/General Purpose	95%	

28nm

Across Application & Car Models

95%

High integration density of 28nm enables wide application coverage with one family

- Less MCU variants and SW platforms to develop -> from 5 to 3
  - Less MCU variants: simple & robust supply chain
- Double digit MUSD reduction of development cost
- Reduction of development lead-time by 6 month
- Re-use of SW within 28mn family

Safe & long lasting process

- 28nm is already industrialized at Renesas: safe launch!
- Long process availability:
  - last node before 16nm finfet
  - becoming industry standard already for industrial

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RH850/U2A SERIES KEY FEATURES

Optimized for Performance

- ✓ RH850 G4MH with out of order execution
- ✓ 400MHz operation
- ✓ Low latency flash & RAM access
- ✓ HW hypervisor mode

Scalable Line-Up

- ✓ 6-16MB Flash
- ✓ (2+2) up to (4+4) CPU cores
- ✓ 144QFP to BGA516 packages
- ✓ Rich set of peripherals

Performance | **Scalability**

U2Ax

Connectivity | **Robustness**

Well suited for gateway tasks

- ✓ Ethernet: Gbit AVB
- ✓ Up to 16ch CAN-FD
- ✓ Flexray, LIN etc.

Provides Safety and Security

- ✓ ISO26262 ASIL D
- ✓ Evita-Full

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RH850/U2A TOOLS

RH850 TOOLS ECO SYSTEM OVERVIEW

U2A SW COMPONENTS AND PARTNER

Virtual platform

- available from ASTC

MCAL

- Inhouse AUTOSAR MCAL development and maintenance
- U2A MCAL available (ASIL D, comply to ISO26262)

Autosar BSW, OS

- Long experience with all major AUTOSAR 3rd parties supplier integrating Renesas MCAL into their BSW stacks.
- AUTOSAR BSW, OS available from e.g. Vector, EB,..

Security

- HSM Security Software available from e.g Vector, Escrypt,..

Hypervisor software

- available from GreenHills ("uVisor")

APPLICATION EXAMPLES

THE VALUE THAT U2A OFFERS

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BENEFITS FOR A DCU/ZONE ECU
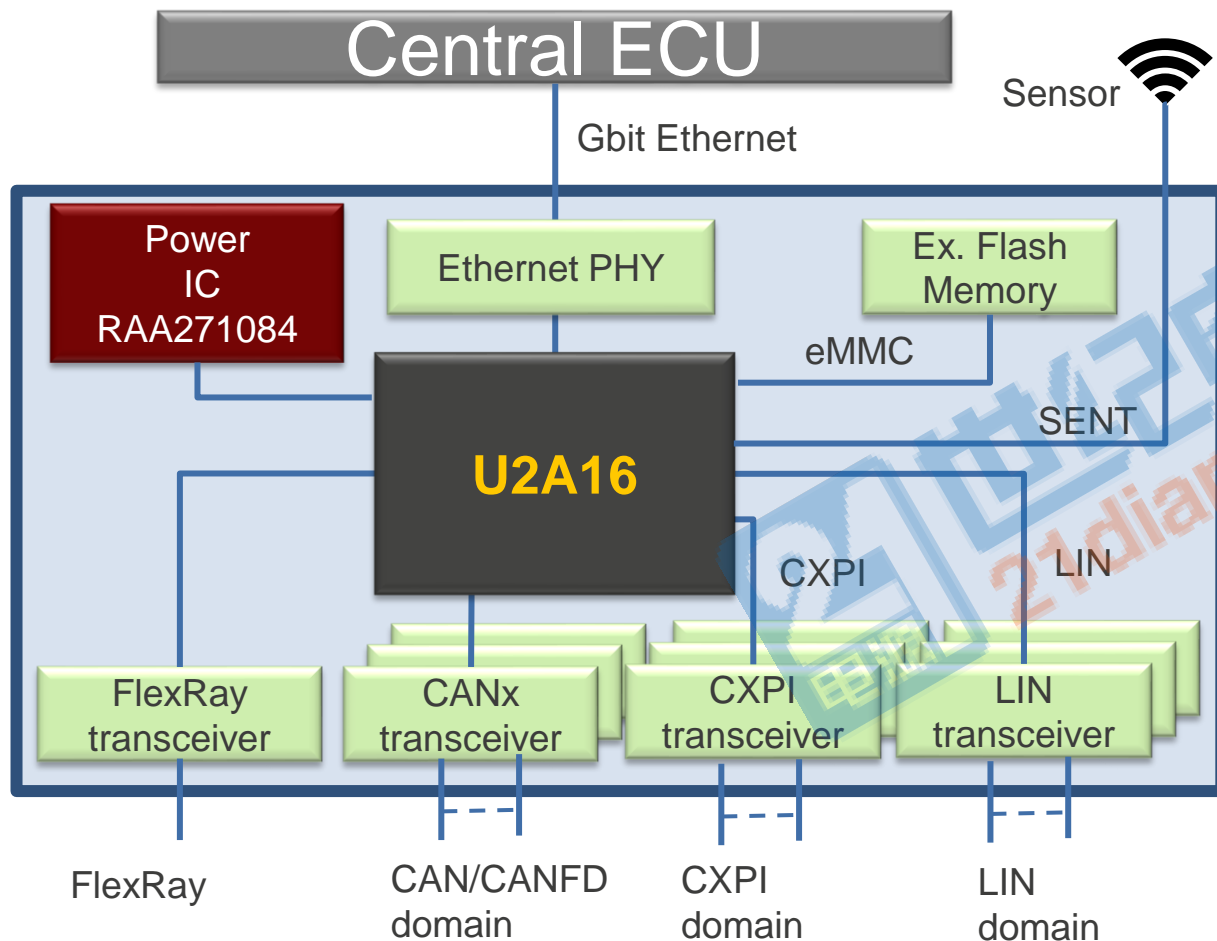
Highest Performance

- 4 x RH850 G4MH cores with 400MHz deliver more than 6kDMIPS

Excellent connectivity

- Supports multiple Interfaces (Ethernet, FlexRay, CAN etc.
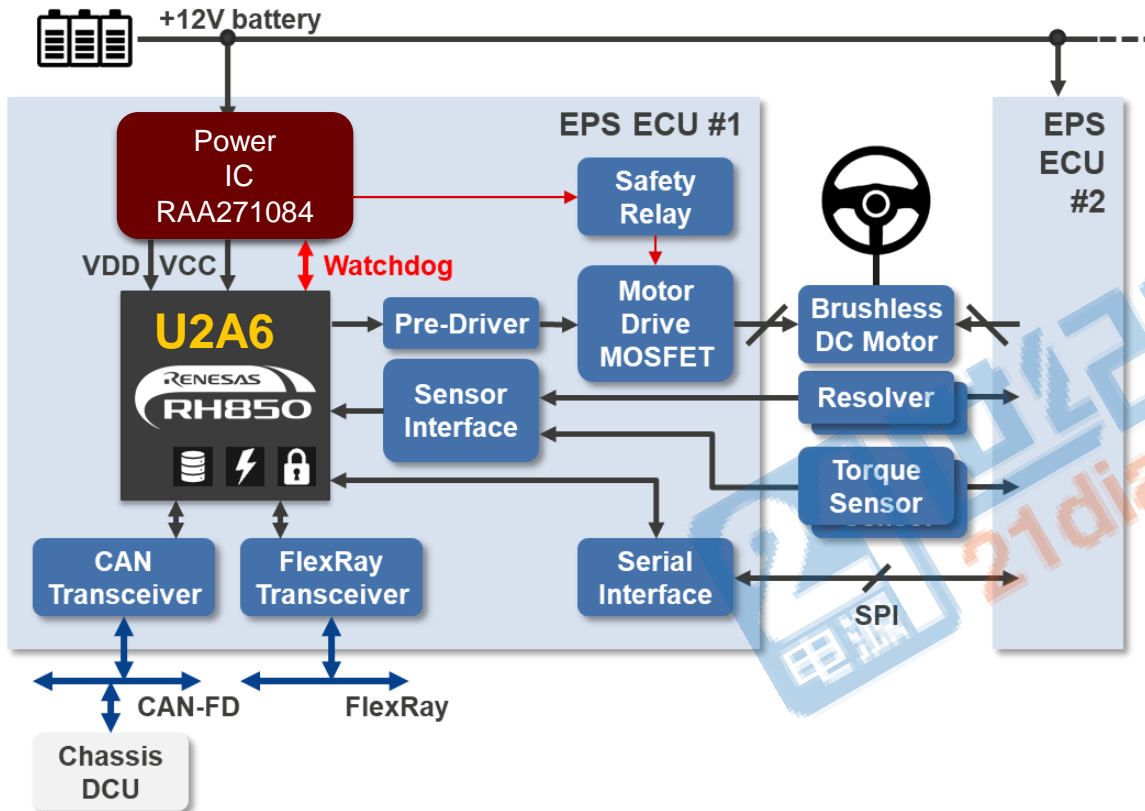- Fast connectivity to the Central ECU (Gbit Ethernet)

Ideal for DCU/Zone with Integration of Applications

- Build-in Hypervisor for separation of applications

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BENEFITS FOR AN EPS CONTROLLER

Optimized Peripheral Set for BLDC Control

- Dedicated timers (TSG3, GTM)
- ADC w/ T/H
- High speed serial interfaces (CAN-FD, Flexray, Ethernet) for accurate control

Small packages for fail operational / dual devices

- Small BGA package for minimum footprint

Ideal for Actuators which need high performance for high quality control

- 400MHz CPU frequency
- ASIL-D compliant

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