



Modular and Open Real-Time Platform for Future Automotive Computing Environment

THE EVOLUTION WEIGHT



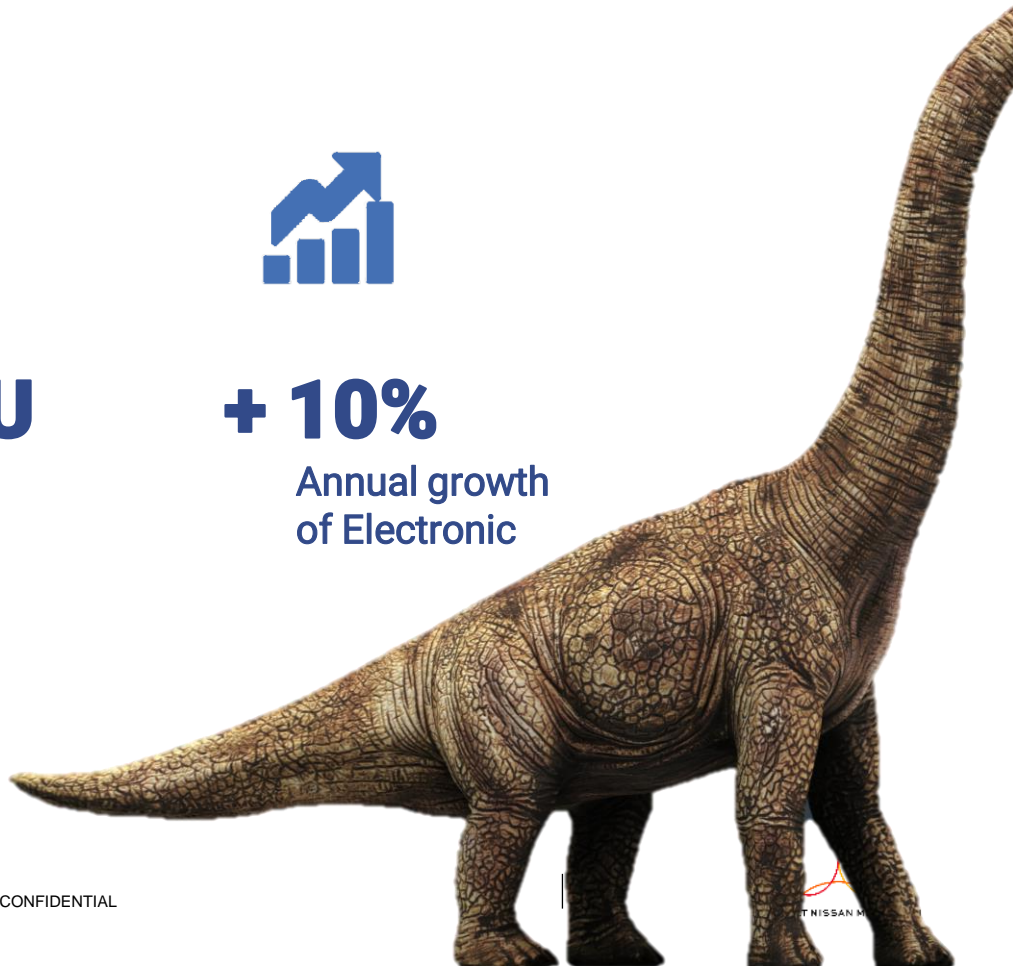
35 years
of electronic legacy



> 90 ECU
per vehicle



+ 10%
Annual growth
of Electronic

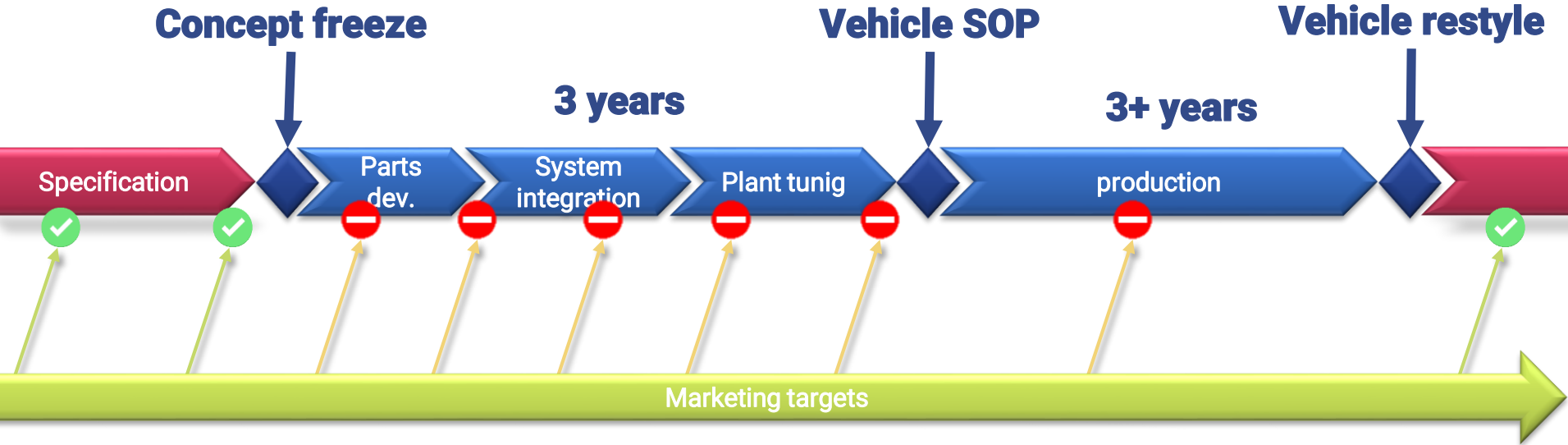


THE NEWCOMER ATTRACTIVENESS



Software Defined Car

THE AGILITY CHALLENGE

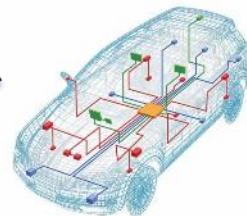


Market expectations cannot be reached during vehicle design and production phases due to strong electronic and features intrication

SOFTWARE ORIENTED ARCHITECTURE



Need to rethink Electronic Architecture around
Software and Services



TCO advantage of USD 175 per vehicle
when gathering just 4 ECU in 1 !



Cockpit ECUs (IVI, cluster, TCU and Radio)	USD 800
HW redundancy impact	USD 110
System reduction (wiring) impact	USD 13
OEM (procurement, development and test, COM complexity reduction, supply chain)	USD 6
Assembly plant complexity reduction	USD 8
Improve upgradeability (all in one place)	USD 30
Reduction of system weight (1.5 kg - fuel save)	USD 8

USD 625 (22%)

CONFIDENTIAL

**Up to 19 ECU can be saved
within 3 years and 39 in 5 years**

THREE KEY MAINSTAYS

1

HW architecture and design



*Offer an innovative E/E architecture enabling **centralized computing** approach*

*Towards a **plug & play, scalable, heterogeneous** computer system*



2

Software and run-time

*Offer innovative services to ensure **the security and the dependability** of the E/E architecture*

*Guarantee **real-time, deterministic and critical and non-critical** execution*



3

Development and integration process

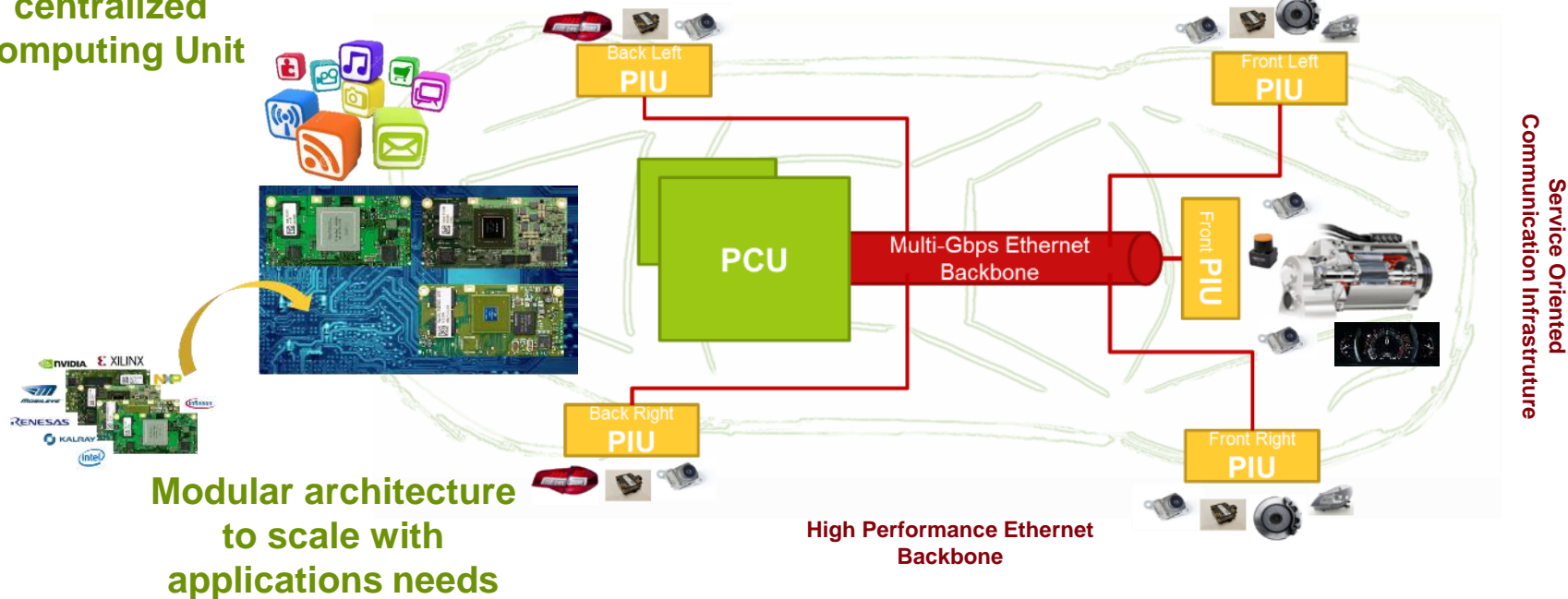
*Adapt the software function **development and integration** for the project*

*Ensure software services validation against **safety and security** requirements*

EE ARCHITECTURE BASICS

Multi-application
centralized
computing Unit

Localized Data concentration
and Power distribution

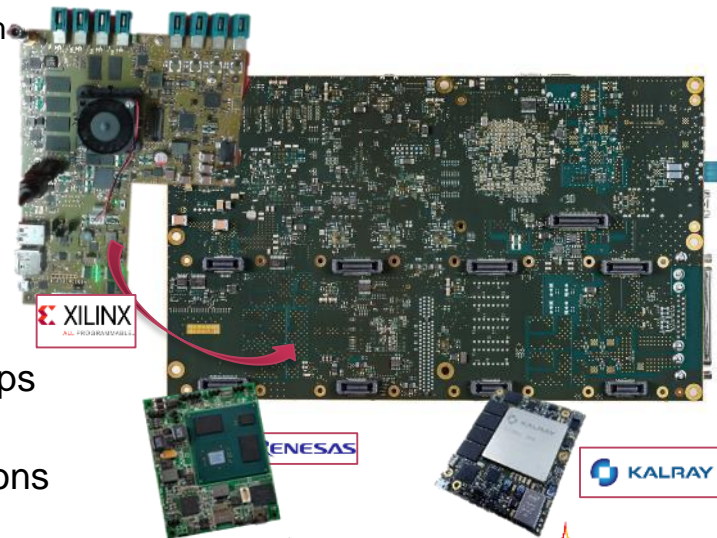


Modular architecture
to scale with
applications needs

High Performance Ethernet
Backbone

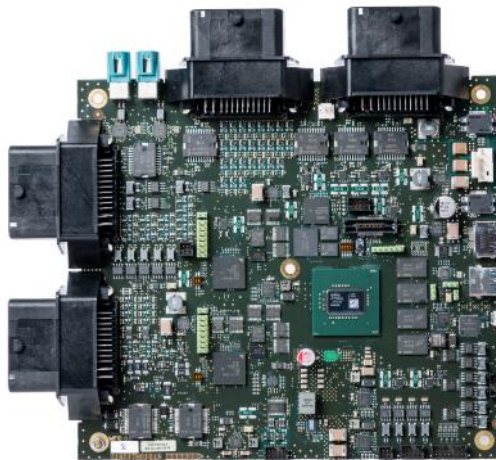
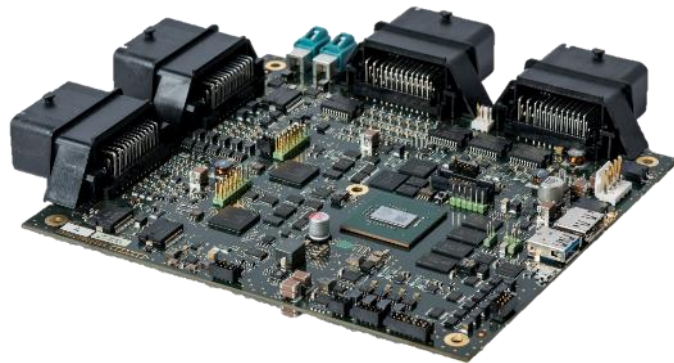
PCU IP ARCHITECTURE

- Modular PCU prototype
 - Motherboard running legacy applications common to all vehicles
 - Up to 4 daughter boards to insure its scalability and its upgradability
 - Initial portfolio includes
 - Renesas RCAR-M3, Kalray Bostan
 - Specific daughterboard for high-speed camera links management, with Xilinx UltraScale+ for low latency data fusion
- Multi-SoC platform integrating high end computing solutions
 - Renesas RCAR-H3 for high performance computing
 - RH850 for Real-time and safety critical processing
 - PCIe based High-speed internal communication network (32Gbps per link)
 - UltraScale+ for Low-latency synchronizations and communications



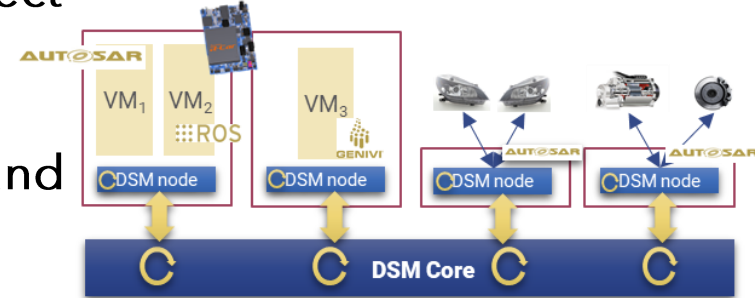
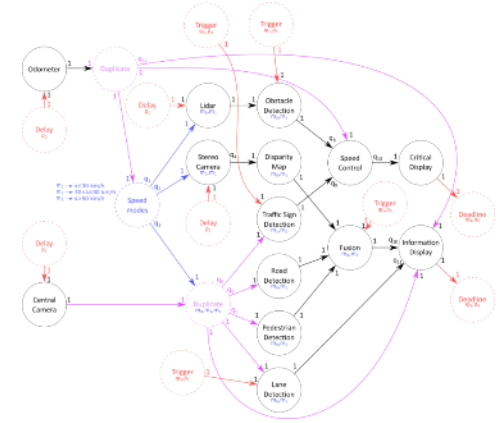
PIU ARCHITECTURE

- Multi-protocol gateway prototype
 - Low-latency multi-protocols translation services running on FPGA for high speed Ethernet (de-)packetization
 - ~180 I/Os pins available, including automotive standard protocols (CAN, LIN, PWM/I/O, etc.)
- Real-time RH850 micro-controller
 - Functional safety & embedded security features
- Ethernet TSN backbone
 - Enabling fast & deterministic communications for packetized data delivered to the PCU



SW ARCHITECTURE AND MOCC

- System level design relies on a communication and computing model enabling multi-source Real Time SW assembly
 - Combining RT and high performance constraints
 - Foundation of conformity and application deployment tools
- Taking benefits from runtime support to detect abnormal behaviors
- SW Architecture leveraging on hypervision and heterogeneous runtime environments
 - Autosar Classic, Adaptive, automotive grade linux



FACE TOOLSUITE

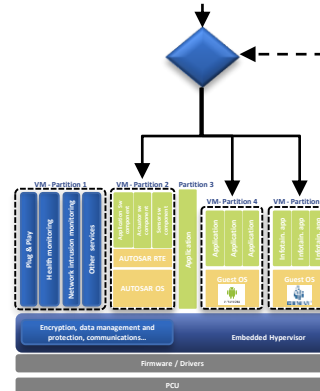


Conformity Management

Platform Model
Integration tests
Quality Checker
SW Characterization

Configuration

Scheduling
Runtime SW configuration

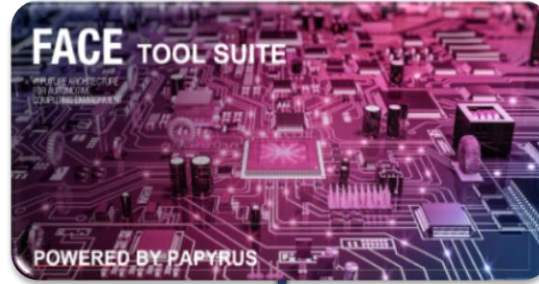


FACE TOOL SUITE

FUTURE ARCHITECTURE
FOR AUTOMOTIVE
COMPUTING ENVIRONMENT

POWERED BY PAPYRUS

3 CONCERNS FOR A SINGLE TOOL



Tools for functional-
level application
specification and design

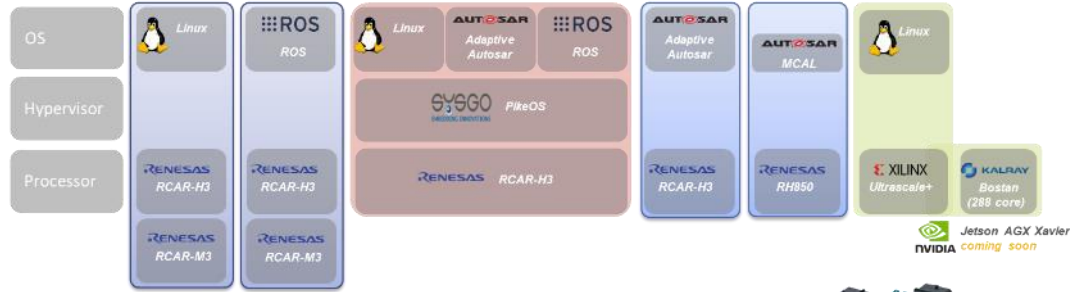
Tools for applications
deployment and
platform configuration

Tools for checking
conformity of
applications
implementation to the
specification

WHERE WE STAND



Available configurations



Supported Communication

IEEE 802 Ethernet TSN (IEEE 802.1 AS - Qbv - Qav)
PCI EXPRESS PCIe (Gen3) – 32 Gbps per link



- HW and eSW platforms are fully operationnal and available in different configurations
 - 4 kind of CPU, 3 OS

- Tools and integration framework demonstrated in CES'19
 - Management of a configurable and adptable Advanced braking system



CONCLUSIONS AND PERSPECTIVES

- The whole automotive industry is moving toward centralized computing solutions
- The real game changer will be the ability to open the data and the computing platform
- With a joint HW/SW and tools approach we show that we can leverage the full value of centralization
- After 3 intensive years of joint Renault-CEA R&D it's time to accelerate opening securely the electronics of the mobility industry

COMING SOON



alkalee

Thank You

