OPAL-RT TECHNOLOGIES

RTI7 INNOVATE BEYOND

Intelligent cars

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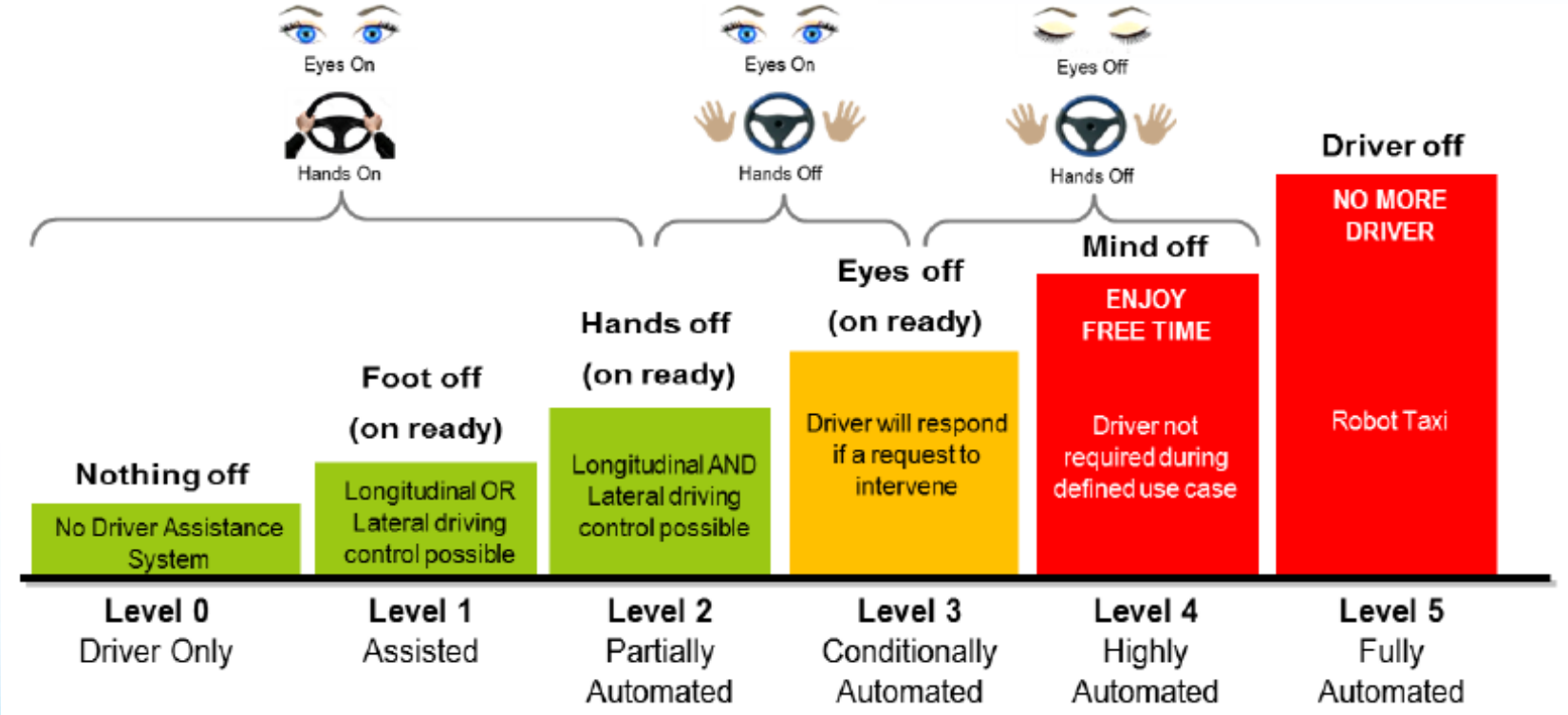
Different levels of autonomous driving



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Increase of the complexity of the vehicle

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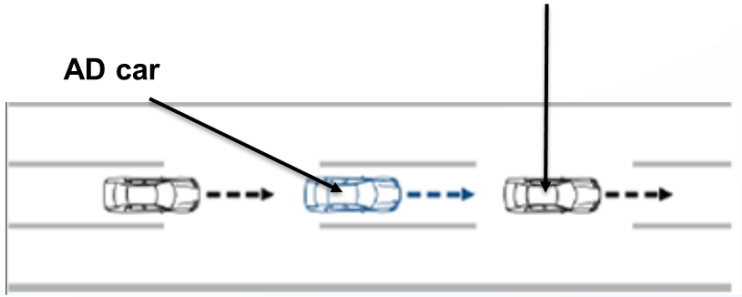
High complexity of the open road cases

AD car maintains the safety distance with preceding veh

Preceding vehicle :
Variations of :
- Speed, acceleration
- Type



Ground :
Variation of
- the number of lanes
- the width, the curve, the tilt of the lane
- the lane marking
- the weather conditions, the luminosity

Car :
- the wear of the car, tires…
- System dysfunctions…

Today, for AD level 4, car makers are converging to a validation plan between 15 to 20 billions of kilometers

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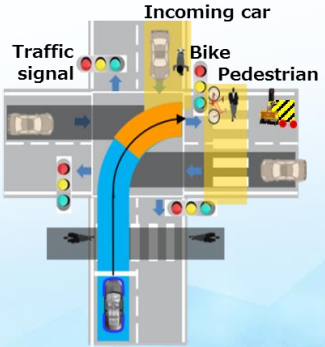
Stake and performance

Technical pre-requisites

ADAS robustness, AD level 3 and 4 validation need to take into account the complexity of open road cases

- Road conditions & variation
- Objects & obstacles (pedestrians, trafic, …)
- Weather conditions

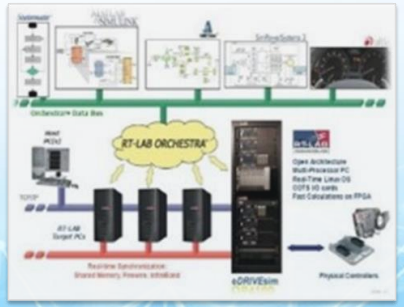
Open road validation is not sustainable in the long term to validate millions of scenarios



What's at stake

Targets to be achieved :

- Improve efficiency of AD/ADAS evaluations by nesting open road testing with simulations
- Improve quality of ADAS & AD performance by CAE parameter variation studies
- Set-up massive simulation infrastructure in order to cover a maximum range of parameters



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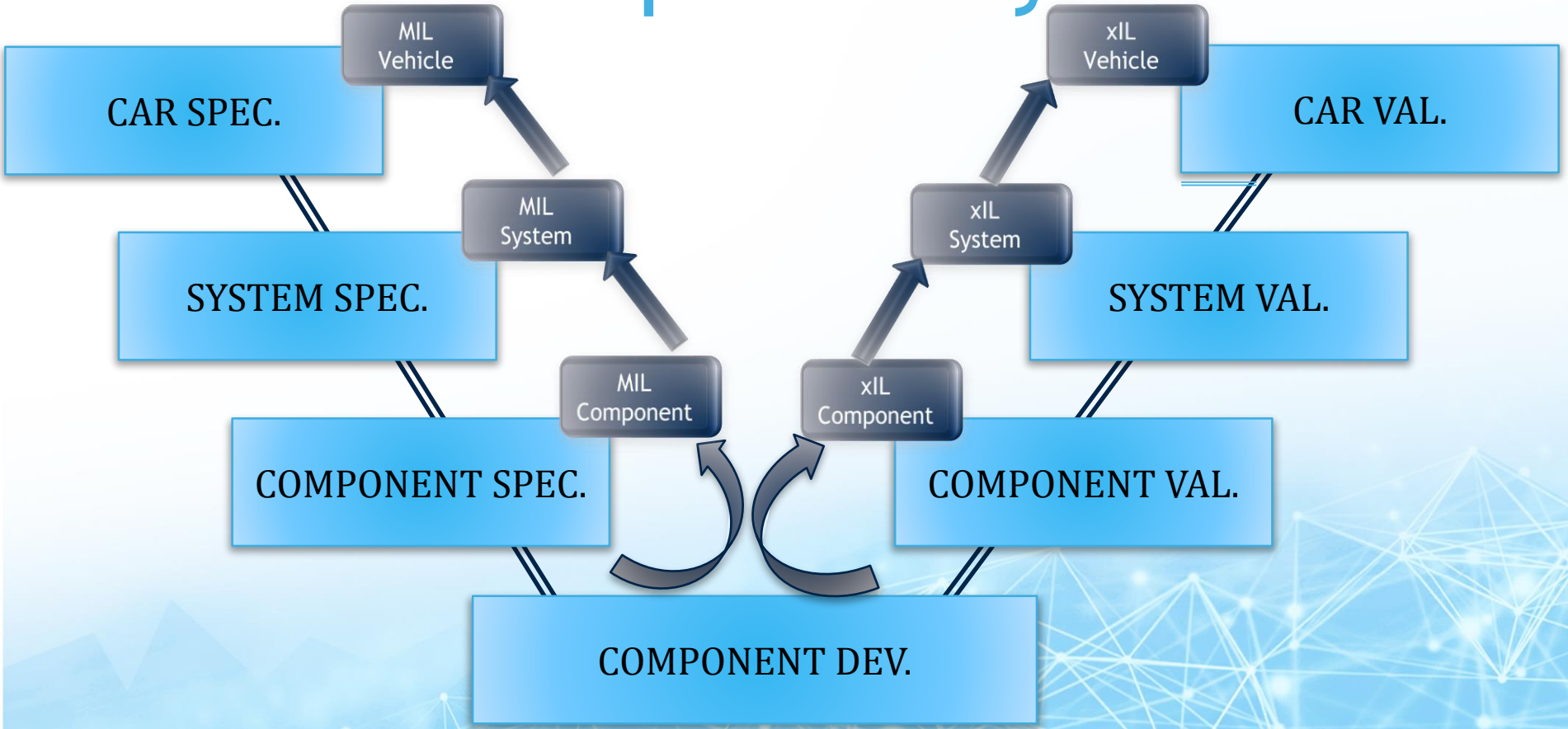
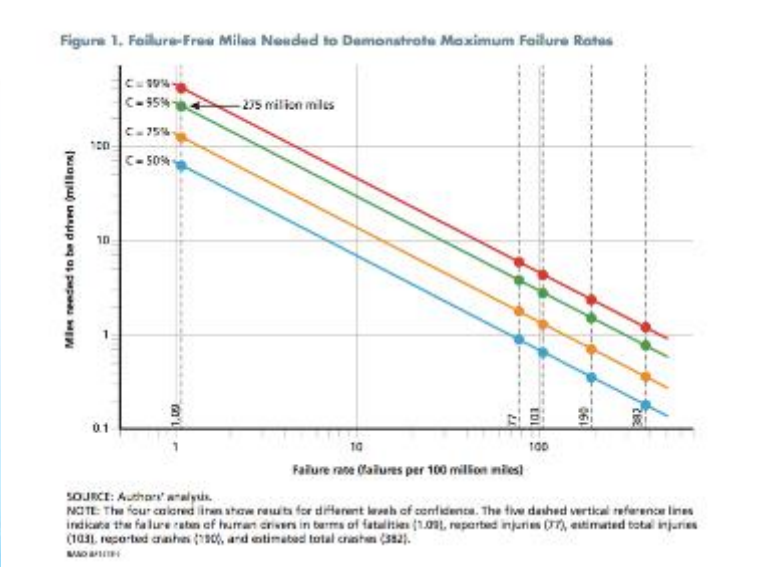
New development cycle



The safety level

- Safe with the same level than a “classic car” :
  - 1.09 fatalities per 100 million miles
  - 275 million miles without failure



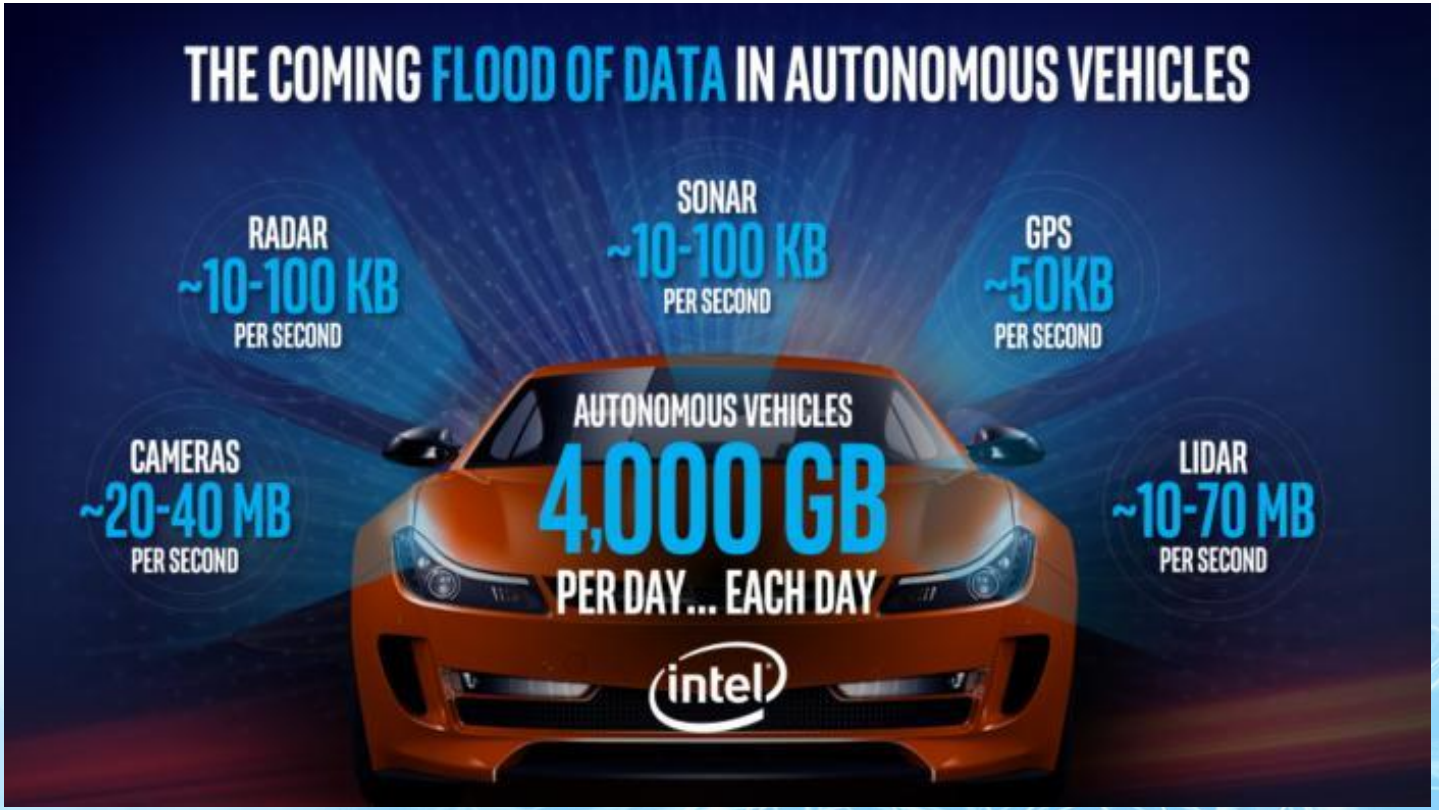
How to validate?

- 8.8 Trillion of miles to test a level 5 !
- With real cars :
  - 100 autonomous cars
  - Driving 24 hours per day
  - Driving 365 days per year
  - 25 miles per hours

400 years

88 Trillion $

High data volume



Resume of the challenges

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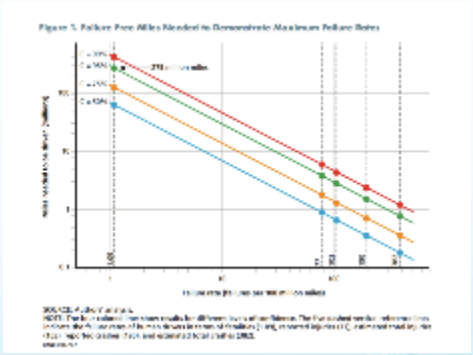
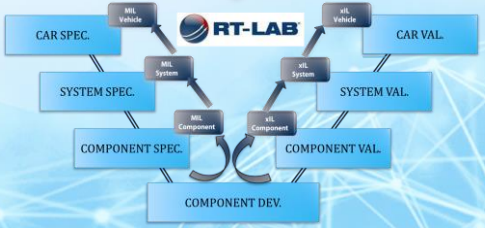
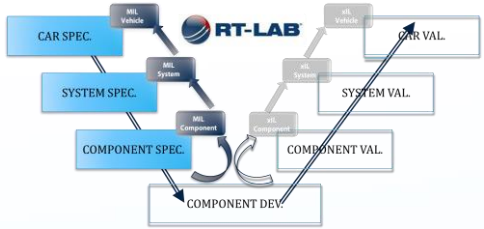
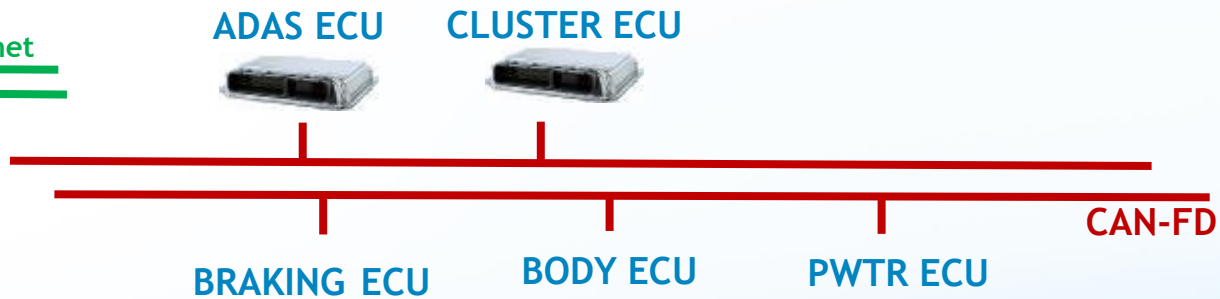
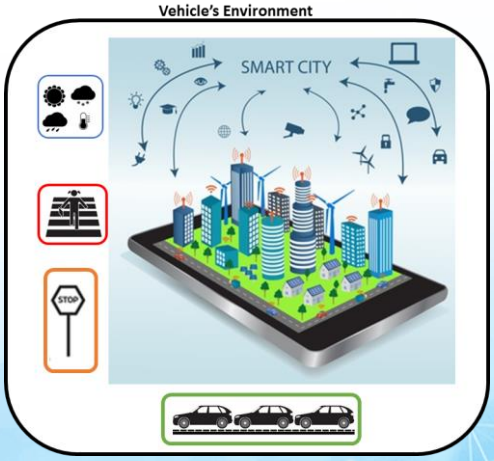




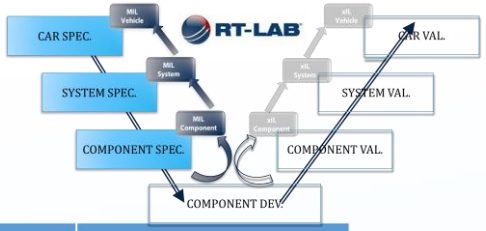
ADAS system example





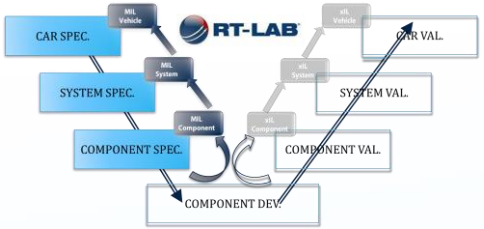


Multi-software



MATLAB SIMULINK	vector	CarMaker	EXE	carSIM MECHANICAL SIMULATION	GT
ADAS ECU 	Ethernet		FL-Radar 		
BODY ECU 	CAN-FD		FR-Radar 		
CLUSTER ECU 			FR-Radar 		
BRAKING ECU 			FL-Radar 		
CLUSTER ECU 			Camera 		
PWTR ECU 					

RT-LAB on Windows



RT-LAB

RT-LAB on Windows

RT-LAB

Pro-SiVIC

carSIM MECHANICAL SIMULA

SCALABLE NETWORK TECHNOLOGI

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OKTAL >> SIMULATION IN MOTI

vector

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MATLAB SIMULINK

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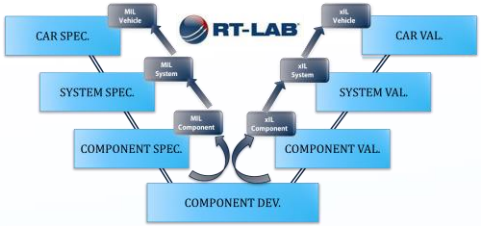
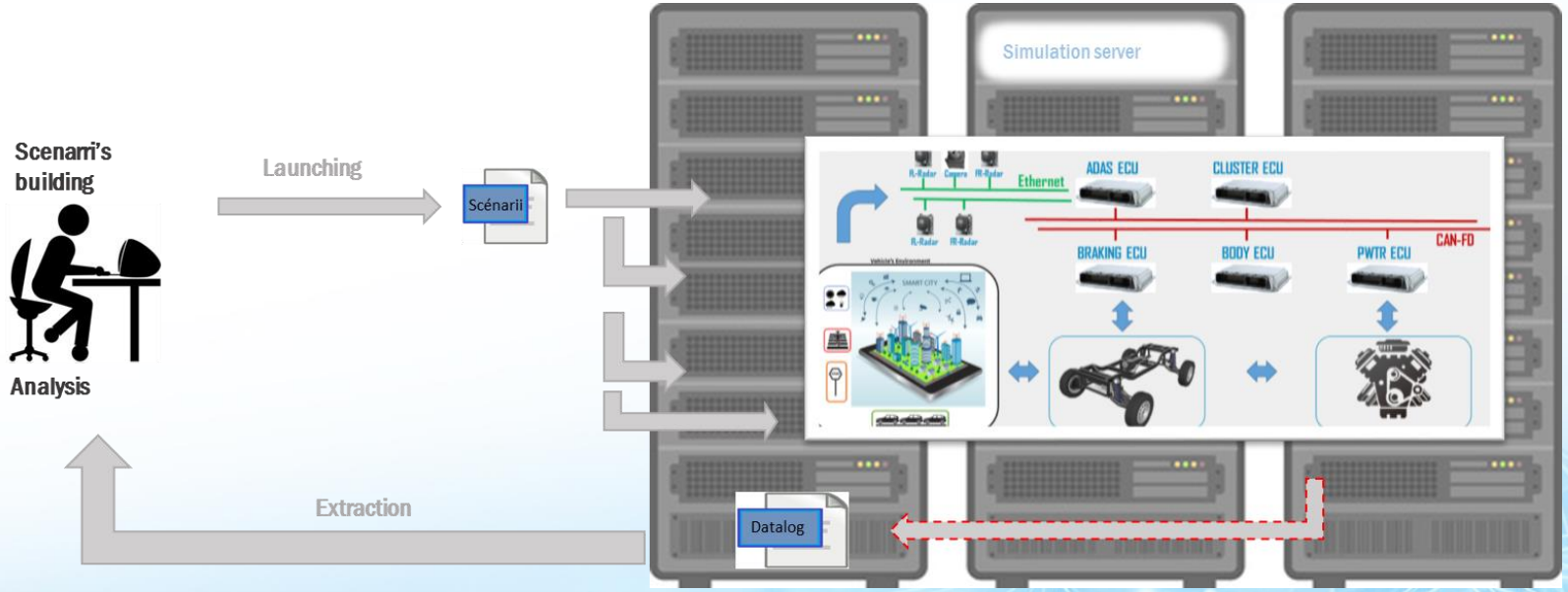
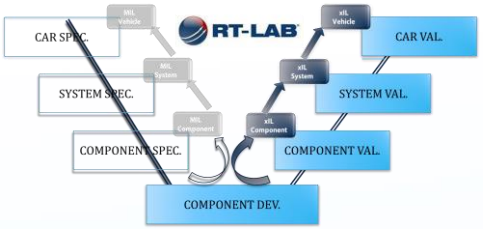
TestStand

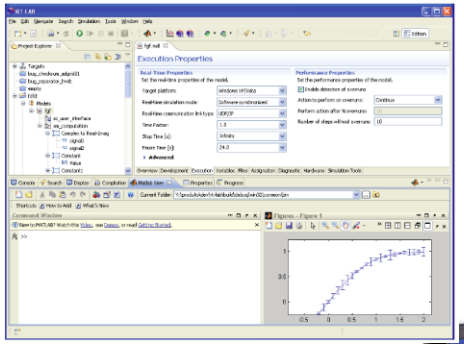
RT-LAB on HPC


RT-LAB
CAR SPEC.
CAR VAL.
SYSTEM SPEC.
SYSTEM VAL.
COMPONENT SPEC.
COMPONENT VAL.
COMPONENT DEV.


Scenarii's building
Launching
Scénarii
Simulation server
Ethernet
ADAS ECU
CLUSTER ECU
CAN-FD
BRAKING ECU
BODY ECU
PWTR ECU
Analysis
Extraction
Datalog

RT-LAB in Real-Time





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Battery Management System (BMS)

Alexandre Leboeuf

September 7th, 2017

What Is a BMS

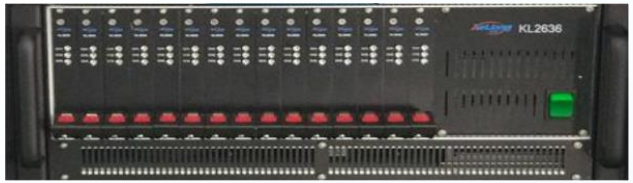
- Electronic device that manage rechargeable battery, either a single cell or a battery pack.

- Functions of a BMS :
  - Total and individual cells voltage monitoring
  - Temperature monitoring
  - State of Charge (SOC) of the battery
  - State of Health (SOH) of the battery
  - Current flow management
  - Cell balance
  - Chassis isolation monitoring

Battery Simulator Technology

BLOOMY

KeLiang 科梁



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Upcoming

- Automotive industry is currently renewing itself toward electrification. The technology of BMS will only grow in the upcoming years.
- Battery manufacturer is aiming to increase the battery performance that will lead to more and more complex BMS system.
- Super capacitor research continues and controller will be needed.
- Increase of renewable energy will command an increase of energy storage which will require more efficient BMS.
- Gasoline engines ban in many countries bring the electrification to a whole new level.

THANK YOU

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