DriveCore™

Visteon´s Autonomous Driving Platform

Visteon

Visteon At A Glance

Visteon

Leading supplier of cockpit electronics and autonomous driving systems to carmakers across the world

$3.15B annual sales

10,000 employees

18 countries

20 manufacturing locations

18 technical centers

Leading the transition of the cockpit to a smart, learning, digital assistant

The Transformation of Visteon

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2012 Sum of Parts

- Exited non-core business to focus on cockpit electronics

2015 Cockpit Electronics Pure Play

- Acquired JCI auto electronics
- Streamlined cockpit electronics products and technologies

2018 Smart Digital Mobile Assistant

- Launched cockpit domain controller
- Introduced autonomous driving controller

Industry-Leading Cockpit Electronics Product Portfolio

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Visteon Market Position

Top 5	Connected car Tier 1 supplier
#1 Rank	Digital clusters
#2 Rank	Center stack displays

Source: Rankings from 2016 ABI Research and IHS Markit.

Rapidly growing in infotainment and domain controller solutions

Visteon Technology Portfolio

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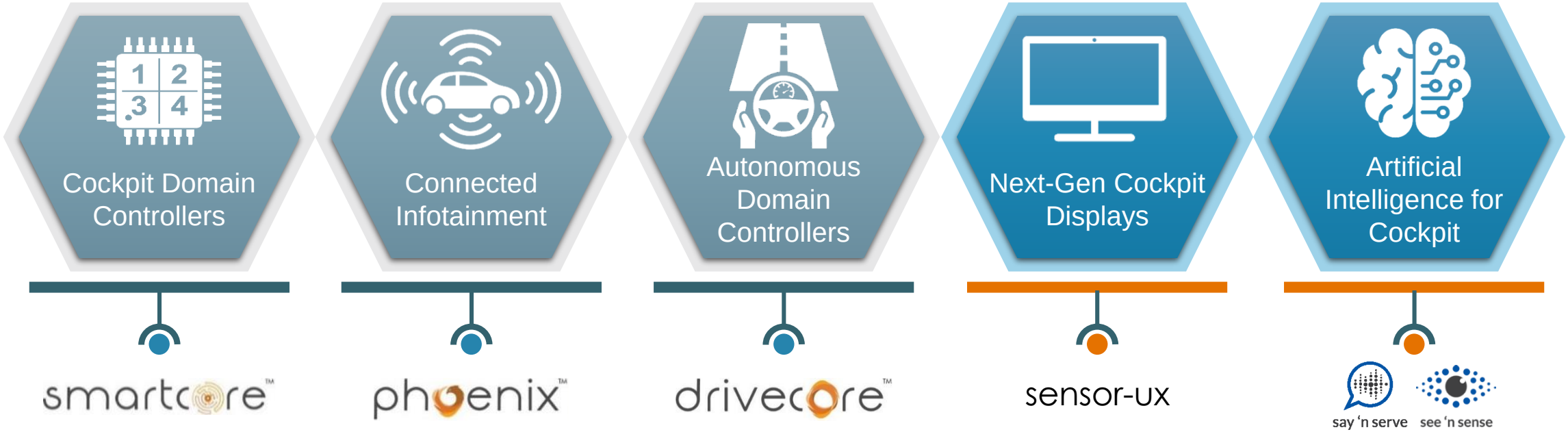


Leading cockpit domain controller solution in industry with two launches in 2018

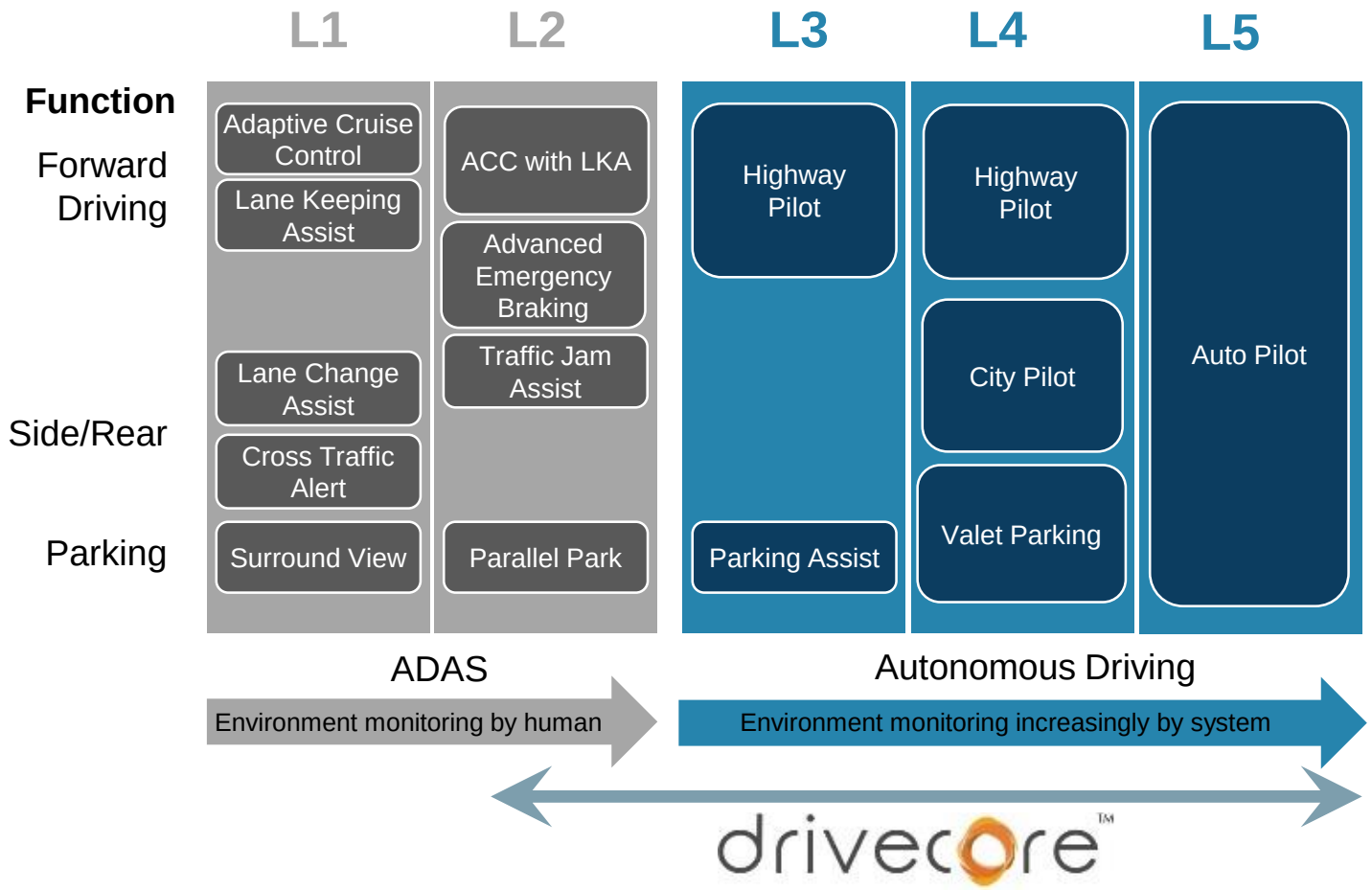
Innovative HTML5 and Android connected infotainment solution

Scalable open autonomous driving solution for Level 2-5 systems

Advanced curved displays with integrated sensor technology

Automotive voice smart assistant and driver monitoring based on Artificial Intelligence

ADAS to Autonomous Driving Roadmap



System Requirements

System performs Environmental monitoring

Radar, Camera & LIDAR sensors

Late fusion of sensor data

Scalable centralized computing

Machine learning algorithms

Autonomous driving technology requires centralized processing of sensor data

Visteon's DriveCore™

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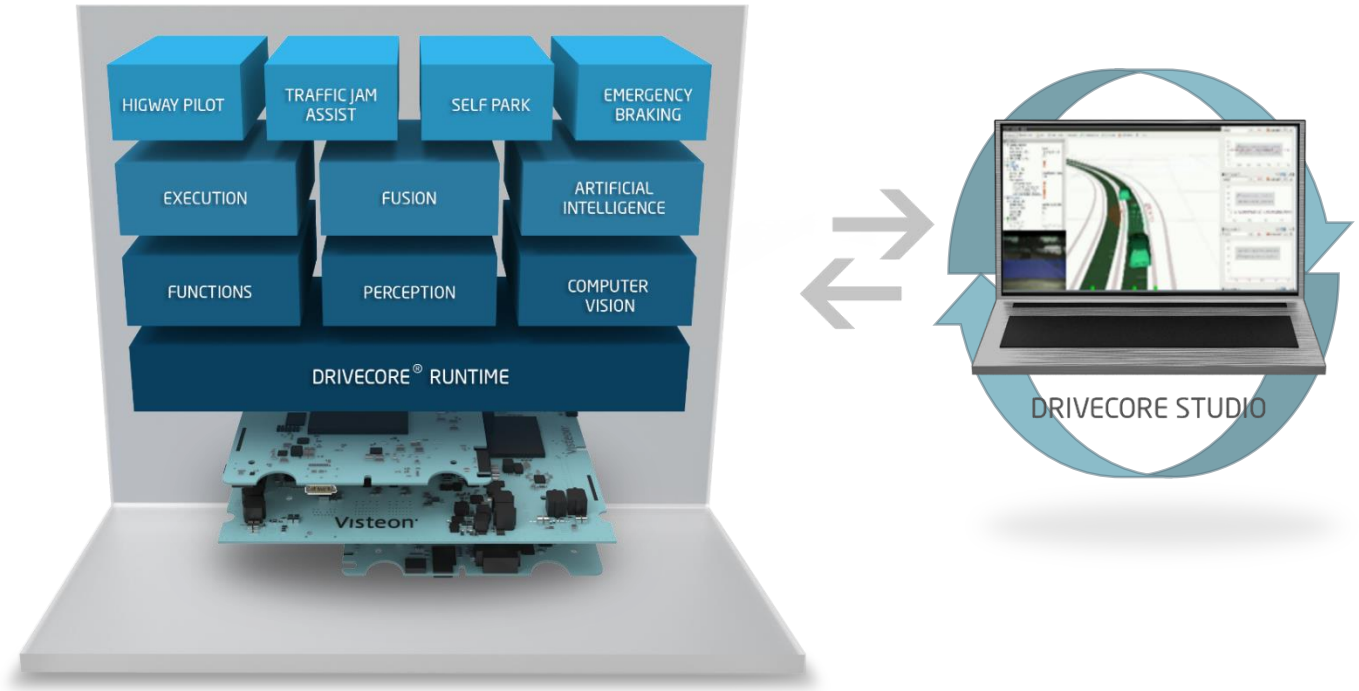
Visteon's Autonomous Driving Platform

- DriveCore™ Compute: Modular and Scalable Design with SoC Flexibility
- DriveCore™ Runtime: Safe Communication and Easy Integration in Vehicle
- DriveCore™ Studio: OPEN for Common end to end Development

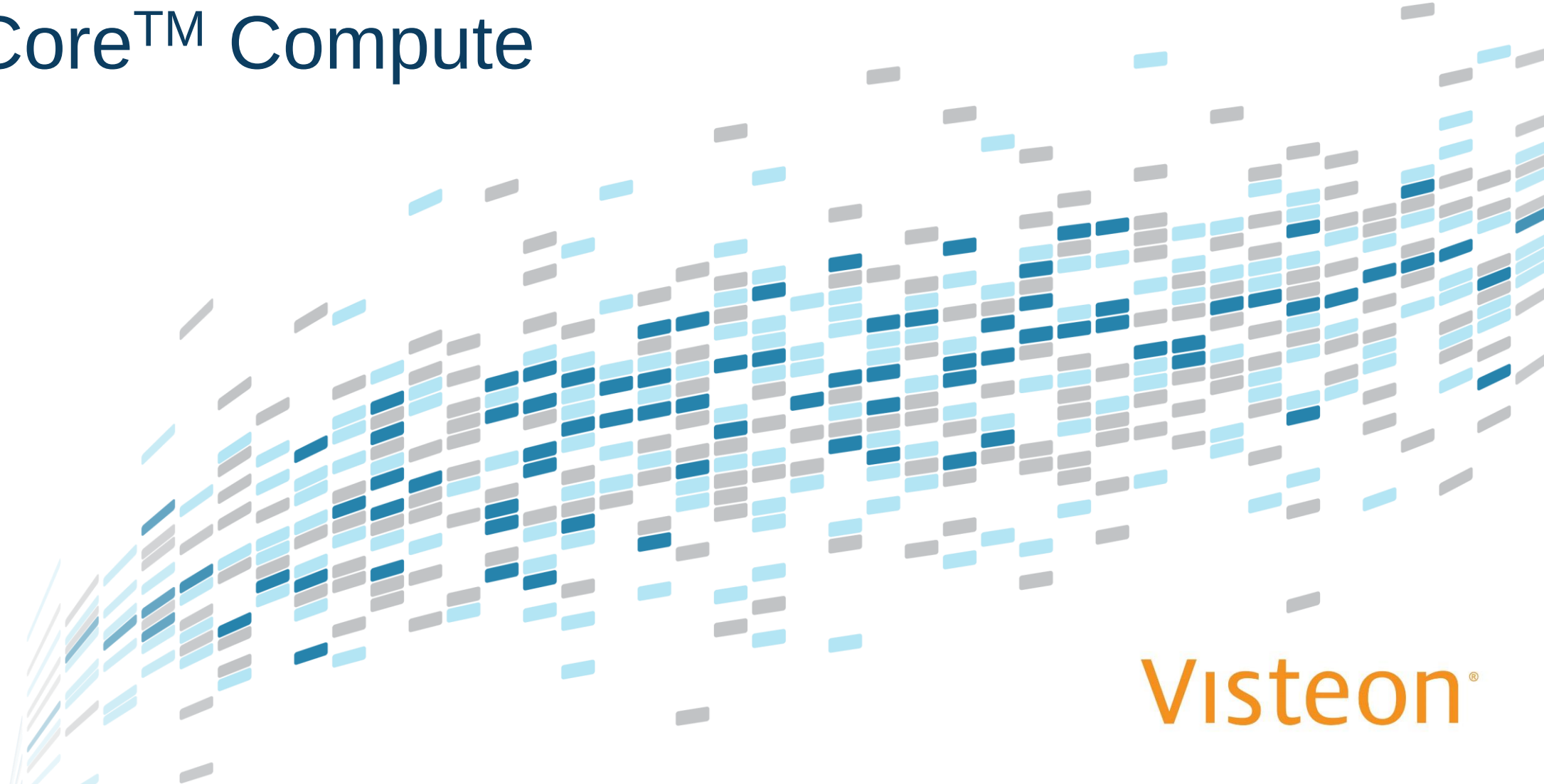


DRIVECORE COMPUTE

drivecore™

Compute | Runtime | Studio

DriveCore™ Compute



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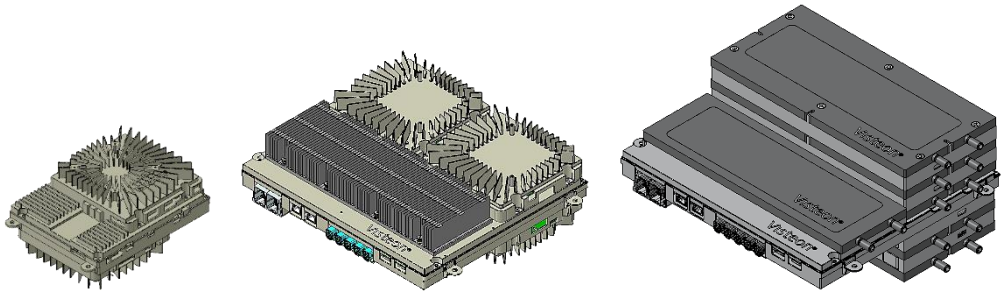
DriveCore™ Compute — Scalable Concept

DriveCore™ Scalable Computing Unit

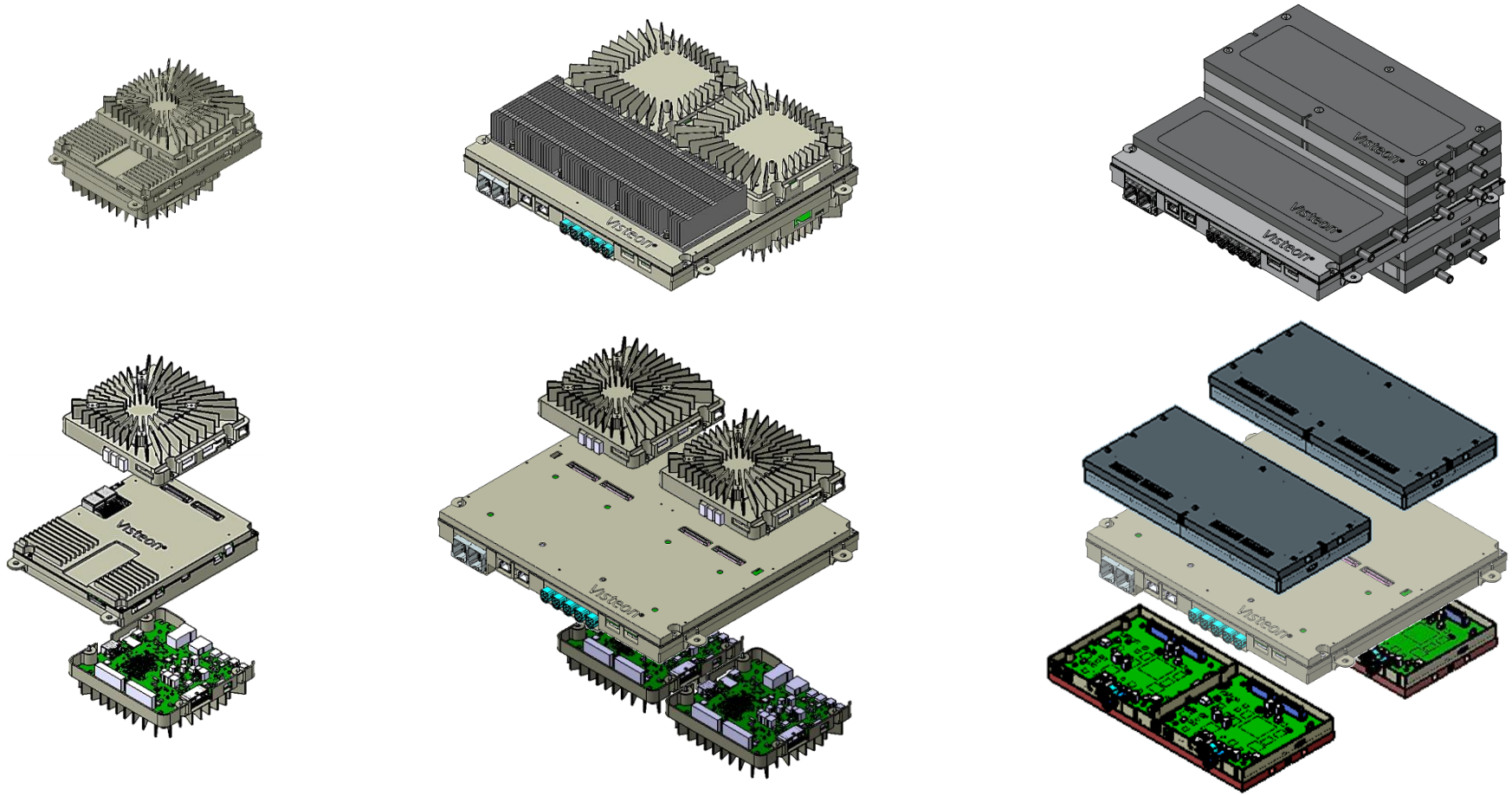


Up to Level 3 | Level 3 and 4 | Level 4 and 5

Key Architectural Differentiators

- Modular design with full HW scalability on system level
- Scalable by using different SoC/VIP from same family
- Scalable in every direction: performance, safety, ability...
- Flexible standardized mechanical designs for car thermal environment
- Highly dynamical workload and data sharing concept
- Ultra low latency (µs level) for communication among SoCs and VIP(s)
- Failsafe (L2-L3), fault tolerant (L4-L5), ASIL compliant
- Straightforward productized adaptation for cost-down in serial production

DriveCore™ — Scalable Concept for Flexible Development



Fail safe and fault tolerant Base Boards: Power supply redundancy, CAN redundancy, Central PCIe
Computing and safety carriers: Daughter boards with integration of different SoCs vendors

DriveCore™ — Productized Adaptation

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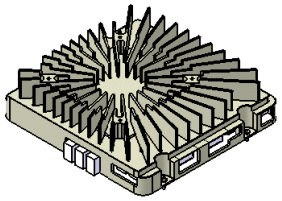
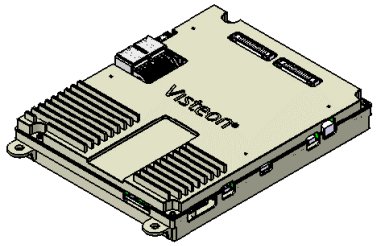
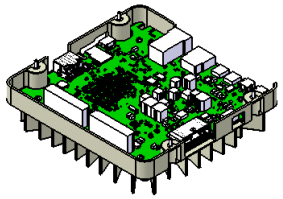
Modular computing carrier #1



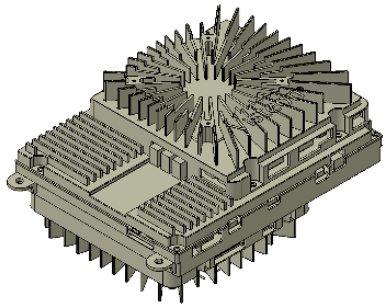
Base board with customer specific form factor



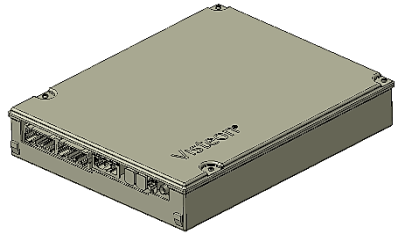
Modular computing carrier #2

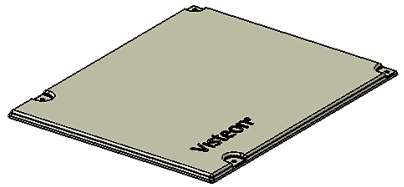


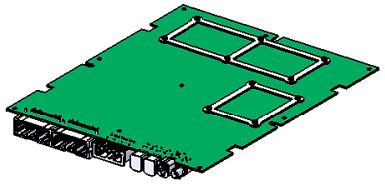
A-Sample Unit

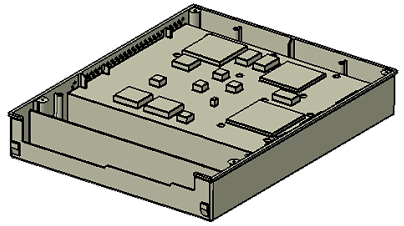


B-Sample Unit







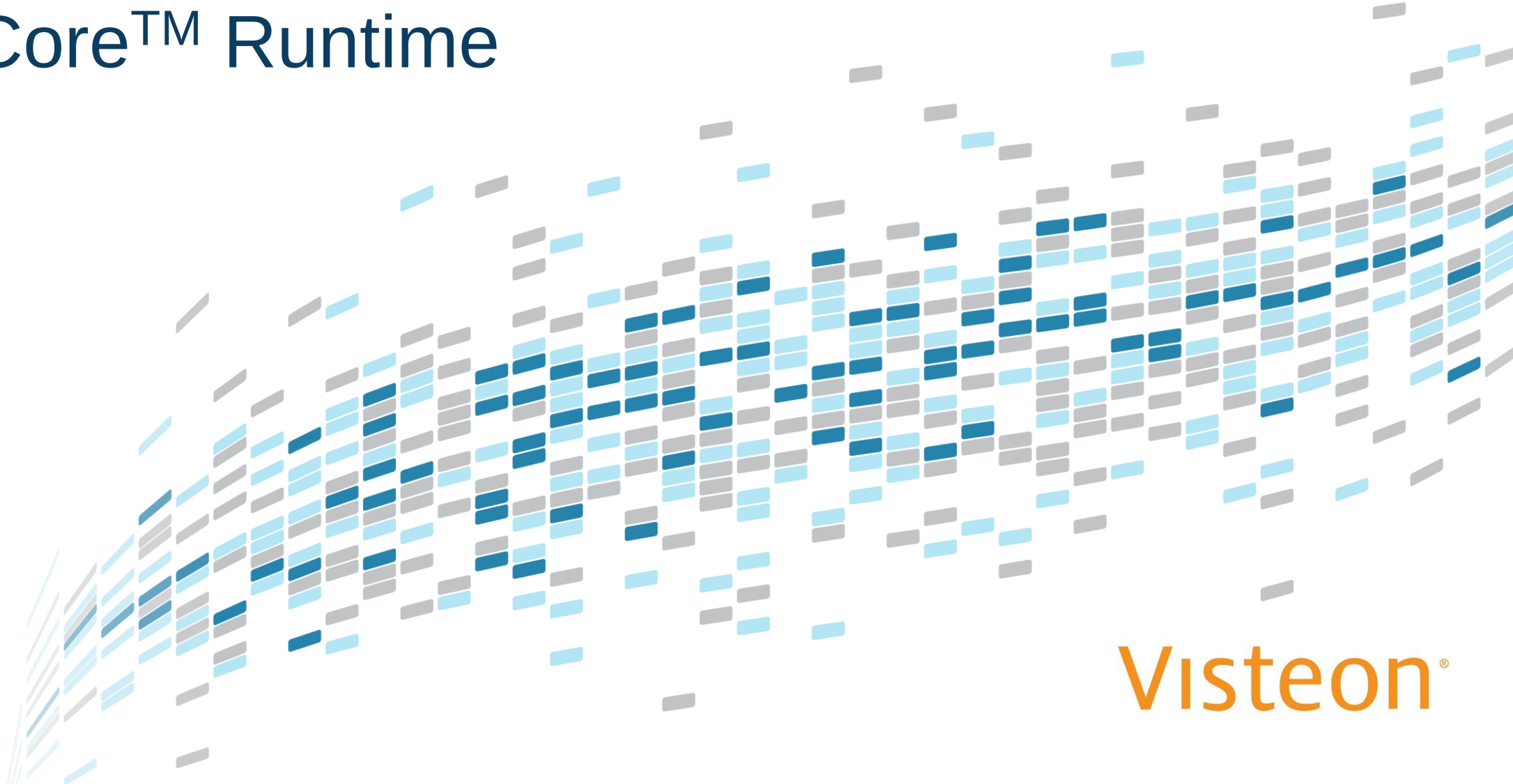


Flexible development combined with straightforward productized adaptation

DriveCore™ Compute – SoCs partners

- DriveCore™ Compute enables flexibility in SoC selection and cohabitation
- Facilitate up-integration, SoC evaluation and performance comparison
- SoC selection based on Customer and Projects needs
- Visteon SoC partners:

DriveCore™ Runtime



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DriveCore™ Runtime – Overview

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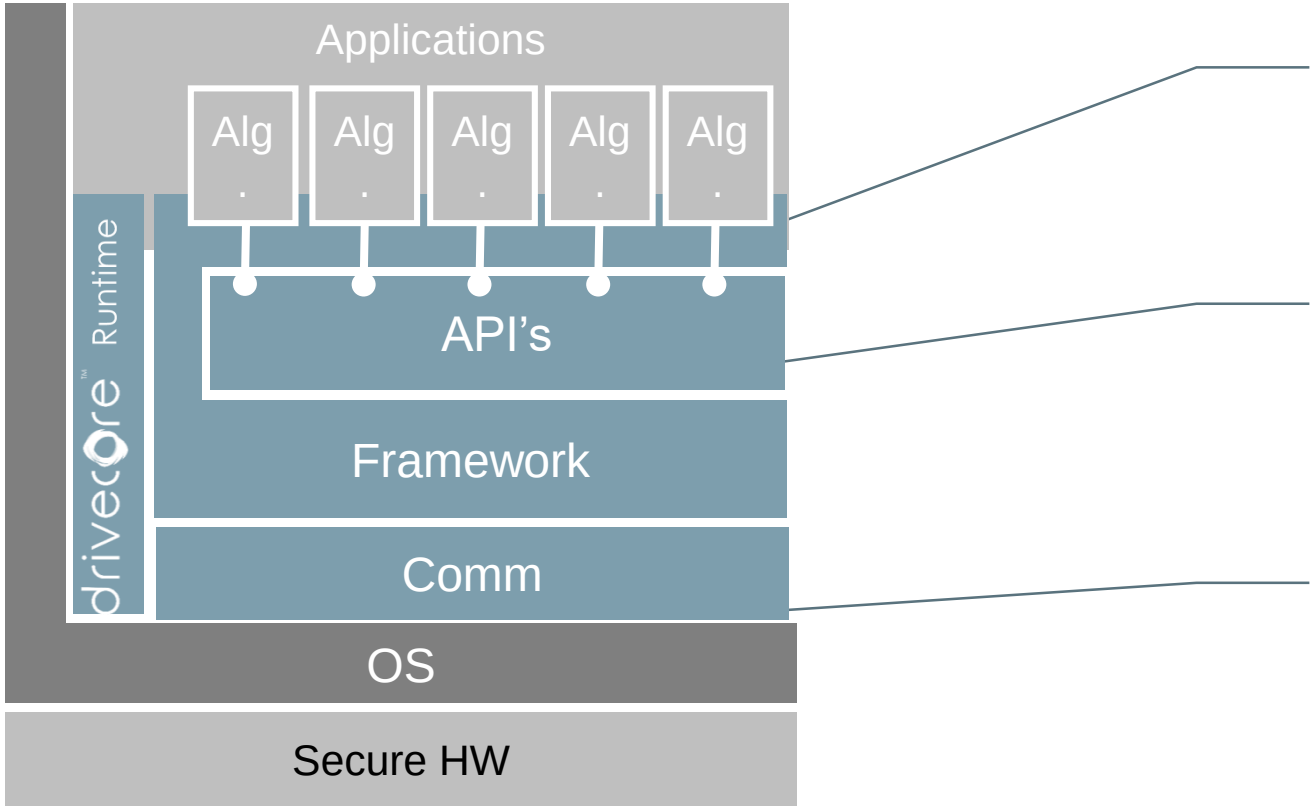


Framework:
- Sandboxing Algorithms
- Environment Model
- Sensor Agnostic

OPEN APIs:
- Interfaces to sensor data, localization, vehicle data
- Common API - compatible with ROS2
- C, C++ & Python

Communication Layer:
- Real Time Pub Sub (RTPS) based protocol
- Multitude of transport interfaces - Network, IPC, Shared Memory
- Optimized for central processing
- Cyber secured

Optimized with IPC based transport and zero copy interfaces

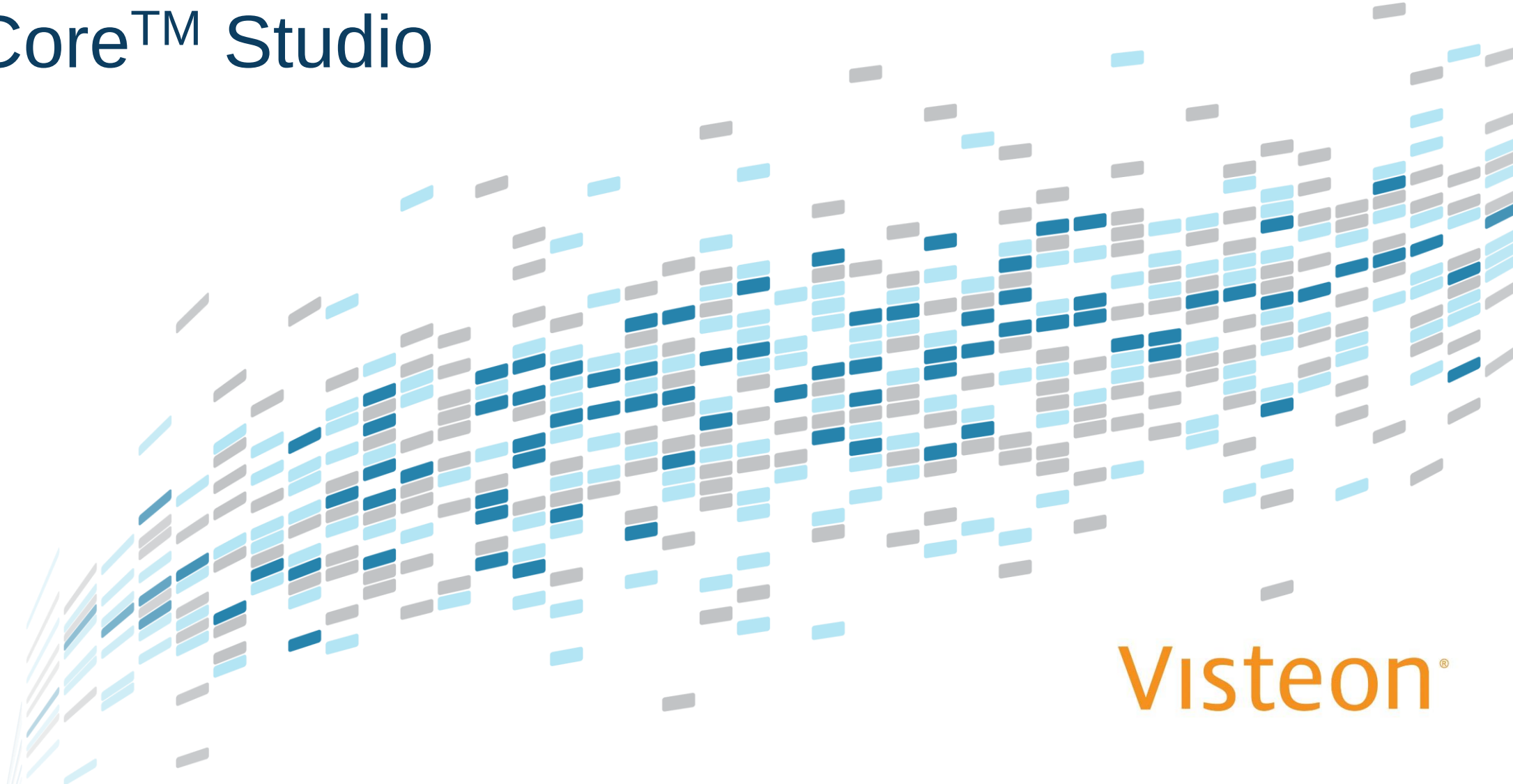
Enhanced for multi-core multi-processor architectures

Maximize performance by leveraging native accelerators

Time synchronized execution pipeline

Secure communication & sensor network

DriveCore™ Studio



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DriveCore™ Studio: Supporting the full Development Process

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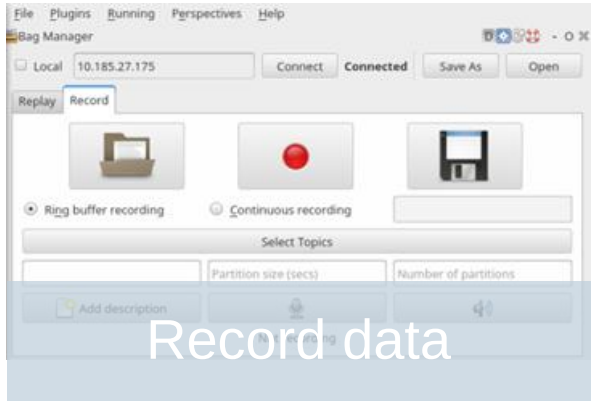

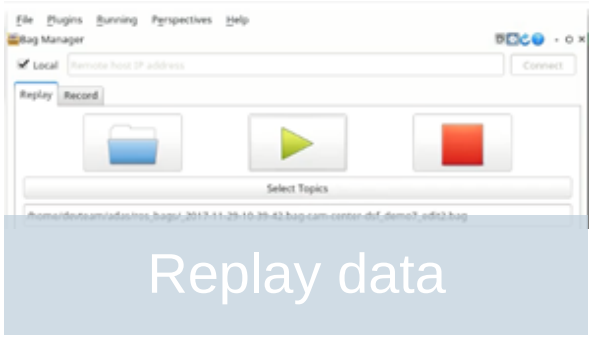

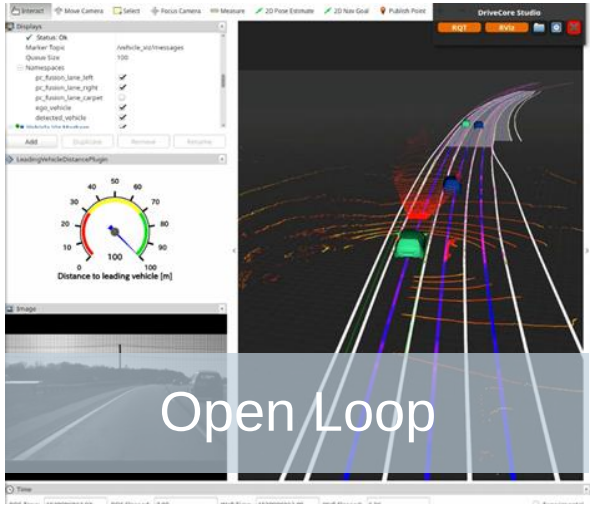

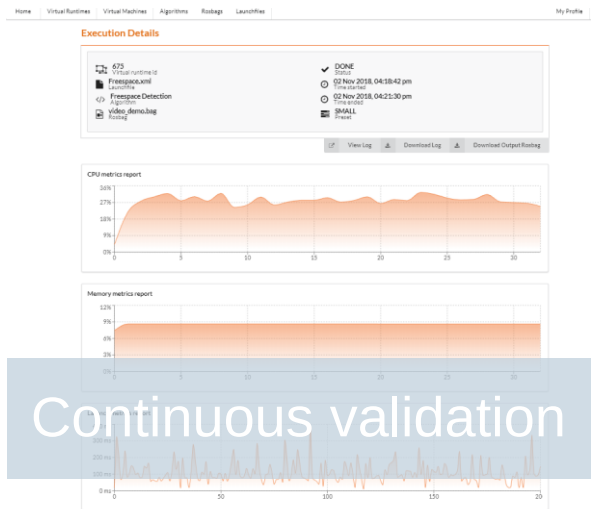

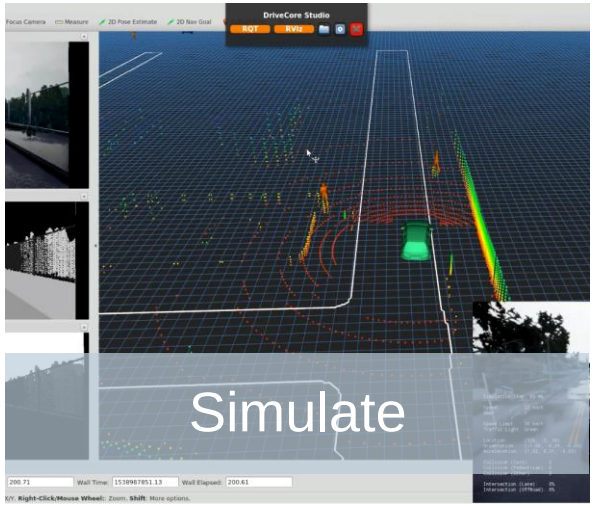

End-to-End Data Processing and Development

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Perspective(s)

Online Help

Middleware abstration

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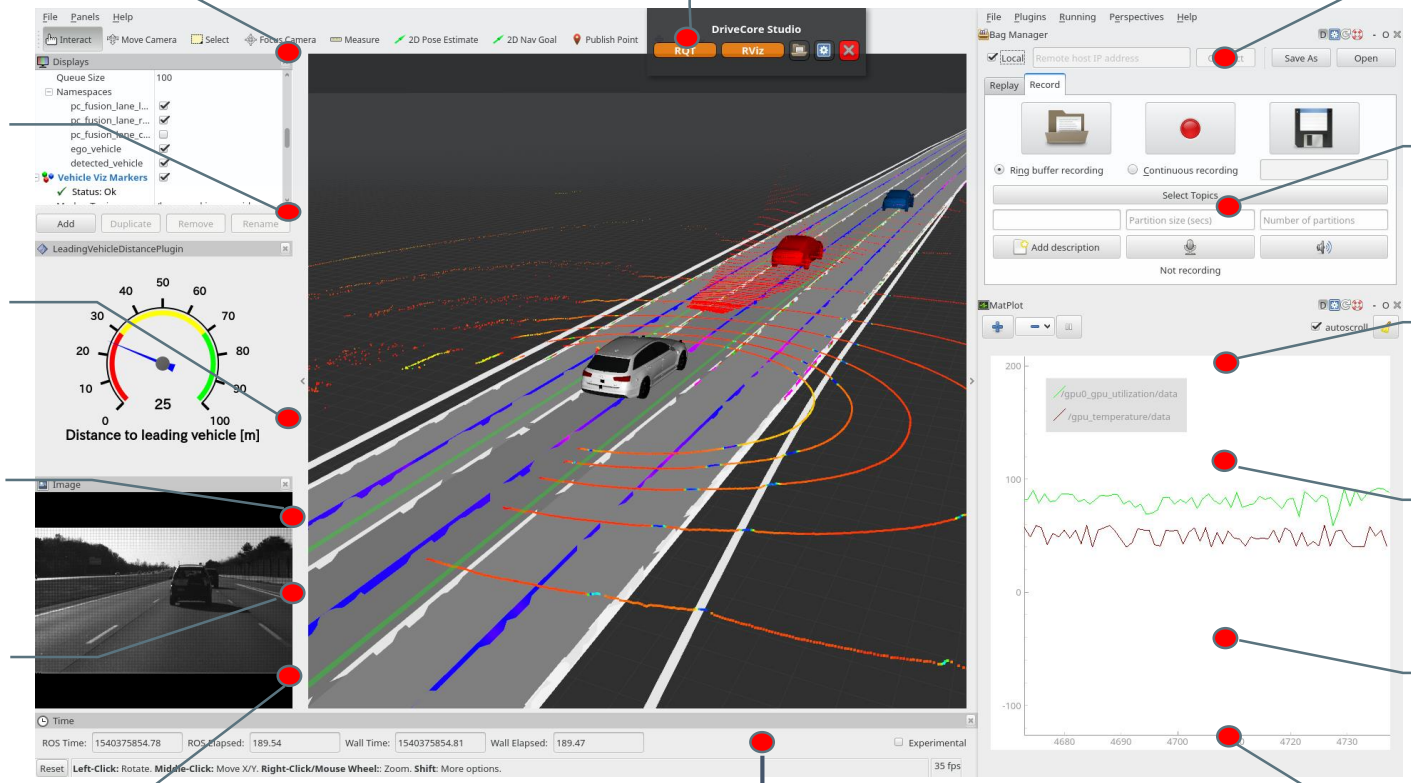
Runtime config.

Sensor Data management
Download/Upload

Simulated sensor data
Carla

Algorithm Profiling



Configure visualizations
Plots, Logs, Rviz.

Log perf. data
Record & play

Analyze logged perf. data

Compare alg. perf. & accuracy

Real-time data profiling

Real-time alg. profiling
CPU, MEM, Latency, Accuracy…

Enables fast and distributed development of AV algorithms

DriveCore™ Studio Cloud provides online access to the DriveCore Studio functions from a public cloud environment

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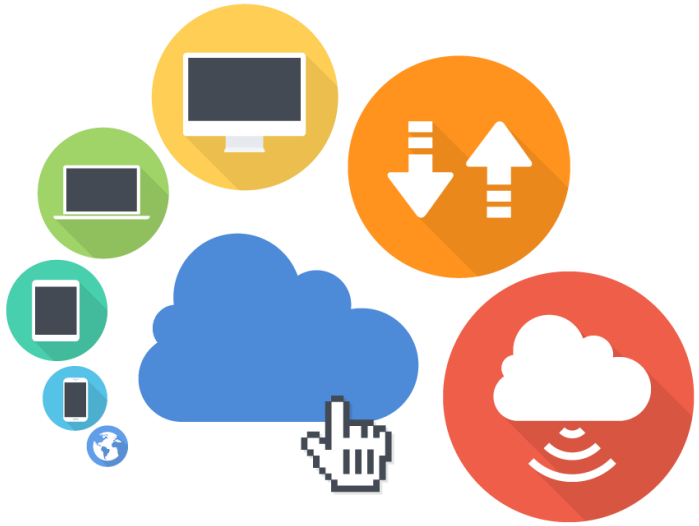
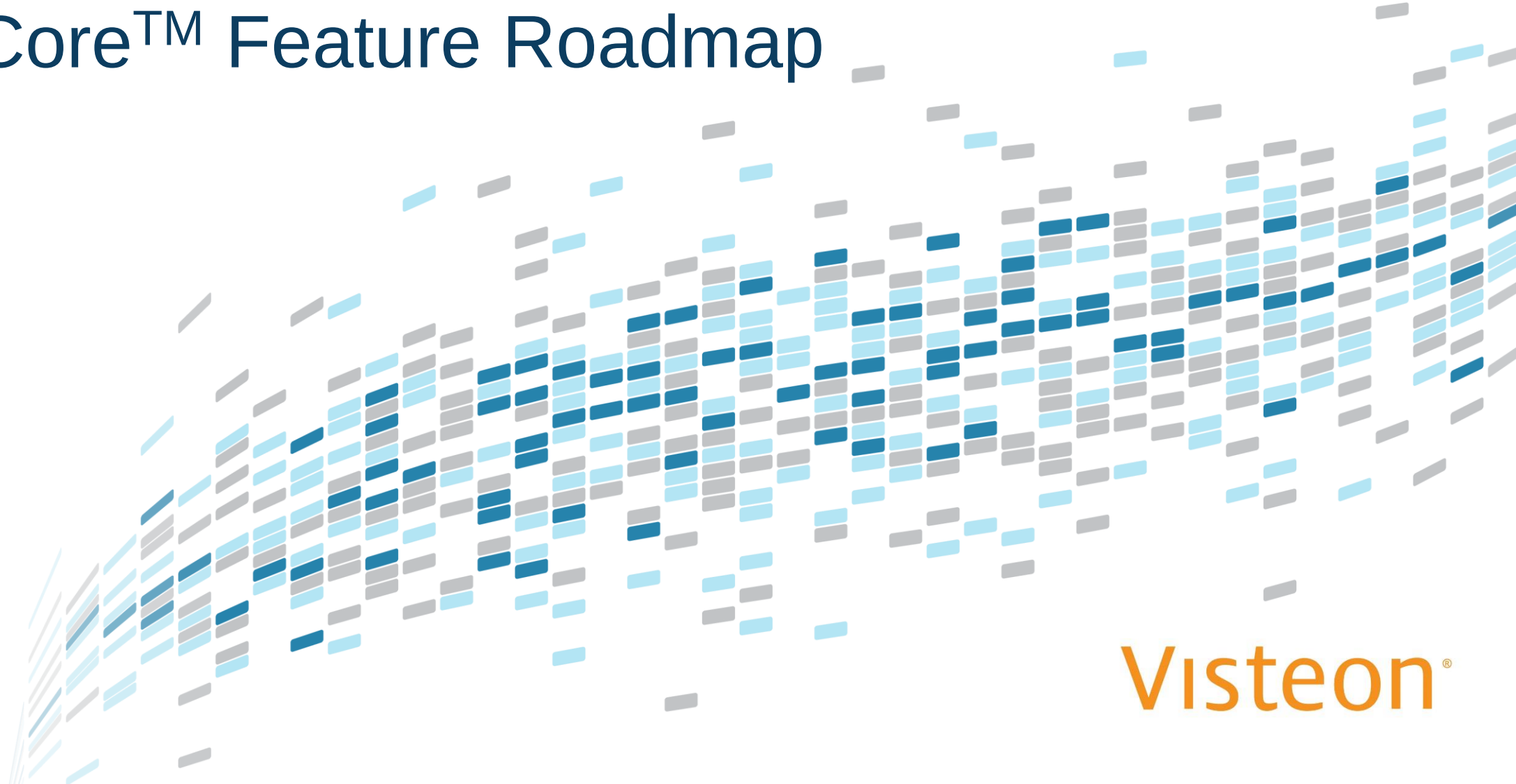


- Web based portal
- Provides REST API for pushing DriveCore Studio artefacts to the cloud
- Public (Microsoft Azure, Amazon AWS) and Private (OEM) cloud support
- Activity and cost analysis dashboard for cost transparency for the usage of resources

- Automation of developer's current workflow in the cloud
- Automating the Quality Assurance process for Algorithms validation and regression testing
- Analytics on executions to benchmark algorithm performance and results
- Performance metrics – CPU, Memory, GPU, Latency, Accuracy
- Record the virtual execution in an Output Rosbag

- Engineering Workstation integration
- Cloud repository for Launch files, Rosbags and Algorithms
- Validation of the uploaded content
- Hardware in line for real world testing
- User access management

DriveCore™ Feature Roadmap



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ADAS Platform // Feature Roadmap

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	Q1 2019	Q2 2019	Q3 2019	Q4 2019	Q1 2020	Q2 2020	Q3 2020	Q4 2020
 Comfort	ACC + LCC	Intelligent Speed Control	Stop & Go in Traffic Jams					
		Driver Initiated Lane Change	Automate Lane Change	Highway Pilot	Field Test Feedback	Construction Zone Assist	Merging on Highways	
			Driver Monitoring	Safe Stop	Take Over Management	Validation	Maturing	Field Test Feedback
 Safety	Warning Functionality FCW, LDW, Cross Traffic Assist		Proving Ground Testing	Field Test Feedback				
			Active Steering (LKA)	Active Braking (AEB)	Functional Safety Validation		LKA for Road Surface	Oncoming Traffic
				Evasive Steering Assist (ESA) for Pedestrian Detection		Interaction AEB and ESA	ESA for High-Speed Object Avoidance	
 Parking	Automated Valet Parking (AVP) to pre-defined spot		Dynamic re-routing	Map download	AVP indoor			
			Create Local Map Online	Follow Pre-Trained Path	Field Test			
					Find Parking Spot	Remote Control and HMI	Usage of ISO-Standard Interfaces for Parking Garages	

Visteon addressing L3 Highway Pilot

L3 Highway Pilot Environment Model

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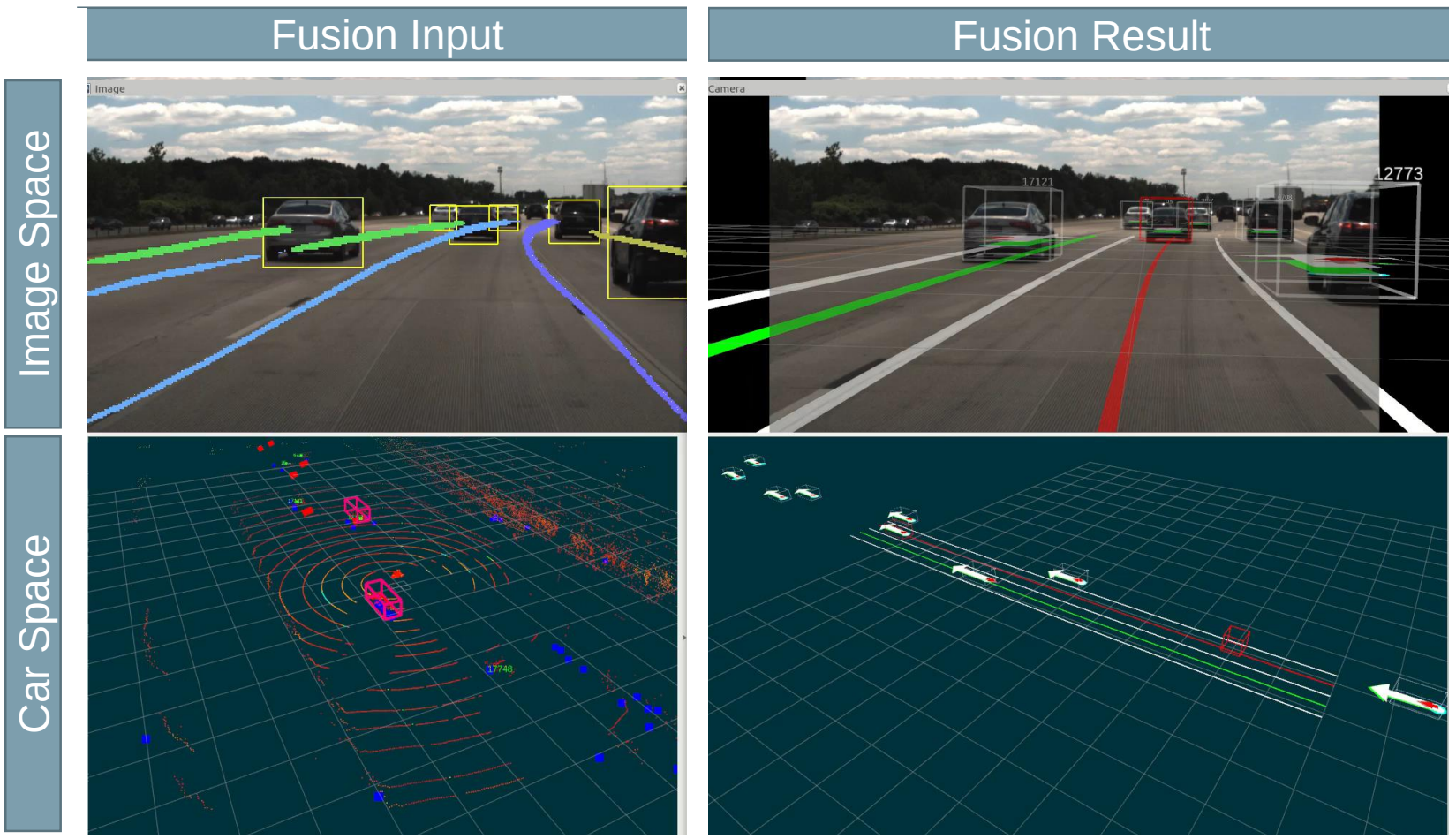

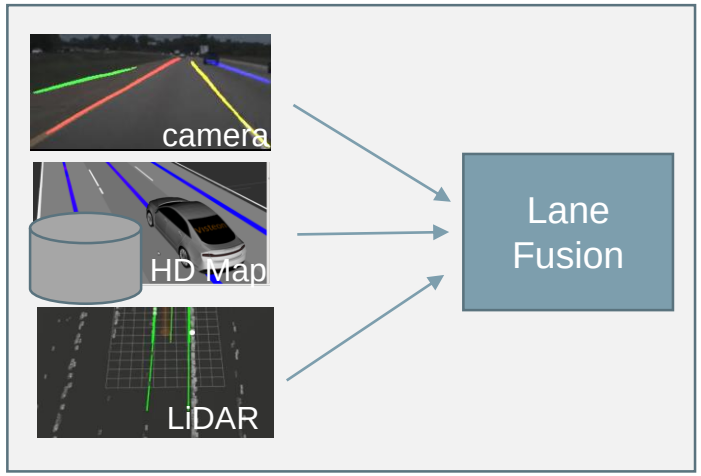

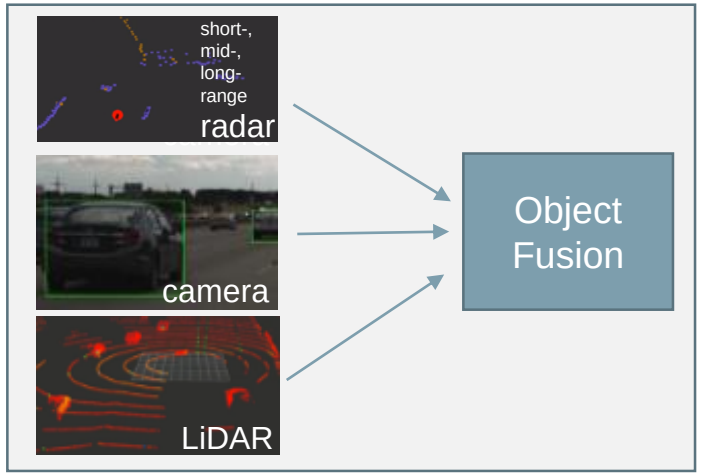

Environmental Model consisting of fused moving objects and fused lanes

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