Model-Based Hyper Scalable Assessment of Automated Vehicle Functions

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DSA = Device Solutions Americas

Samsung @ the Heart of Everything
Unparalleled Product Breadth & Technology Leadership
Samsung in Automotive

- **2017 JAN**
  - Press Release
  - Samsung’s Exynos Processors Selected to Revolutionize Audi’s Next-Generation In-Vehicle Infotainment
    January 18, 2017

- **2018 OCT**
  - Press Release
  - Samsung Expands Exynos and ISOCELL Brands to Include Automotive-Grade Solutions
    October 16, 2018

- **2019 JAN**
  - Press Release
  - Samsung’s Exynos Auto V9 to Power Next-generation Platform for Audi’s In-vehicle Infotainment System
    January 3, 2019

- **2019 MAY**
  - Press Release
  - Samsung Enhances Functional Safety to its Automotive Semiconductors with ISO 26262 Certification
    May 13, 2019

  - Press Release
  - Samsung’s Exynos Auto 8890 Powers In-Vehicle Infotainment System in the New Audi A4 and Upcoming Models
    May 30, 2019

Source: Samsung Newsroom
Global Map

San Jose

Munich

Israel

Seoul
Consistent SoC Strategy

Advanced Process Node of 7nm. ASIL D Safety Island.
Roadmap ADAS/AD

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<thead>
<tr>
<th>2023</th>
<th>202x</th>
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<tbody>
<tr>
<td><strong>Driver Assist Package</strong></td>
<td><strong>Valet Parking Package</strong></td>
<td><strong>Urban Fenced Chauffeur Package</strong></td>
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<tr>
<td>L2</td>
<td>L4</td>
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<tr>
<td><strong>Safety Package</strong></td>
<td><strong>Commuter Assist Package</strong></td>
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<td>L1</td>
<td>L3</td>
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<tr>
<td><strong>Info Package</strong></td>
<td><strong>Advanced Driver Assist Package</strong></td>
<td><strong>Advanced Commuter Package</strong></td>
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<td>L0</td>
<td>L2</td>
<td>L3</td>
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<td><strong>ADAS Platform</strong></td>
<td><strong>Autonomous Platform</strong></td>
<td><strong>Autonomous Platform</strong></td>
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- **Gen 1 SoC** L2 Solution
- **Gen 2 SoC** L3/L4 Solution
- **Gen 3 SoC** L4 Solution
A Three-Pillar Solution

**DRVLINE Metal**
Consistent Exynos SoC strategy to meet computational needs of each car line with efficient scale out.

Designed for safety applications up to ASIL D.

**DRVLINE Liquid**
Middleware that operates multiple SoCs as one.

Enables SW development by OEMs and Tier 1s to easily integrate functions.

**DRVLINE Air**
Cloud-based ecosystem with seamless integration of “in-car” collected data.

Improved accuracy of ACC, LKA, Road Model, AEB.
DRVLINE FRAMEWORK. Modular approach

Open and flexible Approach architected to allow third-party Integration

Option 1  Option 2  Option 3
Interprocess Communication Layer synchronizes source and object data.

Subscriptions to data sources that are on other SoCs are transparent to modules.

Software modules can be distributed across SoCs.

Adaptive Autosar and Autosar difficult to use for developers.

DRVLINE provides Adaptive Autosar with easy to use IDL and pub/sub mechanism familiar for ROS developers.
Samsung, as part of its Exynos Auto product family, offers its customers a comprehensive toolset to accelerate development, verification and validation.

The toolchain is optimized for the DRVLINE™ ADAS Framework and currently consists of five components:

1. Simulation framework (DRVLINE™ Sim)
2. Perception development kit (DRVLINE™ Perception Tool)
3. Functions development kit (DRVLINE™ Functions Tool)
4. Data management toolchain (DRVLINE™ Data)
5. DRVLINE™ Viewer 2019

These services are available through an online portal, which includes the DRVLINE™ Dashboard, showing an overview of continuous improvement (CI/CD/CV), KPIs, and more.
**ADAS SDK User Analysis**

**Function Engineer**

**Objective:** develop Functions like AEB/LKAS based on results from perception. Unit/Module Testing.

**Need:** Model-Based Design Tools, object-level simulation, ...

**Perception Engineer**

**Objective:** develop perception algorithms to detect objects, segmentation based on NN or classic CV. Unit/Model Testing.

**Need:** real data, annotations, high-res synthetic data, sensor modeling, KPI measurement, ...

**Test Engineer**

**Objective:** validate ADAS system solution and detect bugs.

**Need:** Debug, Profile, Use of Certified Testing Solutions, Automation, Test Case Generation, ...
Tools Landscape

ADAS Tools Portal with DRVLINE™ Dashboard

DRVLINE™ Viewer

DRVLINE™ Data

DRVLINE™ Perception Tool

DRVLINE™ Function Tool (including DRVLINE Toolbox for Simulink)

DRVLINE™ Sim

Real Data
Annotated Data

Perception
Functions

Middleware
BSP
Exynos Auto A

Simulated Scenarios,
Simulated Vehicles
DRVLINE™ V&V Strategy – SiL, HiL, ViL Continuity
Problems we are solving

› Rapid prototyping and requirement validation
  › Stateflow, Automated Driving Toolbox
› Fast and "inexpensive" verification
  › Driving Scenario Designer (Automated Driving Toolbox)
› Automatic code generation
› Address needs of multiple stakeholders with different approaches to development
› Mitigate development dependencies while framework is under active development

Our approach:
  develop a DRVLINE Toolbox for Simulink and distribute / deploy it in containers
DRVLINE Toolbox Architecture

DRVLINE ADAS Framework

- Sensor Data
- Object Stream
- Actuation Manager

MATLAB Simulink

- DRVLINE Sensor lib
- DRVLINE Object lib
- DRVLINE Actuation lib
LDW model using DRVLNE Toolbox
DRVLINE Toolbox for verification and validation

› DRVLINE SW & infrastructure allows validation at scale using
  › Headless simulation
  › Parameterization of driving scenarios
› “Smart” validation using
  › Parameter optimization
  › Data augmentation
DRVLINE Toolbox in V&V
Containerized Model in the Loop

Developer Workflow

V&V Workflow

./setup
Model in the Loop

- DRVLINE toolbox
- AD toolbox
- Driving Scenarios Simulink

Model
Software in the Loop

Diagram:
- Parameterization
- Simulation Engine
- DRVLINE framework
- Scenarious
- Test Cases
Enhanced Model in the Loop
DRVLINE toolbox example
Conclusions

› We presented a modern approach & framework to prototype, develop and test Automated Vehicle Functions
  › *MATLAB, Simulink, Automated Driving Toolbox, Stateflow* can be integrated thru the **DRVLIN** Toolbox for Simulink
› Facilitated development for different stakeholders
› Scalability on all stages even for MBD
› More efficient testing on early stage of the development