Testing Considerations for Automated Driving Systems
Testing in the product development phase closely follows the "V" model

- **Customer Function Tests**
- **System Tests**
- **Module Tests**
- **Software Tests**
- **Hardware Tests**
- **Code Tests**

Test types and their purposes:
- **Customer Function Spec**: Testing functional behavior, situations, and required safety.
- **System Spec**: Testing system architecture, components, and data flow.
- **Module Spec**: Testing requirements for individual modules in the system.
- **Software Spec**: Testing requirements for software and ECU functionality and performance.
- **Hardware Spec**: Testing software implementation and hardware design.

Tests ensure specification conformance at every level.
The testing effort increases disproportionately with increasing functional range/safety requirements.

Vehicle testing effort can be reduced by shifting from on-road testing to simulation. => Virtual Test Drive
Simulation via virtual test Drive

- Environment model
- Virtual camera
- Sensor models
- Image processing
- Vehicle model
- Sensor data fusions
- Application SW
  - Longit. control
  - Lateral control
  - Path planner

B. Wendling, December 15, 2014
But virtual testing does not replace vehicle testing

- Testing of automated driving system applications requires validation of nominal, limit, and failure performance under real-world operating conditions.
- Nominal performance testing can be safely performed on public roads by trained test drivers.
- Some test scenarios for limit and failure performance are not suitable for conducting on public roadways:
  - may pose a risk to other road users
  - could disrupt traffic
  - require special test equipment and/or infrastructure
  - require choreographed traffic situations (incl. other road users)
- Such tests require specialized facilities.
- Ensuring privacy for testing entities will be important.
DRAFT SAE J3018 - Guidelines for Safe On-Road Testing of SAE Level 3, 4, and 5 Prototype Automated Driving Systems (ADS)

- Test Driver Training
- Test Driver Workload
- Managing Test Drivers
- Safety Development Process
- Software Development and Modifications
- Selection of Test Routes
- Graduated Road Testing
- Test Data Capture
- Safety Override

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