AUTOMATION OF CAR DRIVE TESTS (CAR2X) USING TTCN-3 AND TTWORKBENCH AS A TEST EXECUTION AND EVALUATION PLATFORM

Presented by Bogdan Stanca-Kaposta
CSC Survey “Connected Cars 2015”

- Like to have
  - Fast accident/hazard reporting 85%
  - Online navigation to avoid congestions 75%
  - Adapt green light to traffic load 71%

- Cons
  - Skeptical on the reliability of the new connected-car features
  - Likely more technical breakdowns 62%
Intelligent Transport Systems
Focus on Car2X Communication
Car2X Tests

- ETSI G5 Tests
- Car2Car Communications Consortium Tests
- Drive Tests (Car manufacturers)
Car2X Tests

- ETSI G5 Tests
- Car2Car Communications Consortium Tests
- Drive Tests (Car manufacturers)
Drive Tests nowadays

- Driver
- Co-Pilot
- Laptop
  - Recording data for later analysis
  - Instructions
  - Evaluation criteria
  - Test Report
Drive Tests nowadays

• **Pros**
  • Flexible: test adjustment
  • Feedback: cancel test, faster, repeat

• **Cons**
  • Reliability of the test result depends on the experience
    • Two co-pilots can rate the same maneuver differently
  • Evaluation in car by co-pilot: lots of inputs, needs good training, details can go unseen
  • Test verdict offline
    • Exhaustive but too late (not on the track)
    • Need to redo the test in the field
  • High costs
AUTOMATED DRIVE TESTS

A TTworkbench project
Automated Drive Tests

- Driver
- TTCN-3 and TTworkbench as Co-pilot
  - Real-Time data analysis
  - Adapt to current car situation
  - Live evaluation
  - Detailed Log
- Instructions
- Test Report
Test Interfaces to the TTworkbench

- **Tested car**
  - System Under Test (SUT)
- **Car2X Protocol**
- **CAN BUS**
- **Tester**
Automated Drive Tests

- Tested car (SUT)
- CAN BUS Access (Ford’s OpenXC)
- Car2X Protocol
- Tester

User Conference on Advanced Automated Testing
Co-Pilot with TTCN-3 backend

Configure

Select Test

Execute

Verdict
Automated Drive Tests Features

- Audio feedback: faster, test failed/cancelled, repeat
- Test control via voice commands: abort test, start test
- Reproducible test results
- All inputs can be analyzed in real time (during the test)
- Online feedback if the test has to be re-done (directly in the field)
- Time synchronization of different logs inside the TTCN-3 log
- Extensible
  - Connection to other Test Access, GPS, e-Call, etc.
- Lower costs
  - Simpler logistics (resource management)
Components / Status

- TTworkbench’s remote Test Management GUI
  - Co-Pilot Android App (TestingTech on GitHub)
- TTworkbench running TTCN-3
  - ITS G5 Types (ETSI)
  - Test Adaptation G5 similar to ITS test suite
- TTworkbench interfacing Ford’s OpenXC (Open source)
  - CAN Simulator web app
  - Capture/Write via OBDII connector
  - Android recorder app
- Available as tailored solution approach to TTworkbench customers → Demo at our Booth
What is next?
Lab Tests / Regression Tests

Tested car (SUT)

Car2X Application Unit

CAN Data

Car2X Protocol

CAN Simulator / Replay

Tester

User Conference on Advanced Automated Testing
Automated Lab Tests

• Pros
  • Regression Tests for each new Firmware
  • Constant reliability of the test result
  • Extensible
    • Connection to other Test Access, GPS, e-Call, etc.
    • Lot of inputs can be analyzed in real time (during the test)
  • Low costs
    • Reusing the existing Test Architecture
    • Can be done before deploying the new firmware in the cars
Outlook

• Can be extended in the ITS space with
  • Sensors: GPS, UV, Temperature, etc.
  • Connectivity: Internet, Multimedia, etc.
  • Devices
    • Road side units
    • Street light, Intersection controls
    • Traffic Management, Parking lot, etc.

• Can be applied to other Domains
  • Vehicle2X: Boats, Airplanes, Trains, etc.
  • Industrial 4.0
Summary

- Automated Drive Tests
  - Reproductible test results
  - Live evaluation
  - Adapt to car situation
  - Detailed log
  - Time synchronization of different logs
  - Extensible
  - Lower test costs
The Team / Acknowledgments

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THANK YOU!

Questions?