



Accelerate cooperative mobility

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DRIVE C2X System Technology Enhancements and Plug Test Report (abstract)

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Executive summary

The present document gives an overview of the work that was carried out in the DRIVE C2X work package WP24 "Technology enhancements and system integration". This work package had two main objectives: (i) the enhancement of the basic system according to the specification agreed in DRIVE C2X D23.1 "Enhanced System Specification" and (ii) the testing of the integrated system in a laboratory environment.

D24.1 is the main document of the work package WP24. It summarizes the technology enhancements that were implemented in the course of the project, including the enhancements of the communication system, management and security, facilities and applications/functions. In addition, the document presents the result of the integration and testing efforts and provides details of test scenarios, test cases and test results of the software integration and test meetings.

The development work in DRIVE C2X has started from available results of the PRE-DRIVE C2X system. This system is called the DRIVE C2X basic system.

As a next step, an analysis took into account several aspects that were studied and developed in parallel, i.e. the methodology framework (WP22), system specification (WP23), test environment (WP25) and input from standardization (WP55). Based on the analysis, enhancements of the DRIVE C2X basic system were planned and structured into three subsystems of the so called DRIVE C2X reference system: communication system, management and security, facilities and functions/applications. While the overall design of the DRIVE C2X basic system was kept, several software components were newly implemented or re-implemented from scratch. Others components were considerably enhanced.

The activities faced several challenges. The high number of software components, which were typically implemented by different project partners, required an intensive coordination and many physical meetings. Also, several partners were strongly engaged in the national FOTs associated to the DRIVE C2X projects and naturally the DRIVE C2X project tried to achieve synergies with the national FOTs; but the timeline of these projects were sometimes diverging. Last but not least, partners responsible in the project were replaced by others. Finally, the role of a software integrator was not foreseen in the project planning.

WP24 has completed technology enhancements, integration and testing of the communication system, facilities, management and security and ten selected applications (Approaching Emergency Vehicle, Extended Electronic Break Light, Green Light Optimal Speed Advisory, Motorcycle Approaching Indication, Obstacle Warning, Roadwork Warning, Slow Vehicle Warning, Traffic Jam Ahead Warning, Weather Warning, and Wrong Way Driving in Gas Stations). These components represent the DRIVE C2X reference system. Some components were not available and could therefore not be integrated and tested, i.e. applications (Dealer Management, Fleet Management, Insurance and Financial Services, Point of Interest Notification, Post-Crash Warning, Transparent Leasing), components related to the backend systems (Backend Integration Manager, Vehicle Integration Manager) and related to roadside equipment (road equipment management,

sensor management). Therefore, these components had to be excluded from the DRIVE C2X reference system. Some components, such as HMI and MAP, became available at a late stage of the WP activities and could therefore not fully be tested in the lab environment. Instead for these components, the laboratory tests were skipped and the remaining components (and overall system) had to be tested in WP26 ("Vehicle integration and interoperability check") and SP3 ("System Validation").

The reference system was tested in a lab environment with a reasonable coverage of test cases including most of the components. One particular aspect was the testing of applications/functions, which requires feeding data into the system that are synchronized in their time and location information. This was achieved by the DRIVE C2X test bench, which was already used in the simTD field trial and adapted to the requirements of the DRIVE C2X reference system. For nine of the DRIVE C2X applications/functions, test specifications and test cases were developed. The test bench then enabled to play traces, to emulate particular scenarios and to study the results in a laboratory. This was also particularly important when issues were observed in real test runs and the scenarios could partially re-played in the lab environment. Hence, in comparison to testing with real vehicles, the test bench helped to decrease the overall efforts in the project.

The DRIVE C2X reference system also participated at the ETSI Plugtest for Cooperative Mobility. In fact, the majority of the partners in the 1st Plugtest were also DRIVE C2X partners. In preparation of the Plugtests, test cases for interoperability were defined by the ETSI CTI, supported by DRIVE C2X partners. At the 1st Plugtest, networking and facilities components were tested; those for which stable base standards and test specifications were available. The event itself was organized by ETSI CTI, ERTICO and TNO. In parallel to the plugtests for interoperability, the DRIVE C2X implementations also tested there standard compliance using the ETSI CTI test platform. The Plugtests for interoperability and test for standard compliance have shown that the DRIVE C2X implementations of the tested components are mature.

In summary, the DRIVE C2X reference system represents a good basis for the integration of the system into vehicles and roadside infrastructure. It will further be tested, validated and adapted to test site requirements in following activities of other WPs. Eventually it builds a solid basis for the execution of the field tests for impact assessment of Car-2-X communication systems.