2016 ITS Plugtests Campaign: Towards the Integration of M2M Technologies in ITS

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2016 ITS Plugtests Team
Intelligent Transportation Systems

User perspective:
- Better mobility experience
  - Multimodal journey planning
  - Real-time travel information
  - Electronic road tolling
- Higher safety levels
- Reduce pollution

Technological perspective:
- Complex system based on multiple technologies
  - Vehicular communications
  - Wireless connectivity
  - IoT objects
- Interoperability issues to be solved through standards
The ITS Plugtests is basically a test event:

- Organized and run by ETSI (as neutral body) in collaboration with academic and industrial partners
- Scope, test infrastructure and test plan based on standards
- Feedback to the ETSI technical group
- A tool for the ETSI technical group to validate and enhance the quality of their standards

An opportunity for implementers and for the community:

- To validate their understanding of the standard
- To demonstrate end-to-end interoperability
ITS Plugtests 2016 overview:

- From 7 – 18 November 2016 at the Port of Livorno, Italy
- Host: CNIT, AVR, Livorno Port Authority
- Organized by ETSI with ERTICO
- More than 20 vendors from worldwide

Main objectives and novelties:

- Past Plugtests events were focused on Car2Car communications
- *This Plugtests edition is the first ETSI ITS CMS event testing infrastructure services (based on draft ETSI TS 103 301) with:*
  - integration of Motorways network;
  - integration with IoT technologies.
ITS Plugtests 2016: use cases

Motorways network Integration

Internet of Things Integration

- UC-01 - Road Hazard Signalling
- UC-02 - Distribution of Road Hazard Signals
- UC-03 - Time To Green / Traffic Sign Violation
- UC-04 - Vehicle Data Aggregation
- UC-05 - In-Vehicle Signage
- UC-06 - Intersection Collision Risk Warning
- UC-07 - Longitudinal Collision Risk Warning
- UC-08 - Loading Zone Management
- UC-09 - Tolling
- UC-10 - Authorization Tickets Reloading
Motorways network integration: advantages

- Events notification (e.g., dangerous situations) from CMS to RSUs and from RSUs to CMS;
- CMS is able to connect directly RSUs for possible coordinated actions.
• On board data collection (e.g., detection of pollutants);
• Pervasive monitoring in the road side segment (e.g., parking slot occupancy detection, vehicle flow analysis).
ITS Plugtests 2016: final service architecture

![Diagram of service architecture]

- **Central Management System**
- **TCC**
- **DATEX Node**
- **DATEX 2 C-ITS Adapter**
- **DENM XER / HTTP**
- **RSU Supplier C**
- **RSU Supplier B**
- **RSU Suppl. A**
- **C-ITS**
- **Extended DATEX / SOAP**
- **DATEX / HTTP**
- **CoAP**
- **Road Side IoT Segment**
- **On Board IoT Segment**
- **Any OBU Supplier**
- **CoAP**

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1. C-ITS to CMS integration based on DATEX and SOAP
2. RSU to CMS through DATEX/HTTP
3. RSU to CMS through DENM XER/HTTP
ITS Plugtests 2016: final service architecture

1. Sensors to RSU through CoAP transactions
2. Sensors to OBU through CoAP transactions
ITS Plugtests 2016: M2M oriented architecture

Central Management System

DATEX Node

DATEX 2 C-ITS Adapter

RSU Supplier A

RSU Supplier B

RSU Supplier C

RSU Suppl. A

C-ITS

HTTP / IPv4

HTTP / IPv4

CoAP / 6LoWPAN

CoAP / 6LoWPAN

Road Side IoT Segment

On Board IoT Segment

Any OBU Supplier

AutostradeTech

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Conclusions

• In ITS Plugtests 2016 an M2M oriented architecture has been designed and developed
  – M2M transport protocols are supported both in the Infrastructure and IoT segments;
  – RESTful capabilities are partially supported.

• M2M capabilities in ITS are necessary to have a meaningful Infrastructure and IoT interoperability;

• For future ITS Plugtests a further step towards the integration with oneM2M is something to consider;

• Joint Plugtests initiatives between ETSI ITS and oneM2M are desirable to foster the standardization in both domains.
thank you!

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Use Case #1 Road Hazard Signalling

1. [0] Input for message generation from AVR

2. [0] C-ITS sends hazard warning to RSU

3. RSU sends DENM to OBU

4. The driver receives the information on the display of his on-board unit or an additional smart device.

- Standard IoT Protocols
- Central ITS-S [optional]

- RSU queries the sensor network and detects the road conditions. Sends DENMs to the relevant zones.
- C2I Road Side Unit

- 5.9 GHz Air Link
- On-Board display Driver Information

- Sensors on the road side perceive a danger on the road surface (water, ice, oil, pollutants / pedestrian).
- On-Board Unit

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Use Case #2
Distribution of locally detected Hazard Warning

1. Vehicle sends hazard warning.
   - a. On board wireless sensors send information about dangerous goods.

2. RSU receives hazard warning and informs C-ITS station.

3. C-ITS distributes IVS (e.g. speed limitations) and DENMs to the relevant zones.

4. The driver receives the information instantly on the Display of his on-board unit or an additional smart device.

C2X
On-Board Unit

5.9 GHz Air Link
On-Board display
Driver Information

Central ITS-S

5.9 GHz Air Link
On-Board display
Driver Information
Use Case #8
Monitored loading/unloading zone

1. The smart camera signals an empty slot in the loading unloading zone.
2. RSU receives the occupancy status of a set of parking slots and propagates a Point of Interest notification with all empty slots.
3. The vehicle shows the information to the driver.
4. RSU forwards the information to the C-ITS Station which monitors the occupancy of parking lots.

Central ITS-S [optional]

Standard IoT protocols

On-Board display

Driver Information

5.9 GHz Air Link

C2X On-Board Unit