Welcome to the World of Standards

C-ITS TECHNICAL SPECIFICATIONS FOR INTEROPERABILITY
STATUS AND ROADMAP

Compass4D Webinar 5.10.2016

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Outline

- ETSI’s Role
- Interoperability Events (so called Plugtests)
- Plugtest Schedule
- Use Cases
ETSI produces globally-applicable standards for Information and Communications Technologies including fixed, mobile, radio, converged, broadcast and internet technologies.

The most famous ETSI standards are DECT, Smart Cards, electronic signatures..and **GSM** (3GPP).

Today ETSI is famous for NFV.. and IoT/M2M developed in oneM2M and TC SmartM2M, part of ETSI « Connecting Things » cluster.

800 member organizations, 64 countries and five continents.
ETSI’s Role

Standards-making

- Development of base communications standards
- Development of conformance and interoperability test specifications
- European Standards (ENs) are developed following a standardization request (mandate) from the European Commission (EC)/European Free Trade Association (ETFA)

Supporting services

- Specification of methodologies for standards writing and test development
- Arrangement and management of interoperability testing events, called Plugtests™
Why do we need standards?

- Enable **interoperability** of systems/services
- **Encourage innovation**, foster enterprise and open up new markets for suppliers
- **Create trust and confidence** in products and services
- **Expand the market**, brings down costs and increases competition
- Help to **prevent duplication of effort**
- Support greater **confidence in procurement**
- **Interchangeability** of system component suppliers

Transport White Paper 2011

- EC Roadmap to a Single European Transport Area
- Towards a competitive and resource efficient transport system

To meet the challenges, transport has to:
- Use less energy
- Use cleaner energy
- Exploit efficiently a multimodal, integrated and ‘intelligent’ network

By 2050 reduce emissions by 60%, and 20% by 2020 (2008 level)
By 2050 move close to zero fatalities in road transport, halving road casualties by 2020

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ETSI TC ITS – Minimum set of standards for interoperability

More than 50 base standards for **Release 1** published

Release 2
Adaptive Cruise Control, Platooning, Vulnerable Road User Safety

6 Test Specification series published for **Release 1**

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## ETSI TC ITS – Major Achievements

<table>
<thead>
<tr>
<th>Category</th>
<th>Standards/Specifications</th>
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<tbody>
<tr>
<td><strong>Release 1</strong></td>
<td>• ETSI TR 101 607</td>
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<tr>
<td><strong>Facility</strong></td>
<td>• ETSI EN 302 637-2 Cooperative Awareness</td>
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<td></td>
<td>• ETSI EN 302 637-3 Decentralized Environ Notification</td>
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<td>• ETSI TS 103 301 Infrastructure Services</td>
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<tr>
<td><strong>Transport/Network</strong></td>
<td>• EN 302 634-4-1 Geo Networking</td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td>• IEEE 802.11p profile</td>
</tr>
<tr>
<td></td>
<td>• Congestion Control</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td>• ETSI TS 103 097 Security Header and Certificate Formats</td>
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</table>
INTEROPERABLE standards evolve in tandem with product development.

Implementations mature from prototypes to INTEROPERABLE commercial products.

ETSCTI

- Market Awareness
  - Simulations
  - Prototypes
  - Demos
  - Proofs of Concepts

- Time

Industry

- Technical Committees

- ETSI CTI

- Market Awareness

- Time

- Implementations mature from prototypes to INTEROPERABLE commercial products

- Base Standard Validation
- Test Standard Development
- Interoperability Testing Events (Plugtests)
- Frameworks for standards writing and test development

- INTEROPERABLE standards evolve in tandem with product development

- Mutual Feedback

- Market Awareness

- Technical Committees

- ETSI CTI

- Time

- Implementations mature from prototypes to INTEROPERABLE commercial products

- Base Standard Validation
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- Mutual Feedback
What is a Plugtests™ event?

A test event

- Organized and run by ETSI (as neutral body) in collaboration with industry 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

- To validate their understanding of the standard
- To test with (many) other real implementations
- To debug their implementation: early bug fixing, saving time

An opportunity for the community

- To promote the technology and the eco system
- To demonstrate end-to-end interoperability
<table>
<thead>
<tr>
<th>Event Date &amp; Location</th>
<th>Companies</th>
<th>Test Scopes</th>
</tr>
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<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Plugtests Nov. 11-18, 2011 Helmond, Netherlands (Hosted by TNO)</td>
<td><img src="image1.png" alt="Companies" /></td>
<td><img src="image2.png" alt="Test Scopes" /></td>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Plugtests Jun. 11-15, 2012 Versailles, France (Hosted by IFSTTAR)</td>
<td><img src="image3.png" alt="Companies" /></td>
<td><img src="image4.png" alt="Test Scopes" /></td>
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<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Plugtests Nov. 25-29, 2013 Essen, Germany (Hosted by Cetecom)</td>
<td><img src="image5.png" alt="Companies" /></td>
<td><img src="image6.png" alt="Test Scopes" /></td>
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<td>4&lt;sup&gt;th&lt;/sup&gt; Plugtests Mar. 17-27, 2015 Helmond, Netherlands (Hosted by Tass International)</td>
<td><img src="image7.png" alt="Companies" /></td>
<td><img src="image8.png" alt="Test Scopes" /></td>
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Plugtest Schedule

Phase 1: Test Track Design
- Livorno-Florence highway
- IoT testbed
- Test track through the port of Livorno

Phase 2: Pre-qualification of Device Under Test (DUT)
- Conformance Testing

Phase 3: Connecting all participants
- Remote labs
- Traffic Control Centre of Autostrade (Datex Node)
- RSUs in harbour and highway test track

Phase 4: Testing!
- 1 week lab test in Cruise Terminal
- 1 week of field tests on test track

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Phase 1: Test Track Design

Definition of the principal route
- 2.5 km in harbor
- 10 km on Fi-Pi-Li highway

Identification of possible RSU installation points
- 11 potential RSU locations

Identification of Urban Canyons and Radio Coverage Measurements
- 4 RSU locations selected

Recording
- GPS recording of the vehicle path

Design of Use Cases
- Zones, Traces, Stop lines, Reference Points, Relevance Areas
Phase 1: Test Track Design
Phase 2: Pre-qualification of DUTs

Test case DB

Test Controller

Logging + Analysis

Upper Tester Commands via Ethernet

GNSS replayer

RF GPS signals

11p

11p signals

Proxy (Convert CAN messages, optional)

CAN

Upper Tester App

App 1

App 2

FAC

NET

PHY

DUT (ITS Station)
Phase 3: Connecting all participants
Phase 3: Connecting all participants
Phase 4: Testing!
(Participants – Status 15. Sep 2016)
Field Interoperability trials

Motorways network integration

Internet of Things integration

Testing tolling interoperability

- 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
Use Case #1 Road Hazard Signalling

AVR Control Center provides input for message generation (DENM)
RSUs which cannot connect to C-ITS send pre-defined messages
Project related Data elements can be send, e.g. Wrong Way Driving, Weather Condition, Hazardous Location, Traffic Condition, Emergency Vehicle Approaching
Use Case #2
Distribution of locally detected Hazard Warning

- A vehicle sends a Traffic Hazard/Stationary Vehicle Warning
- A RSU receives the warning and sends the information to the C-ITS station
- C-ITS station distributes information

1 | Vehicle sends hazard warning.

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.

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Use Case #3
Time To Green / Traffic Sign Violation

- The traffic light sends a pre-defined sequence of SPAT+MAP messages
- Based on GPS positioning and the Intersection Information, the in-vehicle application can provide different intersection assistance functionalities such as Fast preemption of traffic due to traffic light signal change (red to green)
- RSUs which cannot generate SPAT/MAP messages send pre-defined messages
Use Case #4
Virtual Traffic Loop (Data Aggregation)

- Virtual Traffic Loop functionality implemented by RSU
- RSU aggregates CAM data from multiple vehicles and provides information to C-ITS

1. Vehicles send CAMs.
2. RSU receives, aggregates and anonymizes CAMs and sends 'virtual traffic loop' data to C-ITS.
3. C-ITS Station receives the virtual sensor information and decides to relay information to CMS or to generate warnings (e.g. Distribution of locally detected Hazard Warning)
Use Case #5 In-Vehicle Signage

- Message generation of IVI
- RSUs which cannot connect to C-ITS send pre-defined messages
Use Case #6 Intersection Collision Risk Warning – (Stop and Go Scenario)

- HV (host vehicle under test) will run ICRW.
- Target speed of RV can be 20/40 km/h (depends on real traffic situations)
- The distance (testing criteria) between cone RV-A and cone RV-D can be 50m/25m (can be changed according to a vendor’s implementation) with respect to the target speed 20/40 km/h.

1. HV moves forward 50m from the preparation point (cone HV-B) and then stop by the start point (cone HV-A).

2. RV starts to move from the start point (cone RV-C)

3. RV accelerates to the target speed

4. Keep the target speed constant

5. After RV passes cone RV-D, HV start to move forward a short distance (less than 50m) with a very slow speed (less than 10km/h) and then stop by the stop point to prevent from entering into the intersection. ICRW may show a collision warning before RV goes through the intersection point (cone RV-A).

6. RV makes a controlled stop after passing the intersection.
Use Case #7 Longitudinal Collision Risk Warning – Stationary Vehicle

- HV (vehicle under test) will run LCRW
- The distance (testing criteria) between the point A and the emulator is 20m (can be changed according to a vendor’s implementation).

4. HV makes a controlled stop after point A.
4. LCRW may show a forward collision warning before passing by point A.
3. HV keeps the target speed (20 kmh) constant.
2. HV starts to accelerate to the target speed (20 kmh) from point C to point B.

1. One OBU broadcasts CAM with a fix heading and a fix GPS position according to the direction of the lane to emulate a stationary vehicle.
Use Case #8

Monitored loading/unloading zone

- A network of smart camera or presence sensors monitors the occupancy of a loading zone.
- A RSU is able to receive the information and to propagate Point of Interest notification for each free parking slot.
Use Case #9
Mitigation of interferences with tolling equipment

A tolling equipment for testing purposes is deployed, ETSI ES 200 674-1 compliant.
A RSU is able to send CAM with an appropriate ProtectedCommunicationZone content, to protect the tolling zone.
Approaching OBUs are able to receive and consume the CAMs following the procedures defined in ETSI TS 102 792.
The vehicle, having also on board ETSI 200 674-1 OBU, enters the tolling protected zone and applies mitigation techniques.
The ETSI 200 674-1 DSRC transaction is executed with no interferences and no packet loss perceived by the ETSI 200 674-1 RSU.

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Use Case #10
Authorization Tickets Reloading

C2C-CC protocol via TLS
ISE protocol

RSU Operator Backend

AT request/reply

INTERNET

AT request/reply

PKI

AT request/reply

VEHICLE
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http://www.etsi.org/news-events/events/1054-plugtests-2016-itscms5

Thank you!