Guidelines for EFC applications based on in-vehicle ITS stations

Project Team CEN/TC278 PT136

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Project team PT136

- **Administrative data**
  - Grant agreement following the Mandate M/338
  - Contract signed: 04/2012
  - PT136 is monitored by CEN TC 278 WG1 (EFC)

- **Task**
  - Investigate "Guidelines for EFC applications based on in-vehicle ITS stations"
  - Type of deliverable: TR – FprCEN/TR16690

- **PT members**
  - Rolf Suter – Rapp CH,
  - Runar Sorasen – Q-Free NO,
  - Jan Kersten – Trafficteq DE (PT leader)

- **Current status**
  - TR is in formal approval till 2014-04
## Why EFC? / Framework of EFC

### Real-life operational service

<table>
<thead>
<tr>
<th>EFC users in Europe</th>
<th>&gt; 26 Mio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toll revenues per year</td>
<td>&gt; 27 Bill. EUR</td>
</tr>
<tr>
<td>Network</td>
<td>about 50,000 km</td>
</tr>
</tbody>
</table>

### Technical specifications

- Set of standards (CEN TC 278 WG1) available and in use
- Architecture standard; protocol standards, application data, test standards
- Support for both EFC technologies in use – **5.8 GHz DSRC** and **GNSS/CN**

### Regulatory framework

- Directive on Interoperability 2004/52/EC
- Decision on EETS 2009/750/EC

### EFC as a service

- An EFC service is enabled by a set of EFC applications
- ITS station types: in-vehicle, road-side infrastructure, central

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Assumptions and definitions

- **Basic idea**
  - Enable an EFC service by means of EFC applications deployed at and activated on ITS-stations (instead of using dedicated EFC On-Board Units)

- **EFC services**
  - EFC charging service (DSRC mode)
  - EFC charging service (autonomous mode)
  - EFC enforcement service
  - Optional EFC location support service

<table>
<thead>
<tr>
<th>EFC service</th>
<th>Service user</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFC charging services</td>
<td>Road user</td>
</tr>
<tr>
<td>EFC enforcement service</td>
<td>Toll charger</td>
</tr>
<tr>
<td>EFC location support service</td>
<td>Service provider</td>
</tr>
</tbody>
</table>

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Approach

- **Identification of major requirements for EFC**
  - Technical and operational nature
  - Non-functional requirements
  - for the EFC-applications and
  - for the ITS-S

- **Lifecycle**
  - EFC service life cycle – C-ITS roles involved and required in each phase

- **Role model and technical architecture**
  - Partially different viewpoints and methodologies in EFC and C-ITS

- **Major challenges**
  - EFC as a (public) regulated service
  - Performance based contractual framework in EFC
  - Application priorities / multi-application scenarios
  - Certification

- **Synergies**

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Synergies

- **EFC environment**
  - As identified in ISO EN 17573
  - Very similar to C-ITS

- **Benefits**
  - Cost savings
  - Reuse of technical resources
  - Interfaces (telecom systems)
  - Reuse of information and facilities
  - Harmonized security
  - Less clustering of drivers environment

- **Operational**
  - Lifecycle management for HW and SW components
  - Performance monitoring
  - Payment facilities and processes

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Role models in EFC and C-ITS

**EFC**

- Specified in ISO 17573
- Identifies involved roles based on a set of responsibilities that logically related to each other
- Interactions, interfaces, computational objects

**C-ITS**

- Specified in ISO 17427
- Organisational architecture (enterprise viewpoint)
- Roles and responsibilities
- Sub-roles
C-ITS and EFC role model relations

- **Road Side ITS Station**
  - System Management
  - System Operation

- **In-Vehicle ITS Station**
  - System Management
  - System Operation

- **Service Provider Domain**
  - Possible EFC services:
    - Enforcement
    - Localisation support
  - Using the system EFC: Toll Charger
  - Using the system EFC: Service User

- **Service User Domain**
  - Possible EFC services:
    - DSRC EFC
    - Autonomous EFC

- **Toll Charger domain**
  - EFC System Management
  - Toll Charger (Central ITS Station)

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ITS station service provider

- **Responsible** for the ITS-S (not necessarily the owner)

- **Main tasks and responsibilities**
  - Providing the ITS-Station to the Service User, TSP or TC
  - Responsible for the hardware and the basic software platform
  - Supporting the parallel execution of different ITS services
  - Distribution of EFC application(s) or service(s) to the ITS-Station

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EFC migration scenario

- Current phase: Dedicated EFC OBUs only
- Migration phase: **Dedicated EFC OBU and EFC applications** on in-vehicle ITS-S
- Final phase: EFC applications on ITS-S only

**Complex scenarios**
- E.g. more than one EFC application present at a time in one vehicle
- Impact of such scenarios depend on
  - **Operational status** of the EFC applications – non-/active,
  - Non-/overlapping **toll domain coverage** of related EFC contracts,
  - **EFC service contracts** with same or different service providers.

- TR assesses these scenarios
- Set of rules that enable involved stakeholders to avoid such scenarios and mitigate impact (e.g. double charging)
Governance and responsibility

Application configuration of an ITS-Station

- Regulatory ITS-S
- Tolling and charging ITS-S
- Multi-application ITS-S

Relation to ....
- Application priorities
- Secure processing environment
- Liabilities
- Performance based contracts

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Certification and suitability for use

**Toll Chargers** perspective includes 3 different areas for certification:

- ITS-Station (in-vehicle and/or Road side)
- EFC Service

**EFC Service Provider Processes**

Suitability for use test applies only to the
- combination of the above in an operational test

**Complexity** in C-ITS increases due to number of involved actors

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## Recommendations

- Take **non-technical aspects** into account as early as possible
  - Life-cycle management
  - Liabilities
  - Performance monitoring
  - Exception handling

- Define roles, **responsibilities** and interactions
  - Experiences from existing EFC stakeholders (mainly toll chargers, service providers)

- Experiences from EETS!
  - Harmonization in **certification, testing and approval**
  - Avoid re-certifying and re-testing for every toll domain and every combination of HW- and SW.
Thank you for your attention!

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