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Electronic Fee Collection — Value added services based on EFC on-board equipment

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National foreword

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Perception du télépéage - Services à valeur ajoutée basé sur l'équipement embarqué de télépéage

Elektronische Gebührenerfassung - Zusätzliche Funktionen basierend auf den fahrzeugbasierenden Gebührenerfassungssystemen

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Foreword

This document (CEN/TR 16219:2011) has been prepared by Technical Committee CEN/TC 278 "Road Transport and Traffic Telematics", the secretariat of which is held by NEN.

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This document has been prepared by CEN/TC 278 WG1 Project Team 31 on Value Added Services. The work done by the project team has been governed by the Technical Committee CEN/TC 278 "Road Transport and traffic telematics", the secretariat of which is held by NEN and by CEN/TC 278 Working Group 1: Electronic Fee Collection.

Introduction

This Technical Report (TR) analyses the technical feasibility of using EFC OBE for delivering additional services, commonly called value added services (VAS). These VAS may either be delivered on board to the driver of the vehicle, or off board to the road operator, to a freight company or to the general public. The report only analyses the situation where EFC is considered to be the core application, with VAS applications as add-ons, not the reverse situation, namely whether an EFC application can be added to telematics platforms with other core applications, such as EFC that might be delivered as an add-on to a navigation device.

Currently, the interaction between services based on EFC OBE without any additional equipment and comfort service platforms is not clearly visible. Therefore, the scope of this TR includes investigation of the suitability of the available sensor information, data elements, communication media and HMI features for supporting the envisaged mass services such as; fleet management, hazardous goods / livestock management and eCall. This relates to the expectations mentioned in the interoperability directive, Directive 2004/52/EC. It is expected that with the advent of the European Electronic Tolling Service EETS as mandated by Directive 2004/52/EC, VAS will benefit from widespread deployment of capable multi-technology telematics platforms. Commercial transport might achieve efficiency improvements and competitive advantages through a wider take-up of fleet management and related applications that might be offered as VAS to EFC equipment.

The TR identifies potential applications and groups them into application classes for the purpose of a more compact analysis. The application classes are

- Fleet management;
- Entertainment;
- Payment;
- Cooperative road safety;
- Driver assistance;
- Communications;
- Navigation & traffic information;
- Traffic data collection;
- Vehicle usage recording;
- Regulatory applications.

The methodology in this TR is firstly to compile the specific requirements of the applications in each class, then to establish the requirements of EFC applications, and finally to analyse potential synergies and prerequisites for joint delivery. The analysis strives to encompass two viewpoints, namely the business and the technical perspectives.

The TR also analyses how these services can be implemented without jeopardising the security requirements of the EFC Service Provider responsible for the OBE and the charging process. The possibilities and constraints, including privacy requirements as defined in Directive 2006/24/EC and Commission Decision 2008/597/EC, related to the integration of the OBE into a wider open platform for delivery of other public or private added value services form part of the investigation, as well as the required standards and anticipated road map.

The analysis results in a set of recommendations as to how the preconditions for a joint delivery of VAS with EFC might be improved. The analysis in the report shows that certain preconditions required for VAS are not available in current EFC standards and might need to be taken into account for future work.

1 Scope

1.1 Definition of VAS

Value Added Services, VAS, is a term that was coined in the telecommunications industry for services that go beyond core service, such as mobile voice communications. Such additional services are intended to add value for the consumers in order to encourage them to use the telecommunications service more often and to add an additional revenue stream for the Service Provider.

In the context of EFC, a VAS in this strict sense is a telematics service offered to the Service User by means of an EFC OBE. This service might directly be consumed by the driver in the vehicle, or might, particularly in the case of heavy vehicles, be targeted at the freight operator and be consumed in a back office. Such services can be fleet management services like track-and-trace, payment services such as paying petrol automatically at the pump, or regulatory applications such as Electronic Licence Plate or access control. Such additional services and applications create additional value to the user, either by the value the new service creates to him, or in the case of regulatory services, by combining several functionalities in a single device, thus removing the need to install and maintain several pieces of equipment simultaneously.

In a wider sense, the operator of the EFC service can draw additional benefit from the data collected by the EFC system. Data from EFC OBE gives a good account of the traffic situation on the charged network, and may be utilised for statistical purposes, for traffic planning or even in real-time for traffic information purposes.

The scope of this TR covers both the original meaning of VAS, namely both additional services to the user of the core EFC service and additional value created for the operator of the charging system.

1.2 Coverage

The TR analyses all telematics applications that have the potential to be delivered as a VAS to EFC. The analysis covers the requirements of the VAS applications and the fit to the resources offered by the EFC system. It also analyses prerequisites in terms of business and technical system architecture in order to enable VAS to be delivered, including questions of control and governance, security aspects and privacy issues.

The TR does not analyse commercial viability. Cost to benefit ratio and market potential for VAS are considered to be out of scope.

The TR analyses the potential and pre-conditions for EFC equipment to serve as platforms for a diverse range of VAS. The VAS are considered to be add-ons to EFC equipment. The TR does not analyse the reverse situation, namely the situation where an EFC application is added to a telematics platform that has been deployed for another core service, such as the suitability of navigation systems to serve as platforms for EFC.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15509, *Road transport and traffic telematics — Electronic fee collection — Interoperability application profile for DSRC*

CEN ISO/TS 12813, *Electronic fee collection — Compliance check communication for autonomous systems (ISO/TS 12813:2009)*

CEN ISO/TS 13141, *Electronic fee collection — Localisation augmentation communication for autonomous systems (ISO/TS 13141:2010)*

EN ISO 14906, *Road transport and traffic telematics — Electronic fee collection — Application interface definition for dedicated short-range communication (ISO 14906:2004)*

ISO 17573:2010, *Electronic fee collection — Systems architecture for vehicle related-tolling*

CEN ISO/TS 17575-1, *Electronic fee collection — Application interface definition for autonomous systems — Part 1: Charging (ISO/TS 17575-1:2010)*

CEN ISO/TS 17575-3, *Electronic fee collection — Application interface definition for autonomous systems — Part 3: Context data (ISO/DTS 17575-3:2010)*

ISO 14813-1, *Intelligent transport systems — Reference model architecture(s) for the ITS sector — Part 1: ITS service domains, service groups and services*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17573:2010 and the following terms and conditions all apply.

3.1
business architecture
the structure of the relationship between the actors involved in the VAS and EFC services, including the roles of the actors, their contractual relationship, the allocation of responsibilities, and system control and governance

3.2
EFC platform for VAS
an EFC platform for telematics service delivery comprises a set of one or more in-vehicle components, commonly termed OBE, potentially roadside and central equipment, but also a set of business rules and a legal framework. Business rules include an institutional setup, with defined responsibilities, ownership, governance, certification, and contractual relationships

3.3
technical architecture
the concept of the technical delivery platform in terms of technical components, their interfaces and interactions

3.4
Value Added Service
an additional value that is created in an EFC system to Service Users or the system operator beyond the core service, payment for road use

3.5
On-road Service Integrator
the On-road Service Integrator provides to the Service User both tolling services and VAS offers and as such incorporates the role and responsibilities of the EFC Service Provider as defined in ISO 17573 plus the additional responsibilities as provider of VAS

3.6
vehicle-related data
any kind of data related to the vehicle's characteristics (including any trailer), its movements, the vehicle driver or the vehicle's cargo

4 Abbreviations

For the purposes of this document, the following abbreviations apply throughout the document unless otherwise specified.

AEI	Automatic Equipment Identification
AVI	Automatic Vehicle Identification
CALM	Communications Access for Land Mobiles (a set of ISO communications standards)
CESARE	Common Electronic Fee Collection System for a Road Tolling European Service (acronym of a European research project)
CN	Cellular Network communications
COOPERS	COperative SystEms for Intelligent Road Safety (acronym of a European research project)
CVIS	Cooperative Vehicle Infrastructure Systems (acronym of a European research project)
DSRC	Dedicated Short Range Communications
EC	European Commission
EFC	Electronic Fee Collection
EETS	European Electronic Toll Service
ETSI	European Telecommunications Standards Institute
EURIDICE	EURopean Inter-Disciplinary research on Intelligent Cargo for Efficient, safe and environment-friendly logistics (acronym of a European research project)
FCD	Floating Card Data
GALILEO	Name of the European satellite localisation system
GNSS	Global Navigation Satellite Systems (a generic term used for satellite localisation system such as GPS and GALILEO)
GPS	Global Position System (acronym for the satellite localisation system operated by the United States of America)
GST	Global System for Telematics (acronym of a European research project)
GSC	GNSS enabled Services Convergence (acronym of a European research project)
HMI	Human to Machine Interface
IAP	Intelligent Access Programme
ICT	Information and Communication Technologies
ISO	International Standards Organisation
ITS	Intelligent Transport Systems

NCR	Non-Compliance Report
OBE	On-Board Equipment
ORSI	On-road Service Integrator
PDA	Personal Digital Assistant
PSAP	Public Safety Answering Point
RCI	Road Charging Interoperability (acronym of a European research project)
SMS	Short Message Service
SP	Service Provider
TC	Toll Charger
TCA	Transport Certification Australia
UOBU	Universal On-Board Unit (acronym of a European research project)
VAS	Value Added Service
V2I	Vehicle to Infrastructure (communication)
V2V	Vehicle to Vehicle (communication)
WG	Working Group (of a CEN or ISO Technical Committee)
WI	Work Item

5 Background and Context

5.1 Starting Point and Aims

5.1.1 Motivation for VAS

Tolling systems are becoming increasingly automated and EFC is becoming a pervasive service. EFC is the ITS application with the widest deployment. Since payment for road use is mandatory and imposed upon the user, EFC is not perceived by the user as a service.

EFC equipment is also becoming more capable. Since modern approaches to road financing and demand management require more accurate assessment of individual road use, involving more differentiation according to vehicle characteristics, road type and time of day, EFC systems have developed from single purpose object tolling into sophisticated charging systems employing a wide range of technologies, including on-board processing, satellite-based localisation, mobile communications, DSRC, digital maps and cryptographic security services. This technical report focuses mainly on interoperable EFC OBE, which support both DSRC and autonomous tolling, and could therefore, in principle, deliver a wide range of ITS applications. However, more dedicated CEN DSRC OBEs may also provide platforms for delivering selected VAS applications.

These core facts, namely wide deployment, unfavourable user perception and availability of capable ITS platforms, have motivated the services industry to investigate the potential for delivering additional value through EFC equipment.
Motivation for developing a VAS offer can stem from several areas:

— For toll chargers, based on the desire to increase take up of EFC equipment: Toll chargers have an interest in automating processes and increasing the number of equipped users. The availability of VAS might be an additional motivation for users to equip themselves.

— For toll chargers to create value out of the available user movement data: EFC systems collect information about vehicle movements that can be made anonymous and then become a valuable resource beyond the mere tolling purposes. Movement data is especially valuable for planning purposes, for traffic management and even for providing real time traffic information.

— For Service Providers to create an additional revenue stream: Especially in the discussions around the development of the EETS legal background (Directive 2004/52/EC and Commission Decision 2009/750/EC) it has been found that the business case for Service Providers to deliver interoperable EFC services is marginal at best and additional revenue streams will probably be necessary to justify the required investments.

— For the Service Users from the request to have all services delivered through a single channel: Especially for heavy vehicles, the numbers of different EFC OBE, equipment for regulated applications such as Tachograph, eCall and hazardous goods tracking, plus commercial ITS devices for fleet management and navigation are becoming a nuisance. All devices and applications require attention and maintenance, require different hardware, installation, contracts and operation. Owing to the pervasiveness and capability of EFC OBE, these might become the ideal platform for delivering many telematics services through a single channel.

— For policy makers to develop the telematics market in general: For several years it has been the policy of the European Commission and of the Member States to modernise road transport and manage traffic efficiently through the widespread deployment of telematics or ITS technologies. This has recently been underlined in the ITS Action Plan of the Commission which promotes deployment of a universal ITS platform in the vehicle (see ITS Action Plan in the Bibliography). EFC OBE may provide an ideal platform for delivering multiple telematics services through a single channel, based on their increasing capability and growing prevalence across Europe.

5.1.2 Experiences with VAS

For a long time toll chargers have been making use of the rich data provided by EFC systems. For examples see the descriptions provided in Annex A involving national VAS implementation. In EFC systems, road usage data is essentially free for additional use and requires only minimal investment in processing and analysis to create large incremental value. Early uses of this data have been for statistical purposes, e.g. for predicting the revenue flow and for planning investments into road infrastructure renewal. More sophisticated systems can produce very detailed data, including origin-destination information, which is very difficult and costly to produce by other means. EFC OBE equipped vehicles can be considered probe vehicles for the traffic stream. This fact is put to use in Floating Car Data (FCD) applications that use information provided by probe vehicles to produce a picture of the traffic situation. Ideally, this information can be processed and distributed in real time to give road users information on bottlenecks, congestion and expected travel time.

While this field of additional exploitation of EFC equipment has been thriving, VAS in their original sense, namely additional services delivered to the Service User, have seen only limited uptake and deployment. Annex A again gives some examples. Several reasons have been identified as to why the market for VAS to the Service User has not developed as anticipated by many:

— Only comparatively recently have truly capable EFC platforms been deployed.

— EFC is a sensitive application in the sense that toll chargers are not prepared to take any risk in losing revenue due to complications arising from VAS competing for on-board resources.

— EFC systems are often controlled by an operator in a monopoly situation. Delivery of VAS in such an environment will normally put the operator at an advantage that is not allowed by European anti-competition legislation.

- Providers of telematics services have chosen to develop their own dedicated equipment in order to free themselves from the constraints imposed by the toll chargers and in order to be able to serve all types of customers, including those without EFC equipment.

- The market for ITS applications for commercial vehicles is extremely fragmented. No single application has been found that would create significant benefits for a large segment of the market. Especially in the freight sector, the needs of different vehicle operators differ widely, depending on the nature of the transport task speciality they offer.

5.1.3 Objectives

The TR strives to establish the preconditions for delivering VAS on EFC platforms, firstly by identifying which requirements of different VAS are also met by EFC OBE, and which adaptations might be required to make certain VAS possible. The reverse is then also considered, namely the influence of VAS on the core EFC service, mainly with regard to minimisation of the risk of compromising the revenue collection process in any way, and in particular, with respect to security and privacy.

An EFC platform for telematics service delivery comprises a set of one or more in-vehicle components, commonly termed OBE, potential roadside and central equipment, as well as a set of business rules and a legal framework. Business rules include an institutional setup with defined responsibilities, ownership, governance, certification, and contractual relationships.

The objective is to analyse the required preconditions for joint delivery of EFC and VAS on a common platform both from a technical perspective and from the perspective of governance and control over the applications. The analysis of the preconditions leads to a set of recommendations for measures that might improve the environment within which VAS may be exploited via EFC systems.

As detailed below in the discussion of the EFC context, the objective of improving the preconditions for VAS on EFC OBE has to be seen against the background of the development of EETS, which creates new opportunities and challenges both technically and commercially for widespread deployment of VAS.

5.2 EFC Context

5.2.1 Role model for interoperability

For several decades, toll collection was a bilateral relationship between a toll charger and the user. This remained essentially the same with the advent of EFC. Only with efforts to establish interoperability among toll systems did it become obvious that a new relationship model needs to be found. As a result of the series of CESARE projects in particular, a new paradigm of business model was developed that shall form the basis of interoperability in a European context.

This model foresees a new explicit role, Service Provision, and an associated actor, the Service Provider which is the main contact for the user, as shown in Figure 1. A Service User has a contract with a Service Provider and receives all necessary equipment, payment means and information enabling the user to freely roam through the toll domains of all Toll Chargers participating in the interoperability arrangement. Service Users are free to make contact with the Service Provider of their choice. The traditional bilateral relationship between user and charger has been replaced by a multilateral, open, and market based arrangement.

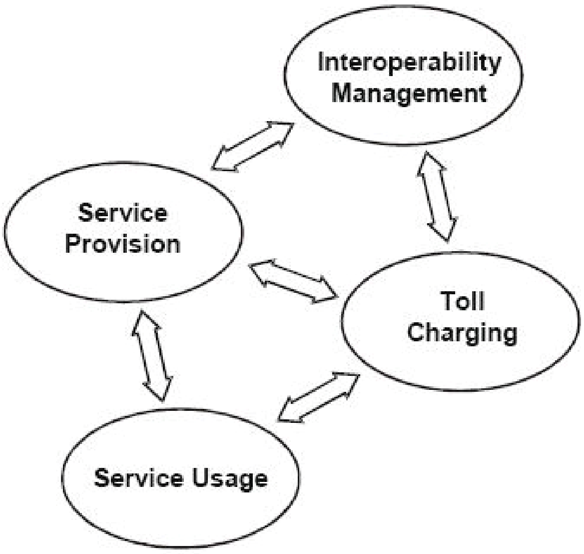

Figure 1 — Role model developed in CESARE, prescribed in Decision 2009/750/EC and standardised in ISO 17573

This business model is underlying the European Electronic Toll Service EETS as mandated by Directive 2004/52/EC and detailed in Decision 2009/750/EC (see EETS Directive and EETS Decision in the Bibliography). The Directive also prescribes a minimum set of technologies that needs to be supported, namely DSRC, GNSS and CN.

The EETS shall be introduced by October 2012 for heavy vehicles and by October 2014 for light vehicles. Its deployment is mandatory for all Member States of the European Community that have EFC systems of sufficient size to fall under the EETS Directive. It is expected that the development and deployment of the EETS will lead to increased availability of telematics platforms with VAS delivery potential. OBE capable of EETS will offer unrivalled capabilities and the potential for a wide range of applications, given that some barriers to deployment are removed. Such barriers might especially stem from issues of governance, control and security.

The EETS requires very capable technical platforms in the vehicle since all European electronic tolling systems need to be served. The suitability of such OBE platforms is established in a certification process that consists of two separate steps:

— In a first step, equipment suppliers will have to prove conformity to standards in a CE marking process.

— In a second step, Service Providers have to prove suitability of their OBE and their back end processes for toll collection in all systems. In principle, such a suitability process has to be performed for every individual toll system separately.

It is unclear how the provision of VAS is influenced by this certification process. It is a prerequisite of VAS delivery that OBE does not lose EETS certification as soon as certain VAS are enabled.

Another peculiarity of the EETS business model that will influence VAS deployment is the fact that the Service Providers have an unconditional payment obligation against the Toll Chargers for all tolls incurred by their Service Users. Hence the core of the EETS is a far reaching payment service arrangement that might well lead to VAS in other payment related domains.

The potential of the EETS to form the basis of a widespread uptake of telematics services through VAS on EETS OBE has not gone unnoticed. Article 13 (2) of Commission Decision 2009/750/EC reads:

Article 13 (2): In addition to tolling, the EETS on-board equipment should enable implementation of future other location-based services. The use of EETS on-board equipment for the purpose of other services shall not interfere with toll operations on any toll domain.

5.2.2 EFC standardisation

Standards have been essential for the success of EFC in Europe. Initially, standards were important to road operators, affirming the investment they were making in EFC infrastructure. Standards are a prerequisite for the development of a competitive multi-supplier market. Hence, in the early times of EFC deployment, standards for technical interfaces, such as the set of 5.8 GHz DSRC standards, have been the focus of European standardisation. Only later did the element of interoperability become important, driving the need for application-level standards such as EN 15509.

CEN has developed more than 20 standards for EFC, most of them in cooperation with ISO as joint work items. For the purposes of this document, four standards are most relevant, namely the ones regarding basic EFC systems architecture (ISO 17573), basic EFC data structures (EN ISO 14906), the interoperable application standard for DSRC-based EFC (EN 15509) and the fundamental set of standards for GNSS based systems (CEN ISO/TS 17575 series):

— ISO 17573 on the *Systems architecture for vehicle related tolling*. This standard defines the architecture for EFC systems and as such is the fundamental basis both for DSRC and for GNSS based systems.
  ISO 17573 defines amongst other standards, a role model and the core processes of EFC systems but does not foresee provisions for the inclusion of VAS. The architecture is specific to EFC and has not been opened for the inclusion of VAS.

— EN ISO 14906 on the *Application interface definition for dedicated short-range communication.* This standard defines basic attributes for tolling. It has been devised specifically for DSRC based systems, but the basic attributes, e.g. regarding vehicle data or payment, are of a very general nature and are imported into most EFC application-related standards in the field, including the ones for GNSS/CN systems.
  Since the data defined in EN ISO 14906 is of a general nature, it is also applicable to a number of VAS. Most VAS require data regarding the vehicle or require some means of payment, such as provided by EN ISO 14906. Thanks to the availability of data definitions of a sufficiently generic nature for several road traffic related telematics applications, to a limited extent EN ISO 14906 already provides for synergies between EFC implementations and VAS. The examples provided in Annex A clearly demonstrate that this type of synergy is already being exploited in some EFC systems.

— EN 15509 on an *Interoperability application profile for DSRC.* This profile standard defines an interoperable EFC application for EFC systems and is already widely deployed in Europe. It will be one of the core building blocks of the EETS.
  EN 15509 does not foresee any specific elements for VAS, but the examples given in Annex A show that the standard is already being used for VAS, such as providing for an extended scope of the payment means including parking lots and ferries. Vehicles equipped with DSRC OBE are also being used as probe vehicles for traffic status monitoring. Processing DSRC transactions can provide information on traffic density but also on travel times. Since such an application involves an element of tracking and tracing the vehicle, it is crucial that the privacy of the user is respected. In its current form, EN 15509 does not offer explicit support for such applications.

— CEN ISO/TS 17575 on the *Application interface definition for autonomous systems* comes in four parts, where part 1 on *Charging* and part 3 on *Context data* is most relevant for the purpose of this TR. This series of documents defines the basic data exchange messages between the back-end and front-end systems in GNSS/CN based EFC systems.
  While CEN ISO/TS 15575 does not explicitly make provisions for VAS, the basic data exchange mechanisms might easily be adapted for several conceivable VAS. The availability of GNSS location information and of a wide-area communication resource in particular, makes GNSS/CN OBE platforms for delivering VAS very promising.

In summary, EFC standards have the potential to be useful platforms for defining VAS services, but no explicit reference to VAS is currently made.

5.3 ITS Applications Context

5.3.1 Beneficiaries of the services

Many diverse ITS applications are operational and many more are envisaged for introduction in the near future. Clause 6 lists the most relevant applications and, for convenience, groups them into classes.

In order to understand the context of the diversity of ITS applications, Figure 2 might be helpful. This figure classifies the domain of ITS applications from the perspective of "who benefits", i.e. from the perspective of the ultimate beneficiary.

— Several ITS applications are mandated by a **regulator** for the general benefit of society, especially with regard to **heavy vehicles**. Such applications include the digital Tachograph, eCall, diverse access control regimes to inner cities, and tolling for internalising the external costs of heavy vehicle traffic. **Light vehicles** are far less regulated. Manual toll payment is an option on all current systems. The automatic emergency call service eCall will most likely be the first regulatory application for light vehicles.

— ITS applications for the benefits of the road or EFC **operator** have low visibility since they are delivered in the back office. Nevertheless, the value generated can be comparatively large. Although heavy vehicles are usually better equipped with OBE, data from light vehicles is of more value to road operators for monitoring traffic, for traffic flow analysis and statistics, for the purpose of prediction and infrastructure planning and for real time traffic information provision. Real time traffic information in particular, is an added value that can be deployed to the Service User as a visible benefit from his toll payments.

— ITS applications that address the **road user** cannot be considered as being directed at a single homogeneous user group. Users might be drivers of private cars, truck drivers or even operators of vehicle fleets, be it a fleet of internationally operating trucks, a fleet of regional delivery vans, or a taxi fleet. Obviously, this segment of the market is quite fragmented. Clause 6 will define application classes that make further analysis more practical than looking at individual applications.

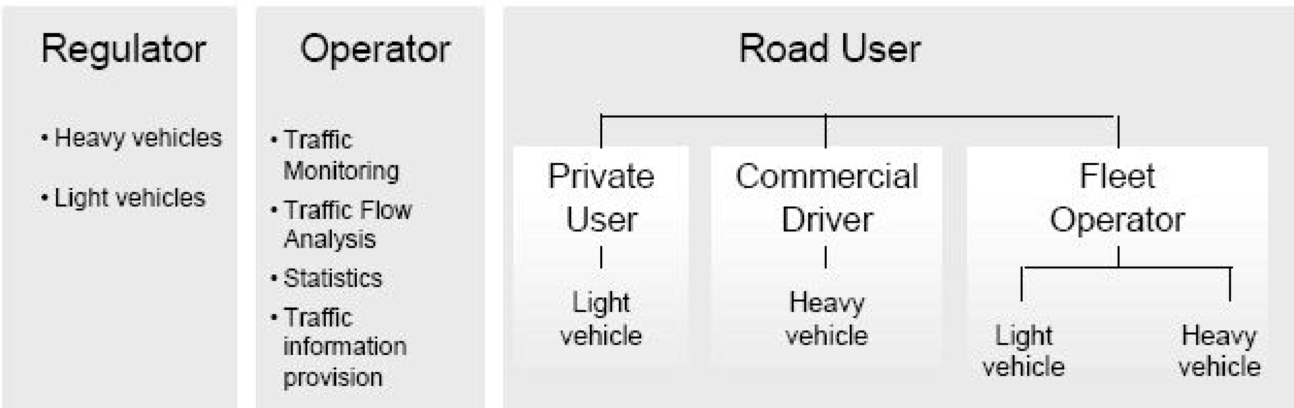

Figure 2 — Classification of OBE-based ITS Applications by user type

5.3.2 ITS Action Plan

In December 2008, the European Commission issued an Action Plan on the deployment of ITS in Europe (see ITS Action Plan in the Bibliography). The Action Plan aims "to accelerate and coordinate the deployment of Intelligent Transport Systems in road transport, including interfaces with other transport modes."

The Action Plan outlines six priority areas for action. For each area, a set of specific actions and a timetable are identified. Fulfilling these by setting a framework to define procedures and specification will call for the mobilisation of Member States and other stakeholders.

The main policy objectives to be achieved are "for transport and travel to become:

- cleaner,
- more efficient, including energy efficient,
- safer and more secure."

Several of these actions are of immediate relevance to the topic of VAS in EFC system. The analysis in this TR is set against this policy background. Conclusions drawn from the analysis shall lead to the support of specific actions defined in the Action Plan.

Especially noteworthy are Actions 4.1 and 4.4 which request the development of an open in-vehicle platform architecture for the provision of ITS services and applications, where the outcome of the activity would be submitted to the relevant standardisation bodies.

The detailed actions set out in the six priority areas are listed in Table 1.

Table 1 — Action areas defined in the ITRS Action Plan

1	Action Area 1: Optimal use of road, traffic and travel data	**Target date**
1.1	Definition of procedures for the provision of **EU-wide real-time traffic and travel information services**, addressing notably the following aspects: – provision of traffic information services by the private sector – provision of traffic regulation data by the transport authorities – guaranteed access by public authorities to safety-related information collected by private companies – guaranteed access by private companies to relevant public data	2010
1.2	Optimisation of the collection and provision of **road data** and traffic circulation plans, traffic regulations and recommended routes (in particular for heavy goods vehicles)	2010
1.3	Definition of procedures for ensuring the **availability of accurate public data for digital maps** and their timely updating through cooperation between the relevant public bodies and digital map providers, taking into account the results and recommendations of the eSafety Digital Maps Working Group	2011
1.4	Definition of specifications for data and procedures for the free provision of **minimum universal traffic information services** (including definition of the repository of messages to be provided)	2012
1.5	Promotion of the development of national **multimodal** door-to-door **journey planners**, taking due account of public transport alternatives, and their interconnection across Europe	2009 to 2012
2	Action Area 2: Continuity of traffic and freight management ITS services on European transport corridors and in conurbations	
2.1	Definition of a set of common procedures and specifications to ensure the **continuity of ITS services** for passenger and freight in transport corridors and in urban/interurban regions. This work should include benchmarking and standardisation on door-to-door information flows, interfaces, traffic management and travel planning, and, in particular, event and emergency planning	2011
2.2	Identification of ITS services to be deployed in support of freight transport (**eFreight)** and development of appropriate measures to progress from concept to realisation. Particular attention will be given to applications for goods tracking and tracing using state-of-the-art technologies such as RFID and EGNOS/Galileo-based location devices	2010
2.3	Support for the wider deployment of an updated multimodal **European ITS Framework architecture** for intelligent transport systems and definition of an **IST framework architecture** for **urban transport mobility**, including an integrated approach for travel planning, transport demand, traffic management, emergency management, road pricing, and the use of parking and public transport facilities	2010
2.4	Implementation of the interoperability of **electronic road toll** systems	2012 / 2014
3	**Action Area 3: Road safety and security**	
3.1	Promotion of deployment of advanced driver assistance systems and safety and security-related ITS systems, including their installation in new vehicles (via type approval) and, if relevant, their retrofitting in a used one	2009 to 2014
3.2	Support the Implementation Platform for the harmonised introduction of pan-European **eCall**, including awareness campaigns, upgrading Public Service Access Points' infrastructures and an assessment of the need for regulation	2009
3.3	Development of a regulatory framework on a safe on-board **Human-Machine-Interface** and the integration of nomadic devices, building on the European Statement of Principle	2010

	on safe and efficient in-vehicle information and communication systems	
3.4	Development of appropriate measures including best practice guidelines concerning the impact of IST applications and services on the safety and comfort of **vulnerable road users**	2014
3.5	Development of appropriate measures including best practice guidelines on **secure parking places** for trucks and commercial vehicles and on telematics-controlled parking and reservation systems	2010
4	**Action Area 4: Integration of the vehicle into the transport infrastructure**	
4.1	Adoption of an **open in-vehicle platform architecture** for the provision of ITS services and applications, including standard interfaces. The outcome of this activity would then be submitted to the relevant standardisation bodies.	2011
4.2	Development and evaluation of **cooperative systems** in view of the definition of a harmonised approach; assessment of deployment strategies, including investments in intelligent infrastructure	2010-2013
4.3	Definition of specifications for infrastructure-to-infrastructure (I2I), vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communication in co-operative Systems	2010 (I2I) 2011 (V2I) 2013 (V2V)
4.4	Definition of a **mandate for the European Standardisation Organisations** to develop harmonised standards for ITS implementation, in particular regarding cooperative systems.	2009-2014
5	Action Area 5: Data security and protection, and liability issues	
5.1	Assess the **security** and personal **data protection** aspects related to the handling of data in ITS applications and services and propose measures in full compliance with Community legislation.	2011
5.2	Address the **liability** issues pertaining to the use of IST applications and notably in-vehicle safety systems	2011
6	Action Area 6: European ITS cooperation and coordination	
6.1	Proposal for a legal framework for European **coordination** on the Europe-wide deployment of ITS	2008
6.2	Development of a **decision-support toolkit** for investment decisions in ITS applications and services. This should include a quantified evaluation of the economic, social, financial and operational impact and cover aspects such as user acceptance, life-cycle cost/benefit as well as the identification and evaluation of best practice for facilities procurement and deployment	2011
6.3	Development of **guidelines** for the public **funding** from both EU (e.g. TEN-T and Structural Funds) and national sources of ITS facilities and services based on an assessment of their economic, social and operational value	2010
6.4	Set-up of a specific **ITS collaboration platform** between Member States and regional/local governments to promote ITS initiatives in the area of **urban mobility**	2010

5.4 European Projects

5.4.1 General

Several European research projects have addressed the topic of multi-application platforms, open ITS architectures, and role models for joint service delivery.

The most relevant projects are

— Universal On-Board Unit (UOBU)

— Global System for Telematics (GST)

— GNSS enabled Services Convergence (GSC)

Some further projects, especially with respect to cooperative systems, also have some relevance for the topic of VAS.

5.4.2 Universal On-Board Unit Project (UOBU)

Universal On-Board Unit has been a project sponsored by the European Commission. Its objective has been to investigate the options to create a universal in-vehicle platform capable of delivering a wide variety of telematics services. In 2006, the project has published a final report with concrete conclusions (see UOBU 2006 in the Bibliography).

By means of the UOBU project, the EC has been assessing the need and scope for consolidation of the in-vehicle applications of particular interest to public authority objectives. This would be carried out with a view to bringing the essential harmonised features of location, identification and time in every vehicle. The ultimate goal is to consolidate the common requirements of the in-vehicle applications into one secure on-board unit, the Universal On Board Unit (UOBU), using open standards and ensuring interoperability.

The fundamental concept of a UOBU is as a platform which:

— is installed on-board the vehicle; and

— provides low-level (elemental) services, such as vehicle location and identification, universal time, and communications, to a range of applications (such as eCall, EFC, digital Tachograph, amongst others) in an open, safe and appropriately secure architecture.

The core work of the UOBU project shows that:

— It is possible to consider the concept as a platform to be installed on-board a vehicle that provides elemental services of location, time, identification and off-vehicle communications to higher-level applications.

— It is possible to define the system level requirements for the UOBU platform, encompassing performance requirements for the provision of the elemental services as well as security requirements for the system to ensure data is handled appropriately. Furthermore, mature and emerging technologies can be used to implement this unit at reasonable cost.

— An architecture can be considered, which is inclusive, catering for those users who require only one application (potentially mandated), as well as users who seek the use of several applications. Furthermore, this architecture promotes the concept of on-board telematics service provision and the associated institutions involved.

5.4.3 Global System for Telematics Project (GST)

GST is an EU-funded Integrated Project that has been coordinated by ERTICO. GST has created an open and standardized end-to-end architecture for automotive telematics services. It is an open telematics system concept for vehicles, their drivers and passengers but also targets nomadic devices such as PDA's and mobile phones.

The purpose of GST is to create an environment in which innovative telematics services can be developed and delivered in a cost-effective manner, and hence to increase the range of economic telematics services available to manufacturers and consumers. The focus of GST is on developing "open systems"; the openness relates to the ability of the architecture to support common mechanisms for the removal, updating and installation of new services and applications. Standards are necessary for the key interfaces such that the complexity and heterogeneousness of the supporting technologies are hidden.

The vision of the GST project is that an open market for telematics services will emerge (see Figure 3). This market will be easily accessible:

— for Service Providers to offer their services

— for end-users to consume the services.

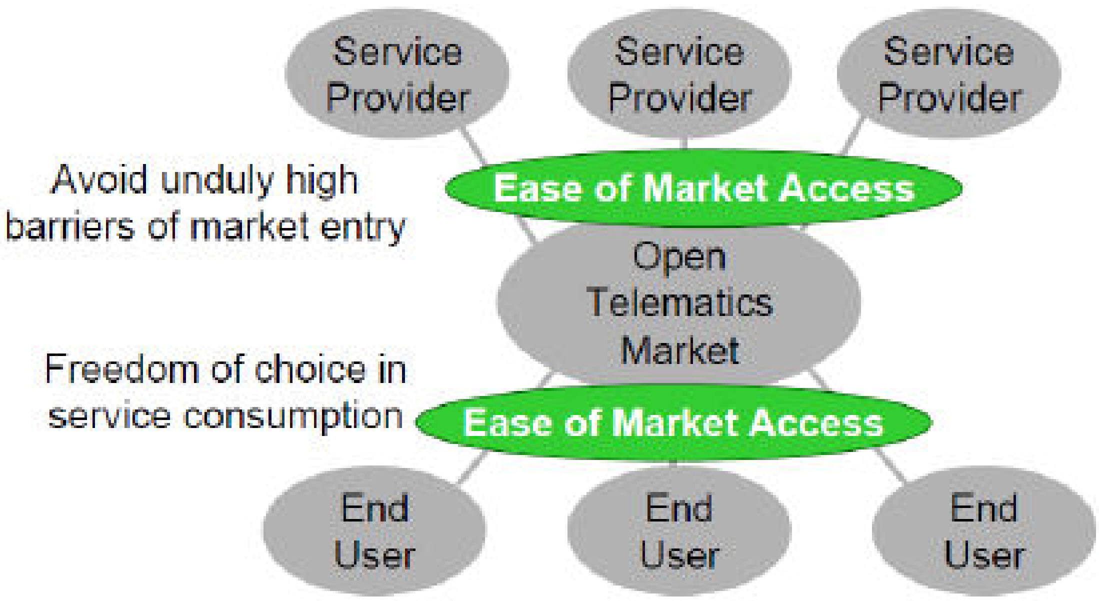

Figure 3 — An open market for telematics services

The GST role model

The project analysed and summarised the GST roles as follows (see also Figure 4)

The **Service Provider** is the entity who constructs, deploys, and operates a Service Centre, which offers one or more ITS Value Added Services (VAS), delivering more value to Service Users. For certain services, the Service Provider requires content, which is delivered by his Content Providers. These content providers are incorporated into the business processes of the Service Provider itself.

The **Service Aggregator** manages from its Control Centre multiple end-users and their platforms. The Service Aggregator is responsible for registration of users (platforms), authentication, service provisioning, subscription and the subsequent download of service applications, service updates, remote administration and all other required management procedures on a platform.

A **Service User** is the person using the services on a platform in the vehicle. The Service User pays a fee for the consumed service to the Service Provider. The Service Aggregator is the enabler for this service.

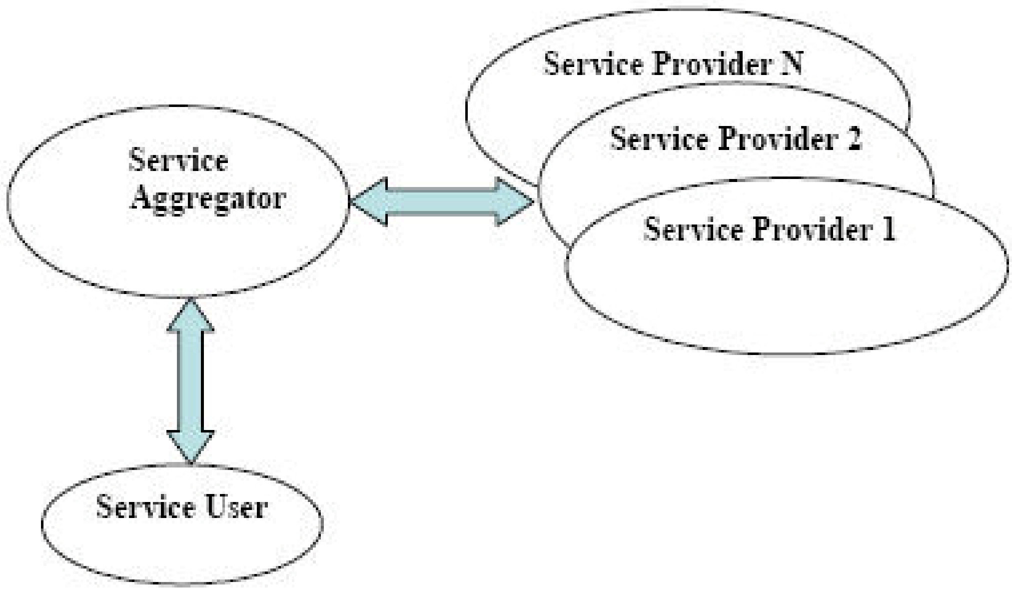

Figure 4 — GST/CVIS high-level role model

Technical view

GST is based on the idea of an open market for servicing, constructed via four processes:

— Content delivery: the activity of providing the content via a Service Application;

— Service deployment: the activity of transferring the Service Application from Service Provider to Service Aggregator (Control Centre User), registering it in the Control Centre and its various administrative systems and publishing it for the end-user to select, and/or subscribe to and execute a service;

— Service provisioning: the activities of providing end-users with all necessary means to consume a service. This usually involves registering users for the service, issuing the appropriate authorization, making the necessary adjustments in the respective registries and control systems and application download. Application download is the activity of downloading the Service Application from the Control Centre to the Client System or platform;

— Service execution.

See also Figure 5 for the GST roles and relations. For more details see the GST project and especially GST Del. 1.3, see Bibliography.

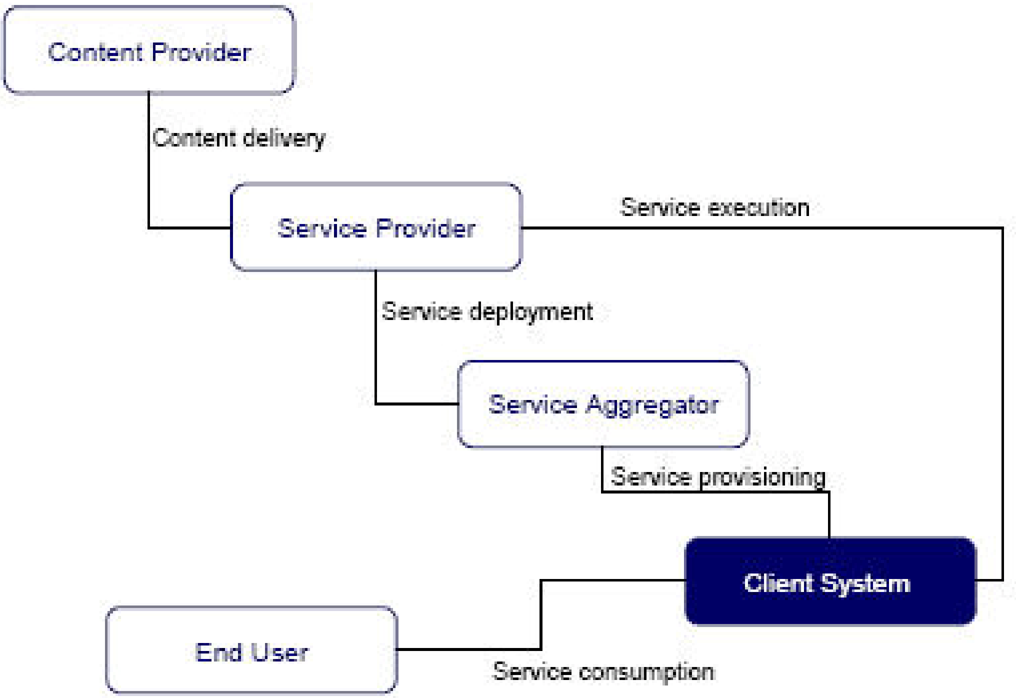

Figure 5 — GST roles and relations

5.4.4 GNSS enabled Services Convergence Project (GSC)

GNSS enabled Services Convergence is a European research project funded through the Galileo Supervisory Authority under the 7th Framework Programme. This project started in March 2009 and is scheduled to end in February 2011. The goal of GSC is to bring existing results of the following projects together into a single context in order to overcome the real world challenge of co-existence of multiple services:

— Road user charging: the CESARE and RCI projects;

— Telematics based services: the GST and CVIS projects.

The GSC project establishes conditions for an open and competitive mass market of GNSS-enabled road transport services. The project identifies the specifications and requirements for GNSS-enabled converged tolling and ITS VAS services that run on the same in-vehicle equipment.

The GSC project not only demonstrates the technical feasibility of the 'multiple services platform' but also presents an analysis and recommendations with respect to the feasibility of market deployment.

Role Model

The following main roles have been identified:

— Service Generator (VAS or Toll Charger)

— Service Aggregator (for VAS and EETS)

— Service User

The (RCI) Toll Charger is the equivalent of the (GST) Service Provider. In order to prevent conflicts the more generic name **Service Generator** is used.

The (RCI) Toll Service Provider / EETS Provider is the equivalent of the (GST) Service Aggregator; both make services available for the driver by offering a payment method for this service. The more generic term **Service Aggregator** is therefore used.

The (RCI) Service User is the equivalent of the (GST) Service User. In both cases, the Service Users make use of a service. Payment in GST could however differ with the payment methods of RCI; the term **Service User** is therefore retained.

Figure 6 shows the GSC role model. For greater transparency, the EETS Provider is shown within the bubble “Service Aggregator”. At the top of the figure, the service generators are shown, comprising commercial and public services (ITS services) as well as the Toll Charger. The Service User is the client, consuming a public or commercial service, or driving along tolled infrastructure (tolling business). The Service Aggregator is the enabler of both public and commercial services, as well as the Toll Service.

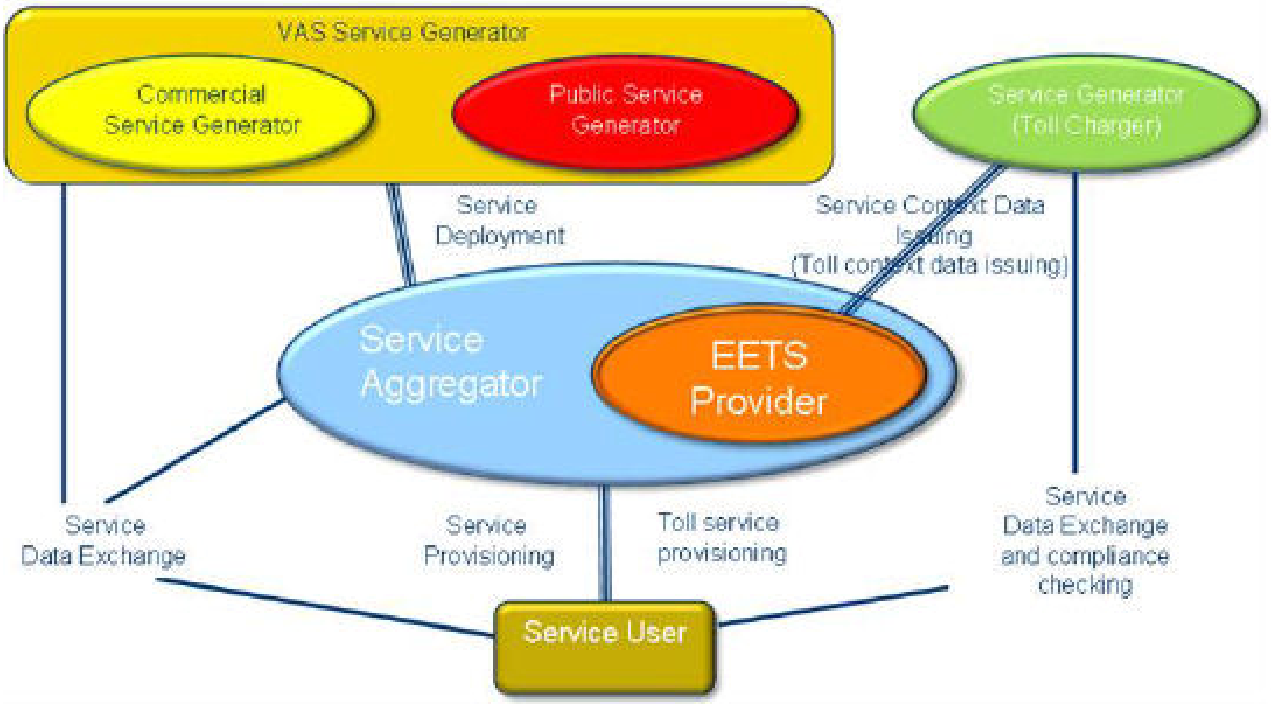

Figure 6 —GSC Role Model (from GSC Del 2.1)

Comparison of the RCI/CESARE and GST/CVIS projects indicates that the EETS Provider of the CESARE /RCI or EETS world involves heavy responsibilities, in contrast to the GST / CVIS where responsibilities are light and not stringently defined.

The main conclusion is that the responsibility of the Service Aggregator is at least identical with the responsibility of the EETS Provider (ETSP).

Business Model

For VAS, the relations between Service Generator, Service Aggregator and Service User depend on the different business models that have to be considered. GSC will evaluate the following business models:

Business model 1 (“App Store” type): The Service Aggregator hosts all services and provides the Service User with information about available services. The Service Generator is responsible for creating a contract with the Service User in order to provide service content data and payment information. Contracts also exist between Service Generator and Service Aggregator, Service Aggregator and Service User, Service Generator and Service User. This results in a “Multiple contracts, multiple invoices” scenario.

Business model 2 (EETS type): The Service Generator deploys a service to the Service Aggregator. The Service Aggregator hosts all services and provides the Service User with information about available services. The Service Aggregator is responsible for provision of a service whenever a Service User subscribes for a service. There are contracts between the Service Generator and the Service Aggregator, the Service Aggregator and the Service User. From the Service User perspective, this results in a “one contract, one invoice” model.

For more details, see Bibliography, GSC Del 2.1. “GNSS-enabled Services Convergence WP2 System Requirements and Role Model High level Role Model Deliverable D2.1”.

5.4.5 Further European Projects

One strategy objective of the research programme of the European Commission is the improvement of the free exchange of persons and goods through the development and deployment of traffic telematics applications. Besides the aforementioned projects, focussed on different aspects of a future multi-application telematics architecture, further projects within this strategic scope are also relevant to this technical report.

COOPERS (CO-Operative SystEms for Intelligent Road Safety)

COOPERS is a European research, development and innovation activity within the Call 4 (Co-operative Systems and in-vehicle integrated safety systems) of the 6th Framework Programme by the European Commission Information Society and Media. COOPERS focuses on the development of innovative telematics applications for road infrastructure with the long-term goal of a “Co-operative Traffic Management” between vehicle and infrastructure, to mitigate any emerging gaps in the development of telematics applications between the car industry and infrastructure operators. The goal of the project is to enhance road safety via direct and up-to-date traffic information, and communication between infrastructure and motorised vehicles on a motorway section. COOPERS started in February 2006 with a planned duration of 48 months.

CVIS (Cooperative Vehicle Infrastructure Systems)

The CVIS objectives are to create a unified technical solution allowing all vehicles and infrastructure elements to communicate with each other in a continuous and transparent way using a variety of media and with enhanced localisation; to enable a wide range of potential cooperative services to run on an open application framework in the vehicle and roadside equipment; to define and validate an open architecture and system concept for a number of cooperative system applications, and develop common core components to support cooperation models in real-life applications and services for drivers, operators, industry and other key stakeholders; to address issues such as user acceptance, data privacy and security, system openness and interoperability, risk and liability, public policy needs, cost/benefit and business models, and roll-out plans for implementation.

Within the main blocks of Core Technologies, Cooperative Applications, Test Sites and Deployment Enablers, the CVIS sub-projects will produce the following key results:

— a multi-channel terminal capable of maintaining a continuous Internet connection over a wide range of carriers, including cellular, mobile Wi-Fi networks, infra-red or short-range microwave channels, ensuring full interoperability in the communication between different makes of vehicle and of traffic management systems;

— an open architecture connecting in-vehicle and traffic management systems and telematics services at the roadside, which can be easily updated and scaled up to allow implementation for various client and back-end server technologies;

— techniques for enhanced vehicle positioning and the creation of local dynamic maps, using satellite positioning, radio triangulation and the latest methods for location referencing;

- extended protocols for vehicle, road and environment monitoring to allow vehicles to share and verify their data with other vehicles or infrastructure nearby, and with a roadside service centre;
- application design and core software development for:
- cooperative urban network management, cooperative area destination-based control, cooperative acceleration/deceleration and dynamic bus lanes;
- enhanced driver awareness and cooperative traveller assistance on inter-urban highways;
- commercial vehicle parking and loading zones booking and management, monitoring and guidance of hazardous goods and vehicle access control to sensitive areas;
- deployment toolkit in the form of models, guidelines and recommendations in the areas of openness and interoperability; safe, secure and fault-tolerant design; utility, usability and user acceptance; costs, benefits and business models; risks and liability; cooperative systems as a policy tool; and deployment of road-maps.

EURIDICE (EURopean Inter-Disciplinary research on Intelligent Cargo for Efficient, safe and environment-friendly logistics)

Euridice is an integrated project funded by EU's Seventh Framework Programme ICT for Transport Area. The basic concept of Euridice is to build an information services platform centred on the individual cargo item and on its interaction with the surrounding environment and the user.

The EURIDICE project has the following main objectives:

- Supporting the interaction of individual cargo items with the surrounding environment and users on the field.
- Improving logistics performance by applying the intelligent cargo concept and technologies, utilized by operators and industrial users.
- Developing collaborative business models to sustain promote and develop intelligent cargo infrastructure.
- Realizing more secure and environmentally friendly transport chains through the adoption of intelligent cargo to support modal shift and door-to-door intermodal services.

SAFESPOT

The "added value" of SAFESPOT is to enhance safety by combining information from vehicles and from the infrastructure. The focus is on R&D activities and identification of cooperative solutions which can initially be applied to critical areas, such as the so-called "black spots".

SAFESPOT aims to:

- Use the infrastructure and the vehicles as sources and destinations of safety-related information and develop an open, flexible and modular architecture and communication platform.
- Develop the key enabling technologies: ad-hoc dynamic network, accurate relative localisation, dynamic local traffic maps.
- Develop and test scenario-based applications to evaluate the impacts on road safety.
- Define a sustainable deployment strategy for cooperative systems for road safety, evaluating any related liability, regulations and standardisation aspects.

The SAFESPOT co-operative system is composed of the following communicating elements:

- Intelligent vehicles equipped with on board co-operative systems.
- Intelligent infrastructure including roadside units.
- Safety centre(s) and/or Traffic centre(s) which are able to centralize or forward safety information coming from the intelligent vehicle and/or the intelligent infrastructure.

5.5 ITS Standardisation

5.5.1 General

Responsibility for the international standardisation of ITS lies with CEN ISO and ETSI. These two organisations work partly in parallel and partly in joint working groups. Specific information regarding the work programme and the produced work, is available on the websites of each organisation.

5.5.2 CEN/TC 278

The scope of CEN/TC 278 Road Transport and Traffic Telematics is defined as follows (see scope section of the CEN/TC 278 website http://www3.nen.nl/cen278/):

"Standardisation in the field of telematics to be applied to road traffic and transport, including those elements requiring technical harmonisation for intermodal operation in the case of other means of transport.

In respect of VAS, CEN/T C278 shall address the following elements:

- vehicle, container, swap body and goods wagon identification;
- communication between vehicles and road infrastructure;
- communication between vehicles;
- in-vehicle human machines interfacing as far as telematics are concerned;
- traffic and parking management;
- user fee collection;
- public transport management;
- user information."

In particular, the following Working Groups are active within the context of VAS:

- CEN/TC 278/WG 2 Freight and Fleet Management systems (see ISO/TC 204 WG7)
- CEN/TC 278/WG 4 Traffic and traveller information (see ISO/TC 204 WG10)
- CEN/TC 278/WG 8 Road traffic data
- CEN/TC 278/WG 12 Automatic Vehicle Identification and Automatic Equipment Identification (joint with ISO/TC 204 WG4)
- CEN/TC 278/WG 13 Architecture and terminology (see ISO/TC 204 WG1)

- CEN/TC 278/WG 14 After theft systems for the recovery of stolen vehicles
- CEN/TC 278/WG 15 eSafety
- CEN/TC 278/WG 16 Co-operative systems

5.5.3 ISO/TC 204

ISO/TC 204 comprises the following working groups, which are specifically focussed on ITS:

WG1 Architecture

WG1 is preparing standards related to information and methods to be shared within the ITS sector; common use of terms, sharing of concepts, and unification of methods to describe documents and data.

WG3 ITS Database Technology

Many ITS services use geographical information. In particular, geographical information is of critical importance for the ever-growing field of car navigation services. In other services, geographical information is often necessary to give information and instructions. For this reason, WG 3 is studying standard plans for interfaces to exchange geographical information, in a variety of situations.

WG4 Automatic Vehicle Identification/Automatic Equipment Identification

WG 4 is in charge of standardization of items necessary for interoperability between systems regarding AVI/AEI, an automatic identification system for vehicles and equipment via such simple media as tags. Initially, WG4 discussed standardization themes on surface transportation such as trucks. An intermodal AVI/AEI system was then added as a further topic.

WG7 General Fleet Management and Commercial/Freight Operations

Subject to this standardization are the data dictionary and message sets for supporting the exchange of information on hazardous materials, and automatic identification and monitoring. This standard could possibly be applied to various forms of communication media, such as DSRC and cellular phones.

WG10 Traveller Information Systems

Traveller information systems, subject to standardization by WG 10, constitute a core part of ITS. This working group is studying data dictionaries and message sets which could provide information for drivers through various media, such as radio broadcasting, DSRC, cellular phones and digital broadcasting.

WG14 Vehicle/ Roadway Warning and Control Systems

This is a central element of ITS involving in-vehicle control technology, which is directly linked to drivers. The purpose of “Driver support systems control” is to reduce driver workload, improve convenience, and increase awareness of danger, as well as preventing accidents and avoiding damage via the use of advanced technologies. Examples of systems already on the market include adaptive cruise control (ACC) and forward vehicle collision warning.

Contents regarding “vehicle/roadway warning and control systems” with a view to international uniformity of systems are subject to standardization. The work covers wide-ranging areas from vehicle control, sensing of and communications with external information, as well as driver interfaces.

WG16 Wide Area Communications

Main work items consist of CALM (Communications Air-Interface, Long and Medium Range) areas and probe areas.

CALM stands for "Communications Access for Land Mobiles" and a set of ISO standards specifying an infotainment communications platform for Intelligent Transport Systems.

The CALM standards provide a standardized set of air interface protocols and parameters for seamless mobile communications via a single medium or multiple media, including existing communication technologies, CALM specific communication technologies, and enabling future communication technologies, networking protocols and upper layer protocols, in order to enable efficient ITS communications services and applications.

More recent additions to ISO/T C204 are the following two working groups, which are also relevant to the issue of VAS:

WG17 Nomadic Devices

WG18 Cooperative Systems

5.5.4 ETSI TC ITS

The European Telecommunications Standards Institute has created a new Technical Committee TC ITS with the ToR to develop standards, specifications and other deliverables to support development and implementation of ITS Service provision across the network, for transport networks, vehicles and transport users, including interface aspects and multiple modes of transport and interoperability between systems.

The TC ITS is organised into 5 working groups, as follows:

- WG1 - User & Application requirements.
- WG2 - Architecture and cross layer issues.
- WG3 - Transport and Networks.
- WG4 - Media & Media related issues.
- WG5 - Security.

The basic set of applications comprises four elements:

- Definitions; Functional requirements;
- Cooperative awareness;
- Decentralized environment;
- Operational requirements.

6 ITS Applications

A large number of ITS applications is in commercial operation, and an even larger number is being investigated or proposed for introduction. In order to assess the potential and requirements of ITS applications for delivery as VAS to EFC, it is necessary to structure the field by combining similar applications into application classes.

ITS applications are best grouped into classes based on the nature of the service they provide to the user. The applications within each class are of the same logical type and share a common set of functional and technical requirements. Grouping these applications into classes enables a more efficient and coordinated approach to the development of solutions.

The approach to class applications builds on the original list of applications and domains defined within ISO 14813-1. The eleven domains defined within the ISO standard serve as a framework for developing ITS-related concepts of operation, and the standard recommends that further ITS architectures should adopt the structure best suited to their ultimate purpose, rather than directly mapping to the eleven defined domains. This report therefore organises applications into ten output-based classes, to best serve the development of common functional and technical specifications:

1) Fleet management;
2) Entertainment;
3) Payment;
4) Cooperative road safety;
5) Driver assistance;
6) Communications;
7) Navigation & traffic information;
8) Traffic data collection;
9) Vehicle usage recording;
10) Regulatory applications.

Each class is briefly outlined below, including a general description of each application within the class. These applications represent a selection of VAS which either already exist or have been proposed in preceding standards such as ISO 14813-1. This list is not exhaustive and the selected applications are intended only to serve as representative examples of their class.

Class 1: Fleet management

The Fleet Management class spans all VAS applications which enable the user to manage vehicle investment, improve efficiency and reduce overall transportation costs. Users of fleet management include a wide range of operators across both heavy vehicle and light vehicle sectors.

Tracking and tracing

Tracking and tracing applications allow the user to monitor the location of vehicles remotely in real time. The geo-coordinates of the vehicle are determined by GPS and transmitted via the OBE to the user, where the vehicle location may be viewed on an electronic map. Users mainly include commercial fleets and public transit operators.

Stolen vehicle tracking

Stolen vehicle tracking is a specific example of tracking and tracing where an RF or GPS transponder within the OBE enables police to identify and recover the stolen vehicle by activating the application and then following the signal.

Vehicle performance monitoring

Vehicle performance monitoring is an application which measures impact on efficiency and running costs via sensor input to the OBE. This data is transmitted to the fleet operator either in real time or periodically, to enable analysis and ongoing performance improvements.

Driver performance monitoring

Driver performance applications represent a specific example of vehicle performance monitoring whereby the OBE gathers data on driver style including gear changes, speed and acceleration. This data is monitored by the fleet operator and compared with benchmarks or other vehicles to identify improvement opportunities through driver training and other solutions.

Fuel Management

Fuel Management applications represent a further specific example of vehicle performance monitoring whereby fleet operators can monitor fuel consumption and other fuel related parameters such as mileage, hours of operation and engine idling time. This data may be combined and analysed to track performance and identify improvement opportunities.

Class 2: Entertainment

Entertainment applications include all those which provide the driver and passengers with media and information services transmitted from a remote source. These applications enable multi-media downloads to the OBE which then reroutes the data to on-board devices such as a visual display, portable media player or PDA.

Media Downloads

Media download applications enable the user to access entertainment such as music, images, video and web-content via an integrated ‘in-dash’ interface or portable multi-media receiver within the vehicle.

Personal data synchronisation

Synchronisation applications allow the driver or other vehicle occupants to connect remotely to the internet, email and other data sources, enabling synchronisation of data within on-board devices.

Class 3: Payment

Payment applications enable mobile, wireless transactions for services such as EFC for toll roads, parking, ferries, drive-through restaurants and pay-at-pump refuelling stations. EFC is treated separately in this report as the base application and is therefore not included within the payment class.

Payment transactions are enabled within the OBE via a DSRC component or other short-range wireless communications component. Transaction authorisation, confirmation and other data may also be routed to in-dash or mobile display devices within the vehicle to provide a user interface.

Extended EFC for Parking and Ferries

EFC based on DSRC technology may be extended in scope and application domain to pay for parking and ferries. The EFC application communicates with roadside equipment, so that the EFC system can detect whether a vehicle is enrolled in the payment service as it passes a charging point, and can then electronically debit the account of the registered user without requiring the vehicle to stop. A similar extension with GNSS/CN-based EFC technology has not yet been demonstrated to date.

Drive-through payment

Payment applications may be expanded to include additional services such as fast-food restaurants where the user purchases goods or services without leaving the vehicle.

Pay-at-pump

Payment of fuel at service stations represents another specific example of a payment application. The processes performed by this application include user identification, pump activation, authorization, payment and confirmation.

Class 4: Cooperative road safety

Cooperative road safety applications are designed to improve traffic management control, increase the efficiency and effectiveness of road transport, and improve the overall driver experience.

These applications are based on communication between vehicles and roadside equipment (V2I) as well as communication between different vehicles (V2V). A mobile interface provides the driver with relevant information regarding accurate traffic jam estimations, weather conditions, road shape, speed and distance from nearby vehicles. The driver is also able to enter data into the interface for use by other vehicles. Further information is generated by on-board sensors and previously stored data.

Class 5: Driver assistance

Driver assistance applications are designed to improve vehicle safety and road safety. Several of these applications require functionality which can be delivered via an OBE. These include eco-drive assistance, in-vehicle signage, lane deviation warning, intersection management, lane change assistance and traffic light optional speed advice. Each application delivers information to the driver via an in-dash interface or safe mobile HMI.

Eco drive assistance

Eco-drive applications improve fuel efficiency by providing advisory information to the driver, based on in-vehicle data such as acceleration, deviations from optimal cruising speed and external data related to traffic and road conditions.

In-vehicle signage

Drivers may receive on-board alerts and reminders of the speed limit, road works and other information posted on roadside signage. This is achieved using an in-vehicle signage application which utilizes the OBE to receive information from roadside transmitters, to be displayed via an integrated or mobile HMI.

Lane deviation warning

OBE-based applications can issue lane deviation warnings via optical detection or via V2V communications.

Lane change assistance

In addition to providing lane deviation warnings, OBE-based applications can also assist with lane changes, based on detection of safe gaps between nearby vehicles.

Intersection Management

Intelligent OBE-based intersection management applications will be responsible for vehicle control and route guidance through intersections via collaboration with other vehicles, and possibly without the need for any centralized control such as roadside signalling.

Traffic light optimal speed advice

Applications which communicate with intersection signalling systems can provide drivers with advice on optimal speeds to reduce braking and acceleration around intersections, and thereby improve journey times and fuel efficiency.

Class 6: Communications

Communications applications include both proactive access to external data by the driver as well as externally-generated information issued to the driver by a third party. Proactive driver access includes email and internet-based communication, as well as web-enabled e-commerce transactions. Externally initiated communications include employer communications to commercial drivers as well as marketing alerts from roadside or other sources.

Internet access

Internet access applications utilize the OBE to establish a remote world-wide-web or email connection for communication, e-commerce or access to any other online functionality.

Company & Marketing communications

OBE-based applications also support externally generated data, which can then be displayed on-board to the driver. Examples include employer communications for commercial drivers as well as marketing alerts from on-road Service Providers such as petrol stations.

Class 7: Navigation & Traffic information

Navigation and traffic information applications can provide the driver with route guidance and other location-based functionality, by utilizing a GPS component to acquire position data, which is then combined with a mapping database and other information sources. These applications include route guidance, congestion alert and avoidance, points of interest, parking availability and traffic alerts.

Route guidance

Route guidance applications provide the driver with advice that facilitates travel between an origin and a destination, through the use of a visual HMI displaying a map or other directional information.

Congestion alert and avoidance

The OBE provides a platform for receiving traffic congestion alerts from a central source, based on vehicle transponder signals from mobile phones, OBEs or roadside equipment. These applications may also provide avoidance functionality in combination with a route guidance system.

Points of interest

Points of interest may be marked on a visual on-board display, providing the driver with relevant information such as location of petrol stations, rest areas and other services. Points of interest are uploaded to the OBE and combined with the route guidance application, where the driver can view the information via the on-board display.

Parking availability

The OBE provides a platform for applications which identify to the driver the location of available parking bays via communication with roadside parking equipment.

Traffic information

Traffic information applications inform the driver of any congestion as well as weather and road conditions. These may include information such as location of road works, temporary road closures and optimal journey times.

Class 8: Traffic Data Collection

Traffic data collection applications provide authorities with valuable information for managing existing roads infrastructure and planning future projects by generating statistics on road usage over time.

Traffic monitoring applications utilize an OBE to transmit floating car data such as location and speed, to a central database where the data is then combined, providing drivers with road usage advice such as congestion warnings. Authorities can also exploit this data in the design of future infrastructure projects.

Traffic data recording

Traffic data recording is the generic term for collecting data on road use, be it for statistical purposes, for planning purposes or other objectives such as allocation of revenue.

Real time traffic data acquisition

Real time traffic data is collected and distributed for immediate use either to inform road users on traffic conditions or to help traffic management to decide on measures.

Class 9: Vehicle usage recording

Vehicle usage recording applications provide a driver's log by automatically collecting information on distance travelled, time of travel and potentially also route data. This information is captured by a black box recorder within the OBE enabling Service Providers such as vehicle insurers to generate user-specific offers and alternative pricing models such as 'pay-as-you-drive'. Commercial fleet operators could also utilize vehicle usage recording data to manage their vehicles more effectively.

Class 10: Regulatory applications

Regulatory applications include all those required by law or developed to facilitate compliance by providing relevant data to the appropriate authorities. Examples of regulatory applications, which can be supported by the OBE include eCall, Tachograph reading, hazardous goods monitoring and livestock transport tracking, access control, quota management and enforcement applications.

eCall

The eCall application will enable the provision of rapid assistance to drivers involved in a collision anywhere in the European Union.

Tachograph

Tachograph readings may be reported via an OBE-enabled application which stores Tachograph data, from which mileage reports may be generated and transmitted.

Hazardous goods and livestock transport tracking

The tracking of hazardous goods and livestock is a legal requirement and can be enabled via an OBE-based application which receives sensor input and ensures this lies within acceptable limits.

Access control and management of quotas

Access control applications allow authorities to monitor compliance with access regulations such as the use of restricted roads by heavy goods vehicles, or use by any vehicle of inner-city areas subject to additional charges such as the London Congestion zone. Quotas such as eco-points may be managed using a similar approach.

Enforcement applications

OBE-based enforcement applications assist authorities in monitoring and controlling driver speed and compliance with other road rules. Enforcement applications may also assist in vehicle detection.

7 Architecture

7.1 Different view points

Architecture is a generic term used for the conceptual description of the layout and structure of systems. In accordance with the ODP model (ISO/IEC 10746), system architectures can be defined at different levels and from (a combination of) different viewpoints.

For an analysis of VAS to EFC systems, two perspectives are particularly relevant, namely:

— The business perspective, or Enterprise Viewpoint, which focuses on the actors and stakeholders, system control and governance, and commercial service provisions and exploitation models, described below in the business architecture.

— The perspective of the technical delivery platform, or Information, Computational and Engineering Viewpoint, which focuses on the data associated with the service, the components of technical service delivery, and their interfaces and interactions, described in a conceptual manner by the technical architecture.

These two perspectives are described in the sub-clauses below.

A communications architecture for ITS Systems focussed on the Engineering and Technology Viewpoint can be found in draft ETSI EN 302 665 Intelligent Transport Systems Communications Architecture. This draft standard specifies a global communication architecture for Intelligent Transport Systems communications.

7.2 Business Architecture

The business architecture for ITS applications in this report is defined by six main stakeholder groups, as listed below. This architecture is proposed based on output from the European Projects described in 5.4. The purpose of this sub-clause is to provide a description of the roles, functional processes and relationships for each of the six stakeholder groups, see Figure 7:

1) Service User;

2) Toll Chargers;

3) Value-added Service Providers (VAS Providers);

4) Authorities;

5) Service Provider for Electronic Fee Collection (EFC SP);

6) On-road Service Integrator (ORSI).

Service User

The Service User group consists of road users and recipients of transport-related value-added services. This group is represented either by the vehicle operator, the driver or the owner depending upon the nature of the service and the contract terms. In the case of private vehicles the driver and owner will both be the same user. The Service User for commercial vehicles will mainly be the fleet manager in the case of tolling and operator-specific VAS offers but may also be the driver for certain VAS offers. The Service User is responsible for selecting a toll Service Provider for any road usage within a charged network or networks. The Service User does not need to procure separate tolling services for each individual toll charger network. A single tolling offer spanning all relevant charged networks may instead be procured from an Electronic Fee Collection Service Provider (EFC SP) which integrates all tolling services. This structure is aligned with the EETS Service Provider model defined in the EETS Directive and allows the Service User to procure all tolling services through a single business relationship. The EFC SP supplies the Service User with an OBE and the Service User is responsible only for ensuring that the OBE is operating correctly. All other operational tolling processes such as fee calculation are managed by the EFC SP.

In addition to receiving a tolling service, the Service User may elect to receive value-added services enabled by the same OBE. The user may also be required to supply regulatory data generated from the same OBE. These value-added services and regulatory data will be delivered via dedicated applications as described in the ITS Application Section of this report. The Service User requires access to providers of these applications in order to receive value-added services or meet any applicable regulatory data obligations. The procurement of these applications may be achieved via a single relationship with an integrated Service Provider, defined in this report as an ‘On-road Service Integrator’ (ORSI).

A single relationship with the ORSI represents a simple business model for the Service User, based on a clear point of contact for service requests, agreement of contract terms and payment transactions. This single relationship model also ensures reliable delivery of all tolling services, without any risk of comprised performance due to sharing OBE resources with other applications. The operation of the OBE remains the responsibility of the ORSI, which can therefore ensure compatibility between tolling and all other applications, as well as managing overall delivery performance. The Service User may receive VAS from the ORSI either as ORSI-branded services or alternatively as ORSI-hosted services. These two different solutions are each detailed below, under the heading ‘VAS Providers’.

Direct relationships between the Service User and VAS providers are not recommended. This is due to both increased complexity for the user, and increased risk to overall OBE performance, where different applications operating over the same OBE are not centrally managed. The direct relationship model would require users to establish and maintain multiple business relationships with their VAS providers, as well as separately ensuring compliance of each VAS application with the ORSI. This may result in an unclear division of responsibilities for application delivery, given that performance level depends on both the VAS provider as well as the ORSI-controlled OBE. A single relationship is therefore the preferred business model, as shown in Figure 7 below, where the direct relationship between user and VAS provider is struck out.

The Service User requires a direct relationship with both the toll charger (TC) and the Authorities. The toll charger relationship is necessary to ensure that the user complies with all applicable tolling regulations. This relationship includes the aforementioned user responsibilities of selecting a toll collection Service Provider and ensuring correct operation of the OBE, as well as any other requirements set by the TC. A direct relationship between the Service User and authorities is required to ensure that the user meets all applicable regulatory obligations, as detailed in Clause 6 of this report. This relationship may require, for example, that the user ensure provision of the relevant regulatory data via their OBE, and inform the authorities of any change in their user status.

Toll Chargers (TC)

The toll chargers (TC) group includes all owners of road networks, for which a fee is payable by the road user. Toll chargers may operate regionally, nationally or across international borders, but, unlike an integrated tolling Service Provider, do not offer tolling services for all required networks. The recommended business architecture therefore involves delivery of tolling services via an EFC SP rather than directly to the Service User, as this could lead to a large number of agreements, which could also not all be delivered through a single OBE. A direct relationship is therefore recommended between each toll charger and the EFC SP, which can then combine individual fees into a single tolling offer for the Service User. The direct relationship between the TC and Service User is limited to ensuring compliance with all applicable tolling regulations, as outlined in the ‘Service User’ section above.

VAS Providers

The VAS Provider group consists of suppliers of any value-added service to be delivered through an application installed on the OBE. These include services such as communications, fleet management, e-payment, entertainment, cooperative road safety, navigation and traffic information. As stated above, a relationship between each VAS provider and the ORSI will serve as the preferred mode of delivery for value-added services, either via an ORSI-branded model or ORSI-hosting model. The ORSI-branded model applies to all services which do not require any ongoing, direct communication between the user and VAS provider. These may include applications within classes such as fleet management, driver assistance and cooperative road safety, as well as navigation and traffic information.

Services involving technical or functional requirements which hinder full incorporation into the ORSI may be more effectively delivered via the ORSI-hosting model. This method involves the use of the OBE as a delivery platform for services which involve direct contact between VAS provider and user such as internet-based offers with e-commerce capability. The hosting function of the ORSI ensures that the OBE remains centrally managed, thus minimising any risk to performance, stemming from multiple, competing applications. This structure is illustrated in Figure 7 below, where the ORSI-branded model is represented by several lines to different VAS providers, whilst the ORSI-hosted model is indicated by a dotted line linking the VAS provider, ORSI and user.

Authorities

The authorities group includes the government authority of any state which requires regulatory data from an OBE. Authorities require direct access to selected OBE data for monitoring and enforcement of application regulations. A direct relationship is therefore recommended between the ORSI and each relevant authority. The Service User thereby delegates to the ORSI all activities required for submission all regulatory data. A direct relationship between the authority and Service User will also be required to ensure the Service User meets all regulatory obligations, as outlined above, under the heading ‘Service User’.

Service Provider for Electronic Fee Collection (EFC SP)

The Service Provider for Electronic Fee Collection (EFC SP) is the provider of all tolling services to the Service User and represents the primary function of the ORSI. The EFC SP establishes and maintains direct business relationships with all relevant TCs on behalf of the Service User and delivers electronic tolling functionality to the user through the provision of an OBE. The relationship between the EFC SP and user is governed by a single contract spanning each of the charged networks required by the user.

On-road Service Integrator (ORSI)

The On-road Service Integrator incorporates the EFC SP, and is the central stakeholder with direct business relationships to each of the remaining four stakeholders, including the Service User, VAS providers, TCs, and regulatory authorities. The ORSI is responsible for providing to the Service User both tolling services and VAS offers, as well as submitting on behalf of the Service User all required regulatory data. The role and relationships of the ORSI are as described within each of the other stakeholder sections above. An ORSI is additionally required to support the branding of any third party VAS provider. For reasons of European competition legislation, an ORSI shall not restrict branding to its own VAS applications, especially when acting as a Toll Charger and/or Service Provider on behalf of the relevant authorities.

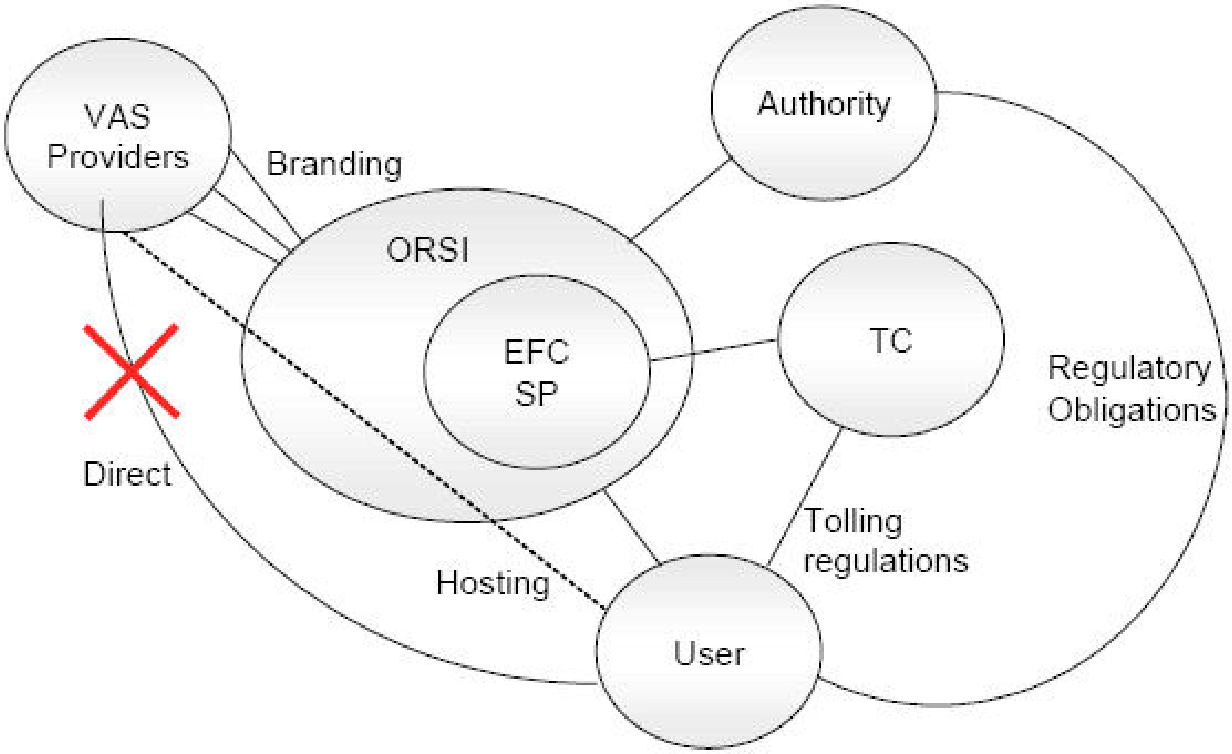

Figure 7 — Business architecture

7.3 Technical Architecture

A technical architecture for VAS on EFC Front-End comprises the technical entities as defined below and shown in Figure 8:

EFC and VAS Front-End

The Front-End for EFC and VAS is composed of an OBE and an optional proxy, according to the general EFC Front-End architecture defined in CEN ISO/TS 17575.

The Front-End is the equipment through which the VAS applications are deployed. Depending on technical requirements, applications may be deployed on the OBE or on the proxy, or on both.

The Front-End generates:

- Information to be transmitted to the user, via the OBE's HMI;
- VAS Data to be further processed in the VAS Provider back-office: Fleet Management data, Entertainment data, Communications data, Payment Data, Traffic Data or Road usage data.

The Front-End interface to the Service Integrator back-office provides for the following exchange of data:

- VAS Data, i.e. the core value added service data which is generated by the Front-End and routed through the Service Integrator Back-office to the VAS Provider back-office;
- VAS applications, updates and geo-data is received from the VAS Provider via the Service Integrator back-office for deployment at the Front-End;
- Payment data and transactions sent to the Service Integrator back-office for further billing and invoicing to the Service User.

Service Integrator Back-office

The Service Integrator Back-office is responsible for managing the VAS applications and deploying them at the Front-End.

The Service Integrator Back-office implements the Customer Relationship Management, billing and invoicing processes of Service Users for EFC, and for selected VAS applications (e.g. payment applications) analogously to the EFC application's case. In this case, payment of VAS Applications is handled between Service Integrator and Service User. The Service Integrator guarantees the payment to the VAS Provider.

The back-office routes VAS Data generated by the Front-End to the VAS Provider back-office.

Roadside infrastructure

Roadside infrastructure provides VAS information directly to OBEs and may also collect data from OBE's or its internal resources or databases. The roadside is not applicable for some applications and is optional for other applications.

Roadside infrastructure either falls within the responsibility of the relevant authority (e.g. the Toll Charger) or may be owned by a specific VAS Provider.

Roadside infrastructure may transmit data to the VAS Provider Back-office such as Road Safety data, Traffic Monitoring Data, etc.

VAS Provider Back-office

The VAS Provider Back-office provides the VAS applications to be deployed on the Front-End to the Service Integrator Back-office. VAS applications include the applications code (software) and a package of geographic application data which is relevant for the specific application (application-specific geo-objects). The geographic application data represents the actual content of the VAS application and may be provided by entities which are external to the VAS Provider (e.g. geographic cards, data on speed limits, etc.).

The VAS Provider Back-office processes VAS data received from the Service Integrator Back-office and provides it:

- to the Service User in an appropriate form (e.g. internet browser) in case of commercial VAS operated by commercial VAS Providers;

— to the relevant authority in case of regulatory applications or traffic monitoring data operated by mandated VAS Providers such as Toll Chargers.

The VAS Provider Back-office implements the Customer Relationship Management, billing and invoicing processes of Service Users for selected VAS applications where payment is not handled by the Service Integrator. In this case, the payment of VAS Applications is handled between VAS Provider and Service User according to the payment or service usage data received by the VAS Provider from the Service Integrator.

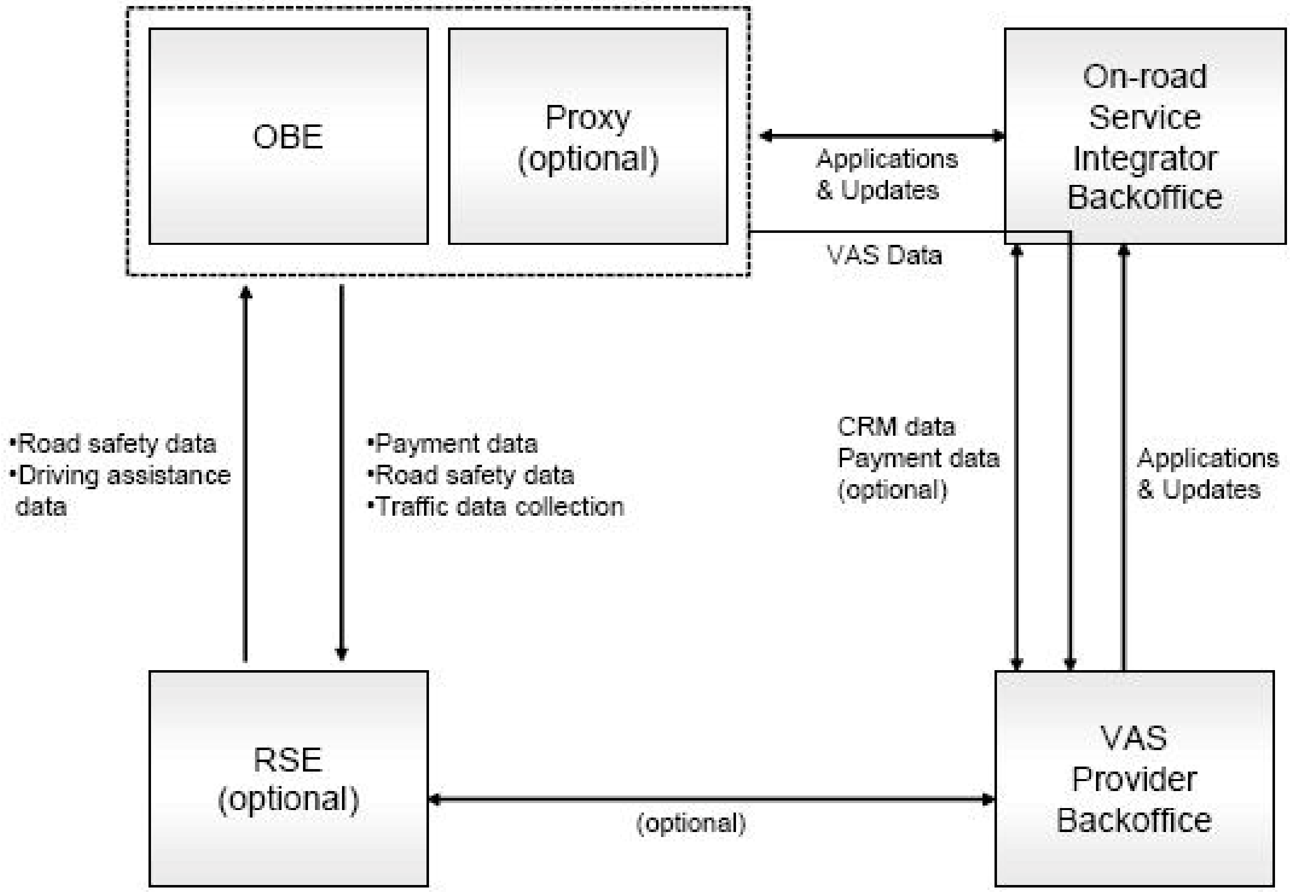

Figure 8 — Technical Architecture

8 Requirements of Applications

8.1 Requirements of VAS applications

8.1.1 Introduction

Each of the following sub-clauses summarizes for a specific application class the main requirements of the OBE and Front-End. These requirements are grouped into six functional areas and presented in tabular form for each application class. The tables are to be read as lists of requirements per functional area only (columns); there is no logical connection between entries in the same line.

The six functional areas include collected data, OBE communication services, the OBE HMI, VAS output to the central system, operational characteristics and roadside infrastructure. Each of these functional areas is outlined below.

1. Collected Data: data collected autonomously by the OBE including:

— the vehicle movement data (positions, driven distance, heading, speed, acceleration, etc.);

— the vehicle's status (ignition active, motor running, etc.) incl. trailer (trailer presence, load information, etc.).

Collected Data may comprise data collected through:

— Positioning or inertial sensors e.g. GNSS, inertial sensors;

— Connection to the in-vehicle network or to the odometer;

— Specifically installed sensors (door opening sensor, trailer presence sensor);

— Optical recognition – Cameras;

— Electromagnetic recognition – Radars.

Collected data does not comprise data collected through external communication interfaces

2. OBE's Communication Services: data communication service which is available in the Front-End for connection:

— to a back-office system (CN or other wide-area technology);

— to roadside infrastructure (DSRC or medium range technology).

3. HMI on OBE: interaction services with the user for:

— Notifications to the user, i.e. the output of the applications as information to the user;

— Input required from users, i.e. information provided by the user while not available via other interfaces (status declarations).

4. VAS Output (Central System): result of the VAS application for:

— Authorities, in case of regulatory applications;

— The Service User, i.e. the customer (not the driver) via central system service;

— The VAS Provider.

5. Operational characteristics: assurance level regarding the operational characteristics of the Front-End services for VAS applications

— The level of availability of the Front-End's services;

— The level of performance of the Front-End's services;

— Integrity and security of the Front-End's services.

6. Roadside infrastructure: the availability of information within a dedicated and defined range of the carriageway (DSRC-based RSE) or from manual interaction with the user (pump, payment terminal):

— Generic information provided by a roadside infrastructure, e.g. localization augmentation information;

— Application-specific information, e.g. information for road-safety applications;

— Interaction with manual payment systems.

8.1.2 Requirements of the Fleet Management application class

Fleet management applications require input data on the vehicle, the driver and the load. This includes real-time position data, and additional optional inputs such as fuel consumption, driving time, speed, distance, driver identity, driving style and load status. An HMI may additionally be required to input driver- and load-related data. These applications also require the functionality to convert raw data into useful fleet management information for customers.

Table 2 — Requirements of the Fleet Management application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Actual real-time position (essential)	CN connection to Back-office, directly or via proxy	Driver information: driving time (optional)	Fleet management information (to customer)	Availability of CN connection	localization augmentation information where required
Basic Vehicle data e.g. ignition status (important)		Load information in public transport services (number of passengers, optional)			Petrol Station: refuelling data and km reading (manual input by driver)
Advanced Vehicle data (optional): gear status, motor status, fuel consumption, fuel level, etc.					
Driver data (optional): driver identity, driving time (from digital tachograph)					
Load Information (vehicle-specific): temperature, door status, trailer presence					

8.1.3 Requirements of the Entertainment application class

Entertainment applications require a high performance CN connection to the back-office. A graphic display and keyboard are also required, and may be provided either through an HMI or via a connection to a user device such as PC or PDA.

Table 3 — Requirements of the Entertainment application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
None	CN connection to the Back-office (internet), either directly or via the proxy	Graphic Display and keyboard (alternative to connection to PC /PDA)	None	Availability of CN connection	None
	Local connection to the user's personal PC / PDA (e.g. Bluetooth)			Performance of CN connection	

8.1.4 Requirements of the Payment application class

Payment applications require secure, high-integrity payment data as well as DSRC roadside infrastructure equipped with an HMI. An HMI on the OBE may also be required to confirm payment.

Table 4 — Requirements of the Payment application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
None	DSRC interface to the roadside infrastructure	Notification of payment to the user	Payment transactions (to ORSI)	Integrity/Security of payment data	Payment is performed by the roadside infrastructure
					User Authentication via HMI at the roadside (for specific services, with high payment risk)

8.1.5 Requirements of the Cooperative Road Safety application class

Cooperative Road Safety applications depend on communication services for OBE to OBE, OBE to roadside equipment, and a CN connection to the back-office. An HMI is also required for driver alerts. Availability of other equipped vehicles and appropriate roadside equipment is a further requirement.

Table 5 — Requirements of the Cooperative Road Safety application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
None	Vehicle to Vehicle (i.e. OBE to OBE) communication services	Appropriate notification of road-safety messages to the user while driving	None	Availability	Source data directly from other vehicles
	Vehicle to Infrastructure (i.e. OBE to RSE) communication services, e.g. DSRC or medium-range			Performance	Source data from other vehicles via a back-office
	CN connection to the Back-office, either directly or via the proxy			Integrity/Security	Source data via local sensors

8.1.6 Requirements of the Driving Assistance application class

Driver Assistance applications will rely on vehicle movement data from both the OBE and roadside infrastructure, as well as vehicle to infrastructure communication. This data requires optical cameras, radar and other object sensing devices. An in-vehicle HMI is also required for driver assistance alerts.

Table 6 — Requirements of the Driving Assistance application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Vehicle movement data: positions (mandatory), driving direction (optional), acceleration (optional).	Vehicle to Infrastructure (i.e. OBE to RSE) communication services, e.g. DSRC or medium-range	Appropriate notification of driving assistance messages to the user while driving (depending on the specific application)	None	Availability	Information for in-vehicle signage

Optic recognition (cameras) of carriageway, lanes, obstacles, etc.				Performance	Information on driving behavior depending on actual traffic situation (e.g. traffic light optimal speed advisory)
Electromagnetic recognition (radar) of other vehicles, obstacles, crash barriers, etc.					

8.1.7 Requirements of the Communications application class

Communications applications require a CN connection to the back-office and potentially also roadside equipment with appropriate connection. An in-vehicle HMI or connection to a user device such as a PC or PDA will also be required.

Table 7 — Requirements of the Communications application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
None	CN connection to the Back-office, either directly or via the proxy	interactive Graphic display and keyboard	None	Availability	Dedicated RSE (optional) at specific places (rest areas)
	Connection to dedicated RSE (optional)				
	Local connection to the user's personal PC / PDA				

8.1.8 Requirements of the Navigation & Traffic Information application class

Navigation and traffic information applications depend upon vehicle movement data and connection to a traffic information service, as well as an HMI to display relevant driver alerts.

Table 8 — Requirements of the Navigation & Traffic Information application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Vehicle movement data: positions	Connection to traffic information service	Appropriate notification of navigation and traffic-information messages to the user while driving	None	Availability	DSRC beacons (optional)

8.1.9 Requirements of the Traffic Data Collection application class

Traffic Data collection applications primarily require the functionality to deliver traffic volume and traffic flow data, including total number of vehicles and trip duration for specified routes, locations and times. This necessitates vehicle movement data as well as a CN connection to the back office as well as DSRC interface to roadside equipment.

Table 9 — Requirements of the Traffic Data Collection application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Vehicle movement data: positions	CN connection to the Back-office, either directly or via the proxy, and/or:	None	Traffic volume (total number of vehicles) at a certain section, at a certain time (per vehicle class)	Availability	Road usage data (optional): identification of vehicles at focal point (e.g. through an EFC transaction)
	DSRC interface to the roadside infrastructure		Traffic volume (total number of vehicles) for defined routes (defined origin - destination)		
			Traffic flow (driving times) for defined routes (defined origin - destination)		

8.1.10 Requirements of the Road Usage Data application class

Road usage data applications provide road usage data to both the customer and the VAS provider, and therefore require high-integrity vehicle movement data as well as a CN connection to the back office.

Table 10 — Requirements of the Road Usage Data application class

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Vehicle movement data: positions (mandatory), acceleration (optional, only for some applications)	CN connection to the Back-office, either directly or via the proxy	None	Road usage data (to the customer), e.g. log book	Availability	None
			Road usage data (to the VAS Provider), e.g. pay-as-you-drive data	Integrity/Security	

8.1.11 Requirements of the Regulatory application class

The class of regulatory applications is not homogeneous. What makes them a class is the commonality that they are either required by law or that they support compliant behaviour of the user or vehicle. Hence, for this class of applications, not only the standard set of application requirements as for the previous sub-clauses is given, but also some specific regulatory requirements for each application.

eCall

eCall will be a mandated application integrated into all heavy and light vehicles across Europe. Requirements of eCall include crash-proof, high reliability equipment for collection of data on vehicle location, direction of travel, crash sensor and eCall qualifier, as well as a CN connection to a Public Service Access Point (PSAP). The defined European service includes a voice communication facility, where people in the vehicle can talk to personnel at the PSAP. Emergency assistance services in a less stringent definition, such as the services already offer by some car manufacturers, may not include the voice communication service.

Table 11 — Requirements for eCall application

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Vehicle location, vehicle travel direction, crash sensor, eCall qualifier (i.e. automatic or manual trigger)	CN connection to PSAP (Public Service Access Point)	Manual alarm button; Microphone and speaker for voice communications	eCall data to PSAP; Voice communications with PSAP	Availability	None
				Integrity/Security	
				Crash proof and failure safe equipment	

Tachograph

The Tachograph is a mandated piece of hardware for all heavy and commercial passenger vehicles, and requires type approval under a specific regime, according to a comprehensive technical specification, which is prescribed by legislation. The Tachograph must also be installed by a certified installer and requires regular calibration for each individual vehicle. Data requirements include distance, speed, travel time and driver identity. Hardware must include a chip card and HMI with speed indicator and printer.

Table 12 — Requirements for Tachograph application

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Distance, speed and travel time deducted from tyre revolutions; driver identity	Chip card	Speed indicator; printer	None	Availability	None
				Integrity/Security	
				Calibration	

Hazardous goods and livestock transport tracking

Functional requirements are prescribed within several European Directives for the tracking of livestock and hazardous goods transportation. Data to be collected and forwarded to authorities may include route, hazard identification and bay temperature. In case of livestock transport tracking dedicated personnel at the roadside needs to be able to read-out tracking data when stopping the vehicle. This can be provided either through printing facilities at the OBE (as it is nowadays) or more cost-effectively via DSRC and dedicated handheld devices. A printer could be connected to such handheld devices instead of equipping each OBE with a printer.

Table 13 — Requirements for hazardous goods and livestock transport tracking applications

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Route (location over time)	CN (for hazardous goods); CN connection optional for livestock tracking	Printer optional	Tracking data (to authorities), for hazardous goods transport	Availability	Roadside enforcement possible
For hazardous goods: Identification of hazard	DSRC communication to be supported for Enforcement tracking			Integrity/Security	
For livestock: bay temperature					

Access control and management of quotas

Regulations require that access control and quota management applications correctly identify the vehicle or vehicle class, via a valid identifier such as the licence plate, emissions class or driver residence status. These applications must therefore collect data on vehicle or driver identity, and enable access transactions between the road user and authorities. Communications equipment is also required to enable DSRC communications between OBE and roadside equipment.

Table 14 — Requirements for access control and management of quotas applications

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Vehicle or driver identity	DSRC	None (or confirmation of communication success)	Access granting transactions (to authorities)	Availability	DSRC or LPR equipment
				Integrity/Security	

Enforcement applications

Shared requirements of all enforcement applications include vehicle and driver identification, speed, location and time data, and the provision traceable records, such as compliance checking transactions.

Table 15 — Requirements for enforcement applications

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Speed, location, time (application dependent)	DSRC (application dependent)	None	Compliance Checking transactions	Availability	DSRC (application dependent)
Vehicle or driver identity / driver's licence data				Integrity/Security	

8.2 Requirements of EFC application

8.2.1 High Level Requirements

The high level requirements of an EFC System can be expressed as follows:

The EFC System must ensure correct income to the Toll Charger;

The EFC System must ensure fair and equal treatment of users;

The EFC System must be simple and transparent for its users;

The EFC System must ensure reasonable operational costs to the Service Provider.

Those high level requirements are broken down into functional, performance and security requirements for the OBE / Front-End in the next sections. The Front-End is under the responsibility of the Service Provider.

8.2.2 Functional Requirements

The responsibilities of the Service Provider translates into a set of technical requirements to their EFC System components which are described in the form of requirements to the interoperable interfaces of the system.

The main functional requirement for an EFC System is that its interfaces are at all time compliant to the relevant standards. This allows correctly collecting fees or enforcing users which are not compliant with the rules of the toll domain.

This requires that at such interfaces:

- Communication media and protocols are available;
- Application data objects are available for transmission at required moments in time.

The interoperable interfaces in an EFC System are:

- The back-office interface between Toll Charger and Service Provider, see prEN ISO 12855;
- The DSRC interface between the Service Provider's OBE and the Toll Charger's RSE. This interface can be used for a variety of purposes. The applications associated with this interface in the context of EFC are:
  - Charging, i.e. the collection of fees via the DSRC interface, see EN 15509;
  - Compliance Checking, i.e. checking of the compliance of the road use with the local toll regime, see CEN ISO/TS 12813;
  - Localisation Augmentation, i.e. the provision of localisation augmentation data to the OBE, see CEN ISO/TS 13141.

This means that the requirements of the EFC application imposed by the OBE are:

- To provide data to the Service Provider's back-office (proxy) or directly to the Toll Charger (for autonomous EFC systems only);
- To make data available at its DSRC interface for the charging, compliance checking and localisation augmentation purposes.

In addition to this, the HMI interface between Service Provider's OBE and the User is relevant as a basis for the user's legal obligation to cooperate.

The HMI must indicate to the driver whether he is allowed to use a defined set of toll domains. This information shall be available prior to and during the journey, and provides the legal basis for Toll Chargers to exercise enforcement if a user does not comply with the rules of a toll domain.

This results in the following requirements of the EFC application in respect of the OBE's HMI behaviour:

- Outside of any toll domain: to check the technical status of the OBE and to indicate this status to the driver either continuously or on demand;
- Inside DSRC based systems: to indicate the result of the transaction (technical and/or contractual status) as provided by the RSE;

- Inside autonomous systems: to indicate continuously the technical and contractual status of the OBE (where available) with respect to the use of the OBE in a pre-defined set of toll domains.

In order to ensure an open toll service market, **users must be freely allowed to choose and/or change Service Provider with an acceptable burden in terms of money and time**. This means that either:

- The OBE is Service Provider-specific and can be easily installed in and de-installed from the vehicle, or

- The OBE is suitable for use with various Service Provider Systems and can be linked to the contracts of various Service Providers .

Note that, in the second case, the portability of the OBE has some restrictions since, according to the general architecture for EFC Front-End (see CEN ISO/TS 17575), OBEs may be linked to an optional proxy, and in those cases the OBE is proxy-specific.

8.2.3 Performance and accuracy requirements

Performance and accuracy requirements are toll domain-dependent and are defined in the Toll Charger's toll domain statement.

Performance requirements mainly apply to the DSRC communication from OBE to RSE. The nature of the communication link is such that it is only briefly available (depending on the vehicle's speed) and a missed communication would imply uncollected fees and/or an unwarranted enforcement event.

The OBE must therefore meet defined performance requirements of communication via the DSRC interface with the RSE of a given toll domain for the aforementioned purposes.

This generally implies that a properly operated OBE shall comply with the state-of-the-art performance figures of reference equipment (e.g. the adopted OBE population) with compliant (reference) RSEs under any situation permitted by the definition of the toll domain.

Accuracy requirements apply for autonomous systems where the localisation technology itself is restricted or not fully defined, or where the subsequent processing of raw location data is manufacturer and Service Provider-dependent. For example in the context of the EETS, autonomous systems shall employ GPS localisation but may also use other means of localisation such as inertial sensors, connection to the odometer, etc. Further examples include sensor fusion, map-matching or filtering processes.

The Front-End must therefore meet defined accuracy requirements of the charge data. The accuracy requirements may be of a different nature depending on the type of required charge data (level of processing).

This implies that the data from the required sensors is available and processed correctly, transparently and in a traceable way by the Front-End to produce charge data.

8.2.4 Security Requirements

The main assets in an EFC System are the charge data and the data for compliance checking.

The main high level security objectives of the EFC data security are:

The charge data shall be protected against unintentional or intentional manipulation, change or deletion.

This means that source data (localisation data, e.g. GPS fixes or DSRC transaction records) shall be collected and processed in order to protect or detect manipulation, change or deletion.

This broad requirement translates into more specific requirements for authenticity, integrity and availability of the charge data provided and the processes hosted by a Front-End.

The charge data shall be court-proof to provide a legal basis for fee collection and enforcement.

This means that source data shall be collected and processed transparently and in a traceable way so as to validate the charge data, used to produce billing details and charge the user's account. This may be necessary in the case of audits of the EFC systems or user claims of incorrect billing details/ charge data or enforcement records.

This broad requirement translates into more specific requirements for authenticity and integrity of the charge data provided and the processes hosted by a Front-End.

Data shall be handled according to privacy regulations

This translates into requirements for the processing of charge data in the Front-End according to Directive 95/46/EC.

8.2.5 Legal and institutional requirements

The legal nature of the charges collected in an EFC system can be very different in different systems. In the case of using a motorway that is operated by a concessionaire, the toll paid is a private levy. This means that the toll is a fee paid for the consumption of a service. Typically such a fee will carry value added tax.

In the case of a national charge for heavy vehicles, such as the systems operated in Germany or Switzerland, the fee is usually legally constructed like a tax. A tax does not convey the right to consume a certain good or service, and is not normally subject to value added tax.

A platform suitable for EFC in different systems must function effectively across a range of different legal environments. In different environments, not only will the legal nature of the charge (private levy or tax) differ, but the liable person may also differ, e.g. the responsible charge payer may be the driver or the vehicle owner or operator, or there may even be joint liability with the Service Provider.

A platform suitable for charging in different EFC systems must be compliant with different legal environments, which requires flexibility in the data security solutions as well as other functionality.

Equipment for EFC is normally not under the full ownership and control of the user. There are usually rules of governance that allocate rights and responsibilities to different actors for some critical processes, such as installing the equipment, entering or altering data with relevance for the tariff, changing identifiers such as the vehicle licence plate or the account number, etc. Governance may be fundamentally different in different EFC systems.

Most issues of governance can ultimately be addressed through a regime of certification and auditing, where OBE is certified by trusted parties and the quality of service provision is audited. A common certification and auditing regime is a prerequisite for any interoperable environment, and hence is one of the pillars of the EETS. Certification of equipment and auditing of processes becomes especially demanding for an open platform.

An open platform for joint delivery of EFC and VAS applications shall be capable of supporting a recognised certification regime for the EFC application without being hampered by the openness of the architecture.

EFC systems are not static, but evolve over time. Tariffs may be increased, tolling laws changed, and networks may be enlarged. Technical solutions also move through lifecycles, in line with hardware and software evolution, constant maintenance and renewal. This requires technical and business solutions that are flexible enough to allow for changes. It has to be noted that changes to telematics equipment and applications occur at a much higher rate than typical vehicle renewal lifecycles.

Charging solutions need to be designed for constant change in the charging rules.

8.2.6 OBE requirements

For the purpose of comparing the EFC application with potential VAS applications with respect to similarities and possible synergies, the following tables give the requirements on the OBE or more generally the Front-End for the EFC application, separately for DSRC and GNSS/CN based systems.

Table 16 — Front-End requirements for EFC in DSRC systems

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Dynamic vehicle classification (e.g. axles number) including trailer declaration.	DSRC Vehicle to Infrastructure (i.e. OBE to RSE) communication services	User declaration of dynamic vehicle classification (axles, trailer)	not applicable	Availability	DSRC beacons
		Feedback on tolling transaction (beep, fee display)		Performance	Enforcement installations
				Integrity/Security	

Table 17 — Front-End requirements for EFC in GNSS/CN systems

Collected Data	OBE Communication Services	HMI Functionality	VAS Output	Operational Characteristics	Roadside Infrastructure
Vehicle movement data: positions and driving direction; Time	CN	User declaration of dynamic vehicle classification (axles, trailer)	not applicable	Availability	Enforcement installations
Dynamic vehicle classification (e.g. axles number) including trailer declaration.	DSRC (for compliance checking)	Feedback on tolling transaction (beep, fee display)		Performance	
				Integrity/Security	

8.3 Applications for VAS

8.3.1 Overview

This sub-clause analyses which ITS applications appear to be most suitable for delivery as VAS together with an EFC service. Suitability is analysed with regard to the two fundamental aspects of the problem:

— **Technical aspects**: This involves an assessment of the technical requirements of the VAS and EFC applications, mainly as captured in the tables contained in the sub-clauses above, to determine whether there is a good fit and where synergies may exist.

— **Business aspects**: Successful delivery of a VAS also requires a fit with the EFC environment in respect of the business aspects, such as a match in the arrangements underpinning institutional setup, certification regime, legal environment and governance. Equipment and service lifecycle considerations must also be incorporated.

The analysis need not be highly detailed, since whether or not an application will be delivered jointly with EFC is ultimately a commercial decision to be reached by the Service Provider. More suitable VAS applications simply require less extra effort and cost for joint delivery and will therefore become "natural candidates" for commercial packaging. For the purpose of this report, it is sufficient to identify the applications with the best fit and concentrate the deliberations later in the report on the best candidates identified.

The table below gives an overview of the suitability of VAS together with an EFC Service in three different types of OBUs: OBE featuring DSRC (only) as used in many current EFC Systems; OBE for autonomous tolling (without DSRC support); interoperable OBU featuring both DSRC and autonomous tolling (e.g. EETS OBE). Details are described in the clauses below.

Table 18 — Overview of VAS Applications suitable for joint delivery

Application Class	DSRC OBE	Autonomous OBE	Interoperable OBE
Fleet Management	-	Suitable	Suitable
Entertainment	-	-	-
Payment	Suitable	-	Suitable
Cooperative road safety	-	-	-
Driver assistance	-	-	-
Communications	-	-	-
Navigation and traffic information	-	-	-
Traffic data collection	Suitable	Suitable	Suitable
Vehicle usage recording	-	Suitable	Suitable
Regulatory: eCall	-	-	-
Regulatory: Tachograph	-	Possibly suitable	Possibly suitable
Regulatory: Hazardous goods and livestock transport tracking	-	Suitable (no enforcement support)	Suitable
Regulatory: Access control and management of quotas	Suitable	-	Suitable
Regulatory: Enforcement applications	Suitable	-	Suitable

8.3.2 Fleet Management

Technical aspects: The sensory requirements of a basic fleet management application are very similar to the requirements of GNSS/CN based EFC. Position versus time plus basic vehicle status is sufficient for most fleet management applications. Additional sensors might be added as required, e.g. sensors indicating trailer presence, door opening, ignition etc. There is also a good synergy between communication requirements, since both EFC and fleet management utilise the CN connection, where fleet management probably requires better availability and shorter latency times.

Business aspects: EFC Service Providers will be eager to extend their scope of service delivery towards fleet management and become true "Service Aggregators" as described within the GSC role model. Security and privacy considerations appear to be non-critical, as long as general security provisions are met to ensure that the VAS application does not interfere with the EFC application. Additionally, in terms of lifecycle, one can expect that users will change or upgrade provider and equipment for EFC and a fleet management VAS concurrently.

In summary, fleet management appears to be an ideal match VAS to EFC for commercial users, i.e. mainly the HGV sector.

8.3.3 Entertainment

Technical aspects: Entertainment applications do not need vehicle sensor data but require a good CN link to a media server plus an on-board media player with sufficient memory. The HMI is also crucial, and must include an audio system as well as several flat panel colour displays with good resolution. There is only minimal synergy between entertainment and EFC technical components.

Business aspects: In business terms, the match between EFC and entertainment applications is low. Security represents a major obstacle, since entertainment applications are resource-hungry and would be difficult to prevent from interfering with an EFC application that requires certification, high availability, integrity and performance. Furthermore, with regard to commercial players, the typical entertainment content providers will not be well positioned to market an EFC application.

In summary, there is little synergy between the world of payment for road use and in-vehicle entertainment.

8.3.4 Payment

Technical aspects: EFC is essentially a payment application and hence there is a natural match to other road-related payment applications. Technically, the synergies are high, especially for local payment applications based on DSRC. In principle, there might also be synergies between GNSS/CN based tolling and payment applications, since the most important asset is a central account payment connection.

Business aspects: Extending the scope of EFC payment to payment for additional road-related services is a natural step in business development and will most likely see more widespread deployment with the advent of the EETS, which is essentially a payment platform with European coverage.

In summary, extending the scope of payment from EFC to related areas is both technically and in business terms a natural step with few implementation barriers.

8.3.5 Cooperative road safety

Technical aspects: Although the communication requirements and some sensory data appear to be similar at first glance, the technical fit between cooperative systems for road safety and EFC is less than ideal. Safety-related applications require far higher availability and real-time performance than EFC.

Business aspects: It is not expected that cooperative road safety applications will be delivered in a Service Provider model akin to EFC or as envisaged by the GSC project for VAS. In addition, equipment with road aspects will need type approval, which is a very different approval regime than the certification foreseen for EFC and the EETS. In terms of lifecycle, road safety systems will probably be fitted inside the vehicle upon purchase and will remain for a lifetime, whereas EFC and other VAS equipment will have faster renewal periods.

In summary road safety applications and EFC have no potential for joint delivery.

8.3.6 Driver assistance

Technical aspects: Driver assistance applications are less safety critical than the cooperative road safety application treated in the above sub-clause. Nevertheless, requirements regarding availability and timeliness of the communication channels are higher than for EFC. Some sharing of communication channels and sensors might be conceivable, but synergies such as those listed for driver assistance, are very limited and will mainly be restricted to GPS and accelerometer data.

Business aspects: Driver assistance applications follow a different model from EFC. In driver assistance, the focus lies on driving the car and not on an off-board service delivery as in EFC. Equipment lifecycles, technical maintenance and payment contracts all follow very different paradigms.

In summary, EFC might share some technical resources with driver assistance systems, but there is no potential for joint delivery in business terms.

8.3.7 Communications

Technical aspects: There is a certain technical match between EFC and communications applications, at least in so far as the CN interface might be used as a shared resource. The communications application will otherwise require an extended HMI, i.e. a keyboard and a high resolution display. It can be argued that the major cost components of the communications application will not be the CN link but rather the HMI and the browsing application, and hence the synergies are limited.

Business aspects: For an EFC Service Provider there is little to gain in providing additional communication services. The provision of the CN link is a source of income for the network provider rather than for the EFC or VAS Service Provider. Communication services are the natural realm of PDAs and other nomadic devices. An EFC OBE will not be able to compete successfully with such offers.

In summary, communications services are not expected to be a driver for VAS to EFC due to limited technical synergies and strong competition from nomadic devices which are tailored for this application.

8.3.8 Navigation and traffic information

Technical aspects: There is a good match with regard to basic location requirements and communications. A GPS receiver might well be used both for EFC and for navigation. There is however no synergy with regard to the requirements of on-board maps, which necessitate a good resolution and display.

Business aspects: Navigation has become a pervasive application in private cars. As such, it cannot be expected that navigation will be delivered as a VAS to EFC, but rather via a separate, pre-existing device.

In summary, joint delivery is conceivable in principle, especially since sharing of the GNSS and CN resources might be attractive, but there may be no business necessity. Since the market of navigation devices is very competitive and dynamic, the certification of EFC devices (and the necessary stability of the devices on the market to reduce continuous certification costs) is also an obstacle to joint delivery.

8.3.9 Traffic data collection

Technical aspects: EFC equipment is used to determine the amount of road usage. As such, the technical match between applications is close to perfect.

Business aspects: Traffic data collection creates additional value to the road operator in the first instance, and not to the road user paying for the EFC equipment and service. This fact creates some conflict of interest. In DSRC systems, the road usage information comes for free and automatically to the Toll Charger, whereas in GNSS/CN based systems this is not necessarily the case. Especially in systems with intelligent client OBE, where data aggregation occurs on the OBE, trip detail is unavailable to the road operator and the data will arrive with a temporal delay rendering them useless for life management purposes. In addition, there is a privacy issue where data anonymity must be ensured.

In summary, technically, there is an excellent match between traffic data collection and EFC, as exemplified by national implantations described in Annex A. In business terms privacy issues have to be addressed.

8.3.10 Vehicle usage recording

Technical aspects: The technical match is excellent. EFC OBE determines the amount of road usage, which gives most basic information required to record vehicle usage. Specific applications require additional sensory information, such acceleration or speed data, but these are quite readily available in EFC OBE.

Business aspects: EFC Service Providers will strive to complete their services offer with extended data recording options. There is also an excellent match in terms of customer base, security and privacy requirements and availability requirements.

In summary, vehicle usage recording is both in technical and in business terms a natural extension of the business offer of an EFC Service Provider and hence a VAS, with few barriers to implementation.

8.3.11 Regulatory applications

eCall

Technical aspects: eCall equipment must be deeply integrated into the vehicle. eCall requires crash sensors, i.e. information regarding airbag deployment. Only the CN functionality appears to be common between eCall and EFC. Sharing the CN communication resource also however creates problems: eCall requires unconditional access to the communication channel, and also requires a voice channel. The requirements for eCall are also very high with respect to crash-proof and failure-safe hardware. eCall boxes must remain functional even in the case of an accident, which is not a requirement for EFC equipment.

Business aspects: The eCall application is not based on a Service Provider model comparable to EFC and the EETS. The eCall in-vehicle component consists of hardware plus a communications contract. The service is provided by the PSAP, i.e. the rescue services (police, ambulance, etc.). The paradigms of eCall and EFC are also very different in terms of lifecycle, certification and manufacturer liability.

In summary, eCall and EFC have no potential for joint delivery or meaningful integration of on-board resources.

Tachograph

Technical aspects: Currently, the Tachograph is specified as a technical device and the specification goes into detail, e.g. prescribing the technical requirements of speed pulses sensor, chipcard, the printer, etc. Hence, there is no possible sharing of resources with other devices. Nevertheless, commonalities with EFC do exist on a functional level, where the purpose of the Tachograph is to register working and rest hours. This creates synergies such as the shared need for distance and time recording and the need for tamper proof design.

Business aspects: Tachograph is not delivered as a service, but as a registration device. There is no business for a Service Provider. Lifecycles are also very different: The Tachograph is integral to the vehicle upon delivery and remains for a lifetime. EFC equipment is usually an after-sales installation with shorter turn around periods. Additionally, the institutional setup is very different.

In conclusion, there is no good match between EFC and the Tachograph as specified today. It is conceivable, however, that in the future "Tachograph" might be defined more functionally, allowing for implementation of the functionality on more open platforms. In this case, synergies might be high – especially since the Tachograph is a mandatory device in commercial vehicles and as such could serve as the "killer application" which opens the market for VAS.

Hazardous goods and livestock transport tracking

Technical aspects: Technically, both applications are based on a track-and-trace functionality, plus additional sensory information (bay temperature for livestock) and load data (for hazardous goods), where synergies with EFC are quite strong. The availability, security and integrity requirements are also similar.

Business aspects: Both tracking applications can quite readily be delivered with the help of the Service Provider. The market volume is very low, however. For livestock tracking, there are only about 5 000 vehicles in Europe equipped for long-distance transport of animals. It is quite conceivable that the EETS might generate interest amongst Service Providers to offer assistance in these tracking applications.

In conclusion, the tracking of hazardous goods and of livestock has high potential for joint delivery with EFC. The deployment of the EETS may additionally support the European wide enforcement of such applications by enabling the exploitation of synergies with the existing tolling systems. This may deliver a business advantage by reducing the cost to be met by the authorities.

Access control and management of quotas

Technical aspects: Synergies are high. Both applications are quite similar to EFC. Management of quotas may even be seen as a form of payment with special quota-tokens. The similarity between applications is already exploited today e.g. access control to restricted areas in Italy, detailed in Annex A.

Business aspects: Access control and quota management are consistent with a service provision model as foreseen in the EETS. Security, availability and integrity requirements also match quite well. Furthermore, the applications of payment and access management are quite similar and are subject to comparable institutional and governance arrangements.

In summary, EFC, access control and quota management are closely related both technically and in business process terms, and have high potential for joint delivery.

Enforcement applications

Technical aspects: A variety of road traffic and transport compliance checking applications exists. Technical requirements are quite similar to EFC in many cases, as evident from the requirements table in 8.1.11. The operational requirements regarding availability, integrity and security match closely.

Business aspects: By their very nature, enforcement applications are not usually delivered as services. Nevertheless, in the case where a certain application becomes mandatory, a Service Provider may play a role in the delivery of this application. In Europe, such arrangements are not known yet, but in other countries private Service Providers are engaged by commercial vehicle operators to assist them in fulfilling their legal obligations. In some European countries, such concepts are currently being studied. E.g. there are attempts to allow repeated speed offenders to keep their driving licence if they agree to be tracked by an OBE which is operated and checked for speed events by a private Service Provider. Australia has already introduced a concept of delivering compliance applications via private Service Providers, as outlined in Annex B.

In conclusion, enforcement applications may quite easily be supplied via EFC equipment and arrangements, but the business aspects suffer from the fact that these applications are handled in a one-to-one relationship between the vehicle operator or driver and the authorities and are traditionally not delivered via third parties.

9 Integration of VAS with EFC

9.1 Introduction

In the sub-clauses below, the VAS which have been identified as potentially suitable for integration into an EFC platform are analysed in more detail. The VAS requirements are compared to the requirements of the EFC application according to the following main aspects:

— Availability of data, including eventual synergies and/or missing elements;

— System of governance, including responsibilities of the roles in relation to the service and the collected data;

— Operational and security requirements.

9.2 Fleet management

The core data required for fleet management is positioning data, which is already available in the EFC Platform, with characteristics of defined accuracy and availability, but this data needs to be made available to the VAS Provider (centrally). Where and how such data is made available in the EFC platform strongly depends on the type of implementation of the Front-End. In particular, edge heavy-implementations (see CEN ISO/TS 17575), are not well suited for supporting fleet management applications due to the amount, type and frequency of data transmitted. This implies that a more edge-light data processing and transmission logic to the proxy/central system needs to be implemented in the EFC platform in order to support fleet management applications.

Additional data is required only in some very specific fleet management applications, i.e. data related to the vehicle, the driver and load information. This data is not typically available in an EFC platform or may only be available in very limited form (e.g. the ignition status of the pulling vehicle). Missing data could be collected through a driver's declaration via an appropriate extended HMI interface, through data collected from the in-vehicle network, and/or via additional application-specific sensors.

The input data is collected by the ORSI's EFC platform and made available to the VAS Provider's application for further processing. The responsibility of the ORSI is confined to providing the data collected for EFC purposes, to be used for this additional service. The responsibility for providing the service to the customer lies with the VAS Provider, whether or not the VAS application runs (partly or fully) at the ORSI. The VAS Provider and the ORSI may agree on some key performance indicators for the VAS application to be executed in order to correctly provide the service.

From an operational point of view, the fleet management service has to be available in real-time and with a defined accuracy. Although the accuracy is strictly defined, the platform for the EFC Service does not need to guarantee a real-time service for the transmission of data to the proxy/back-office, and typically the mobile data transmission call can only be initiated from the OBE rather than from the back-office.

The fleet management application features a subset of the security requirements of the EFC application. Specifically, the availability and confidentiality aspects of the fleet management data is important. Connected to this are the aspects of authorisation (i.e. the identification of the applications and users which are allowed to access the service and the data) and of accountability (i.e. the logging of access events to the service at defined moments in time).

Data is collected and processed with the consent of the user (the Data Subject).

9.3 Payment

Payment applications and services in the ITS context are similar to (but a generalised form of) EFC payment at a certain location. Instead of paying for the use of road infrastructure or the vehicle, the payment is made for a service provided at that specific location.

This means that the amount due is determined by the collecting VAS Provider depending on the actual service, and payment/charging is made via direct connection between the roadside equipment operated by the collecting VAS Provider and the OBE.

The required data to be provided includes the identification of the ORSI and the user account.

Operational requirements with regard to accuracy are high, and are comparable to those for EFC applications, but the traffic conditions are usually relaxed, involving mainly single-lane and low-speed stop-and-go conditions.

Vehicle usage recording applications and the EFC application both share similar security requirements. The most important security features involve requirements for authenticity and integrity of the payment data to be guaranteed by the ORSI in a similar manner as for EFC.

Data is collected and processed with the consent of the user (the Data Subject) which makes usage of the payment application possible.

9.4 Traffic Data Collection

Traffic data collection services provide data to authorities without the intervention of the user. The evaluated data can be either real-time or statistical over a defined period and can be produced from road usage data collected:

- by the ORSI (via the OBE) or;
- by the Toll Charger though its EFC roadside, or
- by a VAS Provider through dedicated roadside (mostly in exceptional cases only).

Data shall be collected in accordance with privacy regulations, which means that these regulations apply to the responsible party, identified as the “Processor”, who collects the data on behalf of the authority. The data is processed on behalf of the authority which is the “Controller”.

For data collected by the ORSI, edge-light data processing and transmission logic to the proxy/central system needs to be implemented to enable traffic data collection.

From an operational point of view, the real-time traffic data collection application requires higher availability and low latency characteristics to the communication network (OBE to Proxy, or Roadside to Toll Charger back-office) compared with the EFC case. Statistic traffic data collection features looser operational requirements.

The traffic data collection application features a subset of the security requirements of the EFC application. Specifically, the availability aspect is important to operate the service. The collection might include actions to guarantee the confidentiality of the data or to make the data anonymous.

9.5 Vehicle usage recording

Similarly to EFC applications, the vehicle usage recording service requires location data related to the use of the vehicle, containing information on where, when and optionally how the vehicle has been used. These data is available in the EFC Platform, with characteristics of defined accuracy and availability, but need to be made available to the VAS Provider. An edge-light data processing and transmission logic to the proxy/central system also needs to be implemented in the EFC platform.

In some specific vehicle usage recording applications (e.g. some pay-as-you-drive’ applications), acceleration values of the vehicle might be needed. For those purposes, inertial sensors might be used if pre-existing in the EFC platform (e.g. an accelerometer used for plausibility of EFC data).

The data is collected by the ORSI according to the rules of the EFC regime and provided to the VAS application or directly to the VAS Provider. The VAS application itself is also executed in the typical EFC environment. The collection process needs to be approved and certified by the VAS Provider, but the certification regime needs to similar to the EFC case in order to be able to positively and cost-effectively exploit the existing synergies.

From an operational point of view, the data collection is similar to EFC: the data needs to feature defined accuracy characteristics but do not need to be made available in real-time.

The vehicle usage recording applications feature similar security requirements to the EFC application. Specifically the authenticity and integrity aspects are important to guarantee the correct operation of the service exactly as in the EFC case. Therefore, it is expected that the existing security mechanisms in the EFC platform can be re-used for this service.

Data is collected and processed with the consent of the user (the Data Subject), which makes the disclosure to the VAS Provider possible.

9.6 Regulatory applications

9.6.1 Tachograph

The current Tachograph specified as a dedicated device cannot present any synergies with the EFC platform. Therefore, the following description applies to a potential future Tachograph service, which would be described from a functional point of view, and would be implemented in an open platform.

A digital Tachograph service requires the determination of distance, speed and travel time. This data could in principle be derived from positioning data, which is available in the EFC Platform by nature with characteristics of defined accuracy and availability. Specific additional algorithms and sensors might be needed to calculate the output. A collection of the tyre revolutions is not directly provided by the EFC platform. Only an interface to an appropriate sensor could be provided at the platform. The correct collection of the data including the prevention of manipulation is outside the scope of EFC.

In addition, the digital Tachograph service requires the determination of the driver’s identity usually from the driver’s digital ID (a chip-card), which is beyond the scope of EFC. Whereas the technical implementation of an interface seems manageable, the setting up of a security scheme which is able to communicate with the secure chip card and securely assess the driver’s identity might introduce additional complexities such as connection to an external security validation centre.

In contrast to the EFC case, the desired output data needs to be made available at the OBE/vehicle for checking purposes. In most cases, this would imply a different data processing architecture compared with the EFC case, where data are made available at the back-office interface to the Toll Charger only.

From an operational point of view, the digital Tachograph service requires high accuracy and real-time transmission, since the required data has to be available at any time for manual checks and maybe, in future, automated checks by dedicated personnel.

From a security point of view, the digital Tachograph service requires functionally similar but potentially different security features compared with the EFC application. In fact, the data is collected by the ORSI according to the rules of the EFC regime and provided to the VAS application. Additionally, the VAS application itself is also executed in the typical EFC environment. On the other hand, the Tachograph service conforms to a security scheme which is defined outside the system of governance of EFC, defined by separate entities, experts and under a different legal framework. Only where the security scheme and policies are aligned, and the collection process is approved and certified by the appropriate authority, can synergies be exploited. Until then the EFC platform and digital Tachograph remain two different separate services.

Data is collected and processed as necessary for the performance of a task carried out in the public interests.

9.6.2 Hazardous goods and livestock transport tracking

A hazardous goods tracking service is comparable to the commercial fleet management service but requires in addition the identification of the hazard connected to the transported good. From a functional point of view, the method of hazard identification is left open but the most typical implementation would be via declaration by the driver. Technically, this may be implemented as a declaration interface to the EFC platform, e.g. via a service made available at the proxy (and accessed using a mobile phone, using SMS or a web browser) or an appropriate HMI at the OBE itself.

A livestock transport tracking service requires in addition to the location of the transport the determination of the temperature of the transport compartment and the livestock. This can only be collected through an appropriate sensor located in the transport compartment and connected to the EFC platform. The implementation of an interface at the EFC platform is certainly viable. The installation of the sensors the cabling and aspects related to fraud and manipulation of the signal is certainly outside the scope of EFC. roadside enforcement may also be useful in future livestock tracking applications.

The data is collected by the ORSI according to the rules of the EFC regime and provided to the appropriate authority: centrally for hazardous goods tracking, and at the OBE for livestock transport tracking.

From an operational point of view, the service resemblances the commercial fleet management service, where data has to be made available in real-time. Data has to be made available in the vehicle for checking purposes as well.

Depending on future certification and an auditing system, a security scheme will be set up for the service which is expected to be functionally similar but also potentially technically different when compared with the EFC case. In fact, the service might need to conform to a security scheme which is defined outside the system of governance of EFC by separated entities, experts and under a different legal framework. Only where the security scheme and policies are aligned, and the collection process is approved and certified by the appropriate authority, can synergies be exploited. At the moment, since a certification and auditing system are missing, nothing hinders the integration of this service into the EFC platform.

Data is collected and processed as necessary for the performance of a task carried out in the public interests.

9.6.3 Access control and management of quotas

From a data collection point of view, access control and managements of quotas services are functionally similar to certain EFC and payment applications even if the application itself is different. The identification of the vehicle (or in some cases, the driver) is collected at certain focal points to check if access is allowed (instead of initiating payment or checking if payment is correctly performed).

The identification of the driver (if applicable) presents similar issues as already described for the digital tachograph.

Technically the service is executed via a DSRC application and interface and can easily be integrated into the EFC platform employing the existing communication media used in the EFC case.

The setting up of appropriate roadside infrastructure is the responsibility of the applicable authority.

The service presents similar operational and security characteristics compared to the EFC case. The data provided by the EFC platform to the roadside is the responsibility of the ORSI and needs to be certified or issued by the authority. This means that there is a need to provide the EFC platform (OBE) either with data issued by the authority or to set-up a specific certification regime, defining how data is made available for this specific service.

Data is collected and processed as necessary for the performance of a task carried out in the public interests.

9.6.4 Enforcement applications

Enforcement applications and services are of various natures. Commonly they provide data about the vehicle itself, the cargo, the vehicle and the road usage to a dedicated roadside. The data is read-out by the (fixed, mobile or portable) roadside operated by the appropriate authority.

— Data about the road and vehicle usage is collected by the EFC platform by nature. Data about the vehicle itself is made available by the ORSI in the OBE. Therefore, the data collection and management process needs to be approved and certified by the authorities.

— Data about the cargo can be written into the OBE during cargo loading procedure via an appropriate existing interface (e.g. DSRC) using a manually operated device. This data is inserted by a human operator and is the responsibility of the user.

— The identification of the driver (if applicable) presents similar issues as already described for the digital Tachograph. Enforcement for example, typically requires video images in order to preserve evidence.

Security aspects comprise requirements for authenticity and integrity of the data to be guaranteed by the ORSI, and by the user in the case of the cargo data. The confidentiality and availability aspects of the collected and stored data is the responsibility of the ORSI. Data is collected and processed as necessary for the performance of a task carried out in the public interests.

A barrier to deployment of enforcement applications by an ORSI is that in Europe compliance checking and enforcement are traditionally performed by authorities typically staffed with sworn public servants. Outsourcing of activities is a new development and still rather rare. The involvement of private Service Providers for checking e.g. compliance with social legislation, i.e. the rules about work and rest hours for drivers of commercial vehicles, is not foreseen. Instead, work and rest hours are registered in a prescribed physical device, the Tachograph, and checked by sworn officers at the road side. One could equally well set up a compliance regime for work and rest hours by employing private Service Providers to assist companies in complying with fatigue regulations. Such companies would monitor driver activities through telematics OBE (ideally as a VAS bundled with other services) and warn the driver when he risks exceeding his allowed working hours. In case of gross excess, the Service Provider would alert the authorities. Naturally this requires certified and audited Service Providers – but actually exactly this is foreseen for the EETS! In the event that the regulatory application would be opened to enable provision by private companies, enforcement applications could become the key drivers of telematics deployment in Europe. See Annex B for an inspiring approach towards the deployment of regulatory applications by a private ORSI.

10 Prerequisites for supporting VAS

10.1 Key design drivers

There are three main design drivers for delivering VAS from the tolling OBE platform. The first driver is whether or not there are synergies, i.e. benefits from a joint delivery both in technical and in business terms. The second driver is that the tolling functionality must not be compromised in any way by a VAS application. Finally, the third driver is the platform architecture including the related operational and cost aspects of delivering tolling and VAS through the same OBE. The cost aspects themselves are represented both by the cost of the platform(s), the operational costs and indirect costs related to (bad) performance.

VAS applications with potential synergies with tolling have been identified in 8.3. Based on that analysis, Clause 9 has analysed how the synergies might be exploited. The following sub-clause now addresses obstacles in terms of risks to the tolling application by a VAS that is delivered concurrently. Additionally, pre-conditions are established for tolling platforms to enable them to deliver VAS without risking tolling performance. Sub-clause 10.3 then analyses possible basic platform architectures.

10.2 Uncompromised tolling functionality

10.2.1 General

The requirements of the EFC application have been described in 8.2 and have to be fulfilled independently of any VAS application. This includes uninterrupted detection of all tolling events including regular transmission of charge data, data exchanges at scheduled moments as well as communication with road side equipment and mobile enforcement units. For this reason an appropriate computing architecture has to be in place at the tolling platform to allow operation of the EFC and VAS application with defined availability, performance and security.

10.2.2 Performance and availability

Especially in case of a delivery of a VAS in a fully integrated way with the tolling service, as described in 10.3.3, the VAS and EFC applications will compete for on-board resources, since resources like memory, processing power, HMI and communication channels might be shared.

As long as a thin-client approach is followed both for the VAS and for the EFC, i.e. as long as most processing intensive tasks are performed in the back-end, there is little risk of conflict. Actually, in a sense both applications are off-board. A thin client architecture is not necessarily the optimal architecture in all application cases, especially when real-time feedback to the driver is essential. In this case, applications will be processed on-board and the risk of mutual interference rises.

Technically it is quite possible to shield off one application from another, and modern computing environments and operating systems are designed for this. Nevertheless, the platforms need to be prepared for these measures, at an increased cost. It should be noted that most EFC platforms of today are optimised for a single use case and rarely have the required prerequisites for a conflict-free delivery of several competing applications.

10.2.3 Privacy considerations

Applications delivered on-board the vehicle usually have few implications regarding privacy. User privacy becomes critical specifically when information about individual user behaviour is transmitted to the roadside. Traffic data collection applications are especially prone to problems with user privacy.

In DSRC based systems, operators have for several years been able to generate additional value from tolling transactions by evaluating trip origin-destination, trip durations, etc. Such information is basically obtained by tracking a random OBE during its journey. In order to protect user privacy, the data is made anonymous as early as possible. An improvement could be using a DSRC OBE which contains a random identifier. This would be an identifier that allows for tracking the vehicle without the need to reveal the identity of the user. This random identity might e.g. be automatically changed (either by the OBE or the RSE) at the end of each day.

Furthermore, in more complex applications one has to ensure that user privacy is protected. On a multi-application platform, for example, one has to ensure that sensitive information from regulatory applications (e.g. vehicle speed or users driving hours) is not communicated to other applications and must not be accessible by third parties.

10.2.4 Integrity and security

EFC is a payment application, often with deep legal implications in case of non-payment or fraud. Integrity of the collected road usage data, including vehicle identity, payment account and user declarations, is of high importance. VAS might compromise data integrity and security either inadvertently, e.g. by overwriting data, or intentionally, e.g. by user-installed malware.

Classical DSRC OBE largely avoid these issues, since the applications are hard-coded. More flexible platforms like the GNSS/CN/DSRC multi-technology platforms required for the EETS, are full-blown processing platforms and can in principle execute a number of applications. Normally the security arrangements are such that only signed software can be executed. At start-up of a tolling application, the operating system first checks whether the software is unchanged. The foundation is thereby laid for true multi-application processing including VAS. Nevertheless one has to see that current designs are not specifically designed for such an extended purpose and will not allow for ultimate flexibility and openness.

A true multi-application integrated in-vehicle telematics platform might in the extreme case require an operating system that ensures that only certified and signed applications can be executed, where each is completely fenced from the other. This can be achieved to a very high degree, but certain conflicts cannot be resolved, e.g. when several messages from different applications compete for user attention at the HMI.

10.2.5 Governance and certification issues

EFC, especially the EETS, require that OBE including the tolling application is certified. While the exact procedures and requirements are far from clear at the moment, it can be expected that an OBE would lose its certification if it were to allow any arbitrary VAS to be executed. In principle, an OBE can only be certified together with the EFC application and all eventual VAS applications. Such a process is not foreseen in the EETS. For reasons of governance, certification agencies will most likely only have the necessary processes and rules in place to certify for compliance with the EETS and will not be able to certify VAS that run concurrently on platforms.

The problem of certification of EFC and VAS on a single platform is unresolved, and might mean that in the near future we will rather see less strongly integrated platforms, i.e. concepts as outlined in 10.3.2 and 10.3.4.

10.3 Platform architecture

10.3.1 General

There is a range of possible approaches towards a technical architecture for a tolling platform supporting VAS, where these may be defined by the extent of integration between tolling and VAS applications. One end of this range is characterized by loose coupling of tolling and VAS platforms and applications, whilst the other end of the range is represented by a fully integrated architecture where tolling functionality and VAS are delivered on the same platform. Between these two extremes, a partially integrated design is also feasible, where ‘tolling-compatible’ VAS may be integrated onto the same platform, alongside a separate platform for ‘tolling-incompatible’ VAS. These three approaches are described below.

10.3.2 Loosely coupled platforms

A separate design based on two loosely coupled platforms eliminates the risk of any VAS applications compromising the performance of tolling functionality. Such a design foresees the duplication of some major components, which would serve only one dedicated type of application.

This design foresees that EFC runs undisturbed on its own dedicated platform; VAS applications would be implemented on typical nomadic devices which by nature have the possibility to host and execute multi-applications without high requirements to security, availability and performance (i.e. unable to host the EFC application). The VAS application would be feed with all necessary vehicle-related data via a defined interface to the EFC platform. The tolling platform itself would work like an in-vehicle gateway for vehicle-related data collected via sensors and interfaces.

This approach is advantageous in achieving a clear separation of the EFC and VAS applications and a defined (and restricted) interface between both. It also presents the advantage of a certain independence of VAS from the EFC application, which could mean a higher flexibility of the user to change ORSI integrator while using the same tolling platform. The loosely coupled platform approach is especially suitable for VAS which need very specific vehicle-related data and/or an appropriate feedback/output to the driver (in the vehicle) and can exploit the existing facilities of the additional equipment.

10.3.3 Fully integrated platform

A fully integrated platform involves the shared use of the EFC platform components for tolling and all desired VAS applications. The prime advantage of such a design is potential cost and space savings from the increased utilization of existing components. The shared platform design must however ensure uncompromised performance of the tolling application, at the same level delivered by a dedicated EFC platform. VAS applications must not interfere with tolling communications such as transmission of regular position coordinates, or communication with roadside equipment and mobile enforcement units. Additional applications must also not compete for shared resources where this may cause a conflict with tolling functionality. Examples of such conflicts may include simultaneous demands for processing time, increased complexity of the HMI to meet specific VAS requirements, competition for display space on the HMI, and memory requirements which exceed storage capacity.

This approach is favourable for those applications which can use synergies from existing EFC facilities, such as payment over the DSRC interface or regulatory applications. VAS application which require additional facilities are less likely to be integrated, since the cost and complexity implications are too high.

10.3.4 Partially integrated platform

A partially integrated design incorporates selected VAS applications directly into the tolling platform. These VAS applications are selected on the basis of their compatibility with the tolling application or of synergies with the EFC application (as analysed in Clause 9), where the maximum number of components may be shared without any adverse effect on tolling performance. An edge-light Front-End implementation particularly benefits from this approach as the proxy is more flexible when integrating additional applications.

This model represents the most promising design platform, where the overall cost may be lower than the sum of individual application costs due to resource sharing.

This approach is particularly favourable for those VAS applications which have a high synergy with EFC and are highly based on EFC data, without requiring user specific processing and output. Such VAS applications are:

— Fleet Management, without application-specific input from the vehicle / user and output to the user;

— Traffic data collection;

— Vehicle usage recording.

10.4 Conclusions for supporting VAS on an EFC platform

Opportunities for supporting VAS exist where resources and vehicle data existing within the EFC Platform can be shared with other selected VAS applications (see Clause 9) without compromising the performance of the tolling application or resulting in other functionality conflicts.

The synergies can reduce the overall cost of providing both tolling and VAS applications when compared with the use of completely separate platforms for each service. According to the actual VAS application to be supported, a certain approach can be implemented. A viable solution would be an EFC platform for VAS which would be able to support all three approaches, i.e. supporting some selected integrated VAS applications, like payment over DSRC, partly integrated applications like fleet management, and additional loosely coupled applications on an additional device.

11 Opportunities for improving the environment for VAS

11.1 Business environment

To date, there has not been a favourable environment for delivery of VAS directly to the road user. As the examples in Annex A demonstrate, VAS were mostly realised at the back-end and for the benefit of the charging system operator. Several factors have been limiting the business opportunities:

— Dedicated Platforms: Until quite recently, for the reason of uncompromised performance as outlined in 10.2 EFC equipment has not been designed to support an interesting range of VAS. Only with the advent of multi-technology platform with GNSS/CN/DSRC resources, high processing power and modern operating systems, did the technical environment offer the potential to deliver wider benefits via additional applications.

— Market too small and fragmented: VAS-capable EFC equipment is currently being deployed for HGV charging system. This is a limited market to start with, and in addition it is very fragmented. The transport trade is a very diverse one, and there are very few applications that can offer benefits for a larger market segment.

— Lack of an open Service Provider market: Historically, EFC equipment was delivered directly from toll charger to user. The scope of the service was limited to the local toll domain. Only with a shift towards the new paradigm of a multi-service provider market, as pioneered by France and as foreseen as the basis delivery model for the EETS, has the service delivery aspect come into the focus. Only with a wide-spread Service Provider model in place, can companies start to develop applications and new services offers to users.

The EETS is creating tangible opportunities for VAS. It can be expected that we will see more widespread deployment of capable technical platforms, that thanks to Europe-wide coverage Service Providers will see a far larger and more homogeneous market, and that the new service provision paradigm will make VAS a commercial must rather than an option. It has been recognised that the EETS alone does not create a business case that is viable enough to allow a Service Provider to create a commercially attractive offer. An EETS offer is costly to create and high investments are required. EETS requires Europe-wide coverage, including tolling systems that do not create sufficient turnover from the individual traffic under contract to a single Service Provider. Without bundling the EETS service with attractive VAS not even a commercial break even appears to be possible according to many active in the market.

It is out of the scope of this TR to recommend the best solution to deliver VAS in a commercially viable way. It can be expected, however that:

— For heavy vehicles, the regulatory applications are the drivers for the market since support of these applications is mandatory in every vehicle. The future of the EETS and of the measures foreseen in the ITS Action Plan will shape the market. These are the "killer applications" that are either mandatory or indispensable for international goods transport on road. Sub-clause 11.2 looks into opportunities offered by developing the regulatory environment.

— Both for light vehicles and for heavy vehicles in addition to the regulatory applications, it is expected that nomadic devices (PDAs, i-Phone, etc.) and navigation systems will be platforms facilitating market deployment of a wider range of telematics applications. Here the EFC platform can be a core gateway which provides the applications on such devices with vehicle-related data through a defined interface. In fact such nomadic devices present the great advantage of both providing a good HMI to the user for input and output data, as well as the capability to host multiple applications without high requirements to security, availability and performance. On the other hand they lack potential support for the EFC application and of vehicle-related data due to not having any interface to the vehicle and/or the powerful and tuned location capabilities of an EFC platform. One very useful action in this respect would be the specification of generic on-board services, as described in 11.3.2

Ultimately the market will decide on the success of the concept of delivering VAS to EFC. Nevertheless, one can support such developments by targeted activities in the regulatory environment and also through standardisation.

In the long range it can be expected that the concept of VAS to an existing EFC platform will only be an intermediate step in the development towards fully integrated multi-application in-vehicle telematics platforms where the notion that one application might be a VAS to another one ceases to exist. Ultimately, EFC will be one of many services offers on a truly multi-functional in-vehicle unit. Many initiatives towards this goal are ongoing, but for the medium term, dedicated EFC equipment that becomes more open towards joint delivery of VAS might be an important step into that direction.

11.2 Regulatory environment

As presented above, regulatory applications are the key drivers of the telematics market for heavy vehicles. As explained in several sections in this TR, see e.g. 9.6.1 and 9.6.4, regulatory applications in Europe are currently not defined in a way to allow for delivery as a service by a private company.

The EETS is the first European wide regulated application that fundamentally rests on a Service Provider model. It would be advisable in future revisions of regulations pertaining to the Tachograph, to hazardous goods management, livestock tracking and the like to allow for a service model. It would mean a certain change in paradigm, though: Instead of the authority pursuing non-compliant users, one could turn the situation around and ask users instead to demonstrate compliance proactively. Users could even be given the choice: option (a): use the Tachograph as is, option (b) go for a private company that assists in managing your fatigue regime. The rules regarding the working and rest hours would be the same, but in option (a) the authority does the policing work and in (b) one allows the company to demonstrate compliance proactively. Cost savings for authorities with option (b) are obvious, but also the transport trade benefits since it can receive a number of services, from EETS over track and trace, to fatigue management from a single ORSI. Annex B gives an example on such an approach that is currently being pursued in Australia. It is noteworthy that this concept is also the scope of an ISO work item, see ISO/WD 15638.

Further benefits could stem from improvements to the regulatory environment by aligning governance of the different regulatory measures. The Tachograph, EETS, and livestock management follow very different rules for institutional arrangement and responsible actors, for equipment certification, and for compliance checking and prosecution. If these frameworks could be more closely aligned, synergies would emerge both on the side of the regulator, but also on the side of the market because it would become easier to deploy these applications through a single delivery channel.

The activities around the implementation of the ITS Action Plan offers opportunities to move into the direction of deploying regulatory applications in a Service Provider model, as outlined in the ITS Action Plan, particularly Action 2.3 on eFreight, Action 3.5 on telematics controlled parking and reservation systems for secure parking areas for trucks and commercial vehicles, Action 4.1 on an open in-vehicle platform architecture for the provision of ITS services and several other of the planned Actions (see 5.3.2 for the complete list) open doors for VAS and for platforms for delivery.

11.3 Support by standardisation

11.3.1 Amendments to existing standards and work items

VAS to EFC currently have no prominent role in the work done in WG1. The analysis in this TR shows that the prospects for delivering VAS in conjunction with EFC can markedly be improved if certain provisions are established. The list below provides some inspiration.

— The **EFC architecture standard**, ISO 17573, currently does not foresee provisions for VAS. It might be advisable to open the model somewhat towards the ideas of the GST and GSC projects (see 5.4.3 and 5.4.4) and include a business architecture as depicted in Figure 7 and a technical architecture as sketched in Figure 8. Ideally the concept of the EFC service provision role in ISO 17573 would be widened to include also the ORSI aspects.

— The WI on an **EFC security architecture**, PNWI 00278270, might consider including in the deliberations the requirements discussed in 10.2 regarding security, integrity and performance which are essential for uncompromised tolling functionality.

— The standards for **communication between front-end and back-end in GNSS/CN systems**, especially CEN ISO/TS 17575-1, might in a revision foresee explicit provision for transferring VAS-related data. See also the discussion in Annex A on the situation in Czech Republic, A.2.
It might also be advisable to foresee functionality to provide feedback from the back-end to the driver via the HMI in CEN ISO/TS 17575-3.

— Currently the CEN ISO/TS 17575 suite of documents does not foresee a request for **OBE data on demand**. This mode of operation might be considered for inclusion in a future version of the standards.

— EN ISO 14906 was originally conceived as **data repository** for EFC applications, and is currently used as such both for DSRC based EFC (see EN 15509) and GNSS/CN based EFC (CEN ISO/TS 17575 series). Future versions of this standard might be widened in scope and also include basic data useful for VAS, such as information on the driver, on speed, etc. For attributes that might be useful see the requirements on collected data in the tables contained in Clause 8.

— Standards for tolling via DSRC, such as EN 15509 or CEN ISO/TS 12813, might foresee **provisions for tracking vehicles in an anonymous way**, i.e. enabling to collect travel time and origin-destination data while preserving the privacy of the user. One way of achieving this would be by providing a random identifier in these standards such as discussed in 10.2.3.

11.3.2 Potential new work items

New work items could be envisaged for two fields of activity:

— It would be a strong enabler for the market if a definition of a **multi-application platform** for regulatory applications under a certification-based regime could be produced in a functional way, i.e. by requirements-based definitions. Such a platform would allow for joint delivery of EFC regulatory applications without problems occurring due to resource competition. Such a standard might define requirements regarding the hardware, the sensors, the communication interfaces and the operating system of a multi-application telematics platform. Ideally such a requirements definition would allow the platform, including the EFC application and the regulatory applications concurrently being executed to be certified as a whole. Such a platform definition might be especially useful for the heavy vehicles market, where the driving applications are the regulatory ones.

— Taking up a suggestion from the UOBU project, see 5.4.2, it would be useful if certain **generic elemental on-board services** could be specified in a standardised way. Such services might be time, location, speed, vehicle identity, driver identity or communication channels. The services could be defined by providing both the lower layers of the services (e.g. physical interface via CAN Bus, Bluetooth or WLAN), as well as the data coding, and, most importantly, the data quality. A generally useful on-board location service might for example make GNSS location data continuously available to all telematics applications in a vehicle. The location data would besides the mere location information also contain quality information and security provision, such as a signature proving that the GNSS location comes from a certified and therefore trustworthy GNSS receiver.
If such generic on-board services were to be made available in the whole vehicle in a broadcast fashion, both permanently installed and nomadic devices would benefit from vehicle-related data and the availability of communications channels to a certified quality.

Activities related to both fields have started recently, as can be seen in the joint CEN and ETSI Response to Mandate M/453, see Bibliography.

Annex A
(informative)

Examples of approaches to VAS based on EFC

A.1 General

This annex provides examples of VAS provided in several European EFC systems. The examples have been provided by members of CEN/TC78/WG1.

A.2 Czech Republic

In the Czech Republic, authorities are able to derive cost effective traffic information from DSRC toll data within the ETC system. For traffic management and traffic planning purposes, accurate real-time as well as historical traffic data is generated on the basis of the electronic toll system. In addition, the Czech road authorities are considering the use of the toll system data for generating additional revenues by selling this data to 3rd-party Service Providers.

Toll systems generate a large amount of data. It will be advisable to use this data to generate profit by providing this data to third parties and thereby generate income to the state based on licensing the data access. Also, this approach calls for high reliability and security of access, because the data could be misused or the system could become a target.
The basic hybrid system structure form the point of view of services provided to each party is described in the figure below. The data generated by and stored in Toll Charger system (marked “Data Processor) is used by many users sharing Standard Telematic Services Interface (STESI), which provide each user with appropriate licensed user data and ensure necessary level of security. The commercial part is represented by Service Level Agreement (SLA2) provider of Value Added Services (marked “Data User”) and Toll Charger system.

The data stored in the Toll Charger system is provided by many Service Providers systems (marked “Data Provider”), which makes their data available over Standard Toll System Interface (STORSI). This data is used by Toll Charger for processing a toll itself and also to provide requested data to third parties for further processing – Value Added Services Providers. The commercial description of the interface remains in Service Level Agreement between Service Provider and Toll Charger (SLA1).

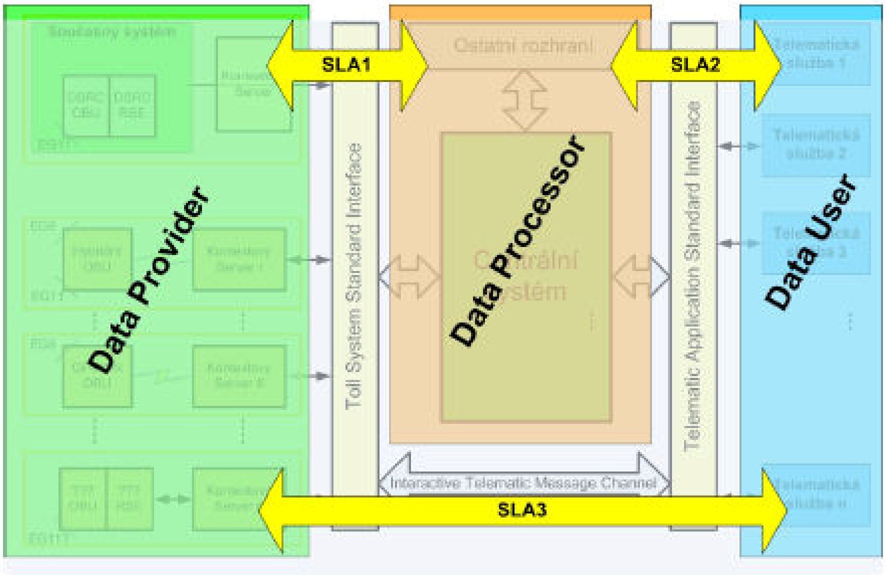

Figure A.1 — Basic Services Structure of Hybrid Tolling System

Furthermore, we have to consider the situation in which a specific request from a Value Added Services Provider, could be represented via a peer-to-peer connection between the Service Provider System and Value Added Services Provider System, using both standard interfaces STESI and STORSI. The reason is quite simple – reliability, security and resulting commercial impact for the Toll Charger. The commercial view of the interface describes the Service Level Agreement between the Service Provider and Value Added Services Provider (SLA3).

Value Added Service from the Standard point of view

Having on the mind the standardization process we have to introduce schematic showed on Figure A.2. It is quite obvious, the demand for development of Value Added Services calls for two new standardization processes:

— definition of new standard on Standard Telematic Services Interface (STESI), marked as “New Standardization Activity”;

— appendix to the part of the Service Provider/Toll Charger Interface (STORSI), marked as “Demand for WG1 Standardization Activity”.

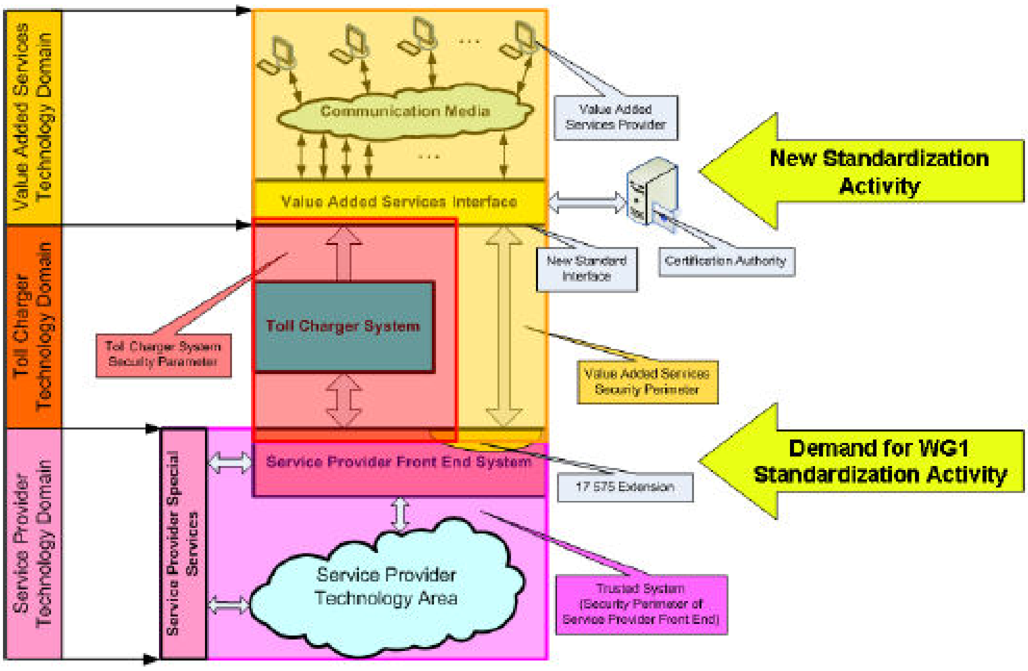

Figure A.2 — Value Added Services in the Hybrid System

Additionally, we have to bear in mind the influence of the STORSI design on the other standards, like e.g. eCall.

Conclusions

As shown, introduction of Value Added Services to the tolling systems and its implementation calls for necessary amendments in current standards and introduction of new standards on STESI. Additionally, security issues regarding this particular interface are not simple to resolve, and it would be necessary to pay particular attention to this crucial task.

A.3 France

The OBEs, delivered according to various CARDME profiles **for trucks**, by 4 ETS Providers (TOTAL, Axxès, Eurotoll, DKV), agreed by the TIS Toll Chargers are used for:

- Toll collection on bridges, tunnels and motorways (14 Toll Chargers in France and 34 Toll chargers in Spain);
- Access Control to "truck secured parking" (see for instance http://www.trucketape.net/eu/accueil.html).

A unique invoice gathers all "Transport Services", detailed per toll domain, per place, per vehicle, etc. Because each OBE is associated with a given vehicle, this allows verification of trips plus parking for a given truck, for a given period:

- with OBEs and Free Flow gantries, tracking of **Hazardous Materials Transport** (HMT) in 20 tunnels for 18 km as whole (40 tubes), between the Italian border and Nice. The ESCOTA traffic management centre knows in real time where a given vehicle is transporting HM, and in the event of an incident in a tunnel, ESCOTA is aware of which vehicles, transporting which HM may potentially be involved.

The OBEs, delivered according to various CARDME profiles **for Light Vehicle**, by 12 ETS Providers (Some French Concessionaires), according to a specific profile, agreed by the TIS Toll Chargers are used for:

— Toll collection on bridges, tunnels and motorways (18 Toll Chargers in France);

— Toll Collection on 200 parkings in France.

A unique invoice gathers all "Transport Services", detailed per toll domain, per place, per vehicle, ...

— Computation of travelling times on the Escota network. The OBEs are read by gantries (25) and a central system calculates the travel time and detects traffic incidents. Corresponding information is used for traffic management and information on VMS.

— Tracking of vehicles (equipped with OBEs), inside the A 86 tunnel (11 km length near Paris) to be fully opened in mid 2011.

A.4 Germany

The following describes the situation regarding VAS in Germany as experienced by the operator of the German truck toll system.

Introduction and Situation in Germany

For some time now experts have indicated significant growth in the market of telematics systems and applications in Germany and Europe. This development is only partially reflected in reality. On the one hand the market for mobile navigation solutions is evolving at a high-speed, on the other hand only few commercial vehicles (especially heavy-goods-vehicles) are equipped with professional telematics systems. In this context the GNSS-based tolling system in Germany could give an impulse for further development in the field of value added services.

In January 2005 a distance based road charging system for heavy trucks with a total weight of >12 tons had been introduced. The system covers the whole German Autobahn (motorway) system of approximately 12,500 km and 40 km of federal roads. In the meantime, more than 640.000 trucks have been equipped with an OBE, thereof approx. 43 % from abroad.

The applied on-board-equipment uses mainly two base functions to operate the toll service. These are on the one hand **positioning** using GPS-signals and on the other hand **communication** both in short-range using Infrared/Microwave and in long-range using GSM-technology. Shared usage of those basic functions by 3rd parties could enable a multitude of transport-related telematics services and create added value for all involved parties.

VAS and demand in Germany

At the moment, the market for transport services is dominated by "full-service-providers" with vertical business models which offer their service bundled with proprietary hardware. In 2007 the German Ministry of Transport (MoT) presented the concept of shared usage of the existing road charging infrastructure including possible use cases to a broad audience consisting of Service Providers, representatives of the transport industry and others. The feedback was very positive and continuing activities to implement the concept were requested.

Use cases for telematics services which could make use of base functions of the truck toll system have been identified in different areas, e.g.

Large-scale applications that address a specific issue and would instantly reach a high number of subscribers

Major logistic hubs (e.g. harbour/flight cargo terminals, major industry areas) are facing the problem of not knowing how many trucks are approaching and at what specific time they will arrive. Due to the lack of real-time information, logistic processes cannot be adjusted to the situation in the short-term. Long waiting periods and congestion are the result. The mandatory introduction of a dedicated traffic management solution, involving all trucks from different transport companies is a challenge that can hardly be solved. For this use case the OBE of the GNSS-based road charging system could be used to provide the missing information in real-time. Basically all trucks are equipped with a dedicated tolling OBE, that would send positioning information in regular intervals or on request. Given that the trucks are registered at the logistic hub and based on the truck's actual position the logistics hub could establish a traffic management that allocates time-slots for loading and unloading in real-time. Furthermore even the internal processes of the logistic hub could be optimized as e.g. the order of containers could already be synchronized with the course of incoming trucks.

Services that aim at improving the business efficiency of individual transport companies

Examples in this area are all traditional applications of fleet management like tracking and tracing or remote diagnostics of vehicle parameters. Besides this even the DSRC-communication functionality used for enforcement in the German toll system offers potential for added value if used by third parties. Several questions and discussions asked for the possibilities to use DSRC for automatic vehicle access control for company sites (e.g. Gate opens automatically for a truck if an authorised license plate number is transmitted over DSRC).

Services that support political objectives

The achievement of political objectives related to road traffic and transport management can be supported by the introduction of specific VAS. The tolling service itself is one example. The service is brought to the respective vehicles by law. In particular, it makes sense here to consider this already existing, public-financed platform as an appropriate basis if other political motivated services should be implemented. Examples of services in the field of road transport could be a tracking and tracing service that is obligatory monitoring all trucks that transport hazardous goods in order to protect residents and the environment. A solution for overcrowding truck parking along the motorway that more or less force truck drivers to disobey the regulations regarding their driving and rest times could be an intelligent parking management system that informs users of free parking space in real-time based on the actual position of the truck and the remaining driving-time of the driver. For enforcement purposes even the data of a truck's digital Tachograph could be downloaded in moving traffic by traffic/police authorities using the existing DSRC communication link (that is used for enforcement in the context of tolling) if the tolling OBE is connected with the digital Tachograph.

Although the market expressed a massive demand and interest for the topic during and after the MoT congress on VAS a technical implementation has not been started yet. The reason for the missing momentum is a complex legal regulation on the European level which puts significant requirements on the operator of the German truck toll system regarding VAS.

Legal Situation for the combination of VAS with the German truck toll system

For the German toll operator Toll Collect the combination of the tolling service with the provision of other VAS is subject to strict legal regulations on the European level. In 2003 the companies Deutsche Telekom, Daimler and Cofiroute could only form the toll operator Toll Collect after committing themselves to not provide VAS using the toll system as long as specific technical and organisational requirements have not been met. These requirements are defined in the EU decision COMP/M 2903 of 30th April 2003.

The decision aims to prevent Daimler and Telekom attaining a dominant position on the market for telematics hardware and services by providing value added services using the truck toll system. The requirements as defined in the decision shall ensure a fair competition between the Toll Collect shareholders and other participants on the market for telematics hardware and services and a non-discriminating access to the components of the truck toll system by other potential Service Providers.

The requirements are in short:

1) A technical GPS-interface has to be integrated in the tolling OBE. Over this interface 3rd party devices shall have access the GPS-position information determined by the tolling OBE in order to process the received raw data for their own purposes afterwards. The idea behind the GPS-interface is that other manufacturers of telematics hardware could benefit from using the existing GPS-hardware of the tolling OBE because they do not have to equip their own devices with GPS-components (e.g. GPS-module, antenna) which leads to cost benefits.

2) A "toll module" which contains hardware and software parts that are necessary for toll operation shall be implemented and provided to 3rd party device manufacturers. This module could be integrated in (or otherwise linked with) devices of 3rd parties and enable these devices to collect toll. Thereby the toll module would in effect be a tolling OBE without display and buttons (no HMI). The idea behind the "toll module" is firstly that thereby it could be prevented that the tolling OBE becomes the dominant telematics hardware-platform and secondly that those 3rd party devices with integrated "toll module" would gain attractiveness as they are able to collect the toll in addition to their original functional intention.

3) A technical platform on backend side ("central telematics gateway") shall be set up that provides access for third party Service Providers to basic functions and data of the tolling OBE. This platform has to be operated by an independent company in which neither the operator Toll Collect nor the shareholders Daimler and Deutsche Telekom have dominant influence.

From a technical point of view the abovementioned requirements could be implemented. As a matter of fact, the implementation and in particular the organisational requirements would require a substantial investment. The underlying business model and the corresponding processes would create a complex system which does not provide VAS in the most efficient way for Service Providers and the users. The creation of the appropriate contractual conditions by the German State is a prerequisite for bringing VAS into operation.

Perspectives created by EETS

The foreseeable introduction of EETS in Europe is possibly a new way how Germany can proceed on the way of combining road charging with VAS. The legal constraints and implementation details in the case of the German truck toll system from 2003 have been driven from the necessity to preserve a fair competition on the market for telematics hardware and services by preventing a monopoly position of its operator and its shareholders.

With the introduction of the EETS an open European market for toll services will be created. In this scenario various toll Service Providers are offering their service to the end-users. VAS that are provided in parallel on the tolling OBE are explicitly foreseen in the EETS decision.

The reasoning therefore is:

1) In an open market the EETS providers are in competition for subscribers. By provision of VAS in parallel to tolling they can differentiate from each other.

2) EETS providers can gain additional revenues by providing VAS. This can be a significant part of the EETS-provider's business case.

3) The utilization rate of the used OBE equipment is raised, which increases the efficiency of operations.

The EETS implementation develops an open market with competition among toll Service Providers and fosters the additional provision of VAS. Since the future German toll operator will be one toll provider among others and thereby exposed to free competition, the relevance of the specific European regulation on the situation of VAS in connection with the German truck toll system must be discussed openly.

A.5 Italy

The same OBE used for electronic toll payment in the Italian tolling roads network is being used for VAS in fields outside the scope of tolling.

One example is the control of access to restricted zones (historical centres of more than 20 cities). Vehicles that are allowed to enter restricted areas are given an OBE which is interrogated by RSEs that are located at the entry points of the restricted areas. If the OBE is recognized, a picture of the licence plate is taken for further processing and possibly fining. The same OBE can then be used in the highway to pay the toll.

A second example is the computation of travelling times in the tolling highways. In this case, a number of RSEs, of the same type as those that are used for tolling, are installed in specific locations along the road. A dedicated application simply "pings" the passing OBEs, and stores their OBE identifier together with the time of passage. The information on the average time needed to travel from a given point to any given destination is then displayed on Variable Message Panels.

A.6 Japan

Since ETC service was put into operation in 2001, number of OBE has grown up over 30 million in 2010. In the meantime various ITS services provided by OBE have been developed and some of them are put into operation recently in Japan. There are two types of OBE used for these ITS services. One type is equipped with voice unit to deliver messages by voice. The other type is equipped with both voice unit and display to deliver messages by voice and image. Voice type OBE can be used for ETC, information provision services and payment services. voice and image type OBE can be used for ETC, information provision services, internet connection services and payment services.

The basis of communication medium for these services is 5.8 GHz DSRC now. However, services by more media will be provided in the future.

Services in Japan

1) ETC;

2) Informational provision services: Road traffic information, traveller information, safe driving assistance information;

3) Information connection services (for stationary vehicle): Internet connection, local information, sightseeing information;

4) Payment services: Gas station payment, parking payment, car ferries payment, drive thru payment;

5) Map download;

6) Probe data;

7) Fleet management;

NOTE 1) – 4) are services already provided.

Figure A.3 — Examples of Services in Japan

A.7 Korea

Two types of DSRC communication media, Infrared DSRC and 5.8 GHz RF DSRC, have been introduced in Korea since January 2003. More than 4 Million OBEs have been deployed until June 2010, as a form of after-market products and in-dash products. The percentage of using ETC service in expressway has reached over 45 % in 2010, and is expected to increase to 70 % by the end of 2012.

Because each DSRC communication protocol has been strictly conformed to ISO 15628 (DSRC application layer) and ISO 14906 (EFC data structure) standard, ETC OBEs are ready to support other ITS services such as parking, access control and etc, as described in ISO standard.

In the meantime, there are several trials to integrate ETC OBE with other devices:

— OBE with mobile phone: IC card in OBE can be interrogated by mobile phone using Bluetooth, and credited by mobile phone using Bluetooth and Cellular network. It was a telecom company who distributes these OBEs to users, meaning that it is not traditional bilateral relations between user and charger, but multilateral, market based arrangement.

— OBE for traffic information: The probe data in expressway and in main roads of metropolitan area is collected from millions of ETC OBEs, and are processed to make real-time traffic information, and then delivered back to vehicle devices, VMS (Variable Message Sign), Internet, ARS and broad-casting. High profile DSRC OBEs are also available in the market such as standalone voice-telling OBEs, a fully integrated navigation terminals and etc.

As the ubiquitous communication environment is in need of being built in Korea, these kind of trials to integrate ETC OBEs with VAS shall be increased.

A.8 Norway

The Norwegian AutoPASS OBE (DSRC) has so far been applied in the application class "Payment" and the application class "Traffic Data Collection" in addition to the national and interoperable EFC system.

The payment applications cover payment for ferries. Norway has many fjord crossings operated by ferries. One of the ferries close to Trondheim (Flakk – Rørvik across the Trondheim fjord) has now introduced payment by the AutoPASS tag. Users with AutoPASS tags are charged via their tag and their EFC Service Provider. Users without the AutoPASS tag are registered by Automatic License Plate Number Recognition (ALPNR) and charged by the Toll Charger operating the charging points on both sides of the fjord. The payment application also covers payment for parking but in these cases the payment application is not part of the national AutoPASS integrated payment. The OBE ID is used by some operators of parking houses for their own and closed payment systems as a pointer to a central account in the back-office system of the operator.

The application in the class of "Traffic data Collection" covers real time traffic data acquisition. The data is used for informing users on the road about travel times on main roads that are congested during weekends, special occasions or incidents. The application also includes a requirement specification for RSE used for this application. Due to privacy reasons the data is encrypted and made anonymous before they are transferred from the RSE to the Central Equipment handling the data and transforming them to travel time messages to the road users.

A.9 Switzerland

The Swiss Heavy Vehicles Fee, LSVA, is an EFC system that employs OBE that offers rich resources for exploitation by VAS, e.g. high processing power, a GPS receiver, a graphic display and a key pad, availability of sensor data regarding distance travelled, vehicle speed, and trailer presence. It was a decision of the system implementer, Swiss Customs Authority, mainly for reasons of governance and security not to allow VAS to be offered on the OBE itself. Instead, all available information, i.e. especially regarding vehicle location, movement and trailer status can continuously be broadcast to other devices in the cabin. The first generation of OBE offered the information via an infrared interface (IrDA) with an optional conversion to a standards serial interface (RS232). A second generation of OBE offers the same information via Bluetooth.

The use of this rich source of free information has been minimal. Very few Service Providers have made use of the high quality data for providing commercial services to the market. The main reason for appears to be the fragmented nature of the traffic telematics market. Different sectors of the freight business have very different information requirements. Vehicle tracking is important to some international long-haulage companies, geo-fenced recording of freight bay doors is of relevance to some others, frozen food transport require monitoring of bay temperature, some companies record speed, acceleration and gear settings in order to educate drivers for better fuel efficiency, and many companies need to connect freight and contract information to trips and delivery points in numerous ways. There appears to be a multitude of niche markets for VAS in Switzerland, where apparently no application has the required volume for successful mass delivery.

Annex B
(informative)

Example for a regulatory framework architecture

Australia has developed and established an innovative way for managing heavy vehicle compliance to road access regulations. The regulatory framework is called the Intelligent Access Programme, IAP. The IAP provides a unique national framework comprising regulatory, contractual and operational elements for monitoring heavy vehicle activity and generating evidentiary level reports in relation to non-compliant activity.

The objective of IAP is to implement a system that remotely monitors heavy vehicles to ensure they comply with their agreed operating conditions using in-vehicle telematics devices that use sensors to monitor parameters of interest (such as location and speed).

In Australia, certain classes of heavy vehicles require permits or operate under agreed schemes on its road networks. Previously, enforcement of schemes and permits was largely a manual process. IAP enables such enforcement to be undertaken automatically and in return provides heavy vehicles with potentially increased access to road networks.

In brief, the IAP operates as follows:

a) Heavy vehicles are fitted with sensors to enable monitoring of a number of vehicle parameters – vehicle identity, position, time and speed. Some, or all of these parameters may be used to ensure that the Transport Operator works within the conditions set by a Jurisdiction.

b) Private sector Service Providers operate the compliance monitoring services. Ideally, they combine these services with other services that they currently provide to a Transport Operator, e.g. fleet management.

c) A transport operator joins the IAP through a Jurisdiction to gain access to the benefits being offered. They engage a Service Provider on a fee-for-service basis.

d) The Service Provider notifies the Jurisdiction whenever the Transport Operator is in breach of the conditions, i.e. an incident of ‘non-compliance’, with a Non Compliance Report (NCR).

e) The certification agency (Transport Certification Australia, TCA) ensures that the Service Providers and their equipment meet the agreed monitoring and reporting requirements.

The IAP operating model is summarised in the figure below. The IAP Service Providers are also permitted to provide non-IAP (commercial) services, which should gain approval of TCA and not affect the quality of IAP services. The whole arrangement is currently being put into a standard, see ISO/WD 15638.

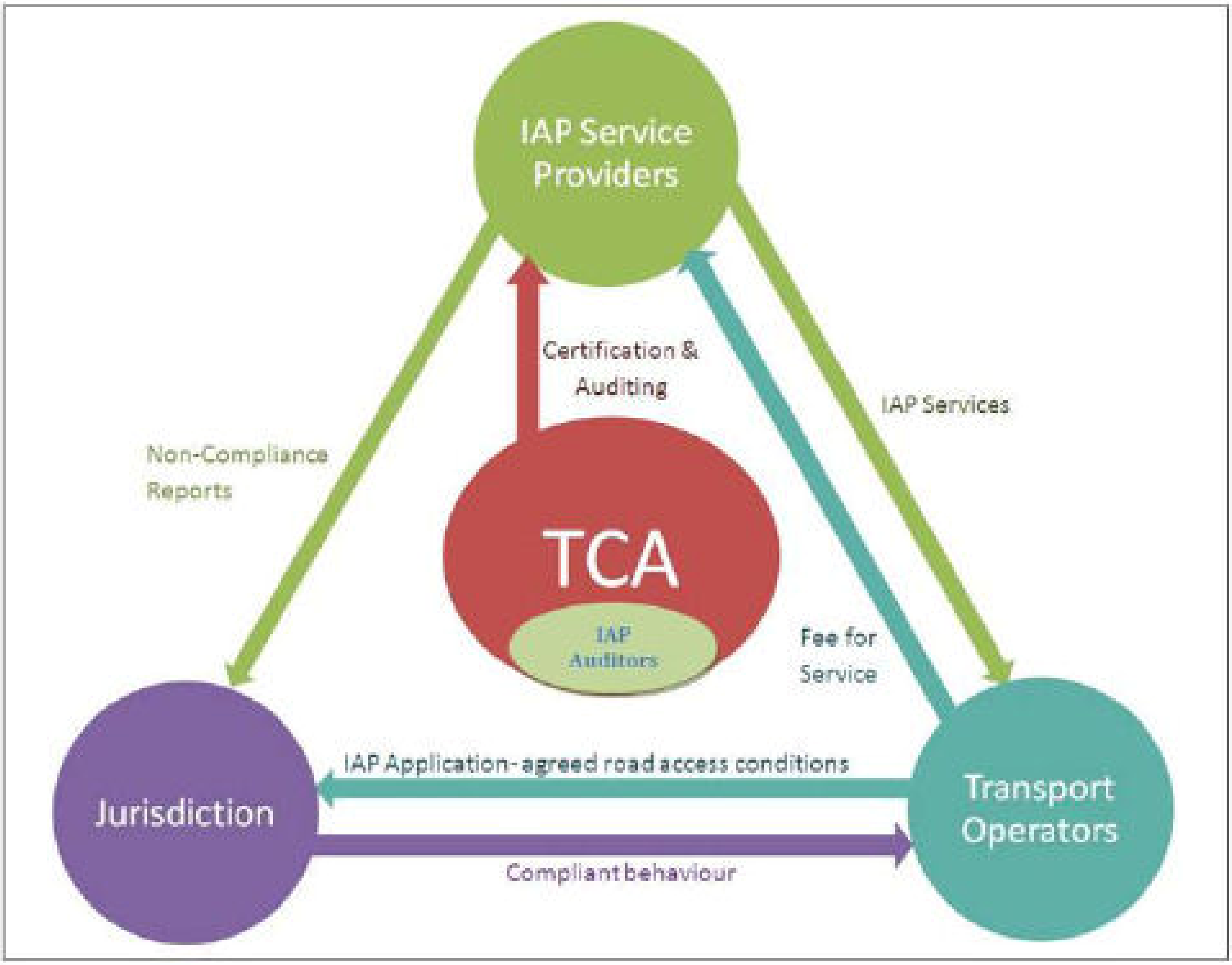

Figure B.1 — IAP operating model

The technical requirements for participation in the IAP as a Service Provider are performance based. That is, the IAP defines required outputs and it is up to each company wishing to be certified as an IAP Service Provider to establish, to the satisfaction of TCA, that its equipment and related back-office systems deliver the required outputs. The IAP does not specify the particular equipment and systems required. Thus, competing companies whose equipment and systems differ significantly may be certified, as long as they deliver the required outputs.

This gives IAP Service Providers the flexibility to take full advantage of innovative, cutting edge ITS technologies when designing and developing their equipment and systems. Coupled with market competition between IAP Service Providers, this flexibility will ensure that ‘IAP technology’ keeps pace with world-wide advances in broader ITS technologies.

TCA is not only responsible for certification and auditing, but also for developing the programme further by widening its scope of applicability. Currently TCA is developing specifications and test protocols for a fatigue management system for drivers of heavy vehicles and a speed monitoring system. TCA is also investigating the feasibility of an on-board mass monitoring application for heavy vehicles.

NOTE For further information see www.tca.gov.au.

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