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Electronic fee collection — Requirements for pre-payment systems

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National foreword

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Electronic fee collection - Requirements for pre-payment systems

Perception de télépéage - Exigences relatives aux systèmes de pré-paiement

Elektronische Gebührenerfassung - Anforderungen für Systeme zur Vorauszahlung

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Foreword

This document (CEN/TR 16092:2011) has been prepared by Technical Committee CEN/TC 278 “Road Transport and Traffic Telematics”, the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

Introduction

The discussion on payment-modes within the environment of electronic fee collection at present is based on the existence of a post-payment contract between the Toll Service Provider (TSP) and the Service User (SU).

Pre-conditions of such a contractual agreement are

- sufficient creditworthiness of the SU, and
- existence of a bank account with the SU.

Questions arise in the context of the access to an EFC system for

- SUs not being able to meet the aforementioned pre-conditions;
- SUs with occasional needs to use an EFC system (mainly from the private sector)
 - not willing to open a bank account;
 - not able to open a bank account (by reasons what so ever) and therefore not allowed to participate;
 - from countries with limited access to the card market to participate in an interoperable EFC system, which may otherwise not be open to them.

To meet the requirements of this clientele, one or more suitable ways of pre-payments have to be established for EFC to grant interoperability:

- stored value on an electronic medium;
- stored value in a central account.

As far as private users are concerned legislation could ask for anonymous payment modes as nobody can be forced to open or communicate a bank account. On the other hand such payment modes help Toll Service Providers to offer an interoperable EFC service to customers with a limited monetary risk.

Before defining necessary standards in that field the requirements of a universal Pre-Payment system able to communicate with the OBE have to be evaluated, especially with regard to validity and feasibility for private users.

1 Scope

This technical report (TR) analyses requirements for a universal Pre-Pay account system for EFC including the following issues:

- relations to other existing standards in this domain;
- the core requirements and functionality that must be provided.

This technical report will show an analysis of the requirements for a universal prepay system and categorise possible different types of pre-pay solutions, in terms of functionality, technical and legal considerations. As far as legal requirements are concerned it will be clarified whether the pre-payment means fall within the scope of European Directive 2000/46/EC on the taking up, pursuit of and prudential supervision of the business of electronic money institutions and whether the medium-issuing organisation has to act as a financial institution and falls within the scope of the Payment Service Directive 2007/64/EC. The latter applying exactly to payment activities undertaken by entities but do not require a full bank license.

The technical report will describe the current state-of-affairs of EFC pre-payment systems, including the demand for standards and inventory of provisions provided by standards. It will identify and prioritize gaps in terms of standards or other enablers needed in order for the market to provide viable pre-payment solutions in a European context.

There are two general approaches to represent the content of the TR:

- a) allocate each requirement under each pre-pay solution;
- b) allocate each pre-pay solution under each requirement.

To achieve a better understanding and readability alternative a) has been decided (this refers to Clause 8 and Clause 9 only).

The TR does not give any decision on how or whether one of the pre-payment solutions described is commercially feasible to be considered as an implementable offer to the Service User. The return for invest for any TSP regarding the system architecture requirements and other obligations (refunding of SU) is questionable.

This TR just gives a summary of the requirements of possible pre-pay solutions. It is up to decision makers to evaluate the alternatives in the light of their individual preconditions of their tolling regime and of market acceptance.

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*

prEN ISO 12855, *Electronic fee collection — Information exchange between service provision and toll charging (ISO/DIS 12855:2009)*

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

prEN ISO 17573, *Electronic fee collection — System architecture for vehicle related tolling (ISO/DIS 17573:2009)*

CEN ISO/TS 25110, *Electronic fee collection — Interface definition for on-board account using integrated circuit card (ICC) (ISO/TS 25110:2008)*

ISO 4217, *Codes for the representation of currencies and funds*

ISO/IEC 7810, *Identification cards — Physical characteristics*

ISO/IEC 7816-1, *Identification cards — Integrated circuit(s) cards with contacts — Part 1: Physical characteristics*

ISO/IEC 7816-2, *Identification cards — Integrated circuit cards — Part 2: Cards with contacts — Dimensions and location of the contacts*

ISO/IEC 7816-3, *Identification cards — Integrated circuit cards — Part 3: Cards with contacts — Electrical interface and transmission protocols*

ISO/IEC 7816-4, *Identification cards — Integrated circuit cards — Part 4: Organization, security and commands for interchange*

ISO/IEC 7816-6, *Identification cards — Integrated circuit cards — Part 6: Inter-industry data elements for interchange*

ISO/IEC 7816-8, *Identification cards — Integrated circuit cards — Part 8: Commands for security operations*

ISO/IEC 14443-1, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 1: Physical characteristics*

ISO/IEC 14443-2, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 2: Radio frequency power and signal interface*

ISO/IEC 14443-3, *Identification cards — Contactless integrated circuit(s) cards — Proximity cards — Part 3: Initialization and anticollision*

ISO/IEC 14443-4, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 4: Transmission protocol*

ISO/IEC 15693-1, *Identification cards — Contactless integrated circuit cards — Vicinity cards — Part 1: Physical characteristics*

ISO/IEC 15693-2, *Identification cards — Contactless integrated circuit cards — Vicinity cards — Part 2: Air interface and initialization*

ISO/IEC 15693-3, *Identification cards — Contactless integrated circuit cards — Vicinity cards — Part 3: Anticollision and transmission protocol*

ISO/IEC 18092, *Information technology — Telecommunications and information exchange between systems — Near Field Communication — Interface and Protocol (NFCIP-1)*

3 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1

Electronic Fee Collection (EFC)

toll charging by electronic means via a wireless interface

3.2

enforcement

process of compelling observance of a law, regulation, etc.

3.3

Interoperability

ability of systems to provide services to and accept services from other systems and to use the services so exchanged to enable them to operate effectively together

EXAMPLE For tolling interoperability aims at enabling a vehicle to drive through various toll domains while having only one OBE operating under one contract with a toll service provider.

3.4

Onboard equipment (OBE)

equipment fitted within or on the outside of a vehicle and used for toll purposes

3.5

tariff Scheme

set of rules to determine the fee due for a vehicle in a toll domain for a EFC object at a certain day and time

3.6

toll

charge, a tax, a fee, or a duty in connection with using a vehicle within a toll domain

3.7

toll charger

legal entity charging toll for vehicles in a toll domain

3.8

toll declaration (from OBE)

statement (from the OBE of a vehicle) to a toll charger, not necessarily transmitted via a direct communication channel, that confirms the presence of a vehicle in a toll domain in a format agreed between the toll service provider and the toll charger

3.9

toll domain

area or part of a road network where a EFC regime is applied

3.10

EFC point

location within a toll domain where the OBE has to issue a toll declaration

3.11

EFC regime

set of rules, including enforcement rules, governing the collection of toll in a toll domain

3.12

toll schema

generic term used for EFC regime and/or toll domain and/or toll system depending on the context

3.13

toll service

service enabling users having only one contract and one set of OBE to use a vehicle in one or more toll domains

3.14

toll service provider

legal entity providing to his customers toll services on one or more toll domains for one or more classes of vehicles

3.15

toll system

off board equipment and possible other provisions used by a toll charger for the collection of toll for vehicles

3.16

EFC object

distinguished part of a toll domain for which one or more tariff schema applies

EXAMPLE An EFC object may be e.g. an area, all public roads within an area, a bridge, a zone, or a stretch of a road (network).

3.17

service user

generic term used for the customer of a toll service provider, one liable for toll, the owner of the vehicle, a fleet operator, a driver etc. depending on the context

3.18

value units bearing device (VBD)

device in the hand of the Service user that contains value units

4 Abbreviations

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

CAD	Card Accepting Device
DSRC	Dedicated Short Range Communication
EETS	European Electronic Toll Service
EFC	Electronic fee collection
EMD	e-Money Directive
GNSS	Global Navigation Satellite System
GSM	Global System for Mobile communications
IC	Integrated Circuit
ID	Identification
IPR	Intellectual Property Rights
IRPA	International Radiation Protection Authority
NFC	Near Field Communication
OBE	On Board Equipment
PDA	Personal Digital Assistant
PMD	Payment Services Directive
POS	Point Of Sale
PSP	Payment Service Provider
RSE	Road Side Equipment
SAM	Secure Access Module

SP	see TSP
SU	Service User
TC	Toll Charger
TR	Technical Report
TS	Technical Specification
TSP	Toll Service Provider = Service Provider
VAT	Value Added Tax
VBD	Value Units Bearing Device

5 Interoperability Issues

5.1 Interoperability based on EFC Roles Model

Any universal Pre-Pay system needs to comply with the EFC Roles model defined in prEN ISO 17573. This standard defines the four main roles shown in Figure 1.

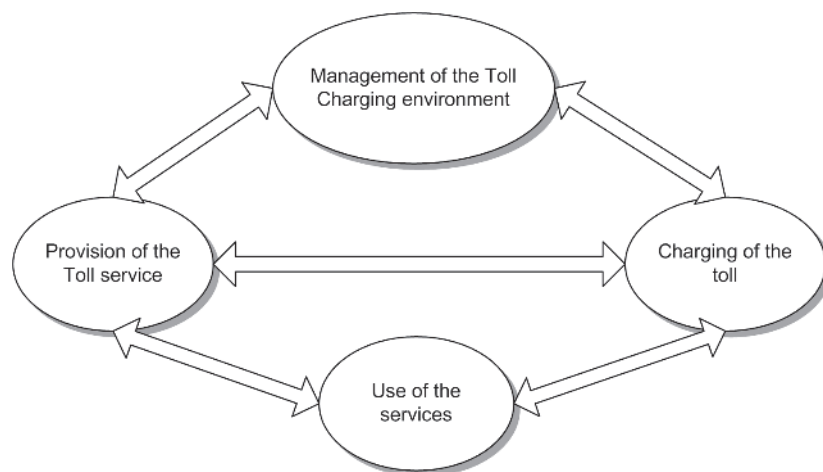


Figure 1 — Roles in the Toll Charging environment

Provision of the Toll Service

The role related to the provision of the Toll service is responsible for providing the basic artefacts, mechanisms, organization structures, and information transfer tools needed to run an EFC system. Provision of the OBE and the EFC contract with the Service User are two of the most important responsibilities of the role. An actor covering all responsibilities of the role is often called a Toll Service Provider or Service Provider.

Use of the services

In this standard a transport service is related to the use of or the presence of a vehicle in an Toll domain. The Toll domain may be a road network, a specific section of a road (e.g. a bridge, a tunnel or a ferry connection) or a specific area offering a service (e.g. a country, a region, a parking lot or access to a protected area in a city). This role is thus identified that it covers all aspects of using the Toll system and the transport service. Implementations of Toll systems in various domains identify actors in this role that are commonly referred to as, e.g. Driver, Service User (vehicle) or Customer.

Charging of the toll

The role related to the charging of the toll covers all actors who define the Toll domain, operate the toll system and may provide transport services. The role includes the related charging infrastructures and who defines the toll and operates the toll system. Enforcement operators are also part of this role.

Management of the Toll Charging environment

There is also a need for an overall management of the Toll Charging environment defining and organising the policy that enables the daily operation of the Toll Charging equipment involving several different actors. A specific role is identified to manage the Toll Charging environment, i.e. defining and maintaining a Set of Rules that, taken together, defines the policy of a given regime or of the overall Toll Charging environment.

Extension for the purpose of this document

The four roles represent a logical model. This does not prejudice any physical organisation. When coming to real organisations sub-actors can take over parts of the responsibilities of a role. With respect to pre-payment it is necessary to introduce the Payment Service Provider (PSP) as sub-actor of the Toll Service Provider.

5.2 Interoperability and Payment

One part of the SU's contract with the TSP is the definition of the payment mode under which the SU pays the toll consumed. If the TSP offers different payment modes, the SU has to decide which payment mode he wants to choose

- central account Post-Pay mode or;
- central account Pre-Pay mode or;
- OBE based Pre-Pay mode.

This can be agreed independently from the toll charger (TC), who has no right to decide on this contractual issue between TSP and SU.

But, a TC may limit the use of his toll domain to the use of OBEs operated through a central account. This limits the interoperable use of an OBE based pre-pay mode and has to be clearly communicated to the SU.

6 Classification of Pre-Pay solutions

6.1 Pre-Pay Account held in Central System

The OBE is equipped with a reference to an anonymous account held in the central system of a TSP which contains a certain amount of value units. This account may be linked to a specific SU, or may be anonymous in the sense that the stored value units have no link to the person or entity who loaded it into this account.

This account can be credited with value units by the SU in the form of:

- cash paid to a bank account of the TSP;
- cash paid at a point of sale;
- automatic direct debit against the SU's bank account.

The toll amount due for the usage of a Toll domain is transmitted from the TC to the TSP and there deducted from the centrally held account. The TSP in turn pays the amount due to the TC.

Advantages:

- the TSP can always see the amount of credit for a given contract/OBE (e.g. not only when the OBE has contact with the TSP);
- flexibility of operating several OBE from the same central Pre-Pay account;
- easier customer care support by Toll Service Providers in case of low credit (e.g. warning sent to non-anonymous user), instead of local belated payment procedures or enforcement;
- takes away complexity from the driver;
- loading of credits centrally by money transfer or over the internet possible;
- no extensive international POS-network necessary for Toll Service Providers (no cash handling);
- increases security for the vehicle operator (e.g. no fraud by drivers due to card or cash handling);
- easy handling of differences in case of problems between Toll Service Provider and Toll Charger;
- currency conversion handled between Toll Service Provider and Toll Charger;
- for the Toll Charger the contract presents itself as a Post-Pay contract;
- reduced risk of theft of OBE (no credits on the device).

Disadvantages:

- credits are held centrally and can only be debited at certain intervals (e.g. daily);
- no real time calculation if credit is sufficient for consumption during this intervals;
- negative credit may result out of a propagation delay between transaction and clearing;
- credit not in possession of the SU but stored at Toll Service Provider.

6.2 Pre-Pay Account held on OBE

The OBE is equipped with an anonymous account containing a certain amount of value units (stored value). The toll amount consumed is calculated and deducted from that on-board account immediately at the time the SU uses the toll domain(s).

The SU has to care for sufficient value units stored on the OBE before using a toll domain. CEN ISO/TS 25110 describes three technological approaches how to equip an OBE with stored value units and get access to it. The TR refers to that.

Advantages:

- anonymous solution;
- value units are portable through all systems without communication at borders of toll domains;
- value units are always in the possession of the SU;
- no negative credit needed (unless contractually defined);
- wide variety of payment means acceptable for loading of credits.

Disadvantages:

- amount of credit at a given time is unknown to the Toll Service Provider (e.g. possible problem if OBE fails or is stolen);
- communication problems may lead to differences between the credit on the OBE and the transactions registered by the Toll Charger (e.g. not properly terminated transaction which was not registered by the TC as valid but deducted the amount from the OBE);
- conformity tests for international POS-network needed;
- only one currency on OBE possible, so Toll Charger has to calculate correct fee in target currency of OBE in real time;
- a real time calculation of the toll amount has to be effected by the TC (e.g. distance based tolling in a complex layout within a closed system);
- strong requirements on enforcement;
- strong impact of the legislation (e-Money Directive) on the solution;
- accepted payment means may differ at different POS operators.

7 Requirements for Pre-Pay account held in Central Systems

7.1 General

There are different requirements for any universal Pre-Pay system with an account held in the central system of a Service Provider. The effective credit is always under the control of the TSP and therefore in his safekeeping in the name of the SU. This leads to several constraints in the view of business process requirements, technical requirements and functional constraints on how to handle these credits.

7.2 Business Process Requirements

7.2.1 General

The foremost business requirement is that the TSP can comprehensibly prove at any time the current amount of credit in the central account.

7.2.2 Issuing of an EFC contract to the Service User

Service User considerations

The first act in a universal Pre-Pay system is the issuing of an EFC contract from the Service Provider to the Service User. In this process the Service User may opt to stay anonymous with the acceptance of all related disadvantages to him. Some of these disadvantages would be among others:

- no issuing of fiscal invoices to the SU for cash payments to the bank account of the TSP;
- issuing of unnamed invoices to the SU for direct cash payments to the TSP under special conditions with a limited amount in certain countries;
- limited serviceability of the SU;
- no way of informing the SU about any problems with the account;
- automatic blocking of all associated OBE if the account falls below a certain floor limit;

- enforcement measures by TC(s), if the associated OBE are blocked due to lacking credit;
- return of remaining funds only in conjunction with the return of the associated OBE (no other way of identification possible).

If the SU opts to be known, the TSP can offer a lot more service to him. Some of these are among others:

- issuing of named invoices to the SU (without limit);
- periodic information on changes of Toll domains the customer is using;
- information of SU in due time before the credit in the account falls below a certain floor limit (thus enabling the customer to react with a timely payment of additional funds);
- direct debit scheme to automatically hold the account on a certain level (see 7.2.4);
- return of remaining funds to any legitimate representative of the SU.

Distribution channels

The central account has to be endowed with an initial amount at the time of the issuing of the EFC contract, whether the SU opts to be known or opts to stay anonymous. The initial amount depends mainly on the safety requirements by the TSP and on the monthly turnover of the SU. It has to be decided between the TSP and SU, how much the initial endowment has to be.

The issuing of an EFC contract can be done through various channels:

- Point of sale network or central office: The EFC contract can be issued at a point of sale or directly at the central office of the TSP. After the issuing of the EFC contract the OBE(s) are issued directly to the SU. Either pre-personalized or personalized OBE(s) can be used. The initial credit has to be paid with any payment means accepted by the POS operator (e.g. credit card, fleet card, cash ...).
- Internet: If the EFC contract is issued through the internet the OBE(s) can be sent physically to the SU or he receives some kind of registration information (e.g. bar code) to pick the OBE(s) up at a point of sale, an installation partner or directly at the central office of the TSP. Either pre-personalized or personalized OBEs can be used through this distribution channel. The initial credit has to be paid with any payment means accepted by the TSP over the internet (e.g. credit card).
- Reseller: If the EFC contract is issued at a reseller (e.g. super market, fuel station ...) only pre-personalized OBE can be handed out directly by him to the SU. The difference between the reseller and the point of sale is that he has no equipment for personalisation. In the case of handing out pre-personalized OBE(s) the link between the OBE(s) and the central account has to be established immediately. Otherwise the issued OBE(s) may produce toll amounts before sufficient credit is available for the payment.

Otherwise the TSP can also split the process by handling the issuing of the contract at a reseller and performing the delivery of the OBE(s) himself. The OBE(s) can then be sent to the customer or he receives some kind of registration information (e.g. bar code) to pick them up at a point of sale, at an installation partner or at the central office of the TSP. For this option, either pre-personalized or personalized OBEs can be used.

The initial credit has to be paid with any payment means accepted by the reseller (e.g. cash, bank card, credit card, fleet card ...).

Contractual requirements

Additional corner points of the EFC contract are

- Type of account: Named or anonymous account.

- Number of OBE: The number of OBE to be associated with the central account has to be defined, since it may have an impact to the associated limits.
- Allowed Toll domains: The SU and the TSP have to agree if the OBE(s) to be issued shall be accepted in all or, if possible, only in a limited set of Toll domains. This may also have an impact to the associated limits.
- Type of payment: The SU and the TSP have to decide whether the TSP may deduct from the SU's bank account or whether the SU takes care of a sufficiently funded account.
- Floor limit: The floor limit is the lowest allowed credit limit on the account. If the credit falls below the floor limit, the TSP automatically blocks any associated OBE from being accepted in the allowed Toll domains.
- Reload limit: If the credit falls below the reload limit, the TSP automatically triggers a collection from the SU's bank account, when they agreed on a direct debit scheme.
- Reload amount: This amount is automatically collected from the SU's bank account when the credit of a direct debit enabled account falls below the reload limit. The height of this amount has to be decided between the SU and the TSP.
- Information limit: If the credit falls below the information limit, the TSP automatically informs the non anonymous SU to reload his account, when they did not agree on a direct debit scheme.
- Roof limit: If the credit goes above a roof level in a centrally held Pre-Pay account, the surplus amount can be transferred back to the bank account of the SU. Through this the effects of an erroneous money transfer by the SU can be limited. The SU and TSP have to agree on the installation of such a roof limit.

7.2.3 Personalisation of OBE

The personalisation of the OBE has to follow the established standards (e.g. EN ISO 14906, EN 15509 ...).

Any OBE for a centrally held Pre-Pay account has to be personalized with a Post-Pay contract, because for all Toll Chargers, this OBE works like having a Post-Pay contract. Since there is no representation of the credit on the OBE the TC is not required to check against any credit limits.

Apart from the above requirements the personalized OBE has only to fulfil all necessary requirements of the EFC regimes it is intended for. This may include the personalization of the nationality and license plate of the vehicle the OBE is intended for, thus limiting the absolute anonymity of the SU.

Pre-personalized OBEs can be used with a centrally held Pre-Pay account, if there is no requirement for the OBE to contain the nationality and license plate of the vehicle. If this is possible, only the link between the ID of the pre-personalized OBE and the centrally held account needs to be established before the first use of the OBE.

7.2.4 Loading of value onto an account

7.2.4.1 General

After the initial loading of value units onto a centrally held Pre-Pay account, this has to become a recurrent process. The periodicity of this depends hugely on the loaded amount and the rate of consumption by the associated OBE(s). There are several possible solutions to load value units onto the account:

7.2.4.2 Manual cash payment to the account of the TSP:

If the SU opts to stay anonymous or is not in the possession of a bank account, he can make cash payments to a bank account of the TSP. This typically means a delay of one to three days until the amount is finally credited to the bank account of the TSP and can be credited to the centrally held Pre-Pay account. For this crediting of the cash payments it is inevitable, that the SU provides some kind of identification of the centrally held Pre-Pay account. Some of this identification marks may be:

- account number of the account;
- customer number for the (anonymous) SU;
- OBE ID associated with the account;
- nationality and License plate of one vehicle associated with the account.

If the SU fails to provide a meaningful identification for the payment, the TSP can only store it until the SU complains the missing credits on his account. The TSP will assume ownership of any unclaimed payments after a legally acceptable grace period (e.g. 3 years).

In case of a cash payment to the bank account of the TSP, the SU explicitly accepts that the TSP can not issue any fiscal invoice to him. This may only be a viable solution for the private sector.

7.2.4.3 Manual cash deposit directly to the TSP:

If the SU opts to stay anonymous or is not in the possession of a bank account, he can make cash payments directly to the TSP. The SU has to be present at a point of sale or at the premises of the TSP to make his cash deposit. The identification of the central account can be solved directly with the SU present for paying and the account is credited immediately.

In this case the SU can also collect an unnamed fiscal invoice for his payment. Due to legal constraints in some countries these unnamed invoices may be limited in their amount and form.

7.2.4.4 Manual money transfer to the account of the TSP:

If the SU does not grant the TSP with a direct debit authorisation for his bank account, he has to manually transfer any money to a bank account of the TSP. This typically means a delay of one to three days until the amount is finally credited to the bank account of the TSP and can be credited to the centrally held Pre-Pay account. He may do this on a regular basis or when he receives any information from the TSP, when his account fell below the information limit.

For these money transfers it is inevitable, that the SU provides some kind of identification of the centrally held Pre-Pay account. Some of this identification marks may be:

- account number of the account;
- customer number for the (anonymous) SU;
- OBE ID associated with the account;
- nationality and License plate of one vehicle associated with the account;
- name and contact details of SU.

If the SU fails to provide a meaningful identification for the payment, the TSP can try to transfer the money back to the sender if he has a valid account number. This may not be the case for every money transfer, since some payments may be transferred through intermediate banks, which do not include the account details of the original sender but replace it with their own intermediate account details. If the TSP does not receive a valid account number of the payer, he may only store the transferred amount until the SU complains the missing credits on his account. The TSP will assume ownership of any unclaimed payments after a legally acceptable grace period (e.g. 3 years).

7.2.4.5 Automatic direct debit against the SU's bank account:

If the SU and the TSP decide on a direct debit scheme to load values onto the centrally held Pre-Pay account, the TSP collects the agreed reload amount after the credit on the account falls below the agreed reload limit. Currently direct debits are only a national solution. If a TSP wants to use this in a broader sense, he either has to open a

bank account in each country he has customers in or wait for a broad adoption of the SEPA direct debit scheme, which will start from November 2009.

The result of a collection is immediately seen on the bank account of the TSP and has also to be reflected immediately on the centrally held Pre-Pay account of the SU. This is the most effective and fastest way to load an account. If a collection fails out of any reason (e.g. SU's bank account is not sufficiently credited to allow the collection of the reload amount, SU's bank account is closed ...), the collected amount will be deducted from the TSP's bank account together with some fees typically within one week. The amount of the reload limit has to be set in a way, that it allows the failing of a collection without leaving the credit on the account below the floor limit. If this happens, the TSP may even run into a negative credit on his account and thus assuming an unwanted credit risk for this Pre-Pay account. Even if the account stays positive, it leaves the SU without any possibility to solve the issue and care for a sufficient funding of the account before the associated OBEs are blocked.

7.2.5 Charging of Toll

The charging of the toll for the TC is the same as with any Post-Pay OBE. He sends the billing details, pre-billing information and invoices for the consumption of the OBE(s) to the TSP and awaits their payment. The TC does not have to check any limits. Every OBE which is not blocked through the exception list is accepted.

The TSP uses the transferred amounts due to deduct the centrally held Pre-Pay account. After the deduction of all amounts due for a period, the TSP has to check whether some accounts fell below any agreed limit. The TSP has to check against the following limits:

- **Information limit:** If an account fell below the agreed information limit, the TSP has to inform the non anonymous SU in the agreed way (e.g. e-mail, fax, letter ...) of this fact and request to refill the account. The SU can then make a money transfer or make a cash deposit onto the TSP's bank account. If the SU opted to stay anonymous, the TSP can not relay any information about the situation to him and has to await any payment from the SU.
- **Reload limit:** If an account fell below the agreed reload limit, the TSP collects the agreed reload amount from the SU's bank account.
- **Floor limit:** If the credit on a centrally held Pre-Pay account falls below the agreed floor limit, the associated OBE(s) have to be included on the Exception list sent to the Toll Chargers. This will block them from being accepted in the agreed Toll domains. Depending on the local rules within the Toll domains this may lead to enforcement measures to be taken.

7.2.6 Invoicing of the Service User

Since the invoicing of the Service User is independent of the location where the Pre-Pay account is held, this is described in Clause 10.

7.2.7 Refund of residual amount

If a SU closes the EFC contract with an TSP, he has to return all associated OBE(s). He may then receive any residual amount, which is left on his centrally held Pre-Pay account. This is again dependent on the way the money was paid to the TSP:

- If the SU opted to stay anonymous and the residual amount was paid in cash, it can only be paid out in conjunction with the return of the OBE(s). The SU has either to return the OBE(s) personally at a point of sale of the TSP or directly at his premises where he can collect the residual amount. Since this procedure makes the customer service very time- and resource-consuming, the TSP does not necessarily have to provide this return method or limit it to certain facilities.

The customer may also be allowed to send in the OBE by postal service and provide a bank account, for the transfer of the residual amount. This means that he becomes a named customer at the end of his contract.

If the customer does not return or send the OBE(s) back or does not provide any account details, the residual amount stays in the possession of the TSP until the SU issues a valid claim. The TSP will assume ownership

of any unclaimed payments after a legally acceptable grace period (e.g. 3 years). This grace period has to be in compliance with EU and national consumer protection laws.

- If the residual amount in the centrally held Pre-Pay account was endowed by the SU by money transfer or collected from the SU's bank account, it will be transferred back to the same account. This protects the TSP from any fraudulent claims for a residual amount.

If the TSP does not have any valid account details, although the money was transferred to the TSP, he will inform the SU and keep the residual amount until claimed by the SU. The TSP will assume ownership of any unclaimed payments after a legally acceptable grace period (e.g. 3 years).

Additionally the reduction of the amount in a centrally held Pre-Pay account can also be initiated by a request from a SU. This option is only available for named accounts. This may be required, if a SU has very high credit in his account due to an error in a money transfer or if his monthly consumption dropped sharply. He may then request the repayment of a part of this credit, if agreed between the SU and the TSP.

This process can also be automated, when a roof level was installed during the setup of the contract. If the credit in the central account goes above the roof level, the surplus amount will be transferred to an initially agreed bank account of the SU.

7.2.8 Clearing of Transactions

The clearing of transactions takes place between the TC and the TSP and is identical to the claiming of Post-Pay transactions.

7.2.9 Handling of Complaints

The SU can always ask to detail the consumption in his centrally held Pre-Pay account and complain any wrong debits to his account. This complaint will then be handled by the TSP with the responsible TC for the Toll domain where the claim was issued from.

Apart from this there are no special considerations on the handling of complaints.

7.2.10 Security Considerations

In interoperable systems with different roles every instance of a role has to trust each other. It has to be guaranteed that any transaction subject to a clearing process has neither been added, deleted nor modified during their way from their source to their destination. So, an end-to-end security architecture is required.

The hardware, software and firmware used to hold the central Pre-Pay account has to be tamper prove with regard to bookkeeping standards and any change to the central account has to be recorded.

7.3 Technical Requirements

7.3.1 Requirements for OBE

The OBE has to comply with all established standards (e.g. EN ISO 14906, EN 15509) necessary for the acceptance at the intended Toll Chargers. For this the OBE has to have passed the acceptance test as a Post-Pay unit in the EFC regimes it is intended for.

There are no other requirements for an OBE for the use with a centrally held Pre.-Pay account.

7.3.2 Requirements for POS Networks

7.3.2.1 General

A POS network can either be operated by the TSP himself or by any partner(s) he has an agreement to do so with. This may enable the TSP to use an extensive international POS network without the need to set it up all by himself.

The need for a POS network is only needed for the first time issuing of the OBE to the SU and is mainly influenced by the decision of the TSP to use pre-personalized OBE or personalize every OBE for the intended vehicle of the SU:

7.3.2.2 Pre-personalized OBE

There is no need for a POS network if the TSP uses pre-personalized OBE without any personal information. The pre-personalisation contains only the EFC Context mark as a branding for the TSP, which can be written into the OBE centrally or even at the time of manufacturing. With such a solution the Toll Service Provider can distribute the activated OBE through all distribution channels described in 7.2.2. The use of pre-personalized OBE without the inclusion of vehicle characteristics either limits the use of such OBE to EFC regimes where there is no further distinction (e.g. passenger cars) or requires the concept to enrich billing details as described in prEN ISO 12855.

The loading of additional value units can easily be done through the procedures described in 7.2.4.

7.3.2.3 OBE personalized centrally

There is no need for a POS network if the TSP personalizes each OBE centrally for the vehicle it is intended for. All relevant vehicle characteristics and license plate information are written into the OBE before handing it out to the SU. With such a solution the TSP can distribute the personalized OBE either by sending them to the SUs by post or by providing it for physical pick-up by the SUs at a central location or at an installation partner.

The loading of additional value units can easily be done through the procedures described in 7.2.4.

7.3.2.4 OBE personalized at a POS

Any point of sale needs to be equipped with proper personalisation equipment from the issuing TSP if an OBE is personalized directly at a point of sale. This would mean that the TSP has to install a point of sale network for all Toll domains his OBE is accepted in either by himself or by using the services of a point of sale network operator. All relevant vehicle characteristics and license plate information are written into the OBE before handing it out to the SU after the issuing of the contract.

Since the loading of additional value units can easily be done through the procedures described in 7.2.4, the POS network is only needed for the first time distribution of the OBE to the SUs.

7.3.3 Requirements for Information and Payment Flow (Interfaces)

As the handling of the payment takes place in the central account at the TSP, the OBE operates like a Post-Pay unit. Therefore there are no special considerations to be taken into account apart the basic layout of operation of these interfaces described in prEN ISO 12855.

7.4 Legal and Functional Constraints

7.4.1 Legal Considerations

7.4.1.1 General

The TR cannot and is not allowed to give any legal proven expertise on the respective subjects. The TR instead points out the issues that have to be investigated in depth and legally confirmed by legal advisers.

The TR refers to European Directives only. Maybe national laws will exceed these.

7.4.1.2 EU e-Money Directive

It needs to be evaluated if a Pre-Pay account held in Central Systems falls under the legislation of the European directive 2000/46/EC on the taking up, pursuit of and prudential supervision of the business of electronic money institutions (EMD).

In this regard, the Directive gives the definition of electronic money. The Directive 200/46/EC states in Article 1 point 3 subparagraph (b):

- (b) *'electronic money' shall mean monetary value as represented by a claim on the issuer which is:*
- (i) *stored on an electronic device;*
 - (ii) *issued on receipt of funds of an amount not less in value than the monetary value issued;*
 - (iii) *accepted as means of payment by undertakings other than the issuer.*

Any value units held in a central account have to be stored on some sort of electronic device as far as bookkeeping software running on a server is considered as such. This fulfils the definition in Article 1 point 3 subparagraph (b) (i). Additionally Article 1 point 3 subparagraph (b) (iii) states, that electronic money should be used as a means of payment for undertakings other than the TSP, which is the case since the credit in the central account is used for the payment for the use of an infrastructure operated by a TC.

Therefore the value units stored in a centrally held Pre-Pay account seem to be electronic money.

For the EU e-Money Directive to be applicable to the operation of a Pre-Pay account held in Central Systems the Article 1 point 3 sub-paragraph (a) needs also to be fulfilled:

- (a) *'electronic money institution' shall mean an undertaking or any other legal person, other than a credit institution as defined in Article 1, point 1, first subparagraph (a) of Directive 2000/12/EC which issues means of payment in the form of electronic money;*

This has to be taken into regard for the setup of a centrally held Pre-Pay account.

The requirement for the TSP of applying for a license either as electronic money institution according to Article 1, 3a) or as credit institution according to Article 1, 4 has to be investigated in depth by a legal adviser.

7.4.1.3 EU Payment Service Directive

It needs to be evaluated if a Pre-Pay account held in Central Systems falls under the legislation of the European directive 2007/64/EC on payment services in the internal market.

In this regard, the Directive states in Article 3 on the negative scope under point (k):

- (k) *services based on instruments that can be used to acquire goods or services only in the premises used by the issuer or under a commercial agreement with the issuer either within a limited network of service providers or for a limited range of goods or services;*

Since the payment of toll is performed under a commercial agreement between the issuer (TSP) and a limited network of service provider (TC's) the value units stored in a centrally held Pre-Pay account seem to be out of the scope of the EU Payment Service Directive.

Even if the TSP is no payment institution himself, he makes use of payment institutions for the transfer of money to the centrally held account as described in 7.2.4 for which the EU Payment Service Directive is applicable.

7.4.1.4 EU Money Laundering Directive

The rulings of the European directive 2005/60/EC on the prevention of the use of the financial system for the purpose of money laundering and terrorist financing have to be taken into account in handling any Payments made to an anonymous Pre-Pay account.

How the rulings of the Directive apply to a TSP needs to be analyzed by legal advisers.

7.4.1.5 Data protection

The rulings of the European data protection regulations has to be taken into account, which are contained in

- European directive 2002/58/EC on the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications)

- European directive 2006/24/EC on the retention of data generated or processed in connection with the provision of publicly available electronic communications services or of public communications networks amending Directive 2002/58/EC.

7.4.1.6 IPR issues

There were no IPR issues identified in regard to the operation of a centrally held Pre-Pay account.

7.4.2 Functional Constraints

7.4.2.1 Evaluation of Credits

If the functionality of a reload limit with automatic debiting is not installed the account could fall negative. A negative balance may raise the question whether a credit in the terms of a bank is issued to the SU by the TSP or it can be considered as a short time operation of a Post-Pay account. If it is seen as issuing a credit to the SU, this would then have to be checked against the national implementation of the EU Payment Service Directive.

7.4.2.2 Currency Considerations

In the operation of a universal Pre-Pay System with a centrally held account all eventually necessary currency conversions take place in the systems of the TSP.

The TC(s) will always generate the transaction for the usage of their EFC regime(s) by an SU in his own currency and sends the claim for the amount due to the TSP in this currency. The TSP will need to convert the amount due from any currency they are delivered in to the currency the central account is led in.

The User will make any reloading of the stored value units in his own currency. The TSP will need to convert the transferred or debited amount into the currency the central account is led in.

The currency of the central account can be defined by the TSP depending on his needs. There are the following possibilities:

- **Use the local currency of the TSP:** If the TSP decides to lead the account in his own local currency, he will assume the exchange rate risk for the time between the loading of the account and the deduction of the amount due by the TC.
- **Use the local currency of the SU the account is held for:** If the TSP decides to lead the account in the currency of the SU, the SU will assume the exchange rate risk for the time between the loading of the account and the deduction of the amount due by the TC. This is comparable to the direct payment of the TC at the time of using his EFC regime(s). In such a solution, the TSP exchanges the simplicity of handling only one currency in his central systems with the exclusion of the exchange rate risk.
- **Use any currency the TSP and the SU agree upon:** If the account is led in any currency agreed between the TSP and the SU (other than the own currency of the TSP or the SU as described above), the TSP and the SU will share the exchange rate risk for the time between the loading of the account and the deduction of the amount due by the TC. For any changes of the exchange rate between the currency the user paid in and the currency the central account is led in, the SU is assuming the exchange rate risk. For any changes of the exchange rate between the currencies the central account is led in and the currency of the TSP, the TSP is assuming the exchange rate risk.

As explained the exchange rate risk depends on the currency the central account is led in. For any currency conversion done by the TSP he may use a mark up on any official exchange rates. It is up to him to decide on the frequency of updating the exchange rate and the height of any mark up.

The advantage for the SU of such a solution is that he does not have to bother about any currencies and will be billed always in one currency regardless of any currencies which are used for different EFC regimes.

The advantage for the TC of such a solution is that he does not have to bother about any currency used by the SU and can always claim his amounts due in his own currency without any exchange rate risk.

8 Requirements for Pre-Pay account held on OBE

8.1 Prerequisites

Instead of an account ID in central account based payment environment value units have to be provided to the OBE in an electronically accessible, manageable and secure way. The value units can be stored in different ways:

- **Storage of value units on a VBD:** An IC can be inserted in different form factors of a value unit bearing device (VBD) like plastic cards or mobile phones or PDAs. The application used in the VBD for the storage of value units has to offer a universal agreed interface amongst all TCs for all toll domains as valid means of payment (i.e. the OBE is able to handle the VBD application in every toll domain).

The issuer of such an application acts as Payment Service Provider (PSP) to the TSP. The question of the PSP being a financial institution or not is part of 8.3.1.

- **Storage of value units on an OBE:** The on board account can also be implemented directly into an application within the SAM of an OBE without the use of any VBD. This implies that the OBE needs a possibility to receive value units over an air interface.

In any case the SU has to care for sufficient value units on his VBD or OBE when using a toll domain. If the stored value units are not sufficient for the use of a toll domain, the SU may be asked for a different means of payment or he may be enforced.

8.2 Business Process Requirements

8.2.1 Issuing of the Pre-Pay mode

OBE based pre-payment affords an extension of the agreement between TSP and TC that not only central account based payment has to be accepted. For further contractual requirements see the following clauses.

NOTE There is only one payment mode applicable for one OBE at a give time. When entering or leaving a toll domain the payment mode has to be clearly fixed. There is no possibility to ask the SU on-trip which mode he wants to choose. If a change of payment mode is requested by the SU, this needs a re-personalisation of the OBE. If this happens during the use of a toll domain (e.g. at a POS), this would end the use of the toll domain with the initial payment mode and start another use with the new payment mode.

The SU's contract has clearly to state the conditions under which payment mode the OBE operates to guarantee an interoperable acceptance.

8.2.2 Personalisation of OBE

The personalisation of the OBE has to follow the established standards (e.g. EN ISO 14906 ...). As there is no explicit standard for the personalisation of OBE, the established standards have to be extended accordingly or handled by the TSP.

Any OBE to be used with a non-central Pre-Pay account has to be personalized with a Pre-Pay contract. As there is a representation of the credit on the OBE the TC is required to check against the credit limit in the OBE when the amount due is deducted.

Apart from the above requirements the personalized OBE has to fulfil all necessary requirements of the EFC regimes it is intended for. This may include the personalization of the nationality and license plate of the vehicle the OBE is intended for, thus limiting the absolute anonymity of the SU. On the other hand one could think about a fully anonymous solution where neither license plate nor nationality is registered on the OBE. As there is an account on the OBE containing value units the toll can instantly be regarded as paid as long as there are enough units available. For any other case, the enforcement rules of the TC apply.

8.2.3 Loading of stored value onto a VBD

The processes of loading value units into an application of an IC on a VBD are not subject to this TR and defined by the PSP issuing the value units.

8.2.4 Loading of stored value into the OBE

8.2.4.1 Transferring of value units from a VBD into the OBE

For the use of value units not directly stored within the OBE they need to be transferred from any VBD into the OBE before the SU can use this OBE in a toll domain. Different to all central account based solutions this Pre-Pay approach has to deal with value units at the time the SU passes a RSE or leaves a toll domain. The toll system must get access to these value units in a fast way which requires that a certain amount of such units has to be provided by the OBE.

CEN ISO/TS 25110 describes three types of data transfer models:

- a) the Buffering Type: This is not considered in this TR as it is limited to non-sensitive data
- b) the Transparent Type: This is not considered for loading processes and described later as there is no loading of value units into the OBE.
- c) the Caching Type: The OBE contains a secure access module (SAM) which is the storage device for the on-board-account in a secure environment to take in value units.

Unless there is no direct access of the RSE to the stored value on a value bearing device (VBD) according to the Transparent Type in CEN ISO/TS 25110 the value units have to be transferred onto the OBE first and stored in the on-board-account of the SAM.

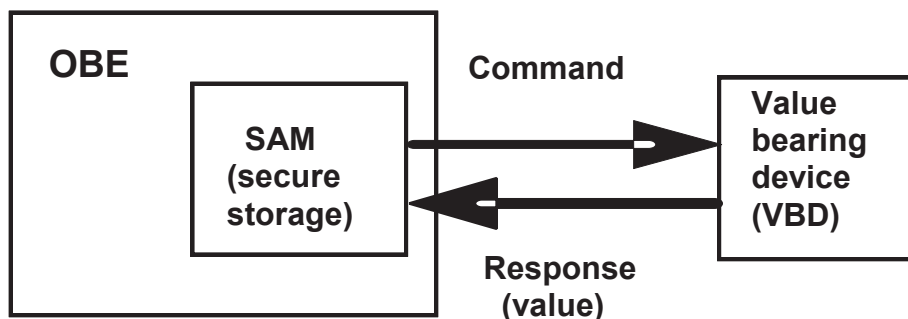


Figure 2 — Manual transfer of value units

The VBD can be equipped with contacts or built as a contact-less device. The chosen technology depends on the technical capability of the OBE and may have strong consequences on the technical requirements of the OBE (see 8.3.2)

In this configuration the OBE acts as the master and the VBD as the slave in the communication. The OBE issues a command to transfer the value units from the VBD to the OBE during the initial presentation of the VBD to the OBE and holds it in a secure storage area. The VBD is only the responding partner in this communication.

8.2.4.2 Automatic transfer of value units into the OBE (Autoload)

The SAM contains the information of the SU's payment means where to debit the value units from (e.g. bank account, credit card, fleet card ...). After having reached a contractually fixed floor-limit, the OBE establishes automatically an over-the-air communication with the SU's PSP and transfers value units into the on-board-account if there is enough credit. This method is defined as "autoload" with the advantage that the SU never falls negative on the OBE.

If the PSP declines the request because of missing funds, the on-board-account is not credited and the SU can only use the remaining value units on the OBE until there is not enough credit to pay the amount due asked in a transaction from the toll system. In this case an alternative form of payment is requested by the SU (e.g. stop at a cash booth where possible) or enforcement procedures are initiated.

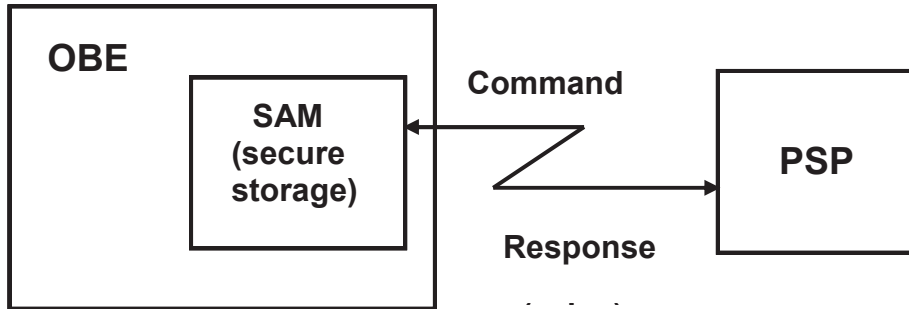


Figure 3 — Transfer of value units via autoload

In this configuration the OBE is the client and the PSP is the server in the communication. The OBE issues a command to request new funds to be loaded into the OBE and the device responds accordingly.

In any case the identification of the value units issuing PSP has to be transferred into the SAM. This is to guarantee the payment to the TC later on in the tolling process.

8.2.4.3 Transferring of value units from the TSP into the OBE

The TSP offers to his SUs the possibility of loading the on-board account within his POS network. Different ways can be offered to achieve this:

- at every or only at certain points of sale the SU can load his account against cash or possibly his credit card
- the account is loaded by wireless transfer of value units from the TSP's back office either automatically (autoload, see 8.2.4.2) or by manual interaction of the SU (e. g. push a button)

8.2.5 Charging of the toll

8.2.5.1 General

The charging of the toll is the most critical part of a Pre-Pay method based upon an account on the OBE. As the money – or the equivalent of it - lies not in a central system but is stored in the OBE the toll amount has to be calculated on-trip and charged immediately when the SU is passing an RSE or leaving a Toll domain. Therefore the process has one strong requirement: the access on the on-board-account has to be performed in real time and in a secure way.

8.2.5.2 General access and data transfer types

Access to values stored on VBD

The command data is transferred directly from the toll system to the VBD through the OBE. The OBE stores the command data and response data temporarily in its buffer memory. Here the VBD holds the on-board-account. In CEN ISO/TS 25110 this is called the Transparent Data Transfer Type.

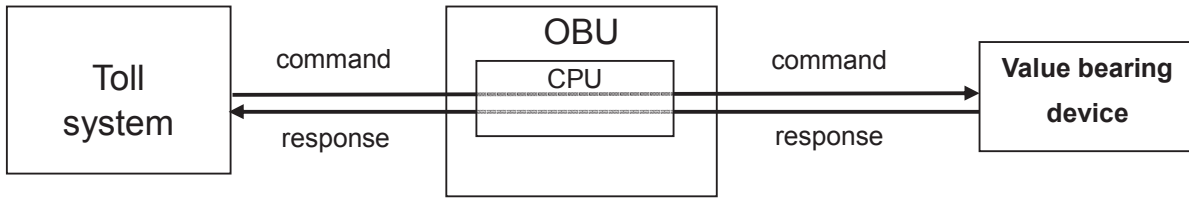


Figure 4 — Transparent data transfer type

In this configuration the toll system is the master and the VBD is the slave. The toll system sets a command and the VBD responds accordingly.

Access to values stored on OBE

During the communication between toll system and OBE, the EFC related data in the SAM is transferred to the toll system. Here, the SAM holds the on-board-account. A VBD or an access to the VBD is not necessary, since the necessary data is already stored in the OBE. In CEN ISO/TS 25110 this is called the Caching Data Transfer Type. For applications, where the data is stored directly in the OBE without the use of a VBD, refer to EN ISO 14906.

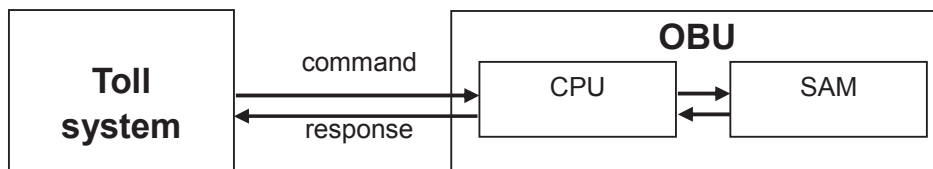


Figure 5 — Caching data transfer type

Remark

The Buffering Data Transfer Type as described in CEN ISO/TS 25110 is not considered for the charging of toll as it is limited to non-sensitive data. For a complete description of the access and data transfer modes and their limitations reference is made to CEN ISO/TS 25110.

8.2.5.3 Access at entrance of the toll domain

At the entrance of an open toll domain with a flat fee or at the passage of an EFC point (e.g. RSE) in an open toll domain with a variable fee the toll system accesses the OBE and

- checks the existence of a valid payment means;
- deducts the toll amount from the on-board-account. It is assumed that the on-board-account is not allowed to fall negative;
- In case of a non-valid pre-pay account or a resulting negative balance the pass-through is prohibited until the SU has refilled his account (where possible) or enforcement procedures have to be initiated;
- generates the toll transaction with the calculated amount due and transfers it to the TC's central system for claiming from the TSP.

At the entrance of a closed toll domain the toll system accesses the OBE and

- checks the existence of a valid payment means;

- checks the existence of sufficient value units when having detected a valid on-board-account as payment means. It is up to the TC to define what means “sufficient” (e.g. maximum amount for any use of the toll domain);
- In case of a non-valid pre-pay account or non-sufficient value units on the OBE the pass-through is prohibited until the SU has refilled his account (where possible) or enforcement procedures have to be initiated;
- stores the EFC point of entrance in the OBE.

Toll systems with an autonomous technology are seen as closed tolling domains.

8.2.5.4 Access at exit of the toll domain

At the exit of an open toll domain with a flat fee no action is required in regard to charging. The toll amount due has already been deducted at entrance.

At the passage of an EFC point of an open toll domain with a variable fee no action is required in regard to charging. The toll amount due has already been deducted during the passage.

At the exit of a closed toll domain the toll system accesses the OBE and

- checks the existence of a valid payment means;
- calculates the toll amount due from the data read from the OBE(e.g. point of entrance, vehicle characteristics...). To manage this it is essential that the valid tariff scheme is available;
- deducts the calculated toll amount due from the on-board-account. It is assumed that the on-board-account is not allowed to fall negative due to the check at the entrance of the toll domain.
- in case of a non-valid pre-pay account or a resulting negative balance the pass-through is prohibited until the SU has refilled his account (where possible) or enforcement procedures have to be initiated;
- generates the toll transaction with the calculated amount due and transfers it to the TC’s central system for claiming from the TSP.

Toll systems with an autonomous technology are seen as closed tolling domains.

8.2.6 Clearing of transactions

8.2.6.1 General

The kind of clearing process depends on the type of data transfer between TC and OBE as described in 8.2.4.

8.2.6.2 Values stored on VBD

As there is no loading of value units into the OBE the TC accesses the VBD of the SU directly through the OBE and gets the value units. The OBE which belongs to the TSP’s regime is only the carrier of the VBD. The TC gets the information about the issuing TSP during the communication with the OBE.

The toll transaction is then transferred to the TC’s central system. Depending on the contractual relationship between TC, TSP and PSP issuing a VBD, the claim may be directed to different entities:

- If the TSP is in possession of the loaded value units on the VBD (e.g. SIM card) the claim for the amount due, which was already deducted from the VBD, will be directed against the TSP.
- If the TSP is in possession of the loaded value units in the OBE without the use of a VBD the claim for the amount due, which was already deducted from the SAM in the OBE, will be directed against the TSP.

- If the PSP is in possession of the loaded value units on the VBD (e.g. bank card, fleet card, credit card) the claim for the amount due, which was already deducted from the VBD, will be directed against the PSP. As a consequence all TCs are required to establish a contractual relation with all VBD issuing PSPs.

8.2.6.3 Values stored on OBE

The clearing processes follow the two-step architecture of this type of implementation. The first step is the loading procedure generating a loading transaction later on followed by the charging process generating a tolling declaration.

Clearing of the loading transaction

- Loading of value units into the OBE takes place through an action of the SU either between ICC and OBE, i. e. in the responsibility between the PSP who possesses the money and the TSP or between the OBE and any POS of the TSP or directly between the SU's bank account and the OBE;
- the value units are stored under the possession of the TSP;
- the TSP generates a loading transaction;
- the TSP transfers it to his central system by establishing a communication link;
- the TSP clears with the PSP;
- the TSP assumes the possession of a corresponding amount of credit to the value units in the OBE;
- the TSP may establish a contractual liaison with any number of payment application issuing instances (PSPs) to be accepted as a means of payment.

Clearing of the toll declaration

- TC accesses the OBE and charges the toll;
- at the end of the charging process the TC generates the tolling declaration;
- the TC transfers it to his central system like in any other payment mode;
- the TC clears with TSP like in any other payment mode;
- no contractual modification against the current state of affairs.

8.2.7 Hotlisting / Enforcement

One reason for starting hotlisting/enforcement procedures has to be considered: there are not enough value units on the account in the OBE.

Hotlisting/enforcement procedures will then be started like usually.

8.2.8 Invoicing of the Service User

Since the invoicing of the Service User is independent of the location where the Pre-Pay account is held, this is described in Clause 10.

8.2.9 Refund of residual amount

If a SU closes the EFC contract with a TSP, he has to return all associated OBE(s). He may then receive any residual amount, which is left on his Pre-Pay account held on the OBE or any residual amount on the VBD if it is operated by the TSP.

- The SU has to return the OBE(s) personally at a POS or the central office of the TSP where the SAM is read out and the SU can collect the residual amount
 - in cash if the value units were loaded by anonymous bank transfer ;
 - as a money transfer to the bank account the value units were initially loaded from;
 - as a credit to the means of payment (e.g. credit card, fleet card ...) of the PSP they were initially loaded from (no cash advance). This may mean that the TSP keeps a register of the latest n loadings for a possible refund;
 - by transferring the value units back onto a VBD. This requires the existence of relevant equipment and application at the TSP's POS or central system.

Since this procedure makes the customer service very time- and resource-consuming, the TSP does not necessarily have to provide this return method or limit it to certain facilities.

- The SU may also be allowed to send in the OBE by postal service and provide a bank account, for the transfer of the residual amount loaded in cash or by anonymous bank transfer. Any residual amount will be credited to the means of payment it was loaded with (no cash advance). If the SU remained anonymous during his use, this means that the SU becomes a named customer at the end of his contract.
- If the residual amount in the Pre-Pay account was endowed by the SU by autoload from the SU's bank account, it will be transferred back to the same account by the TSP. This protects the TSP from any fraudulent claims for a residual amount.
- If the SU does not return or send the OBE(s) back or does not provide any account details, the residual amount stays in the possession of the TSP until the SU issues a valid claim. The TSP will assume ownership of any unclaimed payments after a legally acceptable grace period (e.g. 3 years).

8.2.10 Proof of Transactions

The SU has an interest in getting information about the toll consumed in case he

- wants to examine whether the deduction of amounts from his account was done correctly;
- needs to get this information for the purpose of travel cost reimbursement.

The SU has to be put in the position by the TSP to get access to this information. This information has to be provided by the various TCs to the TSP.

8.2.11 Handling of Complaints

This has to be further investigated depending on the needs of the implementation.

8.2.12 Security Considerations

In interoperable systems with different roles every instance of a role has to trust each other. It has to be guaranteed that any transaction subject to a clearing process has neither been added, deleted nor modified during their way from their source to their destination. So, an end-to-end security architecture is required.

As far as an OBE based Pre-Pay account is concerned the loading transaction and toll declaration have to be confirmed ("stamped") either by the SAM (values stored on OBE) or by a secret object of the VBD (values stored

on VBD). Whether a secure communication channel needs to be established depends on the contractual regulations between the TC and the TSP.

For VBD-based implementations a security concept has to cover the whole communication path from the RSE to the VBD. This may include the inclusion of security tokens in the RSE, which reflect their counterparts in the VBD.

8.3 Technical Requirements

8.3.1 Requirements for Value Unit bearing User Media

As defined in 8.2.4 one of the possibilities to load value units into the OBE's account is the use of a device in possession of the SU being able to communicate with the OBE and bearing the value units, defined as Value Unit bearing Device VBD.

General requirements:

- The VBD has to host an interoperable application which contains stored value in a secure environment and permits to store toll related data. This excludes the use of any kind of magnetic striped or bar coded devices as the VBD, since the information within the magnetic stripe or the barcode can't be changed on the road. The use of such devices for loading values into a VBD is not limited.
- In case of the VBD being a plastic card
 - ID-1 format is being permitted according to ISO/IEC 7810;
 - ID-000 format is being permitted according to ISO/IEC 7810 and GSM 11.11 (SIM card);
 - The card shall operate between -25°C und +70°C;
 - The only use of a magnetic stripe based card is strictly excluded;
 - The microcontroller shall operate between -25°C und +70°C.
- The software architecture of the application has strictly to follow ISO/IEC 7816-4/-6/-9.
- The application shall be accepted at every OBE that grants to the SU the functionality of pre-payment.

Special requirements for devices with contacts:

- The mechanical and electro-technical characteristics have strictly to follow ISO/IEC 7816-1/-2/-3.

Special requirements for contactless devices:

- In case of the device being a plastic card
 - the form factor has strictly to be compliant with ISO/IEC 7810 and ISO/IEC 14443-1;
 - the mechanical and electro-technical characteristics have strictly to be compliant with the ISO/IEC 14443 family of standards (proximity) or ISO/IEC 18092.
- In case of any other form factor the mechanical and electro-technical requirements have strictly to be compliant with
 - the ISO/IEC 14443 family of standards (proximity) and - in case of a mobile phone - the ISO/IEC 18092 series of standards (NFC) being harmonised with ISO/IEC 14443 in the near future;
 - and/or ISO/IEC15693 (vicinity).

- The VBD has to work properly also in cases where the electric field of the reading device is been switched on after the device comes into it.
- The contact-less technology of the VBD together with the corresponding reading device form an inductive transceiver which has to comply with national and/or international rules and regulations on admissions e.g.
 - ETSI EN 300 330: Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Short Range Devices (SRD); Radio Equipment in the Frequency Range 9 kHz to 25 MHz and Inductive Loop Systems in the Frequency Range 9 kHz to 30 MHz;
 - Recommendations of the International Radiation Protection Authority (IRPA).

8.3.2 Requirements for OBE

8.3.2.1 General Requirements

- a) The OBE
 - shall provide the functionality of a Card Accepting Device (CAD);
 - shall contain a standardised application to communicate with the VBD.
- b) In case of accepting a VBD with contacts it is strictly required
 - to install a hardware slot according to ISO/IEC 7810 and the respective reader unit;
 - to be compliant with the ISO/IEC 7816 family of standards.
- c) In case of accepting a contactless VBD it is strictly required
 - to be compliant with the ISO/IEC 14443 family of standards (proximity, type A and B) or ISO/IEC 18092;
 - to be compliant with ISO/IEC 7816-4/-6/-9;
 - to install the respective antenna technology.

It is recommended to install

 - a mechanical device holder near the electric field (absolutely essential when using the transparent data transfer type);
 - an optical or acoustic indication that informs the SU about a correct or incorrect acceptance of the VBD;
 - a small display on the OBE or a separate VBD-reader device to inform the SU about the residual amount of value units - either in the purse on the VBD or on the account on the OBE.
- d) The hardware SAM as a device with contacts which contains the account in a secure environment has to be compliant with the ISO/IEC 7816 family of standards.

8.3.2.2 Requirements for Autoload

If the autoload function is installed as described in 8.2.3 the OBE requires the ability to open a communication link to the server of the SU's bank automatically as soon as the floor limit on the account is reached. Once the link is established the value units have to be securely transferred and secured by the SAM.

8.3.3 Requirements for POS Networks

8.3.3.1 General

A POS network can either be operated by the TSP himself or by any partner(s) he has an agreement to do so with. This may enable the TSP to use an extensive international POS network without the need to set it all up by himself.

A POS network is needed

- for the first time issuing of the OBE to the SU;
- at the time the SU wants a refunding of a residual amount.

This is mainly influenced by the decision of the TSP to use pre-personalized OBE or personalize every OBE for the intended vehicle of the SU:

8.3.3.2 Pre-personalized OBE

There is no need for a POS network if the TSP uses pre-personalized OBE without any personal information. The pre-personalisation contains only the EFC Context mark as a branding for the TSP, which can be written into the OBE centrally or even at the time of manufacturing. With such a solution the TSP can distribute the activated OBE through all channels described in 8.1.1. The use of pre-personalized OBE without the inclusion of vehicle characteristics either limits the use of such OBE to EFC regimes where there is no further distinction (e.g. passenger cars) or requires the concept to enrich billing details as described in prEN ISO 12855.

8.3.3.3 OBE personalized centrally

There is no need for a POS network if the TSP personalizes each OBE centrally for the vehicle it is intended for. All relevant vehicle characteristics and license plate information are written into the OBE before handing it out to the SU. With such a solution the TSP can distribute the personalized OBE either by sending them to the SUs by post or by providing it for physical pick-up by the SUs at a central location or at an installation partner.

8.3.3.4 OBE personalized at a POS

Any point of sale needs to be equipped with proper personalisation equipment from the issuing TSP if an OBE is personalized directly at a point of sale. This would mean that the TSP has to install a point of sale network for all toll domains where his OBEs are accepted either by himself or by using the services of a point of sale network operator. All relevant vehicle characteristics and license plate information are written into the OBE before handing it out to the SU after the issuing of the contract. In case the SU decides for OBE based pre-pay mode the relevant application has to be loaded on the OBE.

8.3.4 Requirements for Information and Payment Flow (Interfaces)

The interface OBE - VBD has to be compliant with the relevant standards according to the type of communication (contacted or contactless) (see 8.3.2). The interfaces TSP - TC have to be compliant with prEN ISO 12855. The loading transaction generated at the time of loading value units on the OBE needs to be implemented as a transaction in the pre-billing process of prEN ISO 12855.

8.4 Legal and Functional Constraints

8.4.1 Legal Considerations

8.4.1.1 General

The TR cannot and is not allowed to give any legal proven expertise on the respective subjects. The TR instead points out the issues that have to be investigated in depth and need to be confirmed by legal advisers.

The TR refers to European Directives only. Maybe national laws will exceed these findings.

8.4.1.2 EU e-Money Directive

As far as stored value is concerned according to the European directive 2000/46/EC on the taking up, pursuit of and prudential supervision of the business of electronic money institutions (EMD) it has to be clarified

(1) whether value units on the OBE or an VBD are to be considered as electronic money

In Article 1 the Directive states

3. (a) *'electronic money institution' shall mean an undertaking or any other legal person, other than a credit institution as defined in Article 1, point 1, first subparagraph (a) of Directive 2000/12/EC which issues means of payment in the form of electronic money;*
- (b) *'electronic money' shall mean monetary value as represented by a claim on the issuer which is:*
- (i) stored on an electronic device;*
 - (ii) issued on receipt of funds of an amount not less in value than the monetary value issued;*
 - (iii) accepted as means of payment by undertakings other than the issuer.*

From this it can be derived that

- the value units are monetary value as represented by a claim on the issuer which is the TSP or PSP
- the value units are stored on an OBE or a VBD which are electronic devices
- the value units issued by a TSP or PSP, which is not the TC, will be accepted by an organisation other than the TSP or PSP

Therefore the value units on the OBE have to be regarded as electronic money.

(2) whether the medium-issuing organisation has to act as a financial institution if it is not.

In Article 1 the Directive states

4. Member States shall prohibit persons or undertakings that are not credit institutions, as defined in Article 1, point 1, first subparagraph of Directive 2000/12/EC, from carrying on the business of issuing electronic money.

The requirement for the TSP of applying for a license either as electronic money institution according to Article 1, 3a) or as credit institution according to Article 1, 4 has to be investigated in depth by a legal adviser.

8.4.1.3 EU Money Laundering Directive

The rulings of the European directive 2005/60/EC need to be analyzed by legal advisers whether the refund of residual amount described in 8.2.9 falls under the restriction of money laundering.

8.4.1.4 EU Payment Services Directive

As far as the autoloading functionality is concerned as described in 8.2.4 a special attention has to be drawn on the European directive 2007/64/EC on payment services in the internal market (PSD).

As long as the instance that possesses the money (TSP) is identical to the one that collects the money from the SU's bank there will be no conflict. But if the TSP uses an intermediate service provider the legal requirements of the PSD have to be considered.

8.4.1.5 Limits for stored value units

- a) With respect to the EMD it is to check how many value units are allowed to be loaded on the account without causing conflicts with the national financial authority.

- b) As described in the charging process it is assumed that the on-board-account is not allowed to fall negative. A negative balance may raise the question whether a credit in the terms of a bank is issued to the SU by the TSP or it can be considered as a short time operation of a Post-Pay account. If it is seen as issuing a credit to the SU, this would then have to be checked against the national implementation of the EU Payment Service Directive.

8.4.1.6 Data protection

As the OBE based Pre-Pay mode can be managed as anonymous (see 8.2.2) no conflicts are expected with data protection laws.

As long as the personalisation procedure remains as it is today, i.e. registration of license plate and nationality, anonymity is limited and you have to avoid a combined storage of the vehicle related data with the toll declaration.

Before generating an OBE based Pre-Pay system it is strongly recommended to ask the advice of the national data protection authorities, explain the detailed architecture of the system to them and get their confirmation of its accordance to the regulations.

The rulings of the European data protection regulations has to be taken into account, which are contained in

- European directive 2002/58/EC on the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications);
- European directive 2006/24/EC on the retention of data generated or processed in connection with the provision of publicly available electronic communications services or of public communications networks amending Directive 2002/58/EC.

8.4.1.7 IPR issues

It would exceed the scope of this TR to investigate possible IPR issues. This subclause is only to not forget the issue when analysing possible solutions in more detail.

8.4.2 Functional constraints

8.4.2.1 Currency Considerations

The value units either stored on the OBE (caching type) or on the IC card (transparent type) represent a given currency. Therefore this currency has to be taken into consideration at the time the toll amount is calculated - i.e. on-trip. There are two ways to take this into consideration:

- a) the fully interoperable solution

The value units are always stored on the VBD or OBE together with their respective currency code according to ISO 4217. At the moment of charging the toll a given up-to-date currency exchange rate has to be taken into consideration. This exchange rate has to be provided, maintained and daily updated by the TC in his toll system.

A possible currency risk has to be answered by relevant countermeasures.

It has also to be considered that any currency conversion puts pressure on the performance of the charging process which is carried out on-trip and has to be as fast as possible.

- b) the regional interoperable solution

TCs of a common currency zone (e.g. the EURO zone) accept only the currency of their zone. When the toll system accesses a VBD or OBE and detects the Pre-Pay account as means of payment the common currency is assumed to represent the currency of the value units being taken from the VBD or OBE.

No currency conversion has to be carried out by the TC.

Thus interoperability is only guaranteed within a limited area - the common currency zone. OBE based pre-payment can only be offered to SUs travelling within their home-currency zone. When travelling through different currency zones it is up to the SU to provide the value units in the accepted currency of the toll domain(s) used.

8.4.2.2 Performance consideration

As the payment process takes place on-trip the calculation of the toll amount **and** the deduction of the respective amount from the on-board account have to be carried out on top of the necessary processes when central account payment applies. This requires an extremely high performance of these processes.

8.4.2.3 Solvency considerations

The basic idea is that the SU has the right to use his Pre-Pay funds to the last extent i.e. Cent. Due to that fact an early warning function has to be technically and contractually realized to:

- inform the SU of the nearing exhaustion of the value units and to enable him to refill the credit to carry on;
- inform the TC about the remaining credit to grant the access or to refuse (this might be more sophisticated to resolve for DSRC than GNSS, which is having continuous communication with the OBE);
- enable financial institutions to transfer funds in duly time to the Pre-Pay mean used;
- avoid a negative balance on the account because of banking law considerations (see 8.4.1.5).

8.4.2.4 Toll Service related Charges

Quite often, the TSPs raise different toll service-related charges to SUs – e.g., for the provision of a guarantee to the TCs. Although related to the toll, these charges are not passed to the TCs. They are kept as income by the TSPs for the service they deliver to the SU.

In case of an OBE based Pre-Pay solution these charges may be considered during the loading process of any credit to the OBE.

9 Invoicing of the Service User

9.1 General

The TSP is legally obliged to issue an invoice for any services used by the SU. The type of invoice depends on the definition of the toll in a legal context in regard to VAT. The SU may thus receive several invoices from the TSP for the different EFC regimes used.

9.2 VAT considerations

The present document uses the term “toll” generically and more in a technical sense. When viewed in a financial context, e.g. used by tax authorities, the term “toll” can actually have one of the four following meanings:

tax = where a duty to pay exists because public authorities have declared something to be a “taxable” attribute, e.g. generating income, owning property, having a pet, producing cars.

duty = where a duty to pay exists because of public governance rules, e.g. importing products from competitive markets, skimming the market of commodities, entering city centres.

fee = where a duty to pay exists because public authorities have set a price for public services, e.g. issuing a passport, drawing up an official document for building a house.

charge = where a duty to pay exists because someone has received a service of the public or private sector, e.g. lunch in school or in a restaurant, painting of the house.

Usually, where tolls are defined as a fee or usage charge, they are subject to VAT. When defined as tax or duty, they are not. In other words, if one understands the provision of a road as an act of state, then the toll is not taxable, if one understands the provision of a road as public or private service, with the aim of making a profit, then toll is subject to VAT.

In case of the toll being a fee or charge and regarding the handling of the respective VAT it is to distinguish between a business-to-consumer relation and a business-to-business relation as far as the relation between TSP and SU is concerned. The SU can play the role of a consumer (private car) or a commercial company (haulier).

a) business-to-consumer

A SU being a private partner to the TSP has no possibility to reclaim VAT. So there exists no necessity of handling VAT.

b) business-to-business

For a SU being a business partner to the TSP VAT reclaim is an essential commercial issue. In a central account based post-payment mode this is easily supported by the periodical invoice fulfilling the requirements of the national tax authorities.

9.3 Business model considerations

The TC and the TSP can agree on different business models on how the actual selling process may be handled.

— Chain sale model:

In the chain sale model, the TC sells the toll to the TSP, who then can sell it on to the SU in his own name. This business model is only allowed if the toll is defined as a fee or a charge, since a tax or a duty can not be sold due to its legal definition. The VAT needs then to be handled by the TC for the selling to the TSP. The TSP has to apply the local VAT rate of the TC and has to handle the VAT for selling it to the SU. With the invoice from the TSP the SU may then reclaim the VAT from the local tax authority of the country of the TC.

— Invoicing on behalf of the TC (agency model):

In the invoicing on behalf of the TC the TSP issued the invoice on behalf and in the name of the TC. By doing so there is no selling of the toll to the TSP. This leaves the full responsibility of handling the VAT with the TSP. With the invoice from the TSP on behalf of the TC the SU may then reclaim the VAT from the local tax authority of the country of the TC.

If the SU is known to the TSP, he can produce the invoice(s) for the service usage in the different toll domains and send it to the SU.

If the SU opts to remain anonymous, the TSP has to prepare an invoice to an anonymous customer. Since he is not able to send it to an anonymous customer he has only to store it in his systems. The SU may then contact the TSP and identify himself (e.g. by presenting his OBE ...) to receive his invoice(s) in a given timeframe.

9.4 Invoice considerations

The TSP has always to pay the gross amount including VAT to the TC. The following example shows the invoice and payment flows between SU, TSP and TC:

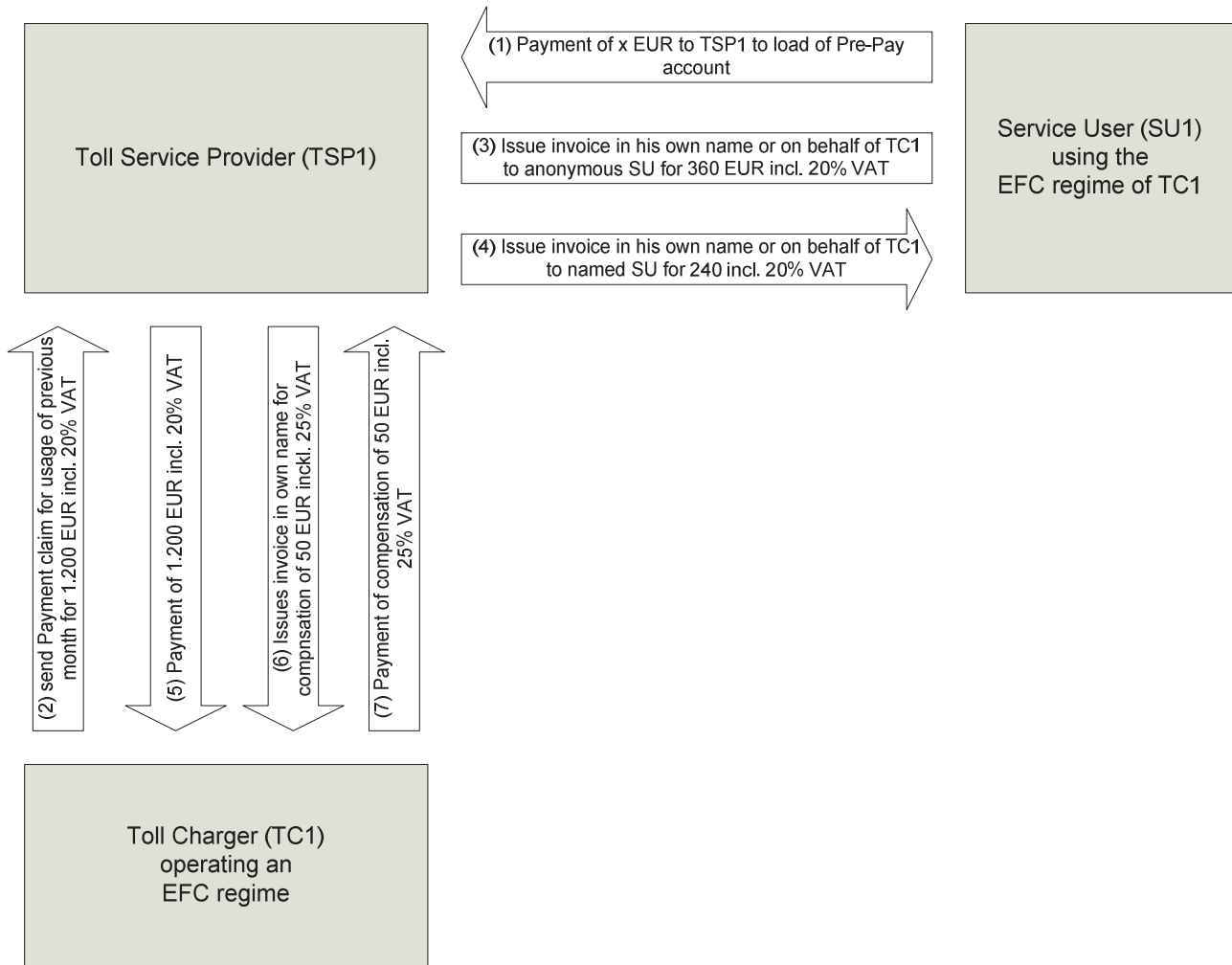


Figure 6 — Invoicing and Payment Flows between SU, TSP and TC

- In (1) SU1 loads his central Pre-Pay account or his account on the OBE with an amount of x EUR. This entitles SU1 to use the EFC regime of any TC as long as the funding is enough.
- In (2) TC1 sends a Payment claim to TSP1 for 1.200 EUR incl. 20 % VAT (as dictated by the VAT law of TC1). This Payment claim comprises all service usages of any OBEs issued by TSP1 including the OBE of SU1.
- In (3) TSP1 issues an invoice to an anonymous SU for a part of 360 EUR of the Payment claim received by TC1 incl. 20 % VAT (as dictated by the VAT law of TC1). This invoice is issued, but can not be delivered and remains stored at the TSP.
- In (4) TSP1 issues an invoice to SU1 for a part of 240 EUR of the Payment claim received by TC1 incl. 20% VAT (as dictated by the VAT law of TC1). This invoice is delivered to SU1. The rest of the payment claim is issued to other anonymous or named SUs.
- In (5) TSP1 pays the Payment claim of 1.200 EUR to TC1. TC1 is able to mark all claims against TSP1 as paid.
- In (6) and (7) the invoices and payment of the compensation (e.g. 4 % of net amount of payment claim) is exchanged between TSP1 and TC1. The VAT of the compensation may be different than the VAT of the payment claim.

10 Gaps in terms of Standards and recommendations

10.1 Pre-Pay Account held in Central System

For the set up of a universal Pre-Pay account held in a central system there are currently no gaps in terms of standards.

10.2 Pre-Pay Account held on OBE

- To guarantee interoperability a universal transport purse IC application is needed to be standardised;
- the security architecture has to be fixed;
- the relevant data elements have to be defined and added to EN 1545, *Identification Card Systems — Surface Transport Applications* —

Part 1: Elementary data types, general code lists and general data elements;

Part 2: Transport and travel payment related data elements and code lists;

- the loading transaction generated at the time of loading value units on the OBE has to be standardised in the frame of the work on prEN ISO 12855;
- existing standards have to be analysed whether they are prepared for the processes that cover pre-payment.

10.3 Recommendation for next steps

As far as the on-board account alternative is concerned a technical study should detail and evaluate the technical feasibility of such a solution defining all technical and procedural consequences and restrictions.

This should give responsible authorities a basis for a decision whether to introduce a pre-pay account held on OBE or not and under which circumstances or for which limited application.

Annex A (informative)

Examples of implementations

Such examples were only found in Asia.

Table 1 Examples for the implementation of systems based on pre-pay account on OBE

Country	Japan	Singapore	China		South-Korea	Malaysia
Region, City			Beijing	Shanghai		
System	ETC	ERP	ETC	ETC	ETC	ETC
Pre-payment or Post-Payment	Post-Pay	Pre-Pay	Pre-Pay	Pre-Pay	Pre-Pay	Pre-Pay
For universal use or EFC use only	EFC use only, four types of card are used 1) Credit card 2) House card 3) Personal card with deposit 4) Corporate card	1) Present card: Universal use excluding public transport 2) New card: Both for EFC and public transport	1) Beijing card: EFC and public transport 2) National ETC card: EFC only	1) Shanghai card: EFC and public transport 2) National ETC card: EFC only	1) Hi-pass card: EFC only	1) Touch & Go card: EFC and public transport
Issuer of the card (a bank or a toll charger or a service provider)	1) Credit companies (13) for credit card 2) Service providers(6) for House card and Personal card 3) Service providers(3) for Corporate card	1) Bank association for Present card 2) Card company owned by service provider for New card	1) Public transport company for Beijing card 2) unknown for National ETC card	1) Public transport company for Shanghai card 2) unknown for National ETC card	1) Service Provider	1) Card company

Table 1 (concluded)

Country	Japan	Singapore	China		South-Korea	Malaysia
Region, City			Beijing	Shanghai		
How does the system work (short description)	<p>1) RSE calculates the fee when vehicle come into ETC lane</p> <p>2) Toll charger transfers the transaction data to the card company or card issuer</p> <p>3) Card company or card issuer sends the bill to users monthly</p> <p>4) The bill is paid by the user's bank account automatically</p>	<p>1) RSE calculates the fee when vehicle come into ETC lane</p> <p>2) RSE debits the fee from the card directly at ETC lane</p> <p>x) refill card balance using machine</p>	<p>1) RSU calculates the fee when vehicle come into ETC lane</p> <p>2) RSE debits the fee from the card directly at ETC lane</p> <p>x) refill card balance using machine</p>	<p>1) RSE calculates the fee when vehicle come into ETC lane</p> <p>2) RSE debits the fee from the card directly at ETC lane</p> <p>x) refill card balance using machine</p>	<p>1) RSE calculates the fee when vehicle come into ETC lane</p> <p>2) RSE debits the fee from the card directly at ETC lane</p> <p>x) refill card balance using machine</p>	<p>1) RSU calculates the fee when vehicle come into ETC lane</p> <p>2) RSU debits the fee from the card directly at ETC lane</p> <p>x) refill card balance using machine</p>
Implemented type of card (contactless or not, chip, memory or micro-processor)	Contact type with micro-processor	<p>1) Contact type with micro-processor for Present card</p> <p>2) Contactless type with micro-processor for New card (Type-B)</p>	<p>1) Contactless type with micro-processor for Beijing card</p> <p>2) Contact type with micro-processor for National ETC card</p>	<p>1) Contactless type with micro-processor for Shanghai card</p> <p>2) Contact type with micro-processor for National ETC card</p>	Combination of contact and contactless type with micro-processor	Contactless type with hard logic (Type-A)
Some information on the security architecture implemented	Security mechanism is implemented on SAM in OBE	(no information)	(no information)	(no information)	(no information)	(no information)

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