Report on the organisational structures and the differences of the existing IFM systems

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List of abbreviations

AFC	Automated Fare Collection
CALYPSO	Electronic Ticketing Standard for (microprocessor) contactless Smartcard, designed by a group of European transit operators
CBO	Central Back Office
CRL	Certificate Revocation Lists
EFM	Electronic Fare Management
EN	European Norm
HOPS	ITSO Back office system
HSM	Cryptographic "Hardware Security Module“ it is the secure central element of the Security Management System that generates (and holds) the key pairs and certificates.
IFM	Interoperable Fare Management
ISO	International Organization of Standardization
ITSO	Integrated Transport Smartcard Organisation; UK Standard for nationwide Interoperable Electronic Fare Management
MO	mobile operators
PT	public transport
OTLIS	Consortium of Operators that Specify, Build and Operate the Interoperable Fare Collection System which manages the LisboaViva, 7 Colinas, Viva Viagem and Lisboa Card contactless cards (Lisbon wide Region)
PTO	public transport operator
RKF	Resekortsföreningen i Norden ekonomisk förening, from January 2007 it is Resekortet i Norden AB
TA	Transport Authority
TO	Transport operator
VDV-KA	VDV Core Application, German Standard for nationwide Interoperable Electronic Fare Management
VDV-KA KG	VDV-Kernapplikations GmbH & Co. KG

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I. Introduction

The goal is to create an Interoperable Electronic Fare Management in Europe, that permits customers in public transport to travel barrier-free and without ticket limits "door to door". Based on the inventory of existing electronic fare management systems in Europe an analysis of functions, organisational models and economic issues was carried out. The systems considered are currently or will be operating in the following countries:

- France,
- Germany,
- The Netherlands,
- Portugal/Lisbon wide Region,
- Sweden and
- United Kingdom.

Representatives of France, Germany, The Netherlands and UK are involved in the IFM project. Sweden and Lisbon were additionally included in the analysis, so that a relatively large area of Europe could be considered.
All of those who have answered a questionnaire for their national system deserve the thanks of the project.
The inventory was categorised into the following four groups:

- Criteria Group 1: IFM System Architecture
- Criteria Group 2: System Concept
- Criteria Group 3: Security
- Criteria Group 4: General Conditions / Legal Framework

In all of the analysed systems there exist specific National Standards for IFM/EFM. So a good common basis for a migration to an European IFM is given.
The basis for all of the various systems is more or less the common IFM System Architecture described in the standard ISO EN 24014-1 (shown in Figure 1). In particular, the role model defined therein describes which system participants comply with which roles and central functions like IFM Manager, Security Manager or registrar.
In Sweden it is planned to conform to ISO EN 21014-1 in 2009.

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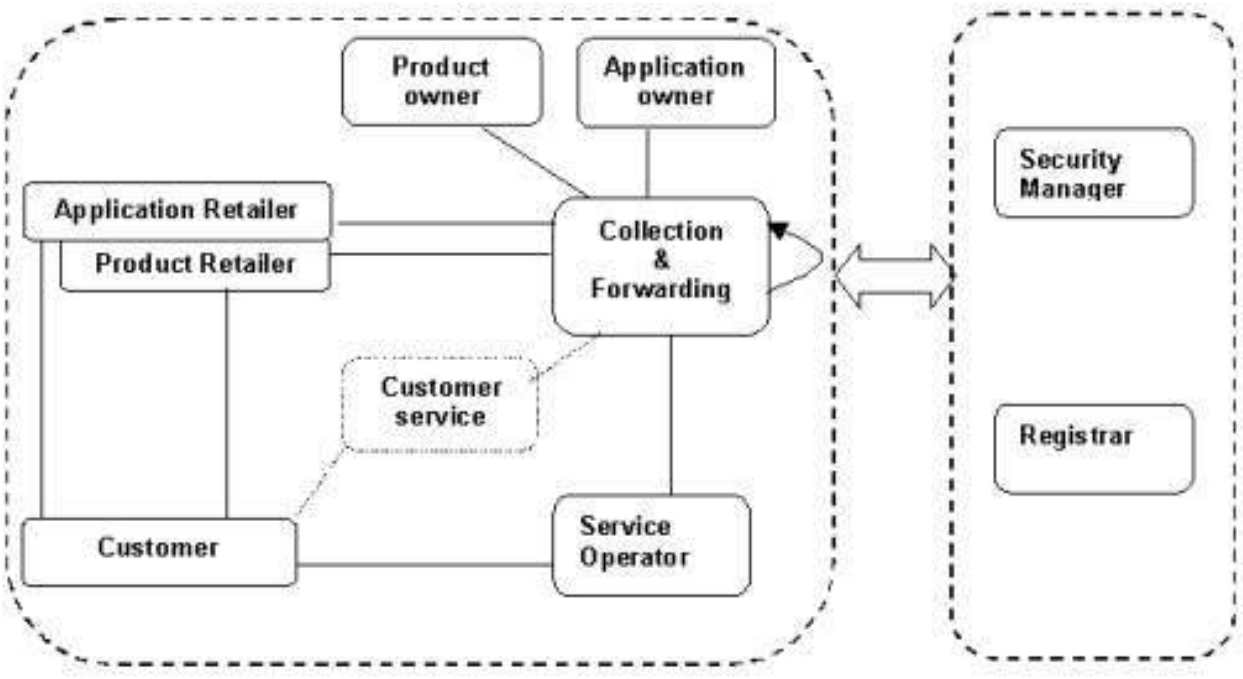

Figure 1 — The two IFM domains (operational and management Entities)[1]

ISO 24014 has not inspired the existing organisations in France, but the existing organisations could be analysed with ISO 24014.
The Portuguese specification follows the core concepts of IFM ISO EN 24014-1 but, because it has been designed over the years based on some other specifications, which are also from the IFM background (ISO-14904, EN-1545), they would not say that it follows strictly the IFM, since the IFM was only released in Q2 2007.
For the implementation of the VDV Core Application the tasks of the companies in an EFM system will be analysed. Based on this analysis the roles will be classified. So it may be that one company has to play more than one role. In the national implementation of the VDV Core Application the Security Manager and also the Registrar are assigned to the Application Owner. The security function of blocking list management is also defined as a separate role attributed to the VDV-Kernapplikations GmbH & Co. KG. The Customer Service is seen as part of the Retailer because he determines the payment with the Customer and holds the Payment contracts. The Collection & Forwarding is seen as a part of the reference systems of every separate role.

[1] Source: ISO/EN 24014-1:2005

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II. Organisational Models

II.1 National System Standards

In all of the analysed systems of the different countries there exist specific National Standards for IFM/EFM. So a good common basis for a migration to a European IFM is given.
The titles of the corresponding standards are:

- INTERCODE; ref. AFNOR XP 99-405 (France)
- VDV-Kernapplikation/VDV Core Application for Interoperable Electronic Fare management - (((eTicket Deutschland (Germany)
- Open ticketing Standard (SDOA, Open architecture) for Trans Link Systems (The Netherlands)
- No official title - set of “Regional specifications so called „OTLIS LisboaViva Specification“ (Lisbon wide Region)
- RFK-specification (Sweden)
- ITSO (United Kingdom of Great Britain and Northern Ireland)

The National Standards encompass also data exchange interfaces between reference systems of various roles in France, Germany, the Netherlands, Portugal/Lisbon, Sweden and the UK.
National Standards for data exchange interfaces in the different EFM systems of the EFM participants, independent of their roles in the EFM system, exist within INTERCODE, VDV Core Application, TLS, Resekortet and ITSO, but not within OTLIS LisboaViva Specification (although it follows standards such as ISO-14904, INTERCODE, EN-1545, etc, to build a data exchange specification).
In France, there do not exist component specifications at a national level; with exception of the card/reader subsystem: INTERCODE is only compliant with microprocessor cards and is CALYPSO-compliant. INTERCODE is a regional standard with various applications in a technically identical user medium. Here we have to verify, to what extent the regional application concept is compatible with the system wide application.
Within the VDV Core Application there exist

- specifications for interfaces between system components using interoperable user media,
- specifications for user medium and SAM,
- sequence diagrams for the interfaces between terminals and user medium,.

Furthermore, interfaces are also specified between PKI, Key management and component manufacturers and a back office system specification is planned as complement to the interface specifications.
Within TLS there exist specifications for:

- Central Clearing House System,
- Fare Media Layout,
- Security Architecture,
- Functional specifications for all Media Access Devices and
- Interface Specifications for messaging, action listing, reconciliation.

Within the OTLIS LisboaViva Specifications there are some technical descriptions and certification guidelines that may be included either in tenders or in system specifications.
There are no component specifications within ITSO and Resekortet.
ITSO TS 1000 defines the key technical items and interfaces that are required to deliver interoperability, defined in detail as follows

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- the end-to-end security system and
- shell layout.

Other elements (e.g. terminals, back office databases) are described only in terms of their interfaces. The business rules that supplement the technical requirements are defined elsewhere.

II.2 National working systems

France
The French systems are termed as regional interoperable applications. A lot of individual systems are in operation. They are not usable interoperably via a single application for the customer. It may be that the medium could be equipped with different applications in the future.

Germany
In Germany EFM has started in several regions based on the VDV Core application specifications. These work together interoperable. The customer can use his medium with application and entitlement also in order to travel within other systems and regions. So interoperability is a matter of migration. Interoperability in one region with more than one participant and more then one back office system is technically the same matter as interoperability between systems in different regions.
Based on the VDV Core Application, interoperable CiCo systems work between Kreisverkehr Schwäbisch Hall and Nahverkehr Hohenlohe and prospectively in Ostalb mobil (authorities in Baden-Württemberg). They use different KA-payment methods (KA accounts or STR (Stored Travel value) within the VDV Core Application to get tickets or to use these within the CiCo systems dependent on the system variant which employed by the authority. eTicket systems are implemented by several authorities in North Rhine-Westphalia, Saarbrücken, Ostalb mobil, prospectively in RMV (Hesse), VBB /Berlin-Brandenburg), VVO (Saxonia), HVV, Hamburg, Schleswig-Holstein), MDV (Leipzig, Halle). Interoperability is today regional limited; the interoperability will be managed with extension of new or existing systems.

The Netherlands
The Netherlands ticketing system is currently in operation and the first regions have been equipped. The customer uses the OV-Chipkaart (one application with STR entitlement) also in order to travel within other systems and regions. The OV-Chipkaart can be used on the bus, metro, tram and train.
Trans Link Systems was established by the five largest Dutch public transport companies. Trans Link Systems works in partnership with the carriers involved to ensure the OV-Chipkaart is made available to people using public transport in the Netherlands.
The OV-Chipkaart was introduced in 2005 in Rotterdam. It was the start of the National System. In 2006, the program was expanded to include all the Metro lines and the SnelTram line in Amsterdam (50, 51, 53, 54). In 2008, all trams and buses will start accepting the OV-Chipkaart, and it will be possible to purchase an OV-Chipkaart anywhere in the Netherlands.

Lisbon (Portugal)

In the OTLIS LisboaViva Specification only one back end system for IFM management is implemented (with secure messaging systems to connect the several operator sub-systems), which is used by the transport authority and all transport companies, who in turn only own the terminals, data pooling systems and some local specific back-offices to manage its network of terminals, account and financial issues and in fact all the operator level issues, but not the overall smartcard and transaction issues. The system is in fact a basis for improving the concept of IFM within the region, with already 2 million cards issued. Improving the concept includes several steps, such as expanding to several other service providers,

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application and product retailers, and even a way to integrate banking and mobile phone players into the IFM concept (which are currently supported in part by other means).

Sweden

"Resekortet" smart card-based multi-modal fare collection system will connect bus and rail services in Sweden.

The system will provide rail and bus commuters with greater convenience by speeding up boarding times and allowing them the option of using the Internet to automatically reload value onto their smart cards. There are 10 separate implementations of new fare management systems based on the RKF technical platform. Five are up and running. Two of those are interoperable in one bus link between Norrbotten and Vaesterbotten (northern part of Sweden). The suppliers are Fara and CPT Nordic.

Two additional systems are in the public test phase, Skanetrafiken (Malmoe) and Ostgotatrafiken (Linkoping).It is to be hoped that SL Access in Stockholm will be implemented during the autumn.

It will start a project in September to analyze the possibility for interoperability between the West region and the Central region.

UK

The introduction of concessionary fares through the English National Concessionary Travel Scheme (ENCTS), whereby specified groups of people are identified for discounted or free travel, follows similar moves by Scotland and Wales, and has strongly endorsed the use of ITSO throughout the UK.

To date over 7 million ITSO concession smartcards have been issued covering a range of media from Mifare Classic to microprocessor cards.

The ITSO specification provides a Transaction Data Repository, enabling non-smartcard Travel Authorities to issue ITSO compliant Concessionary Passes to eligible holders. When a non-smartcard Authority migrates to smartcards, it will become an ITSO member in its own right with its own operation systems.

Additionally the ITSO Specification has already been mandated for over half of the UK National Rail franchises and the first Train Operating Company will commence issuing ITSO smartcard tickets before the end of 2008.

ITSO Schemes are already live on buses in the North West of England, Scotland, Cheshire and Nottinghamshire, and are being implemented at this time across Yorkshire. These schemes involve both concessionary and commercial products, including Stored Value. Furthermore, ITSO compliant schemes have been announced for Birmingham, North East England, Southampton and it has been announced by the Department of Transport that London will accept ITSO smartcards across its Oyster network from 2010.

To date ITSO has certified over 30 different examples of media, a similar number of Point of Service Terminals and 3 back office systems. These cover over 20 different suppliers.

ITSO covers only those aspects of the Back Office that impact upon interoperability between HOPS. ITSO has defined the following HOPS functional requirements:

- Lossless communications management (the Message Processor);
- Message data storage;
- ITSO Shell and IPE account management, including Hot list and Action list Processing;
- Asset management;
- Services:
  - Audit trail and Journal,
  - Rule Compliance,
  - Security Monitoring,
  - Backup,

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- Archive.

ITSO, TLS and VDV-KA are applied similarly. They use one application in different systems, which includes products (normally regional products, but in case of using payment systems, system wide).

II.3 System Architecture

The following types of systems are implemented:

- Manual pre-selection, i.e. storage of predefined, complete tickets in Germany, France, Portugal/Lisbon, UK, Sweden and the Netherlands
- Automated fare collection, e.g. Check-In / Check-Out or Check-In only in Germany, Portugal/Lisbon, UK, Sweden and the Netherlands
- Combinations of the above in Germany, Portugal/Lisbon, UK, Sweden and the Netherlands
- Systems with entry gates in France (partial), Portugal/Lisbon, UK, Sweden and the Netherlands

Other variants are implemented in Portugal/Lisbon in the form of some special pre-selections, which are defined for suburban and national railways and in the Netherlands in the form of open-closed hybrid entries and validators in vehicles or on platforms.
In the inventory it can be seen that different system variants are realized. That means, IFM in Europe also has to support these different system variants.

II.4 Realised Roles in the National Systems

The following roles are realised:

- Application Owner
  In France these are TAs, who agree to interoperate the same application and sign a "charte d'interoperabilité", in which they agree on the objectives and on the common rules to manage the application.
  In Germany it is the VDV-KA KG.
  In Netherlands it is TLS.
  In Portugal/Lisbon region currently the only application owner is OTLIS (negotiations with Parking operators, municipalities, mobile operators and banks are going in the direction of additional application owners).
  In the UK it is ITSO.

- Application Retailer
  In France these are mostly TOs. It can be a special entity, (e.g. joint venture of transport operators for NAVIGO). It can also be the local government as TA for concessionary cards. (e.g. Midi-Pyrénnées)
  In Germany these are different TAs or PT companies (TOs).
  In the Netherlands there exists only one.
  In Portugal/Lisbon this concept is foreseen, but not implemented today, except for some functions of an Application Retailer, Product Retailers can provide it based on an on-line application from the Application Owner.
  In the UK there are many; a lot of transport operators, but also banks.

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- Product Owner
  In France, products owners are TAs, when the product is a fare (solely or in common depending upon the product). When the product is not a fare but a payment facility (i.e. bank account orders - we have no stored value), the Product Owner can be a TO or more generally a product retailer.
  In Germany these are different TAs or PT companies (TOs).
  In the Netherlands these are TLS or PTOs.
  In Portugal/Lisbon the Product Owner concept is implemented. In that case there are 20 operators, combinations of 2, 3, 4 or any of these 20 operators are in fact the Product Owners.
  In the UK there exist 300+ to date; the government for concession schemes; transport operators for commercial schemes; local authorities for private applications (e.g. library).

- Product Retailer
  In France, these are TOs, for Navigo annual passes a joint venture of TO. Independent retailers are generally subcontractors of TOs. For departmental networks (coaches), the product retailer often is a different firm from TOs, linked to a TA.
  In Germany these are different TAs or PT companies.
  In the Netherlands these are PTOs.
  Each of the 20 operators in the Lisbon region is a Product Retailer, additionally SIBS (ATM banking entity), Payshop (POS operating entity), Link/OTLIS (Internet reloading service operating entity) and also Lisbon Tourism ATLX (Lisbon Region tourism agency).
  In the UK many work as Product Retailer, including shops.

- Service Operator
  In France, there may be a difference between the product acceptor and the service operator in some cases. In the case of departmental coaches for example, the ticketing operator (which operates the driver's POS, the validators, the back-office, etc.) and the TO (which operates the coaches) can be different.
  In Germany these are different PT companies or private transport companies. In German TAs it is possible that a service provider is responsible for the ticket control.
  In the Netherlands these are the PTOs.
  All the PT operators in the Lisbon region and in the future the Parking operators, others are being negotiated (not including some partners that allow the usage of the card to get discounts: e.g. Zoos, Cinemas).
  In the UK these are numerous bus, rail, tram operators.

- Collecting & Forwarding
  In France, the function exists, but it is generally decentralised between the different stakeholders.
  It is integrated as part of the several systems in VDV Core application basic systems.
  All connected PTOs in the Netherlands and M-com play the C&F role. Additionally, TLS serves as the central C&F party.
  In the Lisbon region system the concept exists, but it is always part of the role of the Application Owner (OTLIS), with software agents installed in the entities, which perform

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the previously mentioned roles.
In the UK these are scheme operators such as local authorities and large transport operators.

- Registrar
  The function is realised through the "interoperability charter" and is controlled by the steering committee in France.
  The VDV KA KG realises the role of the Registrar combined with security and application management.
  TLS also realises the role of the Registrar.
  This role is still merged with the Application Owner and Security Manager and performed by OTLIS consortium.
  ITSO realises the role of the Registrar.

- Security Manager
  The interoperability charters specify the security agreements. In Ile de France a special contract defines the rules applicable to security management and in case of security incidents according to that contract. TOs are jointly responsible and TA decides, if TOs don't come to an agreement.
  In Germany the VDV-KA KG is responsible for the security management, which is operated by the T-Systems trust center.
  TLS also realises the role of the security manager.
  This role today is still merged with the Application Owner and Registrar and is performed by OTLIS consortium.
  ITSO also realises the role of the security manager.

The enforcement of the role model is very similar in all the analyzed systems/standards. The architecture of fare management systems (in the case of French regional interoperable applications) is based on the standard ISO EN 24014-1.
In Sweden it is only planned to implement the Standard. There are no organisations, which today fulfil the roles of the IFM role model.
The inventory shows that it is possible to determine in every of the analysed systems the role of the players in the national context. So it will also be possible to transfer this to a European context.
The usage of ISO/EN 24014-1 to define „Who is Who“ in the „own“ system will be helpful to look for migration paths for an European IFM. So a migration to an European organizational model should be possible without problems.
In France a National Standard to register TAs has been defined; for other objects, registration is done on a regional level. The community administrates documents that register the products (REFOCO, referential functional common) and their business rules (DMO document de mise en oeuvre) and the corresponding technical specifications (Instanciations). Depending upon the case, these documents are administrated by SNCF or by independent companies.
In Germany, all organizations/entities which are operating in the system or which fulfill a role are supplied with a unique identity. The numbering system for components, applications, products/entitlements/SAMs behind the Organisation_ID is administrated by the entities on their own.
To maintain these principles as unchanged as possible, ways should be considered to allow to use them in the national context. The solution proposed in ISO/IEC 1545 to add a national ID to each Organisation_IDs extends the related data constructions considerably. It needs to be examined whether this could be implemented in the short term.

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A first migration step can therefore use the EN ISO 21014-1 role-model and create an organizational-contractual basis for a common and shared Security Management and a common Registrar for an IFM in Europe.
A second step could be the physical development of a common Security Management and a common Registrar, making available the joint use of security components (keys, certificates, hardware SAMs) by the IFM participants. Thus, it would be possible in the future for each participant to also obtain security components needed in the different PT applications.

II.5 Implementation of Use Cases from the IFM System Architecture Standard

- Certification of Organisations:
  This use case is implemented in ITSO, OTLIS and TLS.
  Organizations, which will use VDV-KA, have to be accredited.
  No certification is executed in INTERCODE and Resekortet.

- Certification of Application Specifications and Templates.
  This use case is implemented in ITSO and TLS.
  The application template is firmly defined in the VDV-KA specification. A Testsuite is used to verify the functions of user media and SAMs; a certification laboratory, which will execute tests for all components, is planned.
  No certification is executed in OTLIS or Resekortet and generally in INTERCODE. Only in the case of NAVIGO does a certification process exists for the card/reader subsystem.

- Certification of Product Specifications and Templates
  This use case is implemented in ITSO, OTLIS and TLS.
  No certification is executed in VDV-KA, Resekortet and generally in INTERCODE.

- Registration of Organisations
  This use case is implemented in INTERCODE, VDV-KA, ITSO, OTLIS and TLS, not in Resekortet.

- Registration of Components
  This use case is implemented in OTLIS, INTERCODE, TLS, and ITSO. Within the VDV-KA it is only implemented for user media applications and SAMs (terminals only within the organizations).
  No registration is executed within Resekortet.

- Registration of Application Templates
  This use case is implemented in INTERCODE and ITSO.
  No registration is executed within Resekortet, TLS, OTLIS and VDV-KA.

- Registration of Applications
  This use case is implemented in INTERCODE, TLS, VDV-KA and ITSO.

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No registration is executed within Resekortet and OTLIS.

- Registration of Product Templates
  This use case is implemented in INTERCODE, TLS, VDV-KA, OTLIS and ITSO.
  No registration is executed within Resekortet.

- Registration of Products
  This use case is implemented in, TLS, VDV-KA, OTLIS and ITSO.
  It is not implemented in Resekortet or INTERCODE.

- Dissemination of Application Templates
  This use case is implemented in INTERCODE, TLS and ITSO.
  No registration is executed within Resekortet, VDV-KA or OTLIS.

- Acquisition of Applications
  This use case is implemented in, TLS, VDV-KA, OTLIS and ITSO.
  It is not implemented in Resekortet or INTERCODE.

- Termination of Application Templates (regular and forced termination of Application Templates)
  This use case is implemented in ITSO.
  It is not implemented in TLS, Resekortet, OTLIS and not yet in VDV-KA (specification is planned in connection with Mobile Ticketing).
  For INTERCODE currently only one application template exists per medium. The ULYSSE group is defining on a national level the processes for these use cases with multi-application media.

- Termination of Applications
  This use case is implemented in ITSO, TLS, VDV-KA, and OTLIS.
  It is not implemented in INTERCODE and Resekortet.

- Management of Products
  - Dissemination of Product Templates
    This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, and OTLIS, not in Resekortet.

  - Termination of Product Templates (regular and forced termination of Product Templates)
    This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, OTLIS, not in Resekortet.

  - Management of Action Lists
    This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, and OTLIS, not in Resekortet.

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- Acquisition of Products
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, and OTLIS, not in Resekortet.

- Modification of product parameters
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, OTLIS, not in Resekortet.

- Termination of Products (regular and forced termination of Products)
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, OTLIS, not in Resekortet.

- Use and Inspection of Products
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, and OTLIS, not in Resekortet.

- Collection of data
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, OTLIS, not in Resekortet.

- Forwarding data
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, OTLIS, not in Resekortet.

- Generation and distribution of clearing reports
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, OTLIS, not in Resekortet.

- Monitoring of IFM processes and IFM data life cycle
  This use case is implemented in ITSO, TLS and VDV-KA, not in INTERCODE, OTLIS and Resekortet.

- Management of IFM security keys
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, OTLIS, not in Resekortet.

- Management of security lists
  - This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, and OTLIS, not in Resekortet.

  - Updating security list data
    This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, not in Resekortet.

  - Add or remove a component to/from security list
    This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, not in

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OTLIS and Resekortet.

- Add or remove an application template to/from security list
  This use case is implemented in INTERCODE and ITSO, not in VDV-KA, TLS, OTLIS and Resekortet.

- Add or remove an application to/from security list
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, not in, OTLIS and Resekortet.

- Add or remove a product template to/from security list
  This use case is implemented in INTERCODE, TLS and ITSO, not in VDV-KA, OTLIS and Resekortet.

- Add or remove a product to/from security list
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, not in OTLIS and Resekortet.

- Management of Customer Service
  This use case is implemented in INTERCODE, ITSO, TLS, VDV-KA, not in OTLIS and Resekortet.

The realisation of the use cases is very similarly in all the analyzed systems/standards. A migration to a European Application standard should be possible without problems.

II.6 Security

In general it can be seen that the security concepts of the different National Systems are based on very different concepts.
Security by the medium itself is only realized in the VDV KA. The signature of the medium supports an audit of transactions over all different system components and systems to the last recipient of this transaction.
The authentication between system components, on the other hand, is postulated in different execution in more or less all of the systems.
Security management, except for key management, is decentralized in the French systems based on the standard INTERCODE.
The unique identification of all objects and participating entities (including transactions between terminals and media/applications) is guaranteed within VDV-KA, OTLIS, ITSO and TLS.
INTERCODE and Resekortet are working decentralized.
The implementation of an integrative security concept maintaining the existing national IFM solutions is not considered realistic.
On this basis it should be considered whether it may be possible to download the different national applications in a first joint IFM phase. This may be a common Internet application focusing on each national IFM-Retailer who downloads the customer the required national applications and the first needed tickets to its multi-application customer medium. This could be a NFC-enabled mobile phone or a multi-application chip card with an ISO/IEC 14443-enabled reader at the customer PC.
Therefore, necessary condition are:
- secure application download to third party media and available related specifications,

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- media with the requirements for secure application download and tested command sequences,
- the secure use of application download is substantiated.

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III. General organizational conditions

III.1 Central Organizations in the National IFM System

National organizational Structures

The state of national organizational structures for IFM is the following:

- There is no national IFM System in France; IFMs are regional. Two discussion platforms are PREDIM (plateforme de recherche et d'expérimentation intermodale) and CN03 (commission de normalisation).
- VDV-KA KG as Application owner, registrar, and security manager, blocking list operator is currently in preparation
- OTLIS with some relation to governmental departments (secretary of state)
- ITSO: specification, SAM, security management, Registrar
- SLTF Resekortet i Sverige AB. Provision of the Technical Specification, granting of licenses for the brand name “Resekortet”, implementation of the “e-purse“, conduction of surveys of clearing systems, setting up and administering of an advisory body for the Travel Card Co-operation
- TLS: Security, Registrar, Scheme Provider, Certification, Clearing and Settlement, Specification development, Card Issuer, Float manager, Customer Service.

Conditions of Participation in the National IFM System

Conditions of participation in the National IFM System are:

- VDV-KA: participants must sign a role specific contract with the VDV-KA KG.
- ITSO: Government mandated for Concession Travel and National Rail; otherwise commercial decisions.
- Resekortet: participants have to fulfill the implementation of the agreement requirements
- TLS: Check-to-Connect

Certification Procedures for EFM Components

Central certification procedures for EFM components are implemented within:

- VDV-KA: a certification lab for all component is planned. Currently user medium and SAMs are functionally tested with a testsuite, terminal are tested using prepared user media.
- OTLIS: all system components from cards to complete terminal solutions are implemented and certified in a “certification lab”, which procedures still need to be better formalized and eventually aligned with standards
- ITSO: All media, point of service and back office systems interfacing to ITSO must be certified to specification and tested for interoperability.
- TLS: All components are certified against the Open ticketing Standard.

Obligations to certify components for participation in the IFM system exist within:

- VDV-KA (planned)
- OTLIS: PT operators consortium

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- ITSO
- TLS

Initiators for the IFM System

Initiators for the IFM System are

- In Germany: transport authorities, larger transport companies, regional PTOs
- In France: transport authorities will decide, often upon suggestion of transport operators
- In Portugal/Lisbon: OTLIS: PT operators consortium
- In UK: government, transport operators, suppliers
- In Sweden: The Swedish PTA's and SJ
- In the Netherlands: larger transport companies. Ease of use, security, reporting and resource management

Who obligates companies to take part in the IFM System?

- VDV-KA: decision of PT authorities, PT companies
- INTERCODE: transport authorities
- OTLIS: in fact operators are not obliged, but instead they only have to choose or not to follow the "recommendation" and specifications from OTLIS, as a basic requirement to be part of the interoperable fare solution (because intermodal fares are an unavoidable reality!)
- ITSO: Government mandated for Concession Travel and National Rail; otherwise commercial decisions
- Resekortet: each of the participants
- TLS: Transport authorities. They can demand the concessionaire to take part in the IFM. The national transport authority (minister) ultimately decides on the abolishment of the paper ticket based system.

Migration Steps within IFM

Who decides about possible migration steps?

- VDV-KA KG with their limited partners
- INTERCODE steering committee where all implied transport authorities stand. This steering committee may be chaired by the regional authority or by the capital city.
- OTLIS in agreement with Operators, sometimes co-financed by the government
- ITSO: commercial decision by operator or public transport authority, often based on franchise obligations
- Resekortet i Norden
- TLS: transport authorities.
  They can demand the concessionaire to take part in the IFM. The national transport authority (minister) ultimately decides on the abolishment of the paper ticket based system.

Possible migration steps are:

- VDV-KA: issue limited kind of product templates, issuing limited kind of payment methods and corresponding technical equipment
- INTERCODE: technical steps, acceptance of new stakeholders, new fares

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- ITSO: existing ISO14443 schemes may migrate but require media to be re-initialized
- OTLIS: follow an “Enterprise Architecture Methodology” to evaluate the current status (e.g. no system, magnetic system, etc) and “where-to-go”, which results in a definition of the system for the operator, but aligned to the interoperable system specification.
- Resekortet: Technical specification and administrative regulations
- TLS: Paper based -- paper and smart card -- smart card

Interoperable Products

The following entities are liable for possible losses incurred in the case of interoperable products:

- VDV-KA: every product retailer (customer contract provider) for his products
- INTERCODE: Would be examined by juridical courts if one stakeholder were proven to be solely responsible. (which may not be the case for successful hacking for example)
- OTLIS: operators with the co-solidarity of OTLIS
- ITSO: depends on commercial agreement; ITSO requires all operators to sign license accepting risk
- Resekortet: Not regulated yet
- TLS: No product clearing yet. As soon as it gets in scope, agreements will be made

The following solutions for revenue apportionment for interoperable products (used in different transport companies) between the EFM participants are employed:

- VDV-KA: revenue apportionment contracts at most based on number of travelers today
- INTERCODE: Different from scheme to scheme. A percentage may be given to the retailer (e.g. for Navigo in Ile de France). The rest is cleared according to fixed rates adjusted periodically from surveys or from validations.
- OTLIS: All the transactions are processed at the OTLIS service centre and clearing maps issued every day and every month in a consolidated mode. The clearing statements are then settled by the operators between themselves and the system keeps a tracking record of the real funds transfers.
- ITSO: commercial agreements between operators; bi- and multi-lateral; ITSO not involved but supports transactions when necessary.
- TLS: No product clearing yet, but will be part of services provided by TLS. Apportionment will be according to agreements between product owners and service providers.

Revenue apportionment is executed only in exceptional cases, depending on the use of covered transactions!

Economic Basis for the Implementation of the IFM

The following economic bases for the implementation of the IFM systems are characteristic:

- VDV-KA: reduction of forgery, minimization of sales costs;
  public funding for first projects on basis of interoperability; in the future KA conformity will be required for public funding
- INTERCODE: decision is mostly not economic, but political (multimode policies), technical (renewal of systems) or commercial (new services to customers)

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- OTLIS: First of all what we could call the "card issuing and management business case" (sharing the costs – and the incomes - for card issuing and management), but also the sharing of costs for third party sales networks (e.g. ATM, Internet, Payshop)
- ITSO: government funding to support countrywide interoperability across bus, tram, metro, rail and ferry
- Resekortet: Entrance and annually fees
- TLS: Public safety, customer convenience, optimization of operations

Calculations concerning profitability of the system are available only within OTLIS.

III.2 Legal framework

Relevant contracts for the national IFM are:

- VDV-KA; Participation contracts for Retailer/Customer contract partner, Product Owner, Service Operator, IOP Clearing, issuing (application/entitlements to customer) contracts, conditions of carriage, Regional PT contracts
- ITSO: membership agreement; licensed operator agreement; registered supplier agreement
- Resekortet: Co-operation agreement
- TLS: contracts between TLS (as Scheme Provider) and IFM participants: Framework agreement, participant agreement, load agent agreement. Part of the participant agreement is the services portfolio.

Uniform, centrally defined Rules & Regulations for participation in the IFM System exist for VDV-KA, OTLIS, ITSO, Resekortet and TLS.
Within VDV-KA there exist specific central agreements between VDV-KA KG and KA-EFM participants, between the security management operator T-Systems and VDV-KA KG, single contracts between the security management operator and companies.
Within ITSO all individual parties have a contract with ITSO.
Within Resekortet there exist contracts between each PTA and Resekortet i Sverige and bilateral and multilateral contracts between PTA's and operators.
Within TLS there exist bilateral contracts belonging to the central agreements between the parties and TLS.

There are relevant requirements stemming from data protection acts

- in Germany: Federal Data Protection Act (Bundesdatenschutzgesetz/Landesdatenschutzgesetze), EFM Guideline
- in France: privacy requirements from CNIL (National Privacy Authority)
- in Portugal: imposed by the National Data Protection Agency (please consult with OTLIS)
- in UK: ITSO makes very limited requirements; up to individual operators to comply with legislation
- in the Netherlands; Dutch privacy law is applicable

There are relevant requirements stemming from data protection acts in every European country!
Open procurement and standardized solutions are mandatory for public bodies.
References to other legal and political requirements may be company laws and obligations stemming from monetary regulations (E-Money Directive, banking law (Credit Transaction Law)

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III.3 Liability

There are liability agreements regarding the Security Management within:

- VDV-KA by a basic agreement between VDV-KA KG and the Security management operator; single supply contracts made with operators and the security management operator
- ITSO, by an Operator License, requires that all operators share liability
- Resekortet: draft is available

The following parties takes over the liability:

- VDV-KA: the security management operator T-Systems
- ITSO: Operators

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IV. Resume

The goal is to create an Interoperable Electronic Fare Management in Europe, that permits customers in public transport to travel barrier-free and without ticket limits "door to door".
In the long term this can be achieved by an Europe-ticketing application, which will realize, both electronic tickets as well as different payment methods, to charge service in travel.
Short term solutions should be based on the existing national Ticketing Applications and support the migration to the forthcoming long-term objective.
The EN ISO standard 21014-1 role model is a good basis. Already today it is possible to make the statement that most of the existing systems are based on the model or that it is possible to map its organizational structure to the role model.
A first migration step can therefore use the EN ISO 21014-1 role-model and create an organizational and contractual basis for a common and shared Security Management and Registrar.
A second step could be the physical development of a common Security Management and a common Registrar making possible the joint use of security components (keys, certificates, hardware SAMs) by the IFM participants.
On this basis it would be possible to permit the download of the different national applications on multi-application customer media in a first joint IFM phase. This may be a common Internet application focusing on each national IFM-Retailer who downloads the required national applications and the first needed tickets to its multi-application customer medium.
This could be a NFC-enabled mobile phone as a multi-application chip card is brought into the system, with an ISO/IEC 14443-enabled reader at the customer PC.

The necessary conditions are:

- an organizational and contractual basis for mutual application downloads,
- an organizational and contractual basis for a common and shared Security Management and Registrar,
- secure application download to third party media and available related specifications,
- media with the requirements for secure application download and tested command sequences and
- the proven secure use of application download.

Dr. Till Ackermann
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