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## The EU - IFM project A seamless travel initiative: Preliminary work

For fifteen years now electronic ticketing has been a central theme at seminars, conferences and congresses, including two specialist events held by UITP (first in Bologna, Italy then in Karlsruhe, Germany).

Initial discussions focused largely on the technology and on proving that 'contactless' could be more robust and more reliable than 'magnetic'.

### Difficulties with ticketing interoperability

Attempts to standardise and ensure consistency did not simply run into industry competition. The key difficulty lay in the fact that absolute interoperability had to mirror an identical commercial structure.

Electronic ticketing is not simply the advent of the chip card and mobile phone as the alternatives of the future. It is a comprehensive information system. All the networks which have chosen it have learned that the biggest difficulty lies in the system's architecture and in maintaining its capacity to evolve. Using the same card and the same security keys is not enough to permit interoperability – data models and back-office processes must also be compatible, in much the same way as two identical computers can only work on the same file if they have compatible programs.

Such deep convergence is virtually impossible in the world of public transport, which is characterised by decentralised decision-making, split between public authorities and operators, and by the parcelling-up of a market that must cater for the needs of everyone, including people who do not have a bank account.

Both the authorities, mindful of exercising their responsibilities towards citizens with complete autonomy, and the transport carriers, often facing competition or reduced to the role of technical operator, receive little encouragement to open up their systems to outside customers from what is essentially a domestic market (urban or regional). More

often than not, cross-border transport services themselves are regarded as no more than local extensions.

This situation is by no means confined to Europe. The main e-ticketing applications in Asia's major cities were also developed at first to serve a given transport policy, and now face similar difficulties in developing interoperability with neighbouring territories or networks.

### Cooperative nature of the project

With these difficulties in mind, UITP published a focus paper on e-ticketing<sup>1</sup>, compiled by a working group within its IT&I (Information Technology & Innovation) Commission in April 2007.

Although it recognised the importance of earlier European standardisation work and its impact on ISO standardisation, the focus paper had to acknowledge that there was still a long way to go in order to make the major systems under development interoperable.

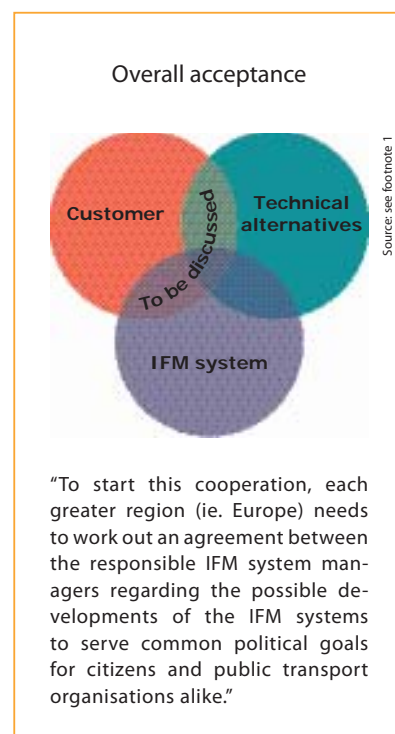
This is the premise underlying the IFM project, selected and funded by the European Commission's Information Society and Media Directorate General. The members of the project's signatory consortium have adopted the focus paper's proposed aim of establishing common bases enabling step-by-step progress to be made.

Initial discussions on the project's foundations started in summer 2006. The project officially began in January 2008 and will end in June 2010.

UITP is a member of the consortium alongside partners from the UK, France and Germany. Through the IFM FORUM,

the consortium gives all countries the chance to contribute by getting their experts involved. For project partners, the forums offer a chance to seek the best consensus by sounding out the solutions they propose.

The consortium faced the danger of becoming bogged down, in the same way as the standardisation groups which had proved powerless in the face of the tech-



nical and structural variety of the systems in operation or under development.

No country wanted to give up an investment it already agreed on, or devalue it by collaborating on the development of a different standard.

A European cooperation system, which was respectful of decision-making autonomy and which limited technical constraints as far as possible thus became the goal.

This position is a hallmark of the IFM project:

IFM is neither a standardisation project nor a business project. It does not seek to pave the way to a single e-ticketing system in Europe, but to compatibility between systems across Europe serving the mobility of people (see text box on the right).

#### Ticketing: a commercial process

An e-ticketing system is much more than simply replacing a paper system with an electronic one, as it encompasses the entire public transport sales system.

The system manages a whole process, from the customer's request through to network access control, and even the collection of the transport fare by the operator.

In a conventional ticketing system, access control marks the final stage after purchase and payment.

In systems with entry/exit controls, access control provides the input data and triggers the fare calculation and payment process (see text box on the next page).

Raising the issue of European interoperability therefore prompts questions about which parts of these processes will be integrated in the long run. The answer can extend as far as floating the idea of European fare products (a universal bus ticket?) or integrated billing systems (catch the bus abroad, then be billed as if you had caught it near your home).

The cooperative nature of the IFM project led the consortium to adopt a cautious, but positive approach: the solutions and architectures put forward must respect the independence of commercial policies whilst permitting all forms of cooperation that meet market needs to be gradually built up in step with political decision-making (bottom up) rather than by seeking to override the decentralised character of public transport by putting forward 'one-size-fits-all' solutions.

International standard ISO 24014 "Public Transport – Interoperable Fare Management System" – part one of which, devised essentially by European experts

## IFM objective: compatibility rather than standardisation

The following scenario from the project clearly illustrates the form of cooperation sought, alongside the goals of flexibility and adaptation to local fare policies and different customer segments.

Mr Move is a cross-border worker. He lives in country A and works in country B.

For his commute to work everyday, he needs to carry two different fare cards. Of course, both are interoperable in their respective countries. But country A and country B have two different IFMs. The only existing agreement concerns the railway link between city A and city B, on which either of the two cards can be used. But for buses, trams and park & ride facilities, only the local card is accepted. Transport authorities in country A and country B have been discussing a fare agreement for buses, but their fare systems are so different that they haven't been able to reach a settlement.

IFM managers from country A and country B finally agree to issue and accept EU-IFM compatible cards. Mr Move is very pleased with this new situation. He applied for the new A-Card which is now recognised in both countries. His colleague, who lives in country B, did the same and applied for a new B-Card.

Next summer, Mr Move plans to travel to Rome and Paris. The transport authorities in both of these cities accept EU-IFM compatible cards from all over Europe. When Mr Move arrives in Rome and Paris, he will be able to use his new A-Card to buy - with either cash or credit card - a transit pass for these cities for the duration of his stay.

Because his new A-Card attests that he is a senior citizen, he will be able to benefit from special prices if any exist.

Mr Move's son uses a contactless EU-IFM compatible mobile phone. He no longer needs any fare cards: long distance railway tickets, with seat reservations, can be downloaded directly on to his mobile phone. He can also download the public transport applications for business trips in Europe by selecting the local application in an EU-IFM compatible network. He can avoid queuing to buy his bus ticket by prepaying it through the internet before leaving home.

His tickets are stored in his mobile phone. He uses it to check-in and to show to control staff on request.

Mrs Move works near home. For the moment, she keeps on using the traditional A-card for her local public transport needs."

from CEN, was published in 2007 – was the first to forge a path in this direction by offering actors an organisational model for building interoperability, irrespective of its content.

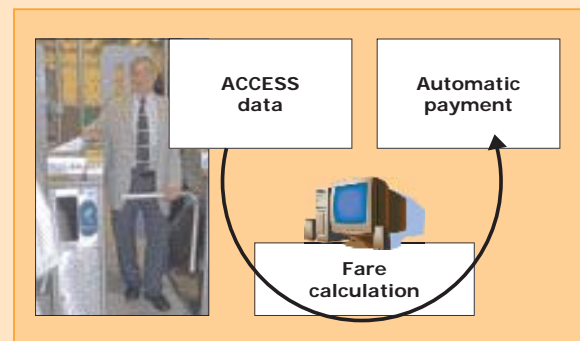
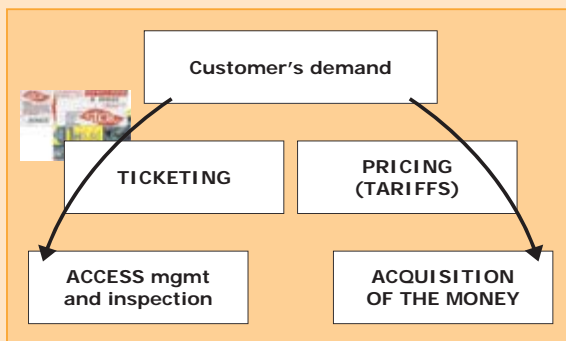
The example of the three countries of the consortium also illustrates this difference between the interoperability of systems and the pooling of commercial practices:

- In the United Kingdom, ITSO established as a prerequisite the cross-acceptance of media (cards) as the basis for interoperability, but does not interfere in the definition of fare products.
- In Germany, VDV-Core Application (VDV-KA) defined a common specification for media and back-end-interfaces for all kinds of electronic fare management. Under the brand '(e)Ticket Deutschland', common rules and regulations including common, interoperable products are issued and accepted with a common interface to the customer.
- In France, the specifications for cards, data models and back-end interfaces are defined as AFNOR standards. Cross-acceptance of cards between regions and the issuing of shared cards by several regions are thus possible,

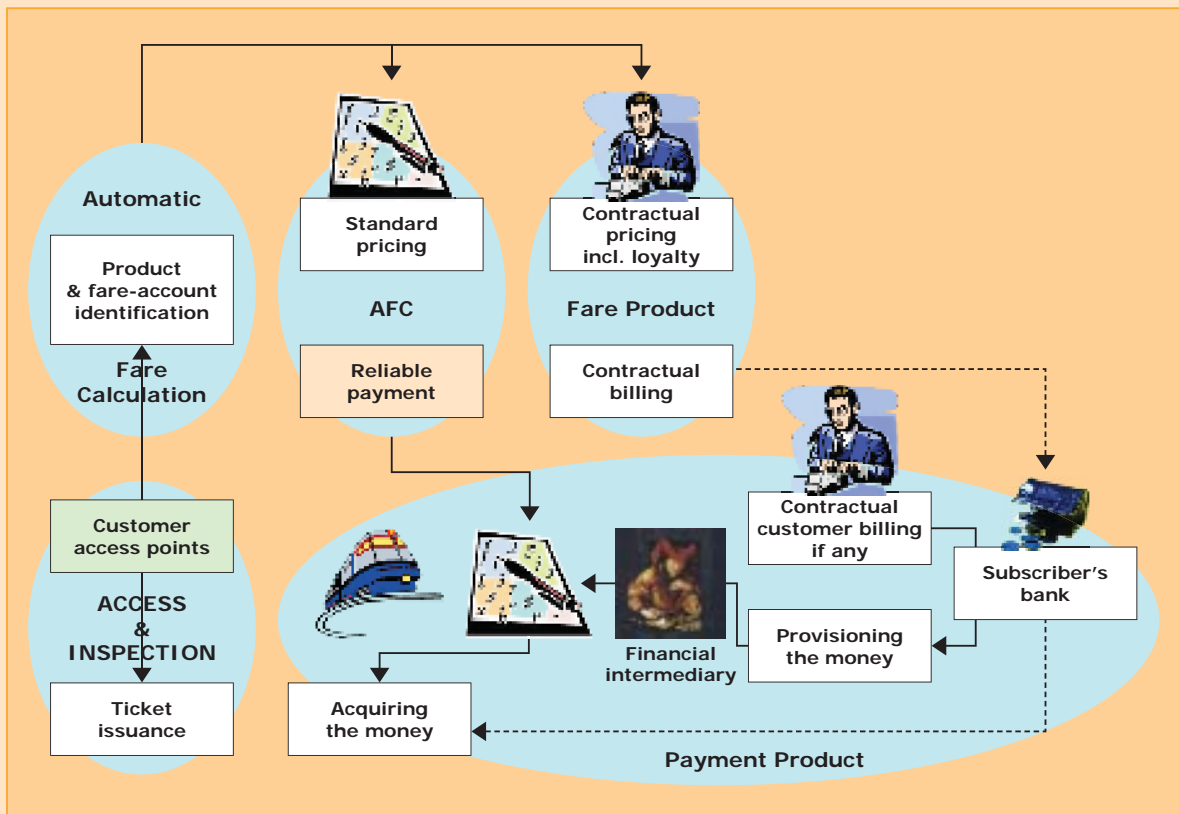
## Different operating modes of the e-ticketing process

In conventional systems the process is initiated at the request of the customer buying his or her ticket. The ticket confers the right to access the network.

In systems based on entry/exit validation, the process works in reverse order. Access data triggers billing as soon as the customer presents an identifier that is deemed creditworthy by the transport carrier, eg. a customer account or a stored value.



Stored-value systems assign the responsibility for provisioning the customer's account to a financial intermediary integrated within the world of transport.



but not compulsory. With products remaining local or regional, nothing has been decided as yet in this regard.

The e-ticketing medium: the key to all interoperability

The medium used by the customer to access networks is at the heart of the matter. Be it a paper ticket, chip card or other medium, in some cases it is the identifier used by the e-ticketing system's various components, while in others it carries the information passing between them:

- The access system in its various forms, most of which in Europe are open, but can be fitted with validating machines or barriers, sometimes upon entry and sometimes upon entry/exit.
- The fare system in the broadest sense: ie. including cost calculation principles, personalised social or commercial fares, and loyalty systems.
- The billing system, complete with the various payment methods (anonymous or nominative; manual or automated; pre-, instant or post-).

Standardisation of equipment is not the most difficult problem: the entire transport community has been using 'local' contactless technology for a long time now, standardised at international level, whose 'NFC' version will provide a solution applicable to new media, including mobile phones.

The trickiest aspect is the interoperability of the application software, as this is contingent upon having common specifications for security integrity and data collection and also for at least some of the operating logic.

Changing any one of these elements involves adapting the corresponding infrastructure software.

Adopting multi-application media: step one towards interoperability

Having learned from the difficulties faced by 'convergence' attempts under the CEN framework, the IFM project is moving towards using the multi-application media now available in the market to support the interoperability of e-ticketing media.

The project website<sup>2</sup> provides or will provide useful information and contacts for those requiring technical details about the adopted 'Global Platform' standard.

This solution allows citizens to load the local applications they need onto their medium, be it a card (multi-application, naturally) issued by a transport carrier, a mobile phone, or any other same-technology medium.

The majority of the customer base is used to downloading such applications either via the internet or via their mobile phones.

The customer then uses this medium in the same way as a local medium.

Applications can conceivably be loaded using a variety of local channels, counter terminals and automatic machines, but long-distance networks over the internet (OTI) or by phone (OTA – over the air) are preferable as they provide customers simultaneously with information about transport services, networks, schedules and fares to help them to plan their journeys.

Once the application has been loaded, customers can purchase the fare product they require, either locally upon arrival or remotely in advance when planning their trip.

Fare products can be purchased via all existing channels, notably existing automatic vending machines and counter terminals.

Remote sale by internet has already been developed as an additional channel to make local customers' lives easier and reduce distribution costs by cutting back on the number of automatic vending machines and counters.

This means that the application server is the only investment the local transport carrier has to make. He no longer has to distribute local cards to occasional customers/tourists and can reduce the use of paper or magnetic tickets.

No other modifications need to be made, since the applications are seamless between each other. The data currently encoded locally and the processing method for fares and other aspects need not be harmonised.

This minimises risks, since no data can be corrupted by passing from one application to another, and each application continues to manage its own security with its own keys, as it would on a dedicated medium.

The implementation of this stage could therefore be very quick.

In the twelve months it has left to run, the project must define the necessary specifications and set of rules.

A European application: step two towards preparing the future

Beyond this first stage, in which totally stand-alone applications are able to simply co-exist on the same medium when requested by the customer, the IFM project proposes specifying a gen-

eral-purpose downloadable European application.

This application is not designed to replace existing applications in the short term, but to act as a bridge between them.

The aim of this far more ambitious stage is two-fold:

- firstly, to simplify passenger operations: this general-purpose application should spare them from having to download local applications whenever they travel elsewhere in Europe.
- secondly, to enable public transport organising authorities who so wish to share information in order to improve their service offers and gradually extend the practical scope of the 'seamless travel' concept.

The IFM project is in charge of proposing the set of rules to make this happen.

All the functions identified by the ISO 24014 standard will have to be defined:

- for example, this application will need to have an owner and licensed distributors authorised to load it onto customer media.
- it will host customer data, products and transaction data whose life cycle will have to be determined from their creation through to their deletion or opposition. Security conditions will need to be accepted and followed by all, under the authority of a 'security manager', etc.
- the conditions must be in place to instil trust between the partners (Business to Business) as well as between people and the various bodies that manage or use the application (Customer to Business).
- the confidentiality of personal data will also have to be safeguarded using common protection measures. It will certainly have to be possible to process transactions anonymously by protecting access to personal identity data. Bodies in possession of these data will need to adhere to confidentiality obligations and acquire 'trusted' status.

This particular topic is addressed in a special work package for which the IFM project contacted the working party made up of privacy protection agencies in the various member countries.

On the technical side, the project will set out the list of user requirements with regard to standardisation and specifications. The actual technical work itself should then be performed by the relevant CEN standardisation technical committees (TC 224 and TC 278).

For example, agreement will be needed on a standard data model to complement existing local models.

Practical implementation of this second stage will therefore stretch far beyond the project completion date.

On one level, it will barely be possible to bring the work on standardisation to a successful conclusion before the end of 2010 or even 2011. On another, creating a structure to govern the European application will require an agreement to be forged between some of the leading actors responsible for systems in different countries.

Ultimately, transport carriers will be required to make more fundamental changes to equipment software and central systems, costly modifications that will only be decided when the time comes to replace systems or significant parts of them.

As a general guide, the natural replacement cycle of information systems is generally once every 20 years or so!

## The roadmap

The figure below illustrates the various stages of the roadmap to European in-

teroperability, as envisaged under the IFM project.

Under the current situation -involving separate applications - interoperability is only possible through cross-acceptance agreements (0a).

What may also happen (0b) is that certain systems extend their territories. This is the case with the VDV-KA application in Germany, which has been adopted by Austria. Undoubtedly, this will also be the case with certain cross-border agreements.

Whatever the circumstances, however, the widespread existence of such agreements is unimaginable on a European scale.

This is why the IFM project has chosen a phase of 'parallel cohabitation' between systems on multi-application media as the most accessible solution.

One year from now, the project should have provided the 'toolbox' needed to carry out this phase.

The challenge now facing public transport in Europe is to throw itself into achieving this phase and find major partners willing to combine efforts to effectively

implement the same multi-application management processes, for the benefit of the most mobile citizens (1a).

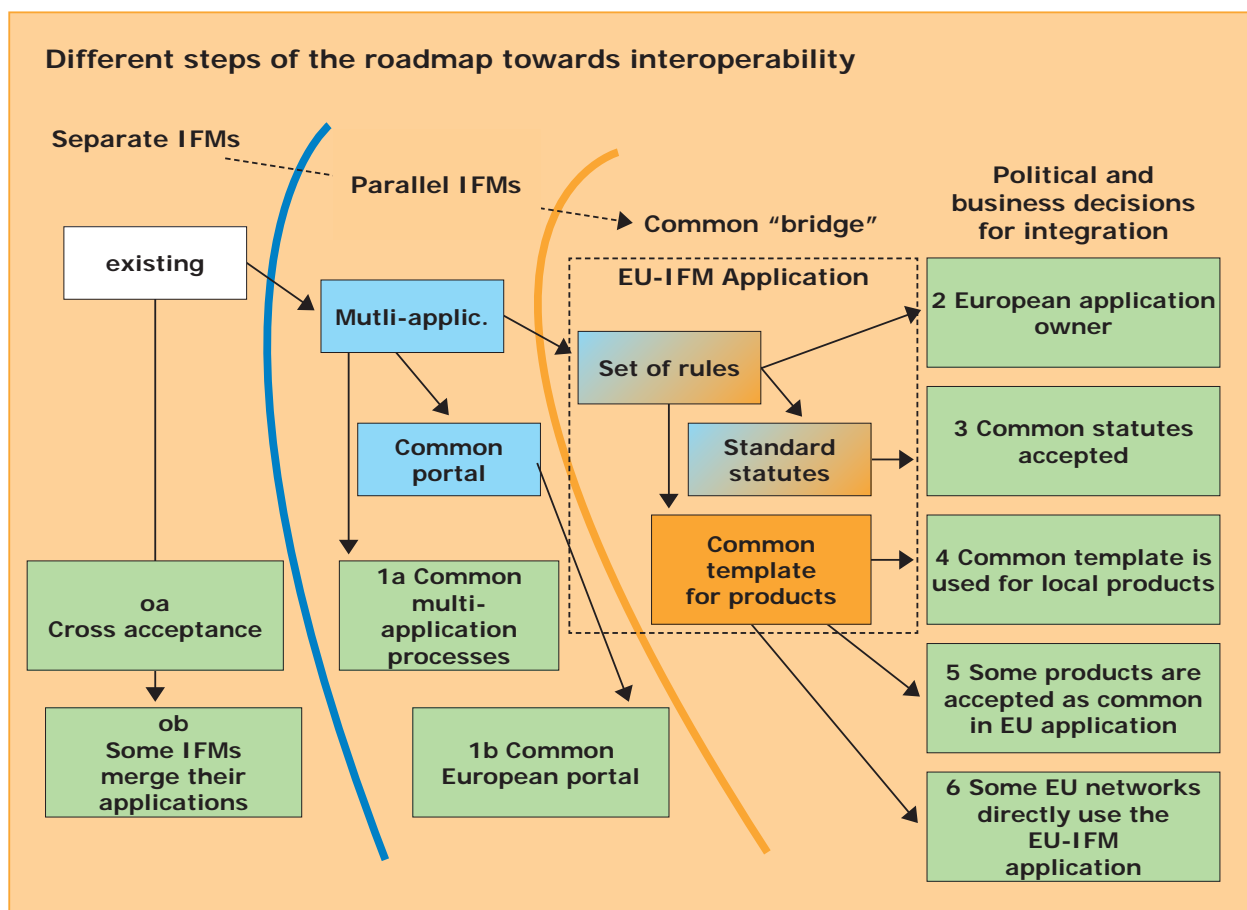
A European internet portal might be approved and implemented to help these keen travellers find the servers from which to download the applications they will need in order to prepare their journeys (1b).

The following stage is to build the European general-purpose application: the bridge towards increased interoperability.

Laying down rules and establishing European standards, both for customer data (statutes) and data on products and transactions, will call for tremendous efforts beyond the end of the project itself.

This technical phase will lead into a succession of decentralised political and commercial decisions:

- implementation of a method of governance for the application (2)
- decentralised decisions on sharing customers' personal data in this application, such as age and language preferences, in order to improve the service (3)



- decentralised decisions on using the general-purpose application to manage local products tailored for occasional customers (one-day users or tourists, for example) to enable remote sales, but without occasional customers having to download the local application (4)

In the longer term, having an application of this kind will make fare agreements easier between European transport authorities confronted with an identical market (5). Regions having yet to develop a local system will find a standard solution directly in the market place (6).

Can the evolution towards interoperability be accelerated?

If the IFM project enables the far-off stages described above to be achieved successfully, this will corroborate the soundness of the decision to favour co-operation over centralisation.

Nevertheless, could any measures be taken to speed up the process?

Politically, strong political will at the European level would undoubtedly be the only thing likely to quicken the pace, as the adoption of the TSI TAP (Technical Standard for Interoperability – Telematic Applications for Passengers) certainly will in the field of long-distance transport.

But simply applying across the board directives designed for this long-distance journey market would risk neglecting what makes the two markets different: what customers expect from them, and the markets' different economic structures.

Therefore, a maturing period is still needed before seeking solutions to the problem.

From a technical perspective, Europe undoubtedly should reflect on the legitimacy of disputes between rival card suppliers.

A decade ago the European CALYPSO project delivered a solution using smart cards with a standardised interface, enabling secure offline operation that comprised standardised commands and file structures, which all European suppliers could have adopted.

The solution then gradually gained its autonomy from suppliers and became compatible with the various international standards. It was selected by a large number of projects, in both France and a host of other countries (Portugal, Italy, Belgium, Switzerland, Canada, Israel, Latvia), and was listed as an accepted standard solution by ITSO in the United Kingdom. However, the choice of the microprocessor for interoperability remained contested until 2007.



Some IFM forum participants visit the NS ticketing training centre in Amsterdam

This proved a wise course of action when the algorithm used for MIFARE-CLASSIC proprietary memory cards was 'hacked'. Users and suppliers alike – including those keenest to protect the proprietary aspect of their products – now acknowledge as much.

The NFC standard marks the end of market segmentation between the different types of transmission. The phase of cohabitation on multi-application media should be an opportunity for the market to curtail the proprietary features that will complicate compatibility with international standards and hamper competition.

Commercially, the IFM project participants, by comparing their approaches, have made huge strides in combining customer value added and technical solutions.

On the whole, however, public transport (authorities and operators) is still struggling to work out why it has committed to, or been pointed in the direction of, e-ticketing; or indeed what is at stake and what the arguments in its favour are.

When it first came on the scene as a technological alternative to the paper or magnetic ticket, e-ticketing was not yet perceived as an investment in an information system that would make it possible to totally redesign sales, fare and inspection systems.

That being so, how can a sufficiently strong common goal be found in order to justify the additional cost of system interoperability?

The decision to implement European interoperability will only be taken if growing numbers of transport managers - operators and authorities combined - become capable of mixing and matching the two approaches: commercial and technical.

This undoubtedly is the most difficult aspect in a sector whose economy draws on so many diverse sources, and in which many operators find themselves having to manage co-opetition: a delicate mix in which the benefits of cooperation counterbalance the constraints of competition.

The project forum and UITP's relevant committees could provide the working bodies for facilitating this convergence of views.

Finally, in the institutional sphere, as soon as the project has outlined the European administration functions of the general-purpose application, it would be necessary to anticipate and prepare to discuss how to introduce the functions and define the administration rules. UITP could play a leading role in designing the architecture of such a European structure, or even propose to host it itself.

1 [www.uitp.org/mos/focus/Everybody-Local-Everywhere-en.pdf](http://www.uitp.org/mos/focus/Everybody-Local-Everywhere-en.pdf)

2 IFM project website: [www.ifm-project.eu](http://www.ifm-project.eu)

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