Multimodality for people and goods in urban areas

FP7 . CP 284906

WP7 – Instant Mobility standardization and regulation recommendations – final version

April 2013

Editor: Thierry Nagellen / France Telecom

Project co-funded by the European Commission within the Seventh Framework Programme (2008-2013)

Project funded by the European Commission under the 7th European Framework Programme for RTD - ICT theme of the Cooperation Programme.

Instant Mobility WP7

Instant Mobility standardization and regulation recommendations – final version

WPXX	Deliverable title
Authors	T. Nagellen – France Telecom
Short Description	This document provides a final overview of main standards which could support Instant Mobility services and regulation recommendations related to multimodal services.
Dissemination level (select)	PU Public
Date	April 20th 2013 – Delivery date (finale version)
Status	Working Document - Deliverable
Contributions by:	Thierry Nagellen – France Telecom Thierry Milin – France Telecom
Internal review by	
Internally accepted by	WP7 leader
Date of acceptance	21/04/2013

Document history

Version	Date	Author /Reviewer	Description
0.1	12/2012	T. Nagellen	ToC updated (Regulation)
0.2	28/02/2013	T. Nagellen	Open Data first part
0.3	30/03/2013	T. Nagellen	Inputs from D5.1
0.4	10/04/2012	T. Nagellen	Open Data second part
0.5	19/04/2012	T. Nagellen	Data business case part
0.6	21/04/2013	T. Nagellen	Security part

Deliverable Abstract

This document describes the status of the relevant parts of the global standardization landscape, and plans related to Instant Mobility scenario and prototypes developed during the second year of the project. These standards could be used in order to make the most efficient use of past developments and help move technologies to the market.

To understand the broad range of topics covered, it is sufficient to note that the Instant Mobility has described thirty-seven elementary services and proposes three development scenarii:

- Personal Travel Companion
- Smart City Logistics
- Transport Infrastructure as a Service

Based on these three development scenario, dedicated prototypes have been developed focusing on some major issues that Instant Mobility partners have identified, as well as potentially supporting business commonalities with some other Use Case project from Future Internet PPP phase 1.

In this final version of this document, a dedicated regulation recommendation focus is developed especially because multimodal services could enhance one trend, Open Data development, but improve also value and demand chain complexity and privacy management.

These recommendations are based on results which are developed in details in other deliverables: "***D6 5 Data Business Cases Final report***" and "***D6 6 - Multimodal services in a city - security and privacy***".

Table of Content

Table of Figures

List of Tables

1. Introduction

Instant Mobility Project partners continually study the actual standards and consider when/how to contribute Instant Mobility research into new standards/protocols in order to make the most efficient use of past developments, and help move technology state-of-the-art towards the advantages inherent in Instant Mobility.

This document describes the status of the relevant parts of the global standardization landscape, and plans related to Instant Mobility activities. It is a "living document" which will be updated as work progresses during the life of the project.
The high-level goal of the Instant Mobility project is to define scenario for multi-modal services using Future Internet technologies.
To understand the broad range of topics covered, it is sufficient to note that the Instant Mobility has described thirty-seven elementary services and is now working on three scenarios:

- Personal Travel Companion
- Smart City Logistics
- Transport Infrastructure as a Service

Based on these scenarios, technical teams have provided a first view of sequences diagrams related to the envisaged seven enablers sets, each of them targeting some dedicated standardization issues:

- Multimodal Journey optimisation enabler set
- Driver & traveller enabler set
- Vehicle & handheld devices enabler set
- Public transport operators' enabler set
- Goods transport operators' enabler set
- Traffic management enabler set
- Mobile Payment enabler set

In this final version of this document, we are describing what could be the most interesting standards and the related Standardization Organizations (SDO). Each partners have in charge to analyze the relevant standards and to represent their companies to support Instant Mobility vision. Despite this analysis, the three main prototypes developed by Instant Mobility consortium are more dedicated to solve some specific technical issues which results could be useful for phase 2 and phase 3 of Future Internet PPP.

Many regulation issues are described in this document based on:

- Acceptability surveys analysis,
- Data business cases
- Security and Privacy analysis

One major trend which could deeply improve how multimodal services are provided today is the Open Data trend, which raises many questions regarding regulation between actors of the transport value chain.
Privacy is also a hot topic based on potential floating data and how social networks are emerging in the specific case of multimodal transport.
Those multimodal services could support new emerging market at European level but merging Public Authorities and private and commercial companies, both legal systems should be improved to support a new complex relationship system.

2. Instant Mobility enabler sets, prototypes and standardization

Standardization issues are directly targeted by technical specifications each Instant Mobility enabler set's team are describing during the first year of the project. We provide a dedicated view for these issues per enabler set while the final prototypes developed by Instant Mobility partners did not target some standardization issues, first because some technical goals seem more relevant to support phase 2 and phase 3 projects based on business commonalities identified in "***D2 4 Impact on Instant Mobility from shared Usage Area commonalities iteration2***". Some prototypes target also the use of Generic Enablers provided by the Core Platform project (wiki.fi-ware.eu). The two major standardization issues are the convergence between CAN bus and ETSI ITS to transform vehicles into standardized communicating vehicles and the implementation of ETSI ITS for virtualized traffic management which requires many ITS-compliant roadside units and cloud services.

If data format are also critical in the transport area, it seems that TRANSMODEL II and SIRI are in a good position to ease data integration while no standardization is planned for Open Data. There is a clear subject for further projects to analyze how specific data standards for transport could take advantage of Open Data especially with real-time data flow.

2.1 Instant Mobility enabler sets

2.1.1 Multi-modal journey optimization enabler set

This enabler set is dealing with major issues related to data collection from lots of transports operators and how these data could be provided in an homogeneous way to end-users (travelers or drivers).
Here are the list of potential standards for exchange format the Instant Mobility team has analyzed:

Standard	Description
TRANSMODEL1.(Reference Data Model For Public Transport, EN12896)[1]	The European Reference Data Model for Public Transport Information. It provides an abstract model of common public transport concepts and structures that can be used to build many different kinds of public transport information system, including for timetabling, fares, operational management, real time data, etc.
NeTEx2	NeTEX2 is a prCEN Technical Standard currently in development. The goal of NeTEX is to provide an efficient European wide standard for exchanging Public Transport schedules and related data. NeTEX is intended to be a general purpose format capable of exchanging timetables for Rail, Bus, Coach, and Ferry, Air or any other mode of public transport. It includes full support for rail services and can be used to exchange UIC (International Union Of Railways) data. NeTEx is based on TRANSMODEL which specifies a Conceptual model for Public Transport data, extended with additional concepts for stops and stations from the CEN Technical standard IFOPT

[1] http://www.transmodel.org/en/cadre1.html

	(Identification of Fixed Objects in Public Transport).
IFOPT Identification of Fixed Objects in Public Transport	IFOPT is a prCEN standard which defines a model and identification principles for the main fixed objects related to public access to Public Transport (e.g. stop points, stop areas, stations, connection links, entrances, etc.).
SIRI (Service Interface for Real Time Information)	When the operators wish to update the timetables that they have provided to the platform, they use standardized SIRI3 messages. SIRI is an XML protocol to allow distributed computers to exchange real-time information about public transport services and vehicles. The protocol is a CEN standard, developed with initial participation by France, Germany (Verband Deutscher Verkehrsunternehmen), Scandinavia, and the UK (UK Real Time Interest Group). SIRI is based on TRANSMODEL. It allows the exchange of structured real-time information about schedules, vehicles, and connections. It is also possible to use SIRI to provide general information about the operation of the services.

Table 1: list of standards for data formats

Instant Mobility team chooses to base the external interface on both TRANSMODEL and SIRI because they are the most mature European standards.
There is however still a need to define a more precise format both for TRANSMODEL representations and SIRI exchanges. Indeed, TRANSMODEL is a generic and very rich model that can fit virtually any type of public transport use case. But it still needs to be optimized for the type of service that is planned. Also, it is always necessary to define an "exchange profile" or local agreement for SIRI messages when developing a specific service.
The SIRI technical specification has to be defined more precisely to be concretely applied: certain classes might prove useless, others might need to be specified and their attributes qualified (id, type, unit, time calculation, methods and protocols taking place, etc.) In future versions, Instant Mobility will have to choose a local agreement based on SIRI and a sub-model of TRANSMODEL that are optimized for the specific context of Instant Mobility.

Data format for data provided by Road Transport Operators is another major issue especially regarding geographical data. These data are described using the European standard GDF[2] (Geographic data file). GDF is an interchange format for geographic data, used to describe and transfer road networks and road-related data. It provides rules on how to capture the data as well as how the features, attributes and relations are defined.
Again, together with theses quasi-static information, road operators have to provide dynamic information about traffic related data (traffic status, disturbances, dynamic speed limits, weather conditions, etc.). To this end, the operators should use the European standard Datex II[3] to interact with the MMT platform.

[2] http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=30763
[3] http://datex2.eu

To provide all relevant data to travelers and drivers, Instant Mobility services require also data from road operators.
In the road sector, the DATEX standard was developed for information exchange between traffic management centres, traffic information centres and service providers and constitutes the reference for applications that have been developed in the last 10 years. The second generation DATEX II specification now also pushes the door wide open for all actors in the traffic and travel information sector.
DATEX II is a multi-part Standard, maintained by CEN Technical Committee 278, CEN/TC278, (Road Transport and Traffic Telematics). The first three parts of the CEN DATEX II series (CEN 16157) have already been approved as Technical Specifications. These three Parts deal with the most mature and widely used parts of DATEX II: the modeling methodology (called Context and framework) as Part 1, Location referencing as Part 2 and the most widely used DATEX publication for traffic information messages (called Situation publication) as Part 3. A fourth Part of CEN DATEX II series, VMS publications, is currently being prepared for standardization to CEN/TC278 and a fifth part on measured and elaborated data is currently proposed as work item. More parts are to follow as new content requirements emerge.

From end-users point of view, travellers and drivers will interact with the platform using standard communication protocols from the Open Mobile Alliance (OMA) to optimize how services are delivered on mobile devices and for any brand of mobile and their related Operating System.
These mobile devices have also to provide their position to the Instant Mobility system. For this purpose, Mobile Location Protocol (MLP) protocol is used. This is an application-level protocol for receiving the position of Mobile Stations (mobile phones, wireless devices, etc.) independent of underlying network technology. The MLP serves as the interface between a Location Server and a location-based application. Basic MLP Services are based on location services defined by 3GPP.

GPS data and European approach:

To support real-time geographical location, the new European service EGNOS[4] could be in the future one of the most promising approach. EGNOS could be a de facto standard for next generation of European location based services.
The European Geostationary Navigation Overlay Service (EGNOS) is the first pan-European satellite navigation system.
Consisting of three geostationary satellites and a network of ground stations, EGNOS achieves its aim by transmitting a signal containing information on the reliability and accuracy of the positioning signals sent out by GPS. It allows users in Europe and beyond to determine their position to within 1.5 metres.
The EGNOS Open Service has been available since 1 October 2009. EGNOS positioning data are freely available in Europe through satellite signals to anyone equipped with an EGNOS-enabled GPS receiver.

2.1.2 Driver and traveler enabler set

NFC offers possibilities in ticket buying, mobile payments and mobile wallets, which store credit or debit card details on the smartphone, enabling payments by tapping the phone on a scanner. Travels could be effectively ticketless when using an NFC-compatible smartphone to gain access to a multi-modal solution, a multi-part ticket with several financial tenancies.

[4] http://egnos-portal.gsa.europa.eu/

As well as buying travel products, travellers and drivers will be able to validate subpart of a multimodal journey, including security mechanisms as authentication, without paper tickets or even ID document. The NFC technology could be used to wirelessly check in the traveller in the car, and using external third-party, identify him to the driver. NFC will also allow driver to check in himself as the expected counterpart for ride-sharing service.

The NFC is a short range communication standard working at the frequency of 13.56 MHz and transferring data between two devices, an initiator and a target, at a distance equal or less than 4 cm. This standard is compatible with the RFID standard, that means that can read RFID tag; the main functional difference between these two technologies is that the NFC is designed for a bidirectional communication, while typically, in the RFID communication, there is a reader and a tag that "is read" from the device.
The possible communication modes are the "passive mode" and the "active mode"; in the first case the initiator generates an RF field on the RFID passive tag. Since this is not powered by an internal battery, it answers simply by modulating this electromagnetic field. In general the object investigated by the initiator is called target and when it is battery-powered it can instantiate a peer-to-peer communication with the initiator. In the second case both the initiator and the target communicate each other by alternating the transmission and reception phases.
The NFC tags are usually read-only but they can be re-writable, especially if protected by custom-specific security codes; they can securely store personal data, like for example the payment references for applications related to the virtual ticketing, networking contacts but also product related information.
According to the standard, the maximum data transfer rate reachable with NFC is 424 Kbit/s.

2.1.3 Vehicle and handheld devices enabler set

This enabler set target new communication mode inside vehicles and how to merge automotive and infotainment issues. The approach is first based on how to provide applications for travellers and drivers and second how to provide always-on connectivity.
Applications inside vehicles will be supported by GENIVI alliance technical environment when other ICT standards will support always-on connectivity.
An additional topic is digital authentication inside vehicle and Instant Mobility team is focusing its effort on the use of NFC technologies as described in the previous section.

The GENIVI alliance proposes an Open Source environment to implement terminal mode where travellers and drivers could use their mobile devices as communication gateways. This type of connection could be used for the implementation of the MirrorLink functionality (previously known as Terminal Mode), which needs a communication channel between the On-Board Unit and the handheld device.
The MirrorLink technology enables the replication of the screen of the phone to a head unit and will also connect the phone to the car's audio system. The head unit, which is generally made up of a dashboard mounted touchscreen and associated buttons, can send input to the phone. In addition, the phone can also use the car sensors (e.g. GPS and microphones), to augment its own built in sensors.
this means that key phone functionality and applications appear to be fully integrated into the car's own systems, going a long way beyond what is possible with current Bluetooth-based systems. The phone holds the data and is doing most of the hard work, but there should be no need to actually interact with the phone directly. Rather, everything can be controlled from the head unit's touchscreen and associated controls.

The intention is that MirrorLink head units will work with any phone that supports the standard.

The mobile router module will ensure efficient and reliable transmission of Instant Mobility application data from the handheld device (check-in, check-out, geo-location, etc.) and/or the vehicle (sensing output) to the Instant Mobility infrastructure. Considering ITS and IETF standardization activities, the overall in-vehicle system may host several communication equipment having interfaces towards the infrastructure: Dedicated Short-Range Communications (DSRC), Wi-Fi, WiMax, LTE, 3G, IEEE 802.11p, Bluetooth on the OBU and LTE, 3G, Wi-Fi, Bluetooth on the handheld device. However, data transmission failures could occur if one relies exclusively on the 3G interface of the handheld device (signal drop in tunnels, reduced cellular bandwidth, etc.). The mobile router would support ITS functionalities to be compliant with future ITS infrastructures.

Intelligent Transport Systems (ITS) are systems to support transportation of goods and humans with information and communication technologies in order to efficiently and safely use the transport infrastructure and transport means (cars, trains, planes, ships).

Elements of ITS are standardized in various standardization organizations, both on an international level at e.g. ISO TC204, and on regional levels, e.g. in Europe at ETSI TC ITS and at CEN TC278.

Intelligent Transport Systems (ITS) include telematics and all types of communications in vehicles, between vehicles (e.g. car-to-car), and between vehicles and fixed locations (e.g. car-to-infrastructure). However, ITS are not restricted to Road Transport - they also include the use of information and communication technologies (ICT) for rail, water and air transport, including navigation systems.

Co-operative ITS systems include vehicle-to-vehicle, vehicle-to-infrastructure and infrastructure-to-infrastructure communications for the exchange of information. Figure 1 shows the participants in the ITS communication architecture and a selection of ITS applications.

Figure 1: ITS Application field

European Commission has requested CEN, CENELEC and ETSI through Mandate M/453 on co-oprative System standardization (October, 6th 2009) to:

- Carry out an analysis of the required European standardization activity based on the existing roadmaps of the standardization process for Co-operative ITS services within the European Standardization organizations. The analysis should:
    - Include a detailed work programme covering the necessary standardization work in support of Co-operative ITS services. This standardization work covers exclusively road-bound traffic. All other ground level traffic, such as water navigation and rail traffic, are not covered. The European Standardization Organisations should identify the potentialities for information interchange between transport modes not included in this mandate and those included. However it is not excluded that the outcome of research and standardization activities would lead to extension of the standardization work to other transport modalities in the future.
    - Identify which are the potential functionalities that the new systems can supply to drivers, infrastructure providers, emergency services, public administrations and any other identifiable stakeholders. The European Standardization Organizations should identify the risks for the privacy of the users of these functionalities and the measures to be taken to eliminate these risks.
    - Identify the minimum set of European standards required in the field of Cooperative systems to ensure interoperability for vehicle to vehicle communications, for vehicle to infrastructure communications and for communications between infrastructure operators. This set of standards should be divided into communication, information and security standards and should take into account existing work, such as DATEX (CEN TC 278 WG8).
- Develop test methods for assessing the conformity of the identified minimum set of standards.
- Develop the rest of the identified standards and technical specifications for Cooperative ITS.

All these topics are quite relevant for Instant Mobility services especially regarding the expected always-on connectivity for real-time services and to include vehicules as sensors in the whole transport infrastructure.

2.1.4 Goods transport operators' enabler set

EPCglobal is a set of RFID standards and services to increase visibility and efficiency throughout the supply chain and provide a higher quality information flow between companies and their key trading partners. EPC was created for businesses to manage products through the supply chain.
Several major retailers and product manufacturers are using EPC technology as a way to improve supply chain management. Similar to the VIN on a car, an EPC is a way to uniquely identify a pallet, parcel or individual product. It is the next generation of the bar code, but unlike the barcode, which needs "line of sight" to be read, EPC tags use radio waves to read product information faster and more efficiently.
EPCGlobal is the most common standard in Europe to communicate with goods and develop new ICT services for supply-chain and logistics value chain.

One of the main issue regarding dynamic time/place drop point service is the need to share calendar and to synchronize activities related to different companies constraints. To identify some solution, Instant Mobility project will follow the work done in the following standards.

For calendar data, CalConnect, the Calendaring and Scheduling Consortium, is focused on the interoperable exchange of calendaring and scheduling information between dissimilar programs, platforms, and technologies. It does not design standards by itself, but identify and state needs and requirements, so that right standards are developed, if required.
The CalConnect web site[5] provides a list of calendaring and scheduling standards.
Listed standards describe data models and protocols that can be used to exchange related data. We can list iCalendar data model (RFC 5545[6]), CalDAV protocol (RFC 4791[7]), SyncML technology[8] (targeting mobile devices – handled by Open Mobile Alliance).
The iTIP specification (RFC5546[9]) describes how iCalendar objects are exchanged, in order to schedule events or tasks. It does not specify any transport protocol. iSchedule[10] is such a protocol, which can be used across different internet domains.

2.1.5 Traffic management enabler set

Geolocation data on a reference cartography is one of the main issue to provide accurate information on urban areas traffic . The cartography could be based on the OpenStreetMap platform.
OpenStreetMap (OSM) is a collaborative project to create a free editable map of the world. Two major driving forces behind the establishment and growth of OSM have been restrictions on use or availability of map information across much of the world and the advent of inexpensive portable GPS devices.
The maps are created using data from portable GPS devices, aerial photography, other free sources or simply from local knowledge. Both rendered images and the vector dataset are available for download under a Creative Commons Attribution-ShareAlike 2.0 licence.

2.2 Instant Mobility prototypes and standardization issues

During the first year of the project, Instant Mobility consortium elaborated more than thirty use-case scenarios which could be implemented into many prototypes. During the past year, based on the partners knowledge of what could be the major challenges for multimodal services in the transport sectors, partners identified three main prototypes which would investigate Specific Enablers and could be related to some Generic Enablers that the Core Platform project would provide early in 2013 in a pre-industrial implementation.

Some exchanges happened also during the first year between Use Case projects and during the preparation phase of phase 2 of the Future Internet PPP. These exchanges have demonstrated that some business commonalities could be identified and that some Instant Mobility Specific Enablers could be useful to enhance a technical collaboration between trials. This is more specifically the case for de dedicated real-time algorithms to provide best-in-class services in journeys optimization.

These different elements explain why three specific prototypes have been developed focusing more on Specific Enablers and without specific standards adoption or improvement. Some issue

[5] http://www.calconnect.org/CD1104_Calendaring_Standards.shtml
[6] https://datatracker.ietf.org/doc/rfc5545/
[7] https://datatracker.ietf.org/doc/rfc4791/
[8] http://www.openmobilealliance.org/tech/affiliates/syncml/syncmlindex.html
[9] https://datatracker.ietf.org/doc/rfc5546/
[10] http://tools.ietf.org/id/draft-desruisseaux-ischedule-01.txt

are always open issues, especially in touch with ITS standards whose have not progress significantly before Instant Mobility partners had to define prototypes specification. This issue should be an important subject in the following years and could part of Future Internet PPP phase 3 challenge.

2.2.1 Multimodal Journey Optimizer prototype

The prototype aims at showing the global effect of ride sharing over a whole city. It will show a large number of realistically simulated Instant Mobility travellers and drivers moving over the map of a city, along with statistics.
This prototype focus is more on the relevant algorithms and specific data required to provide the expected service: be able to manage in real-time reconfiguration of several multimodal journeys (more than 10.000 simultaneous journeys).

This prototype does not focus on any standardization issue, algorithms themselves do not have any specific standardization issue, some of the geographical data could be standardized (delay per street segment, timeslots to be defined along the day...) to be sure that the same information could be provided by several systems.
The identified complexity is more in the scalability of relevant algorithms so the standardization issue was not investigated by the development team.

2.2.2 Smart City Logistics Prototype

The “Smart City Logistics” use cases included in the prototype are: “Load sharing and optimizing”, “Dynamic time/place drop point”, “Itinerary booking and real time optimized route navigation” and “Eco-optimized driving, vehicle and driveline control”.

Regarding “Eco-optimized driving, vehicle and driveline control”, some development are related to the integration with the CAN Bus. The Can (Controller Area Network) bus is a vehicle bus standardized under the Society of Automotive Engineers (www.sae.org) which is a specific association more dedicated to standards for Automotive Industry. Some standardization actions could take place between ITS standardization team and CAN Bus team to define interoperability. But this is not a hot topic regarding ICT challenges Instant Mobility is focusing on.

For the two other services, “Load sharing and optimizing” and “Dynamic time/place drop point” no major standardization issue have been identified by the Instant Mobility developers team.

2.2.3 Traffic Management in the Cloud Prototype

“Traffic management in-the-cloud” prototype is related to “Transport infrastructure as a service” * which allows the rapid deployment of a new generation of traffic management systems by exploiting, among others, Future Internet technologies such as cloud data storage, cloud computing and virtualisation.

Traffic control operations will be hosted in the Internet in secure virtual traffic signal controllers and a virtual traffic centre. The main Specific Enablers covered are Intersection virtual controller and Data collector. By using the cloud computing solutions provided by the Core Platform the prototype will be able to access a pool of configurable computing resources (e.g. networks,

servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Whereas this kind of service could use some ITS message services, it seems more relevant to develop the relevant mechanisms to manage the resources into the cloud to demonstrate what the added-value of this approach instead of implementing ITS messages is.
Because some trials would be managed in the next two years with thousand ITS compliant road – side units, which are not available for the Instant Mobility consortium, the standardization issues were not investigated by the Instant Mobility development team.

3. Standard Organizations

3.1 3GPP

http://www.3gpp.org
3GPP prepares, approves and maintains the necessary set of Technical Specifications and Technical Reports for an evolved 3rd Generation and beyond Mobile System. 3GPP focus on the access network and core network layers of a telecommunication system. 3GPP is constantly looking at service to network interfaces, as well as modern network features including security, network features, and application level signalling. After TS22.868, 3GPP is now discussing special considerations facilitate M2M traffic from a business and connectivity perspective.

- 3rd Generation Partnership Project (3GPP): http://www.3gpp.org/
- 3GPP TS22868 (http://www.3gpp.org/ftp/Specs/2007-03/Rel-8/22_series/22868-800.zip)

In Telco-originated identity management solutions, the central notions are: identifiers and authentication. For instance, IMS distinguishes between the private IMPI (IP Multimedia Private Identity) that is typically only known by the user's home operator and the public IMPU (IP Multimedia Public Identity) that is given to services (i.e. Application Servers), potentially different IMPUs to different services. Authentication is typically performed by means of a tamper-resistant smartcard and the SIM application running on it (Subscriber Identification Module; SIM, USIM, ISIM). Convergence of Telco-originated solutions to Internet-originated solutions started with the introduction of the GAA (Generic Authentication Architecture) by 3GPP, of which the core element is GBA (Generic Bootstrapping Architecture). GBA is used for establishing a shared secret (based upon the long-term master secret in the xSIM card) between the UE (User Equipment) and any service provider (called the NAF i.e. Network Application Function). This shared secret is then used for different purposes such as end user authentication (HTTP Digest, PSK-TLS) or provisioning PKI certificates (SSC i.e. Support for Subscriber Certificates).

Instant Mobility relevance. As Instant Mobility is focusing on mobile devices and especially smartphones, the relevance of 3GPP is limited to interfaces and how they would support real-time data collection.

3.2 CEN

http://www.cen.eu/
The **European Committee for Standardization** (CEN) is a business facilitator in Europe, removing trade barriers for European industry and consumers. Its mission is to foster the European economy in global trading, the welfare of European citizens and the environment.
CEN is a major provider of European Standards and technical specifications. It is the only recognized European organization according to Directive 98/34/EC for the planning, drafting and adoption of European Standards in all areas of economic activity with the exeption of electrotechnology (CENELEC) and telecommunication (ETSI).

Instant Mobility relevance. As Instant Mobility is focusing on Transport and Mobility for multimodal services, and CEN is one of the SDO involves in ITS standardization (Intelligent Transport System), we have to follow achievement and future roadmap related to these activities.

3.3 EPC Global

http://www.gs1.org/epcglobal

EPCglobal is a joint venture between GS1 (formerly known as EAN International) and GS1 US (formerly the Uniform Code Council, Inc.). It is an organization set up to achieve worldwide adoption and standardization of Electronic Product Code (EPC) technology.

The EPC is a unique number that is used to identify a specific item in the supply chain. The EPC is stored on a RFID tag, which combines a silicon chip and an antenna. Once the EPC is retrieved from the tag, it can be associated with the data held in a secured database, such as where an item originated or the date of its production. Much like a global trade item number (GTIN) on the barcode or vehicle identification number (VIN), the EPC is the key that contains the information used within the EPCglobal Network. An EPC tag does not carry personally identifiable information.

EPCIS (EPC Information Services) is a standard designed to enable EPC-related data sharing within and across enterprises. This data sharing is aimed at enabling participants in the EPCglobal Network to obtain a common view of the disposition of EPC-bearing objects within a business context. This standard is largely adopted by logistics and supply-chain actors to assume traceability of goods using RFID tags.

The EPCglobal Architecture defines and includes a list of EPC-related roles and standards.

- *EPCIS Capturing Application*: Supervises the operation of the lower-level architectural elements and provides business context by coordinating with other sources of information involved in executing a particular business process step.
- *EPCIS Accessing Application*: Responsible for carrying out overall enterprise business processes aided by EPC-related data.
- *EPCIS-enabled Repository*: Records EPCIS-level events and makes them available for query by EPCIS Accessing Applications.

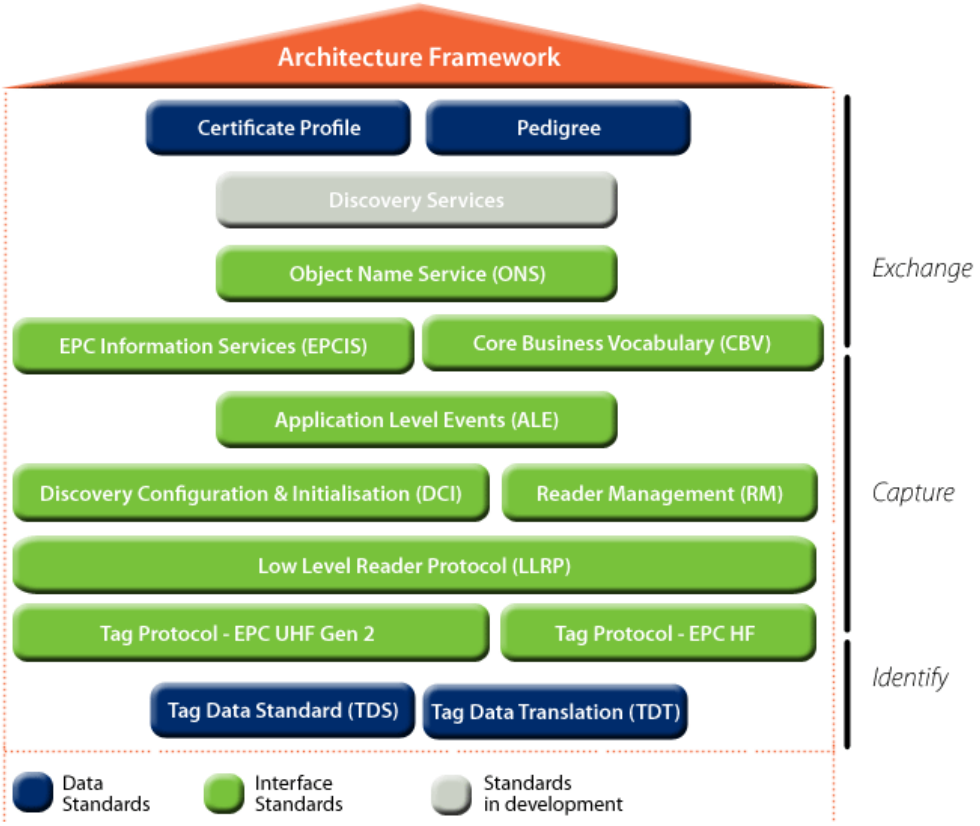


Figure 2: EPC Global standards overview

Instant Mobility relevance. As Instant Mobility is focusing on multimodal services for goods, EPCGlobal is the first ICT standard for goods traceability but it should be associated with other standards especially for geographical and real-time location.

3.4 ETSI

http://www.etsi.org/

ETSI is a key body for both architecture and protocols in telecommunications and will be a reference. As the only European Standards Organisation which covers Future Internet topics, the ETSI structure allows an "early adoption" mechanism, through the creation of an Industry Standardization Group, and it is intended to explore this possibility.

Two main working group are very relevant for Instant Mobility:

- ETSI Technical Committee (TC) M2M is devoted to machine-to-machine infrastructure architecture and protocols. Release 1 was completed at the end of 2011 but it was not comprehensive enough to allow deployments. Release 2 will contain necessary details and will likely be completed in late 2012 or mid-2013 within a new and larger organisation for M2M which includes many other global SDOs.
- ETSI TC ITS is a Technical Committee which has been defining a Basic Set of Application (BSA), which can be deployed within a three year time frame after its standardization completion. This BSA regroups applications and use cases that can be provided to several customers' profiles in different transportation contexts. These customers' profiles are but not limited to:
  - the vehicle owner;
  - the vehicle driver;
  - the vehicle passengers;
  - road traffic managers.

  Moreover, vehicles are moving in different environments and traffic contexts under various speeds and driving conditions. Taking into account the customers' profiles, the environmental and contextual situations, the BSA comprises:
  - active road safety applications targeted to improve vehicle' occupants safety;
  - traffic efficiency applications targeted to improve the road traffic management;
  - a collection of other applications enabling a cost-effective deployment.

ETSI TR 102 638 V.1.1.1 describes BSA to be specified by Intelligent Transport Systems (ITS) in Release 1 of the ETSI ITS standards set.

ETSI EN 302 665 specifies the reference architecture of communications in ITS supporting a variety of existing and new access technologies and ITS applications.

This standard defines ITS station types (or sub-systems):

- **Central ITS station**: Central ITS-S provides centralized ITS applications. A central ITS station may play the role of traffic operator, road operator, services provider or content provider. Furthermore, central ITS station may require further connection with backend systems via e.g. Internet.

- **Roadside ITS station:** Roadside ITS station provides ITS applications from roadside. A roadside station may provide ITS applications independently or co-operatively with central ITS station or other roadside ITS stations.
- **Vehicle ITS station:** Vehicle ITS station provides ITS applications to drivers and/or passengers. It may require an interface to access in vehicle data from the in vehicle network or in vehicle system e.g. CAN.
- **Personal ITS station:** ITS personal station provides ITS application to personal and nomadic devices.

Each of these ITS sub-systems contains an ITS station, i.e. the functionality described by the ITS station reference architecture.

ITS applications are distributed among multiple ITS stations in order to share information using V2X wireless communications. ETSI developed and defined Cooperative Awareness Message and Decentralized Environmental Message to support V2I and I2V communication (V2X messages).
These two messages can be received by ITS stations and then contribute to Instant Mobility ecosystem.

Cooperative Awareness Message (CAM)

ETSI TS 102 637-2 V1.2.1	Specification of communication protocols, message format, semantics and syntax as well as key interfaces for the co-operative awareness basic service supporting the defined basic set of applications.	Publication (2011-03-24)

The Cooperative Awareness Messages (CAMs) are distributed within the ITS-G5 or another relevant network and provide information of presence, positions as well as basic status of communicating ITS stations to neighborhood ITS stations that are located within a single hop distance.
All ITS stations shall be able to generate, send and receive CAMs, as long as they participate in V2X networks.
By receiving CAMs, the ITS station is aware of other stations in its neighborhood area as well as their positions, movement, basic attributes and basic sensor information.

NB: A new revision of TS 102 637-2 is in progress at ETSI which includes:

- First discussion was mainly about vehicle identification. It was decided to refer to ISO 24534-3 (Electronic Registration Identification) and to have CAM elements to be put in concordance with SAE standards.
- Public Transport information is integrated in CAM payload. It will be specified in another document in the future.

Decentralized Environmental Message (DENM)

ETSI TS 102 637-3 V1.1.1	Specification of Communication protocols, Message format, semantics and syntax as well as key interfaces for the Decentralized Environmental Notification basic service supporting the selected Basic Set of Applications.	Publication (2010-09-08)

ITS station will be able to broadcasts useful information that is related to traffic conditions.
Consequently, roadside ITS stations may collect the broadcasted information from vehicle ITS stations, process the information and forward the information to a central ITS station in order to improve the traffic efficiency and traffic management. In this case, the application execution can be achieved through V2V/I2V and/or other communications.
In addition, the ITS station that receives the DENM is able to provide appropriate HMI information to the end user, who makes use of these information or takes actions in its driving and travelling.
The general processing procedure of a use case is as follows:

- Upon detection of an event that corresponds to a RHW use case, the ITS station immediately broadcasts a DENM to other ITS stations located inside a geographical area and which are concerned by the event.
- The transmission of a DENM is repeated with a certain frequency.
- This DENM broadcasting persists as long as the event is present.

NB: A new revision of TS 102 637-3 is in progress at ETSI.

Instant Mobility relevance. ITS standard is one of the most relevant European standard to deal with transport and mobility message-oriented services. It will support Instant Mobility approach to use vehicles as sensors, as well as collected data from road infrastructure. As another Technical Committee is working on Machine to Machine standard, Instant Mobility partners have to understand how both standards could be complementary.

3.5 GENIVI Alliance

http://www.genivi.org/
GENIVI® is a non-profit industry alliance committed to driving the broad adoption of an In-Vehicle Infotainment (IVI) open-source development platform.
In August 2011, the GENIVI's Compliance Program was announced which defines a required set of features and components that comprise the GENIVI platform. With this program, auto manufacturers and their suppliers now have a clear definition of what GENIVI considers essential to delivering a compliance IVI software platform.
The vehicle and some of its infotainment use cases do not fit comfortably into any of the traditional consumer or IT categories. As a mobile device itself, it must function as a master for communication with portable consumer devices and as a client for connection to the cloud. It must avoid driver distraction through its ease of use; it must have the speed and reliability of an embedded device, but the rich user functionality and ecosystem support of a PC. At the heart of the answer is the middleware. The middleware provides the hardware and software abstraction for the applications whilst providing the services upon which the applications depend.

Instant Mobility relevance. As GENIVI Alliance provides an Open Platform to develop communication set on board, it is one of the promising way to improve connectivity into next vehicle generation.

3.6 IETF

http://www.ietf.org
The mission of the IETF is make the Internet work better by producing high quality, relevant technical documents that influence the way people design, use, and manage the Internet. Many working groups in IETF are of relevance to the Instant Mobility project. IETF is discussing context services, mainly in the SIMPLE and GEOPRIV working groups. The IETF 6lowpan and CoRE working group focuses on including sensor nodes on transport and service level which could be particularly relevant for Instant Mobility scenarios.

Instant Mobility relevance. The main interest here is to cross IETF M2M standards with the European standards.

3.7 ISO

The Working Group 7 (WG7) is working on sensor networks.
This standardization Working Group is dedicated to the area of generic solutions for sensor networks and application-oriented sensor networks including standardization of terminology. The development of a taxonomy and standardization of reference architectures, development of guidelines for interoperability could be useful for a kind of interoperability between transport oriented standards.

Instant Mobility relevance. The main interest here is to cross ISO M2M standards with the European standards especially because of these standards are exchanging specific message as the ETSI ITS standard.

3.8 OMA

http://www.openmobilealliance.org
"The mission of the Open Mobile Alliance is to facilitate global user adoption of mobile data services by specifying market driven mobile service enablers that ensure service interoperability across devices, geographies, service providers, operators, and networks while allowing businesses to compete through innovation and differentiation." Generally the OMA specifies application interfaces on the server-side and on the user device end, while re-using as much as possible existing protocols for the communication, which should work over all mobile networks or even be network agnostic.

Instant Mobility relevance. The main interest here is to use OMA standards to implement easily multimodal services into mobile devices and to be able to transform some of them as sensor.

3.9 W3C

http://www.w3.org

W3C defines the standard for an open and interoperable Web. As Instant Mobility scenarios are built on top of Web technologies, W3C activities are of high relevance. It seems that two working groups are relevant for Instant Mobility.

- W3C HTML 5 is to bring the web into maturity as a full-fledged application platform with standard video, sound, images, and animations. The whole specification is still being worked on. Based on the current draft, existing browser (Firefox 3.5, Internet Explorer 8, Safari 4, Chrome 2 and Opera 10) have already implemented parts of the specification and demonstrated many advanced features that in the past used to be provided by external browser extensions
- W3C Geolocation WG is created in response to requests from the community for W3C to develop a standardized, secure and privacy-sensitive interface so that Web applications may gain access to location information. The objective of this Geolocation WG charter is to enable Web access to the user's location information via a standardized interface or interfaces.

Instant Mobility relevance. The main interest here is to potentially use W3C standards to implement new HMI to provide user-friendly interfaces for multimodal services and to follow W3C work regarding geolocation using Internet capabilities.

4. Instant Mobility and regulation issues

Instant Mobility partners do not expect to analyze all regulation issues because not all kind of actors are represented in the consortium. Three major hot topics have been identified especially through the work achieved by Work Package 6 “Societal Issues” and based on several discussions which happened during working sessions with cities and some business partners to develop Data Business Cases.

As expected at the beginning of the project, data related to all type of transport means, as well as floating data are of high relevance to improve existing multimodal services and to take benefit of Future Internet technologies.

A major trend, which was really emerging at a business level in 2010, is the Open Data trend. Instant Mobility partners could follow some interesting developments of this trend at three levels: European level with many strategic meetings related to this subject, National level because some countries are more than some other earlier adopter of this trend, Local level (Smart Cities) where also some additional knowledge support another approach to deliver better services to citizen.

Floating data have been identified as a key enabler for a potential technological breakthrough, pushing for new technologies and integration models in the specific case of transport, especially because real-time is a criterion of higher value to deliver the right services. Through the acceptability surveys which were managed at the beginning of 2012 and consolidated at the end of 2012, a majority of travellers are not really afraid by the use of their personal floating data. Despite this first feedback, Instant Mobility took into account security and privacy issues to propose some mechanisms and tools to decrease some risks related to privacy.

4.1 Open Data and Transport sector

The concept of Open Data emerged some years ago but was not so well-known from a business point of-view when the Instant Mobility project was defined. The definition of Open Data can be summarized by the statement ***"A piece of data is open if anyone is free to use, reuse, and redistribute it — subject only, at most, to the requirement to attribute and/or share-alike."***[11] and one of the key event which boosted the communication around Open Data is the nomination, by the British Prime Minister, in June 2009, of Tim Berners-Lee to support the British Government at making data more open and accessible on the Web through data.gov.uk.

Nowadays, Open Data websites are emerging everywhere around the world:

Figure 3: Open Data map (www.data.org)

At the European level, many countries have put in place an Open Data strategy during the last two years:

Website	Country	Launched date	Languages
data.norge.no	Norway	April 2010	Norwegian
data.belgium.be	Belgium	September 2011	Dutch/English/French/German
data.overheid.nl	Dutch website	October 2011	Dutch
dati.gov.it	Italy	October 2011	Italian
datos.gob.es	Spain	October 2011	Spanish/Spanish Regional languages/English
data.gouv.fr	France	December 2011	French
opendata.ee	Estonia	Mars 2011	Estonian/English
dados.gov.pt	Portugal	November 2011	Portuguese
ate.gov.md	Moldavia	October 2011	Romanian/English/Russian
data.gv.at	Austria	April 2012	German
www.opendata.cz	Czech Republic	2012	Czech/English
www.portalu.de	Germany	February 2013	German/English

[11] http://opendefinition.org/

digitaliser.dk	Denmark	January 2013	Danish
open-data.europa.eu	EU	2013	23 languages

Table 2: European Open Data websites

We could go in regional details and identify many regional Open Data website, especially for cities but through this first table we assume that **it would be very difficult for European citizen as well as for innovative companies to use easily the first data sets** because the language is the first barrier to find and retrieve relevant data.
At the European level **there is no Open Data network or map** to retrieve all websites and identify which kind of data are available, the world map in figure 3 is extracted from an American website.

The Open Knowledge Foundation[12] has also clearly identified that transport is a typical sector where Open Data could emerge and provide innovation. We can notice here that Instant Mobility is aggregated four kinds of data to deliver urban multimodal best in class services: transport, geodata, environment (partially) and weather (partially).

Figure 4: Open Knowledge Foundation – What kinds of open data?

But in the 14 websites of the European Union listed in the table 1, it is very difficult to retrieve relevant datasets for transport sector, and nothing useful for multimodal services.
Using "Transport timetables" which is a basic requirement for multimodal services, the request returns 486 results on the UK Open Data website but beyond lots of statistical results, only few national timetables are available.

We have to go to specific cities Open Data website to find more details. On the amsterdamsmartcity.com website, in the mobility part you can find some specific data regarding electric charging or how to share cars but nothing on Public Transport means. On another website for the metropolitan area of Angers data.angers.fr, a French city, we can find the static timetables for transport but nothing regarding real-time data associated with the GPS tracking of the Public

[12] http://okfn.org/

Transport fleet because it is very difficult to update a website with a huge volume of data along the day.
We could find many other cases to demonstrate that Transport dataset which could be really useful to improve multimodal services in a smarter environment are not really available and, this is more important, **not a top priority for cities**.

In the area of Open Data, there is a common understanding that, when public money is used to produce data, these data should be provided as open data. But regarding the definition ***the fact to use, reuse or redistribute them, from a business perspective***, could be subject of a deeper and legal analysis of many different cases.
Because of the high-level of complexity of the transport value chain, and because lots of public actors are using several contracts following their national laws, we cannot just state that transport data are open data.

We can raise here some specific opened questions, each of them required a specific survey:

- Which entities are data owners ?
  In the specific case of Instant Mobility focusing on multimodal services in urban and peri-urban areas, Public Transportation means do often involve public and private actors. Public actors define the expected services for citizen with dedicated resources. They submit a call following National and European rules for public authorities.
  Private companies do provide a commercial proposal to fulfill the needs of the Public Authorities. They can cover the whole scope of the call, propose some additional services or a more limited scope for technical or commercial reasons.
  There is no room for very specific negotiations in this type of call so we could define, if the contract is signed, that the data defined in the contract and for which the Public Authorities would sue public funding or taxes, could be Open Data.
  But, because of the emerging trend of Open Data, few data sets are declared and those contracts have a long duration, so it could be difficult to impose to share these data: the private company could argue that some additional costs are required which would deeply impact the expected financial balance of the contract.
  A city could clearly state that some raw data have to be provided but also required a multimodal integrated system (MIS) so the additional work provided by private supplier will add a value and the new data could be out of the scope of the envisaged public dataset. European and National authorities have to maintain consistency with existing regulation because aggregating factual data into “database” could be covered also by “database rights” or “database directives”.

- Redistribute open data: how to define an added-value?
  In the definition of Open Data, we have this statement that we can ***use, reuse or redistribute*** the data. If the use and reuse of Open Data should not provide any commercial concern, distribution of these data aims some potential business conflicts. First because of heterogeneity of formats, relevant smart tools to access easily to some datasets could be seen as an added-value and Open Data could be sell not as there are but through another interface.
  Does the integration of floating data collected for free from travellers with some other Open Data add a value than providers could redistribute through commercial offers? How could people agree and be sure that anonymous mechanisms would be put in place to protect their privacy.

In the specific case of Muldimodal Integrated System included in the contract between Public Authorities and private companies, do the Open Data (raw data) support emerging competitors who will not have the same constraints than the private company which has to deliver the official multimodal offer? We can imagine that a startup could collect static and dynamic timetables from Public Transportation means in a specific city and deliver another multimodal offer with lower costs because the startup has not to assume the whole system collecting and distributing all data. Are we sure that there is no distortion between competitors?

- Economic role of travelers?
  If we admit the rule that when public money is used to produce data, these data should be provided as open data, because traveler do also pay for their tickets, what is the right balance between public funding and private funding of Public Transport means to declare that the dataset should be Open Data. Based on the crisis we have currently in Europe, we could find some specific situations where Public Authorities could increase prices of tickets to spend less public funding. There are few risks that travelers themselves would claim some benefits of the potential Open Data but without specific laws, private companies could identify niche markets and claim no to share the relevant datasets.
  If travelers would provide in a close future more and more floating data and that these data could represent a bigger volume of data than the dataset defined between Public Authorities and private companies, another question would raise on the properties of these data and how they could or could not be integrated in Open Data sets.

- Data collected by private companies: lack of information?
  Based on the critical role privates companies which have signed contracts with Public Authorities to deliver Public Transport services, it is difficult to evaluate what kind of additional data they could collect as floating data from passengers, statistical data based on services included in the contract (typically NFC services or bike sharing services). Because the contract is between Public Authorities and private companies there are no information of the ecosystem and consumers/travelers which kind of data are really stored and shared.

- How to protect privacy of travelers in case of Open Data?
  If private companies which have contract with Public Authorities could better manage information of consumers/travelers it is much more difficult to evaluate first how the use of some Open Data could endanger privacy of people and second collect private information without traveler's agreement.
  Regarding how Open Data could endanger privacy, we assume that a unique dataset should not provide any kind of information that could relay on a specific person but a cross analysis of several public dataset using some smart algorithms as Big Data projects would provide soon could introduce a breach in to privacy. This risk could especially occur with the emerging floating data collected through several applications or services and if there is not specific privacy rules described, including some anonymous mechanisms, cross-analysis could reproduce your specific moves during a day.
  Because also smartphones are currently use for many small apps without clear privacy rules, floating data could easily corrupt individual privacy. When Europe is

looking in deep into privacy rules of large players as Google or Facebook, privacy rules which exist because a first service deployed over Internet, there are no guidelines for Apps on smartphones. In fact users do not take time to read privacy rules or statements in general but when installing an Apps on your smartphone, the screen size do not allow you to read easily how the Apps will use some local data. You regularly need to open each statement to understand what the collected data are. Typically, a famous Apps as Angry Bird requires collecting all data from your contact book… These information are not relevant to handle open the game when you receive a call because this is the smartphone system which will associate the incoming call or message with your contact book. Looking for a multimodal Apps, and because geographical location is a key enabler for this kind of service, as consumer you can agree to send many personal data without to be really informed about them and then crossing these personal data with other Open Data could provide another view on your habits.

4.2 Data business cases results

As elaborated in the Open Data chapter, the transport ecosystem is highly complex and merges public legal system, concurrence laws and privacy issues. In the following picture, we describe the existing value chain to generate Public Transport networks in an urban and peri-urban environment. Because multimodal services are over the top of existing public transport networks, they should follow the relevant rules for each well-known interaction. Pushing to share data which could be Open Data, Public Data or private data could introduce competitive distortion in any competitive value chain.

The contract between Google and the Deutsche Bahn to include data from Deutsche Bahn network into Google transit is a good example. Deutsche Bahn, the German railway company, is entirely owned by the state. So based on an Open Data framework, its timetable data should be freely available. But when a group of open data enthusiasts calling themselves OpenPlanB put all the data online in torrent form, under the Open Database License (ODbL), the official reaction from Deutsche Bahn management was an open letter explaining that the group had violated the rights of not only Deutsche Bahn, but also **the third parties with which it has exclusive agreements.** For that, read “Google”: the U.S. web giant launched its Transit service in Germany a couple of weeks ago, based on exactly the same data we’re talking about here.
Of course Deutsche Bahn timetables are publicly available in every train station and everybody could digitalize them but providing exclusive right to a specific actor could limit the emergence of new services and introduce a kind of distorsion in the competitive market. Of course, because the contract is signed between two private parties, despite Deutsche Bahn is a public entity, any deep analysis could be achieved to define how Google could takes a better commercial seat, especially using also Google Ads to create value and maybe collecting floating data from trfavelers who will use new Apps using Google Maps and Deutsche Bahn data.
In another way the French and British railways companies are opening up their transport data. Again the use, reuse and distributed data model is not well defined and each apps developer could collect floating data from travellers and try to sell an enriched dataset under its own commercial contract.

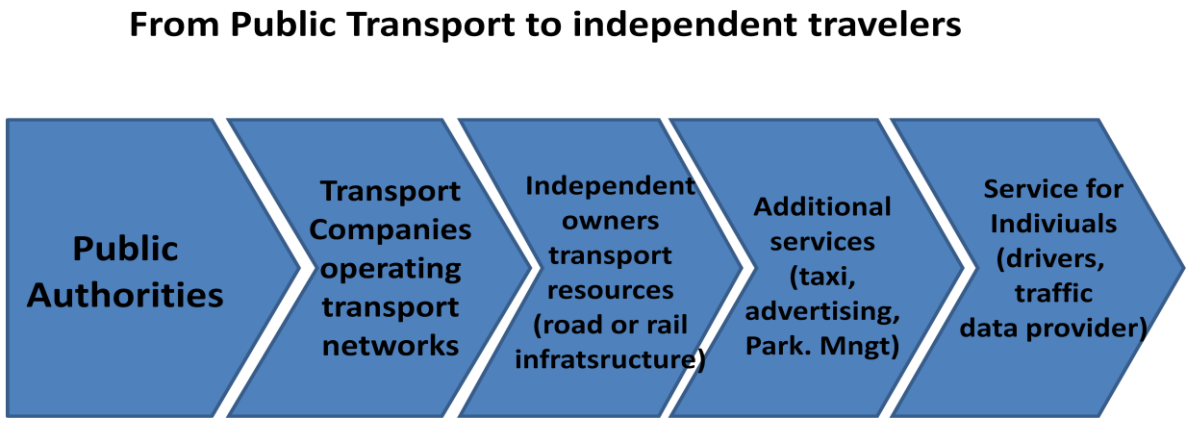


Figure 5: basic value chain for Public Transports

Taking into account the value and demand chain as it was evaluated based on the Osterwalder Canvas using by Instant Mobility as well as by other Use Case Projects, the complexity of the multi-sides market which is the market for multimodal services is described in another way and we can identified some costs to offer these new services. If some new costs are identified, we can also identify some new resources which could require improvement of business and commercial regulation.

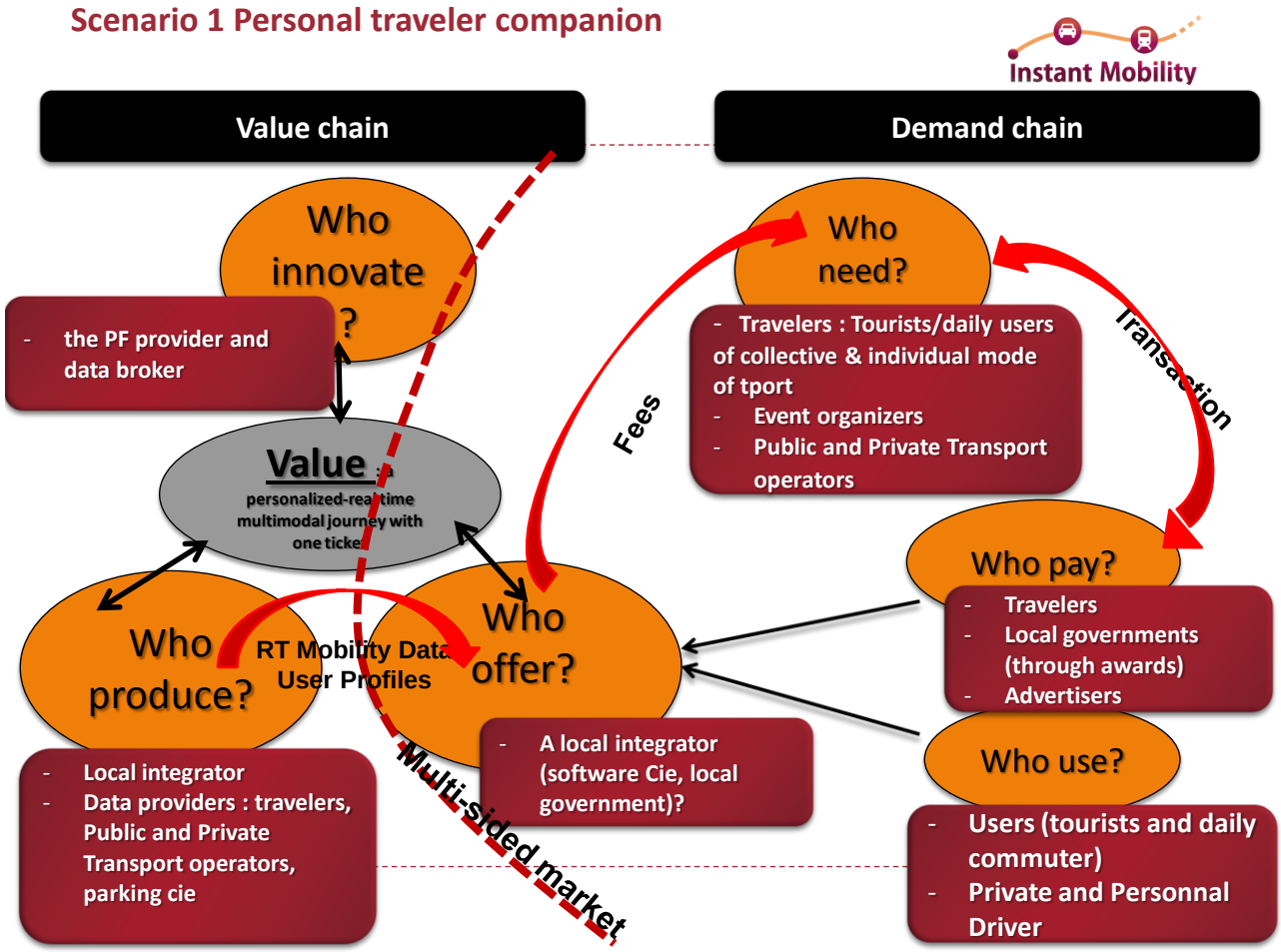


Figure 6: Personal Travel Companion Value and Demand Chain, according to Amel Attour, 2012 [13]

[13] Attour A., 2012, "Innovation stratégique et business model des écosystèmes "mobiquitaires" : rôle et identification de l'acteur leader", working paper BETA, n°2012-12, Août 2012

The main resources needed to deliver multimodal services are data, technical platform, promotion and community management.
Regarding data, license models are required because the system needs to collect data from the different transport operators, traffic and road operators and potentially floating data. All these data should be normalized to ensure interoperability and a competitive access to the new market. A specific license model could be defined to access real time data including how it is possible to store them or manage some statistical models on top of them, or just to use them as a real-time flow of information without storage.
This kind of licence could be similar to the licence applies for stock market real-time data where some actors can store them and resell the dataset in some additional offers, typically specific tools for day traders.

Public Authorities are strongly involved in the management of property of transport dataset. They are also leading the move for a greener urban environment optimizing how public and private transport means could be used. Because Public Authorities deliver also many subsidies to support transport networks as well as many other citizen services, one option to push to a quick adoption of multimodal services and to decrease in the same time the public budget would be a cross-awarding system. An example is that citizen who have children and will use very regularly multimodal services could receive an award of 0,10 Euros per use of the application, and may use the awards sum as a sort of credit for many urban services (school canteen, communal swimming pool, etc.).
Because all these services are managed under specific laws, a deep legal analysis should be conduct to avoid any conflict with competitive laws.

Another option is the new advertising revenues based on geographical information that the multi-modal service could use to monitor in real-time each specific journey. It is well-known that geolocation data are not currently very well defined and how some actors have to inform end-users how they manage these floating data. To be able to define their real value, some regulation should emerge to manage also the lifecycle of all these data and the level of detail which could be use in different cases. Without specific regulation, a huge flow of banners could invade smartphones or vehicle on-board screens with a strong impact on safety or adoption of these services.

The complexity of this value an demand chain is also related to the emerging trend of social networks in the context of multimodal services. Many smart applications encourage travelers to belong to dedicated mobility communities and social networks (Waze, WeDrive...)

The social mobility network seems to be a relevant tool not only to generalize the Instant Mobility services but also to get the local communities involved, and to use the virality of the social media to quickly get the demand to meet supply.
The success of the ride sharing programs and apps in the US is due to the first target they chose: local communities of travel within an organization (Army Administration employees or a local University). The idea is to create a community of interest, and make the citizens of an urban area who share the same points of interest to meet thanks to the social networks: same neighborhood, same employer, same school, common hobbies, concert or social event, favorite shops, etc. Recently the French startup WeDrive has adopted the same approach to manage ride sharing for a community of travelers and drivers travelling between common areas.

The web 2.0 and 3.0 will help communities to build themselves : people who would like to share a new way of traveling, more economical, ecological and collaborative to foster multimodality, optimization and sharing of public and private transport (taxis included) in their daily or occasional trips (concerts, just a meeting between friends).

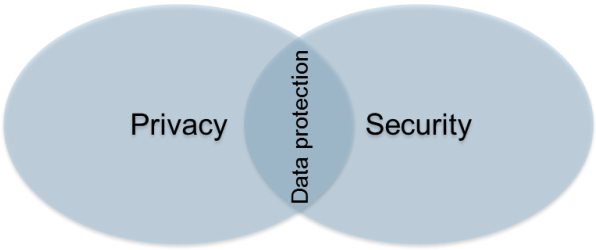
Two issues have to be developed in future projects: first, how could it be possible to build multimodal services on top of several communities launch by different applications, especially when these applications are targeting a specific part of the multimodal services (pre-trip or on trip, public transports or private drivers...), second, the management of floating data from several social networks could provide a new but very heterogeneous transport environment without any standardization which could limit the interoperability and the market to reach a mature level.

4.3 Security and Privacy results

In the Instant Mobility Deliverable 3.3, three conceptual scenarios were defined for different Instant Mobility applications:

1. Personal Travel Companion: demonstrates the capabilities provided by the future Internet technologies for multi-modal travel, mainly in urban and inter-urban areas.
2. Smart City Logistics Operations: describes how transport operations can be improved with respect to safety, efficiency, environmental performance and quality of service.
3. Transport Infrastructure as a Service: a study of the conditions needed for dynamic traffic & integrated urban space management, on how to use Future Internet technologies such as cloud data storage, Cloud computing virtualization or services in the cloud.

For each of these scenarios, both security and privacy are of critical importance for the user acceptance of such services. Security and privacy can be regarded as complimentary, each concept including aspects not directly relevant for the other. For example, anonymous mechanismsdedicated to personal data can be used as both a security measure and a privacy-enhancing one, whereas the security of critical non-personal data is highly important but not a privacy issue as such. However, with regards to the protection of personal data, there is a significant overlap:



Based on the technical analysis of the three development scenarios, a list of risks has been identified in deliverable “D6 6 - Multimodal services in a city - security and privacy challenges”. Some are more technical risks which should provide a lack of quality in the delivered services:

- Inaccessibility of the Journey Monitoring
- Inaccessibility of the Route Determination Engine
- Inappropriate assessment of traffic
- Failure of Visualization Services

These four risks should be covered by contract when a consumer would subscribe to the service. But the following five other risks could require legal developments.

- Lack of trust in the authentication service
  If some technical solutions could provide a strong authentication service, to avoid any misunderstanding, role and missions could be defined at the European level and a kind of certification process or delivery could be put in place. This is typically the case for existing systems which required public/private keys or token systems.

- Unauthorized disclosure of personal information
  As we elaborated in the Open Data chapter, there are many issues regarding how personal information could be directly disclose, but also how they could be collected, anonymized, reused and redistributed. Especially because many geolocation data have been collected by many applications through smartphones, this work requires lots of legal knowledge and background and some legal recommendations could deeply influence the technical solutions. These points should be quickly investigated because a major problem could definitively reduce the trust people could have in such services and public authorities or private companies operating them.

- Unavailability of travel data
  Unavailability of travel data could be a positive answer to the previous risk but it could directly influence business issues (two next risks) and per se limits the trust in such multimodal services. Maybe contracts between parties could propose some generic solutions but a legal evaluation seems of high value to avoid different approaches through the different European countries.
  It should be also interesting to investigate the complexity between open data, floating data and private data which are all relevant for multimodal services to evaluate how missing data could impact in different ways the service and financial issues.

- Invoicing errors
  This kind of risk should be solved directly between parties through the contract but there is a link with the previous risk to analyze how to cover this risk and if some insurance or competitive laws should be improved or clarified regarding multi-actors transport services.

- Inaccessibility of Enrollment services
  Because multi-modal transport services are multi-actors and multi data providers services, responsibilities should be clearly defined to distribute the risks between all actors or to define in some cases which actor is responsible of a specific part of risks. Multi-actors systems should increase the risk of attacks again specific systems which should be open and connected to Internet to collect and receive some of the data relevant for enrollment.

Encryption of data and, anonymous mechanisms are specific risks which have some specific regulation. Any new technical solution provided in the specific case of multimodal services should follow these respective regulations or submit new requirements for improvement

Associated to this risks list Instant Mobility partners defined some security recommendations. We provide here an extract from all risks and security recommendations described in deliverable

"D6.6 - Multimodal services in a city - security and privacy challenges" , extract focusing on subjects which should required a specific legal approach for a European framework.

Security measure	Risk related to unauthorized disclosure of personal data	Risk related to unavailability of travel data	Risk related to error in invoicing	Risk related to the lack of trust in authentica-tion service	Risk related to inaccessi-bility of Enrollment service
Development of Security Policy	X	X	X	X	X
Strict obligations of confidentiality	X		X		
Agreement on data exchange (customers & partners)	X	X			
Annual audit of security measures	X	X	X	X	X
No lax management of access rights (least privilege policy)	X	X	X	X	X
Keys management policy	X	X		X	X
measures to preserve legal evidences	X		X	X	X
Strong authentication service	X	X	X	X	X
Encryption of data	X	X		X	X
Encryption flow	X	X		X	X

Table 3: Risks and security recommendations to apply

To resume privacy recommendations, Instant Mobility refers to a set of principles which are those that were formulated by the U.S. Department of Health, Education and Welfare in 1973:

- **Notice/Awareness**: Consumers should be given notice of an entity's information practices before any personal information is collected from them. Without notice, a consumer cannot make an informed decision as to whether and to what extent to disclose personal information.
- **Choice/Consent**: giving consumers options as to how any personal information collected from them may be used.
- **Access/Participation**: an individual's ability both to access data about him or herself and to contest that data's accuracy and completeness.

- **Integrity/Security**: personal data must be accurate and secure.14

These principles form the starting point for most data protection regulations, and have been updated and extended over time, most recently in the proposed EU Data Protection Regulation. We use an updated and condensed set of these fair information practice principles as a practical set of high-level privacy requirements for Instant Mobility applications:

- **Limited collection and use of personal data**:
  Personal data is only collected and processed for a clearly defined purpose. The data must be adequate for this purpose, and may not be used for other purposes without consent of the data subject or stored longer than required for achieving the purpose.
- **Transparency of personal data processing:**
  There must be an easy way for a data subject to find out what information about him or her is collected and how it is used.
- **The user is in control**
  Personal data will only be collected or used for a purpose with the data subject's clear consent. The user must have a way to correct or amend his or her personal data.
- **Security of personal data processing**
  Appropriate organizational and technological security safeguards are used to protect personal data from loss or theft.

As we elaborated before in the context of Open Data, it is very difficult currently, from the end-user point of view, to analyze if these principles are applied and how data are stored and processed. In parallel and to not emphasize too much this part, the acceptability surveys managed in 2012 in the context of the Instant Mobility project have shown that the feeling of consumers regarding especially geolocation and privacy, is that geolocation provides benefits which undervalue privacy risks.

[14] Ware, W. W. (1973) Records, Computers and the Rights of Citizens. United States: U.S. Department of Health, Education and Welfare. Read more on the FIPs online at: http://www.ftc.gov/reports/privacy3/fairinfo.shtm

5. Conclusion

5.1 Standardization

The on-going standardization especially on data format to improve interoperability between several systems and public transportation means is on a good shape but could be deeply impacted by Open Data and floating data emerging from social networks in the context of multimodal offers. Dedicated studies should be managed on this topics in the following months, real-time data should push de facto standard when a major actor will emerge.

Smart and communicating vehicles are more and more visible in showrooms around the world and the transport sector should work on the interoperability between two different standards: CAN Bus which is under the responsibility of the Automotive Industry and ETSI ITS which will bring ICT facilities.

ETSI ITS is a promising standard with a lack of low costs compliant devices and systems. It was difficult to identify in Instant Mobility prototypes how this standard could be implemented especially regarding the other technical challenges. But more specifically in the context of traffic management and how to implement it based on cloud capabilities, this standard should provide good foundations to deploy innovative solutions.

5.2 Regulation

Instant Mobility has identified three major regulation issues: Open Data, Business relationships between Public Authorities and a myriad of existing and new commercial partners and suppliers, privacy and data traceability.

Open Data regulation: this is an open field but transport data are potentially open data and if multimodal services would emerge, they should use open data. There is no common definition and no common delivery of these transport open data and many issues as license model and property of the data have to be solved.

The openness of data from public sector to private sector should merge two different legal systems and it seems relevant to work on a compliant system which will protect Public Authorities and Citizen against a wrong usage of existing data and the possibility for some actors to use them for their own profit without to support the launch of a new ecosystem.

Regarding privacy and data traceability, through smartphones applications and the emerging social networks dedicated to transport services, as well as future real-time floating data that everybody could provide, it is quite impossible for consumers to know, assume and validate how their data are used. In the same way, it is impossible to require deletion of personal data which have been collected without a detailed agreement of the end-user.