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1 Input

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2 Introduction

The Public Transport Market is facing new challenges that requires standardisation in several areas. New technologies enable a variety of communication opportunities for PT organisations. With the more advanced communication networks follows possibilities to implement new equipment, such as video and wire-less access.

Customers demand for services and the Authorities need to provide competitive services will drive the expansion of onboard information systems. It is therefore important for the PT operators to have a robust infrastructure that can cope with these demands.

Currently, the public transport vehicles are generally equipped after-sales with a first generation of expensive telematics equipments, mainly of type AVMS, Fare Collection and Destination Signs. There are a number of problems with this today:

- Limited functions (localization, managements of the advances and the delays along the line, emergency call, sound announcement).
- Proprieto interfaces
- Functioning only in closed and dedicated communication network (not interoperable between depots)
- Low evolutionary without modularity
- Difficult to maintain
- Intrusive inside the vehicle (location, wiring, installation, CEM, vibration).

Following new European institutional and lawful obligations but also due to new economic and environmental constraints, the new telematics equipment in the public transport must fulfil new functions:

- To interface itself easily with new equipment and applications on board and at the back-office (like contact less ticketing system, communication router for local call or long distant call, fuel station, platform dynamic assignment, bus traffic signal priority, several applications in the back-office with their own databases)
- To inform and help the traveller before its transfer or during its trips (by visual and vocal announcement)
- To protect the environment (emissions/consumption, momentary comfort, air-conditioning, heating ......)
- To visualize in real time the safety aspects on board (video camera)
- To improve the availability of the vehicle (predictive maintenance, telediagnosis)
- To control the operations (counting traveller, service carried out)
- To allow an exploitation multi site of the vehicles
- To make modular and portable this equipment telematics of second generation on several public transport vehicles in order to obtain scale effects (bus, coach and tram)

The new challenges for the Public Transport Market will affect all actors and requires a joint effort from:

- Public Transport Authorities
- Operators of public transport
- Equipment supplier of telematic system
- Vehicle Manufacturer
There are today several projects in Europe, with similar project justification, that have identified this opportunity. It is promising that the European Public Transport Market has a common view and it is further promising that several projects have already been started or initiated.

The justification of the three represented projects below demonstrates the overall justification of the project.

Project Justification:

**FORDONSNÄTVERK – Västtrafik, Sweden**
- Support multi-vendor on-board systems integration and reduce cost
- Support “native” implementation by bus manufacturers
- Reduce overall equipment cost
- Improve quality of services to customers and drivers
- Improve system reliability and maintainability to reduce cost
- Support ITS diffusion in the market and reduce cost for uptake of new technologies

**FORMAT – Turin, Italy**
- Support multi-vendor on-board systems integration
- Support “native” implementations by bus manufacturers
- Reduce overall equipment costs
- Improve driver interface ergonomics
- Improve system performance through synergies
- Improve systems reliability and maintainability
- Support ITS diffusion in the market

**Proposed modification of EN 13149 – VDV, Germany**
- Support the use of heterogeneous communication systems in one public transport network
- Support the interoperability between public transport vehicle fleets
- Support the data exchange between public transport vehicles
- Support the development of functionally compatible devices
- Support the development of generic software tools for fleet management
- Support the automation of diagnostic for an efficient maintenance

The proposed standardisation project will, based on existing projects and proposed projects, define a Public Transport Vehicle Network that will enable the Public Transport market to leverage on new technologies and communication techniques.
3 Scope

The Public Transport Vehicle Network project will embrace several components in order to establish a set of rules and protocols that will enable an advanced communication backbone for the Public Transport Industry. This includes:

- To define extensions to EN 13149 defining General Application Rule, Cabling and Message Content for IP over Industry Ethernet and a Generic Data Dictionary for Public Transport Vehicle Networks.
- To define Communication Management Protocols for Bandwidth Management and Communication Gateway
- To define Generic Service Protocols for Power Management, Network Services and Version Control
- To identify relevant information to describe the overall rules and usage of the Public Transport Vehicle Network.

Deliverables: The project includes 10 deliverables:

Public Transport Vehicle Network
1) A Technical Specification that describe the Vehicle Network components. (This document)

Extensions to EN 13149:
2) EN 13149-7 General Application Rule (IP)
3) EN 13149-8 Cabling Specification Industry Ethernet
4) EN 13149-9 Message Content (IP)
5) EN 13149-10 Generic Data Dictionary (including chapter 3 Terms and Definition)

Communication Management Protocols:
6) Bandwidth Management Protocol – Enables control of wireless data transmission depending on wireless access, cost, etc.
7) Communication Gateway Protocol – Provides mechanisms for discovering and delivering on-board protocols to back office applications.

Generic Services Protocols:
8) Power Management – A common device protocol to wake-up or shut down any information network system on-board for exquisite control of power consumption.
9) Network Services – A protocol for registration of capabilities or services, discovering of services, subscription to services and access to vehicle unique data.
10) Version Control – A common version control protocol to encourage continuity for device firmware downloads from the back office.
4 Normative References

This document uses the following CEN, ISO and W3C standards as normative references:

CEN ENV 12896, TransModel (version 5.1). The Reference Data Model for Public Transport.

prCEN/TS 15531 SIRI Service interface for real-time information relating to public transport operations.

5 Terms and Definitions

This section includes terms for both PT entities and properties of PT entities used in the Public Transport Vehicle Network Project, SIRI, IFOPT and Traveler's information intended for Visual Impaired People Project. For each term, it is indicated whether the term derives from TransModel (ENV12896 version 5.1), another

5.1 TransModel (ENV 12896 version 5.1)

5.1.1 ACTIVATED EQUIPMENT - Transmodel
Description: An equipment activated by the passage of a vehicle at an ACTIVATION POINT or on an ACTIVATION LINK.

5.1.2 ACTIVATION ASSIGNMENT - Transmodel
Description: An assignment of an ACTIVATION POINT/LINK to an ACTIVATED EQUIPMENT related on its turn to a TRAFFIC CONTROL POINT. The considered ACTIVATION POINT/LINK will be used to influence the control process for that TRAFFIC CONTROL POINT (e.g. to fix priorities as regards the processing of competing requests from different ACTIVATION POINTs/LINKs).

5.1.3 ACTIVATION LINK - Transmodel
Description: A LINK where a control process is activated when a vehicle passes it.

5.1.4 ACTIVATION POINT - Transmodel
Description: A POINT where a control process is activated when a vehicle passes it. Equipment may be needed for the activation.

5.1.5 ACTUAL VEHICLE EQUIPMENT - Transmodel
Description: An item of equipment of a particular type actually available in an individual VEHICLE. Identified by: TYPE OF EQUIPMENT, VEHICLE

5.1.6 ALARM - Transmodel
Sub-type of: EVENT
Description: An EVENT alerting the staff in charge of operations control on a probable dysfunction: operational threshold exceeded (e.g. delay), emergency call, failure etc.

5.1.7 AUTHORITY - Transmodel
Description: The organisation under which the responsibility of organising the transport service in a certain area is placed.

5.1.8 DRIVER - Transmodel
Sub-type of: EMPLOYEE
Description: An EMPLOYEE whose usual work is to drive a public transport vehicle.
5.1.9  EMPLOYEE - Transmodel
Description: An employee of a public transport company.

5.1.10  LOCATING SYSTEM - Transmodel
Description: The system used as reference for location and graphical representation of the network and other spatial objects.

5.1.11  LOCATION - Transmodel
Description: The position of a POINT with a reference to a given LOCATING SYSTEM (e.g. coordinates).
Identified by: LOCATING SYSTEM, POINT

5.1.12  OPERATOR – TransModel
An organisation in charge of the operation of some or all transport services within a particular area.

5.1.13  PASSENGER QUERY - Transmodel
Description: A request for a specific information on public transport, expressed during a PI TRANSACTION.

5.1.14  PI TRANSACTION - Transmodel
Description: A connection of a passenger to the operator information system, directly or via an employee, including one or several queries.

5.1.15  POINT - Transmodel
Description: A 0-dimensional node of the network used for the spatial description of the network. POINTs may be located by a LOCATION in a given LOCATING SYSTEM.

5.1.16  TIME BAND - Transmodel
Description: A period in a day, significant for some aspect of public transport, e.g. similar traffic conditions or fare category.

5.1.17  TIME DEMAND TYPE - Transmodel
Description: An indicator of traffic conditions or other factors that may affect vehicle run or wait times. It may be entered directly by the scheduler or defined by the use of TIME BANDs.

5.1.18  TRAFFIC CONTROL POINT - Transmodel
Description: A POINT where the traffic flow can be influenced. Examples are: traffic lights (lanterns), barriers.

5.1.19  TRAIN - Transmodel
Description: A vehicle composed of TRAIN ELEMENTs in a certain order, i.e. of wagons assembled together and propelled by a locomotive or one of the wagons.

5.1.20  TRAIN COMPONENT - Transmodel
Description: A specification of the order of TRAIN ELEMENTs in a TRAIN.
5.1.21 TRAIN ELEMENT - Transmodel
Description: An elementary component of a TRAIN (e.g. wagon, locomotive).

5.1.22 TRANSPORT MODE - Transmodel
Description: A characterisation of the operation according to the means of transport (bus, tram, metro, train, ferry, ship).

5.1.23 TYPE OF EQUIPMENT - Transmodel
Description: A classification of equipment items to be installed at stop points or onboard vehicles, for instance.

5.1.24 TYPE OF PI FACILITY - Transmodel
Description: A classification of PI FACILITIES (e.g. stand-alone terminal, information desk, printed leaflet.).

5.1.25 TYPE OF TRAFFIC CONTROL POINT - Transmodel
Description: A classification of TRAFFIC CONTROL POINTS.

5.1.26 TYPE OF TRAIN ELEMENT - Transmodel
Description: A classification of TRAIN ELEMENTS.

5.1.27 VEHICLE - Transmodel
Description: A public transport vehicle used for carrying passengers.

5.1.28 VEHICLE DETECTING - Transmodel
Description: An activity consisting in the identification of a vehicle at a certain time by a detection device and of collecting crude data such as an absolute location of the vehicle.

5.1.29 VEHICLE EQUIPMENT PROFILE - Transmodel
Description: Each instantiation of this entity gives the number of items of one TYPE OF EQUIPMENT a VEHICLE MODEL should contain for a given PURPOSE OF EQUIPMENT PROFILE. The set of instantiations for one VEHICLE MODEL and one purpose gives one complete ‘profile’.

5.1.30 VEHICLE MODEL - Transmodel
Description: A classification of public transport vehicles of the same VEHICLE TYPE, e.g. according to equipment specifications or model generation.

5.1.31 VEHICLE TYPE - Transmodel
Description: A classification of public transport vehicles according to the vehicle scheduling requirements in mode and capacity (e.g. standard bus, double-deck, ...).
5.2 SIRI

5.2.1 SITUATION – Trident
A set of traffic/travel circumstances linked by a causal relationship which apply to a common set of locations. A situation can be composed of situation elements.

5.2.2 STOP MONITORING POINT– SIRI
A point at which real-time status is reported. Normally corresponds to a STOP POINT.

5.3 IFOPT

5.3.1 ENTRANCE TO VEHICLE – IFOPT
An entrance or exit for pedestrians onto a public transport VEHICLE, usually having a door.

5.3.2 EQUIPMENT PLACE – IFOPT
A STOP PLACE COMPONENT containing equipment associated with other STOP PLACE COMPONENTs or other places accessible to passengers.

5.3.3 EQUIPMENT POSITION – IFOPT
The precise position within an EQUIPMENT PLACE for particular equipment.

5.3.4 LOCAL SERVICE– IFOPT
A named service relating to the use of the STOP PLACE or transport services at a particular location, for example porterage, assistance for disabled users, booking offices etc. The service may have a VALIDITY CONDITION associated with it. A LOCAL SERVICE is treated as a form of non-material EQUIPMENT.

5.4 Traveler’s information intended for Visual Impaired People

5.4.1 Visual Impaired Person – TIVIP
A person with .......

5.5 Public Transport Vehicle Network

5.5.1 Power Management – PTNV
The possibility to control Power Consumption in a Vehicle.
6 Public Transport Vehicle Architecture

This section will describe the Vehicle Architecture and the interaction with back-office systems.

**Figure 4-1 Public Transport Vehicle Architecture**

The Vehicle Architecture consists of three parts:

- Extensions to EN 13149:
- Communication Management Protocols:
- Generic Services Protocols:
7 Public Transport Vehicle Network

This section will describe proposed extensions to the EN 13194 standard.

![Diagram](image-url)

### Figure 5-1 Extension to EN 13149

**Extensions to EN 13149:**

- EN 13149-7 General Application Rule (IP)
- EN 13149-8 Cabling Specification Industry Ethernet
- EN 13149-9 Message Content (IP)
- EN 13149-10 Generic Data Dictionary
8 Public Transport Vehicle Communication Management

This section will describe the Communication Management protocols that are used in order to establish communication with the Vehicle.

Communication Management Protocols:

- Bandwidth Management Protocol – Enables control of wireless data transmission depending on wireless access, cost, etc.
- Communication Gateway Protocol – Provides mechanisms for discovering and delivering on-board protocols to back office applications.
8.1 Communication Gateway Protocol

The Gateway Protocol includes functions for:

- Communication Carrier Selection and Optimization
- Data tunneling, Routing and Network Arbitration
- Reduce unplanned communication redundancy
- Data Security
9 Public Transport Vehicle Generic Services

This section will describe Generic Services that are used by several applications and/or that can be provided by several applications.

**Figure 7-1 Generic Services**

**Generic Services Protocols:**

- **Power Management** – A common device protocol to wake-up or shut down any information network system on-board for exquisite control of power consumption.

- **Network Services** – A protocol for registration of capabilities or services, discovering of services, subscription to services and access to vehicle unique data.

- **Version Control** – A common version control protocol to encourage continuity for device firmware downloads from the back office.
9.1 Network Services

There are a number of services that are either used by serveral subsystems (onboard or at the back-office) and/or that have potential conflicting information that has to be managed. The Network Services Protocol defines registration of Services and how to subscribe.

This appy to the following services.

- Vehicle speed can originate from FMS speedometer, GPS, etc. and will be useful to coordinate.

- Position can originate from a Vehicle GPS but can also be an embedded function in the Tickting System, Passenger Counting System and Security Systems.

- Vehicle data originated from the FMS gateway is useful for many subsystems on-board as well as in the back-office.

- A unique Vehicle Identity, used by alla subsystems.

- etc
10 References

10.1 Västrafik – Sweden

10.2 Turin – Italy
10.3  Distel project – Germany

FAS - Communication concept

10.4  EMT Madrid – Spain
Tomorrow vehicle operation between several networks

10.5 VEOLIA Transport - France

10.6 CEN TC 278/WG3 SG1

CEN TC 278 - WG3
Public Transport Standards
SG 1 – On Board Data Bus transmission