Public transport network and stop place model and its importance for multimodal information systems
1. Introduction

2. Main CEN Data & Interface Standards for Public Transport

3. Public Transport Network and Stop Model Use Cases & Projects:
   - Management information & statistics
   - User Information:
     - Inter-regional / multimodal trip planning
     - Stop place information: stop representation – accessibility
     - Passenger guidance
     - Stop identification

4. Conclusion & Invitation
Inter-System Exchanges & Multi-Source Data: Need for Unambiguous Data

Standard Data Models (Transmodel/IFOPT) Interfaces (NeTEx/SIRI)
Main Standardisation Organisations & Structure

WORLD-WIDE
Also:
IEC : International Electrotechnical Commission
ITU: International Telecommunications Union

EUROPE-WIDE
Also: ETSI, CENELEC
Result of standardisation: textual documentation (e.g. functional specification of a system, terminology, data model specification, interface specification, etc)

Standards are in general not mandatory (except a small percentage)

Have a different status than regulations/directives which are mandatory

Directives sometimes recommend the use of norms: this is the case for the CEN norm Transmodel and the European Directive for Rail
Standardisation Topics in CEN Working Group Dedicated to Public Transport

SIRI: Service Interface for Real-time Information
NeTEx: Network & Timetable Exchange
DJPS: Distributed Journey Planning (planned)
TI-VIP: Traveller Information for Visually Impaired (dormant)

TC278 WG3 – Public Transport

Data models

Transmodel: Reference Data Model for PT
IFOPT: Fixed Objects for PT

ISO/ CEN: Geographic Data models

Functional models

Integrated Fare Management

Inter-system communication
Reminder: Data Modelling Levels

Three main steps:

- Semantics of a domain
- Hardware Independent
- No redundancy

- Additional attributes
- Data formats

- Choice of a DBMS
- Controlled denormalization optimisations & redundancies
- Organisational rules

UML: Unified Modelling Language
Reminder: UML Formalism for Data Models

Roles of the classes in the relationship

CLASS A
- id
- attribute 1
- attribute 2

CLASS B
+ id
- attribute 1
- attribute 2
- attribute 3

Cardinality of the relationship
1 one and only one
0..1 zero or one (optional)
* many
x..y between x and y

A link between two points
(here stop points)

Data Standards: Transmodel
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Transmodel to Solve System Complexity & Lack of Interoperability

Numerous inter-application links
- Information system complexity
- Lack of interoperability
- Proprietary applications
- Lack of open, common system specifications

Common data structure
- Allows for a progressive migration
- Opens the market
- Reduces development costs
- Considers intermodality & multi-operators
- Is hardware independent
- Considers a variety of practices

Transmodel: Conceptual & Static

Data Standards: Transmodel
Field Trial in Lyon/France: TITAN project

- Stop Point Management
- Scheduling (vehicle+driver)
- Schedule Assignment, Budget Management
- Schedule Assignment, Budget Management
- On-line Control System
- Production follow-up
- Personnel Disposition, Payroll

TITAN Data Base Transmodel

Data Access System

Passenger information (telematic and telephone servers, displays)

in operation
Transmodel-based Implementations in UK

Stops
NaPTAN

Points of Interest
e.g. PointX

Places, Areas
Nat Gazetteer

Bus Timetables
TransXChange

Train
Timetables
RJIS CIF

Data Build

Journey Planner Engines

Real-Time Server

StopEvents

JourneyWeb
2.1

Points

Operators

Services

Journeys

Stop Events

Timetables

Client

PC

WAP

VOICE

Transmodel: Common Abstract model

Data Standards: Transmodel

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A Robust Basis for Information System Architecture

 Contributors over 10 years:

- France
- UK
- Germany
- The Netherlands
- Spain
- Austria
- Italy
- Greece
- Sweden/Denmark

Support of EC & French/German/Dutch Ministries

European Projects:
- Cassiope, EuroBus, Harpist
  
  Transmodel V4.1
  
  ENV 12896

E/R “Oracle” formalism

European Project
- TITAN 1 & 2

Implementations
- Transmodel V5.0: multi-modality, real-time control, layers, data versioning

1989
1996

French/German Project SITP

Transmodel V5.1

UML formalism added

2000
2003

CEN TC278 WG3 SG4:

Transmodel V5.1

voted as EN12896

2011: decision for revision

Covers:

- Network description
- Versions management
- Tactical planning
- Personnel (driver) disposition
- Operations monitoring and control
- Passenger information
- Fare collection
- Management information and statistics
- Multi-modal PT operation
- Multiple operators environment


http://www.transmodel.org
**IFOPT: Stop Place Model**

**Physical view**

**Logical/macroscopic view**

- **Bercy**
- **Gare de Lyon**
- **Cour St Emilion**

**Details of a stop**

**Global view of a stop**

**Data Standards: IFOPT**
IFOPT means: Identification of Fixed Objects for Public Transport

Gives a precise definition of the concept STOP and its physical «reality»:

- Dedicated zone
- Quay
- Boarding position
- Vehicle stopping position
- Entrance

- Equipment & services
- Navigations paths

IFOPT became recently a norm (EN)
Transmodel STOP POINT is a view of the IFOPT STOP PLACE

IFOPT Stop Model is multimodal

Rail, coach, metro stations, bus stops, airports, etc.
NeTEx Interfaces: Planned Information Exchange

NeTEx stands for Network and Timetable Exchange and is a TS

Planning System A: Network Timetables Fares

Planning System B: Network Timetables Fares

Passenger Information System

Automatic Vehicle Monitoring System

NeTEx

NeTEx

NeTEx

NeTEx

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From Transmodel to NeTEx

1. Modularised: Transmodel Domain Model + harmonised with IFOPT

2. Created: a physical UML model: add attributes, formats, etc

3. Encoded: as XML schema
   - Reusable, Modular subpackages
   - Well defined dependencies
   - Uniform versioning and data ownership model
   - Validation with Examples of data from each country
**SIRI : Real-Time Information Exchange**

Real-time vehicle location

- AVMS System
- NeTEx

**Example of Use case:**
Estimated arrival time at stops

**Passenger Information System**

- Estimated Vehicle Arrival Time

**Interface Standards: SIRI**

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SIRI is for Real Time Information Exchange

Structured into a range of services

Common data transport layer

SIRI is a TS

Transmodel: PT model
Stop Points, Vehicle Journeys, Lines, Journey Patterns, Vehicles, etc

SIRI : Common Services

Production timetable
Estimated timetable
Stop timetable
Stop monitoring
Connection timetable
Connection monitoring
Vehicle monitoring
General Message
Situation Management
Facility Management

Status
Pull
Push
Currently Known SIRI Users

- EU: Germany, France, Ireland, Norway, Sweden, UK
- Switzerland, Australia - considered
- Israel
- Canada, USA
- China (Shanghai)

https://groups.google.com/group/siri-developers
The PT topology is a submodel of Transmodel:
Line, Route, Route Point, Journey Pattern,
Stop Point, Timing Point

IFOPT:
Stop Place & related concepts
Transmodel+IFOPT => Standard PT Network Model

UML Data Model:
Description of a Public Transport Multimodal Network
Multisource Data Collection by A PT Authority for statistics:
A common reference model facilitates data aggregation
What is the Use of a Network and Stop Model?
Passenger Information (2)

General Architecture of the CAMERA Project

Data Entry

- PT data
  - Bus Stop Points
  - Entrances
  - Path Links
  - Quays
  - Stairs
  - Lifts
  - Escalators

- Additional data
  - Street Network
  - 2D / 3D Buildings
  - Green areas
  - Maps (i.a. pdf)

Tools

- GIS 2D, 3D, WEB application

Use Cases

- Stop Place Representation
- In-door Passenger Guidance
- Accessibility for disabled
- PT search around a POI
- Stop Publication according to INSPIRE

Use Cases for a PT Network and Stop Model

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What is the Use of a Network and Stop Model? Passenger Information (3): navigation paths

CAMERA: 2D/3D representations of complex stations

Navigation paths through complex stations according to mobility constraints

Implementation of webservices:  http://stationways.dryadebox.net
What is the Use of a Network and Stop Model? 
Passenger Information (4)

Stop Place maps for trip preparation: pilot stop places

La Baule

Saumur
What is the Use of a Network and Stop Model?
Passenger Information (5)

Representation of Complex Stations
What is the Use of a Network and Stop Model?
Passenger Information (6)

Virtual visit of Stop Places
Inter-regional Trip Planning

A trip from Paris to the Swiss Alps may involve several systems and several modes: in order to correctly describe each part of the trip a common stop place identification is necessary. IFOPT indicates a method for such an unambiguous identification.
Method to build clusters of physical stops (STOP PLACEs)
Systematic built of IDs \( \rightarrow \) stop « numbering » method
Example: Project of the Greater Paris Region (PT Authority STIF)
What is the Use of a Network and Stop Model?
Multi-Modal On-board Information Private Car/Public Transport (ISO)

Currently discussed at ISO

Public transport Information system

NeTEx for planned
SIRI for RT info

Available public transport lines
and next departure time

Car ITS Station

Central
/ Roadside ITS Station

PT stops
PT lines
Timetables

Current situation: location & time

Data: PT lines, PT stops, Timetabled passing times
Importance of Coherent Data and Interface Standards

A coherence between standard interfaces & data models - basis for data bases simplifies export/import applications
Use of Standards Suite in France: Standard based DB and Interface

Network topology

Timetables

Connections

CHOUETTE - tool: data capture & export

Exchange messages

Export files
NEPTUNE Format
(based on Transmodel)
“NeTEx like”

Network & Time Tables

CHOUETTE DB
Trans model & based data

Connections

Timetables

Network topology

CHOUETTE - tool: data capture & export
Use Standard Data Models for Your Data Bases and Interfaces!

Join the Standardisation Groups!

Your Input and Needs will be Taken Into Account
Thank you !

Thanks to MobiGIS and to my CEN TC278 WG3 colleagues Christophe Duquesne and Nick Knowles for providing some of the pictures for this presentation

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