# Key elements of Transmodel standard

**Webinar**

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# Transmodel main features

**Transmodel** : short name for the European Standard "**Public Transport Reference Data Model**" (EN 12896)

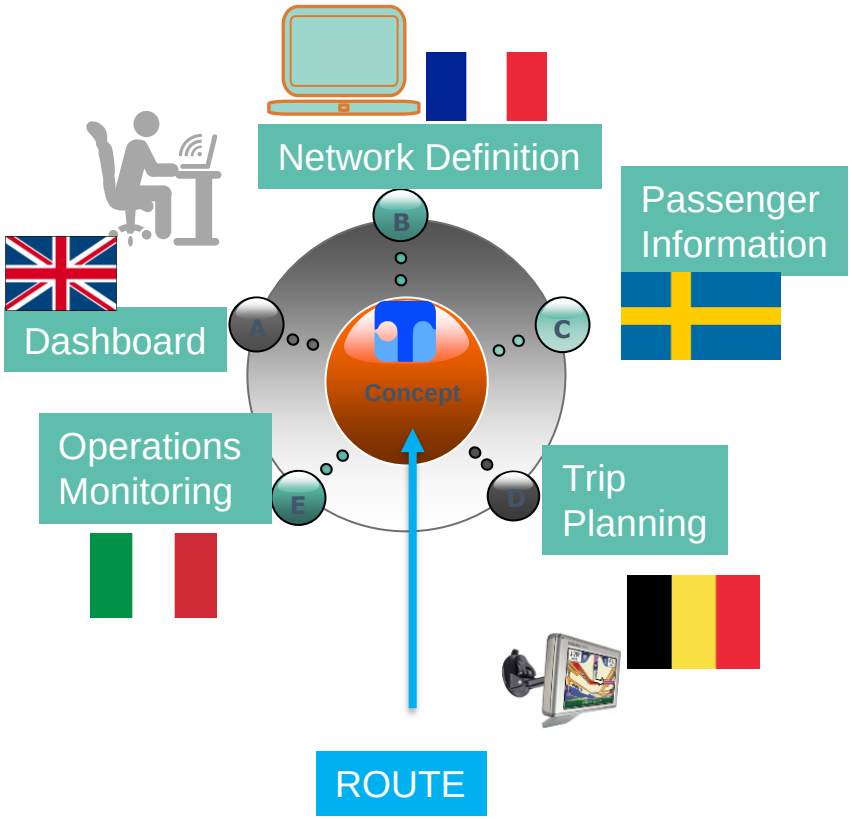
- **Common language & data structures to describe semantics** of the Public Transport domain**:**
- considers a number of public transport features for information and service management
- includes concepts, properties & links between concepts

- **Multimodality:** describes aspects covered by conventional public transport, including flexible transport but also alternative modes

- **Interoperability** between the information processing systems of transport operators

Transmodel facilitates
- connecting applications/systems
- communication between operators, authorities and software suppliers

Transmodel keyword: **semantic interoperability**



# Applicability: 4 key use cases

**1. Specification of Information Architecture**

Transmodel may be used

- as a strategic guide for system planning and evolution
- as the basis for the specification and acquisition of individual systems

e.g. definition of the structure/contents of data held in system databases or to be exchanged.

**2. Specification of a Database**

Transmodel can serve as a starting point for the definition of a database schema, used for the physical implementation of databases

**3. Specification of an Interface**

Public transport organisations may need to define interfaces between applications or data exchanges with other organisations.

In either case, the reference data model can be used to help design the interfaces.

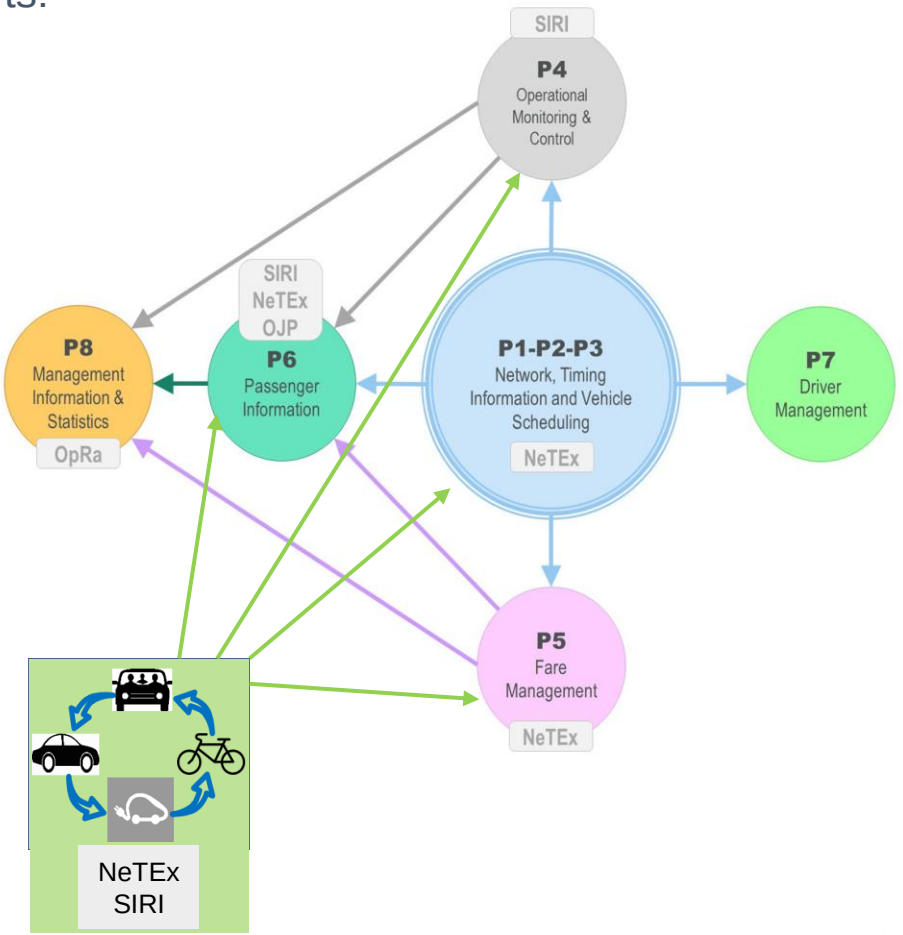
**4. Mapping of transport data specifications**

As a semantic standard reference, Transmodel is a stable reference for the mapping of data standards

# Transmodel framework is composed of 10 key parts

Transmodel covers most of the Public Transport domains. The overall model is divided into 10 parts:

1. Common Concepts
2. Public Transport Network
3. Timing Information & vehicle scheduling
4. Operations Monitoring & Control
5. Fare Management
6. Passenger Information
7. Driver Management
8. Management Information & Statistics
9. Informative documentation
10. Alternative modes – renewed publication



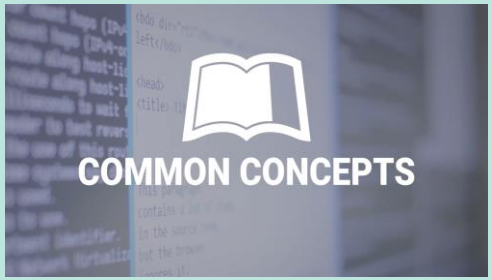
# Part 1: Common Concepts

Transmodel **Part 1 Common Concepts** comprise models used in all other parts:

1. Versions and validity :
   - Versions of data & Validity Conditions
   - Responsibility upon data

2. Generic framework:
   - Generic network elements: Points and Links, Link Sequences; Zones;
   - Layers and Projections, Places
   - Groupings
   - Accessibility

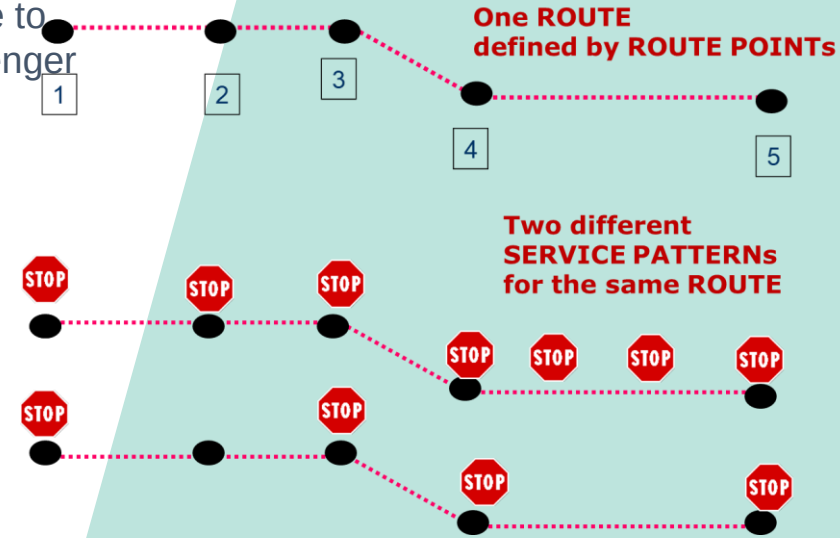
3. Reusable Components: generic models for
   - Transport Modes
   - Calendars
   - Addresses & Topographic Places
   - Generic Equipment & Facilities,
   - Vehicle Types & Trains
   - Transport Organisations, …



# Part 2: Network description

Transmodel **Part 2 :** Public Transport Network

- Working Paths of vehicles defined using JOURNEY PATTERNs - ordered lists of SCHEDULED STOP POINTs and TIMING POINTs on a single ROUTE;
- Itinerary defined through the concept of ROUTE that represents a schematic vehicle path through the network
- Connection i.e. physical and spatial possibility for a passenger to change from one public transport vehicle to another to continue the trip, CONNECTION is a passenger view of a transfer.
- Network restrictions and constraints represented in Transmodel by a range of concepts: OVERTAKING POSSIBILITY, IMPOSSIBLE MANOEVRE, MEETING RESTRICTION, etc
- Includes Flexible Network.


Transmodel PT Network = Service Infrastructure

**Implementation as NeTEx Part 1**

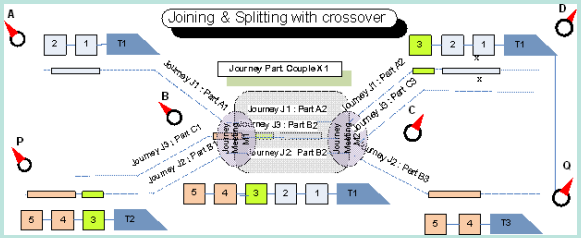
# Part 3: Timing information and vehicle scheduling

Transmodel **Part 3 Timing information** time-related aspects, well separated from the space-related ones.


The key concept: VEHICLE JOURNEY
defined as the **planned** movement of a public transport vehicle on a **DAY TYPE** from the start point to the end point of a JOURNEY PATTERN on a specified ROUTE.

Different types of journeys are modelled:

- SERVICE JOURNEYs (passenger view),
- DEAD RUNS (operational view),
- COUPLED JOURNEYs and JOURNEY PARTs (for particular vehicle types).




Different types of times are modelled:

- RUN TIMEs, WAIT TIMEs, PASSING TIMEs.

A timetable is an aggregated data in the TIMETABLE FRAME.

This Part includes also operational vehicle schedules including

- BLOCKs,
- VEHICLE SERVICEs, etc
- and building a VEHICLE SCHEDULE FRAME

Part 3 also models Flexible Services.

**Implementation as NeTEx Part 2**

# Part 4: Operations Monitoring & Control

Transmodel **Part 4 Operations Monitoring & Control** deals with all the aspects needed to operate the PT service on a particular OPERATING DAY.

Tactical Planning: designing and building a reference schedule which may be modified/adapted  in a further phase to the real operating conditions in a plan that is constantly updated during the OPERATING DAY

Key concept : PRODUCTION PLAN i.e. reference version of production activities (service journeys, dead runs, duties...) modelled as Dated Production Components


Data referring to

- vehicle DETECTION, MONITORING
- different types of CONTROL ACTIONS are modelled.

CONTROL ACTIONs are described with reference to the PRODUCTION PLAN they amend.

Different types of operational EVENTs and MESSAGEs are modelled. This leads to represent the PT SITUATION (*incident or deviation affecting the planned PT operation).*

Part 4 models MONITORED FACILITies that may have different states of availability.

**Implementation: SIRI Part 1 to 5**
**(Real Time Timetables &  Connections, Situation Exchange, Facility Monitoring)**

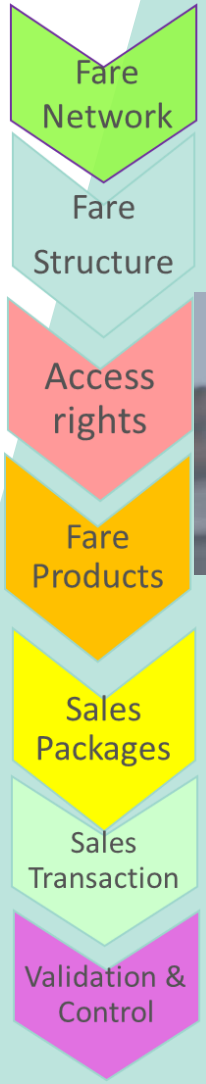
# Part 5: Fare Management

Transmodel **Part 5: Fare Management** deals with all aspects relevant to Fares in Public Transport Service like:

- Access Rights defined through the elements of a fare system (rules to access PT) and relevant parameters (quantitative, validity, usage, etc);

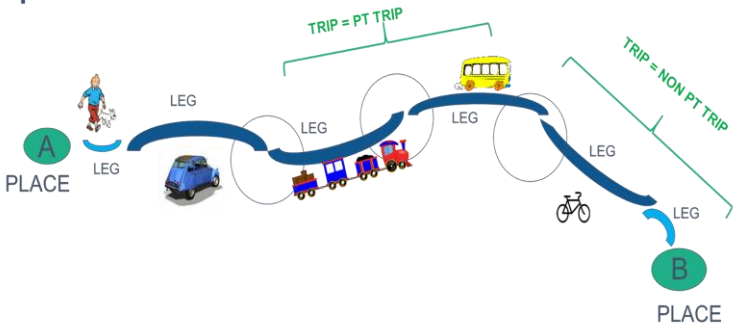
- Fare Products as combination of Access Rights, materialized as
- Travel Documents and grouped into
- Sales Offer Packages to be distributed/sold to the customers;

- Controls are applied to the access rights present on the fare media in order to be able to:
- to validate the use of the access rights and/or
- to identify an offence to be reported on blacklists
- Elementary price elements linked to the access rights, fare products and sales packages.




# Part 6: Passenger Information

Transmodel **Part 6: Passenger Information** deals with all aspects needed to provide information to passengers about Public Transport Service





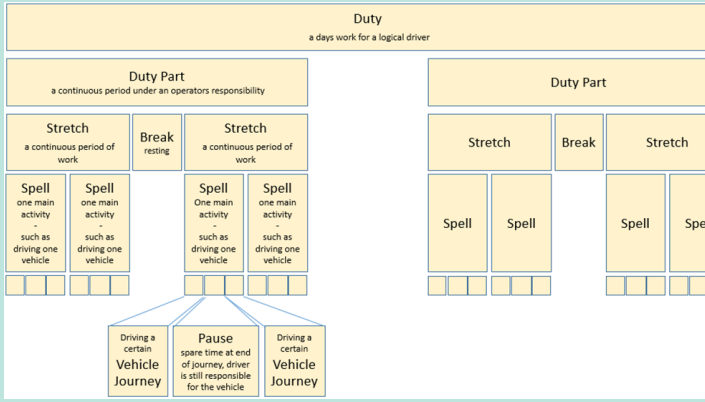
- **TRIP Model**
  - TRIP PATTERN: A movement of a passenger (or another person, e.g. driver) from an origin to a destination PLACE, done for a specific TRAVEL REASON. A TRIP PATTERN may consist of one or more consecutive TRIPs
- Concepts underpinning **Trip Planning Requests / Responses** as used by the
  - e.g. I want to go from A to B, I want to know arrivals/departures at stop S, etc

**Implementation:** Open API for Distributed Journey Planning (OJP)

# Part 7: Driver Management

Transmodel **Part 7: Driver Management** deals with all the aspects relevant to Driver Management like:

- Driver Scheduling to organize work of the drivers: duties and its components (duty parts, stretches, spells), breaks, pauses;
- Resource Plan, Driver ROSTERs, link between the BLOCKs and DUTIEs;
- Driver Control Actions (change of driver, driver cancellation, etc);
- Driver Accounting: recording of driver activity

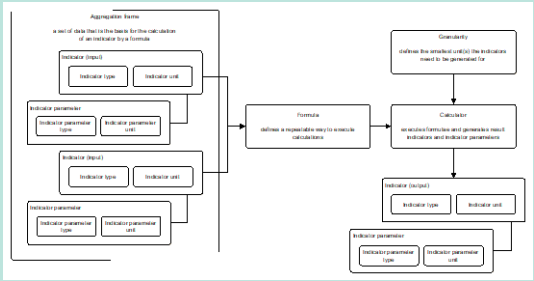
# Part 8: Management Information & Statistics

Transmodel **Part 8: Management Information & Statistics** describes how to structure **raw data** which either refers

- to the planning stages (e.g. timetables, run times, driver rosters etc.) and/or
- to the daily actual production,

and which is registered for different purposes, in particular to build **indicators.**


Rather than describing multiple data structures for each use case (each type of indicator), Transmodel provides a **generic structure (a design pattern)** that shall be used to represent the changes of state of objects and their recording.



**Towards an implementation:**
**CEN TR Operating raw data and statistics exchange (OpRa WI 00278429)**

# Transmodel video

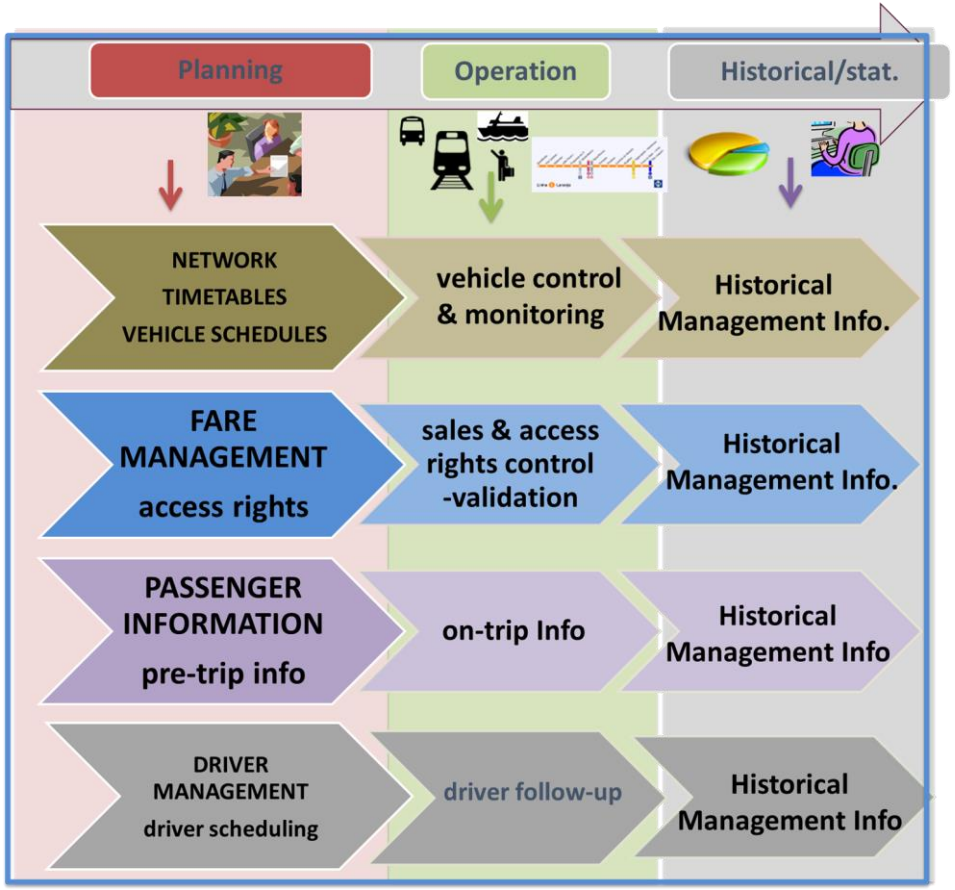

http://www.transmodel-cen.eu

# Time scale of data and domains

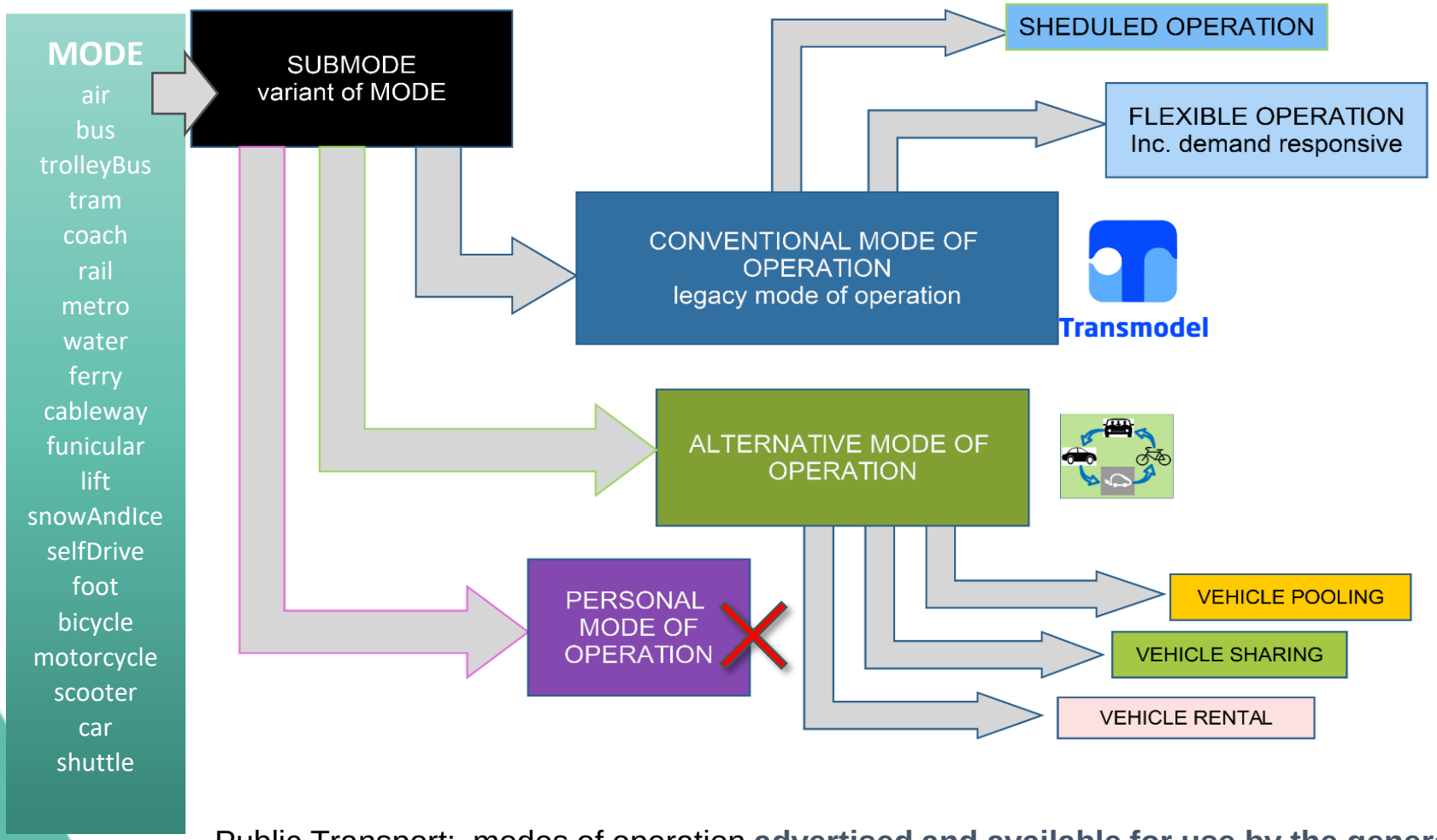
Transmodel describes data:

- **For planning purposes**: these are often called ‘static’ data;
- **For operational aspects** of the transportation processes, i.e. ‘dynamic’ data.

**Historical data** may be registered to be used for different purposes, for instance for the computation of indicators (KPIs), statistics, management information.



# Transmodel transport modes

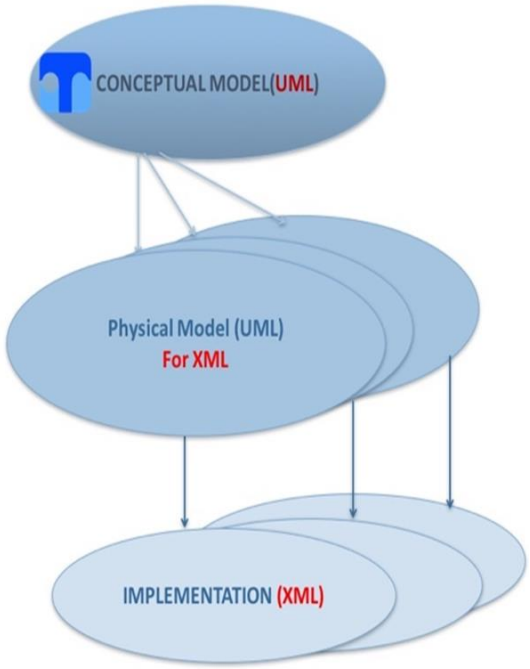



Public Transport: modes of operation **advertised and available for use by the general public**

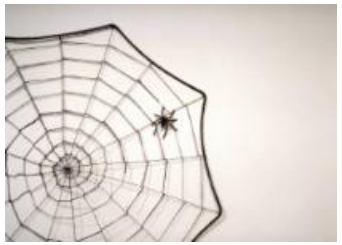
# Methodology: model-driven design

Object–oriented modelling method UML 2 is used for describing, specifying, documenting and visualizing the conceptual data model.

- Conceptual model is implementation independent (Transmodel)
- Multiple physical models for different target implementations may be derived from one conceptual model
  - Example : NeTEx XML Physical design
- Implementation is derived from physical model
  - Example: NeTEx XML Schema




Transmodel



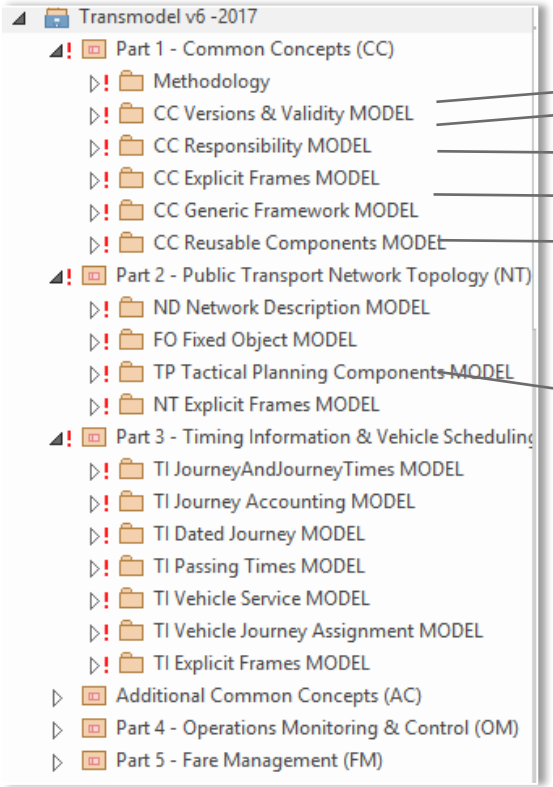
NeTEx

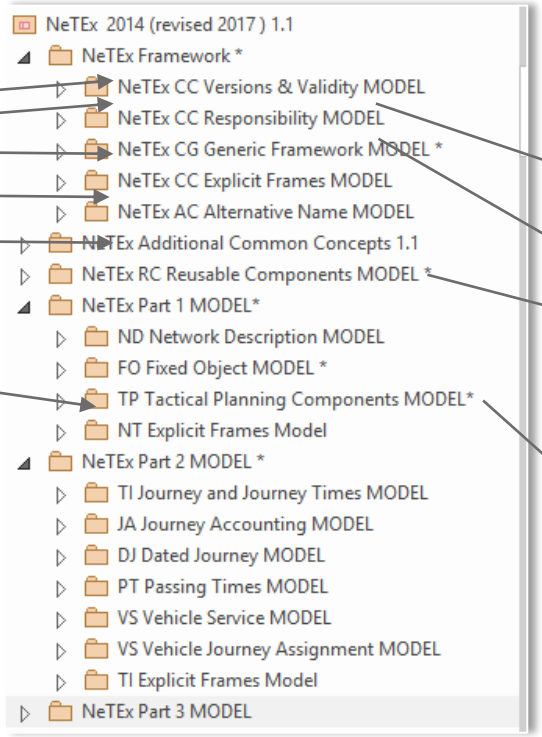
# Modular - Package & Element level traceability

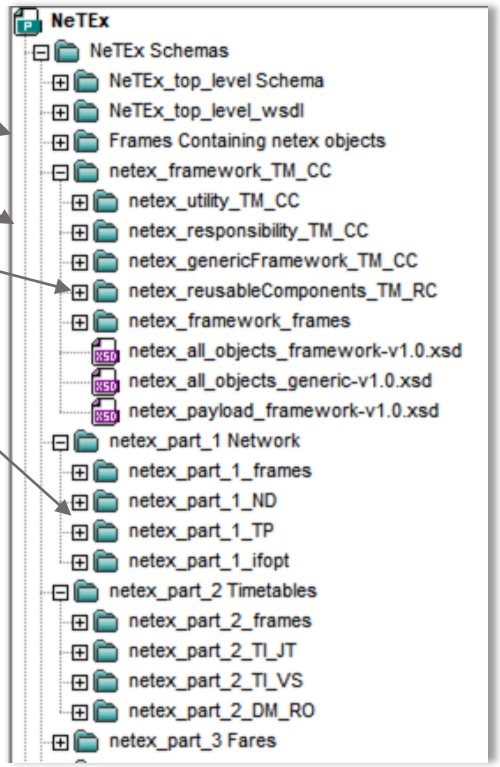
Conceptual

Physical

Schema

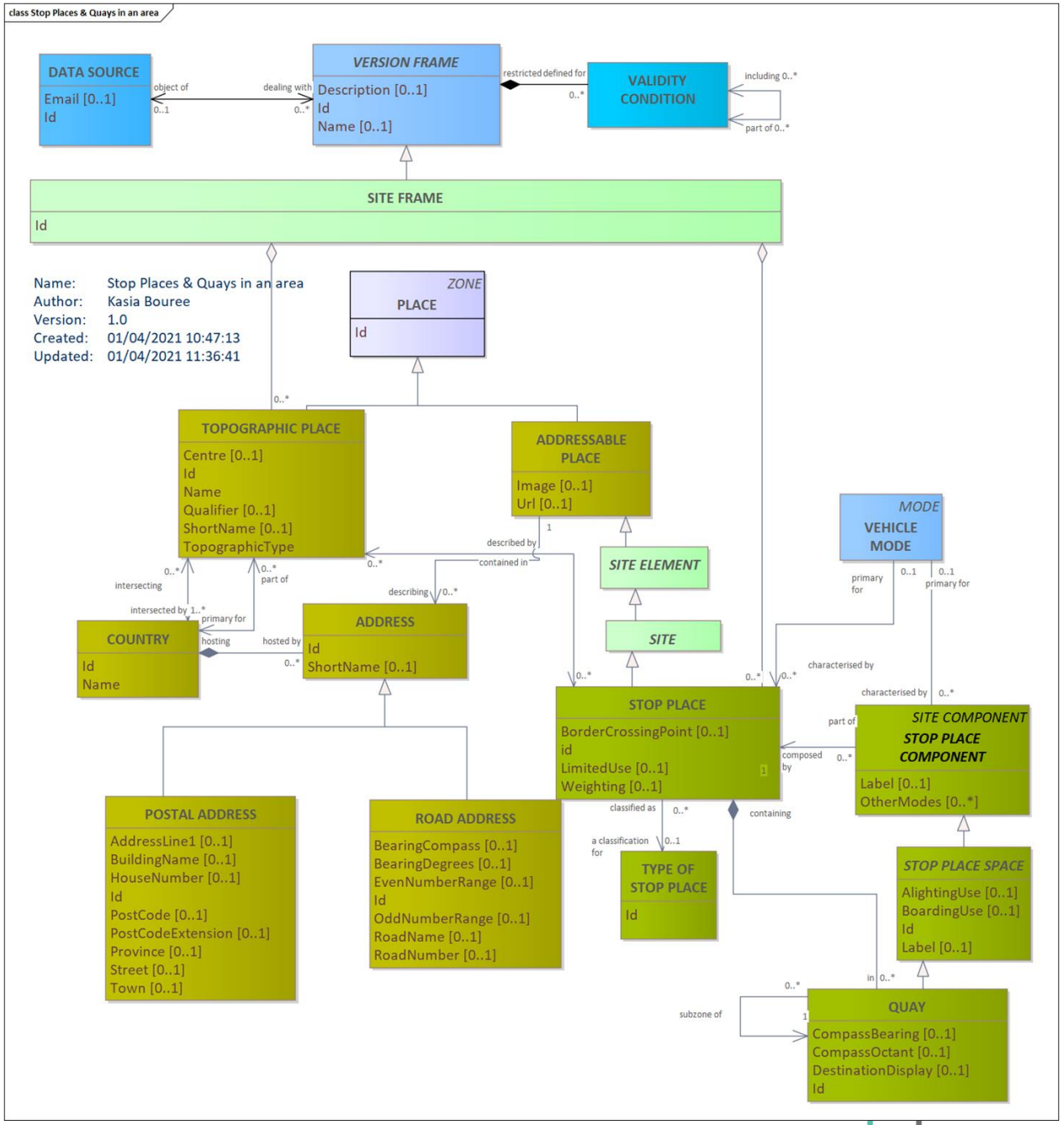


# Conceptual Data Model (example)

Information necessary for the representation of
Stop Places and/or Quays for a particular
Mode of transport in a particular area



# Implementation

Exchange formats (i.e. NeTEx, SIRI and OpRa):

1. Are based on a subpart of Transmodel depending on their use cases
2. Are implemented using an exchange language (XML/XSD)
3. May group or simplify several concept in « views » when they don’t need all the details provided by Transmodel (but MUST stay consistent with Transmodel)
4. Define an XSD (XML Schema Definition) and Web Services when needed

# Exchange formats (example)

```
<!-- Frame NETEX_ARRÊT-->
<GeneralFrame version="001" id="AURIGE:TypeOfFrame:NETEX_ARRET-Le-Corbusier:LOC">
        <Name>Frame NETEX_ARRET Le Corbusier</Name>
        <Description>Frame NETEX_ARRET pour l'exemple d'arrêt Le Corbusier</Description>
        <TypeOfFrameRef ref="FR:TypeOfFrame:NETEX_ARRET">version="1.01:FR-NETEX_ARRET-1.0"</TypeOfFrameRef>
        <members modificationSet="all">

                <!-- ======================================== -->
                <!-- LIEU D'ARRET MONOMODAL Jules Michelet -->
                <StopPlace version="001" id="FR:78197:StopPlace:00004:LOC">
                        <!-- le "LOC" sera supprimé si l'on dispose d'un référentiel d'arrêt partagé -->
                        <Name>Jules Michelet</Name>
                        <Description>Lieu d'arrêt monomodal Jules Michelet</Description>
                        <Centroid>
                                <Location id="AURIGE:Location:00011:LOC">
                                        <Longitude>2.071341</Longitude>
                                        <Latitude>48.766715</Latitude>
                                </Location>
                        </Centroid>
                        <placeTypes>
                                <TypeOfPlaceRef ref="monomodalStopPlace"/>
                        </placeTypes>
                        <RoadAddress version="any" id="AURIGE:RoadAddress:address11:LOC">
                                <RoadName>Rue Le Corbusier</RoadName>
                        </RoadAddress>
                        <Landmark>Face à l'école maternelle Jeanne Moreau</Landmark>
                        <TopographicPlaceRef ref="INSEE:TopographicPlace:78297"/>
                        <OrganisationRef version="001" ref="AURIGE:Operator:768:LOC"/>
                        <!-- Fait partie du Pôle Monomodal Le Corbusier -->
                        <ParentSiteRef version="001" ref="FR:78197:StopPlace:00001:LOC"/>
                        <TransportMode>bus</TransportMode>
                        <StopPlaceType>onstreetBus</StopPlaceType>
                        <quays>
                                <QuayRef ref="AURIGE:Quay:008:LOC" version="001"/>
                                <QuayRef ref="AURIGE:Quay:008:LOC" version="001"/>
                        </quays>
                </StopPlace>
                <Quay version="001" id="AURIGE:Quay:008:LOC">
                        <Name>Jules Michelet</Name>
```

# Transmodel development timeline

**1989-1991**

**Cassiope**

Transmodel v0 development start
Cassiope project (Drive I programme)

**1992-1995**

**EuroBus, Harpist**

Transmodel v4 development (pre-standard publication)
(EuroBus and Harpist projects (Drive II Program)

**Titan**

**1996-1998**

Titan project: development of Transmodel V5.1 validation Transmodel in 2 European pilot sites (Lyon, Hannover).

**1999-2002**

**SITP, SITP2**

Further extension and validation
SITP and SITP2 projects (France)

# Transmodel development timeline

**Transmodel v5.1**
Publication of Transmodel v5.1 as a full European Standard EN12896.

**2006**

**2011**
**Decision by CEN TC278 WG3 to update Transmodel V5.1**

**Transmodel v6 Part1-2-3**
**2016**

**2019**
**Transmodel v6 Part4-5-6-7-8-9**
**CEN TS 17413 extension to alternative modes**

**2021**
**Decision to convert CEN TS17413 to EN12896-10**
In coherence with NeTEx – Part5
Pending: decision to update the documentation of Transmodel Part 1,2,3

# Implementations around Europe

Currently there are several implementations of Transmodel all around Europe as:

- DB (e.g. TITAN DB in Lyon, France)
- data exchange format NeTEx (planned Information) or SIRI (Real-time information).

More information about
on NeTEx and SIRI implementations

http://netex-cen.eu/?page_id=65
https://www.vdv.de/siri.aspx.

Examples of Transmodel implementation:
http://www.transmodel-cen.eu/implementat

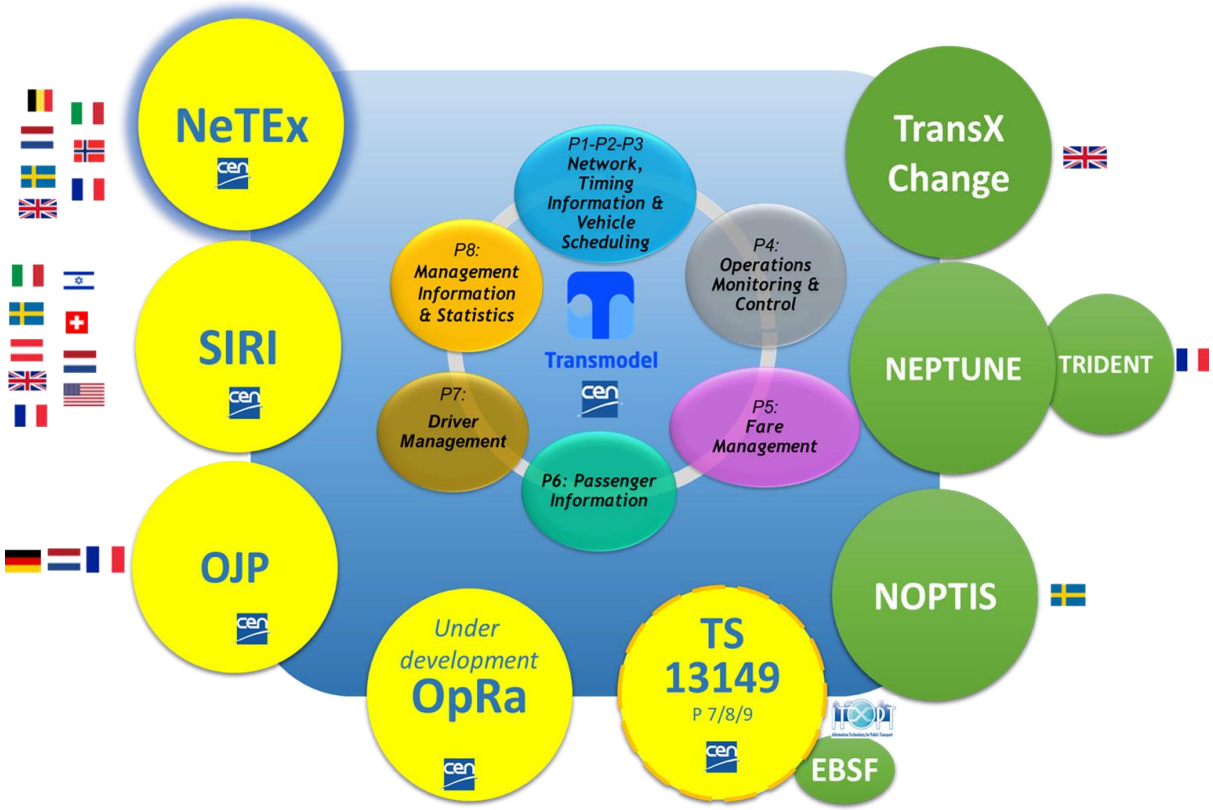
# Transmodel builds an eco-system

## EU standards & national standards

For what concerns the exchange of static scheduled data the relevant data in the national access point should use the CEN data exchange standard NeTEx CEN/TS 16614 based on the underlying conceptual data reference model Transmodel EN 12896: 2006 and subsequent upgraded versions or any machine-readable format fully compatible by the agreed timeline.

For what concerns the exchange of dynamic public transport data, if Member States choose to include dynamic data in the national access point the relevant parts of the CEN public transport data exchange standard SIRI CEN/TS 15531 and subsequent upgraded versions or any machine-readable format fully compatible should be used.

Strong relationship with the **Delegated Regulation EU 2017/1926** for Multimodal Travel Information Services



**Thank you for your attention!**

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