COMPREHENSIVE TOUR THROUGH THE DATEX DATA MODEL

Jörg Freudenstein
About me

- **Jörg Freudenstein**
- Computer scientist, born in 1977
- Since 2005 project engineer at AlbrechtConsult (Aachen, Germany)
- Emphasis on software engineering / software processes, communication networks und distributed systems, software architectures as well as data modelling
- Specification of DATEX II-profiles for the German Mobility Data Market Place (MDM)
- Participation in the DATEX development and standardisation
- Editor of the DATEX II parking extension
Today's hands on workshops

- Basics
  - Tour through the DATEX Level A data model
  - Creating of profiles
    - Data selection
    - Creation of subschemas
  - Usage of extensions
    - Extension of the model with new content
  - Creation of publications
  - Perspective on current developments (e.g. intelligent truck parking)
What is DATEX II?

- An open, interoperable interface specification for the machine to machine exchange of dynamic road traffic and travel data between traffic centres and with third parties, including broadcasters and providers of commercial ITS services.

- Consists of a set of artefacts:
  - Methodology (Meta data model \( \subseteq \) UML 1.4.2, rules) partly
  - Data model (dynamic road traffic data)
  - Software to generate data schema (~ message syntax)
  - Documentation partly

- Based on general accepted IT standards (UML, XML, http, ...)

- Made available free of charge and without rights reserved by the DATEX user community (mainly road operators)

- \( \rightarrow \) standardized as CEN/TS 16157 Part 1 – Part 5 (as Technical Specification)
  (in a modified form, but content consistent)
DATEX Methodology

- Basis for the mapping of the data model in UML and for the creation of profiles and extensions
- Based on the division into three model levels:
  - M0: Data
  - M1: Data model
  - M2: Meta model

Where appropriate in this lecture, this methodology document is quoted.
Elements of DATEX II (v2.2)

Reference documents (normative)
- Data model (UML, as EAP-file or for web browser)
- Methodology (file „DATEX_II_Metodology.pdf“)
- XML schema
- XML-schema & software tool (Windows .NET) to generate a schema
- Exchange specification: text document (PDF) & WSDL-files

Additional documents (informative)
- Handbooks for users, for software development and the creation of extensions
- Documentation of the platform independent exchange (Exchange-PIM)
- Data Dictionary
- Handbook for the XML schema generation tool
- Example messages
The data model (and all other files mentioned) are available on the DATEX website.

To get access on the current documents, a login (free registration) is necessary:

http://www.datex2.eu
Get access

www.date2.eu

DATEX User Forum 2012 - Stockholm

The 2012 edition of the DATEX User Forum have been held in Stockholm on 20th-21st March

Session Presentations are now available from this link.

DATEX II newsletter

Stay informed on our latest news!

Previous issues

DATEX II User Forum – Prague – 19 20 May 2014
### Get access

The reference set of documentation defining the DATEX II specifications is downloadable from this page. This documentation set constitutes the official release of DATEX II.

The set comprises:
- the data model and the modelling methodology used to build it
- the XML schema and the tool used to automatically generate it from the data model
- the exchange platform specific model.

Further useful information for understanding and using this documentation set can be found at Supporting Documentation.

- DATEX II Schema generation tool 2.1
- DATEX II v2.1 Releases Notes
- DATEX II PIM v2.1
- DATEX II Exchange PSM
- DATEX II XML Schema 2.1
- DATEX II Modelling Methodology 2.1
The data model (DATEX II PIM v2.2) is available as

- Enterprise Architect format (.eap) (see before)
- In HTML format for web browser, as offline ZIP or online browseable:

  http://www.datex2.eu/datex-model/HTML.Version_2.2/index.htm

- TamTam research developed an alternative online browser to search through the DATEX model:

  http://datexbrowser.tamtamresearch.com
Enterprise Architect

- Inexpensive UML modelling tool used to view
- To obtain from Sparx Systems: http://www.sparxsystems.com/
- There is also a free version (viewing only) available!
Settings in Enterprise Architect
Entry point for the model: D2LogicalModel

Special UML profile for DATEX for the generation of preconfigured UML elements
Tagged Values

Tagged values offer user-defined additional information and consist of a ‘tag’ and an associated ‘value’ element.

Within the meaning of UML (1.4!) tagged values can be associated to any element in any quantity.

In terms of the DATEX methodology, the used tagged values are well defined, however.
Two important DATEX tagged values:

- **definition**
  A definition for each component, attribute, literal and package. It becomes part of the schema and can be visualized by software tools.

- **order**
  An information for the relative position of this element within the schema.
Check for the current version

Current version of DATEX II is 2.2.
(2.3. to come this year)
Older versions should not be used unless there is a need for it.
You can find the version information as a tagged value on the component 'D2LogicalModel'.
Used UML elements in DATEX II

- component
- package
- attribute
- relation
- enumeration
- literal
- multiplicity
- qualifier
UML example

class Temp

Car
BMW
Tyre
ParkingAssistant
+ operatingStatus : Boolean

4
0..1
DATEX meta model

An aside:
Attributes, relations etc. for DATEX are defined in a meta model with the means of UML.
The data model can be visualized through customized figures. These figures all access the same data basis - the data model.

Multiple figures can not contradict each other, but they can offer different views. They can focus different details or hide some elements.

This is no contradiction to the example before. A Cabrio is also a car and may have a parking assistent.
Data basis („the truth“)

Elements in one package

Connections / relations
Views on the Point item

```
class Point1
    NetworkLocation
    Point
    AlertCPoint
    + alertCLocationCountryCode : String
    + alertCLocationTableNumber : String
    + alertCLocationTableVersion : String

PointByCoordinates
    + bearing : NonNegativeInteger [0..1]

PointAlongLinearElement::PointAlongLinearElement
    + administrativeAreaOfPoint : MultilingualString [0..1]
    + directionBoundAtPoint : DirectionEnum [0..1]
    + directionRelativeAtPoint : LinearReferencingDirectionEnum [0..1]
    + heightGradeOfPoint : HeightGradeEnum [0..1]

AlertCPoint
    + alertCLocationCountryCode : String
    + alertCLocationTableNumber : String
    + alertCLocationTableVersion : String

TpegPointLocation::TpegPointLocation
    + tpegDirection : DirectionEnum
```
Views on the Point item

In this view, the possibility to express a point by coordinates is not shown, however, this is still a valid method.

A little awkward, because mandatory attributes are not shown. Anyway, it’s not forbidden.
Data types

- All used (simple) data types are also realized in the form of DATEX components. A distinction is made between generic and specific data types. The latter are derived from the generic types. DATEX simple data types are mapped to the corresponding XSD simple types (using the tagged value ‘schemaType’).

<table>
<thead>
<tr>
<th>Tagged Values</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class (String)</strong></td>
</tr>
<tr>
<td>changed</td>
</tr>
<tr>
<td>definition</td>
</tr>
<tr>
<td>facets</td>
</tr>
<tr>
<td>origin</td>
</tr>
<tr>
<td>originalCode</td>
</tr>
<tr>
<td>originalName</td>
</tr>
<tr>
<td>schemaType</td>
</tr>
<tr>
<td>type</td>
</tr>
</tbody>
</table>

**class Generic**

```xml
<xs:simpleType name="string">
  <xs:restriction base="xs:string"/>
</xs:simpleType>
```
Data types (generic)

class Generic

- «datatype» Boolean
- «datatype» Float
- «datatype» Integer
- «datatype» String
- «datatype» DateTime
- «datatype» NonNegativeInteger
- «datatype» Date
- «datatype» Time
- «datatype» MultilingualString
- «datatype» Language
- «datatype» Url
- «datatype» Reference
- «datatype» VersionedReference
Data types (specific I)

```
Data types (specific I)

class Specific

- «datatype» VehiclesPerHour
- «datatype» AxlesPerHour
- «datatype» PassengerCarUnitsPerHour
- «datatype» PartsPerMillionConcentration
- «datatype» Years
- «datatype» ConcentrationVehiclesPerKilometre
- «datatype» ConcentrationKilogramsPerCubicMetre
- «datatype» IntensityKilogramsPerSquareMetre
- «datatype» AlertCLocationCode
- «datatype» AngleInDegrees
- «datatype» MetresAsNonNegativeInteger
- «datatype» NonNegativeInteger
```
Data types (specific II)

```
class Specific

  «datatype»
  IntensityKilogramsPerSquareMetre

  «datatype»
  CubicMetres

  «datatype»
  ConcentrationKilogramsPerCubicMetre

  «datatype»
  Seconds

  «datatype»
  WattsPerSquareMetre

  «datatype»
  MetresPerSecond

  «datatype»
  KilometresPerHour

  «datatype»
  ConcentrationMicrogramsPerCubicMetre

  «datatype»
  IntensityKilogramsPerSquareMetre

  «datatype»
  ConcentrationMicrogramsPerCubicMetre

  «datatype»
  TemperatureCelsius

  «datatype»
  IntensityMillimetresPerHour

  «datatype»
  MetresAsFloat

  «datatype»
  Tonnes

  «datatype»
  Kilohertz

  «datatype»
  Percentage

  «datatype»
  CubicMetres

  «datatype»
  TemperatureCelsius

  «datatype»
  IntensityMillimetresPerHour

  «datatype»
  KilometresPerHour
```
References

- Using cross references as an alternative to direct aggregation or between different messages
- Example: Relationship between static data (e.g. infrastructure information) and dynamic data (e.g. high-frequency measurements)
- Identification by stereotype ‘identifiable’ (using an ID "unique in space and time")
- Reference with data type ‘Reference’
- Different versions: Usage of ‘versionedIdentifiable’ and ‘VersionedReference’.

```uml
class MeasurementSiteTablePublication
  «versionedIdentifiable»
  MeasurementSiteTable
  + measurementSiteTableIdentification :String [0..1]

class MeasuredDataPublication
  PayloadPublication
  MeasuredDataPublication
  + measurementSiteTableReference :VersionedReference
```
References in XML instance example

Definition of MeasurementSiteTable in static message:

```
<measurementSiteTable id="92126FC7-3D2E-4AAE-A1AC-FE33812D572F" version="1">
  <measurementSiteTableIdentification>Diebg12</measurementSiteTableIdentification>
  <measurementSiteRecord id="C69BE0FB-CA4C-43CE-A00F-9B3A77E5CB86" version="1">
    <measurementEquipmentTypeUsed>
      ...
    </measurementEquipmentTypeUsed>
  </measurementSiteRecord>
</measurementSiteTable>
```

Reference in dynamic message:

```
<payloadPublication xsi:type="MeasuredDataPublication" lang="de">
  <publicationTime>2012-08-14T09:00:01.0Z</publicationTime>
  <publicationCreator>
    <country>de</country>
    <nationalIdentifier>DE-MDM-xxxxxxx</nationalIdentifier>
  </publicationCreator>
  <measurementSiteTableReference targetClass="MeasurementSiteTable" id="92126FC7-3D2E-4AAE-A1AC-FE33812D572F" version="1" />
  <headerInformation>
    <confidentiality>noRestriction</confidentiality>
    <informationStatus>test</informationStatus>
  </headerInformation>
</payloadPublication>
```

*a so called UUID was used (Universally Unique Identifier)*
PRESENTATION DATA MODEL (LEVEL A)
# Standardisation time schedule

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>q1</td>
<td>q2</td>
<td>q3</td>
<td>q4</td>
<td>q1</td>
<td>q2</td>
</tr>
<tr>
<td>Part 1: Context and Framework</td>
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<tr>
<td>Part 2: Location referencing</td>
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<tr>
<td>Part 3: Situation</td>
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<tr>
<td>Part 4: Variable Message Sign</td>
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<tr>
<td>Part 5: Measured &amp; Elaborated data</td>
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<tr>
<td>Part 6: Parking Information</td>
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<td></td>
</tr>
</tbody>
</table>

- **Red** = Ratification and preparation of definitive texts by CMC (3m)
- **Green** = Preparation of TCA-draft by CMC and Voting (6,5m)
- **Yellow** = TC-review, processing comments by WG (6m)
- **Orange** = Drafting stage (6m)
- **Blue** = Preliminary stage, optional (12m)
DATEX data model 'interoperability levels'

Level A
- 'Existing' data model
- Data catalogue, ontology, data registry, ....
- The Level A model is 'fix' and can only be adjusted within new DATEX versions, but not in general (but see also profile creation)

Level B
- Backward compatible extension/amendment to Level A

Level C
- Completely independent, no longer to Level A compatible scheme which corresponds to the DATEX methodology anyway.
DATEX Data model Level A
DATEX Data model Level A

Tree structure of Enterprise Architect Project Browser:

- Main package
- Figure / view
- Sub packages
- Package for Level B extensions
- Main component
  (starting point of the model)
The packages: Exchange

- Protocol relevant data like for example
  - type of subscription
  - keep alive message
  - delivery interval
  - update method
- no content related data
- The Exchange specification is currently being updated
The packages: Exchange

- space for customized Level B extensions
- since DATEX II version 2.1, this package already contains the Parking extension
  (please note, that this is a antecessor of the current CEN workitem Parking extension)
The packages: General

‘General’ contains

- data types package (generic, specific)
- groups of location package (georeference)
- all enumerations (because of their mass divided into alphabetically sub packages)
- reusable classes, i.e. structures, which are used elsewhere in the model
The packages: Management

A small package containing some information for the life cycle of situations (e.g. traffic messages)
The packages: Management

A small package containing some information for the life cycle of situations (e.g. traffic messages)
The packages: PayloadPublication

The main payload packages for different types of messages.
The packages: PayloadPublication

- **Data created through algorithms**
- **Empty structure to add customized publications**
- **Data directly recorded**
- **Using locations by reference to define them just once**
- **Variable message signs**
- **Traffic view on particular section**
- **Traffic messages**
### Basic objects

- Elaborated Data
- Traffic Elements
  - Congestion, Accident...
- Operator Actions
  - Network Mngmt, Roadworks...

### Additional objects

- Location Referencing
  - Area, Point, Linear
  - ALERT-C, ISO 19148, Coordinates, TPEG-LOC, OpenLR (extension)
- Predefined Locations
- Additional Positional Descriptions
- Validity
- Comments, URL, ...
- Impact, Source, Causes
- Data Quality and Faults
Access to the model:

**PayloadPublication::PayloadPublication**
- defaultLanguage :Language
- feedDescription :MultilingualString [0..1]
- feedType :String [0..1]
- publicationTime :DateTime

**Exchange::Exchange**
- changedFlag :ChangedFlagEnum [0..1]
- clientIdentification :String [0..1]
- deliveryBreak :Boolean [0..1]
- denyReason :DenyReasonEnum [0..1]
- historicalStartDate :DateTime [0..1]
- historicalStopDate :DateTime [0..1]
- keepAlive :Boolean [0..1]
- requestType :RequestTypeEnum [0..1]
- response :ResponseEnum [0..1]
- subscriptionReference :String [0..1]
Access to the model:

- **D2LogicalModel**
  - Root-Element
  - PayloadPublication
    - (main component for different kind of payload)
  - Exchange
    - (protocol add on)
class PayloadPublication

+ defaultLanguage :Language
+ feedDescription :MultilingualString
+ feedType :String
+ publicationTime :DateTime

PayloadPublication

MeasuredDataPublication::MeasuredDataPublication
+ measurementSiteTableReference :VersionedReference

ElaboratedDataPublication::ElaboratedDataPublication
+ forecastDefault :Boolean
+ periodDefault :Seconds
+ timeDefault :DateTime

TrafficViewPublication::TrafficViewPublication

SituationPublication::SituationPublication

PredefinedLocationsPublication::PredefinedLocationsPublication

GenericPublication::GenericPublication
+ genericPublicationName :String

VmsPublication::VmsPublication

VmsTablePublication::VmsTablePublication

ReusableClasses::InternationalIdentifier
+ country :CountryEnum
+ nationalIdentifier :String

MeasurementSiteTablePublication::MeasurementSiteTablePublication

class PayloadPublication

PayloadPublication

+ defaultLanguage :Language
+ feedDescription :MultilingualString
+ feedType :String
+ publicationTime :DateTime

PayloadPublication

MeasuredDataPublication::MeasuredDataPublication
+ measurementSiteTableReference :VersionedReference

ElaboratedDataPublication::ElaboratedDataPublication
+ forecastDefault :Boolean
+ periodDefault :Seconds
+ timeDefault :DateTime

TrafficViewPublication::TrafficViewPublication

SituationPublication::SituationPublication

PredefinedLocationsPublication::PredefinedLocationsPublication

GenericPublication::GenericPublication
+ genericPublicationName :String

VmsPublication::VmsPublication

VmsTablePublication::VmsTablePublication

ReusableClasses::InternationalIdentifier
+ country :CountryEnum
+ nationalIdentifier :String

MeasurementSiteTablePublication::MeasurementSiteTablePublication
DETAILED EXAMPLE 1:

SITUATION

(TRAFFIC MESSAGES)
class PayloadPublication

PayloadPublication
+ defaultLanguage : Language
+ feedDescription : MultilingualString
+ feedType : String
+ publicationTime : DateTime

PayloadPublication

MeasuredData

ElaboratedData

TrafficView

Situation

InternationalIdentifier

PredefinedLocation

Generic (for Level B)

VMS

VMS Table

MeasurementSiteTable

Payload Publication

VMSPublication::VMSPublication

VmsTablePublication::VmsTablePublication

+ publicationCreator
1
1
Message type „Situation“
Message type „Situation“
Validity model

class Validity
Validity
+ validityStatus  :ValidityStatusEnum
+ overrunning  :Boolean [0..1]
DayWeekMonth
+ ... 0..*
1
+exceptionPeriod 0..*
1
+recurringTimePeriodOfDay0..*
1
+recurringDayWeekMonthPeriod0..*
1

Total period
(Start and optional End)

Included or excluded periods

Time periods within a day

Specification of the day
(e.g. 1st Monday each month)
Validity model

The validity results from the intersection of

- Overall period
- Union of all other specified periods
- Complement of the union of all exclusion periods

All periods can be defined on date, times, days of the week etc..

Example:
Every 1st Monday of the month from 15-18 clock from April 1 to May 30 except May 1

The specification of validity is particularly interesting for planned road works or closures.

The model can also be used for opening times (for example, gas stations or parking facilities).
For traffic information usually only the start time is indicated (even the end time is already optional).
Impacts

- Remaining capacity
- Number of blocked lanes
- Original number of lanes
- Total width available
- Type of constriction:
  - Lanes (partially) blocked
  - Road (partially) blocked
  - Carriageway (partially) blocked
class Cause

«enumeration»
CauseTypeEnum

accident
congestion
earlierAccident
earlierEvent
earlierIncident
equipmentFailure
excessiveHeat
frost
holidayTraffic
infrastructureFailure
largeNumbersOfVisiters
obstruction
pollutionAlert
poorWeather
problemsAtBorderPost
problemsAtCustomPost
problemsOnLocalRoads
radioactiveLeakAlert
roadsideEvent
rubberNecking
securityIncident
shearWeightOfTraffic
technicalProblems
terrorism
toxicCloudAlert
vandalism
other

«versionedIdentifiable»
SituationRecord

+ probabilityOfOccurrence: ProbabilityOfOccurrenceEnum
+ situationRecordCreationTime: DateTime
+ situationRecordVersionTime: DateTime

ManagedCause

+ managedCause: VersionedReference [0..1]

NonManagedCause

+ causeDescription: MultilingualString [0..1]
+ causeType: CauseTypeEnum [0..1]
class Cause
«enumeration»
CauseTypeEnum

| accident      |
| congestion   |
| earlierAccident |
| earlierEvent |
| earlierIncident |
| equipmentFailure |
| excessiveHeat |
| frost         |
| holidayTraffic |
| infrastructureFailure |
| largeNumbersOfVisitors |
| obstruction   |
| pollutionAlert |
| poorWeather   |
| problemsAtBorderPost |
| problemsAtCustomPost |
| problemsOnLocalRoads |
| radioactiveLeakAlert |
| roadsideEvent |
| rubberNecking |
| securityIncident |
| shearWeightOfTraffic |
| technicalProblems |
| terrorism     |
| toxicCloudAlert |
| vandalism     |
| other         |

Cause defined by enumeration (see left side)

Cause defined by reference to another situation element
Types of Situation elements

class SituationPublication_MDM...

«versionedIdentifiable»

SituationRecord::SituationRecord

NonRoadEventInformation::NonRoadEventInformation

OperatorAction::OperatorAction

+ actionOrigin: OperatorActionOriginEnum [0..1]
+ actionPlanIdentifier: String [0..1]
+ operatorActionStatus: OperatorActionStatusEnum [0..1]

TrafficElement::TrafficElement
Types of Situation elements

- Non traffic related situation
- Traffic related situation
- Operator action
Types of Situation elements

- Non traffic related situation
- Traffic related situation
- Operator action
Types of Situation elements

- PoorEnvironmentConditions
  - poorEnvironmentType: PoorEnvironmentTypeEnum [1..*]
- Humidity::Humidity
- Wind::Wind
  - windMeasurementHeight: MetresAsNonNegativeInteger [0..1]
- Temperature::Temperature
- Pollution::Pollution
  - pollutantType: PollutantTypeEnum
- Visibility::Visibility
- PrecipitationDetail::PrecipitationDetail
  - precipitationType: PrecipitationTypeEnum [0..1]
DETAILED EXAMPLE 2:
MEASUREMENT SITES AND MEASURED DATA
class PayloadPublication
PayloadPublication
+ defaultLanguage :Language
+ feedDescription :MultilingualString
+ feedType :String
+ publicationTime :DateTime

Payload Publication

MeasuredData
ElaboratedData
TrafficView
Situation

Predefined Location

Generic (for Level B)

VMS
VMS Table
Measurement Site Table

International Identifier

Forecast Default :Boolean
Period Default :Seconds
Time Default :DateTime

Measured Data
Elaborated Data
Traffic View
Situation

Predefined Locations Publication::PredefinedLocationsPublication
Measured Data Publication::MeasuredDataPublication
Elaborated Data Publication::ElaboratedDataPublication
Traffic View Publication::TrafficViewPublication
Situation Publication::SituationPublication

Filtered Contents Publication::FilteredContentsPublication
Payload Publication::PayloadPublication

VMS Publication::VmsPublication
Measured Data Publication::MeasuredDataPublication
Predefined Locations Publication::PredefinedLocationsPublication
International Identifier::InternationalIdentifier
Measurement Site Table Publication::MeasurementSiteTablePublication
Predefined Locations Publication::PredefinedLocationsPublication

VMS
VMS Table
Measurement Site Table

International Identifier

Forecast Default :Boolean
Period Default :Seconds
Time Default :DateTime

Measured Data
Elaborated Data
Traffic View
Situation

Predefined Location

Generic (for Level B)
The location of a measurement site may be a point, a linear section of road or an area. Linear sections may even be specified as itineraries or predefined location sets, e.g. for travel time routes which comprise one or more different roads.

The index provides the means for a measured value (in the MeasuredDataPublication) to be referenced to the relevant MeasurementSpecificCharacteristics at the measurement site.
Measurement Site Table (static)

Message and header information

Measurement site table

Measurement site record
site name, equipment, computation method

Characteristics of one individual measurement
valid for special vehicle characteristics

Georeference

The location of a measurement site may be a point, a linear section of road or an area. Linear sections may even be defined as itineraries or predefined location sets, e.g. for travel time routes which comprise one or more different roads.

The index provides the means for a measured value (in the MeasuredDataPublication) to be referenced to the relevant MeasurementSpecificCharacteristics at the measurement site.
Measured Data (dynamic)

The "index" qualifier provides a reference to the specific MeasurementCharacteristics that are relevant for the MeasuredValue at the referenced measurement site.
Measured Data (dynamic)

Message and header information

Reference to static record

Individual measurement

Basic data (see next slide)

Location override

Fault information

The "index" qualifier provides a reference to the specific MeasurementCharacteristics that are relevant for the MeasuredValue at the referenced measurement site.
Basic Data (dynamic)

The location (e.g. the stretch of road or area) to which the data value(s) is or are pertinent/relevant. This may be different from the location of the measurement equipment (i.e. the measurement site location).
Basic Data (dynamic)

- Calculation time, period etc.
- Traffic status and trend
- Traffic data (headway, flow, speed, concentration)
- Travel time and journey data
- Weather data (wind, temperature, humidity, ....)
- Location, if different from measurement site

The location (e.g., the stretch of road or area) to which the data value(s) is or are pertinent/relevant. This may be different from the location of the measurement equipment (i.e., the measurement site location).
DETAILED EXAMPLE 3:

GEOREFERENCE
Georeference

Additional description

Coordinates for visualisation

Location by reference

Ordered group of locations

Non ordered group of locations

Group of locations

Point

Linear

Area

AffectedCarriagewayAndLanes

+ carriageway:CarriagewayEnum
+ lane: LaneEnum [0..*]
+ footpath: Boolean [0..1]
+ lengthAffected: MetresAsFloat [0..1]
Point location

1. Coordinates (ETRS89)
   • WGS84 coordinates can be used instead, because the discrepancy is very small
   • Optional: bearing
   • Optional: coordinates for visualisation (in addition to above)
   • Optional: lane

2. Point on a Linear (ISO 19148)
   a) Start-, middle and endpoints of Linear with ETRS89 oder
   b) ID of linear

   For both cases:
   • Distance between Point and the beginning of the Linear
   • Optional: road name and road class

3. ALERT-C, here as example method 4
   • Location code with offset (method 2 without offset)

4. TPEG-Point

5. OpenLR-Point (not part of Level A)
Specifying coordinates in **ETRS89** (European Terrestrial Reference system)

- Three-dimensional, geodetic reference system
- Discrepancy to WGS84 coordinates is currently about 1,20m (+2 cm / year)

Additional bearing

(360°, Reference North) possible

(➔ directed point)
Georeference – Point Coordinates

Class Point

GroupOfLocations::GroupOfLocations

Point

GroupOfLocations::Location

PointByCoordinates

+ bearing: NonNegativeInteger [0..1]

+ locationForDisplay 0..1

GroupOfLocations::NetworkLocation

GroupOfLocations::PointCoordinates

+ latitude: Float
+ longitude: Float

Bearing 360 degree, reference North

Additional coordinates for visualisation

ETRS89

Punkt-Verortung nach ETRS89 (auf Grund nur sehr geringer Abweichungen kann auch WGS84 stattdessen verwendet werden). Zusätzlich zu der eigentlichen Punkt-Verortung kann optional auch noch eine Koordinaten-Angabe für die Visualisierung erfolgen ("locationForDisplay"). "bearing" ist ein 360 Grad-Winkel (0-Grad-Bezug ist Norden).
Georeference – Point as ISO 19148

a) Distance from starting point of Linear in meter
   - Starting point of the linear element
   - multiple path points
   - End point of linear element

or b) Linear by ID
Georeference – Point as ISO 19148

Diagram showing relationships between classes such as `PointAlongLinearElement`, `LinearElement`, `DistanceAlongLinearElement`, `DistanceFromLinearElementStart`, `LinearElementByPoints`, `LinearElementByCode`, `Referent`, and `PointCoordinates`. The diagram illustrates the properties and relationships within these classes, such as `roadName`, `roadNumber`, `directionBoundAtPoint`, `distanceAlong`, `latitude`, and `longitude`.
Offset in meter (between point and primary ALERT-C location)

Primary ALERT-C Location
direction of driving

Location Codes as from country specific location tables

From the point considered the Primary ALERT-C location is always located in driving direction (with given offset distance).

It must be specified, whether the direction of travel is the same or the opposite direction than the ALERT-C coupling of points.
Georeference – Point as ALERT-C (M4)
Links

DATEX II
- http://www.datex2.eu

DATEX II Modelling Methodology

Enterprise Architect
- http://sparxsystems.eu/
- http://www.sparxsystems.eu/enterprisearchitect/download-trial/

DATEX platform independent model

DATEX schema generation tool

DATEX schema

XML Viewer

Comparing files
- http://winmerge.org/
Thank you

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