CROCODILE 2

A common agreement on how to exchange Static Data related to Delegated Regulation 2015/962

Draft Version

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Background

According to Delegated Regulation (EU) 2015/962, road authorities and road operators shall provide static road data, which they collect and update, in a standardized format, if available, or in any other machine-readable format, on a non-discriminatory basis; and digital map providers shall collaborate with the data providers to ensure that any inaccuracies related to static road data are signalled without delay to the road authorities and road operators from which the data originates. The regulation also provides a list of types of static road data to be addressed.

The list of Static Road Data, as defined in the ANNEX of the delegated regulation, consists of the following attributes:

- road network links and their physical attributes, such as:
  - geometry;
  - road width;
  - gradients;
  - junctions;
- road classification
- traffic signs reflecting traffic regulations and identifying dangers, such as:
  - access conditions for tunnels;
  - access conditions for bridges;
  - permanent access restrictions;
  - other traffic regulations;
- speed limits;
- traffic circulation plans;
- freight delivery regulations;
- location of tolling stations;
- identification of tolled roads, applicable fixed road user charges and available payment methods;
- location of parking places and service areas;
- location of charging points for electric vehicles and the conditions for their use;
- location of compressed natural gas, liquefied natural gas, liquefied petroleum gas stations;
- location of public transport stops and interchange points;
- location of delivery areas.

Within the CROCODILE 2 consortium, a Working Group on Static Data was established already in 2016, followed by a first workshop later that year, where first ideas and also the status within the Member States were defined.
The second workshop then took place in November 2018. There, the availability of static data in the Member States was checked, and also the next steps and a pilot definition were defined.
As for 2019, a common pilot will be established in the course of the CROCODILE 3 project.

Availability of Data

Currently, there are 19 different attributes for static road data defined within the Delegated Regulation 2015/962, the availability is given in various formats and shows a wide range in terms of quality and quantity within the CROCODILE countries.
Based on a questionnaire, sent out in October 2018, the feedback of the Member States of the CROCODILE 2 – project can be seen in the following overview:

	Austria	Croatia	Czech Republic	Germany	Greece	Hungary	Italy	Slovenia
1)road network links and their physical attributes, such as:	Y	Y	Y	Y	Y	Y	Y	Y
(i) geometry;	Y	Y	Y	Y	Y	Y		Y
(ii) road width;	Y	Y	Y	Y	Y	Y		Y
(iv) gradients;		Y	Y	Y	Y			Y
(v) junctions;	Y	Y	Y	Y	Y	Y		Y
2) road classification:	Y	Y	Y	Y	Y	Y	Y	Y
3)traffic signs reflecting traffic regulations and identifying dangers, such as:		Y		Y	Y		Y	Y
(i) access conditions for tunnels;		Y	Y	Y	Y		Y	Y
(ii) access conditions for bridges;		Y	Y	Y	Y	Y		Y
(iii) permanent access restrictions;		Y	Y	Y	Y	Y		Y
(iv) other traffic regulations;		Y	Y	Y				Y
4) speed limits;	Y	Y	Y	Y	Y	Y	Y	Y
5) traffic circulation plans;		Y	partially	Y			Y	Y
6) freight delivery regulations;		Y	partially	Y				
7) location of tolling stations;	Y	Y	Y	Y	Y	Y	Y	Y
8) identification of tolled roads, applicable fixed road user charges and available payment methods;	Y	Y	partially	Y	Y	Y	Y	Y
9) location of parking places and service areas;	Y	Y	Y	Y	Y	Y	Y	Y
10) location of charging points for electric vehicles and the conditions for their use;				Y				
11) location of compressed natural gas, liquefied natural gas, liquefied petroleum gas stations;	Y	Y		partially				
12) location of public transport stops and interchange points;						partially		
13) location of delivery areas.								

There is a large variety of formats, which are currently used in the different countries, highly depending on the system in which it is used. I.e., road network links with geometry and its basic information are often INSPIRE-based and retrieved from a GIS such as the GIP in Austria , the BISStra in Germany or WESP in Slovenia, while more complex traffic regulation-information such as tolling stations or parking places are often TN-ITS (Slovenia) or DATEX-based (Austria).

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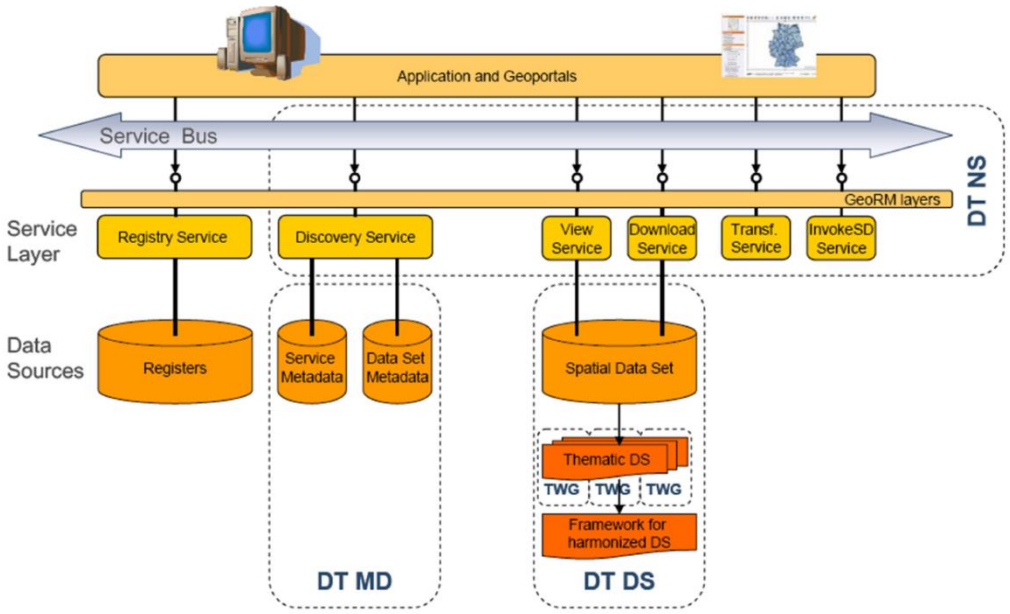
Availability of Standards

(a) INSPIRE

Directive 2007/2/EC aims to establish an Infrastructure for Spatial Information in the European Community (INSPIRE) for environmental policies, or policies and activities that have an impact on the environment. **INSPIRE is based on the infrastructures for spatial information that are created and maintained by the Member States**. To ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and trans-boundary context, the Directive requires that common Implementing Rules (IR) are adopted in a number of specific areas.

INSPIRE does not require collection of new data. However, Member States have to make their data available according to the Implementing Rules. Interoperability in **INSPIRE means the possibility to combine spatial data and services from different sources across the European Community in a consistent way** without involving specific efforts of humans or machines. It is important to note that "interoperability" is understood as providing access to spatial data sets through network services, typically via Internet. Interoperability may be achieved by either changing (harmonising) and storing existing data sets or transforming them via services for publication in the INSPIRE infrastructure. It is expected that users will spend less time and efforts on understanding and integrating data when they build their applications based on data delivered within INSPIRE.

The INSPIRE Network services architecture is illustrated in the figure below



This service architecture also inspired the service specification of TN-ITS.

(b) TN-ITS

From its origin in the use within in-car navigation systems, the increasing need for digital maps evolved via ADAS and C-ITS towards automated driving. Furthermore, these maps show high significance for the provision of real-time road status and traffic information.
Building on these premises, the TN-ITS concept allows transfer of information on changes on roads to in-vehicle systems with little delay.

TN-ITS is concerned with the **exchange of information on changes in static road attributes**, meaning that they are of a more or less permanent nature, even though they may sometimes change (i.e. speed limits). The focus is in general on road attributes based on regulations, but this may extend to other road and transport related features.

It is important that digital maps for ITS are highly up to date for attributes that are critical in terms of safety and efficiency. Map providers are often not in the position to easily keep their maps up to date for such attributes, but up-to-date maps are a key asset for ITS applications.

The solution is to **retrieve the information on changes from the road authorities**. As they create the changes, they are the most efficient and immediate source for such information. This requires digital storage and maintenance on the side of road authorities, and also some kind of flagging of these changes. With governments going more and more digital, systems for such digital storage and maintenance are increasingly available - however, with a multitude of solutions, which are different in terms of GIS and data models applied. Consequently, a common exchange format is needed, enabling creation of plugins to existing (legacy) systems for extraction of information on changes in road attributes. Immediate updates from authorities to map makers only make sense if this part of the data chain - from map makers to end user devices - will also be in place.

The idea for the TN-ITS concept for data exchange developed during the EU-funded projects PReVENT/MAPS&ADAS (2004/2007) and SpeedAlert (2004/2005), and was further elaborated and tested in the EU-funded ROSATTE project (Road Safety Attributes Exchange Infrastructure in Europe; 2008-2010), in which the basis for a recently issued CEN/TC 278 draft technical specification (FprCEN/TS 17268) was laid. This work led in 2013 to the foundation of the TN-ITS Platform for deployment of the concept. In the past years, implementation in several European countries took place, and a further roll-out in Europe with support from the EU CEF Programme (Connecting Europe Facility) is ongoing.

The TN-ITS data content specification specifies the various classes of information that are being used within TN-ITS, without mandating a particular technology for implementation. The data content specification uses UML constructs such as packages, classes, attributes, associations and OCL constraints, and assumes that the reader is familiar in that domain. It is organized in packages where each package corresponds to a separate subset of the TN-ITS domain. Each package contains a number of classes with attributes and associations.

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The TN-ITS model defines the following basic concepts:

- Datasets consisting of road features and metadata describing the content of the dataset. These datasets are foreseen as being exchanged from road authorities/road operators to information users (map providers).
- Another type of dataset consisting of feedback information from information users (including map providers) to information providers (e.g. road authorities/road operators).
- Road features which describe the contents of traffic regulations, safety-related features or other road-related features of interest to road users. A road feature is primarily described by:
  1) its type (for example: speed limit, restriction for vehicles, overtaking ban, etc.)
  2) property values (for example: speed limit value, maximum weight, etc.)
  3) conditions for when the road feature is applicable (which may include: time period, vehicle type, weather conditions, etc.)
  4) location
  5) update information; for datasets containing incremental updates, all road features shall contain information on the applicable update primitive

(c) DATEX II

According Article 6 of the Delegated Regulation (EU) No 886/2013, to achieve compatibility, interoperability and continuity, it is necessary to **define minimum requirements for road safety-related universal traffic information services**. These requirements should relate to the identification and use of a standardised list of safety-related traffic events or conditions to be communicated to end users, as well as to the content of the information to be provided to end users. If end users receive information through various delivery channels that are under the control of public and/or private road operators, service providers and broadcasters dedicated to traffic information, that information should not be contradictory, therefore should consist of the same elements and be based on the same description of the event or condition in question.

DATEX II profiles are usually customized by DATEX II users individually to provide individual functionalities (e.g. level of service that needs to be maintained, features/services that can be delivered, etc.), whilst **keeping interoperability on common parts with other users is necessary**
In order to achieve harmonized bilateral data exchange, a DATEX II profile has to be provided, that

- Covers the full content of the exchanged DATEX II data sets
- Needs to be in accordance to a specification, (such as the EU Delegated Regulations supplementing the ITS Directive (2010/40/EU), e.g. No 886/2013 EU for *„road safety-related minimum universal traffic information"; „SRTI"*), or needs to rresult from ITS corridor projects that have implemented agreed profiles for the harmonized exchange of DATEX II data within the member states (e.g. CROCODILE)

Conclusion: specifications that mention DATEX II to be applied for the exchange of road data and traffic information (e.g. by defining required data categories) have to be "converted" into **a DATEX II profile providing a minimum content of data for enabling the minimum functional requirements of a specific exchange**

As a first step, a "reference profile" containing all events that are known as being SRTI flagged in the EU has be established, followed by effort to limit this to "what is the **minimum information** according to the regulation", and finally reach a decent and unambiguous model for this (minimum) DATEX II data set.
This approach then allows to create a common European basis for the exchange of SRTI without having the risk of developing additional, non-compliant and non-functional DATEX II profiles

Data-exchange between Member States

Though the availability of static road data is remarkable high in virtually all Member States, a data exchange is only feasible through countries which use the same basic for their data, so having the same kind of standards – regardless of the quantity and other quality perspectives.

Nevertheless, due to the advanced willingness of the involved CROCODILE Member States, the status of an exchange of data is already very advanced.

Within the consortium, there is already a commitment from six Member States (AT, CZ, HR, HU, IT, SI) for setting up a pilot with the goal of an exchange across national borders.

As for the next steps, there will be more specific discussions about the relevance of the data categories, followed by the decision what standards can be used and also what should be seen as the role of National Access Points.

The responsible road operators will meet again in March 2019 to coordinate their efforts. At that point in time, first results for data exchange should already be feasible.

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