Information Exchange for Navigation Systems

European Union Location Framework – Transportation Pilot

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SEMIC Workshop: Community of Practice on Core Data Models
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www.jrc.ec.europa.eu

Serving society
Stimulating innovation
Supporting legislation
What happens when a 60 ton truck crosses a bridge with a 4 ton weight limit?

- This driver was running late
- He saw the weight restriction and hoped a full-speed run would get him over the bridge – it didn’t!
- What could have happened with his navigation system to direct him here?
- How do other drivers know this “event” has occurred?

Flottbron bridge Lidköping, Gagnef, Sweden March 2015
Content

- Driver information needs and challenges
- Making it happen
- How this is being tested in the EULF project
- Conclusions
- Questions for discussion
Driver information needs and challenges

- **STATIC road network information:**
  - roads, junctions, stopping points
  - distances, speed limits
  - restrictions, e.g. one way streets, vehicle limitations

- **TEMPORARY information:**
  - Road closures and other planned events

- **DYNAMIC information:**
  - accidents and other unplanned events
  - traffic volumes

- **ROUTING and POSITIONING capability:**
  - initial journey planning
  - time to destination, next petrol station
  - rerouting options
Making it happen - INSPIRE

- INSPIRE Directive 2007/02/EC – to establish a spatial data infrastructure for environmental policy
- 34 data themes including reference data (e.g. coordinate systems, transport networks) and thematic data (e.g. buildings, land use)
- Common cross-domain data models to facilitate interoperability
- Thematic extensions being developed
- Decentralised publication via network services and metadata (discovery, view, download, transform, invoke)
- Data and service sharing policy
- Comprehensive monitoring and reporting
- Implementation 2009 to 2020
INSPIRE ... and beyond: the European Union Location Framework

Strategic framework based on EU survey

Practical problems solved through pilot studies

Benefits in multiple use cases

Policy and strategy alignment
Effective governance and partnerships
Standardisation and interoperability

Return on investment

e-Government integration

Working together with MS to address priorities

Recommendations and guidance in 5 focus areas

Delivering savings, growth and better services through “location-enabled government”
Making it happen - The role of the EULF

- The European Union Location Framework (EULF) project promotes effective location-enabled e-government across Europe, as part of the Interoperability Solutions for Public Administrations (ISA) programme.

- It does this through a series of recommendations, guidance and actions targeting priority needs of citizens and businesses across all government sectors, and addressing cross-border applications and the goals of the Digital Single Market.

- INSPIRE is a key element in the EULF toolkit.

- The actions include pilots in different sectors, with the EULF Transportation Pilot aiming to improve the exchange of safety-related data between public road authorities and private sector map providers and assessing the contribution of harmonised cross-border mapping information.

- The EULF Transportation pilot is being carried out in two phases:
  - Phase 1: Norway and Sweden
  - Phase 2: Two or more additional countries
Making it happen – Information Exchange

GPS Satellites

Traffic Detector

CURRENT LOCATION

Driver Navigation System

TRAFFIC SPEED, DENSITY, FLOW

NAVIGATION SYSTEM UPDATES

Navigation System Vendors

TRAFFIC MESSAGES

Traffic Control Centres

MAP DATA EXCHANGE

Private Sector Map Providers

SEAMLESS X-BORDER MAPPING

Mapping Agencies / ELF Project

STATIC ROAD DATA CHANGES

Road Authorities
Making it happen – Static v Dynamic Data

GPS Satellites

TRAFFIC DETECTOR

Traffic Control Centres

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STATIC

DYNAMIC

7 May 2015
Making it happen – Standards

GPS Satellites
Traffic Detector

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Driver Navigation System

NAVIGATION SYSTEM UPDATES

TRAFFIC SPEED, DENSITY, FLOW

Traffic Control Centres

TRAFFIC MESSAGES

RDS-TMC TPEG

DATEX II for exchange between TCCs

AGORA-C, OpenLR referencing

Linear referencing

MAP DATA EXCHANGE

Physical storage format, e.g. NDS
Full/Transactional Update

Exchange Format e.g. GDF, NDS

Linear referencing

SEAMLESS X-BORDER MAPPING

INSPIRE-TN

Navigation System Vendors

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TN-ITS

INSPIRE-TN

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Making it happen – EULF Transportation Pilot

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INSPIRE-TN
Transportation Pilot: Data shared using TN-ITS channel

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**Transportation Pilot**: Data shared using TN-ITS channel.
Conclusions

• INSPIRE data specifications serve as core data models that can be extended to accommodate additional information requirements in other domains (e.g. TN-ITS specifications)

• The EULF Transportation Pilot has proven that more frequent exchange of road safety data between public and private sectors is feasible using TN-ITS

• Road authorities relationships with map providers are already established and are likely to be enhanced by the conversion to TN-ITS based ‘change notification’

• Most importantly, users are likely to benefit from more accurate and timely STATIC road information (provided they have access to the latest software and data!)

• BUT this only addresses part of their needs:
  ▪ DYNAMIC data is also important
  ▪ Other services are part of the picture (e.g. what are the public transport alternatives? what can I do when I get there?)
Questions for discussion

- Is there a role for INSPIRE in supporting the implementation of cross-domain base registries across Europe?

- How can INSPIRE be leveraged in other thematic use cases? What use cases may be relevant? What related standards and initiatives are involved?

- Are you interested in this topic? Do you want to know more? Are you willing to share your experiences?
Contact and join us!

http://ec.europa.eu/isa/actions/02-interoperability-architecture/2-13action_en.htm

https://joinup.ec.europa.eu/community/eulf/description


e-mail: eulf-info@jrc.ec.europa.eu

https://twitter.com/EULocation

#EULF
Additional content . . .
How to extend INSPIRE data models?

Conceptual data model (UML)

INSPIRE Generic Conceptual Model
+ INSPIRE TN Data Specification
+ TN-ITS extension

Methodology for the development of data specifications:
http://inspire.ec.europa.eu/index.cfm/pageid/2

Tool: e.g. ShapeChange

Guidelines for the encoding of spatial data:
http://inspire.ec.europa.eu/index.cfm/pageid/2

Syntax binding
(XML Schema)

INSPIRE GML application schemas
ISO 19136 Geography Markup Language
ISO 19118 Geographic information - encoding
Some of the challenges

- Inconsistency in existing public sector road data and mapping data supply models across Europe
  - Different standards
  - Centralised v federated
  - Commercial charges v free access

- How to get the information to the users device in a timely manner
  - Updates to “static” data
  - Real time information

- How to keep pace with technology advances
  - Updates to standards
  - Enabling innovation
INSPIRE – Road Transport Network elements

Individual links and link sequences form link set (e.g. motorway with exits)

Individual links are used to build link sequences (e.g. for linear referencing of transport properties)

Basic network of transport links and (optional) nodes

Transport property on link sequence (e.g. speed limit)

Linear reference from start of link sequence

TransportLinkSet

A1

TransportLinkSequence

TransportLink

TransportNode
Making it happen - ITS

- Intelligent Transport Systems and Services (ITS)
- A communications infrastructure for mobility
- ITS Action Plan adopted 2008
- Relevant actions:
  - 1.2 Collection and provision of road data
  - 1.3 Availability of accurate public map data through timely updates to map providers
- ITS Directive 2010/40/EU and Delegated Regulation 18.12.2014 on real time traffic information provide the legal basis – and reference INSPIRE
Making it happen –

- TN-ITS is a protocol and for notification of changes in static road data to support ITS applications
- It extends the INSPIRE Transport Network data specification with additional attributes
- TN-ITS builds on specifications developed in the Rosattein Project:
  - Conceptual specification of data content (using UML)
  - Physical exchange format (using GML)
  - Service specification (using UML + RESTful interface)
- TN-ITS has been developed by a community of public authorities and private sector organisations, through an association called ERTICO
- TN-ITS will become a CEN Technical Specification under CEN TC 278 WG7
## Making it happen – Data used in ITS applications

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Both LR methods are relevant for ITS applications
Making it happen – Dynamic data standards

- **RDS-TMC (Traffic Management Channel)**
  - Used for radio traffic updates
  - A side band of the FM carrier wave
  - Can be integrated with vehicle navigation systems
  - Protocol + location referencing standard, with pre-coded event types and locations

- **TPEG (Transport Protocol Expert Group)**
  - Late 1990s onwards
  - Higher bandwidth systems
  - Delivery via radio broadcast (e.g. DAB) or IP
  - Code lists
  - Location referencing containers – linking to TMC, AGORA-C and OpenLR standards

- **DATEX II – CEN TS 16157**
  - Designed to support Intelligent Transport Systems (ITS)
  - Supports exchange of dynamic traffic information between control centres, service providers, traffic operators and media organisations
  - Uses include rerouting, lane control, truck parking, car-to-infrastructure systems
Transportation Pilot: Phase 1 Overview

INSPIRE Compliance: Optional

Private Sector

Public Sector

INSPIRE Compliance: Legally mandated

Business

Map Providers

ELF Infrastructure

TN-ITS Infrastructure

Kartverket

INSPIRE EC/EEA Team

National Mapping and Cadastral Authorities

Statens vegvesen

Public Road Authorities

DG MOVE

7 May 2015
Navigating through the standards

- Geographic Data Files (GDF) for interchange of geographic data
- Navigation Data Standard (NDS) for storing data on user devices
- TN-ITS exchange protocol to enable timely updating of static data
- RDS-TMC, TPEG, DATEX II dynamic information standards
- INSPIRE TN data specification, publication and access standards
Location referencing methods

- Geographic coordinates – the location of speed sign on a map
- Linear referencing – the distance of speed sign from a junction
- Location coding – the code used for speed sign in a database
  - Pre-assigned number, e.g. TMC
  - Map based creation of code, e.g. AGORA-C and OpenLR