



# Transport Network ITS Spatial Data Deployment Platform Purpose, status and prospects

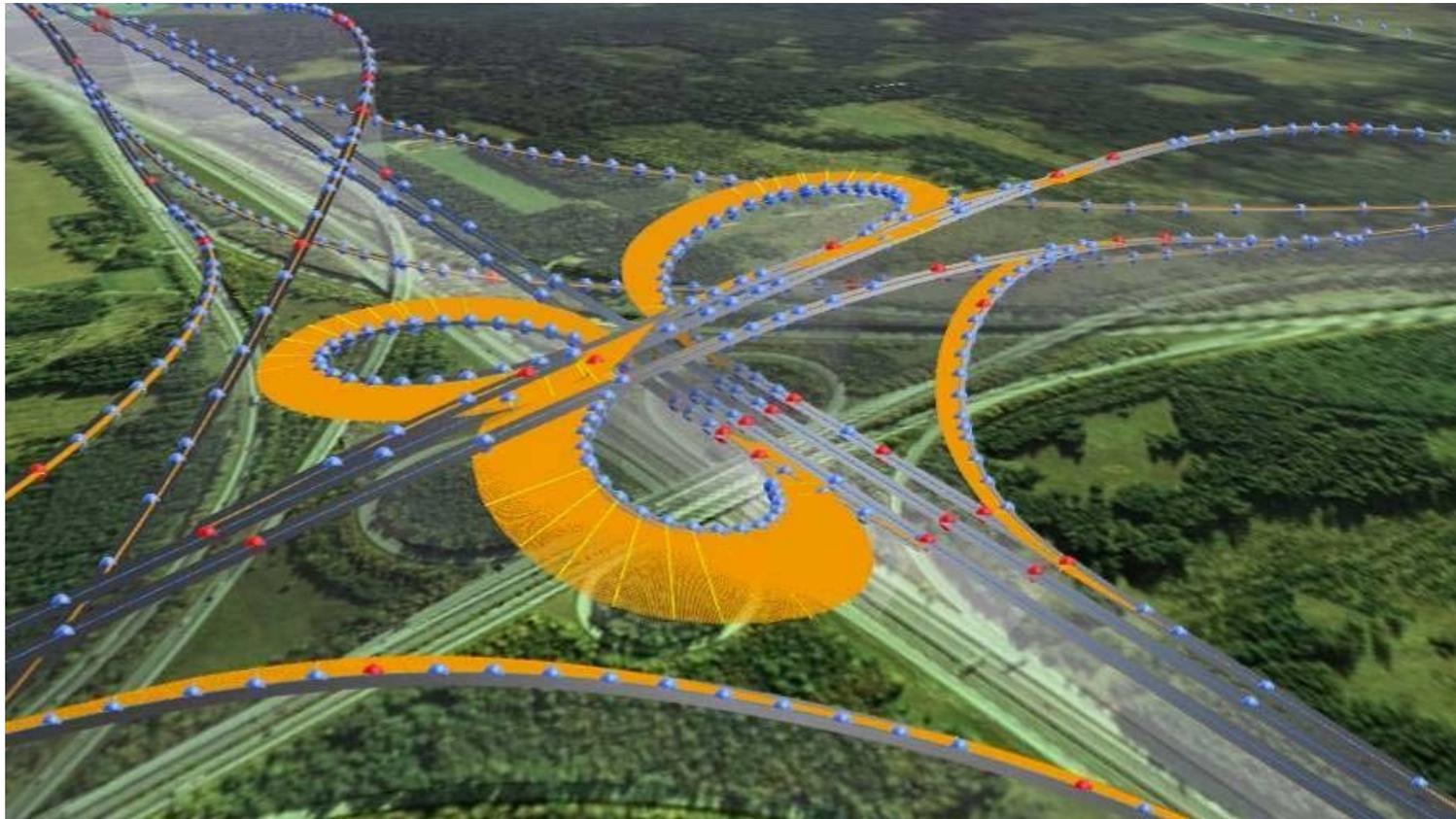
Kees Wevers, President TN-TS



Expert meeting on priority action (b) of the ITS Directive - 15-10-2014, Brussels

# ITS digital maps: navigation drives the technology

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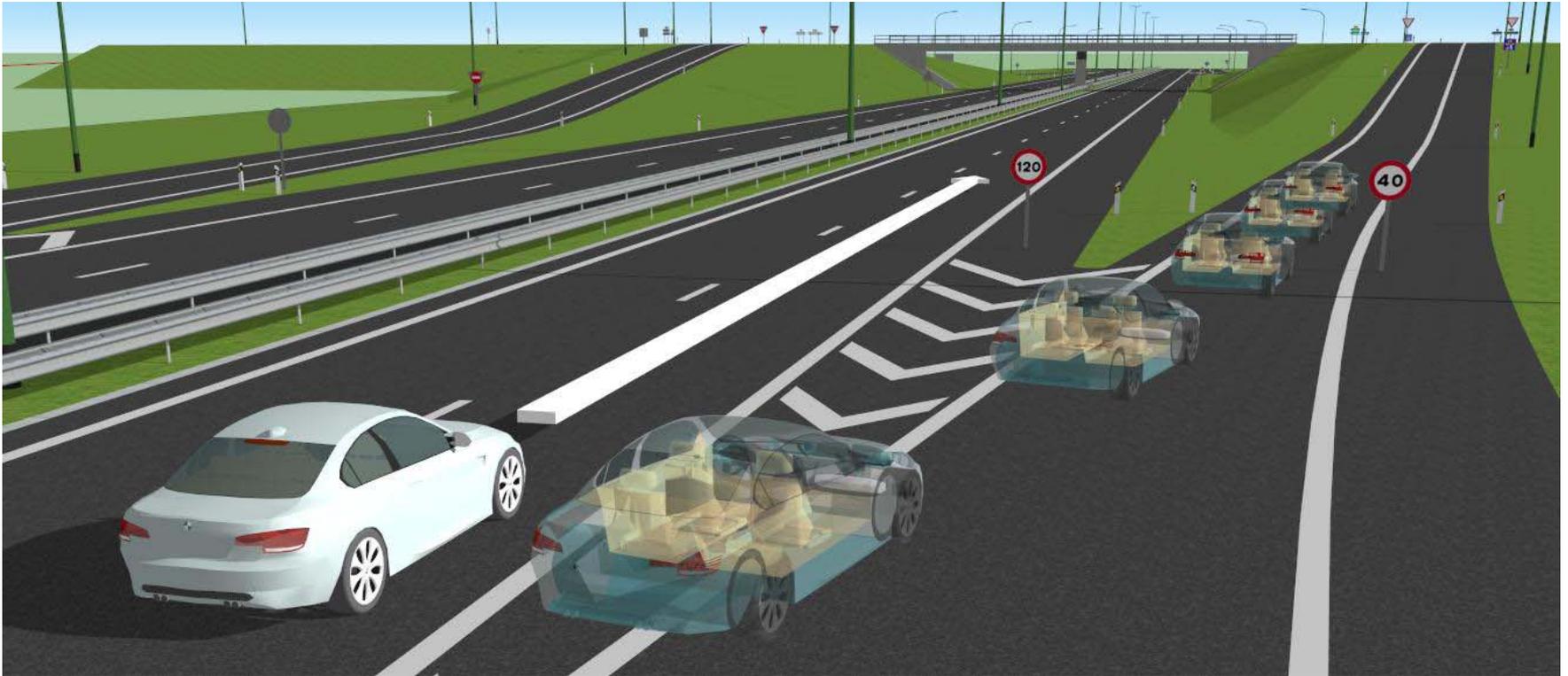


- routing for vehicles has been driving the technology for some 20 years
- basics of vehicle navigation:
  - search/destination selection/routing/positioning/guidance/map display
  - road-centrelines structure of the data underneath

Image: NAVTEQ (Nokia/HERE) / presentation,

# navigation → ADAS → cooperative → automated

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- advanced automotive applications require more accurate positioning and thus accurate/precise maps:
  - ADAS Geometry, more detailed lane level modelling
- safety, efficiency and comfort need look-ahead capability
- timeliness of updates

# 30 years evolution of the digital map for ITS

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- 1984 foundation of Tele Atlas, Belgium
- 1985 foundation of Navigation Technologies (NavTech), USA
- 1985 start of GDF development (Demeter project)
- 1986 start of the development of the Carin **navigation** system (Philips)
- 1991 foundation of European Geographic Technologies (EGT), The Netherlands
- 1995 (around this time) first use of term ADAS and gradual start of development (from ~1999 real take-off)
- 1996 first factory-installed vehicle navigations system (Carin, BMW)
- 1996 Philips merges EGT into NavTech, headquarters Chicago
- 1996 completion of CEN GDF 3.0 as ENV14825:1996
- 1999 IN-ARTE project, on integration of **ADAS** applications
- 2000 Tele Atlas acquires Etak (USA) from Sony
- 2001 foundation of the ADASIS Forum
- 2004 start of EU-funded PReVENT/MAPS&ADAS project (Feb 2004/Jan 2007) - developed ADASIS v1
- 2004 start of the work on the Navigation Data Standard (NDS)
- 2004 Navigation Technologies renamed to NAVTEQ & NYSE IPO
- 2004 completion of ISO GDF 4.0 as ISO14825:2004
- 2006 start of SAFESPOT (01/2006-12/2009) and CVIS (06/2009-06/2010) projects on **cooperative systems**
- 2007 TomTom acquires Tele Atlas
- 2008 Nokia acquires NAVTEQ
- 2011 Nokia integrates NAVTEQ as a division
- 2011 completion of ISO GDF 5.0 as ISO14825:2011
- 2012 gradually increasing interest in **automated driving**, start WG Automation of iMobility Forum
- 2013 NAVTEQ renamed to HERE
- 2013 foundation of the Transport Network ITS Spatial Data Deployment Platform



# Increasing requirements for the map

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- turn-by-turn navigation
  - road centrelines, turn restrictions, speed limits, address ranges, POIs
  - connected networks
  - accuracy 5-20 m
- ADAS (advanced) driver assistance systems (autonomous ADAS)
  - curvature, slope, banking, traffic signs, splines
  - accuracy 1-5 m
- cooperative systems (cooperative ADAS - local dynamic map)
  - lane centrelines, intersection paths, stop lines, traffic lights
  - accuracy ~1 m (in which lane)
- highly automated<sup>1</sup> driving (HAD): driving still requires limited human input as not all driving situations/environments are supported
  - infrastructure objects for positioning (e.g. light poles)
  - accuracy < 1 m (where in lane)
- automated<sup>1</sup> driving (AD): vehicle drives by sensing its environment and navigates without human input

<sup>1</sup> alternative term: (highly) autonomous driving (as used in source)

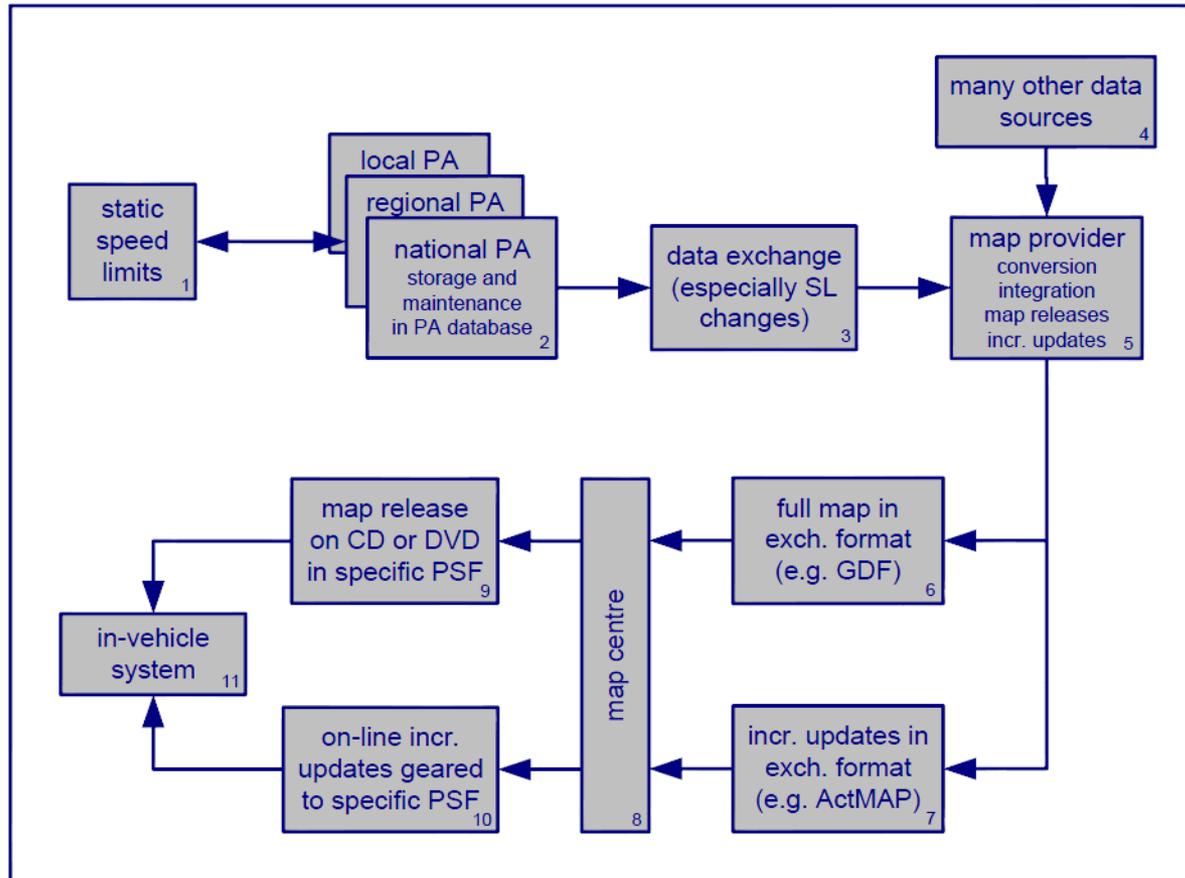
# The concept: exchange of updates for ITS maps

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- important that ITS digital maps are highly up to date for critical attributes (ADAS, cooperative systems, automated driving, as well as for other applications, e.g. public transport/multimodal)
- the ITS map providers cannot easily keep immediate track of changes
- a solution is to retrieve the information on changes from the most efficient source: road authorities, who make the changes
- can establish an additional trusted source for ITS map providers
- this approach requires digital storage and maintenance on the side of road authorities, and some kind of flagging of changes
- concern is road attributes based on regulations, but may extend to other map features, like public transport, and even geometry
- focus on updates concerning information that will go into the map
- multitude of solutions at governments that are different in terms of GIS and data models applied
- hence a common agreed exchange infrastructure is needed



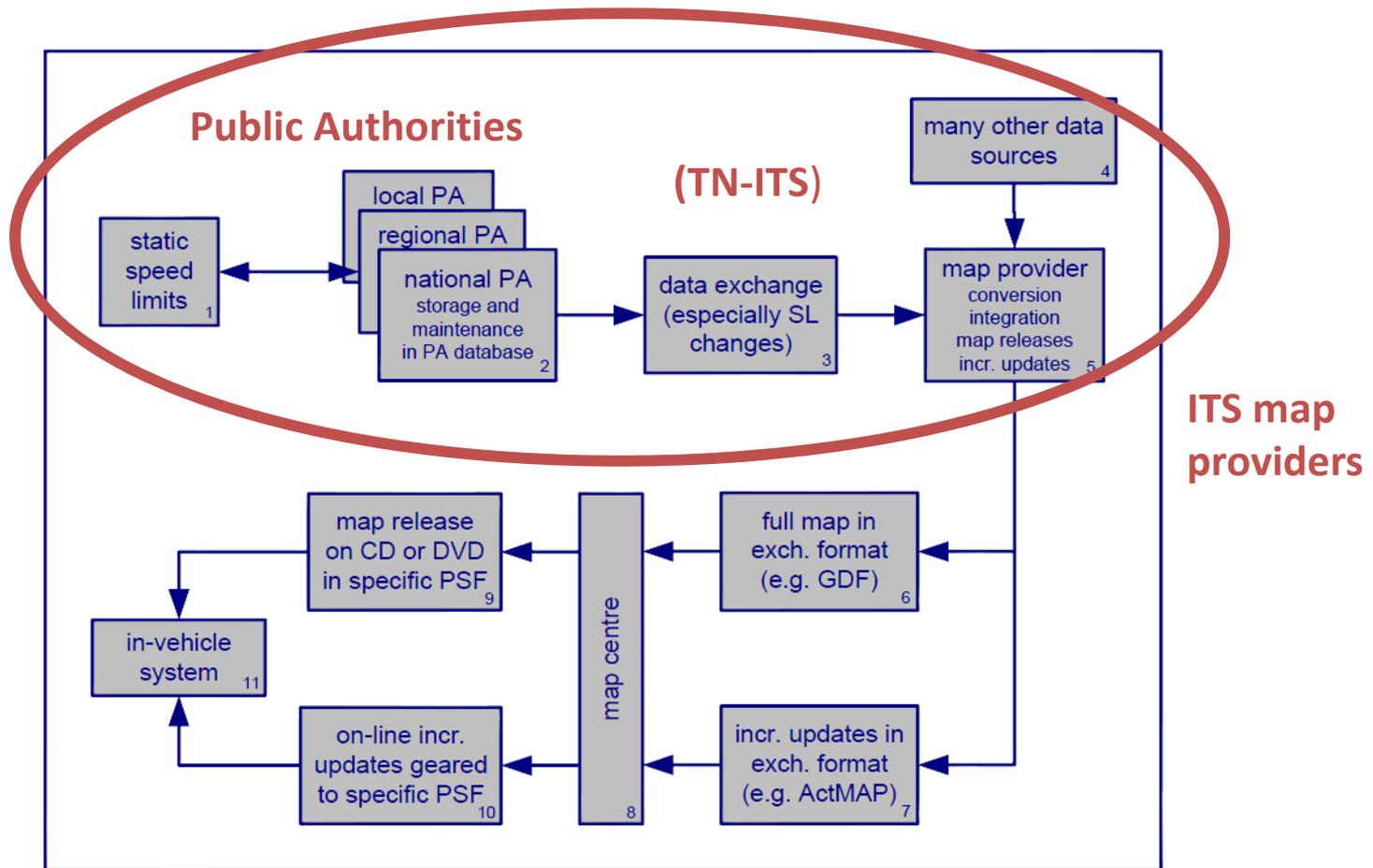
# The vision of the data chain: 2005



## Overview of the data chain for static speed limits

Source: Wevers, K., Lu, M. "Provision of in-vehicle speed limit information", ITS World Congress, San Francisco, November 2005 (with acknowledgement of the EU-funded SpeedAlert project)

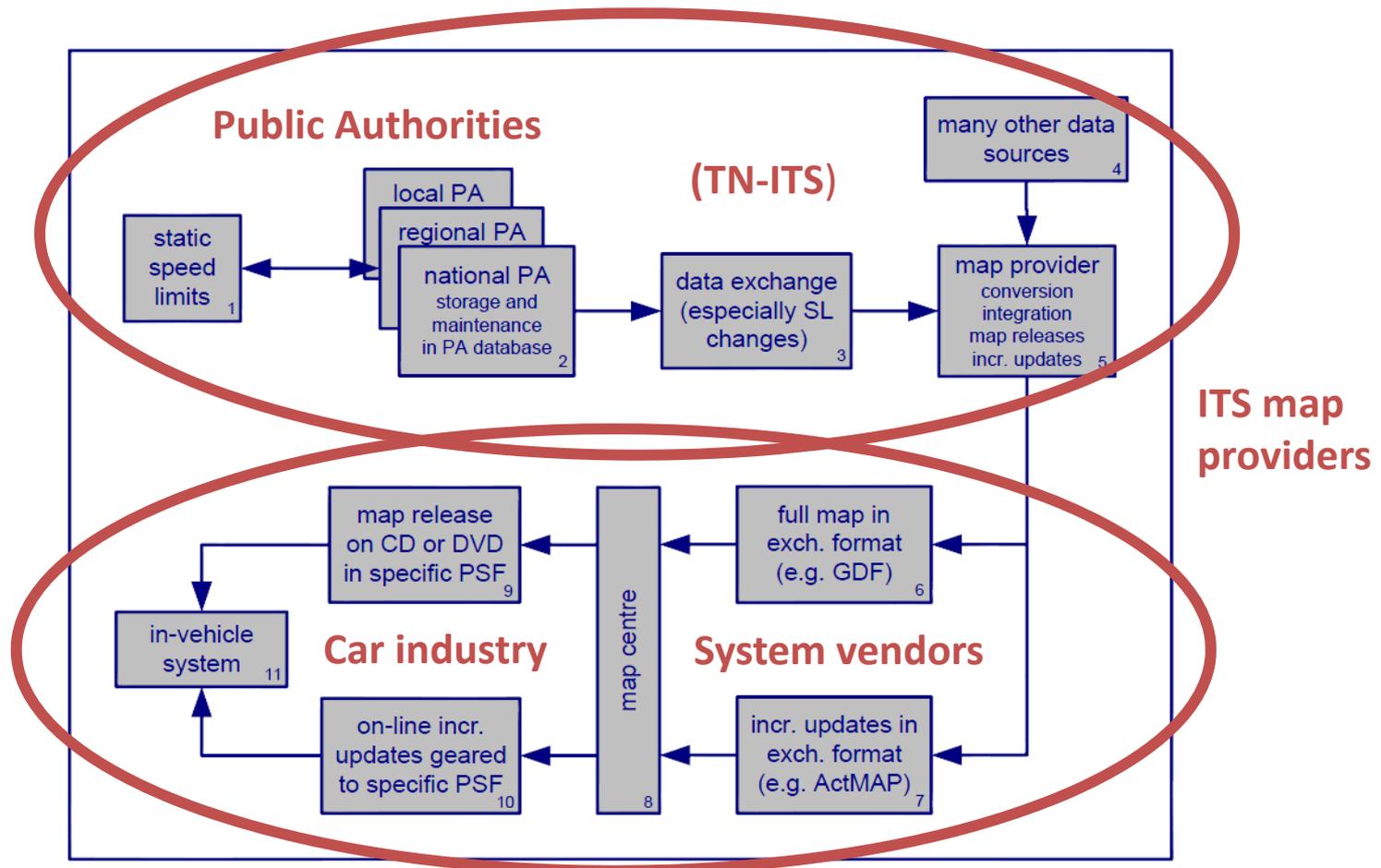
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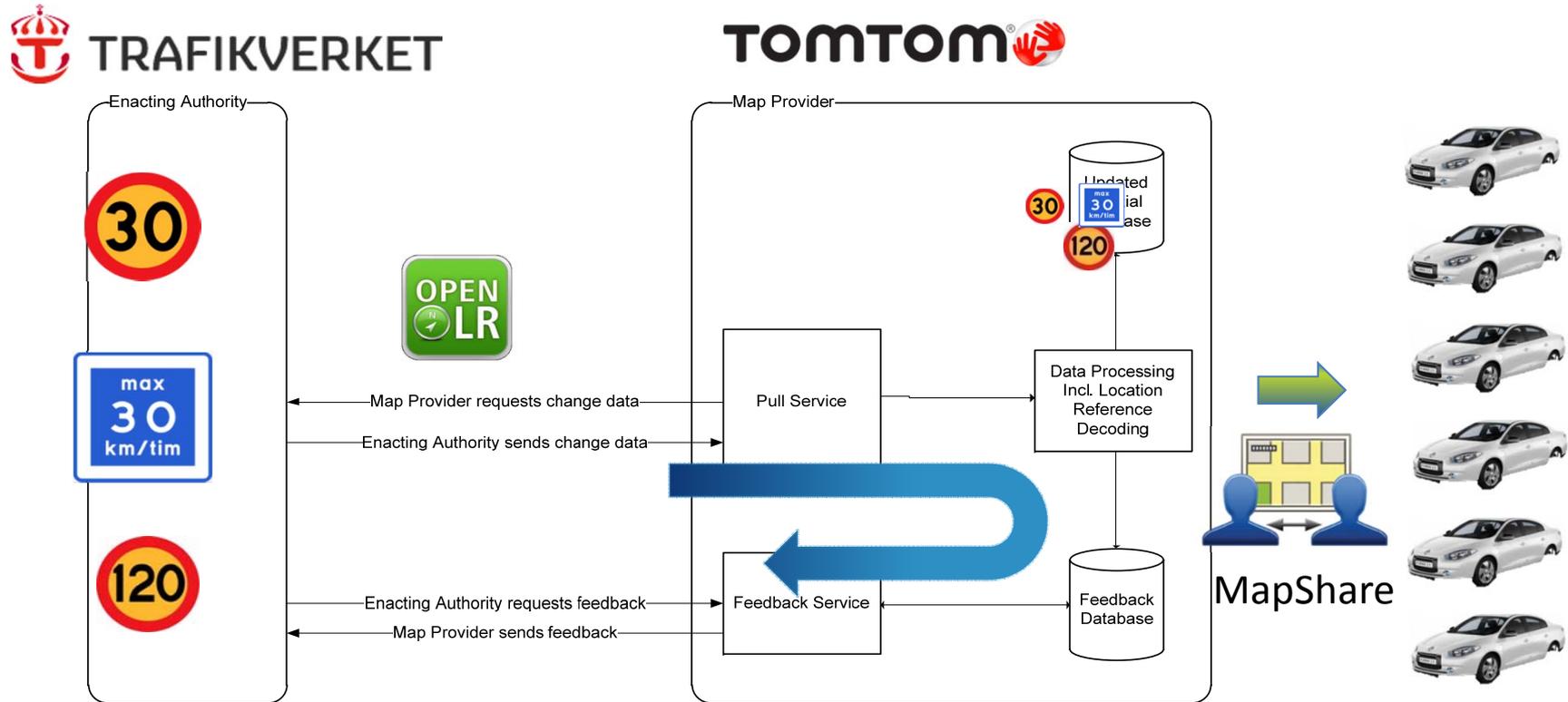
# Origins of TN-ITS

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- PReVENT/MAPS&ADAS project (Feb 2004/Jan 2007)
  - apart from the important work on the ADAS Interface Specification, this project extensively addressed safety-related road attributes for ADAS applications
- SpeedAlert project (May 2004/Jun 2005)
  - work on speed limit information in digital maps
- ROSATTE project (Jan 2008/Jun 2010)
  - aimed at establishing an efficient and quality-ensured supply chain for information on safety-related road attributes, from public authorities to commercial map providers and other road data users, with a focus on changes in the concerned attributes rather than full data sets
- Digital Maps Working Group of the iMobility Forum (Sep 2011/May 2013) and eMaPS project (same period)
  - prepared the creation of TN-ITS (as a deployment platform for roll-out across Europe)



# ROSATTE infrastructure still in place



Source: TomTom / presentation M. Flament 15-04-2013

# TN-ITS - basis, objective and mission

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- ITS Action Plan (16 Dec 2008) priority actions
  - (1.2) optimisation of the collection and provision of road data
  - (1.3) procedures for ensuring the availability of accurate public data for digital maps and their timely updating through cooperation between the relevant public bodies and digital map providers
- ITS Directive (7 July 2010) specification (b) items
  - (3) National access points
  - (4) Accessibility, publication, exchange and re-use of static road data
  - (8) Updating static road data
- INSPIRE
  - Transport Networks (TN) specification
- TN-ITS objective
  - to give support, on a permanent basis, for the implementation of priority actions 1.2 and 1.3 of the ITS Action Plan of 16 December 2008
- TN-ITS mission
  - to facilitate and foster, throughout Europe, the exchange of ITS-related spatial data between public road authorities as data providers, and map makers and other parties as data users



# TN-ITS working groups

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- WG 1 - Location referencing
  - dynamic methods not (always) sufficiently accurate for road data exchange
  - improve performance using current methods, additional attributes and elements of linear referencing
- WG 2 - Specifications and standardisation
  - bring the TN-ITS specification to a formal status
  - close cooperation with CEN/TC 278/WG 7
- WG 3 - Implementation support
  - provide guidelines, best practices and Q&A
  - support new implementation of road data maintenance and the TN-ITS framework
  - produce quality process for TN-ITS data suppliers (certification)
- WG 4 - Generic tools and reference implementation
  - provision of generic tools (interoperability testing, quality control and location referencing conversion) and a reference implementation
- WG 5 - Policy, awareness and dissemination
  - policy contributions along the current EU Directives: ITS, INSPIRE, PSI
  - promotion and dissemination actions



# ROSATTE exchange specification

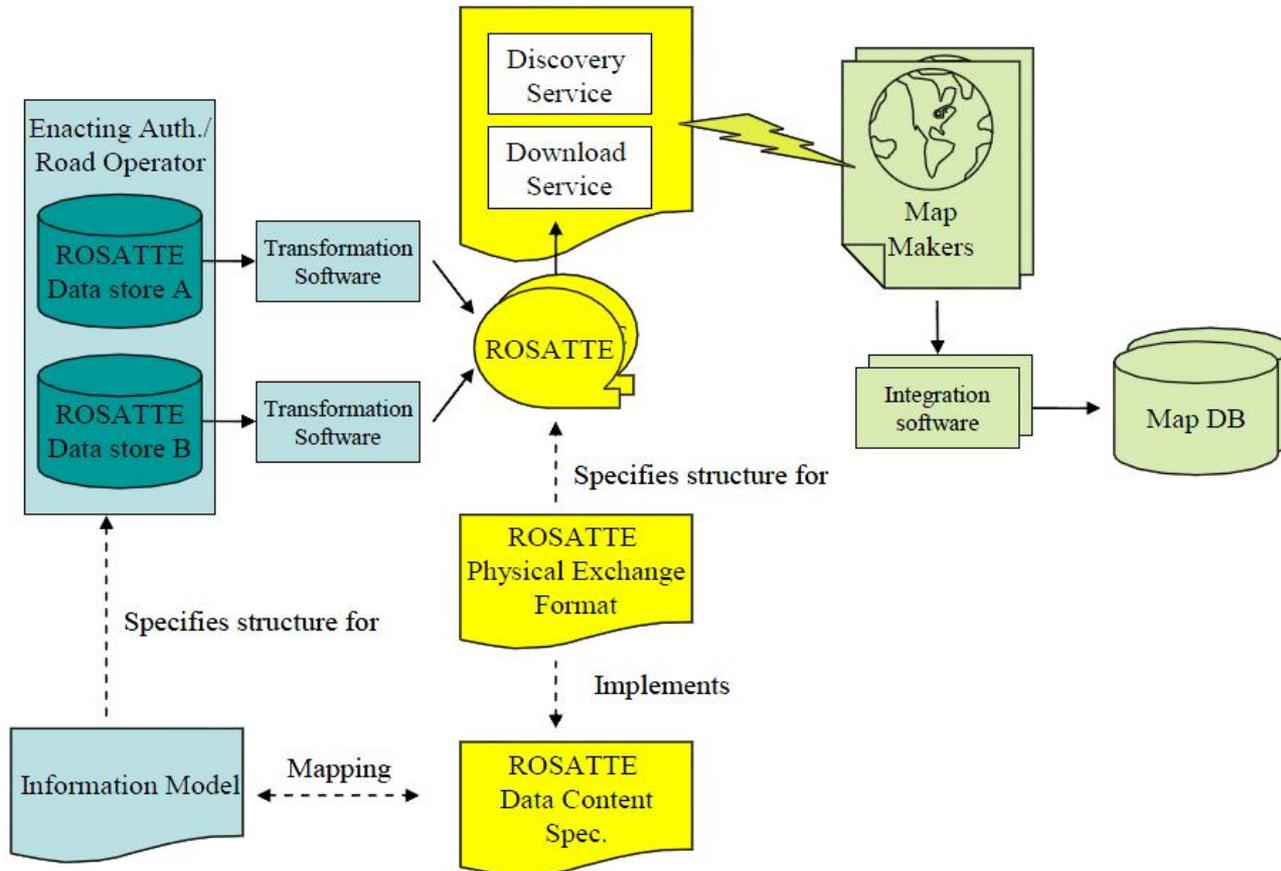
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- The ROSATTE project developed and tested specification for exchange infrastructure for static road data
- Components of the ROSATTE specification:
  - a conceptual specification of the data content (information model). This is done using UML (packages, class diagrams, attributes, associations and OCL constraints). The data content specification is organized in a number of packages where each package corresponds to a separate subset of the ROSATTE domain.
  - a physical exchange format (structure and coding using GML schema) to specify a coding for the various types of data listed under the conceptual model.
  - a service specification is implemented using UML (class diagrams), in order to facilitate the actual data flow between the various actors within ROSATTE. This service specification is inspired by INSPIRE network services architecture.

Source: Wikström, L. (ed.), et al., "Specification of data exchange methods", ROSATTE Consortium, deliverable D31, version 16 (final), 31 August 2009.



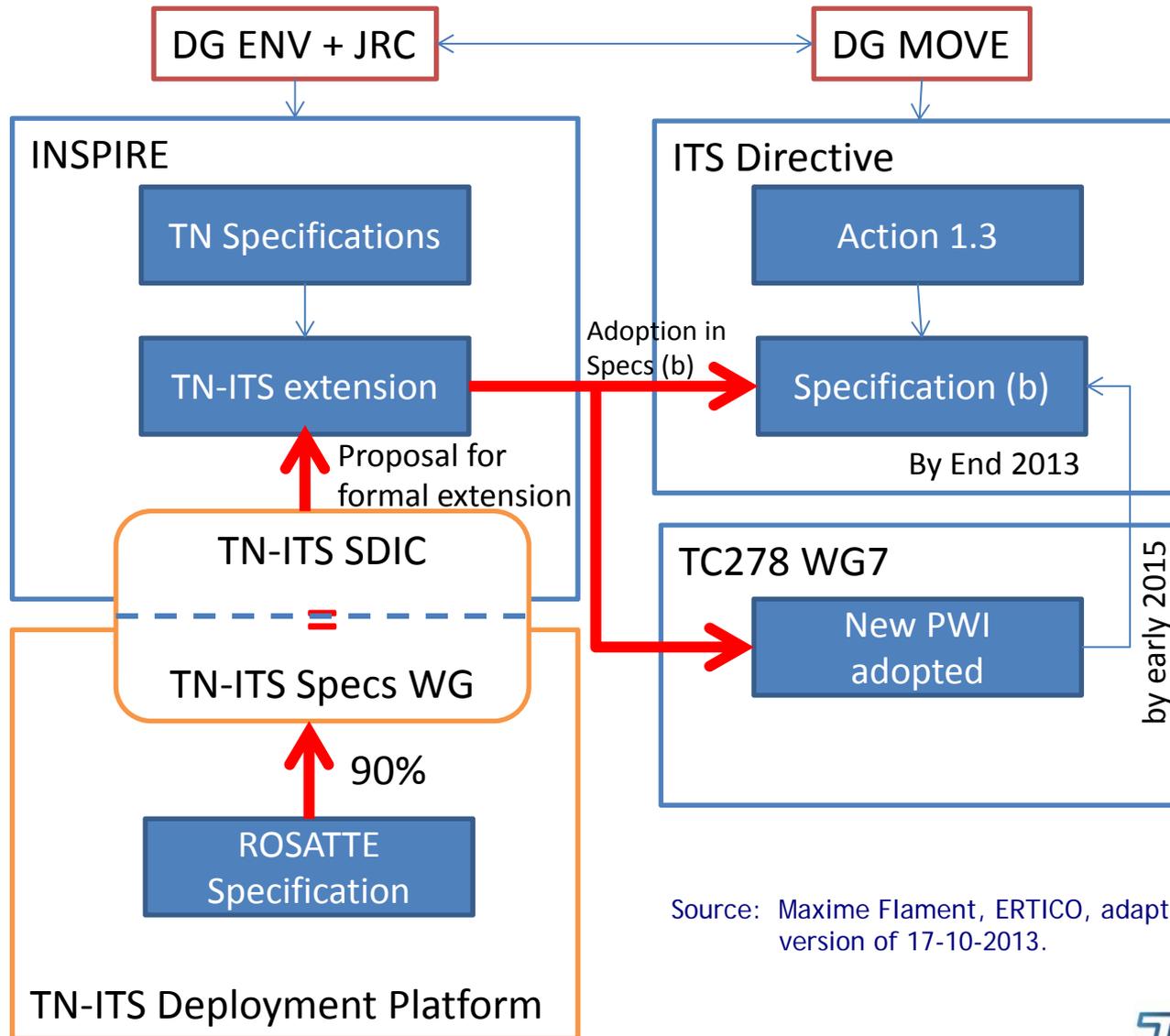
# The ROSATTE exchange framework: 2009



## Conceptual and concrete levels of the ROSATTE data exchange framework

Source: Wikström, L. (ed.), et al., "Specification of data exchange methods", ROSATTE Consortium, deliverable D31, version 16 (final), 31 August 2009.

# TN-ITS: flow of specifications



Source: Maxime Flament, ERTICO, adapted version of 17-10-2013.

# Transportation Pilot - driver for implementation

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- Joint collaborative effort of the JRC (through their EULF project), TN-ITS and the ELF project, to test the usability of INSPIRE for the transport sector
  - EULF: European Union Location Framework, a concept for an EU-wide, cross-sector interoperability framework for the exchange and sharing of location data and services; mission of the EULF project is to test this concept, inter alia by bringing INSPIRE to other sectors
  - ELF: European Location Framework, three-year EU-funded project aiming at delivering a pan-European cloud platform and web services building on INSPIRE to enable access to harmonised data in cross-border applications
- Phase 1: September 2014/March 2015
- Phase 2: March 2015/ December 2015
- Benefits for TN-ITS in Phase 1
  - Boost for implementation: NO/SE, HERE/TomTom
  - Enabling of linear referencing, testing of dynamic linear referencing
  - Quick progress with the TN-ITS specification
  - One or two other (less advanced) countries in Phase 2

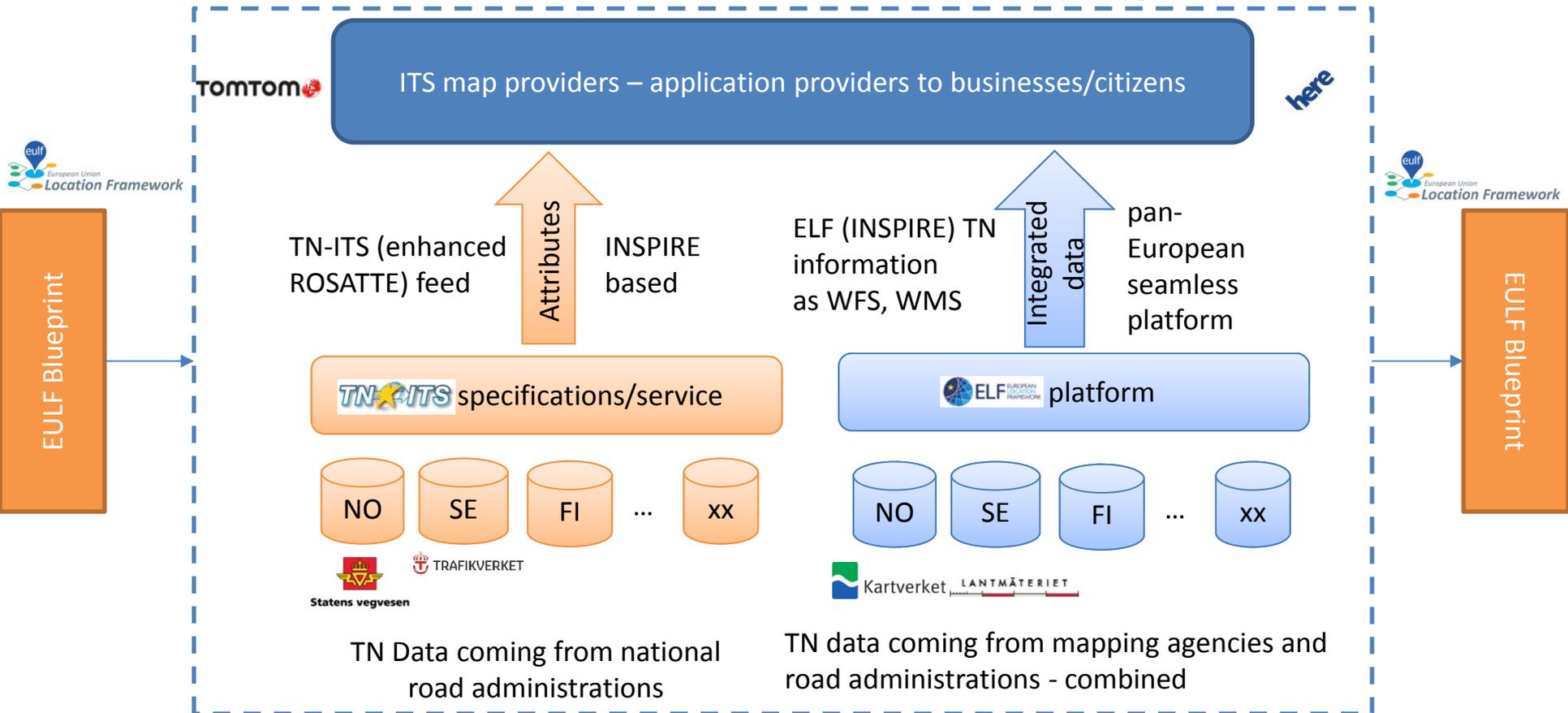


# The Transportation Pilot in one slide

**Phase 1** – test in Norway and Sweden - by March 2015



**Phase 2** – test in one other country – by December 2015



# Physical Storage Format

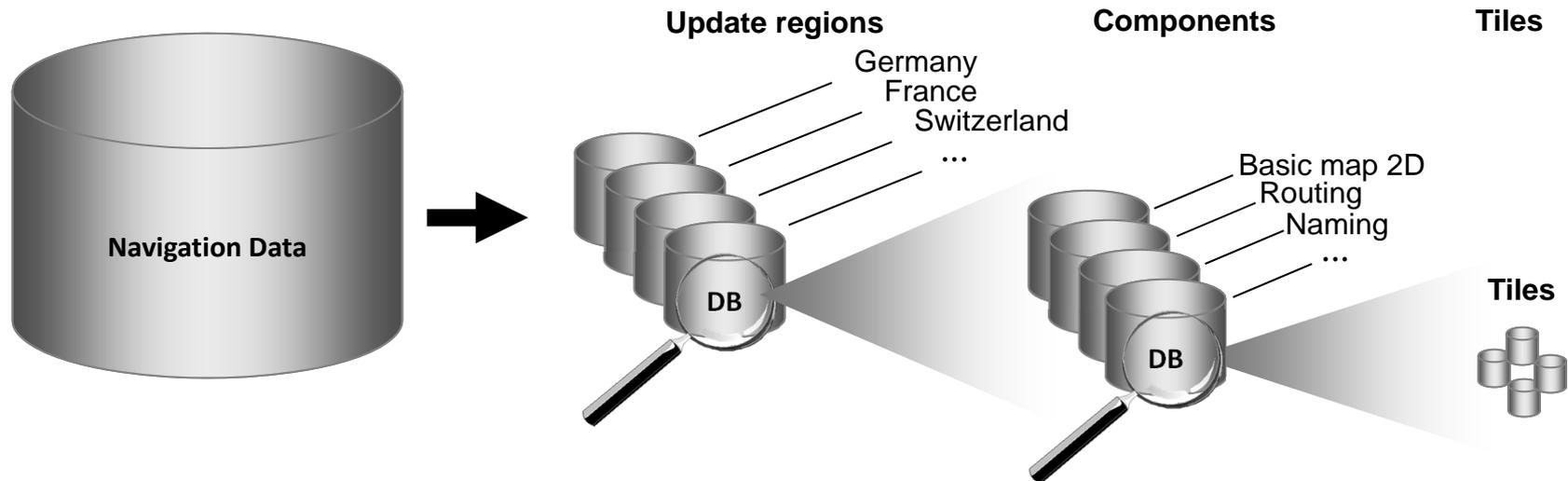
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- the run-time format for the map db that is used in the navigation system
- each system vendor used its own proprietary PSF
- disadvantages:
  - for each different PSF a specific compilation process is needed
  - map data can only be used in the specific system, no interchangeability
  - many different PSFs, therefore small series per vendor (CDs, DVDs)
  - even worse if incremental updating becomes a must
  - ERTICO "Committee for Global Standardisation of Digital Map Databases for ITS" looked into this topic (second half 1990s)
- in 1999 NavTech released its SDAL format for PSF
  - this format was not widely adopted and did not become an industry standard

# Navigation Data Standard

- industry initiative, started 2004, to develop a new standardised Navigation Map Format (or PSF)
- now a registered association with paying members
- will overcome the disadvantages mentioned
- will especially allow for incremental updating (tiled layers)
- each NDS db consists of different components stored in separate files



# Navigation Data Standard

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## Important features

- efficient mechanism for incremental updating
- use of SQLite database allows fast data access at small memory footprint
- digital rights management to prevent illegal copying
- sophisticated versioning for on-demand online updates
- building blocks allow flexible product configuration
- compatibility and interoperability

## However

- not a public standard, but an industry standard
- substantial admission and annual membership fees (EUR 60,000)
- map providers cannot deliver NDS formatted data to non-NDS members
  - it is permitted that navigation system vendors deliver NDS-based systems to non-NDS OEMs, and this does happen already

# Drivers for TN-ITS

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- Speed Assistance Systems in Euro NCAP protocol
  - map-based, camera-based or combination
  - may be a driver for accelerated introduction of such systems
  - this in turn may be a driver for the TN-ITS activities
- Transportation Pilot
  - showcase that INSPIRE (environmental) can be used in other sectors
  - JRC (EULF project) teams up with TN-ITS and ELF project
  - promising activity in terms of:
    - strengthening the links with the European Commission and INSPIRE
    - doing some actual roll-out of TN-ITS services
- In general: ADAS, cooperative ITS, (Highly) Automated Driving
- Strong involvement of and support from the ITS map providers

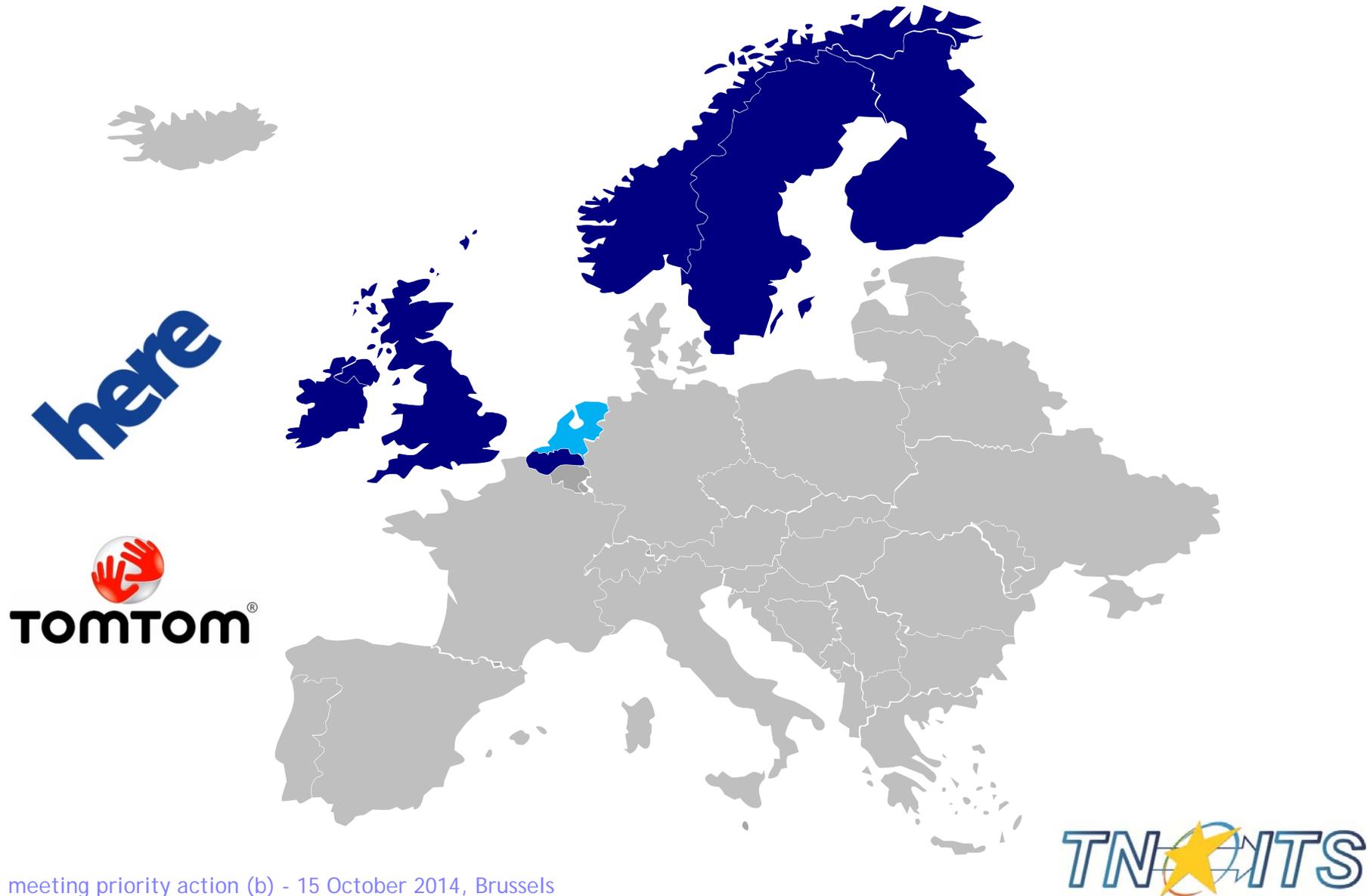
However,

- Increased involvement of public road authorities of countries across Europe is a must



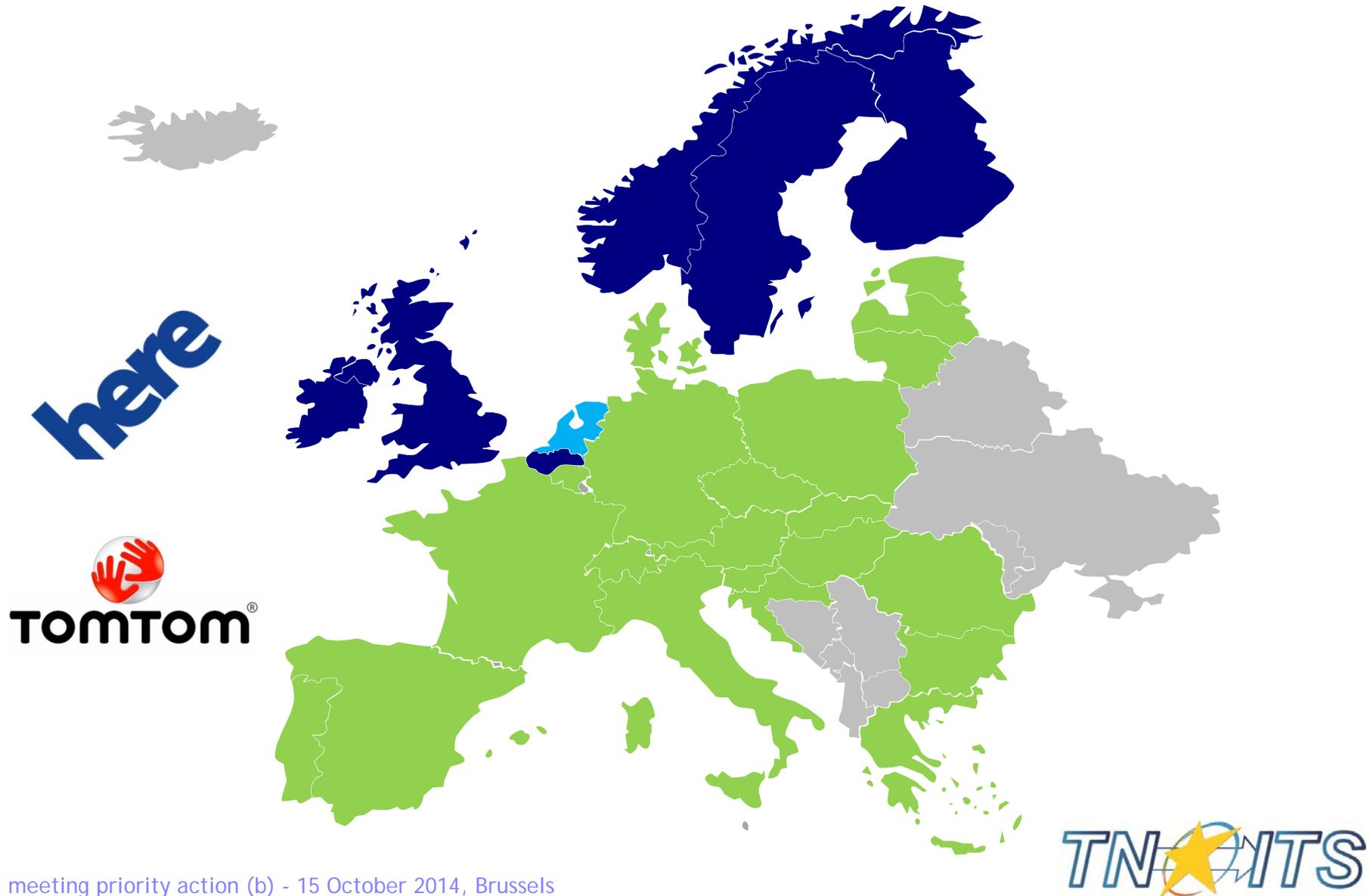
# TN-ITS membership - current members

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# TN-ITS membership - prospects

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# In conclusion

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- Status of TN-ITS and membership
  - substantial progress was made in starting up and establishing the platform, and in initiating its core activities
  - to make TN-ITS sufficiently interesting for members to be part of it, a significant increase of the membership is required
  - more involvement in the working groups is needed
  - especially membership of the other "big four" is a must (DE/FR/IT/ES)
  - this is a long-term effort with substantial potential benefits for public authorities and society in general, to enable highly up-to-date ITS digital maps for advanced mobility applications
  - TN-ITS exists primarily to facilitate member states in implementation of an important part of specification (b)

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