E-FRAME

Extend FRAMEwork architecture for cooperative systems

WP600

D16 – Current cooperative systems standardisation and its relation to ITS Architecture

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3	ATE	AustriaTech - Federal Agency for technological Measures	AT
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5	CTU	Czech Technical University in Prague	CZ
6	CERTU	Centre for Studies on Urban Planning Transport Utilities and Public Construction	FR
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Executive Summary

The objective of this document is to describe the links between the current (July 2011) standardization activities, with an emphasis on cooperative systems, and ITS architecture. It also provides guidelines for the use of standards in this area by giving information on Standards Development Organizations, the main standards currently available, ongoing activities (including the work being done in response to Mandate M/453) and makes recommendations for the usage of standards together with the cooperative systems architecture. Finally, this document proposes measures or tools for a more efficient and better utilization of standards.

It introduces the current situation in standardization by highlighting the benefits of having standards and presenting the main National Standards Organisations, together with the most important standards in the field of cooperative systems and ITS architecture. The global point of this view is very important, as the ITS architecture domain has several levels of relationship with standards (different types of standards). This is because there are two main levels of architecture; the "high" level from which specifications of what is needed to fulfil services can be produced, and "low" level which describes actual component design. The consequence is that any standards coming from "high" level architectures will be more generic, e.g. definitions of terms, and standards coming from "low" level architectures will be more technically orientated, e.g. defining communications mechanisms.

The document describes today's situation in standardization in relation to the FRAME Architecture and cooperative systems with respect to the ongoing activities mainly, but not only, on the European level including the contribution of the E-FRAME project via its members.

The process of standards creation is very complex; therefore with regard to the actual need and the future usage of this document, it does not aim to give a full list of standards related to the FRAME Architecture, as this information starts to be obsolete from the moment the standards are summarized. It therefore aims to give useful recommendations of how the standards and ITS architectures can be used together to achieve greater mutual benefit. For this purpose a tool for working with standards is proposed, based on an example from the Czech Republic. The principles of this tool can be generalized and serve as a guideline for work with standards in other countries or at the European level, and thus significantly contribute to the use of standards in relation with the ITS Architecture.

Contents

1 Introduction

1.1 Outline

This document is the final deliverable produced by Work Package 600 of the E-FRAME project. The aim of this deliverable is to show how the FRAME Architecture, which has been extended to include support for cooperative systems, is being used to influence some of the standardization activities that are currently developing standards for cooperative systems. This deliverable summarizes WP 600 results.

1.2 Scope of the document

At the time of the project proposal, the objective of WP600 was to take part in the standardization process and to help standardize new “ideas” emerging from its work within cooperative systems community.

However, in the meantime, it was found, that such task was unnecessary because of the active role of EC in cooperative systems, as described further in this document, that occurred independently of, and at the time the project began. Even though E-FRAME did not propose any standards by itself, it has actively participated in the CEN/ISO standards Working Group responsible for cooperative systems, as well as in the EU-US Task Force.

It was therefore decided to amend / remodel the document to better fit to current situation in ITS and procurement of ITS architecture. Therefore the document now focuses on explaining the current status of cooperative systems standardization and on proposing how to fit standards and ITS architecture together in the most efficient and effective way.

1.3 Document structure

This document begins by providing information about standardization in general, starting with the reasons for having standards and describing the main standardization organizations. Then it focuses on the ongoing European activities in the field of standards for cooperative systems, all driven along by developments in Europe, the US and Japan. Standards related to Architecture and cooperative systems are categorized and briefly described. Furthermore, a description of national architectures usage, and experience with them, is given, resulting in recommendations on how to approach standards in Framework ITS Architectures and how to promote the use of ITS architectures at the national level.

2 Terms and definitions

Architecture
A set of concepts and rules for a system that describes the inter-relationship between entities in the entire system, in a way that is independent of the hardware and software environment. An architecture is described through a series of viewpoints that may be at varying levels of generality/specificity, abstraction/conception, totality/component and so on. [ISO TR26999]

Viewpoint
The representation of a system from the perspective of an identified set of architecture related concerns. Often they will be used to show such things as functionality, physical components, communications requirements, organisational issues, etc. [ISO TR26999]

Publicly Available Specification
A normative document that does not fulfil the requirements of an International Standard but is published prior to the development of such a standard. In IEC it may be published in collaboration with an external organisation. In ISO (and CEN) the decision to publish a Publicly Available Specification shall require a simple majority of voting members. It shall only remain valid for a maximum period of three years at which point it needs to be reviewed for continuing validity.

Technical Specification (TS)
A normative document that is produced when something is still be developed or where for any other reason there is the future but not immediate possibility of an agreement to publish an International Standard. In ISO (and CEN) the decision to publish a Technical Specification shall require a two thirds majority of voting members. It shall be reviewed for continuing validity not more than three years after its first publication.

Technical Report (TR)
An informative document that does not contain any materials that is normative, i.e. that says what is "required" or what "must" be done. So, for example, it can contain advice on how something should be done, the results of surveys, etc. The process for creating a Technical Report is much shorter and in ISO (and CEN) only requires a simple majority of voting members. Once produced it should be regularly reviewed for continuing validity.

International Standard (IS)
A normative document, developed according to consensus procedures, which has been approved as a draft International Standard and/or as a final draft International Standard and which has been published by the ISO Central Secretariat. In ISO (and CEN) the decision to

publish a Technical Specification shall require a two thirds majority of voting members. An IS must be reviewed for validity no more than five years after publication.

(Note: the above descriptions of the different types of standards documents are based upon the contents of ISO/IEC Directives, Part 1, seventh edition, 2009. The different processes used to prepare these standards are illustrated by Figure 1 in section 4.4.)

2.1 Abbreviations

2.1.1 General

- CEN Comité Européen de Normalisation
- ETSI European Telecommunications Standards Institute
- CENELEC European Committee for Electrotechnical Standardisation
- ITS Intelligent Transport Systems
- ISO International Organization for Standardization
- SAE Society of Automotive Engineers
- IEEE Institute of Electrical and Electronics Engineers
- IEC International Electro technical Commission
- CALM Communications Access for Land Mobiles
- CVIS Cooperative Vehicle Infrastructure systems
- SAFESPOT Safe Spot
- COOPERS Cooperative Systems for Intelligent Road Safety
- LDM Local Dynamic Map
- NSO National Standards Organisation
- VMS Variable Message Sign
- WG Working Group
- TC Technical Committee
- ACC Adaptive cruise control

2.1.2 Abbreviations related to ISO standards development stages

- PWI Preliminary Work Item - initial feasibility and scoping activities
- NP New Proposal (or study period) - formal scoping phase

- WD Working Draft (1st WD, 2nd WD etc.) - development phase
- CD Committee Draft (1st CD, 2nd CD etc.) - quality control phase
- FCD Final Committee Draft - ready for final approval
- DIS Draft International Standard - nearly there
- FDIS Final Draft or Distribution International Standard - just about ready to publish
- IS International Standard – published

2.1.3 Abbreviations related to ISO documents

- ISO/PAS Publicly available specification.
- ISO/TS Technical specification.
- ISO/TR Technical report.
- ISO/IS (ISO) International Standard

3 Why develop standards?

3.1 Some reasons for developing standards

There are many reasons why standards need to be developed. Some of the most important of these are that standards will provide a:

- Consistent and clear expectations for product performance;
- Foundation for regulatory compliance;
- Basis for consistent product quality;
- Product compatibility and interoperability;
- More efficient procurement due to the previous points
- Mechanism to lower trade barriers, making it easier for manufacturers to compete in markets where there are a known set of product standards;
- Mechanism to lower purchasing costs, because the lower trade barriers encourage more organisations to develop competing products and because the same product can be produced for a wider market;
- Decrease in design time through the ability to use such things as common hardware and electrical architecture, resulting in an increase in the speed with which new technology is adopted in the market place;
- Mechanism to promote innovation and foster competition;
- Advance in the collective technology of industry.

These reasons do not just apply to Europe and are considered to be important by many organisations around the world.

3.2 Barriers to standards development and adoption

There are many organisations that are fearful of standards and in some cases will actively discourage their creation and adoption. Part of the reason for this is that these organisations may have already developed "proprietary" standards from which they derive a competitive advantage for their products. An example of this is the tolling industry, where standards have only started to appear after several competing products have appeared on the market. The result of this has been to lengthen the standards development process and has led to some compromises over the technical details that are included in the standards.

Other reasons that have been cited by some organisations for not supporting the development of standards include, the cost of adapting existing systems to conform to a new standard, the cost of demonstrating compliance with a standard, the speed (or lack of it) and cost associated with developing standards, politics and the availability of the standards themselves. Often organisations will say that they see no sales advantage in adopting standards and that in fact it makes life easier for their competitors.

Finally there is no universal compunction on the part of organisations to require that the systems they purchase conform to standards. Indeed it has been known for particular organisations to write their specifications in such a way as to avoid compliance with certain standards.

3.3 Standards for cooperative systems

The current effort to create standards for cooperative systems is attempting to mitigate the effect of "proprietary" standards by developing them at the "proof of concept" stage achieved by the work of projects such as COOPERS, CVIS, SAFESPOT and others. Thus there are few, if any, cooperative systems products for which "proprietary" standards have been developed. Also regulatory organisations such as the European Commission, the US Department of Transport are taking an active part in the development of cooperative systems and are keen to ensure that standards are available at an early stage to promote such things as product inter-operability and supplier competition.

What is not clear is how much regulation will be needed to ensure that standards are included as a requirement for the implementation of cooperative systems. At the moment the use of standards is largely voluntary and at the discretion of the stakeholders promoting the implementations. It remains to be seen whether cooperative systems will follow the example of the mobile phone market place where standards are common and enable existing manufacturers to compete and new manufacturers to enter the market. If it does not, then some coercion may be necessary, which in Europe may be the imposition of European Directives. These are promoted and drafted by the European Commission for adoption by the European Council and the European Parliament.

4 Standardization organizations and standardization process

4.1 Introduction

This chapter provides overviews of the main Standards Development Organisations (SDO's) around the world that are involved in the creation of standards for cooperative systems. There are varying methods for standards development amongst the SDO's and this deliverable uses the ISO document stages as an example that is relevant to ITS standards. Standards development has become a world-wide activity because cooperative systems are being developed in one form or another in different regions and counties, such as Europe, the United States and Asia, i.e. Japan and Korea. One factor that is driving this is the globalisation of many automotive manufacturers making it increasingly common for vehicles and some of their components to be produced in countries other than the ones in which they will be sold and used when new.

Attention was drawn to the need for harmonised international standards for ITS in a press release produced by the International Organization of Motor Vehicle Manufacturers (Organisation Internationale des Constructeurs d'Automobiles - OICA, which was founded in Paris in 1919). In it, OICA said that these standards are should be produced to avoid the need for automotive manufacturers to "develop their own unique systems for regional markets". If this were to happen then, in the view of OICA, the development of ITS would be hampered by the creation of "ad hoc" standards that were unique to particular manufacturers and/or world regions.

The next chapters will briefly introduce following standards development organizations:

- Comité Européen de Normalisation (CEN),
- European Telecommunications Standards Institute (ETSI),
- European Committee for Electrotechnical Standardisation (CENELEC),
- International Organization for Standardization (ISO),
- Society of Automotive Engineers (SAE),
- Institute of Electrical and Electronics Engineers (IEEE),
- International Electro technical Commission (IEC) and
- Their mutual cooperation.

4.2 European SDOs

4.2.1 CEN

The Comité Européen de Normalisation (CEN) is one of the European Standards Development Organisations (ESDO's) creating and updating standards across a selected[1] range of domains in Europe. In general, but not solely, it is divided into what are called Technical Committees (TC's), which may themselves have sub-committees and/or working groups. Other ESDO's use different structures for their organisations. The Technical Committee 278 (TC278) is the oldest standards group in the ITS field having been established in 1991. In fact its name, Road Transport and Traffic Telematics (RTTT), predates the creation of the term ITS by several years.

TC278 is divided into several parts which are called Working Groups (WG). Each WG concentrates on the creation and maintenance of standards in a particular area, e.g. tolling, Public Transport and travel information. WG's only remain in existence for as long as they have a programme of work to create new standards, or to update those that have already been created. Once the programme of work is completed, the WG will become dormant and will only be revived if there is some further work for it to do. The list of the WG's that are currently part of TC278 is shown in Table 1. CEN TC278 has a new web site at: http://www.itsstandards.eu.

Table 1 Working Groups within CEN TC278

Number	Title
WG 1	Automatic Fee Collection and Access Control
WG 2	Freight, Logistics and Commercial Vehicle Operations
WG 3	Public Transport
WG 4	Traffic and Traveller Information
WG 5	Traffic Control (dormant)
WG 6	Parking Management (dormant)
WG 7	Geographic Databases (dormant)
WG 8	Road data traffic/Elaboration, storage and distribution

[1] The domains that CEN and CENELEC each support are very clearly defined to prevent overlap between the two organisations. A similar situation exists for ISO and IEC – see section 4.3.

Table 1 Working Groups within CEN TC278

Number	Title
WG 9	Dedicated Short-Range Communication (dormant)
WG 10	Man-Machine Interface
WG 11	Subsystem and Intersystem Interfaces (dormant)
WG 12	Automatic Vehicle and Equipment Identification
WG 13	Architecture and Terminology
WG 14	After theft Systems for Stolen Vehicles
WG15	Safety Systems (eCall)
WG16	Cooperative Systems

The standards that CEN produces are available through several organisations, but chiefly from the National Standards Organisations (NSO's), such as O-NORM (Austria), AFNOR (France), DIN (Germany), BSI (UK) and CNI (Czech Rep.). A fee is payable to the NSO for each copy of most but not all of the CEN standards, the money being used to support the work of both the NSO and CEN. Some organisations are registered as members of their local NSO and thus can obtain their copies as part of a bulk purchase arrangement.

TC278 has produced many successful standards in the ITS domain using a methodology that is similar to that used by ISO, which is described in section 4.4. One prime example is Dedicated Short-Range Communication (DSRC) using 5.8GHz which has been sold worldwide for use in tolling systems. It is estimated that there are more than 30 million units in daily operation. TC278 has many other standards in its repertoire, such as tolling (EFC), electronic licence plates (AVI/AEI/ERI), public transport interoperability, parking support, and so on.

Because of the importance of cooperative systems, TC278 has introduced a new Working Group (WG16) that is specifically dealing with this area of standards creation. Further information about CEN and its standards can be found from its website at: http://www.itsstandards.eu.

At least three of the E-FRAME partners (PJCL, Siemens plc and CTU) are actively involved in the work of CEN TC278. The Siemens plc representative (Richard Bossom) is the convenor of WG13 (Architecture and Terminology) and actively participates as a member of WG16 (Cooperative Systems), being involved in the work in response to Mandate M/453 – see section 5.2. CTU representative (Petr Bureš) is a long time member of WG12 (Automatic Vehicle and Equipment Identification).

A further example of the involvement of the E-FRAME partners (Siemens and PJCL) in standards work is the creation of a new standard, TR26999. This is a Technical Report that describes the methodology behind the creation and use of the FRAME Architecture. It is currently in the final stages of preparation and should be published shortly.

4.2.2 ETSI

The European Telecommunications Standards Institute (ETSI) produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies. Founded initially to serve European needs, ETSI now has over 700 organisations in 60 countries across 5 continents that are members. The fees paid by its members are dependent on their business turnover and range up to about 150,000 Euro per year. By having membership fees, ETSI is able to make the standards that it produces freely available to download from its website at: http://www.etsi.org/WebSite/Standards/Standard.aspx.

ETSI has been active in this field of ITS standardisation since before 2008, but this aspect of its work achieved more prominence within the organisation with the establishment of Technical Committee ITS (TC ITS) in 2008. This is one of the more active European SDO's and has a high level of participation from automotive manufacturers. The main subject of the work by TC ITS concerns communication subsystems and its activities are split amongst the Working Groups shown in Table 2.

Table 2 Working Groups within the ETSI TC ITS

Working Group	Title
WG1	Application Requirements and Services
WG2	Architecture and Cross-layer coordination
WG3	Transport and Network
WG4	Media and Medium Related
WG5	Security

The TC had an early focus on a European variety of 5.9GHz safety relevant communication. To meet this aim, ETSI has developed basic communication architecture co-ordinated with the COMeSafety and latterly PRE-DRIVE C2X communications architecture deliverables. It is also developing two data set standards for cooperative multicast CAM (Cooperative Awareness Message) and DENM (Decentralised Environmental Notification Message) and network standards for Vehicle-to-Vehicle geo-addressing and basic operation of 5.9 GHz in Europe. Other parts of its work include security, conformance to regulatory requirements for privacy, data protection, lawful interception and data retention, interoperability testing procedures and test suites, the development of data transport and network protocol layers and management of these layers including network architecture, novel networking protocols for ITS, reliable transport protocols over multi-hop routing, integration of dedicated ITS network protocols and transport protocols with the Internet protocol suite and IP mobility extensions, standardisation on OSI model layers 1 and 2 including the management of these layers

Some of the above tasks have been financially supported by funding from either ETSI or the European Commission, or both. This support has enabled the process of creating the ETSI standards to be accelerated. A full overview of the ETSI TC ITS activities can be found at: http://portal.etsi.org/its.

4.2.3 CENELEC

CENELEC is the European Committee for Electrotechnical Standardisation. It was created in 1973 as a result of the merger of two previous European organizations, CENELCOM and CENEL. CENELEC is a non-profit technical organization and is composed of the National Electrotechnical Committees from 31 European countries. The organisation is more complex than that of CEN, but like CEN it has Technical Committees that actually do the work and like CEN these are split into Working Groups. The main focus of CENELEC work is on things such as electrical connections and is therefore not directly relevant to ITS. Much more information about CENELEC can be found from its website which is at: http://www.cenelec.eu/Cenelec/Homepage.htm.

4.3 Worldwide or outside Europe SDOs

4.3.1 ISO

As its name implies, the International Organization for Standardization (ISO) is the SDO that creates and updates standards across a selected[2] range of domains for world-wide use. There are several similarities between ISO and CEN: In general but not solely it is divided into Technical Committees (TC's), which may themselves have sub-committees and/or working groups This structure enables each part of ISO to concentrate on the creation and maintenance of standards in a particular area. Copies of the standards it produces are available through several organisations but chiefly the National Standards Organisations (NSO's), with a fee being required for a copy of most of them. In ISO it is

[2] The domains that ISO and IEC each support are very clearly defined to prevent overlap between the two organisations. A similar situation exists for CEN and CENELEC – see section 4.2

TC204 (established in 1993), that is responsible for standards that are relevant to ITS and the way that it creates them is described in section 4.4. Like the WG's in CEN TC278, those in TC204 only remain in existence for as long as they work to do and once this is completed they will become dormant until more relevant work is found. The list of the WG's that are currently part of TC204 is shown in Table 3.

Table 3 Working Groups within ISO TC204

Number	Title
WG1	Architecture, Taxonomy and Terminology
WG2	Quality and Reliability (dormant)
WG3	ITS Database Technology
WG4	Automatic Vehicle/Equipment Identification
WG5	Electronic Fee Collection
WG6	General fleet management (closed – merged with WG7)
WG7	Freight
WG8	Public Transport/Emergency
WG9	Integrated Management and Control
WG10	Traveller Information Systems
WG11	Route Guidance and Navigation Systems
WG12	Parking (dormant)
WG13	HMI (closed – transferred to TC22)
WG14	Vehicle/Roadway Warning & Control Systems
WG15	Dedicated Short Range Communications (dormant)
WG16	Wide Area Communications
WG17	Nomadic Devices
WG18	Cooperative Systems

ISO TC204/WG16 CALM has been very active and has produced or refined many of the base standards used in CVIS and other European projects. The full architecture and management subsystems in the CVIS platform are directly based on CALM standards, and CVIS is therefore the main validation source for this part of the work that ISO TC204 is doing. Most of the CALM base standards are already stable and are moving towards becoming fully published international standards. More information about ISO TC204 and its standards can be found from the website of the US Telecommunications Industry Association at: http://www.tiaonline.org/standards/secretariats_tags/iso_tc204/. .

Several European experts hold key roles in WG16 and have been involved in the development of the CALM standards. Europe also provides the convenors for WG1 (Architecture, Taxonomy and Terminology), WG4 (Automatic Vehicle/Equipment Identification), WG8 (Public Transport/Emergency), WG10 (Traveller Information Systems) and WG18 (Cooperative Systems). Europe is also well represented in other WG's such WG3 (ITS Database Technology) and WG9 (Integrated Management and Control). It should also be noted that when it comes to voting on new standards and other matters, Europe has one vote for each of its participating countries, whereas the USA, Japan and other countries only have one vote each. Thus it is perfectly possible for Europe to dominate the work of TC204 through its participating countries.

The involvement of European experts is seen as crucial to the success of ISO standards and may help to dispel the belief held by some people in Europe that ISO is dominated by the United States and its interests. In fact the opposite is true in that the US has one vote as do each of the many countries in Europe that are members of TC204. Thus it is perfectly possible for Europe to impose its views on standards that are used around the world, including the US.

WG18 (Cooperative Systems) provides the ISO equivalent of CEN TC278 WG16 and therefore has as its focus, cooperative systems and is very heavily involved in the work in response to Mandate M/453 – see section 5.2. WG18 and WG16 usually meet together as part of the Vienna Agreement – see section 4.4 on harmonisation. In addition, the WG18 convenor jointly chairs the "Cross Cutting" session, which looks at how the WG's are working together and which has now become a permanent part of every ISO TC204 meeting. The need for the WG's to work together more closely is a bi-product of the need to develop standards for cooperative systems.

At least three of the E-FRAME partners (PJCL, Siemens plc and CTU) are actively involved in the work of ISO TC204. The Siemens plc representative (Richard Bossom) is the convenor of WG1 (Architecture, Taxonomy and Terminology) and actively participates as a member of WG18 (Cooperative Systems). Both Siemens and PJCL have collaborated in the creation of TR26999, described at the end of section 4.2.1.

The PJCL representative (Peter Jesty) has a background in ITS functional system safety and made major contributions to, and was the editor of, the UK motor industry MISRA Guidelines for the safety analysis of vehicle based systems [MISRA 2007], whose scope includes ITS such as Cooperative Systems. The approach recommends the use of models that, when applicable, can be derived directly from FRAME Architecture subsets. He is also a UK Expert on ISO/TC22/SC3/WG16 working on ISO 26262 “Road Vehicles – Functional Safety”[3].

4.3.2 SAE

The Society of Automotive Engineers (SAE) says it is the premiere world resource for the design, manufacturing, operation, and maintenance of self-propelled vehicles for use on land, or sea, in the air, or in space. Like the other SDO's, SAE has a number of committees that are grouped under the headings of Aerospace, Automotive and Commercial Vehicle. The most relevant of these is the automotive group, from which the following are the two standards that are most relevant to cooperative systems:

(1) SAE J2735 Dedicated Short Range Communications (DSRC) Message Set Dictionary – published in November 2009;

(2) SAE J2945 Dedicated Short Range Communications (DSRC) Minimum Performance Requirements – currently being developed.

SAE is under contract with the US Department of Transport Federal Highway Administration (FHWA) for the work it does on standards development. Much more information about SAE can be found from its website at: http://www.sae.org/.

4.3.3 IEEE

The Institute of Electrical and Electronics Engineers (IEEE) is an US based organization that was created on 1 January 1963 from the merger of the American Institute of Electrical Engineers (founded in 1884) and the Institute of Radio Engineers (founded in 1912). It has expanded to become the world's largest technical professional association that has been responsible for the creation of over 900 active standards. Further information about the IEEE can be obtained from its website at: http://www.ieee.org/index.html.

The IEEE has its own Standards Association that is responsible for creating and managing standards. One of the most significant standards that it has produced is 802.11p for wireless access in vehicular environments. This standard provides the basis for the creation and communication of data between vehicles (V2V) and between vehicles and the infrastructure (V2I and I2V) that are an essential part of cooperative systems. Other ITS and cooperative systems related standards include message sets for DSRC (1455-1999)

[3] Unfortunately the WG decided on a scope that does not include normal ITS or Cooperative Systems, and so some of the recommended techniques, in particular for safety analysis, are not suitable for Cooperative Systems. At the time of writing the next topic(s) to be considered by the WG have yet to be agreed, but Cooperative Systems has been suggested by the UK.

and the Wireless Access in Vehicular Environments (WAVE) set of standards (1609.x – various dates). A part of 1609 defines the upper layers for 5.9GHz communications in North America. Within this region, standards for the higher layers of 802.11p are being developed, and this therefore covers a subset of CALM/ETSI architectures. Another part of 1609 defines the pre-standards or test standards that have been validated in VII (now Cooperative Systems Research) test sites.

In 2000 the IEEE published IEEE standard 1471-2000 "Recommended Practice for Architectural Description of Software-Intensive Systems". It was therefore too late to influence the creation of the first version of the FRAME Architecture by the KAREN project (1998-2000), but it did provide the term "viewpoint", which has been used by all later versions.

Further information about the IEEE standards can be obtained from its dedicated website at: http://standards.ieee.org/

4.3.4 IEC

IEC is the International Electro technical Commission and prepares and publishes International Standards in the areas of Smart Grids; safety-related systems risk reduction, smart energy, electromagnetic compatibility between devices, generation of electricity from renewable resources and ensuring colour consistency for the connections between devices. Again as in the other SDO's it is the Technical Committees and Sub-committees that actually develop the standards. More information can be found from the IEC website at: http://www.iec.ch/index.htm.

4.4 Standardization process according to ISO

ISO has developed a process for the development of all types of standard. This is described in the ISO/IEC Directives, Part 1. A schematic representation of the way that different types of standard are prepared is presented in Figure 1. It is important to be noted that other SDO's have different standards development processes.

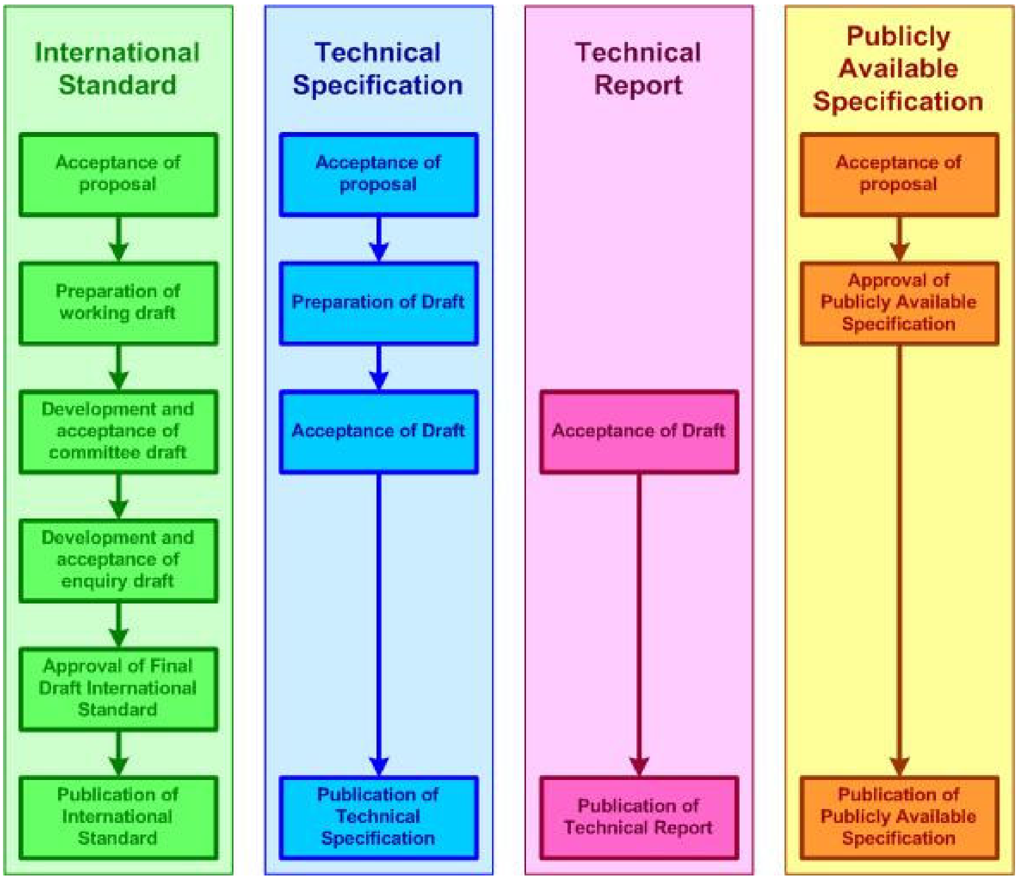

Figure 1 Relationship between standards development stages and resulting types of standards (source: ISO)

4.5 Cooperation of standardization bodies

4.5.1 Cooperation of CEN and ISO

One of the most prominent instances of cooperation between standards bodies is that between CEN and ISO. The "Vienna Agreement" was created many years ago to enable CEN and ISO as a whole to work together. It relates to how individual standards products are produced and has the presumption that ISO always takes the lead in this work. For CEN TC278 this means that most of its Working Groups will have their counterparts in ISO TC204, although often they have different numbers and titles. The close cooperation between CEN TC278 and ISO TC204 WGs does help to produce a degree of international harmonisation among standards, which is very welcome. A list of CEN WGs is shown in Table 4, together with their corresponding ISO WGs.

Table 4 CEN TC278 WG's and their related ISO TC204 WG's

CEN Working Group		Corresponding ISO Working Group	
Number	Title	Number	Title
WG 1	Automatic Fee Collection and Access Control	WG5	Electronic Fee Collection
WG 2	Freight, Logistics and Commercial Vehicle Operations	-	
-		WG7	Freight
WG 3	Public Transport	WG8	Public Transport/Emergency
WG 4	Traffic and Traveller Information	WG10	Traveller Information Systems
		WG9	Integrated Management and Control
		WG3 WG11	ITS Database Technology Route Guidance and Navigation Systems
WG 8	Road data traffic/Elaboration, storage and distribution	WG9	Integrated Management and Control
WG 10	Man-Machine Interface		
WG 12	Automatic Vehicle and Equipment Identification	WG4	Automatic Vehicle/Equipment Identification
WG 13	Architecture and Terminology	WG1	Architecture, Taxonomy and Terminology
WG 14	After theft Systems for Stolen Vehicles	-	
WG15	Safety Systems (eCall)	-	
WG16	Cooperative Systems	WG14 WG18	Vehicle/Roadway Warning and Control Systems Cooperative Systems

Some WG's effectively operate as one Working Group. A current good example of this is CEN TC278 WG16 and ISO TC204 WG18 (Cooperative Systems), which only ever meet as one WG. One or two of the other Working Groups do have separate meetings for their CEN and ISO counterparts. There are also a few CEN Working Groups that do not have ISO counterparts, e.g. WG14. Conversely there are some ISO Working Groups that do not have a CEN equivalent, often because the CEN WG has become dormant, e.g. ISO WG9, which used to have CEN WG5 as its counterpart until it became dormant. CEN WG2 and ISO WG7 are not shown as being equivalent because, although they do cooperate, they have separate convenors and may develop separate standards.

Most Working Groups are frequently referred to by their joint identities, which are often truncated into a short form, an example of which is WG13/WG1. This can be very confusing as it is not obvious if it is the CEN WG number that is shown first or that for the ISO WG. In the above example the CEN WG number is shown first. In order to avoid this confusion, the full title is used throughout this document. One important point to note is the existence of CEN WG16/ISO WG18, which covers standards for cooperative systems – see section 5.3.

As noted in section 4.3.1, although ISO TC204 is "international" it is in fact dominated by representatives from Europe, both in terms of participation and the numbers of WG convenors. Thus, should it wish to do so, it is perfectly possible for Europe to exert a very strong influence on the creation of ITS related standards.

4.5.2 Cooperation of CEN and ETSI

Until recently cooperation between CEN and ISO has been an isolated instance. In general international harmonisation, both on standards and research, has not been progressing well, with growing splits becoming evident. Circumstances had deteriorated to the point where CEN/ISO and IEEE each had their own set of standards that they were creating, and these were then joined by ETSI with its TC ITS, which had begun to develop a further set of standards. However the European Commission has started to take steps to bring some order to the situation through the publication of Mandate M/453 – see section 5.2.

4.5.3 Broader cooperation – liaison between SDOs

Currently there is little to suggest that this attitude is changing, since all of these organisations use their perceived pre-eminence as a creator of standards to justify their continued existence. Indeed the OICA press release highlighted in section 4.1 appeared after a rather abortive telephone conference that it hosted involving many of the SDO's described in the previous sections.

What little cooperation there is between SDO's is patchy and in practice for CEN TC278 and ISO TC204 does not amount to much. As an example the IEEE and ISO have recently renewed the Partner Standards Developing Organisation (PSDO) agreement and broadened its scope. The agreement enables a published IEEE standard within the scope of ISO TC204, and having global use and acceptance, to be quickly adopted as an ISO International Standard. Cooperation between ISO and IEEE on the development of new unpublished standards can also take place. The objective is to avoid the creation and availability of competing standards.

As another example of cooperation, the work of SAE J2735 is co-ordinated with IEEE P1609, but this is currently not being coordinated with ISO TC204 or European activities. However SAE is working together with ISO TC204 on other data registry efforts. In addition, and outside of Mandate M/453, ETSI has an agreement with ISO TC204 to produce test and validation standards for the CALM series of standards. There is also some cooperation between IEEE and ETSI.

One of the key strands in the work of the EU-US Task Force (see section 5.5) is standards for cooperative systems. The main objective of this work is to reducing the number of competing standards.

5 Ongoing standardization activities related to cooperative systems

5.1 Introduction

Recent developments in cooperative systems have caused the EC to focus a lot of effort into the harmonization of possible cooperative systems. Such harmonization can be steered by timely standardization. Therefore this chapter describes the principal activities that have taken place in this field since the start of the project E-FRAME.

These activities are:

- EC mandated coordination and allocation of responsibilities of two European SDO's on the creation of standards in ITS, namely in cooperative systems (see section 5.2). With regards to this mandate there was also an ETSI workshop on cooperative systems (see section 5.4),
- establishment of joint cooperative systems working group in CEN and in ISO, as a result of cooperative systems projects (e.g. COOPERS, SAFESPOT, CVIS), so that standards developed in Europe will have its mirror image in world standards (see section 5.3) and
- EU-US Task Force with a primary goal to harmonize R&D projects and implementation activities between EU and US (see section 5.5)

5.2 EC Standardisation Mandate M/453

As noted in Section 4, there is a distinct lack of cooperation between the SDO's over the creation of standards. In the past only CEN and ISO actively cooperated to produce one set of standards for what is now called ITS. The entrance of SDO's such as ETSI, IEEE and SAE into this field has led to a confused situation with the potential for two or more of these SDO's to produce what are effectively competing standards.

In the ITS Action Plan the European Commission recognised that the potential for creating competing standards existed and in late 2009 issued Mandate M/453 to the three main European SDO's, CEN, CENELEC and ETSI. In this Mandate the Commission invited the SDO's to produce a plan to cooperate in the development of a set of standards that will be needed for the deployment of cooperative systems and to ensure interoperability for vehicle to vehicle communications (V2V), for vehicle to infrastructure communications (V2I) and for communications between infrastructure operators. Special focus on the EC Decision for the 5.9 GHz spectrum for ITS safety-related applications is underlined in the Mandate. **Without**

this cooperation, the Commission believed that there would be confusion over which standards applied where and when, and that this could significantly delay the deployment of cooperative systems.

CENELEC declined to participate because it considered that the area of standardisation in which it operates is distinct from those of CEN and ETSI. However, the latter two SDO's agreed (with great reluctance on the part of ETSI) to cooperate and as a result in April 2010 produced the "Response to Mandate M/453". As evidence of ETSI's reluctance, it has so far fought hard to ensure that its work programme is entirely separate from that of CEN. It also continues to take steps to ensure that there is no effective joint work on products under M/453.

As noted in section 4.5.1, CEN cooperates with ISO to produce ITS related standards. But it cannot formally represent ISO in the work on the response to Mandate M/453. What CEN has done is to draw the attention of the Commission to the capabilities that ISO can offer. Also through its joint Working Groups CEN has openly sought to involve experts from the wider ISO community in its work.

In the "Response" document, CEN/ISO and ETSI have identified what they believe to be the aspects of cooperative systems for which standards will be needed, and provided plans to coordinate the development of these standards so as to avoid overlaps and duplication of effort. They are now working to produce standards for the most essential of these aspects by August 2012 and to continue with the standards development work after that date until all those that are required are available for use. Progress with the work is reported formally at defined times in the elapsed programme but it is also informally monitored via the meetings of the ITS Steering Group (ITSSG) at approximately 6 monthly intervals.

The areas and services identified in the "Response" document for which CEN/ISO and ETSI believe standards must be developed are shown in the table in Annex A. The contents of this table represent the clearest view of required standards for cooperative ITS when the "Response" document was prepared (April 2010). It can be expected that this table will need to be revised and updated as CEN/ISO and ETSI make progress with their work in response to Mandate M/453. Another reason for revising the contents of the table is that it is orientated particularly towards the lower levels of the OSI communications stack. It is expected that in the future, more application oriented standards will be identified, perhaps as a result of the current and future Field Operational Test (FOT) related projects and other cooperative systems demonstration activities

The list of potential areas needing standards in the table in Annex A could also be improved if work is done to add more detail to the rather sketchy service descriptions that are included. A way to do this is to use the FRAME Architecture to create a "model" of an implementation for each of the services identified in Annex A and see what standards would aid their implementation and if these standards currently exist. This would be a significant piece of work and it has been suggested to a CEN TC278 Plenary meeting, although as yet there has been no response. In the future (after the E-FRAME project) this work could be managed by the FRAME Forum and carried out by some of its members with the support and assistance of the FRAME Team. The benefit of this work is that it would examine a more application orientated aspect of cooperative systems implementations, which as noted previously is not very well addressed by the table in Annex A.

Even in its current form, the work that will be needed will cut across the standards domains of several CEN/ISO Working Groups. For this reason, CEN TC278 WG16 / ISO TC204 WG18 have been tasked with coordinating and managing this work – see section 5.3. It has also led to the introduction of what are called "cross cutting" meetings that take place before the ISO Plenary meetings. The purpose of these "cross cutting" meetings is to provide a forum in which the cooperation between the Working Groups can be debated and managed.

Standards relevant to Architecture and cooperative system are further described in chapter 6.

5.3 Establishment of CEN TC278 WG16 / ISO TC 204 WG18

CEN TC278 WG16 was set up by CEN TC278 at its meetings in Prague during March 2009 and is lead by DIN (Germany). Its purpose is to see what standards can be created from some of the results being achieved by the FP6 Integrated Projects COOPERS, CVIS and SAFESPOT, plus the expectation that a mandate for the development of standards to support the deployment of cooperative systems would be produced as a result of the publication of the ITS Action Plan. ISO followed this with the setting up of the parallel Working Group ISO TC204 WG18, at its meeting in Barcelona during September 2009.

This new Working Group was given the task to develop harmonised application standards in the area of cooperative systems; to explore and define its scope and work programme; and to report back to the next TC278 meeting. As a result, in the autumn of 2009, ISO TC204 set up the equivalent Working Group (18) with the same objectives.

The WG operates under the leadership of CEN and currently has meetings several times a year. These are often in conjunction with the regular CEN TC278 and ISO TC204 Plenary meetings, but the WG also meets on other occasions, e.g. during the ETSI TC ITS Workshop at Venice in February 2011 – see section 5.4.

In the report to the ISO TC204 meetings in November 2010, the convenor provided the following list of current WG activities to create standards:

1. Classification and management of ITS applications in a global context (DT2);
2. Cooperative system application messages, protocols and profiles;
3. ITS application requirements for the selection of communications profiles;
4. The definition of LDM concepts (DT3);
5. The definition of the roles and responsibilities in the context of cooperative ITS based on architecture(s) for cooperative systems (DT4);
6. Data exchange specification for in-vehicle presentation of external road and traffic related data ("Embedded VMS") (DT5, but this is now called "in-vehicle signage");
7. Transfer of information from vehicles for infrastructure management, control and guidance applications (DT6);
8. Contextual speeds (DT7).

The "DT" identification that has been added to each of the above indicates the Drafting Team that was created by the WG during its meetings in March 2011. Each of them will produce a standard relating to that topic and are now the main standards creation mechanism within WG. The topics without Drafting Teams will be considered at a later date.

The WG also has the task of co-ordinating the work to create the standards for cooperative systems that are being carried out as a result of Mandate M/453 by other CEN/ISO Working Groups (see section 5.2). In order to promote this work, the WG convenor is also the CEN/ISO representative at the regular progress meetings that are held with the European Commission to monitor the work on the response to Mandate M/453.

The representative of E-FRAME project partner Siemens plc frequently attends the meetings of this WG. As well as providing reports to the project, he has participated in the meetings and gave a presentation at a joint CEN/ETSI workshop on the use of the FRAME Architecture in May 2010. The definitions of Terminators and Actors from the FRAME Architecture are to be used in item 5 (DT4) as part of the basis on which the definitions of the roles and responsibilities are created. This work is expected to result in a new Technical Report for roles and responsibilities in cooperative systems, thus providing a direct link between the FRAME Architecture and standards.

5.4 ETSI Workshops on Cooperative Systems

The ETSI Workshops on Cooperative Systems have been running every year since 2009 and are organised by the TC ITS. They include sessions on topics that are related to the creation of standards for cooperative systems, as seen from an ETSI perspective. This means that they mostly relate to the actual communications, and not the applications that require the communications, in order to be able to deliver their services. Thus, although there is a session on "architecture", the papers presented concentrate on those at a lower level of abstraction than that of the FRAME Architecture, i.e. at the "design" level.

The Workshop is usually well attended, with some attendees from countries outside of Europe such as the US. It is expected to be a regular feature of the ITS calendar for several years to come.

The E-FRAME project has repeatedly tried to get a paper included in this workshop, but has been rejected at every attempt. This is despite the proposal being re-written each time to provide what it was hoped would be more suitable material.

5.5 EU-US Task Force

The joint EU-US Task Force was set up as a result of the EC DG-Information Society and the Research and Innovative Technology Administration (RITA) part of the US DOT signing a Memorandum of Understanding during the US Transport Research Board (TRB) Annual Meeting in January 2009. The intent is for the Task Force to co-ordinate the research and development activities that are being carried out into cooperative systems in Europe and the US and thus avoid needless parallel work. The Task Force will also act as a mechanism for planning joint demonstrations of cooperative systems that are expected to take place during the ITS World Congresses in Orlando (2011) and Vienna (2012).

Perhaps, not un-naturally, the Task Force is split into two groups, one based in Europe and the other in the US. Separate meetings are held from time to time by each of these groups and a joint meeting is held usually twice per year. These joint meetings are timed to coincide with events such as the TRB Annual Meeting in Washington D.C. every January, and at a suitable European event at any time of the year. In September 2009 it was the ITS World Congress in Stockholm, in June 2010 it was TRA2010 in Brussels and in June/July 2011 it was the IEEE FISTS Conference in Vienna.

At the time of writing this document the Task Force has groups working in the following areas of activity:

- Driver Distraction and Human Factors – the co-ordination of research into how distraction can be reduced and the influence of human factors on the performance of vehicles in cooperative systems services;
- Standards – the main thrust of work in this area is the Harmonisation Assessment Programme (HAP) that has been created by the US DOT and which will look at both existing and new ITS related standards to resolve overlaps and duplications;

- Safety Applications – two applications have been selected for joint development in Europe and the US – Forward Collision Avoidance and Cooperative Intersection Collision Avoidance (Signal Violation), and specifications are currently being prepared;
- Eco-friendly or Sustainable Application – this application will focus on the management of traffic at signal controlled intersections to minimise the energy consumption caused by stopping and starting, particularly for Freight Vehicles;
- Assessment Tools – ways of assessing cooperative systems performance;
- Plans for joint demonstrations – the creation and management of demonstrations of the above applications at the ITS World Congresses in Orlando (2011) and Vienna (2012);
- Glossary of Terms used in Cooperative Systems – the first version of the Glossary has been published and a second version is being prepared, with the focus of both on terms that are used in the work of the Task Force, rather than for ITS as a whole;
- Technical Roadmap for Cooperative Systems deployment – separate European and US Roadmaps are being produced, with the European Roadmap now in its second version.

The progress made and future plans for each of the above topics is reviewed at Task Force meetings, whether for the separate European and US parts, or at the bi-annual joint meetings.

The Siemens plc representative (Richard Bossom) represents the E-FRAME project at these meetings. He has also been the European half of the team that has produced the Glossary of Terms used in Cooperative Systems (first published in 2010 and available from the EC and ITS America websites) and has acted as the editor for the European version of the Technical Roadmap. At the joint EU- US meetings he attends the sessions on standards and the both types of applications.

5.6 Standards for definitions of terms

One of the aspects of ITS that has become apparent to many of the E-FRAME project partners is the proliferation of definitions of terms. For example there are several definitions of the term "cooperative systems", and for "architecture" there are probably more definitions than there are letters in the word! It appears that ITS has inherited the lack of discipline prevalent in the IT industry, which leads to the commonly accepted practice of "if you don't like something, then invent a replacement". However nothing is every simple, and given that ITS is evolving with time and changes in what technology can deliver, the services that it provides (and hence its definition) will almost certainly need to be changed. The problem appears to be that at any given point in time for many terms more than one definition is being used for the same term.

In addition, there is often no common definition of such things as the units of measurement for different terms. For example, how is headway to be measured? Usually it is in time, but where is this defined? Without a common understanding of units of measurement it becomes difficult for applications to successfully share data, which is one of the main aspects of cooperative systems.

A sense of the importance that is attached to this problem by CEN and ETSI can be seen from the fact that the first item in the table in Annex A is "Definition and Harmonised Terminology". Its description says "Common agreement on definitions and terminologies to be used for standardisation. Harmonisation and cross-check of terminologies among SDO's."

Unfortunately any work to respond to this item in the table is outside the scope of work of the E-FRAME project. However it is encouraging to learn that a proposal to address this issue (called CHIRD) has been submitted by CEN to the European Commission. If the proposal is accepted, it will create a Project Team to create a data registry for data items and terms used in ITS. The Team will collect terms and their definitions from ITS related standards and other sources and use them to populate the data registry. There will then be a process of harmonisation, to try and reduce the number of different definitions for the same term. Once this process has been completed, the Team will help with the task of putting mechanisms in place that will enable the data registry to be kept running for the foreseeable future. The most appropriate mechanism(s) through which this data registry is accessed and managed will have to be determined by the Project Team. But some of the ideas and experiences gained from the work in the Czech Republic will provide good pointers as to what can and should be done – see a description of this work in section 8.1.4.

6 ITS standards with relevance to cooperative systems and ITS architecture

The previous chapter give a general overview about standardization activities in cooperative systems. Annex A summarizes topics that, according to CEN and ETSI, require some standardization. This chapter goes into more detail and identifies those standards from the elaborated topics (full list of standards in presented in Annex B) that are relevant to architecture and cooperative systems (see Table 5) and then discusses them in more detail. As of the date of writing this document (July 2011).

Table 5 Standards related to cooperative systems and ITS architecture

Relevance	Name of the standard
Architecture in general	ISO 14813-1:2007 Intelligent transport systems -- Reference model architecture(s) for the ITS sector -- Part 1: ITS service domains, service groups and services (being revised)
	ISO 14813-5:2010 Intelligent transport systems – Reference model architecture(s) for the ITS sector – Part 5: Requirements for architecture description in ITS standards
	ISO/TR 24529:2008 Intelligent transport systems — Systems architecture — Use of 'Unified Modelling Language' in ITS International Standards and deliverables (being revised)
	ISO TR26999:2011 Intelligent transport systems – Systems architecture – Use of 'Process Orientated Methodology' in ITS International Standards and deliverables (being revised)
Freight architecture relevance	ISO TS 26683-1 Intelligent transport systems – Freight land conveyance content identification and communication – Part 1: Context, architecture and referenced standards
	ISO 15638-1 Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) – Part 1: Framework and architecture
Simulation methods	ISO 16786 Intelligent Transport Systems –The use of simulation models for evaluation of traffic management systems: input parameters and reporting template for simulation of traffic signal
Terminology	ISO TR 17465 Intelligent transport systems – Definition of terms for "Cooperative ITS" and requirements for standards
In-vehicle systems involvement	ISO 15622 Transport information and control systems – Adaptive Cruise Control Systems (ACC) – Performance requirements and test procedures
	ISO 26684 Intelligent Transport Systems – Cooperative Intersection Signal Information and Violation Warning Systems (CIWS)
HMI – messages hand-over control	EN ISO 15005 Road vehicles – Ergonomic aspects of transport information and control systems – Dialogue management principles and compliance procedures

Table 5 Standards related to cooperative systems and ITS architecture

Relevance	Name of the standard
	EN ISO 15006 Road vehicles – Ergonomic aspects of transport information and control systems – Specifications and compliance procedures for in-vehicle auditory presentation
	EN ISO 15008 Road vehicles – Ergonomic aspects of transport information and control systems – Specifications and compliance procedures for in-vehicle visual presentation
	ISO TR 16352 Road vehicles – Ergonomic aspects of in-vehicle presentation for transport information and control systems – Warning systems
	EN ISO 16951 Road vehicles – Ergonomic aspects of transport information and control systems (TICS) – Procedures for determining priority of on-board messages presented to drivers
	ISO TR 12204 Road vehicles - Ergonomic aspects of transport information and control systems - Guidelines for identification of conflicting safety-critical and time-critical warning signals and their integration in road vehicles
Safety Data	ISO 24978 ITS – ITS Safety and emergency notifications using any available wireless media – Data registry procedures
Data Privacy	ISO TR 12859 Intelligent transport systems – System architecture – Privacy aspects in ITS standards and systems
Data quality	ISO/TR 21707:2008 Intelligent transport systems -- Integrated transport information, management and control -- Data quality in ITS systems
Navigation data format and maps	ISO 24099 Navigation data delivery structure and protocol
	ISO TR 17384 Intelligent transport systems – Interactive centrally determined route guidance (CDRG) – Air interface message set, contents and format
Communication	See section 6.2.9 CEN / ISO standards with relevance to Communication
Cooperative systems standards	ISO TS 17274 Intelligent transport systems - Cooperative systems - Classification and management of ITS applications in a global context
	WI0278286 Intelligent transport systems (ITS) - Co operative systems - Roles and responsibilities in the context of cooperative ITS based on architecture(s) for cooperative systems

Table 6 ETSI standards with possible relevance to Cooperative systems

Relevance	Name of the standard
TR 102 638	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Definitions
TS 102 637 series	Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications
TS 102 665	Intelligent Transport Systems (ITS); Vehicular Communications; Architecture
TS 102 636 series	Intelligent Transport Systems (ITS); Vehicular Communications

Table 6 ETSI standards with possible relevance to Cooperative systems

Relevance	Name of the standard
ES 202 663	Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band
HMI	
TS 102 689	Machine to Machine Communications (M2M); M2M service requirements
TS 102 690	Machine to Machine Communications (M2M); M2M functional architecture
TR 102 691	Machine to Machine Communications (M2M); Smart Metering Use Cases
DTR/M2M-00004	Machine to Machine Communications (M2M); M2M definitions

6.1 CEN / ISO standards with relevance to Architecture

Listed below are only standards that are directly relevant to ITS Architecture, the list does not have to be complete. **Listed standards are evaluated as to their relevance to FRAME Architecture.**

6.1.1 ITS Architecture in general

ISO 14813-1:2007 Intelligent transport systems – Reference model architecture(s) for the ITS sector -- Part 1: ITS service domains, service groups and services (being revised)

This standard provides a list (with a very brief description) of services that are candidates for inclusion in those supported by any ITS architecture. An earlier version of this standard was used as a starting point for the classification of the User Needs in the first version of the FRAME Architecture by the KAREN project in 2000. Following the update of this standard to the current version, the relationship with the User Needs was broken. The standard is now being revised again to include services for cooperative systems.

ISO 14813-5:2010 Intelligent transport systems – Reference model architecture(s) for the ITS sector – Part 5: Requirements for architecture description in ITS standards

The standard gives requirements for the description and documentation of the architecture of intelligent transport systems (ITS) in standards dealing with ITS. It also gives the definitions of terms to be used when documenting or referencing aspects of architecture description in those standards.

The FRAME Architecture documentation does not include any references to this standard because what Part 5 of ISO 14813 contains is intended for use in the writing of other standards. However the FRAME Architecture does conform to the definitions of such things as "Functional Architecture" and "Physical Architecture" that this standard includes.

ISO/TR 24529:2008 Intelligent transport systems — Systems architecture — Use of 'Unified Modelling Language' in ITS International Standards and deliverables (being revised)

This standard describes the use of Universal Modelling Language (UML) in ITS architectures. It is therefore not relevant to the FRAME Architecture and is mainly applied to architectures at the system design level.

ISO TR26999:2011 intelligent transport systems – Systems architecture – Use of 'Process Orientated Methodology' in ITS International Standards and deliverables (being developed)

This standard describes the use of the FRAME methodology for the creation of ITS architectures and thus describes how ITS architectures similar to the FRAME Architecture can be created. It is currently in its final stages of revision before publication.

6.1.2 CEN / ISO standards with relevance to Freight Architecture

Listed below are only standards that are directly relevant to ITS Architecture, the list does not have to be complete. **Listed standards are evaluated as to their relevance to FRAME Architecture.**

ISO TS 26683-1 Intelligent transport systems – Freight land conveyance content identification and communication – Part 1: Context, architecture and referenced standards

This Technical Specification provides the context for application interface profiles for the exchange of land transport data using current technologies and existing standards for item identification, package identification, container identification, and international standards and practices regarding freight and its movement. From the point of view of ITS architecture the standard provides architecture for the collation and transfer of data agglomerated / aggregated from information contained in the transport load to transport operating systems. The objective being to enable efficient handling of truck/trailer identification and on-board cargo information for tracking, tracing and cargo monitoring purposes in a land cargo transport situation.

ISO 15638-1 Framework for collaborative telematics applications for regulated commercial freight vehicles (TARV) – Part 1: Framework and architecture

This multipart standard is in its “new proposal” stage. The first part states this scope:

1. A framework for the provision of collaborative* telematics application services for regulated commercial freight vehicles.
2. Describe the concept of operation, regulatory aspects and options and the role models.
3. Conceptual architecture using an on-board platform and wireless communications to a regulator or his agent.
4. Taxonomy of the organisation of generic procedures
5. Common terminology for the 15638 family of standards

The deliverable will be based on a (multiple) service provider oriented approach.

Once it has been produced, this standard will need to be evaluated against the FRAME Architecture. Any differences will probably have to be resolved by changing the Architecture unless it can be shown that the standard is at fault, or that it does not represent European practice for the regulating commercial freight vehicles.

6.2 CEN / ISO standards with relevance to cooperative systems

6.2.1 CEN / ISO standards with relevance to Simulation methods

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

ISO/TR 16786 Intelligent Transport Systems –The use of simulation models for evaluation of traffic management systems: input parameters and reporting template for simulation of traffic signal

This report can be used to provide a specification for a future modelling of cooperative systems, especially at controlled crossroads.

The scope of this report is to establish a recommendation for the evaluation of new or existing signal control systems before their implementation in the field, focusing on the algorithm that establishes signal timings based on traffic conditions:

Thus, the main aims of the evaluation of signal control systems are to:

- Evaluate the quality of the algorithm in various traffic conditions
- Evaluate the validity of the algorithm for specific applications (types of intersection)

- Establish a fair comparison of the algorithm versus other adaptive algorithms or other types of control systems (fixed, scheduled etc)
- Evaluate the results of the implementation of a signal control system objectively.

The FRAME Architecture contains some functionality that represents simulation models that are used for the evaluation of traffic management strategies. So this standard should be used in the implementation of that functionality.

6.2.2 CEN / ISO standards with relevance to Terminology

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

ISO TR 17465 Intelligent transport systems – Definition of terms for "Cooperative ITS" and requirements for standards

This new Work Item is for a Technical Report that provides a definition of the term "Cooperative ITS". It is being proposed in response to resolution 816 agreed at the 37th ISO TC204 Plenary meeting in Prague during April 2011. The contents of this Technical Report will be based on the materials presented to the WG18/WG16 and Cross Cutting meetings in Prague. This includes a candidate definition of the term "Cooperative ITS", as well as a structure for standards relating to particular services and requirements for what should be in those standards. The work on this standard is being led by the representative of the E-FRAME partner Siemens plc in his capacity as convenor of CEN TC278 WG13 / ISO TC204 WG1. It is expected that other members of the E-FRAME project will contribute to the preparation of this standard by providing comments on the definition of terms that it contains.

Once completed, the standard will provide valuable guidance to the way that terms within the FRAME Architecture are used. Where the Architecture has an incompatible use of a particular term, part of the work of the FRAME Forum will have to include an update to the FRAME Architecture so that it conforms to this standard.

6.2.3 CEN / ISO standards with relevance to In-vehicle systems

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete. The standards of in-vehicle systems should be taken into account when specifying the requirements for V2V and V2I communication.

ISO 15622 Transport information and control systems – Adaptive Cruise Control Systems– Performance requirements and test procedures

This International Standard contains the basic control strategy, minimum functionality requirements, basic driver interface elements, minimum requirements for diagnostics and reaction to failure, and performance test procedures for Adaptive Cruise Control (ACC) systems. Adaptive cruise control is fundamentally intended to provide longitudinal control of equipped vehicles while travelling on highways (roads where non-motorized vehicles and pedestrians are prohibited) under free-flowing traffic conditions. ACC can be augmented with other capabilities, such as forward obstacle warning.

ISO 26684 Intelligent Transport Systems – Cooperative Intersection Signal Information and Violation Warning Systems

This standard specifies the concept of operation, system requirements, and test methods for Cooperative Intersection Signal Information and Violation Warning Systems (CIWS) at signalized intersections. CIWS are intended to reduce the likelihood of crash injury, damage, and fatality by enhancing the capability of drivers to avoid crash situations at signalized intersections. The CIWS application shall include at least one of the following two functions:

- A system that communicates the current phase of the traffic signal to the subject vehicle for display to the driver, thus enhancing the driver's awareness of the signal state; and
- A system that uses the traffic signal phase information communicated to the subject vehicle approaching an intersection to provide an in-vehicle warning to the driver of an imminent traffic signal violation, thus enhancing the opportunity for the driver to avoid the signal violation.

The scope of CIWS standardization includes basic functions, functional requirements, performance requirements, information contents, and test methods.

6.2.4 CEN / ISO standards with relevance to HMI

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

EN ISO 15005 Road vehicles – Ergonomic aspects of transport information and control systems – Dialogue management principles and compliance procedures

This standard presents ergonomic principles for the design of the dialogues that take place between the driver of a road vehicle and the vehicle's Transport Information and Control Systems (TICS) while the vehicle is in motion. It also specifies compliance verification conditions for the requirements related to these principles.

This Standard is applicable to TICSs consisting of either single or multiple devices, which can be either independent or interconnected. It is not applicable to TICSs without dialogues, TICS failures or malfunctions, or controls or displays used for non-TICS functions.

EN ISO 15006 Road vehicles – Ergonomic aspects of transport information and control systems – Specifications and compliance procedures for in-vehicle auditory presentation

This standard establishes ergonomic specifications for the presentation of auditory information related to Transport Information and Control Systems (TICS) through speech or sounds. It is applicable only to the use of auditory displays when the vehicle is in motion. It presents a set of requirements and recommendations for in-vehicle auditory messages from TICS, and provides message characteristics and functional factors for maximizing message intelligibility and utility while helping prevent auditory or mental overload.

EN ISO 15008 Road vehicles – Ergonomic aspects of transport information and control systems – Specifications and compliance procedures for in-vehicle visual presentation

This standard specifies minimum requirements for the image quality and legibility of displays containing dynamic (changeable) visual information presented to the driver of a road vehicle by on-board Transport Information and Control Systems (TICS) used while the vehicle is in motion. These requirements are intended to be independent of display technologies, while reference to test methods and measurements for assessing compliance with them have been included where necessary.

ISO 15008:2009 is applicable to mainly perceptual, and some basic cognitive, components of the visual information, including character legibility and colour recognition. It is not applicable to other factors affecting performance and comfort such as coding, format and dialogue characteristics, or to displays using

- characters presented as a part of a symbol or pictorial information,
- superimposed information on the external field (e.g. head-up displays),
- pictorial images (e.g. rear view camera),
- maps and topographic representations (e.g. those for setting navigation systems), or
- quasi-static information.

ISO TR 16352 Road vehicles – Ergonomic aspects of in-vehicle presentation for transport information and control systems – Warning systems

This technical report provides a literature survey about the human-machine interface of warning systems in vehicles. It covers the experimental experiences about the efficiency and acceptance of different modalities and combinations of warnings, and the design of the sensorial, code and organizational parameters of visual, auditory and tactile warnings.

EN ISO 16951 Road vehicles – Ergonomic aspects of transport information and control systems– Procedures for determining priority of on-board messages presented to drivers

The standard provides formal procedures and two alternative methods for determining the priority of on-board messages presented to drivers of road vehicles by Transport Information and Control Systems (TICS), and other systems. It is applicable to the whole range of TICS in-vehicle messages, including traveller information, navigation, travel and traffic advisories, "yellow pages" information, warnings, systems status, emergency calling system information, and electronic toll/fee collection, as well as to messages from non-TICS sources.

ISO TR 12204 Road vehicles - Ergonomic aspects of transport information and control systems - Guidelines for identification of conflicting safety-critical and time-critical warning signals and their integration in road vehicles

The only information that is available – Target publication date: 2013-02-13

6.2.5 CEN / ISO standards with relevance to Safety Data

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

ISO 24978 ITS – ITS Safety and emergency notifications using any available wireless media – Data registry procedures

This Standard provides a standardized set of protocols, parameters, and a method of management of an updateable "Data Registry" to provide application layers for "ITS Safety messages" using any available wireless media. It provides the framework for the standardized operation and quality of service for one or more freely available data registries for ITS safety messages and data concepts.

This International Standard provides the framework in which to operate such a data registry. It does not mandate the use or provision of any data concepts, nor involve itself with the security of transmission, issues of privacy, nor technical means of data transfer. It simply provides the rules to operate, with a high quality of service, a data repository to enable relevant parties to understand the precise and unambiguous meaning of an emergency safety-related message immediately, usually by automatic means.

6.2.6 CEN / ISO standards with relevance to Data privacy

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

ISO TR 12859 Intelligent transport systems – System architecture – Privacy aspects in ITS standards and systems

The scope of this Technical Report is to give guidance to developers of ITS standards and systems in respect to data privacy aspects and associated legislative requirements when developing and revising ITS Standards and deliverables. The deliverable is a technical report and not a Standard, and provides general guidelines rather than a mandated requirement.

National laws shall always take precedence over International guidelines, and readers should interpret these guidelines in the context of their National legislation. Readers in EU Member States should be aware that the European Data Privacy Directive and its succeeding instruments are mandatory within EU Member states.

Cases made to International courts are likely to give precedence to a combination of the OECD Recommendation and either the European Data Privacy Directive or APEC Privacy Framework as appropriate.

Those requiring guidance in respect of specific data protection and data privacy requirements in respect of ITS 'Probe' Data are referred to ISO 24100,"Basic principles for personal data protection in probe vehicle information services ".

It should be noted that according to the Resolution 278/046/027/2011 of CEN/TC 278 meeting, in Vienna Spring 2011, there is to be a European guide based on the described ISO TR.

6.2.7 CEN / ISO standards with relevance to Data quality

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

ISO/TR 21707:2008 Intelligent transport systems -- Integrated transport information, management and control -- Data quality in ITS systems

ISO/TR 21707:2008 specifies a set of standard terminology for defining the quality of data being exchanged between data suppliers and data consumers in the ITS domain. This applies to Traffic and Travel Information Services and Traffic Management and Control Systems, specifically where open interfaces exist between systems. It may of course be applicable for other types of interfaces, including internal interfaces, but this Technical Report is aimed solely at open interfaces between systems.

This report identifies a set of parameters or meta-data such as accuracy, precision and timeliness etc. which can give a measure of the quality of the data exchanged and the overall service on an interface. Data quality is applicable to interfaces between any data supplier and data consumer, but is vitally important on open interfaces. It includes the quality of the service as a whole or any component part of the service that a supplying or publishing system can provide. For instance this may give a measure of the availability and reliability of the data service in terms of uptime against downtime and the responsiveness of the service or it may give a measure of the precision and accuracy of individual attributes in the published data.

It should be noted that in the context of ISO/TR 21707:2008 data may be taken to be either raw data as initially collected, or as processed data, both of which may be made available via an interface to data consumers. The data consumer may be internal or external to the organisation which is making the data available. Additionally the data may be derived from real time data (e.g. live traffic event data, traffic measurement data or live camera images) or may be static data which has been derived and validated off-line (e.g. a location table defining a network). Measurements of data quality are of importance in all such cases.

This report is suitable for application to all open ITS interfaces in the Traffic and Travel Information Services domain and the Traffic Management and Control Systems domain.

6.2.8 CEN / ISO standards with relevance to Navigation data format and maps

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

ISO 24099 Navigation data delivery structure and protocol

This Standard defines the data structures and protocol(s) used in intelligent transport system (ITS) applications for the delivery and update of map-related data from Service Centre (SC) to users [(In-vehicle Systems (IVS)].

This Standard also specifies the message generation protocols in the Service Centre and the message receiving protocols in the In-vehicle Systems.

The map centre specified in this Standard represents the supplier of map data and the Service Centre provides data and services to user devices.

The term protocol as used in this Standard is a temporal sequence of map-related data interactions between system components that implement map-related data delivery and update. The delivery and update of map-related data relies on existing communication technology. The protocols associated with communication technology, and the other application control protocols and non-map-related data, for example images to display independent of the map database such as HTML images, are outside the scope of this International Standard.

Definitions of security mechanisms and business transaction mechanisms are also outside the scope of this Standard.

ISO TR 17384 Intelligent transport systems – Interactive centrally determined route guidance (CDRG) – Air interface message set, contents and format

This Technical Report describes the message contents and format of the air interface between the infrastructure and the in-vehicle unit in the Interactive CDRG system. The scope of standardization work will be the message set requirements for the air interface.

- The air interface message set for route guidance information in the interactive CDRG system in this Technical Report is applicable to both vehicles equipped with an onboard map database and those which are not equipped (i.e. those equipped with simplified graphic output and/or text message display functions).
- This Technical Report covers media independent systems. In this Technical Report, messages required for both cellular phone-based CDRG and beacon-based CDRG have been taken into account.
- The size of each message is defined by considering the “In-vehicle Navigation Systems Communication Device Message Set Requirements”.
- When applying this Technical Report, which is recommended practice for the implementation of any CDRG system, any values less than the defined field size values are allowed, as great importance is attached to the communication efficiency, and the order of messages proposed in the message set of this Technical Report might not necessarily be observed.

6.2.9 CEN / ISO standards with relevance to Communication

All CALM standards are relevant for cooperative systems. The title provides sufficient information about the scope of a standard.

Table 7 Communication standards

number	Title
ISO 15662	Intelligent transport systems – Wide area communication – Protocol management information

Table 7 Communication standards

number	Title
ISO 21210	CALM IPv6 Networking
ISO 21212	Intelligent transport systems – Communications Access for land mobiles (CALM) – 2G Cellular systems
ISO 21213	Intelligent transport systems – Communications Access for land mobiles (CALM) – 3G Cellular systems
ISO 21214	Intelligent transport systems – Communications Access for land mobiles (CALM) – Infra-red systems
ISO 21215	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – CALM M5
ISO 21216	Intelligent transport systems – Wireless communications – CALM using millimetre communications – Air interface
ISO 21217	Intelligent transport systems – Communications Access for land mobiles (CALM) – Architecture
ISO 21218	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Medium Service Access Points
ISO 22837	Vehicle probe data for wide area communications
ISO 24100	Privacy – Basic principles for probe personal data protection in probe vehicle information services
ISO 24101-1	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Application Management – Part 1: General requirements
ISO 24101-2	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Application Management – Part 2: Conformance Test
ISO 24102	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Management
ISO 24103	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Media adapted interface layer (MAIL)
ISO 25111	Intelligent transport systems – Communications Access for land mobiles (CALM) – General requirements for using public networks
ISO 25112	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Mobile wireless broadband using IEEE 802.16
ISO 25113	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Mobile wireless broadband using HC-SDMA
ISO TS 25114	Intelligent Transport Systems – Probe Data Reporting Management (PDRM)
ISO 29281	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Non-IP networking
ISO 29282	Intelligent Transport Systems – Communications Access for land mobiles (CALM) – Applications using Satellite networks

Table 7 Communication standards

number	Title
ISO 29283	ITS CALM Mobile Wireless Broadband applications using communications in accordance with IEEE 802.20
ISO TS 29284	Event based Probe Vehicle Data
ISO TR 11766	Lawful Interception in ITS and CALM
ISO TR 11769	Data retention for law enforcement in ITS and CALM
ISO 13181-1	ITS – Communications access for land mobiles (CALM) – Security – Part 1: Framework
ISO 13181-2	ITS – Communications access for land mobiles (CALM) – Security – Part 2: Threat vulnerability and risk analysis
ISO 13181-3	ITS – Communications access for land mobiles (CALM) – Security – Part 3: Objectives and requirements
ISO 13181-4	ITS – Communications access for land mobiles (CALM) – Security – Part 4: Countermeasures
ISO 13183	Intelligent transport systems – Communications access for land mobiles – CALM using broadcast communication
ISO 16444	CALM Geo-routing
ISO 16445	CALM Handover mechanisms
ISO 16460	CALM WAVE
ISO 16461	Criteria for Privacy and Integrity protection in Probe Vehicle Information Systems

6.2.10 CEN / ISO standards with relevance to Cooperative systems standards in general

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

ISO TS 17274 Intelligent transport systems - Cooperative systems - Classification and management of ITS applications in a global context

This new work item aims to complement ETSI TS 102 860 by specifying mainly non-technical elements and procedures needed for registration and management of ITS areas. ETSI TS 102 860 specified the ITS application object identifier (ITS-AID and related technical elements for classification, registration and management of ITS application objects (ITS application, application classes and messages sets).

WI0278286 Intelligent transport systems (ITS) - Co operative systems - Roles and responsibilities in the context of cooperative ITS based on architecture(s) for cooperative systems

Currently there is no information available about the scope

6.3 Standards of other SDOs relevant to cooperative systems

6.3.1 SAE standards with possible relevance to Cooperative systems

Listed below are only standards that are directly relevant to cooperative systems, the list does not have to be complete.

J1698/1: Vehicle Event Data Interface--Output Data Definition

This document is part of the J1698 document family, and provides the definitions for event-related data items.

J2540/2_200911: International Traveller Information Systems (ITIS) Phrase Lists

This SAE Standard defines methods and messages to efficiently translate sequences of text and other types of data into and out of indexed values and look-up tables for effective transmission. This document defines: Methods and Data Elements for handling indexes and strings in ITS applications and Message Sets to support the delivery and translations of tables used in such strings Tables of Nationally standardized strings for use in ATIS message descriptions While developed for ATIS use, the methods defined in this document are useful for any textual strings in any Telematics application found both in Intelligent Vehicles and elsewhere.

J2399: Adaptive Cruise Control Operating Characteristics and User Interface

Adaptive cruise control (ACC) is an enhancement of conventional cruise control systems that allows the ACC equipped vehicle to follow a forward vehicle at a pre-selected time gap by controlling the engine, power train, and/or service brakes. This SAE Standard focuses on specifying the minimum requirements for ACC system operating characteristics and elements of the user interface. This document applies to original equipment and aftermarket ACC systems for passenger vehicles (including motorcycles). This document does not apply to commercial vehicles. Furthermore, this document does not address future variations on ACC, such as “stop&go” ACC, that can bring the equipped vehicle to a stop and reaccelerate. Future revisions of this document should consider enhanced versions of ACC, as well as the integration of ACC with Forward Collision Warning (FCW).

J2400: Human Factors in Forward Collision Warning Systems: Operating Characteristics and User Interface Requirements

Forward Collision Warning (FCW) systems are onboard systems intended to provide alerts to assist drivers in avoiding striking the rear end of another moving or stationary motorized vehicle. This SAE Information Report describes elements for a FCW operator interface, as well as requirements and test methods for systems capable of warning drivers of such rear-end collisions. This Information Report applies to original equipment and aftermarket FCW systems for passenger vehicles including cars, light trucks, and vans. This report does not apply to heavy trucks. Furthermore, this document does not address integration issues associated with adaptive cruise control (ACC), and consequently, aspects of the document could be inappropriate for an ACC system integrated with a FCW system.

J1698/2: Vehicle Event Data Interface-Vehicular Data Extraction

This Recommended Practice is intended to define a common method for determining how to extract Event Data from a motor vehicle, including the Event Data Set needed to output the Event Record of data elements defined in SAE J 1698. It is intended for use by those developing tools for the purpose of Event Data Set extraction.

This Recommended Practices aims to utilize existing industry standards to define a common physical interface and the protocols necessary to Event Data Set extraction. To accomplish this, the SAE J 1962 Diagnostics Connector has been designed the primary physical interface and associated industry standard diagnostic protocols have been designated for communications.

J1698/1_200503: Vehicle Event Data Interface--Output Data Definition

This document is part of the J1698 document family, and provides the definitions for event-related data items.

J1698_200502: Vehicle Event Data Interface-Vehicular Output Data Definition

This recommended practice aims to establish a common format for displaying and presenting crash-related data recorded and stored within certain electronic components currently installed in many light-duty vehicles. This recommended practice pertains only to the post-download format of such data and is not intended to standardize the format of the data stored within any on-board storage unit, or to standardize the method of data recording, storing, or extraction. Historically, crash data recording technology in light-duty vehicles has developed and evolved based on differing technical needs of manufacturers and their customers without industry standards or government regulation. As a result, wide variations currently exist among vehicle manufacturers regarding the scope and extent of recorded data. For this reason, this recommended practice is not intended to standardize or mandate the recording of any specific data element or to specify a minimum data set.

Rather, it is intended to be a compilation of data elements and parameters that various manufacturers are currently recording, as well as those elements reasonably predicted to be recorded in the foreseeable future, and to establish a common format for display and presentation of that data so recorded. This version of the recommended practice is limited in application to vehicular data recorded in single frontal impact events. Provisions for multiple-impact events may be included in the next version. Side-impact and rollover events may be addressed at a later time.

J2266_200410: Location Referencing Message Specification

The Location Referencing Message Specification (LRMS) standardizes location referencing for ITS applications that require the communication of spatial data references between databases. ITS databases may reside in central sites, vehicles, or devices on or off roads or other transportation links. The LRMS is applicable to both homogeneous (same database) and mixed database environments that may be implemented on wireless or landline networks. While developed for ITS applications, the LRMS may be used for non-ITS applications as well within the field of geographic information processing.

J2678_200408: Navigation and Route Guidance Function Accessibility While Driving Rationale

This document provides the rationale used by the Navigation Function Accessibility Subcommittee for the development and content of a SAE J2364 Recommended Practice: Navigation and Route Guidance Function Accessibility While Driving. It provides both the reasoning for the overall recommended practice as well as each of its elements.

6.3.2 The latest IEEE standards with possible relevance to Cooperative systems

Since the IEEE deals a lot with communication and almost all communication standards do play certain role in cooperative systems, the list below could be rather long. Therefore we decided to include in this section **only newest documents**, so reader will not find here all standards relevant to cooperative systems, i.e. series 802.11.

IEEE 802.1Qaz-2011 30-Sep-2011

IEEE Approved Draft Standard for Local and Metropolitan Area Networks---Virtual Bridged Local Area Networks Amendment XX: Enhanced Transmission Selection for Bandwidth Sharing Between Traffic Classes

IEEE 802.1Qbc-2011 23-Sep-2011

IEEE Approved Draft Standard for Local and Metropolitan Area Networks Virtual Bridged Local Area Network Amendment: Provider Bridging - Remote Customer Service Interfaces

IEEE 802.1Qbe-2011 07-Sep-2011

IEEE Approved Draft Standard for Local and Metropolitan Area Networks -- Virtual Bridged Local Area Networks Amendment: Multiple I-SID Registration Protocol

IEEE 802.1Qbb-2011 07-Sep-2011

IEEE Approved Draft Standard for Local and Metropolitan Area Networks - Virtual Bridged Local Area Networks - Amendment: Priority-based Flow Control

IEEE P802.3bd/D2.2 August 2010 - DRAFT 16-Aug-2011

Standard for Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications - Amendment: MAC

IEEE 802.22-2011 01-Jul-2011

IEEE Approved Draft Standard for Information Technology -Telecommunications and information exchange between systems - Wireless Regional Area Networks (WRAN) - Specific requirements - Part 22: Cognitive Wireless RAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Policies and protocols

IEEE 1581-2011 20-Jun-2011

IEEE Standard for Static Component Interconnection Test Protocol and Architecture

IEEE 802.16m-2011 06-May-2011

IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Broadband Wireless Access Systems Amendment 3: Advanced Air Interface

7 Use of standards in ITS architectures

The previous chapters gave an overview of work that is in progress in standardization, namely in the field of cooperative systems. A description of project partners involvement, together with identification of emerging standards related to cooperative systems was also provided (the authors do not claim that the list is complete).

This chapter now focuses on a broader view on how the standards can be used in regard to the particular ITS architecture. Starting with a description of the different meanings of term ITS Architecture and how it is used throughout this chapter and the document, followed by brief introduction to the architectures of selected European countries and the general findings of standards involvement in ITS architecture.

7.1 Different levels of ITS architecture

An objective of ITS architecture is the achievement of interoperability between individual telematic applications, including the maximum use of available infrastructure by all telematic applications while keeping system requirements in individual telematic applications (technical requirements, transport related requirements …).

The concept of ITS architecture ranges from relatively simple definitions of a single telematics system to “huge” definitions of a complex telematics system describing several viewpoints of the system, together with its deployment plan, process and object oriented procedures, cost benefit analysis etc. The viewpoints of an ITS architecture are constructed using different perspectives (e.g. functional, physical) and may go into different level of details.

From the general point of view this variety of approaches can be broken down into two basic concepts of an ITS architecture that are used in the ITS domain: high-level (conceptual) and low level (design driven) ITS architectures, they are described in following sections.

7.1.1 Types of ITS architecture

The objectives mentioned above can be guaranteed only if the ITS Architecture is implemented at all corresponding decision levels. The levels at which is the ITS architecture used, gives us three different representations (in level of detail):

- Overall concept / mission (political national, local) statement
- System structure / framework (high level) architecture
- System design / reference (low level) architecture

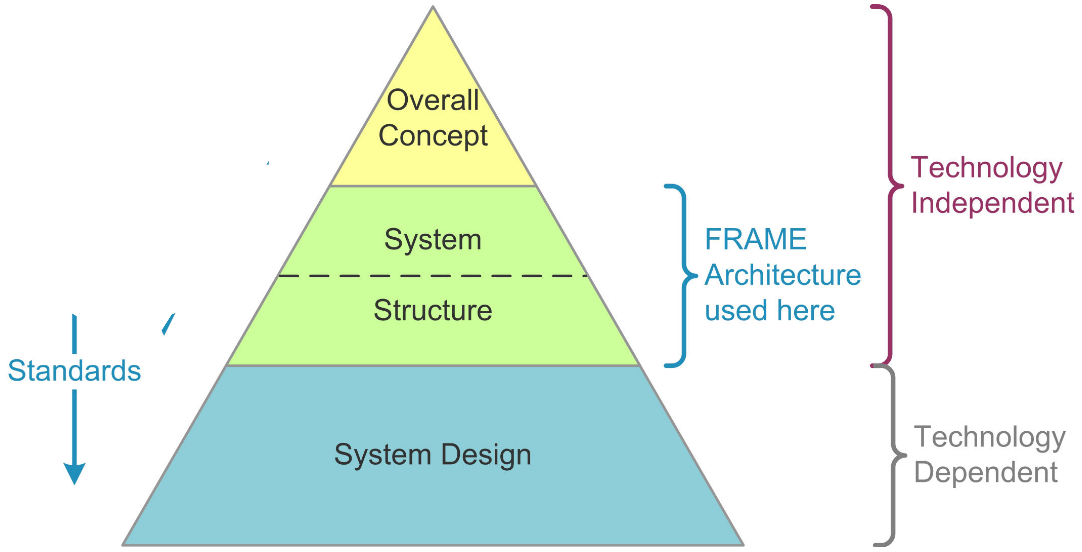

Figure 2 Hierarchy of ITS architectures

7.1.2 Overall concept / ITS national mission statement

It is a clearly structured, overarching, long-term political vision in regard to the use of systems to influence and control traffic to serve the interests of the stakeholders and users and represent goals and benefits. The model is elaborated in a framework which meets the requirements, responsibilities, roles, and the policies and measures and contains a rough implementation plan.

7.1.3 System structure / High level ITS Architectures

Provides the abstract implementation framework for the realization of the mission statement consisting of conceptual, functional, technical, physical and organizational descriptions and agreements that need to exist. They should be as inclusive as possible and also provide for future extensibility. Whilst the term “architecture” can be applied at any level of abstraction and may be used iteratively, in the field of ITS two levels are normally used and are called High and Low Level Architectures.

High-level ITS architectures are used to provide a description of the functionality and communications needed to provide the services expected by stakeholders from a particular ITS implementation. Within a high-level ITS architecture the functionality is shown as the "component specifications" required by ITS to implement the services, with the "communication specifications" describing how the links between the "components" will be provided. All of the "specifications" are technology independent and are intended for use as inputs to the procurement part of the overall ITS implementation process.

Making the "specifications" technology independent gives suppliers the freedom to employ the most appropriate technical solution when tendering, and still comply with the Architecture.

This type of ITS architecture is created by (or for) organisations such as national and regional governments, municipalities, research projects, etc. Aside from the FRAME Architecture the most obvious and widely used example is the US National ITS Architecture.

Creating high-level ITS architectures is a precursor to the creation of low-level (or system design) ITS architectures. The "bridge" between them is provided by the component specifications and communications specifications which are used in the procurement process.

A number of low level ITS architectures may be derived from one high level ITS architecture. Since the high level architecture is technology independent it shall not be driven by low level architectures, therefore the creation is one way process so the low level ITS Architecture shall not influence the high level ITS architecture.

7.1.4 System design / Low level ITS Architectures

It is a specialization of the high level architecture for a general application, such as city traffic signal control. It includes the specification of the functions, their implementation into components, the specification of interfaces and communication between the various system components, the specification of used data types and their structure and the institutional description. It is so detailed that it can serve as a template for the implementation of concrete applications.

Low-level ITS architectures are used to describe the detailed design of the components and the communications, which are needed for ITS implementations. These architectures are created as part of the design activity that commences once procurement has been agreed and use the "component specifications" and "communications specifications" as their starting points. The term "components" is used because the functionality described in the specifications may be realised using either hardware, software, or some combination of the two. The use of particular technologies will almost always form a part of the low-level architecture descriptions.

For many ITS implementations, several low-level ITS architectures may need to be developed depending on the choice of technologies, physical layout and constraints, processing power, communications, security and resilience considerations etc. The actual number of these architectures will depend on how many "specifications" have been produced. In simple terms the creation process for each low-level ITS architecture will be an expansion and refinement of the "component specifications" and "communications specifications" from which the ITS implementation is being made.

7.2 Studied national ITS Architectures

In the project we have studied ITS architectures of European countries. The study was based on two main documents and personal experience of authors. Documents are summary of ITS architectures, one was made by Richard Bossom (Bossom2010) and the other we received form technical university of Darmstadt (Boltze2010). A brief introduction of studied architectures follows:

- In France architecture, ACTIF (first version), was produced in 2000. It is high level architecture based on a draft of the FRAME Architecture. It is used to model the subsystems needed for ITS implementations and has been applied by wide range of jurisdictions and organisations in France. The ACTIF architecture has undergone a number of major updates and is now in Version 5, which incorporates the results of case studies into the architectural framework. These studies are also meant for a broad technical and political audience to help them understand where the architecture helps and where it can be used to their benefit.
- The Italian architecture, ARTIST, was created in 2003 and is based on the European FRAME and ACTIF architectures. It is used by different organisations – e.g. EU projects, universities, local authorities, etc. The emphasis is laid on multimodal transport of hazardous goods, integrated management of emergency calls and goods distribution in urban areas. Since it also deals with the organisational and business aspects of ITS, it has introduced an Organisational Architecture.
- The Finnish architecture, TelemARK, was produced in 2000 and although not based directly on KAREN, it has been shown to be equivalent. The results were disseminated through series of training workshops for specific stakeholders. Update of the architecture was provided by FITS programme. Also a corresponding architecture for goods transport has been created.
- The Norwegian architecture, ARKTRANS, has been developed separately from both the European and the US National ITS Architecture. It currently concentrates on multi-modal freight with experience from maritime transport.
- In Austria, the TTS-A architecture was introduced in 2002, and took the FRAME Architecture as its “template”. The use of an ITS architecture is required by the Austrian Telematics Master Plan. TTS-A should also cover implementation recommendations based on landscape study of an available technology.

- In the Czech Republic, TEAM architecture was launched in 2005. It is based on the French ACTIF architecture. It is now being redesigned not only to bring in new functionalities, but also to make the ITS architecture easier to use.
- Hungarian ITS architecture HITS is based on the FRAME Architecture. It is still under development. In future it is planned to make the usage of ITS architecture compulsory.
- Also under development is the Romanian ITS architecture NARITS. The architecture team has been translating the FRAME tools, and it is planned to use them to build a national ITS architecture when funding permits.
- In the United Kingdom a national ITS architecture does not exist. However, there are several architectures created at the regional level such as the architecture of the County of Kent, and for Transport Scotland and for Transport for London. The first two of these architectures have not been developed further, but the Transport for London ITS architecture will form part of a larger development of an Enterprise Architecture for London.

The ITS architectures above were questioned with regards to their overall concept and their role in the usage or deployment of standards. A description of standards and main questions is in the following two sections.

7.3 Ideal relationship of standards and ITS architecture

Standards are required to ensure compatibility between the various sub-systems and components of ITS. The standards ensuring this are usually concerned with communications between sub-systems and their functions. However, “simple” communications standards are not always sufficient to produce a working and workable system. Of equal importance are the data that they use, and the behaviour of the sub-systems and functions at each end of the communications link, e.g. that one end can produce information in time for the other to make use of it, and the receiving end will understand the units and format in which the data is being provided.

The above mentioned issues are important when an ITS architecture is used to identify required functions, data flows and interfaces for a particular ITS project. In addition the architecture (even FRAME Architecture) itself has to have some framework, within which it could be created. Such a framework is created by architectural standards. Architectural standards define the behaviour and properties of data registries and dictionaries, requirements on the use of architecture, requirements on the modelling tools for architecture creation, templates and some of them even define the ITS architecture itself.

Standards can be divided to 3 categories according to their place in ITS architecture definition / usage.

- Architectural standards – used only when the architecture is being created or updated. They influence only architecture not particular ITS deployments. See sections 6.1 and 6.1.2.
- Communication standards – used at defined interfaces, where data transmission from one function to another function is needed.
- Functional standards – a subgroup consisting of
    - Data and interface specification standards – used for the definition of data structures needed inside ITS functions and the behaviour (data / protocol) of the function interaction.
    - System parameter specification standards – used for setting levels of functionality, robustness and interoperability of ITS functions within desired functionality.
    - Test procedures standards – used for ensuring that particular ITS components could be used within specific ITS function.

Figure 3 depicts the relationship between standards and architectures. Arrows symbolize the flow of ideas or information and mean certain type of "one sided" action, i.e. standards for the support of architecture helps to form / define the architecture, while other standards come from the architecture either as a requirement for new standards (at newly defined interfaces) or as set of existing standards which have to be followed.

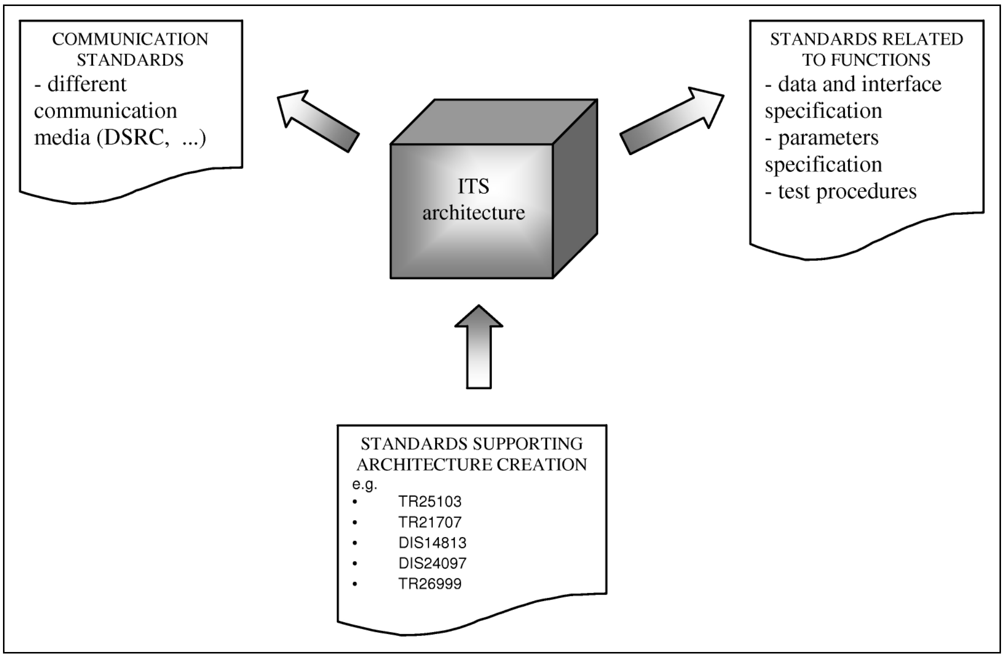

Figure 3 Relationship between ITS architecture and different types of standards

7.4 Practical influence of standards

One of the tasks of this deliverable was to investigate relationship "links" between standards and examined ITS architectures. In the project we studied how previously mentioned ITS architectures affected or have been affected by standards. Three types of influence was identified, they can be summarized in three questions mentioned below:

- Are standards used to create the architecture?
- Is architecture used in the creation of standards?
- Are standards included into the architecture for some purpose?

Answer these questions, given bellow, is based on close examination of national ITS architectures by E-FRAME team members.

7.4.1 Are standards used to create the architecture?

According to our analysis there is <u>no influence of architecture definition standards</u> on any particular ITS architecture creation. Framework ITS architectures and sub-set ITS architectures (created from a framework ITS architecture), are not explicitly influenced by any of architectural standards. The only exception is the national ITS architecture of Australia which was based on the ISO standardized ITS architecture, but there is no evidence of it being used, or it being understood by anyone other than its authors. Other architectural standards just specify how the architecture should be used in standards and implemented in real life (in the form of recommendations and examples), therefore they cannot have any effect on the creation of an ITS architecture itself.

7.4.2 Is architecture used in the creation of standards?

One of the primary reasons for the creation of the US National ITS Architecture was so that the required Communication Standards could be identified. Version 1 led to the setting up of a large number of IEEE standard Working Groups and the creation of about 40-50 new Communications standards.

However, this is not the case for the FRAME ITS architecture, where the use of a higher abstraction level does not support the identification or creation of new communications standards. According to our findings, other standards which emerged from ITS architecture creation were again architectural standards (technical reports), i.e. implementation standards, requirements on architecture description in standards, etc.

According to chapter 5, the creation of new standards is based on the needs expressed in the ITS Action Plan and in the CEN/ETSI Response to Mandate M/453. Recently many proposals for new standards have emerged, but there is still work that could usefully be done to find missing applications related standards. This work would be made much easier if the FRAME Architecture was used to show what is needed to deliver particular services.

7.4.3 Are standards included into the architecture for some purpose?

In certain national ITS architectures (e.g. TEAM) standards are linked to functions and data flows, so are at the functional viewpoint level. The effect of this linking is beneficial when the architecture is used for setting up conditions for new ITS projects. Then conformance requirements to standards for certain functionality of ITS project can be automatically used while contracting for the deployment of ITS systems.

However, even though the linkage to the standards existed it was on too high abstraction level. There are too many standards that can be linked at functional viewpoint, giving too many options for an architect to choose from. Also the person in charge of the “linking” of the standards has a difficult task, since at a certain level all standards and functions are somehow related. This could end up as having “all standards linked to all functions”.

7.5 How does it fit together

Summarizing the knowledge of E-FRAME partners, about the standards used and “their” high level national ITS architectures:

- national ITS Architectures have not had a direct impact on standards or promoted the creation of standards

- also none of the high level national ITS architectures have been explicitly created using standards and
- because of their high level of abstraction they have no relation to existing standards. Mainly it depends on the level of abstraction of a high level architecture.

The FRAME Architecture, through the functional viewpoint, allows association with only a small number of standards. This is primarily, because it describes the systems at a higher abstraction level than the one where communication standards, being the most common standards, are used.

Communication standards can be linked to a communication viewpoint, if a high level architecture contains one. This association may be a big benefit that could support the usage of the architecture.

However this linking of a high level ITS architecture to standards results in **need for continuous updating** of the link due to the ongoing process of standardization. Even the high level architecture has to be updated regularly, in the period of years the standard then has to be maintained practically constantly, as new standards are being published every month. Therefore the **linkage of standards to ITS architectures is, in reality, a complicated task and is valid only for short period of time.**

A proposal for a solution to the problem how to link standards to the high level architecture is presented in the following chapters.

8 Specific experiences regarding standards and ITS Architecture

This chapter follows the considerations mentioned in previous chapters and, using specific examples it tries to explain how an ITS Architecture can be made more usable, by using below mentioned stand-alone tools for the support and development of ITS systems.

The authors approach ITS Architecture as a concept of building of ITS installations in an effective and efficient way. Therefore the ITS Architecture shall not only help in the creation of system viewpoints, but also support the identification of the right standards for specific ITS installations and, on a higher level, support the standards creation process by maintaining publicly available and consistent terminology for use in ITS standardization.

The use of these two tools is explored more widely in the following sections of this chapter, as they represent experience gained from the Czech implementation of a database of “excerpts” of standards (will be described later) thoroughly described together with a methodology for its creation and also the Czech experience with the creation of a terminology database.

Later in this chapter we present a summary of challenges with potential exploitation of these tools, the expected benefits and cost of wider scale European implementation.

8.1 The database of excerpts of ITS standards[4]

Using technical standards to improve cooperation / interfacing of individual system components is one of the main reasons for having an ITS architecture. However, it has been proven difficult to relate standards to “virtual” / framework architectures. Since the high level architectures are too vague for this, linking with standards must be done on different level and in a different way.

8.1.1 Introduction

The Czech Republic has been following the work of CEN/TC 278 since 1994 and ISO/TC 204 since 2005. As the native language is not English, there was a need to decide which ITS standards are to be implemented into a national standardization framework and what is the suitable form of their implementation – either by translation or in English. Since translation is very costly it was decided to first gather the possible knowledge of the

[4] For more detailed description see Annex C.

contents of the standards, and their potential use, and to decide on whether they should be translated or not.

8.1.2 Set up of the project

The Czech Ministry of Transport set up the project STANDARD. The project was aimed at creating a knowledge system of information about ITS standards. The primary goal of the project was to promote the existence of ITS standards, and their intended use, in real ITS systems implementations.

There were 140 European and international normative documents, the vast majority not translated into Czech, with a volume of 8 000 pages (in English).

The team had to come up with the revolutionary idea of a special document type, an extract that is a strictly formalized text about a standard, with an emphasis on its intended use. The second goal that should be highlighted is the innovative way of ITS standard categorization to improve the search for the right standards. The categorization has resulted mainly from the fact that the work of ISO and CEN committees´ WG's is not done in a particularly cooperative manner, and the categories could connect many existing standards within a specific selection.

8.1.3 Extracts

Extracts have become a **new type of document exclusively created for raising the awareness of existing ITS standards,** but it is **intended to be used as a standardization marketing tool** for all sectors.

To ensure the consistency and unification of the form and content of the extracts, a specific methodology for its creation has been worked out. Each extract is a simplified text about a technical standard providing its reader with detailed information about the content of the standard. The aim of the extract is to deliver information about the intended use and application of the standard.

The extract does not describe the scope of the standard, nor does it replace the standard itself. Its purpose is to provide the reader with the possibility of making a good choice from the standards for his/her intentions and guide him/her to buy and use the standard. Simply said, its purpose is the marketing of the standard. Further information about extract creation and the web application for ITS standard search can be found in Annex E.

8.1.4 Project results / deliverables

There were three relevant outputs of the project STANDARD – user guidebook with 140 extracts that have been worked out and reviewed by national experts, the great majority by national “convenors” of specific working groups. **The extracts are compiled within a User**

Guidebook of 679 pages that represents the comprised information about treated ITS standards.

The second output was the system to search for ITS standards, an expert system that has been designated as decision-makers support system. The system enables the user to look up selected extracts of standards according to some criteria in five different ways – criteria of working group (WG), thematic criteria, criteria of structurally classified categories, criteria of key words and full text search, see Figure 4. Available at www.silmos.cz/standard/en/.

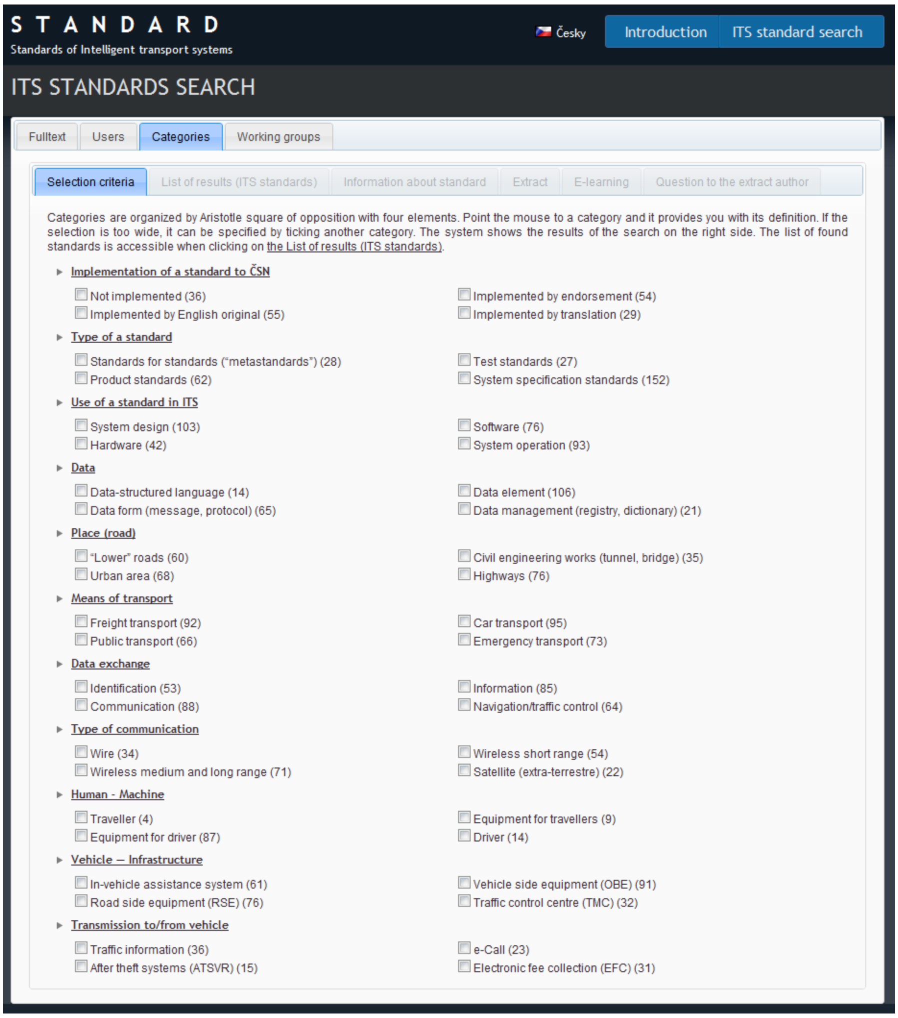

Figure 4 System for look up of relevant standards (source: (http://www.silmos.cz/standard/en/)

The third output was based on a detailed analysis of 10 selected ITS standards that were stated as being very important. The standards were analysed into the form of e-learning to provide detailed on-line guidance for differentiated users, non-specialist and expert. Available in Czech at http://standard.eltodo.cz/.

8.2 Terminology database[5]

In order to understand the content of standards it is necessary to know the meaning of ITS terms. The path to settle down a common terminology is long even with a systematic approach. To better understand and possibly share the experience of the Czech Republic the following wider introduction is provided.

8.2.1 Introduction

Due to the systematic long term work with ITS standards in the Czech Republic it has been possible to run horizontal activities projects above ITS standards as e.g. the above presented project STANDARD.

The ITS industry is a quite new sector and there was **no existing terminology available**. Czech standardization committee TNK 136 Traffic telematics has ITS in its scope, SILMOS CTN, is the secretariat for TNK 136 and it is empowered to implement the standards into the Czech standardization framework and support the translations.

Within its systematic approach to implement almost two hundred European standards the specific terminology should be settled down and harmonized with the existing terms within the transport domain and possibly create new terms as equivalents to new European terminology.

In 1998 the terminology of CEN/TC 226 Road equipment was decided and 44 European standards offered 380 terms and definitions. In 2002 the terminology of CEN/TC 227 Road materials was accomplished (version 3.0, version 1.0 in 1999) – from 81 standards 296 terms and definitions was accumulated. Both terminology dictionaries were updated regularly and formed the basis for unified translations of European standards.

8.2.2 Set up of the project

In the years 2003-2004 the first terms dictionary were worked out from approximately 100 European standards (and some ISO), mostly at the draft stage. The final result contained more than **1,700** ITS terms and definitions. The next year, 2005, it was complemented by the Nordic Road administration terminology and in autumn 2006 the results were presented in Budapest at a CEN/TC 278 meeting.

[5] more specific information contained in Annex D and Annex F

8.2.3 Realization and consolidation phase

In 2009 the terminology work dealt with 106 new or revised ITS standards to gain about 1,500 terms and definitions. The final consolidation of ITS dictionary (version I from 2006 and version II from 2009) resulted in approximately **2 500 unique ITS terms and definitions**. Czech experience in the field of terminology work shows that the work should be done in phases as the terminology develops.

First phase can be simply designated as the phase of collecting (aggregating, accumulating) terms and definitions.

The second phase concentrates on work with accumulated terms and definitions. Its result is on different higher qualitative level than a dictionary of terminology from standards. The result is a standard. The goal was to leave out old (no longer valid) terms and fill the standard with properly selected terms and definitions, mostly from European standards. The second part introduced a terminologically non-codified field – traffic engineering with almost 300 terms and definitions. Both standards took almost two years to finalise.

The third part was mostly based on new European standards. The scope was traffic equipment and it was made into a three European languages edition – term and its definition in Czech and the equivalent term in official European languages – English, French and German. It built on an updated version of CEN/TC 226 dictionary. Besides the linguistic work on 346 terms and definitions the big problem to solve was the harmonization of Czech legislation terminology and classification of traffic equipment and European classification. The standard is an exemplary compilation of national terminology with European terminology implementation.

8.2.4 Project results

The stabilisation of such a terminology takes years of detailed attention and stable team coordination. In 2008 the Ministry of Transport came up with the project to create a Transport dictionary based on previous results.

To get the number of terms in the table below many hundreds of documents have been studied and more than 1,000 of them contained some terminology. The biggest reduction in terms (most severe selection) was made in road transport; from more than 20,000 terms the book now contains about 7, 000 terms and their definitions.

Table D.1 Terminology in terminological dictionary

Number of terms within different phases of the project	Rail transport	Road transport	Water transport	Traffic telematics	TOTAL
Version 0 (Phase II)	8 370	7 202	5 893	3 824	25 289

Table D.1 Terminology in terminological dictionary

Number of terms within different phases of the project	Rail transport	Road transport	Water transport	Traffic telematics	TOTAL
Increments and complements	861	13 177	*726	*89	*14 853
Phase III before duplicities removal and selection	9 231	20 379	6 619	3 913	40 142
Phase IV after duplicities removal and selection	7 612	(11 000)	4 578	2 582	25 772

The project resulted in three outputs – The book published in November 2010 (1,034 pages, 22,000 Czech terms and definitions and English terms equivalents), the web application www.slovnikdopravy.cz and the methodology for the dictionary update.

8.3 Challenges and benefits on European scale

8.3.1 The database of excerpts of ITS standards

The system for extracts and its methodology is well tested, however it still needs to develop, both in a quantitative manner – reflection of new standards and also ETSI involvement, and in a qualitative manner – developing the remaining four squares of opposition (16 polarities) to describe the ITS reality by 64 categories (complete square...).

An analysis of future needs have been made, based on a comparison with knowledge systems in medicine. “User of standard” (patient) is subject to “asking for standards” (health investigation) and receives “standards packages” (diagnosis) to choose a particular standard/ extract (cure). This simple comparison underlines the real need to create “market packages of standards” for a particular ITS domain. Such a package should be accompanied by introductory comment. The web application could represent a universal marketing tool in the form of a web portal for all ITS standards.

Benefits of database of standards excerpts together with their ontology and a search tool

Such a tool brings many benefits, below are listed some of them:

- Helps to market the standards. Users know what they are buying.
- Helps to identify needed standards while creating system architecture, by several means (terms, categories, full text search, users, etc.)
- Helps architects and public representatives to see if the identified standard is really relevant and if there are other related standards that might be needed.

- Reduces the time needed for creation of system architecture
- Leads to a better understanding of whole standards (much better than introduction in the standard – the excerpt really answers the basic questions what?, why? and how?.

Stable independent financial support

To update the database regularly there should an intention to have the administrator financially supported by, but independent of, business interests and so the web application should be supported by European funds as a contribution to worldwide ITS harmonization.

Financial support might come from EC through mandate M453. Creation of new excerpts shall be main responsibility of standard's authors, since they know the intention of the standard.

8.3.2 The European terminology database

This detailed description clearly shows that the creation of common terminology from international and national sources requires long term commitment and work. And more, that it is the first work to do. If there is an official proclamation about a mutual European and Asian and American approach to cooperative systems, and there is a common work programme settling down the important issues, it would be right to start with terminology consolidation first to avoid the following confusion of the mis-understanding of terms at the international level, and second hand within translations at the national level. **The common harmonized terminology could save as much time for document creators** (ITS legislation makers, ITS calls for tender documentation makers, ITS standards makers etc.) as for other stakeholders – users of produced documents. A development plan for such database is in Annex F.

Benefits of common terminology web dictionary

Such a web tool brings many benefits, below are listed some of them:

- reduces terminology inconsistency;
- makes it easier for standards developers to find suitable terms and definitions and so saves time of a standard development;
- raises the use of already defined terms and prevents from "new-old terms" creation (already defined terms that are slightly modified and so become new terms);
- helps relevant Working Groups manage their terminology that can be different due to its development in different Working SubGroups;
- leads to the harmonization of the terminology within WGs and among WGs;

- common terminology means a higher degree of planning and collaboration among areas (consortium psc-europe)

Stable independent financial support

To update the database regularly there should an intention to have the administrator financially supported by, but independent of, business interests and so the web application should be supported by European funds as a contribution to worldwide ITS harmonization.

8.3.3 European looks for common understanding

From the example from the Czech Republic it can be concluded that agreeing the terminology and having database of excerpts is the first step for getting cooperation among different parties involved. It helps the development of the sector and brings a broader context of the produced work.

The use of these architectural tools as the prime goal is based on several premises:

- Availability 24/7
- Free of charge, full supportive tool
- Regular update
- Simple web application (simple domain name)
- Thematic division
- Different users mean the possibility of different scales of data presentation
- tools should be respected and should be referenced in all relevant documents

9 Summary

9.1 Creation of new standards and influencing emerging ones

At the time of the project proposal, the objective of WP600 was to take part in standardization process and help to standardize new “ideas” emerging from its work within the cooperative systems community. However it was found that such a task was unnecessary because of the active role of the EC in cooperative systems, as described in chapter 5, that occurred independently of, and at the time the project began. Even though E-FRAME did not propose any standards by itself, it has actively participated in CEN TC278 WG16 / ISO TC204 WG18 that is responsible for cooperative systems, particularly contributing to the work on roles and responsibilities. It has also actively participated in the work of the EU-US Task Force. E-FRAME project partners are also actively involved in CEN TC278 in working groups WG13 architecture (R. Bossom is the convenor) and WG12 identification (P. Bures is long term member).

Another task of WP600 was to make an overview of standardization in the field of cooperative systems, which it has done in chapters 4 – 7. The most important standards have been described, and provide the reader with a good overview.

9.2 Standards and architecture

European ITS architectures, based on FRAME, have been analysed (see section 7.2), with the task of finding out how these architectures utilized standards (if they used them while creating the architecture, if they define new standards, or if they linked complete standards to some architectural function).

Summarizing knowledge about standards use, the E-FRAME partners and their high level national ITS architectures have not had a direct impact on standards or promoted the creation of standards from these architectures. Also none of the high level national ITS architectures have been created using standards and because of their high level of abstraction have no relation to existing standards. Mainly it depends on the level of abstraction of a high level architecture. However this is being addressed through the creation of standard (TR26999) that describes the methodology behind the creation and use of the FRAME Architecture.

From the types of standards being produced it can be seen that only a small number of standards can be linked directly to the FRAME Architecture, as it only provides the Functional Viewpoint and thus only describes the functionality that can be included in systems and not the systems themselves. It is only when the systems themselves are created that it is possible to identify which standards (usually communication standards as they are the most common standards) are used. At the moment this is being done in ITS architectures created from the FRAME Architecture by projects and for specific ITS implementations.

The high level architecture can be associated with standards; this is particularly true when the architecture consists of communication viewpoint, where the association brings benefit to the users. However this linking of a high level ITS architecture to standards results in need for continuous updating of the link due to the ongoing process of standardization. Even the high level architecture has to be updated regularly, in the period of years the standard then has to be maintained practically constantly, as new standards are being published every month.

Linkage of standards to ITS architectures is, in reality, a complicated task and is valid only for short period of time. Therefore we have sought other ways how to create a relationship between standards and the architecture.

9.3 ITS architecture–standards linkage proposal

9.3.1 The Czech Republic example – Database of standards extracts and Terminology database

While standards could not be linked to ITS architectures directly (or it is very complicated) there is a need to know about them while producing system designs from the architectures, or preparing contract conditions for Calls for Tenders. Therefore, the creation of a database of excerpts from standards, together with a web search tool supported by different search patterns (key word, categories, full text search) have been studied extensively.

The Czech Republic project STANDARD came up with the idea of a special document type, an extract that is a strictly formalized text about a standard, with an emphasis on its intended use.

The extract does not describe the scope of the standard, nor does it replace the standard itself, its purpose is to provide the reader with the possibility of making a good choice from the standards for his/her intentions, and to guide him/her to buy and use the standard. In summary, its purpose is the marketing of the standard.

Such a freely accessible database will make a linkage of standards to the architecture irrelevant and should also speed up the process of system development through a free and easy to use tool, which would help its users to find out the right standard.

The final consolidation of an ITS dictionary resulted in approximately **2 500 unique ITS terms and definitions**. (Web application www.slovnikdopravy.cz)

The creation of a common terminology from international and national sources requires a long term commitment and work. If there is an official announcement about mutual European and Asian and American approach to cooperative systems, and there is a common work programme settling down the important issues **it would be right to start with terminology consolidation** first to avoid the confusion of misunderstanding common terms at the international level, and subsequent translations at the national level.

The common harmonized terminology could save much time for document creators (ITS legislation makers, ITS calls for tender documentation makers, ITS standards makers etc.) as for other stakeholders – users of the produced documents. A development plan for such a database is in Annex F.

In order to update the database (excerpts from standards, and terminology) regularly there should an intention to have the administrator financially supported by, but independent of, business interests and so the web application should be supported by European funds as a contribution to worldwide ITS harmonization.

10 Recommendations

The authors of this deliverable feel that high level ITS architecture, i.e. FRAME, shall NOT be directly linked with standards, since both are subject to change and the benefit of this link is questionable. Having standards at lower level ITS architecture is a different matter, there the benefit is clear, because such architecture is associated with real world projects.

Since the standards are not (as we recommend) linked to high level ITS architecture, from which the lower levels of ITS architecture are derived, we therefore recommend a different solution as to how to handle this issue.

We **recommend** that a database containing excerpts of all available standards shall be created consisting not only of description, but also of key words, categorization, comments from authors, for more about this database see section 8.1 or Annex C. This database should be used while creating lower level ITS architectures to identify and select standards which are relevant to the proposed system.

Moreover, one of the tasks of high level ITS architecture (such as FRAME) is to set up a framework for creation of ITS. To such framework belongs also a terminology, which is currently not maintained and therefore the terms and definitions are scattered.

Authors **recommend** that one of responsibilities of the FRAME-Forum shall be the creation and maintenance of a terminology database across the ITS standardization world. The database would allow harmonization, clear up misinterpretation and as result speed up the process of standards creation. For more information see section 8.2 and Annex D.

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Annex A The areas and services identified in the "Response to mandate M453"

The areas and services identified in the "Response" document for which CEN/ISO and ETSI believe standards must be developed are shown in the following table.

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
GENERAL			
Definition and Harmonised Terminology	Common agreement on definitions and terminologies to be used for standardisation. Harmonisation and cross-check of terminologies among SDOs.	CEN	c
European Reference ITS Communication Architecture	Standardised communication architecture for ITS Cooperative Systems, the defined architecture accommodates multiple applications and communication means. The architecture is based on OSI model.	ETSI	m
European cooperative ITS framework architecture	Analysis and description of roles and responsibilities in the context of cooperative ITS and necessary information flows among roles.	CEN	c
Common Data Dictionary	Common definition and description of data elements, data frames to be used inside station and in transmitted messages. This common data dictionary will allow different in-vehicle system and road infrastructure system to have a common base of data (communication).	ETSI	i
Common Data Dictionary	Common definition and description of data elements, data frames to be used inside station and in transmitted messages. This common data dictionary will allow different in-vehicle system and road infrastructure system to have a common base of data (payload).	CEN	i

[6] The following three codes are used in the column headed “Purpose”: **i** = interoperability; **c** = cooperation; and **m** = modularity.

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
TESTING			
ITS Test Framework	Specification of the global framework for conformance and interoperability testing.	ETSI	i
ITS Conformance Testing	Conformance testing for each base standard	ETSI	i
ITS Interoperability	Testing Interoperability testing of related standards	ETSI	i
APPLICATION (use case, payload, communication requirements, etc.)			
Cooperative Awareness Driving Assistance (safety) V2V	Information from other vehicles as basis for the generation of in-vehicle Warnings: Emergency Vehicle Warning, Intersection Collision Warning, Slow Vehicle Warning, Motorcycle Approaching Indication.	ETSI	i
Floating Car Data Collection for Infrastructure Applications	Collection of Information from vehicles for infrastructure applications	CEN	i
Event Driven Road Hazard Warning V2I, I2I	Based on a certain event, a warning message is sent out: Roadwork Warning, Wrong Way Driving Warning, Collision Risk Warning from an ITS-Station Roadside, Traffic Condition Safety Warning, Weather condition warning.	CEN	i
Event Driven Road Hazard Warning V2V	Based on a certain event, a warning message is sent out: Emergency Electronic Brake Light, Stationary Vehicle Warning, Roadwork Warning, Wrong Way Driving Warning, Traffic Condition Safety Warning, Weather condition warning	ETSI	i
Traffic Management V2I, I2I	Optimum traffic throughput via speed limits, centrally determined routing, road network management, no overtaking for trucks. Monitoring and routing of dangerous goods	CEN	i

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
Traffic Management V2V	Improved traffic throughput based on information from other vehicles for example, position, speed, acceleration information.	ETSI	i
Cooperative Traveller Assistance V2I, I2I	Navigation considering information received about restricted access, etc. Parking information/booking. POI.	CEN	i
Cooperative Traveller Assistance V2V	Navigation considering information received about restricted access, etc. Parking information/booking.	ETSI	i
Value Added Services V2I, I2I	Insurance & Financial Services	CEN	i
Value Added Services V2V	Insurance & Financial Services	ETSI	i
FACILITIES			
Facilities Layer Architecture	Facilities layer internal architecture including functional specifications of interfaces and information exchange among components.	ETSI	m
SAP specification between application and facilities layer	SAP provides interface for information exchanges between application and facilities layer, for example, application requirements, information exchanges.	ETSI	m
Cooperative Awareness Message (CAM)	Cooperative awareness messages are broadcasted messages sent by ITS Stations to announce periodically its presence, basic attributes information to other Stations in its vicinity, for example, position, mobility, basic sensor status.	ETSI	i

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
Decentralised Environmental Notification Message (DENM)	DENM is event driven message broadcast to ITS Stations to provide information about the detected event, e.g. event type, location and time.	ETSI	i
Local Dynamic Map (LDM)	Local dynamic map providing a data base of time and location referenced elements.	ETSI/CEN[7]	c
Services Announcement / Advertisement	Providing information about available services, service access, activation, deactivation and services registry.	ETSI	i
ITS Station Position and Time Service	This facility provides functionalities for station position and time. It takes into account requirements from application and other layers (for example, Network layer) in terms of positioning, time and data quality in order to provide relevant position and timing information.	ETSI	i
HMI Support	HMI support provides a common interface between ITS applications and multiple HMI devices. This facility does not standardise HMI. For road safety applications a standardised presentation may be needed, for example, icons.	ETSI	optional
Road geometry messages and regulation information provision	This facility provides functionalities to construct sequence and transmit a message in a common format, providing road and intersection geometry, path and regulation information from roadside station to oncoming vehicles.	CEN	i
Traffic signal phase and timing	This facility provides functionalities to construct, sequence and transmitting a message in a common format, providing traffic signal phase and timing from roadside station to oncoming vehicles.	CEN	i

[7] Depends on the results of the existing ETSI WI and CEN Proposed Work Item (PWI).

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
GNSS correction data	This facility provides functionalities to construct sequence and transmit a message in a common format, providing GNSS correction data or positioning augmentation data from roadside station to oncoming vehicles.	CEN	i
Localised traffic information	This facility provides functionalities to construct sequence and transmit a message in a common format, providing localised traffic information from roadside station to oncoming vehicles.	CEN	i
Location referencing	This facility provides location referencing functionalities and encoding specifications for geographic position used in V2X messages.	CEN	i
Facilities Layer communication congestion control	This facility support communication congestion control at Facilities Layer and in connection with overall system congestion control concept.	ETSI	i
Priority / Traffic Class Consistency Check	This facility provides functionalities to check consistency of traffic classes and priority levels for communication with application requirements.	ETSI	i
NETWORKING and TRANSPORT			
NETWORK architecture	Specifies network architecture, its components and network reference points in relation to the overall communication architecture. This includes the definition of networking-related deployment scenarios and the provision of a framework for the design of network protocols.	ETSI	m
SAP specification between facilities and N&T layer.	This SAP provides the interface for the information exchange between the network & transport layer and the facilities layer. • Minimum interface functionalities • Information to be exchanged via SAP	ETSI	m

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
Geo-Networking media-independent functionalities	Network protocol for *ad-hoc* communication among vehicles and between vehicles and road-side base stations over short range wireless access technologies • Network protocol required for communication over ITS-G5 (and potentially other access technologies) • Provides single-hop and multi-hop communication	ETSI	i
Geo-Networking for ITS-G5A	Media-dependent functionality of Geo-Networking for support of ITS-G5A • Required extensions of Geo-Networking for ITS-G5A • Specific extensions for data congestion control, channel usage, etc.	ETSI	i
Geo-Networking for ITS-G5B and ITS-G5C	Media-dependent functionality of Geo-Networking for support of ITS-G5B ad ITS-G5C • Required extensions of Geo-Networking for ITS-G5B and ITS-G5C • Specific extensions for data congestion control, channel usage, etc.	ETSI	i
Transmission of IPv6 packets over Geo-Networking	Initial standard to define the transmission of IPv6 packets by means of tunnelling over Geo-Networking	ETSI	i
Basic Transport Protocol for Geo-Networking	Simple transport protocol for non-IP networking (provides UDP like functionality)	ETSI	i
IPv6 networking in ITS	Specifies usage of IP-related protocols for ITS scenarios • Specifies the role of IETF-related standards in ITS	ETSI	i
Service announcement and multi-channel support for ITS networking	Specifies support for service announcement/advertisement and multi-channel coordination for ITS-G5 and other media	ETSI	i

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
Advanced IP mobility support	Usage of existing Internet standards for advanced IP mobility support. Optimisation of IPv6 mobility support with respect to signalling overhead and latency	ETSI	i
Network Layer Communication Congestion control	Support of the communication congestion control at Network Layer and in connection with overall system congestion control concept.	ETSI	i
ACCESS			
SAP specification between N&T and Access layer.	This SAP provides the interface for the information exchange between the network & transport layer and the Access layer.	ETSI	m
European profile on ITS G5	European profile of the physical and media access control sub-layer of 5 GHz ITS using IEEE 802.11 as the base standard.	ETSI	i
Multiple channel management for ITS G5	Support of multiple channels, for example, with dual radio	ETSI	i
PHY/MAC Congestion control	Support of the communication congestion control at Access Layer and in connection with overall system congestion control concept.	ETSI	i
Mitigation Techniques for ITS G5 Mitigation	Techniques to improve coexistence between DSRC and ITS in the 5 GHz range	ETSI	i
MANAGEMENT			
ITS Station Management	Detailed specifications on ITS Station management as defined in the reference architecture, cross layer information handling, cross layer functionalities. This includes also lifecycle management.	ETSI	i
Congestion Management	The overall system congestion control concept supported by the layer specific functions.	ETSI	i

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
Identities Management	This functionality manages all relevant identifiers within the station.	ETSI	i
SAP specification between management and facilities layer	SAP provides an interface for information exchanges between management and facilities layer for example, application requirements.	ETSI	m
SAP specification between Management and N&T layer.	SAP provides an interface for the information exchanges between the network & transport layer and the management.	ETSI	m
SAP specification between management entity and access layer.	This SAP provides the interface for the information exchange between the management entity and the access layer.	ETSI	m
Communication Management	Assignment to applications of relevant communication profiles according to their respective functional & operational requirements. Consideration of associated communication costs in case of several profiles being locally available	ETSI	i
SECURITY			
Security architecture	Specifies security architecture, its components and security reference points in relation to the overall communication architecture. This includes the definition of security related deployment scenarios and the provision of a framework for the design of security measures.	ETSI	m
SAP specification between security entity and the facility layer.	This SAP provides the interface for the information exchange between the security entity and the facilities layer.	ETSI	m

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
SAP specification between security entity and the N&T layer.	This SAP provides the interface for the information exchange between the security entity and the N&T layer.	ETSI	m
SAP specification between management and security entities.	This SAP provides the interface for the information exchange between the security entity and the management entity.	ETSI	m
SAP specification between security entity and access layer.	This SAP provides the interface for the information exchange between the security entity and the access layer. (Check Work Item)	ETSI	m
ITS Station Security Management	Specifications of ITS Station security management for ITS Station operation as well as to provide security services to different layers.	ETSI	i
Confidentiality Services	Specification of measures to ensure the required level of privacy for the participants in cooperative ITS.	ETSI	i
Identity, Trust and Privacy Management	Specification of key management functions for issuing and managing long-term and short-term identities, for example, pseudonym certificates.	ETSI	i
Access Control	Specification of authentication and authorisation services to avoid unauthorised access.	ETSI	i
Plausibility validation	Specification of procedures, which enable plausibility validation of communicated data.	ETSI	i
Secure and Privacy-Preserving Messaging	Specification of measures to ensure the required level of security and privacy for message communication.	ETSI	i

Table A.1 Areas in which Standards for Cooperative Systems are to be developed by CEN and ETSI

Proposed Standard	Description	Responsible SDO	Purpose[6]
Plausibility Validation	Specification of procedures and interfaces for coarse plausibility validation of data received with respect to security.	ETSI	i

Annex B Elaborated standards according the areas and services identified in the "Response to mandate M453"

The first joint report of CEN and ETIS (CEN-ETSI, 2011), provides, in accordance with the Response to Mandate M/453, a list of standards with information about their stage of development and expected date of publication/approval.

According to (CEN-ETSI, 2011): *"A typical process is development and adoption of a Technical Specification in relation to a work item followed by a process for adoption as an EN with public enquiry and national voting. Five new STFs funded by the European Commission have been established with strong support the standardization activities in response to the Mandate. The STFs includes both development of base standards and support for test specifications.*

ETSI TC ITS expects to finalise most of the standards before July 2012 while some test specifications and the process for transferring a standard from TS to an EN may take somewhat longer."

ETSI TC ITS status of standardization activities on the list of minimum set of standards indicated in the Mandate report April 2010.

General standards and Testing	**SDO**	**ETSI Standard**	**WI**	**Approval**	**Priority**
Definition and terminology	CEN				
Communication Architecture	ETSI	EN 302665		Published	Critical
Framework architecture	CEN				
Com data dictionary (comm)	ETSI	Not started			Critical
Com data dictionary (payload)	CEN				

Standards - Testing	**SDO**	**ETSI Standard**	**WI**	**Approval**	**Priority**
ITS testing framework	ETSI	EG 202798		Published	
ITS Conformance Testing					
Basic Transport Protocol validation (ATS, TSS&TP, PICS)	ETSI	TS 102870-1 TS 102870-2 TS 102870-3		Published	Critical
GeoNetworking ITS G5 (ATS, TSS&TP, PICS)	ETSI	TS 102871-1 TS 102872-2 TS 102873-3		Published	Critical

Standards - Testing	SDO	ETSI Standard	WI	Approval	Priority
IP packets over GeoNetworking (ATS, TSS&TP, PICS)	ETSI	TS 102859-1 TS 102859-2 TS 102859-3		Published	Critical
CAM (ATS, TSS&TP, PICS)	ETSI	TS 102868-1 TS 102868-2 TS 102868-3		Published	Critical
DNM (ATS, TSS&TP, PICS)	ETSI	TS 102869-1 TS 102869-2 TS 102869-3		Published	Critical
Channel congestion 5.9 (ATS, TSS&TP, PICS)	ETSI	TS 102917-1 TS 102917-2 TS 102917-3	40025 40026 40027	Nov 2011	Critical
Coexistence methods DSRC/ITS G5 (ATS, TSS&TP, PICS)	ETSI	TS 102916-1 TS 102916-2 TS 102916-3	40022 40023 40024	Nov 2011	Critical
CALM – Medium service access points	ETSI	TS 102760-1 TS 102760-2 TS 102760-3	 20021	published published 	Critical
CALM - Architecture	ETSI	TS 102 984-1 TS 102 984-2	0020027-1 0020027-2		Critical
CALM - Management	ETSI	TS 102797-1 TS 102797-2 TS 102797-3	20010 20011 20030		Critical
CALM – Non-IP networking	ETSI	TS 102985-1 TS 102985-2 TS 102985-3	0020028-1 0020028-2 0020028-3		Critical
CALM – M5	ETSI	TS 102983-1 TS 102983-2 TS 102983-3	0020026-1 0020026-2 0020026-3		Critical
CALM – Infra-red systems	ETSI	TS 102982-1 TS 102982-2 TS 102982-3	0020025-1 0020025-2 0020025-3		Critical
CALM – Ipv6 Networking	ETSI	TS 102981-1 TS 102981-2 TS 102981-3	0020024-1 0020024-2 0020024-3		Critical
Interoperability testing					
Validation of CAM	ETSI	TS 103061-1	10011	OCT 2012	Critical
Validation of DENM	ETSI	TS 103061-2	10012	OCT 2012	Critical

Standards - Testing	SDO	ETSI Standard	WI	Approval	Priority
GeoNetworking Validation	ETSI	TR 103061-3	30020	2012	Critical
Basic Transport Protocol validation	ETSI	TR 103061-4	30019	2012	Critical
Ipv6 over GeoNetworking validation	ETSI	TR 103061-5	30018	2012	Critical

Standards – Applications	SDO	ETSI Standard	WI	Approval	Priority
Cooperative Awareness application	ETSI	TS 101539-1	10017	Oct 2011	Critical
Event driven hazard warning V2V					
Longitudinal Collision Risk warn	ETSI	TS 101539-3	10016	Oct 2011	Critical
INTERSECTION Collision Risk Warn	ETSI	TS 101539-2	10015	Oct 2011	Critical
Event driven hazard warning V2I-I2I	CEN				
Floating car data collection for infrastructure	CEN				
Traffic management V2V	ETSI	Not started			
Traffic management V2I – I2I	CEN				
Cooperative traveller assistance V2V	ETSI	Not started			
Cooperative traveller assistance V2I – I2I	CEN				
Electrical Vehicle charging spot notification.	ETSI	TS 101556-1	10014	Oct 2011	Critical
Value Added Services V2V	ETSI	Not started			
Value Added Services V2I – I2I	CEN				

Standards – Facilities	SDO	ETSI Standard	WI	Approval	Priority
Facility layer architecture	ETSI	TS 102894	10004	Dec 2011	Critical
SAP spec (APP/FAC)	ETSI	Not started			
Cooperative awareness (CAM)	ETSI	TS 102637		Published	Critical
Decentralized Environ Not (DENM)	ETSI	TS 102637		Published	Critical
Local Dynamic Maps	ETSI	EN 302895	10005	May 2012	Critical
		TR 102863		Published	
Service announcement	ETSI	TS 102890-2	10009	May 2011	Critical
Facility communication management	ETSI	TS 102890-1	10010	Nov 2011	Critical
ITS station position and time	ETSI	TS 102890-3	10013	Apr 2012	Critical
HMI support	ETSI	Not started			
Facility layer com congestion control	ETSI	Not started			
Priority / Traffic class consistency check	ETSI	Not Started			
Road geometry messages and Reg info.	CEN				
Traffic signal phase and timing	CEN				
GNSS correction data	CEN				

Standards – Facilities	SDO	ETSI Standard	WI	Approval	Priority
Localized traffic information	CEN				
Location referencing	CEN				

Standards – Network and Transport	SDO	ETSI Standard	WI	Approval	Priority
Network architecture	ETSI	TS 102636		Published	Critical
GeoNetworking Requirements and scenarios	ETSI	TS 102636		Published	Critical
Definition of GeoAreas	ETSI	EN302931		Published	Critical
SAP (FAC/NET)	ETSI	TS 102723-11	30008	Nov 2011	
GeoNetworking media independent functionalities	ETSI	TS 102636-4-1	30001	May 2011	Critical
GeoNetworking for ITS-G5A Media dependent	ETSI	TS 102636-4-2	30007	Nov 2011	Critical
GeoNetworking for ITS-G5B/G5C	ETSI	Not started			
Transmission Ipv6 over GeoNetworking	ETSI	TS 102636-6-1		Published	Critical
Basic Transport protocols for GeoNetworking	ETSI	TS 102636-5-1		Published	Critical
Ipv6 Networking in ITS	ETSI	Not started			
Advanced IP mobility support	ETSI	Not started			
Network layer congestion control	ETSI	Not started			Critical

Standards – Access network and media	SDO	ETSI Standard	WI	Approval	Priority
SAP (N&T/Access)	ETSI	TS 102723-10	40018	Nov 2011	
European profile on ITS 5G	ETSI	ES 202663		Published	Critical
Profile standard on ITS 5G	ETSI	EN 302663	40028	Jun 2012	Critical
Multichannel management G5	ETSI	Not started			
PHY/MAC Congestion control	ETSI	TS 102687	40014	Nov 2011	Critical
Mitigation DSRC 5.8/5.9 GHz	ETSI	TS 102792	40013	Jun 2011	Critical
STDMA		TR 102861	40020	Nov 2011	
		TR 102862	40021	Nov 2011	
ITS 5G channel configuration	ETSI	TS 102724	40016	Nov 2011	Critical

Standards – Management	SDO	ETSI Standard	WI	Approval	Priority
ITS station internal management	ETSI	Not started	20036	NWI AbC	Critical
Congestion Management	ETSI	Not Started			Critical
Identity Management					

Standards – Management	SDO	ETSI Standard	WI	Approval	Priority
ITS Object Identifier Tree	ETSI	TR 102707		Published	
Classification of applications	ETSI	TS 102860	20023	Oct 2011	Critical
Addressing schemes	ETSI	TS 102723-1	20015	Nov 2011	Critical
Management information base	ETSI	TS 102723-2	20016	Nov 2011	Critical
SAP (Man – N&T)	ETSI	TS 102723-4	20018	Mid 2011	
SAP (Man – FAC)	ETSI	TS 102723-5	20019	Mid 2011	
SAP (Man – Access)	ETSI	TS 102723-3	20017	Mid 2011	
SAP (Man – SEC)	ETSI	TS 102723-6	20020	Mid 2011	
Communication Management	ETSI	Not started		NWI AbC	Critical
Service discovery and multichannel support	ETSI	TR 102919	20029	WI cancelled	

Standards – Security	SDO	ETSI Standard	WI	Approval	Priority
Security Architecture	ETSI	TS 102731		Published	Critical
Threat Vulnerability and Risk Analysis	ETIS	TR 102893		Published	Critical
SAP (SEC – FAC)	ETSI	TS 102723-9	50009	Apr 2011	
SAP (SEC – N&T)	ETSI	TS 102723-8	50008	Apr 2011	
SAP (SEC – ACCESS)	ETSI	TS 102723-7	50007	Apr 2011	
Security mapping for IEEE 1609.2	ETSI	TS 102867	50013	May 2011	Critical
ITS station security management	ETSI	ES 202910	50010	Nov 2012	Critical
Confidentiality Services	ETSI	TS 102943	50017	May 2012	Critical
Identity, trust and privacy	ETSI	TS 102941	50015	Nov2011	Critical
Access control, secure and privacy-preserving services	ETSI	TS 102942	50016	Nov 2011	Critical
Security architecture and management	ETSI	TS102940	50014	Aug 2011	Critical
Plausibility validation	ETSI	Not started			

Annex C Search for right standards through a web application

A NSO (ÚNMZ, in Czech Republic) provides users with formal information about implemented standards giving its number, classification, title and short description (abstract) specified within 1 to 2 paragraphs. The purpose of the project STANDARD is to provide a user with an on-line overview of ITS standards that is properly classified, and to enable them to be found by several search methods. The goal of the search is to find appropriate standards. The standards themselves are not available but the web application provides several results – degree of information – according to the importance of a standard.

The web application contains all relevant CEN and ISO ITS standards. The results of the standards search provide at first the numbers and the titles of standards that have been found; then the user chooses a particular standard to get more information about it. All the standards are provided with basic information (similar to NSO information). 175 standards are provided with their extracts. These standards are also provided with the possibility to get in touch with the author (Question the author). 20 standards, the "most important at that time", are provided with e-learning that is done by a particular web application.

There are several searching methods. The simplest is the full text search. The other possibilities are: search by user, search by category and search by WG. The last choice is familiar to all those involved in ITS standardization; the other two have been the result of the project STANDARD and are described as a particular matter.

Search by user

One of the possible approaches to search for standards is based on the user view. In the project STANDARD four categories of user have been defined. First of all – a "NON-SPECIALIST", who needs to receive the appropriate guidance through the web page (through the ITS world). This option provides much more explanatory and contextual work than the project was able to provide, and it was left for a future activity.

The second and third categories have been put together as they have the same point of view – manufacturer/ test laboratory and contractor/supplier have been covered by one classification "EXPERT". The category "EXPERT" represents a user who is already familiar with technical content of the ITS world and benefits from keywords that lead him towards relevant standards immediately. The keyword can be entered or chosen from the list which is provided. The current list contains about 90 keywords. Every standard is defined by at least by one keyword. Several keywords can be used at once to specify the subject of a search. One possibility to get the right keyword supported by “completion insight” giving also the resulting number of standards belonging to that particular keyword.

The fourth category is the INVESTOR/ITS SYSTEM OWNER who is creating a Call for Tender. The investor can use the classification of possible standardized ITS application, e.g. EFC. Each application is then subdivided into more specific fields of interest – e.g. microwave EFC, satellite EFC, payment by card, EFC security protection etc. The classification was done at the time of the project and does not involve the latest development.

Search by category – general description

The most complex and inventive search is the search by category. The reason for the creation such a system of classification was the lack of a horizontal view across the standards. The system started as a knowledge-based system and became a so-called “decision-making system”.

The basic idea of the system was to identify knowledge units within the standards and through a systematic approach develop an ontology of ITS. After some discussion a suitable tool for such categorization was chosen. It is a Square of Opposition which is an Aristotle tool within his system of logic that delimits several propositions by their logical relationship (polarity). The use of the tool prevents creators from possible repetitions or overlaying of the categories. The use of the tool has enabled 48 different categories to be classified within three groups of 16 categories. Each group is created by three “higher dipolarities” and each of their elements, “basic dipolarities”, is subdivided into four elements, (4 x 4 = 16). The three identified groups are User and Standard (formal categories), Transport and Data (general categories) and Interface and Communication (specific categories). Table C.1 shows that there are 12 squares of opposition specified as basic dipolarities.

Table C.1 Dipolarities

Higher dipolarities	Basic dipolarities	Categories (elements)
1. User and standard	1.1. User of a standard	4
	1.2 Implementation of a standard to ÈSN	4
	1.3 Type of a standard	4
	1.4 Use of a standard in ITS	4
2. Transport and data	2.1 Data	4
	2.2 Place (road)	4
	2.3 Means of transport	4
	2.4 Data exchange	4

Table C.1 Dipolarities

Higher dipolarities		Basic dipolarities	Categories (elements)
3. Interface and communication		3.1 Type of communication	4
		3.2 Human – Machine	4
		3.3 Vehicle – Infrastructure	4
		3.4 Transmission to/from vehicle	4
Total:	3	12	48

The square of opposition elements are defined by quality (positive or negative proposition) and quantity (particular or universal proposition). The Figure C.1 provides an illustration of one of the squares of opposition coming from particular to universal – from "simple identification" upon "one-way broadcast traffic information" and then "two-way communications" to complex "traffic control and navigation".

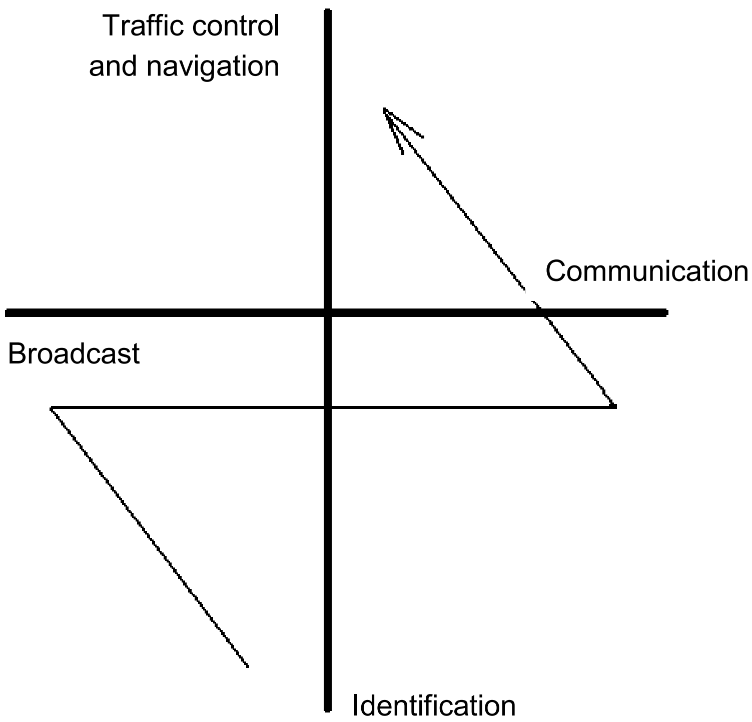

Figure C.1 Example of a square of opposition

NOTE: The simplest item, identification, is the opposition to the most complex communication, traffic control, and it is a part of the whole. On the basis of identification the information is disseminated (one-way communication) and in more complex situations a two-way communication must to be used.

Search by category – specific description

Each ITS standard has been classified into 48 categories (not all of them are relevant for a particular standard) and is searchable independently on its technical committee or working group. It gives the user the potential to find relevant CEN and ISO standards for a particular need. When ticking the chosen category the system shows the number of relevant results and generates a list of them. The list shows the number and title of the standard and its source (particular WG).

The project describes and defines all the levels of polarities and their meaning for ITS standardization. The polarities are described within relevant squares of opposition to follow an element interrelation with the other three elements. It shows the way to classify a particular standard and gives an example of ISO 14816 classification, the same example as was chosen for the extract creation demonstration. All the standards (about 200) have been classified by those categories. The classification has been done by the authors of the extracts, mainly by “national convenors”. In order to manage this, every category had to be defined in a proper way so as to be unambiguously understood. Then the authors were provided with some examples of classification to help them complete the task. Some categories could be considered as non relevant for ITS today, but the square of opposition is a universal tool and so it applies for the description of whole of the ITS systems (world) and it is not bound to existing state-of-art, but it can also tackle future problems and development. Such classification helps even a “non-specialist” to orientate in a better way. The system could help the synergy based on WG 18 Cooperative systems activities.

Future visions

The system needs to develop, both in a quantitative manner – reflection of new standards and also ETSI involvement and in a qualitative manner – developing the remaining four squares of opposition (16 polarities) to describe the ITS reality by 64 categories (complete square...). An analysis of future needs have been made, based on comparison with knowledge system in medicine. “User of standard” (patient) is subject to “asking for standards” (health investigation) and receives “standards packages” (diagnosis) to choose a particular standard/ extract (cure). This simple comparison underlines the real need to create “market packages of standards” for a particular ITS domain. Such a package should be accompanied by introductory comment. The web application could represent a universal marketing tool in the form of a web portal for all ITS standards.

Knowledge system – ontology creation

This system for searching ITS standards should be compared with its original intention – to provide a system with the ability to search for a particular piece of information described within a standard – to search in the text of standard. The vision of the approach is to make a semantic web. To realize such a big idea an ontology of ITS should be created. The ontology serves as a base for knowledge units that should be made by intuition or gained from ITS standards. The knowledge units represent information that could be looked for. In order to create an ontology it should define the structure of the metadata, then the context metadata, content metadata and at the end the data according to the architecture of a semantic web.

A knowledge unit should be found and identified (as a data unit) in a particular standard by an expert on the basis of a predefined ontology of a specific ITS domain. The knowledge unit could be used by a user looking for specific information not only in ITS standards, but also ITS projects, ITS implementations etc. The domains could be specified according to ISO 14813-1.

A draft architecture of a knowledge system was developed in the project STANDARD and further on in the project ZNALSYS.

Annex D Terminology database

In order to understand the content of standards it is necessary to know the meaning of ITS terms. The path to settle down a common terminology is long even with a systematic approach. To better understand and possibly share the experience of the Czech Republic the following wider introduction is provided.

Introduction

Due to the systematic long term work with ITS standards in the Czech Republic it has been possible to run horizontal activities projects above ITS standards as e.g. the above presented project STANDARD. As the language of ITS standards is English and due to the fact that only a half of Czech population is able to speak and understand English the main goal for raising awareness of ITS standards was to deliver the most important ITS standards in the Czech language.

To implement ITS standards in Czech properly a common terminology has been created. The ITS industry is a quite new sector and there was no existing terminology available. In 2003 the agenda of ITS standardization reached such a point that it had to be organizationally supported by setting up a new standardization committee (TNK 136 Traffic telematics). The first goal of the newly established committee was to find a common Czech telematics language – there has been some supportive terminology works from the former activities under the umbrella of standardization committee TNK 51 Roads that telematics had been the part of from 1995 to 2002.

Terminology as the basis for unified European standards implementation

SILMOS CTN, the centre of technical standardization, had been the secretariat for TNK 51 till 2006. It coordinated horizontal activities in TNK 51 and has been doing it also for TNK 136. It is empowered to implement the standards into the Czech standardization framework and support the translations. Within its systematic approach to implement almost two hundred European standards the specific terminology should be settled down, harmonized with the existing terms within the transport domain and possibly create new terms as equivalents to new European terminology. In 1998 the terminology of CEN/TC 226 Road equipment was decided and 44 European standards offered 380 terms and definitions. In 2002 the terminology of CEN/TC 227 Road materials was accomplished (version 3.0, version 1.0 in 1999) – from 81 standards 296 terms and definitions was accumulated. Both terminology dictionaries were updated regularly and formed the basis for unified translations of European standards.

First Czech ITS dictionary of codified terms

The first big issue of newly established TNK 136 was to deliver a similar ITS terminology dictionary. In the years 2003-2004 the first dictionary was worked out from approximately 100 European standards (and some ISO), mostly at the draft stage. The final result contained more than 1,700 ITS terms and definitions. The next year, 2005, it was complemented by Nordic Road administration terminology, with their permission, to gain the definitions of general terms. In autumn 2006 it was published as a Czech-English dictionary for national community and the results were presented in Budapest at a CEN/TC 278 meeting. The following discussion about European terminology harmonization has not resulted in any action within the standardization field. It can be concluded that the first phase of terminology work has been accomplished.

In 2009 it was stated that the amount of new ITS standards is so high that the ITS dictionary should have been complemented. The terminology work dealt with 106 new or revised ITS standards to gain about 1,500 terms and definitions. The final consolidation of ITS dictionary (version I from 2006 and version II from 2009) resulted in approximately **2 500 unique ITS terms and definitions**.

The second phase of terminology work – terminology consolidation within a (road transport) domain

Czech experience in the field of terminology work shows that the work should be done in phases as the terminology develops. First phase can be simply designated as the phase of collecting (aggregating, accumulating) terms and definitions. In all three cases it took more than three years to make it valid and stable for some time.

The second phase concentrates on work with accumulated terms and definitions. Its result is on different higher qualitative level than a dictionary of terminology from standards. The result is a standard. In 2005-2007 SILMOS CTN coordinated the work to create three terminological standards in the field of road transport. The work had been planned in a five-part standard, but actually “only” three of them have been successfully created. The first part deals with general terminology for road transport and it is an update of the standard from 1983. The goal was to leave old (no longer valid) terms and filled the standard with properly selected terms and definitions, mostly from European standards. As the era of new legislation was to come it was an important issue for the use of common terms and definitions. The work was the hardest of all the work until that date as the proper establishment of representative parts of the road transport sector and selection of proper key terms had been the scope of tens of meetings with tens of participants involved. Finally the standard is divided in 18 chapters of similar volume (one of them is ITS) with 700 terms and definitions.

The second part introduced a terminologically non-codified field – traffic engineering with almost 300 terms and definitions. Both standards took almost two years to finalise.

The third part was mostly based on new European standards. The scope was the traffic equipment and it was made in three European languages edition – term and its definition in Czech and equivalent term in official European languages – English, French and German. It built on an updated version of CEN/TC 226 dictionary. Besides the linguistic work on 346 terms and definitions the big problem to solve was the harmonization of Czech legislation terminology and classification of traffic equipment and European classification. The standard is an exemplary compilation of national terminology with European terminology implementation.

The two other parts – terminology of road building and traffic telematics still have to be created.

The third phase of terminology work – terminology as a basis of a scientific discipline

Transport was not considered a single discipline, a science, until recent times. One of the main reasons of this consideration was that every scientific discipline must have its stable terminology to be able to describe states and phenomena in an unambiguous way.

The stabilisation of such a terminology takes years of detailed attention and stable team coordination. In 2008 the Ministry of Transport came up with the project to create a Transport dictionary based on previous analysis. The two-year project supported the work of four teams under the SILMOS coordination. The work was strictly based on codified terminology only. The sources were different – from European regulations and international conventions, to national laws, specific Ministry regulations, technical standards and lower level regulations within four sectors of Transport – Road, Rail, Water and Traffic telematics.

To get the number of terms in the table below many hundreds of documents have been studied and more than 1,000 of them contained some terminology. The biggest reduction in terms (most severe selection) was made in road transport; from more than 20,000 terms the book now contains about 7, 000 terms and their definitions.

Table D.1 Terminology in terminological dictionary

Number of terms within different phases of the project	Rail transport	Road transport	Water transport	Traffic telematics	TOTAL
Version 0 (Phase II)	8 370	7 202	5 893	3 824	25 289
Increments and complements	861	13 177	*726	*89	*14 853
Phase III before duplicities removal	9 231	20 379	6 619	3 913	40 142

Table D.1 Terminology in terminological dictionary

Number of terms within different phases of the project	Rail transport	Road transport	Water transport	Traffic telematics	TOTAL
and selection					
Phase IV after duplicities removal and selection	7 612	(11 000)	4 578	2 582	25 772

The project resulted in three outputs – The book published in November 2010 (1,034 pages), the web application www.slovnikdopravy.cz and the methodology for the dictionary update (the methodology is important due to the fact that there is about 3,000 European "acts" to be transposed to national legislation per year. The dictionary in the form of the book has 22,000 Czech terms and definitions and English terms equivalents.

This long introduction was done to underline the necessity of step-by-step terminology work development to the expected form – web database that is to be maintained and updated.

ITS terms database in European scale

The introduction clearly shows that the creation of a common terminology from international and national sources requires long term intentions and work. In addition it is the first time such work has been done. If there is an official announcement about mutual European and Asian and American approach to cooperative systems and that there is a common work programme settling down the important issues it would be sensible to start with terminology consolidation first to avoid the confusion of misunderstanding of common terms at the international level and subsequent translations at the national level. The common harmonized terminology could save much time for the document creators (ITS legislation makers, ITS calls for tender documentation makers, ITS standards makers etc.) as for other stakeholders – users of produced documents. Development plan for such database is in Annex F.

The premises of common terminology use

The use of common terminology as the primer goal is based on several premises:

- Availability 24/7
- Free of charge, full supportive tool
- Regular update
- Simple web application (simple domain name)

- Thematic division of terms
- Different users mean possibility of different scale of data presentation
- Terminology sources registry and their interrelations
- Stable number of mandatory metadata of ITS dictionary
- Limitation to codified terminology only (not everything in the world)
- Hierarchy of codified terms in near future (what terms are preferred)
- Codified terminology should be respected and such a tool should be referenced in all relevant documents

The terminology work should be planned within a longer term conception to be consolidated in the whole sector – ICT; that means that for the first stages of work the referenced normative and other documents should be taken into account

Benefits of common terminology web dictionary

Such a web tool brings many benefits, below are listed some of them:

- reduces terminology inconsistency;
- makes easier for a standard developer to find suitable terms and definitions and so spares time of a standard development;
- raises the use of already defined terms and prevents from “new-old terms” creation (already defined terms that are slightly modified and so become new terms);
- helps relevant Working Groups manage their terminology that can be different due to its development in different Working SubGroups;
- leads to the harmonization of the terminology within WGs and among WGs;
- common terminology means higher degree of planning and collaboration among areas” (consortium psc-europe).

Low cost and easy administration – there is no need to have a special committee and a registrar who decide about terms entries, as it is stated in ISO 14817, because all the terms are codified. The decision that the term is right is made by relevant working group when creating a standard; all the standards are developed according to CEN Internal rules that assures the standard has been approved by voting of EU Member States.

No work burden on relevant CEN and ISO TC - a term is considered relevant when being the part of an ITS standard. The administrator of the web application just puts the terms and definitions from a standard into the common database and has no right to change the terms or wording of the definitions.

Stable independent financial support

In order to update the database regularly there should an intention to have the administrator financially supported by, but independent of, business interests and so the web application should be supported by European funds as a contribution to worldwide ITS harmonization.

Europe looks for common understanding

From the example from the Czech Republic it can be concluded that agreeing the terminology is the first step for getting cooperation among different parties involved. It helps the development of the sector and brings broader context of the produced work. As common standards are the public consensus on industry innovations, common terms are the result of common understanding. For the sector that is full of innovation the common terminology is the first step for becoming a discipline.

Annex E Extract creation methodology

Extract is defined as a document created by the reduction of a standard to approximately 5 pages, made according to a methodology with respect to formal and content elements of the standard in such a way that it provides the users with adequate information about the scope of the standard and its application.

The methodology gives the structure of an extract specifying the formal elements but also the procedure to create an extract. The formal elements are:

Above headline – Above the headline there is a title "Extract" complemented with information whether it is an extract of an implemented or non-implemented standard. Every extract is qualified with the sentence "the extract does not replace the standard itself and is an informative document about the standard".

Headline – the author uses the headline of the extract in the same form as it comes up from the headline of the standard. There is a standard code, title, type and number of the normative document and number of pages.

Introduction – the author explains briefly the context of the standard within the ITS world of applications, services and systems.

Use – the author states potential users and their possible approach to the use of the standard.

Relevant normative references – the author mentions significant normative documents that are relevant to the standard, they can be grouped together to underline their purpose.

Now it should be mentioned that the formal structure of extract is kept the same as it is in the standard.

1 Scope of the standard – the author describes the scope shortly.

3 Terms and definition – the author chooses the significant terms and their definitions mainly if they are mentioned in the extract

4 Symbols and abbreviation – the author chooses the significant symbols and abbreviation mainly if they are mentioned in the extract

Chapters of the body of standard – the author respects the structure of the standard and gives numbers and full titles of the chapters that are complemented by author's comments to the content and, in some cases, giving the examples from the standard to support the user understanding. The rule to follow the structure of the standard enhances user orientation afterwards; when using the standard itself.

Annexes – the author describes the annexes in the same way as chapters of the standard body.

All the extracts have been stored in a database and are freely available through a special web application.

Annex F Phases of realization of common terminology web application

The project creates a common ITS dictionary consisting of these phases of realization:

- Physical storage and data work (possible input of Czech terminology project)
- Setting up common rules for regular up-date and organizational management for collaboration with CEN/TC 278 and ISO/TC 204.
- Web application creation and database administration
- Test use (when developing standards) and promotion

Phase 1 Physical storage and data work

This phase requires the collection of all ITS standards and taking out their terminology defined usually within the chapter 3 Terms and definitions. The terms are then put into a specific template with the relevant fields to be filled. The work has already been done by Czech Republic, SILMOS CTN in the middle of 2009, so the update is also relevant. The database entry consists of a term, its definition, possible abbreviation, synonym and its source. The set of relevant metadata should be also considered before the start of collecting the terms.

Phase 2 Setting up common rules for regular up-date and organizational management for collaboration with CEN/TC 278 and ISO/TC 204

This phase is the most important because it specifies the rules for management and organization of CEN/TC 278 and ISO/TC 204 collaboration with the dictionary administrator. It is necessary to set up common rules among relevant entities to be able to update the dictionary on the regular basis (e.g. every month, per item etc.). An ITS Cross-cutting group (CEN/ISO) can specify the rules for term sources handover, possible additional data (approval of the data template), functional properties of the web etc.)

Phase 3 Web application creation and database administration

In this phase the terms within the template are put into a database and the web application with user-friendly interface is made.

Phase 4 Test use (when developing standards) and promotion

This phase provides the creator/administrator with comments from relevant users of the tool. Its main aim is to present the tool and make every developer of an ITS standard to be aware of it (e.g. presenting the tool on plenary meetings of the relevant technical committees, ITS congress and conferences, ITSSG etc.).

Phase 5 Possible future extensions

The work could be developed in many ways in near future. The following are given for illustration.

- Monitoring of common (most used) terms giving the real preference
- The thematic search
- Involvement of the other European (national) languages (based on national activities) if it is required

Possible terms metadata – creation of ITS terminology – dictionary upgrade by specifying common metadata for terms classification: Term classes: Objects (products), data (elements, concepts), interfaces (communication), processes (application) etc.