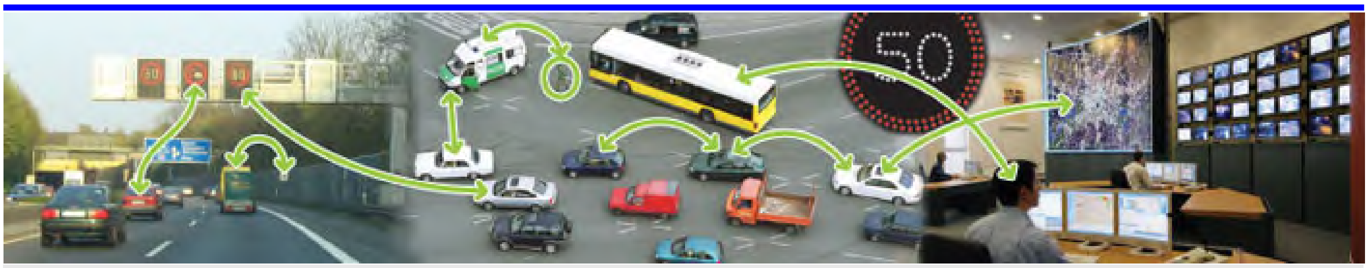
Elektrische Signalverarbeitung Dr. Fischer GmbH

ESF News

Issue 2016/1 **_Intelligent Transport Systems (ITS)_** April 2016



Editorial

C-ITS Platform

The Platform for the Deployment of Cooperative Intelligent Transport Systems in the European Union (C-ITS Platform) was created by the European Commission service DG MOVE in November 2014, finished its phase one, and published its final report (http://ec.europa.eu/transport/themes/its/c-its_en.htm) in January 2016.

The report is structured in 15 chapters starting with an Executive Summary and the project's Objectives and Processes, and ending with Conclusions. Ten working groups investigated in Cost Benefit Analysis (WG1), Business Cases (WG2), Legal Issues (WG3), Data Protection and Privacy (WG4), Security and Certification (WG5), Technical Issues (WG6), Standardization (WG7), Public Acceptance (8), Implementation Issues (WG9), and International Cooperation (WG10).

The WGs developed policy recommendations and proposals for action for both the European Commission but also for other relevant actors along the C-ITS value chain.

Essential conclusions are:

- The need for a unique legal and technical framework in the EU.
- Agreement on a precise and short list of initial services.
- A common standardized C-ITS trust model and certification policy all over the EU.
- The need for hybrid communications (Ad-hoc and Cellular Networks) and protection of ITS frequency bands around 5,9 GHz and 63-64 GHz.
- Protection of the EU ETC service at 5,8 GHz.
- Efficient Decentralized Congestion Control (DCC) algorithms for ad-hoc communications enabling fair and efficient access to communication channels.
- Fair and secure access to in-vehicle data (vehicle probe data) and resources applying appropriate methods to cope with privacy requirements.
- Legitimacy of the deployment of C-ITS, and the need for continued financial support by the EC in order to achieve quick deployment with reasonable coverage during the introductory phase of "no return of invest".
- Recommendation, the Commission to enlarge cooperation on deployment practices at government level with other regions, such as Canada, Australia, South Korea.

To summarize, this report confirms the initial approach towards C-ITS started at ISO TC204 WG16 more than a decade ago, which was complemented by activities of CEN TC278 WG16, ISO TC204 WG18, and ETSI TC ITS under the EC Mandate M/453 (C-ITS Mandate).

The highlight of this initial approach is the standard ISO 21217 "*Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*", which was copied later on in ETSI's EN 302 665. Core CALM standards ISO 29281-1 "*Fast Networking & Transport Protocol*" and ISO 24102-5 "*Fast Service Advertisement Protocol*" were validated in the EC's project CVIS (2004—2009) that introduced the term "Cooperative ITS", and subsequently harmonized with IEEE 1609.3 (WAVE). The revised IEEE WAVE and ISO FAST standards are published in 2016; the common message format is specified in ISO 16460.

ISO 21218 was the first attempt to standardized hybrid communications; ISO 17423 and ISO 24102-6 added additional flexibility and scalability in support of C-ITS applications being agnostic to specific communication technologies.

ISO 24102-2 on Remote Station Management enables protocol agility (not limited to the requested crypto agility).

ISO 18750 on Local Dynamic Map constitutes a "data store" in an ITS station unit that is filled by various messages (e.g. CAM, DENM standardized at ETSI, and SPaT, MAP, IVI, SRM, SSM standardized by CEN/ISO, DATEX, TPEG, ...) that is one means of sharing data between different applications.

Standardization is continued at CEN/ISO, with work items on topics as recommended in the final report of the C-ITS Platform.

Dr. Hans-Joachim Fischer
Managing Director
ESF GmbH

Proliferation of C-ITS (messages)

The “C” in C-ITS means “co-operative” and “avoiding silos”. Reality of standardization and deployment activities unfortunately prefers the “silo” concept. Whilst definitions of data are almost globally harmonized, a multiplicity of messages based on different architectural philosophies popped up. A natural consequence is a significant delay of deployment by stakeholders, e.g. road operators and administrations, as reliability and trust are jeopardized.

It can easily be observed that the silo-approach is the favoured approach of NGOs such as ETSI, C2C, SAE, CAMP, IEEE. The cooperative approach is favoured by governmental SDOs, e.g. CEN and ISO.

As traffic does not stop at borders, ITS services can only be provided reasonably if a harmonized cooperative approach is agreed amongst all parties. One of the technical prerequisites is an agreement on the general approach for observable and testable communication interfaces, including also message formatting in all OSI layers. Message formatting covers e.g.:

- address types and globally unique values at every OSI layer;
- header types and structures at every OSI layer.

Whilst at the ITS access layer agreements are achieved, diverging approaches are standardized at higher layers:

* At the transport layer, CEN, ETSI, and ISO - in line with traditional conventions - are using port numbers for identifying upper layer entities. IEEE uses the ITS Application Identifier (specified in ISO 17419, referred to as PSID in IEEE) as a replacement for a port number, but without having a unique specification of the meaning of PSID.
* ETSI duplicates address information by defining a common ETSI message header that includes a redundant message identifier and a uniqe station identifier that may be subject to privacy issues. Actually the message identifier is addressing the facility that can parse a message. The same functionality is standardized in the ETSI Basic Transport Protocol by means of port numbers. ETSI is referencing all C-ITS messages in this header, disregard whether these are specified by ETSI or not. This makes interoperability with implementations according to CEN/ISO and IEEE/SAE specifications more difficult.
* CEN/ISO developed - similar to the traditional approach in the lower layers - a flexible approach at the facilities layer based on optional headers to enable facility services independent of specific ITS applications. This approach is not supported by all other SDOs.
* SAE, ETSI and CEN are developing ITS applications for the same ITS service, all based on the same or very similar data definitions, but assembling the data in their specific messages, thus hindering interoperability. The situation becomes even more confusing, as these messages also use different address types based on globally unique identifiers with at least slightly different meanings.
* The worst problem however is the problem on how to secure C-ITS. The current security approach is on authenticating the sender of a message in a message-specific way. This is not in line with the general requirement of a trusted ITS station unit, i.e. a Bounded Secured Managed Entity– specified in ISO 21217, and further illustrated in ISO 17419.

There are two ways out:

1. Global harmonization (= banning of silos);
2. Mutliple “silos” in a single implementation.

The latter one looks more like a C-ITS “show-stopper”.

Current message designs follow the initial approach from SAE to have highly optimized ASN.1 definitions of quite complex dedicated messages with many optional elements in order to achieve a minimum number of octets per message. This design is quite nice for transmission of messages over narrowband radio channels once the requirements are fixed. Such designs are difficult to extend. Considering diverging needs from different stakeholders, the problem on achieving harmonized solutions becomes obvious. In order to get a scalable approach, messages need to be based on an agreed basic message framing and a dynamically extendible data dictionary such that messages are no more predefined, but are assembled “on-line” according to actual needs. That means that the concepts of CAM, BSM, DENM, SPaT, MAP, IVI, ... dedicated messages is replaced by a general approach that also fits directly to the Local Dynamic Map, and to the real-time data distribution inside an ITS station unit. This scalable approach is standardized in ISO 17429. A somehow increased message size is the cost for scalability and acceptability by a multiplicity of stakeholders.

Functional requirements for geo-dissemination of information

Geo-dissemination of information is one of the key-features presented by the C2C-CC, and investigated in detail in the EC’s GeoNet project. (http://www.geonet-project.eu/)

The basic idea of geo-dissemination is quite old: information should be made available only where it is needed.

ETSI was first standardizing geo-dissemination and selected a technical approach referred to as GeoNetworking. GeoNetworking is a multi-hop forwarding protocol for IEEE 802.11 @ 5,9 GHz communications. A major focus is on multi-hopping from car to car in order to reach a roadside unit granting access to Internet. This approach is not feasible in many road traffic scenarios due to bandwidth limitations in the radio channel. Simple multi-hopping extending the communication range beyond the single-hop range is achieved also by other messaging protocols without the need of a large protocol header (40 octets). The major global requirement, to disseminate information as part of the general traffic management at different far-away locations is not in the main focus of GeoNetworking.

Consequently other approaches, also investigated in the GeoNet project, are more favourable, e.g. a solution at the ITS-S facilities layer similar to the one suggested by the German Converge project. A solution at the ITS-S facilities layer is independent of the lower communications protocol stack and thus supports hybrid communications.

Dissemination of information (originating e.g. from in-vehicle sensors or roadside sensors) in the near field around a vehicle or a roadside unit preferably uses the harmonized messaging protocol (format specified in ISO 16460); this includes a multi-hop feature. Dissemination of information at far-away distances from the location of data generation is based on cellular network technologies and Internet, where sensor data are collected, validated, and pre-processed in a traffic management center, and then forwarded to the dissemination locations where again the harmonized messaging protocol can be used as the last hop into vehicles. All geo-information is part of the messaging payload rather than being duplicated in geo-messaging headers.

Fair and efficient access to probe data

Probe data are data from sensors that may be installed in vehicles or in the infrastructure (loops in the lanes, temperature sensors, fog detectors, ...). Such data is relevant for (1) general traffic management (travel time measurement, accident detection, ...), and (2) particularly for traffic participants approaching locations of hazards. Probe data primarily are owned by the owner of the sensor producing the data. However some data may be of public interest, and some may be subject to privacy considerations.

Probe date generated in vehicles are subject to continuous discussions on ownership, accessibility, privacy, etc. All of these discussions are misleading, as the only real issue is the “business model”. Although car makers start understanding that they don’t own the probe data, they are still objecting against a direct provision of selected data to vehicular ITS station units. Such an access would be based on an in-vehicle gateway protecting both sides of it, i.e. protecting the vehicle’s CAN bus from unauthorized access by the ITS-SU, and protecting the ITS-SU from unauthorized usage by the vehicle.

Without such a direct access to selected vehicle probe data, e.g. requested in the European C-ITS corridor project as one of the two major applications, efficiency of traffic management is lowered. Car makers want to sell pre-processed data to road operators, but road operators for some reasons need raw data from specific sections of their road network.

ISO TC204 is now developing a Technical Report that presents the functional requirements and intended use cases.

This issue is also well presented in the final report of the EC’s C-ITS platform project.

Minimum requirements for hybrid communications

Almost two decades ago, ISO TC204 WG16 „invented“ the concept of hybrid communications, e.g. presented in ISO 21217, ISO 21218, the set of ISO 24102-x standards, and the set of standards for access technologies including IEEE 802.11 @ 5,9 GHz (CALM-M5) ISO 21215), Infrared (CALM-IR) (ISO 21214), Millimeter Waves (CALM-M6) (ISO 21216), and cellular network standards. Still the wrong paradigm of application-specific silos was in the head of most stakeholders. Due to the power of these stakeholders (mainly car makers) ETSI (TC ITS was founded in December 2007)and IEEE focused on a single radio technology system specification for the OEMs extended sensor (meant is their view of an ITS station using ISO 21215). Quickly it became obvious that this approach is not scalable, and not supporting the continuously increasing set of ITS applications and services.

The discussion on business cases - difficult due to the basic concept of ITS (ISO 21217) as a non-controlled, decentralized, “chaotic” system - resulted in the requirement presented by the German Converge project (http://www.converge-online.de/), that hybrid communications is a prerequisite for deployment. Simultaneously discussions on usage of the future 5G cellular network technologies popped up, aiming on being the only technology for C-ITS (i.e. back to “silos”).

As a matter of fact, G5 cannot solve most of the problems that were identified during intensive investigations in CALM M5 (named “ITS-G5” at ETSI). Deployment has to start with CALM M5, and CALM M5 will remain for long time one of the very important technologies for C-ITS!

Hybrid communications distinguishes different functionalities:

- localized communications, i.e. communications without networking;
- Internet access, i.e. in general communications with real networking.

Various technologies are identified for these two functional groups.

(Continuation on page 4)

(Continuation from page 3)

For Release 1, which is considered to be a test release, usage of

- localized communications with CALM M5, and
- networking using 3G and 4G

are agreed.

For subsequent releases, at least starting with Release 3, the following access technologies are considered essential for C-ITS:

- localized communications:
  - CALM M5 / ETSI ITS-G5;
  - CALM M6;
  - CALM IR;
  - 5G direct mode;
- networked communications:
  - 3G, 4G, 5G;
  - Internet.

Wired communications and e.g. Bluetooth are also relevant for C-ITS deployment.

In addition to these access technologies, a powerful ITS station management is needed ensuring efficient usage of these access technologies.

In the meanwhile it is well understood, that ITS applications should not know any details of access technologies, but should only present functional requirements for communications to the ITS station management. This is standardized in EN/ ISO 17423 (Publication expected in 2016/17; TS 17423 is already published).

The ITS station management continuously is monitoring the communications capabilities of the station (including actual channel load), applicable regulations and policies (dependent on the actual location of the station), and rules set up by the user of the station in order to perform an optimum mapping of applications to communications protocol stacks, and avoiding overload of communication channels and self-interference between various access technologies (including protection of CEN DSRC road tolling services). This process of path and flow management is standardized in ISO 24102-6.

It is suggested to consider implementation of access technologies as "plug-and-play" devices without imposing standardized requirements on implementation details, as implementation of antennas in vehicles is a very challenging task. This indicates also that access technologies are transparent, i.e. without any security schemes.

Current discussions on

- band-sharing at 5,9 GHz (ordinary WiFi usage, railway applications), and

Content:

- replacing ITS-G5 by 5G,

supported by discussions on privacy issues are considered severe attacks aiming on stopping the already started deployment of C-ITS, and promoting Machine-to Machine (M2M) and Internet of Things (IoT) approaches as replacing systems being fully controlled by network operators. Obviously this new attempt is not reflecting the interest of the European Commission, as the EC and also its member states already invested millions of Euros in the development of C-ITS as it is defined so far; see also the final report of the EC's C-ITS platform project.

ESF GmbH, as an independent consultant, is promotor of C-ITS from day 1 on. Let C-ITS become reality on the roads!

Latest news

ESF GmbH joined its bavaria (http://www.its-bavaria.de/), aiming on activities in C-ITS deployments in Germany.

ESF GmbH opened a new office at Blumenstraße 19 in 72827 Wannweil / Germany. This office is lead by Mr. Jürgen Fischer, Senior Software Engineer. Jürgen Fischer has experience in customer-specific software for Microsoft Windows (Visual Basic, Back Office, SQL server applications). Other software developments are also offered, e.g. C / C++ for microcontrollers and signal processors.

ESF GmbH finalized the EU/US (ISO/IEEE) harmonization on messaging protocols and service advertisement. The related standard specifying the messages, ISO 16460, currently is in the process of publication. Beside the ISO/IEEE interoperability modes, ISO 16460 specifies additional features that may be added by IEEE at a later stage. ETSI TC ITS re-started work on their version of a service advertisement specification indicating usage of ISO 16460 as a basis.

Imprint

Company: Elektrische Signalverarbeitung Dr. Fischer GmbH
Fichtenweg 9, 89143 Blaubeuren, Deutschland, +49 7344 175 340
Managing Director: Dr. Hans-Joachim Fischer
Registration: Ulm, HRB 3433