Elektrische Signalverarbeitung Dr. Fischer GmbH

ESF News

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Editorial

Quite often I am asked about the meaning of ITS and C-ITS, and the difference to existing systems already in use to improve road traffic. Well, first of all, the term "Cooperative ITS" (C-ITS) indicates a feature of ITS as explained in this news. Thus I am only speaking here about ITS in general, and the ITS station (ITS-S) reference architecture (ISO 21217) in particular. This ITS-S architecture has two essential characteristics:

1. Future proof stations.
2. Trust.

Note that a physical instantiation of the ITS-S functionality is referred to as an ITS station unit (ITS-SU), or simple as a station.

Because there is a number of critical safety-of-life and -property applications that will be deployed, and because of the broadcast nature of many of these applications, there is a need to establish a-priori means of trusting and authenticating sources of information. This leads to the concept of an ITS-S as a "Bounded Secured Managed Domain" (BSMD), and to the need for a "Public Key Infrastructure" (PKI) for trust assertion and certificate management. An ITS-SU can be trusted to operate according to the policies and procedures assigned to it by a trusted authority. It is mainly this attribute of trust within the ITS domain that distinguishes ITS SUs from all other communication nodes. As a managed domain, elements of the ITS-S need to be aware of and interact with the ITS-S management entity, e.g. for the purpose of automatic assignment of communication profiles to ITS-S applications (TS 17423). As a secured domain, installation (e.g. "plug-and-play") of an element of an ITS-S such as an ITS-S application, communication interface, or a communication protocol must be performed in a controlled and secure manner, applying the procedures for registration of identifiers of ITS objects and the authentication of registered elements at time of installation (TS 17419).

There is an on-going discussion on required communication features (standardized communication protocol stacks) for ITS. As a matter of fact, communications with a vehicle can use either cellular network technologies enabling continuous sessions typically based on IP networking, or technologies for (single-hop) communications at singular locations (spots) using narrow-band channels, e.g. 5,9 GHz (ISO 21215), Infrared (ISO 21214), microwaves (ISO 21216). The agreed plan is that vehicles periodically send out "Here I am" messages (e.g. CAM), and event notification messages (e.g. DENM). Having in mind typical road traffic situations, communications system theory shows that such narrow-band channels will be quickly overloaded just with CAMs. Emphasis thus has to be on avoiding protocol overhead and achieving small messages. DENMs typically need to be disseminated in defined geo-areas, which could require forwarding of them to remote locations. Applying multiple single-hop communications for this purpose, where vehicles act as relay stations, definitively risks significant overload problems in the narrow-band channels. On the other hand, in cases of low traffic, vehicles acting as relay stations and keeping a message alive at a certain location may not be available.

As ITS-S supports multiple communication protocol stacks, standard and system designers should learn from system theory and select the proper combination of tools, e.g.:

- Autonomous components (e.g. radar) to manage potential problems with next traffic neighbours, especially in situations with high traffic density.
- Optimized port mapper protocols for single-hop communications (e.g. FNTP and WSMP) used for CAM and FSAP (ISO 24102-5).
- Geo-dissemination facility.
- Central traffic management centres for "sensor fusion" and dissemination of reliable traffic information via roadside ITS subsystems and cellular networks.
- Cellular networks and Internet applying IPv6 to reach remote destinations.

2012 was the year of International Harmonization, pushed by the US DOT and the EC expressed by the "EU-U.S. Joint Declaration of Intent on Research Cooperation in Cooperative Systems" (see ESF News 2011). The Harmonization Task Groups HTG1 on Security and HTG3 on Communications (groups of independent experts) evaluated existing standards and specifications from CEN, ETSI, IEEE, ISO and

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Geo-dissemination of information - a simplified presentation

Geo-dissemination is dissemination of information in a defined geographical area (destination area or target area). A predecessor of geo-dissemination is the well known route and station specific traffic information service provided via cellular networks.

The EC funded GeoNet project (http://www.geonet-project.eu/) investigated in basic aspects of geo-dissemination applicable for road safety. Safety applications, e.g. in vehicles, depend on reception of information gathered at different locations by different stations. These locations of source of information may be close to destination locations, or quite far away from them. Information to be disseminated in a target area may even originate from different applications, which is supported by the "cooperative feature" of ITS, i.e. the sharing of data between applications and stations. Sensor fusion may apply in central stations, at roadside units or even in individual vehicles.

In the uppermost urgent case, the source of information may e.g. be just a vehicle or roadside sensor next to a destination vehicle, such that simple single-hop communications based on the port mapper protocol FNTP (ISO 29281-1) is favourable. FNTP's big advantage is the extremely small protocol overhead which makes it best suited for narrowband communication channels such as those at 5,9 GHz.

Relaying of information via roadside units may be a means to reach recipients at medium distance, and to keep messages alive for a defined time.

Reaching far away destinations beneficially may use central stations, cellular network services and Internet.

GeoNet did intensive work on usage of IPv6. The key idea is to map a geographic area to an IPv6 multicast group. Details will be further developed in standardized protocols.

In addition to the location (centre) of the information destination area, its shape, size and orientation may be important, e.g. to distinguish intersections (square target area) from lanes (thin rectangle or ellipse).

To have a harmonized standardized approach serving the various scenarios of geo-dissemination of information, a geo-dissemination protocol designed as an ITS-S facility seems to be essential, which fits perfectly to the concept of a BSMD (ISO 21217) and to C-ITS. This approach enables usage of the best communication technology possible for a specific scenario and the capabilities of an ITS station.

ISO TC204 WG16 prepared to develop a facility protocol for geo-dissemination of information.

ETSI follows the approach to implement geo-dissemination functionality as the "GeoNetworking protocol" at the ITS-S networking & transport layer which is linked to 5,9 GHz narrow-band communications. Even in case of single-hop communication GeoNetworking requires a large unused protocol overhead, also applied for the transmission of every "Cooperative Awareness Message" (CAM) - "here I am message". Consequently there is a high risk to flood the 5,9 GHz communication channel such that almost no message can be delivered properly in due time. A new attempt at ETSI, pushed by cellular network experts, is to investigate in the usage of cellular networks for geo-dissemination at remote locations. However this would open two "silo" geo-dissemination stacks which can hardly work together in a reasonable way.

Please present your technical questions to the experts on geo-dissemination, e.g. to Dr. Thierry Ernst at Mines Paris Tech (thierry.ernst@mines-paristech.fr).

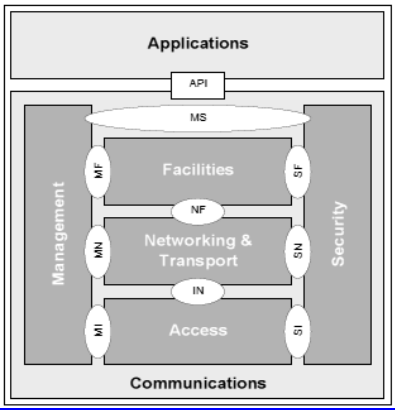
Cooperative Intelligent Transport Systems (C-ITS)

The term C-ITS was introduced in the context of the EC mandate M/453. Below some reasoning on the technical meaning of C-ITS.

Cooperative ITS (C-ITS) is a functional subset of ITS in which ITS station units (ITS-SUs) communicate and share information among themselves and other devices to offer advice and/or facilitate actions with the objective of improving safety, sustainability, efficiency and comfort above and beyond that which can be achieved by stand-alone transport related communication systems. C-ITS is best described in terms of ITS services and applications rather than the hardware or software used to instantiate them. The essential attribute of C-ITS is that information is shared between different applications providing ITS services in a single ITS-SU and with different applications running in different ITS-SUs. The ITS station architecture described in ISO 21217 is designed to support download and execution of these applications via different access technologies that will enable the provision of services in a manner similar to that used in smart phones.

C-ITS has the following features:

- a common reference architecture;
- the sharing of information between any instance of ITS station (e.g. Vehicle, Roadside, Central and Personal);
- the sharing of information between applications in a single ITS-SU;
- the sharing of resources (communication, positioning, security,…) by applications in an ITS station;
- the authorized use of information for purposes other than the original intent; and
- the support of multiple applications running simultaneously.



The ITS station architecture described in

ISO 21217 as a BSMD is ideally suited to the development and deployment of C-ITS applications and services, many of which can beneficially exploit functionality available in the ITS-S facilities layer, e.g. a Local Dynamic Map (LDM).

Obviously from a communications point of view, there is no difference between C-ITS and ITS, as both C-ITS and ITS share the same communication architecture.

Major standardized protocols and procedures in support of the cooperative feature in ITS station units are under development and to be developed in the future at CEN TC278 WG16 / ISO TC204 WG18 in cooperation with ISO TC204 WG16 and other WGs / other SDOs, e.g.

- Common data dictionary;
- Access to standardized data elements by authorized protocols;
- Download and activation of new application software and the update of installed software (ITS application shop);
- Cooperative message sets (BSM, CAM, DENM, MAP, SPaT, PVD, PDM, ...);
- Facility layer message handling for dissemination of messages to registered facilities and applications inside an ITS-SU.
- Relevance checking of received information.

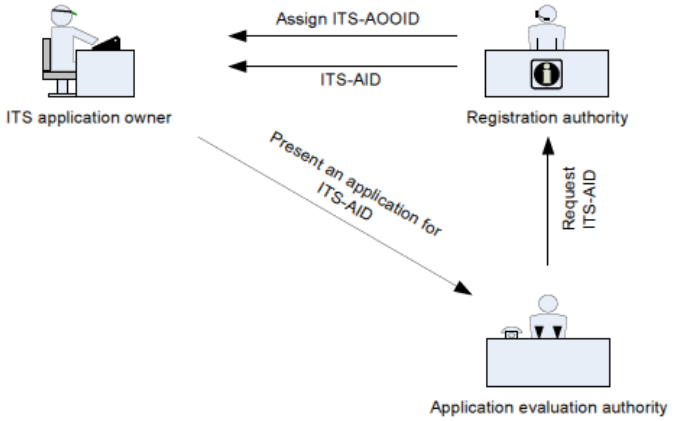
Application Management

A salient feature of the ITS-S architecture that distinguishes it from the concept behind traditional communication systems is that applications are abstracted from both the access technologies that provide the (wireless) connectivity and the networks that transport the information from the source to the destination(s). ITS-SUs are not limited to either a single access technology, or to a specific networking and transport protocol. ITS-SUs can implement any of those technologies that are supported through appropriate adaptation specifications.

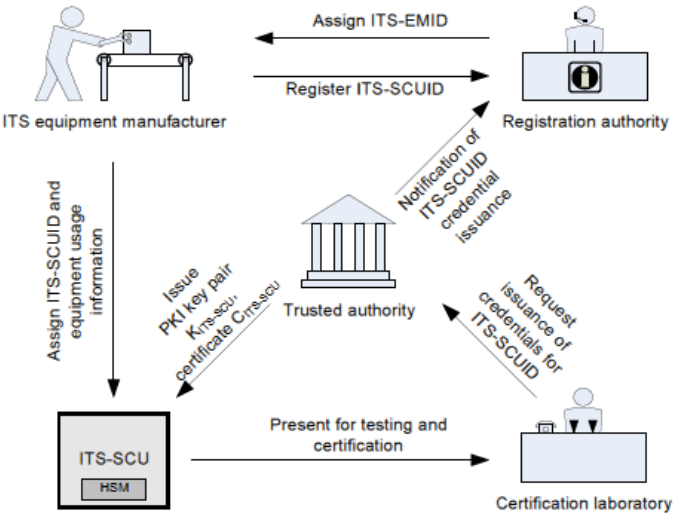
Funded under EC mandate M/453, Project Team CEN TC278 PT1601 develops TS 17423 *Intelligent Transport Systems — Cooperative Systems — Application requirements for selection of communication profiles*. PT1601 reports to CEN TC278 WG16 / ISO TC204 WG18. TS 17423 identifies and specifies those parameters which can be used by ITS-S applications to present online their communication needs. These needs primarily are presented in functional terms. However for applications being subject to regulation, e.g. road safety, the requirements can also explicitly select specific communication protocols and parameter settings.

Application management refers to objects and procedures, both internal and external to the platforms on which the applications are installed, which are used to ensure the efficacy and authenticity of these applications and these platforms. The platforms are ITS-SUs and the applications are ITS-S applications as specified in ISO 21217. These application management procedures involve protocols for exchanging information between the various entities involved in application management and are to be used for authorizing and authenticating the use of ITS-S applications over the ITS communications network.

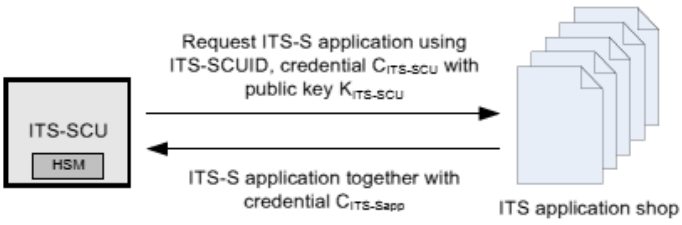
PT1601 develops also TS 17419 *Intelligent Transport Systems — Cooperative Systems — Classification and management of ITS applications in a global context*. TS 17419 describes and specifies globally unique addresses and identifiers which are both internal and external to ITS-SUs and are used for ITS station management. Further on TS 17419 describes how ITS object identifiers and related technical parameters are used for classification, registration and management of ITS applications and ITS application classes. Examples of procedures are registration of ITS-AIDs and ITS-MsgSetIDs,



certification of ITS-SCUs and ITS-S applications,



and the download of ITS-S applications from an ITS application shop.



Please visit the web site of PT1601 at http://pt1601.its-standards.info/, read the draft standards and provide your valuable feedback.

Testing, Conformity and Releases

Base protocol standards from ISO TC204 WG16 refer to ETSI Technical Test Specifications. Examples of published ETSI Test Suites are those for FNTP (ISO 29281-1), FSAP (ISO 24102-5), IICP (ISO 24102-4) and Access Technology Support (ISO 21218). The European Commission has agreed to fund a Specialist Task Force (STF) at ETSI to implement these CALM Test Suites in the ETSI C-ITS test platform. Selection of experts for this new STF will be on February 4th 2013. The goals of this STF are

- validate the ETSI Test Suites
- provide a platform for conformance testing of implementations
- provide final feedback to ISO.

Manufacturers are invited to present their implementations of one or several of these protocols as early as possible in the course of 2013.

Content:

In case you are interested in open source implementations, or in support to implement these protocols, please contact ESF GmbH.

In subsequent steps, abstract test suites will be developed for all communications and applications protocols from CEN / ISO, and be integrated in the same test platform. Duplicates of this test platform can be produced and used in test laboratories.

Conformance testing requires knowledge of features to be implemented in a specific type of equipment. Protocol standards provide mandatory, optional and conditional technical requirements related tor conformity, but never specify conformity. Thus the approach towards conformance testing includes as prerequisites

- specifying and maintaining global ITS releases covering base and test standards from all relevant SDOs,
- identifying conformance requirements for specific types of equipment, referring to a specific release.

ISO TC204 clearly aims, as expressed by a resolution, on a global release, as there is only one world and one ITS. None of the SDOs is capable to develop all necessary standards for ITS in due time, and thus the SDOs are cooperating in a way to provide complimentary standards. These standard “puzzles” from e.g. CEN, ETSI, IEEE, ISO, SAE are to be considered equally in the definition of global releases.

Editorial

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SAE, identified overlaps and gaps, and developed recommendations to the Standard Development Organisations (SDOs) on how to achieve the global goal of one common technical and operational approach for ITS including the cooperative features of ITS. The reports of HTG1 and HTG3 are publicly available at http://its-standards.info/HTG1&3_Reports.zip.

There are two key protocols from TC204 WG16 which correspond to protocols from IEEE 1609.3 “Wireless Access in Vehicular Environment” (WAVE) and which are functionally almost equivalent, i.e.

- the *ISO Fast Networking & Transport Protocol* (FNTP. ISO 29281-1) corresponding with the *IEEE WAVE Short Message Protocol* (WSMP), and
- the *ISO Fast Service Advertisement Protocol* (FSAP, ISO 24102 -5) corresponding with the *IEEE WAVE Service Advertisement Message* (WSA) specification.

HTG3 clearly recommended to harmonize fully these two pairs of standards which are essential for ITS on a global basis in order to have two fully-compatible standards implementations serving the needs for single-hop communications (BSM, CAM, some DENM and the new message sets MAP, SPaT, SRM, SSM, PVD, PDM from ISO TC204 WG18 / CEN TC278 WG16). Experts in ISO and IEEE already started to work on this harmonization task. This is to be complemented by the suite of standards from ISO TC204 WG16 on IPv6 for ITS to get a workable ITS standards release 1.

ISO finished revision of a number of essential ITS standards: ISO 21218, ISO 24102 parts 1, 3, 4 and 5, ISO 29281 parts 1 and 2.

The globally harmonized ITS communications architecture ISO 21217, also applicable for ETSI ITS standards, will be in DIS ballot soon.

Dr. Hans-Joachim Fischer
Managing Director
ESF GmbH

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