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Intelligent transport systems — Cooperative ITS

Part 2: Framework overview

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Intelligent transport systems — Cooperative ITS —

Part 2: Framework overview

Systèmes intelligents de transport — Systèmes intelligents de transport coopératifs —

Partie 2: Aperçu général du cadre de travail

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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

ISO 17427 consists of the following parts, under the general title *Intelligent transport systems — Cooperative ITS*:

— *Part 2: Framework overview* [Technical Report]

— *Part 3: Concept of operations (ConOps) for 'Core' systems* [Technical Report]

— *Part 4: Minimum system requirements and behaviour for core systems* [Technical Report]

— *Part 6: Core systems risk assessment methodology* [Technical Report]

— *Part 7: Privacy aspects* [Technical Report]

— *Part 8: Liability aspects* [Technical Report]

— *Part 9: Compliance and enforcement aspects* [Technical Report]

— *Part 10: Driver distraction and information display* [Technical Report]

The following parts are under prepartion:

— *Part 1: Roles and responsibilities in the context of co-operative ITS architechtures(s)*

— *Part 5: Common approaches to security* [Technical Report]

— *Part 11: Compliance and enforcement aspects* [Technical Report]

— *Part 12: Release processes* [Technical Report]

— *Part 13: Use case test cases* [Technical Report]

— *Part 14: Maintenance requirements and processes* [Technical Report]

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This Technical Report provides an informative 'framework overview' of Cooperative Intelligent Transport Systems (C-ITS). It is intended to be used alongside ISO 17427-1, ISO/TR 17465-1 and other parts of ISO 17465, and ISO 21217. Detailed specifications for the application context will be provided by other ISO, CEN and SAE deliverables, and communications specifications will be provided by ISO, IEEE and ETSI.

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Introduction

Intelligent transport systems (ITS) are transport systems in which advanced information, communication, sensor and control technologies, including the Internet, are applied to increase safety, sustainability, efficiency, and comfort.

A distinguishing feature of 'ITS' are their communication with outside entities.

Some ITS systems operate autonomously, for example, 'adaptive cruise control' uses radar/lidar and/or video to characterize the behaviour of the vehicle in front and adjust its vehicle speed accordingly. Some ITS systems are informative, for example, 'Variable Message Signs' at the roadside, or transmitted into the vehicle, provide information and advice to the driver. Some ITS systems are semi-autonomous, in that they are largely autonomous, but rely on 'static' or 'broadcast' data, for example, *GNSS* (3.9) based 'SatNav' systems operate autonomously within a vehicle but are dependent on receiving data broadcast from satellites in order to calculate the location of the vehicle.

Cooperative Intelligent Transport Systems (C-ITS) are a group of ITS technologies where service provision is enabled by, or enhanced by, the use of 'live', present situation related, dynamic data/information from other entities of similar functionality [for example, from one vehicle to other vehicle(s)], and/or between different elements of the transport network, including vehicles and infrastructure [for example, from the vehicle to an infrastructure managed system or from an infrastructure managed system to vehicle(s)]. Effectively, these systems allow vehicles to 'talk' to each other and to the infrastructure. These systems have significant potential to improve the transport network.

A distinguishing feature of 'C-ITS', is that data is used across *application* (3.1)/service boundaries.

ISO/TR 17465-1 provides a summary definition of C-ITS as a 'subset paradigm of overall ITS that communicates and shares information between ITS stations to give advice or facilitate actions with the objective of improving safety, sustainability, efficiency and comfort beyond the scope of stand-alone systems'.

The benefits of Intelligent Cooperative Systems stem from the increased information that is available from the vehicle and its environment and from other vehicles. The same set of information can be used to extend the functionality of the in-vehicle safety systems, and through vehicle-to-infrastructure communications for more efficient traffic control and management. The benefits include the following:

— improved safety;

— increased road network capacity;

— reduced congestion and pollution;

— shorter and more predictable journey times;

— improved traffic safety for all road users;

— lower vehicle operating costs;

— more efficient logistics;

— improved management and control of the road network (both urban and inter-urban);

— increased efficiency of the public transport systems;

— better and more efficient response to hazards, incidents and accidents.

(source: EC project CVIS)

The difference between any 'ITS system' and a 'C-ITS system' is that C-ITS systems are dependent from the interaction with other vehicles and or the infrastructure, and the exchange of dynamic data, to receive data to enable their function, or conversely to provide data to other vehicles/infrastructure to enable their C-ITS systems to function.

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C-ITS as an entity, is therefore the functionality that enables such 'cooperative' and collaborative exchange of data, and in some cases, collaborative control, or subservient decision making, in order to provide an *application service* to one or more actors. Descriptions of the roles and responsibilities of those actors can be found in ISO 17427-1.

It is important to understand that C-ITS is not an end in itself, but a combination of techniques, protocols, systems and sub-systems to enable 'cooperative'/collaborative service provision.

This Technical Report describes and specifies the framework which enables such collaborative and cooperative systems to operate. It is agnostic in respect of technology, and operates with whatever communications and hardware technologies can support its functionalities. Other deliverables in this family of C-ITS standards will define specific aspects of technology and behaviour, and the roles and responsibilities within the context of C-ITS.

This Technical Report may therefore be seen as an 'overview' of the features and physical and functional architecture elements that comprise C-ITS.

This Technical Report is a 'living document' and as our experience with C-ITS develops, it is intended that it will be updated from time to time, as and when we see opportunities to improve this Technical Report.

Further technical reports in this series are expected to follow.

Please note that these TRs are expected to be updated from time to time as the C-ITS evolves.

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Intelligent transport systems — Cooperative ITS —

Part 2:
Framework overview

1 Scope

This Technical Report characterizes and provides an overview of the framework which enables collaborative and cooperative ITS to operate and defines the characteristics and components of a Cooperative-ITS (C-ITS), its context and relevance for *ITS service* provision, and provides references to International Standards deliverables where specific aspects of C-ITS are defined. The objective of this Technical Report is to raise awareness of and consideration of such issues and to give pointers, where appropriate, to International Standards deliverables existing that provide for all or some of these aspects. This Technical Report does not provide specifications for solutions of these issues.

This Technical Report is agnostic in respect of technology and operates with whatever communications and hardware technologies can support its functionalities.

NOTE Other deliverables in this family of C-ITS standards will define specific aspects of technology and behaviour and the roles and responsibilities within the context of C-ITS.

2 Terms and definitions

2.1
application
app
software application

2.2
application programming interface
API
set of routines, protocols, and tools for building software applications

[SOURCE: ISO 17627:2009, 2.4, modified]

Note 1 to entry: An API expresses a software component in terms of its operations, inputs, outputs, and underlying types; it defines functionalities that are independent of their respective implementations, which allows definitions and implementations to vary without compromising the interface. An API can also assist otherwise distinct applications with sharing data, which can help to integrate and enhance the functionalities of the applications.

Note 2 to entry: APIs often come in the form of a library that includes specifications for routines, data structures, object classes, and variables. In addition to accessing databases or computer hardware, such as hard disk drives or video cards, an API can be used to ease the work of programming graphical user interface components.

2.3
application service
service provided by a service provider accessing data from the *IVS* (2.11) in a vehicle in the case of C-ITS, via a wireless communications network, or provided on-board the vehicle as the result of software (and potentially also hardware and firmware) installed by a service provider or to a service provider's instruction

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2.4
bounded secure managed domain
BSMD
secure peer-to-peer communications between entities (*ITS-stations* (2.17)) that are themselves capable of being secured and remotely managed; the bounded nature is derived from the requirement for *ITS-stations* to be able to communicate amongst themselves, i.e. peer-to-peer, as well as with devices that are not secured (referred to as 'other *ITS-stations*'), and realizing that to achieve this in a secure manner often requires distribution and storage of security-related material that must be protected within the boundaries of the *ITS-stations*, leads to the secured nature of the entity, as there is great flexibility to achieve desired communication goals, there is a requirement that this flexibility be managed

Note 1 to entry: Within C-ITS and ISO 21217, such *ITS-stations* are defined as operating within bounded secured managed domains (BSMD), or outside of the BSMD.

2.5
Cooperative ITS
C-ITS
use of ITS technologies where service provision is enabled, or enhanced by, the use of 'live', present situation related, data/information from other entities (for example, from one vehicle to other vehicle(s)), and/or between different elements of the transport network, including vehicles and infrastructure (for example, from the vehicle to an infrastructure managed *central system* (2.6) or from a central infrastructure managed system to vehicle(s))

2.6
central system
service centre system that provides/supports *application service(s)* (2.3) managed through a central facility

2.7
Controller Area Networking bus
CAN bus
network designed for use in automotives, which:

a) uses a single terminated twisted pair cable;

b) is multi master;

c) uses a maximum signal frequency used is 1 Mbit/sec;

d) has a typical length of 40 M at 1 Mbit/sec up to 10 KM at 5 Kbits/sec;

e) has high reliability with extensive error checking;

f) has a typical maximum achieveable data rate of 40 KBytes/sec;

g) has a maximum latency of high priority message <120 µsec at 1 Mbit/sec

Note 1 to entry: CAN is unusual in that the entities on the network, called nodes, are not given specific addresses. Instead, it is the messages themselves that have an identifier which also determines the messages' priority. For this reason, there is no theoretical limit to the number of nodes, although in practice it is ~64.

2.8
'Core' system
combination of enabling technologies and services that will provide the foundation for the support of a distributed, diverse set of *applications* (2.1)/*application* transactions, which work in conjunction with 'External Support Systems' such as 'Certificate Authorities'; the system boundary for the *core system* is not defined in terms of devices or agencies or vendors, but by the open, standardized interface specifications that govern the behaviour of all interactions between core system users

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2.9
global navigation satellite system
GNSS
comprises several networks of satellites that transmit radio signals containing time and distance data that can be picked up by a receiver, allowing the user to identify the location of its receiver anywhere around the globe

2.10
host management centre
HMC
service gateway that supervises the secure provision of software and services for C-ITS service provision

2.11
in-vehicle system
hardware, firmware and software on board a vehicle that provides a platform to support C-ITS service provision, including that of the *ITS-station* (2.17) (ISO 21217), the facilities layer, data pantry and on-board *'apps'* (2.1)

2.12
intelligent transport systems
ITS
transport systems in which advanced information, communication, sensor and control technologies, including the Internet, are applied to increase safety, sustainability, efficiency, and comfort

2.13
ITS application
functionality that either completely provides what is required by an *ITS service* (2.16) or works in conjunction with other ITS *applications* (2.1) to provide one or more *ITS services*

2.14
ITS border router
ITS-s router with additional functionality that provides connectivity to other ITS communication nodes over external networks

2.15
ITS mobile router
ITS-s border router (2.14) with additional functionality that allows a change of point of attachment to an external network while maintaining session continuity

2.16
ITS service
functionality provided to surface transport users

2.17
ITS-station
entity in a communication network (comprised of *application* (2.1), facilities, networking and access layer components) that is capable of executing ITS-s application processes (sometimes within a bounded, secured, managed domain), comprised of an ITS-s facilities layer, ITS-s networking and transport layer, ITS-s access layer, ITS-s management entity and ITS-s security entity, which adheres to a minimum set of security principles and procedures so as to establish a level of trust between itself and other similar ITS stations with which it communicates

2.18
wireline
traditional permanent 'wired' connection (although may in reality include microwave and other wireless connections)

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