SIST

SLOVENSKI STANDARD
SIST-TS CEN/TS 17400:2020

01-junij-2020

Inteligentni transportni sistemi - Mestni ITS - Mešana prodajna okolja, metodologije in prevajalci

Intelligent transport systems - Urban ITS - Mixed vendor environments, methodologies & translators

Intelligente Verkehrssysteme - IVS in Städten - Herstellergemischte Systemlandschaften, Methodik und Umsetzung von Schnittstellen

Systèmes de transport intelligents - STI-urbain - Environnements de fournisseurs mixtes méthodologies et traducteurs

Ta slovenski standard je istoveten z: CEN/TS 17400:2020

ICS:

35.240.60	Uporabniške rešitve IT v prometu	IT applications in transport

SIST-TS CEN/TS 17400:2020 **en,fr,de**

TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 17400

April 2020

ICS 35.240.60

English Version

Intelligent transport systems - Urban ITS - Mixed vendor environments, methodologies & translators

Systèmes de transport intelligents - ITS urbain - Environnements de fournisseurs mixtes méthodologies et traduction

Intelligente Verkehrssysteme - Städtische IVS - Gemischte Anbieterumgebungen Methodologien & Übersetzer

This Technical Specification (CEN/TS) was approved by CEN on 29 December 2019 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available promptly at national level in an appropriate form. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No. CEN/TS 17400:2020 E

Contents

Page

European foreword

This document (CEN/TS 17400:2020) has been prepared by Technical Committee CEN/TC 278 "Intelligent Transport Systems", the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a Commission Implementing Decision (M/546) given to CEN by the European Commission and the European Free Trade Association [1], and supports essential requirements of the EU ITS Directive [2]. It fulfils part of the workplan identified in CEN/TR 17143:2017, Intelligent transport systems - Standards and actions necessary to enable urban infrastructure coordination to support urban-ITS [3].

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This suite of standards ([4], [5] and the present document) assist stakeholders to implement urban-ITS systems in a mixed vendor environment.

This suite of standards deliverables will support the family of existent standards, and others under development, referencing both common communications protocols and data definitions, that, in combinations, enable Urban-ITS (and ITS in general) to function and be managed, and will reference application standards, and their interdependencies and relationships.

Urban authorities use an increasing array of intelligent transport systems (ITS) to deliver their services. Historically, urban ITS have tended to be single solutions provided to a clear requirements specification by a single supplier. Increasingly, as ITS opportunities become more complex and varied. They involve the integration of multiple products from different vendors, procured at different times and integrated by the urban authority.

The need for a mixture of systems provided by different manufacturers to so-called Mixed Vendor Environments (MVEs) is a growing paradigm, which results primarily from the demand for the introduction of competition in the context of public tenders, and the increasing networking of existing stand-alone solutions to address complex traffic management systems.

The mix of systems of different manufacturers is also, in part, a result from technological change. Established companies are suddenly in competition with new companies that exploit technological changes and offer exclusively, or at a reasonable price, new or improved functionality for sub systems.

However, ITS design is often proprietary and, as a consequence, integration and interoperability can be difficult, time-consuming, and expensive, limiting the ability of urban authorities to deploy innovative solutions to transport problems. In some Member States, national/regional solutions to this problem have been created, and there are also some solutions in specific domains, which have been very beneficial. However, these are not uniform across Europe, compromising the efficiency of the single market.

This document provides the methodologies and translators to avoid vendor lock-in, introducing suitable methodologies for system architecture design, making appropriate use of standards, and specifications to be used when translator systems are adopted.

This specification is designed to enable ITS architects to develop concrete architectural concepts for mixed-manufacturer systems in order to achieve the migration of existing monolithic single-manufacturer systems, by creating and delivering EU-wide MVE communication specifications designed to actively support the implementation of distributed and open system structures for regionally and nationally networked systems in the transport sector throughout the EU.

This document should be read together with [4], which provides a ‘Guide’ giving a high level introduction into the concept of operations (CONOPS) for a mixed vendor environment (MVE); provides a high-level architectural context explanation of an MVE and its operational requirements, and describes the problems and effects are associated with vendor lock-in. It also provides a systematic approach for many aspects of Urban-ITS implementation, and indeed almost all ITS MVE implementation; and provides a methodical guideline with a procedural model, in order to provide assistance to implementers and managers involved with the structure of an MVE and/or with the removal of vendor lock-in.

This document should also be considered together with [5], which focuses specifically on the area of traffic management systems in an MVE, identifies appropriate standards to use to enable an MVE, and addresses aspects associated with the accommodation of regional traffic standards (RTS) in such mixed vendor environments (RTS-MVE), with particular emphasis on the centre/field systems context. The document also provides information regarding MVE provisions in the public transport domain.

1 Scope

This document focuses on the principal aspects of urban ITS where vendor lock-in is recognized as a technical and financial problem: primarily centre-to-field communications and traffic management systems. It will cover the following scope:

— approaches to the management of MVEs by urban authorities, including mitigation and migration options;

— procedural and operational protocols to achieve interworking, using product/interface adaptation, translation products, replacement/reengineering, and other migration strategies;

— technical options for interworking multiple vendors' products;

— mechanisms to enable interoperability through automated translation between specifications, frameworks and product interfaces;

— review of principal approaches taken to date to implement these options in community frameworks and specifications.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

• IEC Electropedia: available at http://www.electropedia.org/

• ISO Online browsing platform: available at http://www.iso.org/obp

3.1
central system
collection of ITS products and services maintained and managed at one or more control centres, in a sheltered environment

3.2
field device
ITS device that is intended for location within the public realm, whose primary mode of operation does not involve control by a human operator

Note 1 to entry: Field devices may operate in a standalone mode; these are not subject to significant MVE issues. Generally in this document, therefore, the term will refer to field devices which are connected to a central system by an operational communications link, over which the communication (in real time) is essential to their designed operation.

3.3
ITS
system in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport

Note 1 to entry: This definition is taken from EU Directive 2010/40/EU.

3.4
ITS system
ITS with at least two interfaces compliant to different specifications, used to facilitate the effective interworking of ITS that are unable to interwork through a direct connection

3.5
manufacturer
legal entity that designs and creates ITS, and offers and provides them for public use

Note 1 to entry: A manufacturer may or may not be a vendor.

3.6
methodology
constructive framework of design decisions, operating procedures and development processes intended to achieve a specific overall set of ITS goals

3.7
mixed vendor environment
ITS system containing products which are supplied and/or maintained by more than one vendor

Note 1 to entry: A single company may have multiple semi-independent operating divisions, or multiple product suites which are not designed to operate together. Systems using a collection of products from such a company are likely to share many features of an MVE, and this standard may also be applied.

3.8
operator
legal entity responsible for sustaining the efficient operation of an urban road transport network on a day-to-day basis, including through the deployment and/or use of suitable ITS

Note 1 to entry: An urban authority may be an operator, or may contract operator services from a third party. In the latter case, the authority and contracted operator normally share the role of specifying, procuring, and deploying ITS, although the precise split of roles may vary from case to case.

3.9
product
ITS, or a collection of ITS, provided by a vendor under a commercial contract or similar arrangement

Note 1 to entry: The use of this term implies that contractual law applies. In particular, the vendor is held to warrant the suitability and effectiveness of the product, and to underwrite the compliance of the product with the customer specification.

Note 2 to entry: Whether a supply by a vendor is considered to be one product or a collection of connected products will normally be determined by the structure of the procurement specification and resulting supply contract.

3.10
translator
ITS with at least two interfaces compliant to different specifications, used to facilitate the effective interworking of ITS that are unable to interwork through a direct connection

3.11
urban authority
legal entity responsible for the management of a road transport network within an urban area

Note 1 to entry: This definition includes both public bodies that are legally responsible for the network, as well as public and private bodies which have devolved responsibility under a service contact or similar arrangement.

3.12
vendor
legal entity that offers and provides ITS products to urban authorities, typically under a commercial contract

3.13
vendor lock-in
situation where a user is dependent on a specific vendor for products and services, and unable to use another vendor without substantial switching costs (also known as proprietary lock-in or customer lock-in)

4 Abbreviations

ADSL	Asymmetric Digital Subscriber Line
ANPR	Automatic Number Plate Recognition
APP	Application
ASN.1	Abstract Syntax Notation 1
CCTV	Closed circuit television
CEO	Chief executive officer
C-ITS	Cooperative-Intelligent Transport System(s)
CPU	Central processor unit
CROCS	Controller to Roadside Open C-ITS Standard (a protocol associated with UTMC, qv.)
DATEX	standardized DATa EXchange
DATEX II	standardized DATa EXchange II
DfT	(UK) Department for Transport
DSL	Digital Subscriber Line
DVM	Dynamisch Verkeers Management (Dynamic Traffic Management)
GPRS	General Packet Radio Service
GSM	General System for Mobile communications
HTTP	Hypertext Transfer Protocol (world wide web protocol)
ICT	Information and Communication Technologies
IEC	International Electrotechnical Commission

IP	Internet protocol
ISO	International Organization for Standardization
iTLC	Intelligent Traffic Light Controller
ITS	Intelligent Transport System
IVERA	Formed on IVER + ASTRIN, the two organisations that developed the eponymous open specification
IVERA-APP	IVERA Application
IVERA-TLC	IVERA Traffic Light Control
JPEG	Joint Photographic Experts Group (image format)
JSON	JavaScript Object Notation
LA	Local authority
LTE	Long Term Evolution (associated with UMTS)
MVE	Mixed vendor environment
NeTEx	NEtwork and Timetable EXchange
OCA	Open Traffic Systems City Association
OCIT	Open Communication Interface for Road Traffic Control Systems
OCIT-C	OCIT – Centre protocol
OCIT-O	OCIT – Outstation protocol
ODG	OCIT Development Group
OSI	Open Systems Interconnection
PC-SCOOT	Personal Computer – Split Cycle and Offset Optimization Technique?
POSSE	P
PPP	Point-to-Point Protocol (Internet)
PSTN	Public Switched Telephone Network
PW	Private Wire
RIS	Road ITS System
RSMP	RoadSide Management Protocol
SCOOT	Split Cycle and Offset Optimization Technique
SIRI	Service Interface for Real-time Information relating to public transport operations
SNMP	Simple Network Management Protocol
STA	Swedish Transport Administration
SXL	Signal eXchange Lists (a protocol of RSMP, qv.)
TCP	Transmission Control Protocol
TCS	Traffic Control System
TDS	Traffic Data System
TERN	Trans-European Road Network

TETRA	TErrestrial Trunked RAdio
TLC	Traffic Light Controller
TM	Traffic light controller Middleware
TMC	Traffic Management Centre
TPEG	Transport Protocol Experts Group
UDG	UTMC Development Group
UDP	User Datagram Protocol
UMTS	Universal Mobile Telecommunications Service
UTC	Urban Traffic Control
UTMC	Urban Traffic Management and Control
VDV	Verband Deutsches Verkehrsunternehmen
VMS	Variable Message Sign
VPN	Virtual Private Network
XML	eXtensible Markup Language

5 Mixed vendor environments in urban ITS

5.1 General

[4] reviews the context and emergence of the requirements for mixed vendor environments in the urban-ITS paradigm, and provides the context for which the methodologies and translators specified in this document have been specified. Specifically, the following sections of [4] describe:

— The MVE context and issues to be addressed (Section 5), including:

- factors driving the emergence of MVEs (Sections 5.1/5.2);
- MVE contexts (Section 5.3);
- MVE challenges: vendor lock-in (Section 5.8);
- MVE challenges: integration and interoperability (Section 5.11);
- MVE requirements: functional integration (Section 5.13); and
- MVE requirements: the operator perspective (Section 5.14)

— The nature of MVE architectures (Section 6), providing an overview, and the context of cooperating traffic management system and the architectures of roadside systems.

The reader is referred to these sections of [4] in order to obtain a better understanding regarding the paradigm for which the methodologies and translators specified in this document are specified.

5.2 Interfaces between systems

5.2.1 Introduction

Section 6 of [4] describes how, in order to achieve an MVE that meets the urban authority's goals of section 5.1 while minimizing the management challenges, it is crucial to specify the interfaces between systems in a clear, precise and open way. Moreover, this needs to be common across the sector if it is to create a genuine competitive environment with proven products and stable suppliers (see Figure 2).

A number of approaches to this are possible, through formal standards, common industry practice, and (sometimes) specifications produced by an individual authority. The effectiveness of these depends on the context for the interface.

5.2.2 Interfaces with other system owners

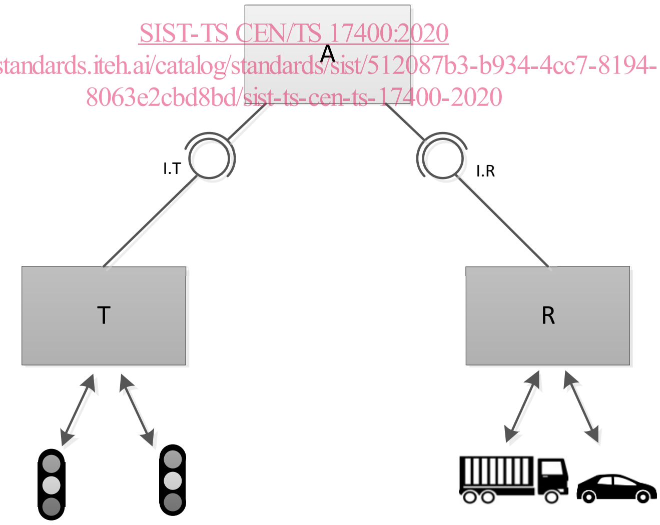
These interfaces are relevant where several traffic management systems and sub systems are interconnected.

This interface exchanges data and service requests between the both systems enabling one traffic management system to have access to the measures and instruments of another traffic management system. For these interfaces there are already important standards, including:

— DATEX II, a European protocol, much of which is now standardized in the EN 16157 series [14].

— Standards for exchanging public transport data based on the Transmodel architecture, including SIRI (EN 15531, [15]) and NeTEx (EN 16614, [16]).

— TPEG (ISO 21219, [17]), which is designed for data exchange with information service providers.



Key

A ITS Application

T Smart traffic light controller

R Roadside C-ITS station

I.T Interface from A to T

I.R Interface from A to R

Figure 1 — iTLC: architecture for connected roadside units (example)

Of these, DATEX II (in Europe, DATEX in USA) is much the most important for traffic management systems. Transmodel and TPEG standards may also be of use for particular functional requirements, although unfortunately the three standards are not entirely compatible.

These standards are complemented or profiled in local implementations. Examples include:

— DVM-Exchange, a Dutch protocol for horizontal and vertical connections between traffic management systems based on exchanging and requesting services.

— UTMC, a UK protocol for interconnecting traffic management ITS, which references DATEX II but without significant profiling.

— OCIT-C, a German protocol for interconnecting traffic management ITS as part of the OCIT environment, heavily based on DATEX II.

Using an open protocol such these, vendors are able to work together in a MVE at this level and road authorities have the opportunity to combine several systems from multiple vendors. Locally, vendors often favour the more specific and well-publicised protocols available in frameworks such as DVM-Exchange, UTMC or OCIT-C, although national highways administrations and some large urban authorities make use of DATEX as well.

5.2.3 Interfaces between procurements by a systems owner

For a system owner, the architecture as shown in Section 6 of [4], cover several nodes. The vendor providing a node in the owner's system is likely to be part of a separate procurement (an individual node B, C or D) or a large procurement covering all or much of the complete system (a complex of nodes B, C and D).

The availability of existing equipment, like a node D, usually give need to procure the other node B and or C separately as the existing equipment is usually too expensive to replace. In this case, the interfaces between existing nodes and newly procured nodes are likely to be open or known, otherwise it becomes almost impossible for a vendor to fill in the needs.

The vertical connections between a traffic management system and its underlying measures/ instruments (as depicted Section 6 of [4] between nodes B, C and D) are intended to give control over the actual systems, and need more detailed protocol in order to facilitate this.

At present there are few standards to assist with this integration context. While frameworks such as DATEX II may be used, they may not be efficient – especially for centre-to-field communications, where the environment is entirely different from the centre-to-centre context for which DATEX II (or DATEX in USA) is designed. In particular:

— Communications links may be constrained in terms of bandwidth, reliability etc.

— Security may be a greater challenge for on-street devices.

— There may be less need for complex management overhead within the system controlled by a single authority/operator.

Vendors of these systems may have their own proprietary protocol; however open protocols exist as well:

— Disperanto and IVERA, Dutch protocols for the technical interface between a traffic control system and (respectively) VMS and traffic lights.

— OCIT-O, a German protocol for the technical interface between a traffic control system and actual measures and instruments, focussing on traffic signal control.

- RSMP, a Swedish protocol for the technical interface between road side equipment and a centralized traffic control system.
- UTMC, a UK protocol for the technical interface between a wide range of traffic management and control systems.

5.2.4 Interfaces within a single procurement

Where an authority procures several traffic management ITS in one procurement (i.e. as one product), it has the opportunity to take care of the potential vendor lock-in risk by ensuring that open protocols are requirements in the tender.

These interfaces are technically comparable to the interfaces as mentioned in section 5.2.3. However, their specification and validation are subject to different pressures, since they are logically within the design authority of the vendor.

Interoperability with other systems can be requested as part of the system's verification where the supplier has to prove it deployed the system using these open protocols. In an environment where other traffic management systems already exist in neighbouring systems, it provides possibilities to integrate between them.

However, this approach constrains the vendor to follow the authority's system architecture. This can sometimes have the effect of rendering potentially good solutions non-compliant.

5.3 Legacy and migration issues

5.3.1 General

A transition to a MVE in an existing environment poses challenges to the way of how the systems migrate in order to get connected in such an environment. Older equipment plays an important role in the total architecture, especially in legacy systems.

Three solutions are seen in practical approaches:

- Adaptation, through the alteration of one or more products to match the connectivity requirements of a connected product.
- Translation, using specially defined software or hardware that are able to convert one protocol to another protocol in such a way that they are able to connect different vendor's applications and systems.
- Migration, a well-defined process where existing equipment gets migrated step by step by replacing or updating the individual parts.

5.3.2 Adaptation

Adaptation is often contractually the simplest approach to resolving an incompatibility based on legacy products. However, it is dependent on the authority being able to:

- Identify exactly what products/interfaces need to be changed, and to what.
- Convince the relevant product vendor(s) (or in some cases a third party) to undertake the work for an acceptable price, and in an acceptable timescale.

Both of these can be challenging, particularly for older products, where the original design information may not be fully accessible and the product may not be able to support the necessary alteration.