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Inteligentni transportni sistemi - Mestni ITS - Vodnik za mešana okolja ponudnikov

Intelligent transport systems - Urban-ITS - Mixed vendor environment guide

Intelligente Transportsysteme - Urbane Verkehrssysteme - Leitfaden für gemischte Anbieterumgebungen

Systèmes de transport intelligents - ITS urbain - Guide pour un environnement de fournisseur mixte

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Intelligent transport systems - Urban-ITS - Mixed vendor environment guide

Systèmes de transport intelligents - ITS urbain - Guide pour un environnement de fournisseur mixte

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European foreword

This document (CEN/TR 17401:2020) has been prepared by Technical Committee CEN/TC 278 "Intelligent transport systems", the secretariat of which is held by NEN.

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Introduction

CEN/TR 17401[1] CEN/TS 17402[2] and CEN/TS 17400[3] are a suite of standards deliverables designed to achieve successful implementation of urban-ITS systems in a mixed vendor environment. This document should be considered as the introductory part.

This suite of standards deliverables supports the family of existent standards, and those 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, consequently, 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.

CEN/TR 17401, this document, is a ‘Guide’ providing 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 of ITS MVE implementations; and provides a methodical guideline with a procedural model, in order to assist implementers and managers involved with the structure of an MVE and/or with the removal of vendor lock-in.

CEN/TS 17402 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 emphasis on the centre/field systems context.

CEN/TS 17400 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.

Against this background, this document is designed to enable ITS architects to develop architectural concepts for mixed-manufacturer systems in order to achieve the migration of existing monolithic single-

[1] Under preparation. Stage at the time of publication: FprCEN/TR 17401.

[2] Under preparation. Stage at the time of publication: FprCEN/TS 17402.

[3] Under preparation. Stage at the time of publication: FprCEN/TS 17400.

manufacturer systems, by creating and delivering EU-wide MVE communication specifications. These are designed to actively support the implementation of distributed and open system structures for regionally and nationally networked systems in the transport sector throughout the European Union.

1 Scope

This document provides a "Concept of Operations (CONOPS) for the introduction and maintenance of a "Mixed Vendor Environment" (MVE) in the domain of urban-ITS. Structured as:

- PART I Context and issues to be addressed
  - Describes the context, background, objective of the MVE Guide, and describes the architectural context.
- PART II work concepts
  - Aspects of system design and architecture are examined and the basic knowledge required for the application of Part III are presented.
- PART III Practice
  - Provides system design and procurement on three levels against the background of a procedure model.
    - user level;
    - conceptual explanation;
    - examples.
- PART IV Outlook
  - Guidance and requirements for the application of MVE for future business.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CEN/TS 17400:—, *Intelligent transport systems – Urban ITS – Mixed vendor environments methodologies & translators*

CEN/TS 17402:—, *Intelligent transport systems – Urban ITS – Use of regional traffic standards in a mixed vendor environment*

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

3.5
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 document may also be applied.

3.6
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.

3.7
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.

3.8
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

3.9
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.

3.10
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

Note 1 to entry: Also known as proprietary lock-in or customer lock-in.

4 Symbols and abbreviations

ADSL	Asymmetric digital subscriber line
ANPR	Automatic number plate recognition
API	Application programming interface
ATM	Active traffic management
ATMS	Advanced traffic management systems
CCTV	Closed circuit television
C-ITS	Cooperative-intelligent transport system(s)
DATEX II	standardized DATa Exchange, version II (CEN 16157 (all parts))
DVM	Dynamisch Verkeers Management (Dynamic Traffic Management)
GDPR	General Data Protection Regulation
GNSS	Global Navigation Satellite System
GPS	Global positioning system
GUI	Graphical user interface(s)
ICT	Information and communication technologies
IP	Internet protocol
ISO	International Organization for Standardization
iTLC	Intelligent traffic light controller
ITS	Intelligent transport system(s)
IVERA	Formed on IVER + ASTRIN, the two organisations that developed the eponymous open specification
IVERA-APP	IVERA Application
IVERA-TLC	IVERA Traffic Light Control

MVE	Mixed vendor environment
NeTEx	NEtwork and Timetable EXchange
OCIT	Open Communication Interface for Road Traffic Control Systems
OCIT-O	OCIT – Outstation protocol
OSI	Open Systems Interconnection
RSMP	RoadSide Management Protocol
RWIS	Road weather information system
SCOOT	Split Cycle and Offset Optimization Technique
SIRI	Service Interface for Real-time Information relating to public transport operations
SNMP	Simple Network Management Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TLC	Traffic Light Controller
TMC	Traffic management centre
TMS	Traffic management system
XML	eXtensible Markup Language
UDP	User Datagram Protocol
UTC	Urban Traffic Control
UTMC	Urban Traffic Management and Control
UVAR	Urban Vehicle Access Restriction
VMS	Variable Message Sign

5 Part I: Context and issues to be addressed

5.1 Background

The first traffic signal was probably that installed outside the UK Houses of Parliament in 1868, had waving semaphore arms and red-green lamps, operated by gas, for night use. Modern traffic signals, red-green systems were installed in Cleveland, USA, in 1914. Three-colour signals, operated manually from a tower in the middle of the street, were installed in New York in 1918. In 1920 the first three-coloured traffic signals with red, yellow and green lights were put to service in New York and Detroit, USA. The first traffic lights in Europe were installed in Paris and Hamburg in 1922, in London in 1925. Automatic, electronically interconnected, signals were first introduced by Houston in USA in 1922. They soon spread to Europe (UK 1926, France 1927). It was the post war evolution of computers in the early 1950s that led to what came to be called “advanced traffic management systems” (ATMS). But while the basis of computer logic behind them was common, the solutions were designed to meet local traffic geography needs (which are often very different in different towns and cities), and so the logic and architecture evolved into different philosophies and different system architectures.

As these systems have been developed by systems specialists, local authorities have tended to buy-in solutions from experts, because it is usually not cost effective to obtain and maintain such skills in-house. The result is that there are now several such system providers who have historically been used to dominating traffic management and information systems within an administration, region or country, and who have, accidentally or deliberately, created walls around proprietary systems, which make interoperability more difficult.

In a coordinated urban paradigm, this impairs interoperability, and the ethos behind this series of MVE standards deliverables, while recognizing the reality of already implemented systems, is to enable workable MVE (see CEN/TS 17400, Intelligent transport systems – Urban ITS – Mixed vendor environments methodologies and translators and CEN/TS 17402, Intelligent transport systems — Urban-ITS — Use of regional traffic standards in a mixed vendor environment).

The motivation to create MVEs derives directly from the objectives of urban authorities and operators. In addition to domain specific goals (that is, regarding the operation of the urban transport network), local authorities also have goals related to procurement, including the following:

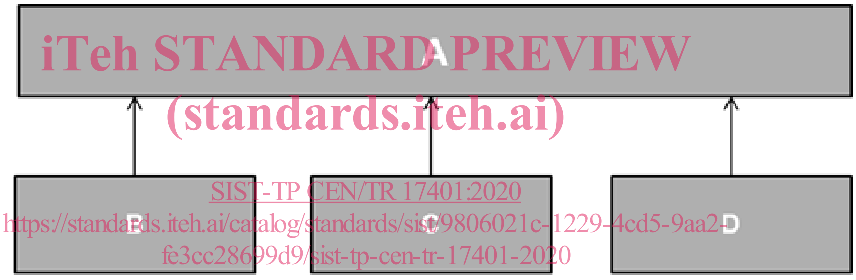
— Facilitating and exploiting a competitive supply market;

— Ensuring that requirements statements are practical and implementable, and in line with good practice by other authorities;

— Ensuring economic efficiency and quality assurance in awarding and operating contracts;

— Simplifying and shortening tendering procedures.

However, the mix of systems is also a result from technological change, the increased capabilities of networks and need for networking, and financial pressures to benefit from competition between different manufacturers. See Figure 1.



Key

A Pressure for vendor mixed environments
B Demand of competition
C Demand of networking
D Technological change

Figure 1 — Typical demands leading to mixed vendor environments

Furthermore, operators have a legitimate expectation that ITS will adopt good technical practice, and will typically aim to follow the following principles as far as practical:

— Minimization of the cost to acquire, use and maintain the equipment, both financially and in human resource;

— Deployment of future-proof systems (as far as practical);

— Achieving greater independence from suppliers so that components can be replaced, or suppliers changed, at any time;

— Increasing reliability, adaptability and sustainability of systems in use;

— Enabling the ability to introduce new technologies (integrated to current systems wherever appropriate);

— Reducing complexity of systems in use.

Other goals that are likely to be relevant include the ability to adapt traffic management to new developments such as:

— New transport demands: new vehicle types, new usage patterns, new land use developments etc.;

— Changing policy environments (for example changes in priority between maximizing flow and minimizing emissions);

— Road user expectations, for example on live travel information and guidance or direct vehicle connectivity.

This document focusses on the co-existence and interworking/interoperability of the established regional standard solutions for TMS to achieve MVE, but recognizes that other aspects of the urban-ITS paradigm, such as public transport, also have similar issues regarding vendor lock-in, and can benefit from a similar systematic approach to achieve an MVE.

5.2 Objective of MVE Guide

This clause explains the objective of the MVE guide.

This document is part of a series of CEN documents dealing with the ITS standards required and primarily useful for traffic management in urban environments particularly where holistic MVE products are largely not yet available.

This document is intended to support those who are involved in tasks for the specification and procurement of traffic management systems (or components such as systems for traffic control, traffic guidance and traffic information), particularly in the context of the required European 'open' market, and provides a systematic approach to achieve their objectives.

Users of this document are faced with the difficult task of justifying their decisions or justifying their decisions regarding requirements defined by others. This MVE guide provides a systematic approach for the definition of 'lots' in the context of tendering procedures.

The general technical trend is towards increasing networking "MVE", and this makes solutions far more complex, providing a difficult analysis task. System parts have different lifetimes which increase the complexity of determining optimal solutions.

System designers or system architects need to be forward thinking and work to influence the development towards mixed-manufacturer system landscapes through their procurement measures. This document provides foresight regarding the strategic decisions for the successful achievement of mixed-manufacturer environments.

This document provides recommendations for actions aimed to identify and avoid the problems that can be expected to occur with mixed systems. This is necessary because systems for road traffic generally have to be procured and operated by the public sector, and thus under the application of public procurement law, i.e. enabling competition; which will inevitably result in a mixture of manufacturers.

This document is divided into the following parts:

— PART I Context and issues to be addressed (this clause)

    — Describes the context and objective of the MVE Guide.

— PART II work concepts

  — Aspects of system design and architecture are examined and the basic knowledge required for the application of Part III is presented.

— PART III Practice

  — Provides system design and procurement on three levels against the background of a procedure model.

    — user level;

    — conceptual explanation;

    — examples.

— PART IV Outlook

  — Guidance and requirements for the application of MVE for over the coming years.

5.3 Approach of the MVE Guide

This document provides guidance on suitable procedures that authorities may use to achieve an effective MVE for their ITS. It focuses on the creation and adoption of a coherent system architecture and relevant standards, and the management of such a system from design, through procurement and operation, to maintenance and evolution.

It is recommended that a formal systemised approach to the planning and management of projects is used to develop, migrate to, and maintain, a mixed vendor environment. Annex A provides some guidance regarding the use of such approaches and tools for project planning and project management and provides some examples of project management aspects that are particularly relevant in order to develop, migrate to, and maintain, a mixed vendor environment.

In each case, a solution concept needs to be developed that encompass “all” of the requirements. A formalized approach starts with a representation at the conceptual level, and it is necessary to ensure that any components of solution supplied by different manufacturers not only successfully interact with the existing system environment, but also with each other, as intended.

The recommended general approach is to create a “distributed system” (regardless of whether it is actually implemented as a manufacturer-mixed or manufacturer-specific solution). In a distributed system the definition and specification of messages to be exchanged, and their representation in specified open format, are an indispensable component of the specifications.

5.4 Target audience of the MVE Guide

While much of the focus of this document is on traffic management systems, the general principles are applicable across the entire gamut of urban-ITS service provision, including public transport MVE aspects which are explicitly addressed below.

Within the arena of traffic control and management, the renewal or extension of existing traffic control systems, or their confederation into regional or supra-regional traffic information and traffic management systems, involve tasks which can be very different in different cases.

This document is aimed primarily at those who are responsible for the development of integrated urban-ITS concepts and the associated processes of procurement, operation, and evolution.

Particular attention is paid to the concept development stage, that is to say the capture of system requirements in a coherent architecture and operations model, since this will define the scope for the necessary procurements. This stage is fundamentally important: what is misinterpreted or omitted at this stage is likely to be much harder to correct later.

5.5 Mixed vendor environments in Urban ITS

Historically, urban ITS have tended to be single solutions provided to a clear requirements specification by a single supplier. Today, urban authorities use an increasing array of ITS to deliver their services. 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 manufactured by different manufacturers to so-called 'Mixed Vendor Environments' (MVEs) is a growing issue, which results primarily from the demand for the introduction of competition in the context of public tenders (European 'open' market), and the increasing networking of existing stand-alone solutions to achieve complex, connected, 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, consequently, 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.

Against this background, this document is designed to enable ITS architects to develop 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 regional markets.

5.6 The 'setting': MVE challenges and vendor lock-in

While the achievement of an effective MVE can broadly be described in the terms of any project to be managed, there are aspects concerning MVE that are particular to its situation and objectives, and which provide the 'setting' in which the project is to be undertaken.

"Vendor lock-in", is a 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).

The lock-in effect is both a market strategy and a marketing strategy of manufacturers and suppliers. It is regarded as technical-functional customer loyalty, because product or service components can only be obtained from one manufacturer or complementary products only provide joint benefits. Although the lock-in term implies that customer loyalty activities originate from the manufacturer, it can also be triggered by the customer itself through preferences for the supplier or its product(s), or simply seeking the easiest and quickest short-term solution.

Vendor lock-in is widespread in the transport sector, especially in cities. It has largely developed because of the special system architecture of urban traffic control and traffic management systems, each with a control centre and many field devices connected to it. These solutions have, in general, developed and evolved, often in a piecemeal fashion, over time, with the road authority asking its present supplier to extend its present system to also be able to do task b, or operate c. However due to this architecture, and with the use of proprietary communication interfaces, the supplier of the control centre can prevent other "external" manufacturers from connecting their field devices to this control centre. The principle