Paper

Implementation of Standardized Cooperation Environment for Intelligent Transport Systems

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Abstract—Many of Intelligent Transport Systems (ITS) solutions are using components that dynamically change in time and space. Among these, there occur changes of location, movement parameters, components configuration, external environment influence, automation use, etc. Standard facilities in ITS communication model are useful base for implementation of the services in such variable environment. Such features have an influence on the implementation of the services and requirements for the lower communication layers.

Keywords—C-ITS, communication, facilities, services.

1. Introduction

In each phase of the transportation and logistic actions (e.g. loading goods, transferring, the unloading etc.) a relevant information is exchanged. Thus, present transport needs reliable communications as essential part of such activity.

The communication is gaining the even greater significance in transport systems using information and communication technology (ICT) solutions, acting in the automated or full automatic way. One can say, that sophisticated communication is a key to intelligent transport systems cooperation with each other Cooperative ITS (C-ITS).

ITS information exchange requirements are similar to the communication requirements generally used in other ICT applications such as: capacity, response time, reliability, etc. However, in certain instances a special requirements are applied, and, from a point of view of purposes and activity conditions of the transport system, they are often critical. These particular requirements cover: the knowledge of local conditions, the adaptation to them, the speed, the certainty of acting, etc. Implementation of the application responsible for the safety or programming automatic reaction to circumstances of the environment can depends on these local conditions, e.g. weather conditions, infrastructure state, breakdowns, other object behavior, etc.

Such issues are important especially in application in moving vehicles which have to cooperate with applications located in other vehicles as vehicle to vehicle – V2V relation, or with applications located in transport infrastructure as vehicle to infrastructure – V2I relation or infrastructure to vehicle – I2V relation, generally V2X relation.

In ITS solutions, the mechanisms to provide the communication for applications in varying conditions are used. This is an effect of standardization, so that all transport services can use them in different circumstances.

Implementation of ITS services on the standard base needs:

- methodology of defining ITS components, their description and principles of cooperation with other platforms,
- service solutions adapted to real conditions, including local experience from their usage,
- tools needed for the implementation of standardized solutions.

Such standardized solutions are described in public documents, i.e. European Standards (EN). Knowledge of these solutions is necessary for implementation C-ITS services in Poland.

Communication processes in ITS are important for not only the completion of separate transport processes, but also for the integration and the cooperation of transport systems, which are based on various platforms. The good knowledge of communication environment will accelerate designing and manufacturing of big ICT systems in ITS area.

The facilities layer takes an essential role in the standardized architecture of the ITS communication [1]. This layer executes shared functions, allowing actions and cooperation integration. The communications means, required by the facilities layer, are seen as the network and the transport layer.

Action presentation and problems indication connected to realization, especially in the layer of facilities, are significant steps for implementing ITS systems. The Polish national environment should be also considered. However, it is significant, that presented solutions are in the course of creation (even they are placed in approved documents). Therefore, in many places there appear remarks on the incomplete statements and follow-up works on standard documents.

Methods and solutions proposal, presented here are taken from standards. This study is an attempt of the synthesis of the certain essential fragment of the ITS standardization results. It is also an attempt to locate these issues in Polish context for better assimilation in professional environment.

2. Application Requirements

The aim of ITS are transport services where ICT applications take an important part. It means that ITS is cooperative product of transport entities as well as ICT technologies.
From institutional point of view, ITS applications issues and their communication requirements were an object of the activity many international projects, inspired by industry as well as by state administrations. An example of powerful and fruitful activity is CAR 2 CAR Communication Consortium, created by major automotive companies from Europe, USA and Far East regions. This consortium prepared a document [2] where visions of the communication were framed in ITS systems. These visions were developed and experimentally verified as part of other projects [3]. Their result, are standardization documents.
One of that document is ETSI TR 102 638 report [4], which defines Basic Set of ITS Applications (BSA). According to ETSI methodology, this document supports beginning of the technical specifications and standards development process. List of the services and applications included in BSA along with the proposal of their Polish translation and definitions were placed in [5]. BSA is important, in case of statement of fundamental assumptions in relation to the structure of the homogeneous environment for the set of ITS specific services. This set of services remains open. However, functional requirements resulting from it were transferred into methodology solutions for building the application layer, especially layers of common facilities of the ITS communication model.
In this section is shown how requirements are formulated, leading to the completion of services from components, supposed to ensure execution of the services in the dynamically changing environment.

2.1. ITS Applications Functional Requirements Statement

Functional requirements description rules are based on ETSI TS 102 637-1. They are divided into two groups: application requirements and use case requirements.
Application functional requirements: General application functional requirements, which applies for all use cases of this application. Application functional requirements are signed as **[FR_application_#_stationtype]**, where:

- **FR** means functional requirement,
- **application** provide acronym of application to which the requirement applies,
- # is sequence number of requirement,
- **stationtype** indicates ITS station type to which the requirement applies; it could missed when the requirement is not correspond to any specific station type.

Use case (UC) functional requirements: Functional requirements for specific use cases, do not apply to other use cases of the same or other applications. Use case functional requirements are signed as **[FR_UC#_#_stationtype]**, where:

- **FR** means functional requirement,
- **UC#** is designation of use case, to which the requirement applies,
- # is sequence number of requirement,
- **stationtype** indicates ITS station type to which the requirement applies; it could missed when the requirement is not correspond to any specific station type.

Station types defined in ITS communication architecture are:

- CS – central station,
- VS – vehicle station,
- RS – roadside station,
- PS – personal station.

An example of an application of the functional requirements is the Cooperative Awareness (CA) application. Its implementation is based on exchange of messages named Cooperative Awareness Message (CAM) and Decentralized Environment Notification Message (DENM), in the ITS network, in V2X relations. These messages transfer information on vehicles attributes and their nearest surroundings. Details of these messages proceedings will be shown hereinafter.
Table 1 provides list of functional CA applications requirements (to be verified in real conditions) connected to driver support[6].
The next specification stage is use case requirements set for one use case included in CA application, e.g. UC003: Intersection collision warning, shown in Table 2 [6]. It should be noted that at this detail level are required interfaces to technical means, like transmission media or Human Machine Interface (HMI).

2.2. Identification of Facilities for ITS Applications

Functional requirements implementation is common for many use cases and applications, and is addressed to the facilities layer of ITS communication model, located directly below the application layer. This is so-called facilities layer serves typical operations and applications specified on higher layer.
ETSI TS 102 894-1 [7] identified two groups of facilities for ITS applications: common facilities and domain fa-

Table 1
An example of Cooperative Awareness application functional requirements

FR_CA_001	An ITS station shall announce its presence to its vicinity
FR_CA_002	An ITS station shall broadcasts its position, speed and moving direction to its vicinity
FR_CA_003_VS	A vehicle ITS station shall broadcast its basic dynamics and status information to its vicinity
FR_CA_004	CAM shall provide the position information with a confidence level that is sufficient for the all use cases
FR_CA_005_VS	Vehicle ITS station shall have access to the in vehicle system to obtain the required information for the CAM construction
FR_CA_006	A receiving ITS station should update the position of the sending ITS station
FR_CA_007	Information included in CAM shall allow receiving ITS station to estimate the relevance of the information and the risk level
FR_CA_008	An ITS station shall be able to modify the sending interval of two consecutive CAMs
FR_CA_009	CAM shall be set with high priority for transmission
FR_CA_010	ITS station shall provide one hop broadcasting functionality for CAM

Table 2
An example of use case functional requirements for UC003: Intersection collision warning

FR_UC003_001	Unique use case identifier shall be defined in this use case
FR_UC003_002	Unique event identifier shall be defined for this use case If the "intersection collision" event can be divided into multiple sub event types, a unique event identifier shall be defined to each of the sub event type
FR_UC003_003	The application at the originating ITS station shall be able to request the construction and the transmission of an "intersection collision warning" DENM in complementary of CAM
FR_UC003_004	If DENM is sent, the originating ITS station shall be able to detect the vehicle positions and movements within the intersection area
FR_UC003_005	If DENM is sent, the originating ITS station shall be able to verify whether the "intersection collision warning" event that may be a risk
FR_UC003_006	If DENM is sent, the application at the originating ITS station shall be able to provide required information for the "intersection collision warning" DENM construction
FR_UC003_007	If DENM is sent, the application at the originating ITS station shall define the transmission rate of the "intersection collision warning" DENM
FR_UC003_008	If DENM is sent, the application at the origination ITS station shall define the transmission area of the "intersection collision warning" DENM and provide to the network and transport layer
FR_UC003_009	If DENM is sent, the application at the originating ITS station shall define the transmission latency requirement and the priority of the "intersection collision warning" DENM
FR_UC003_010	If DENM is sent, the application at the ITS station shall provide the estimated intersection collision position as the event position
FR_UC003_011	If DENM is sent, the application at the originating ITS station shall be able to stop sending the DENMs when the "intersection collision" event is terminated
FR_UC003_012_VS	The vehicle ITS stations shall include the vehicle type and size information in CAM
FR_UC003_013_VS	Information in CAM or DENM shall allow the application at the receiving vehicle ITS station to check the relevance of the information and estimate the risk level
FR_UC003_014_VS	The application at the receiving ITS station shall decide whether a warning or information of "intersection collision" event is provided to the driver via HMI
FR_UC003_015_VS	The application at the vehicle ITS station should present the "intersection collision warning" to the driver via HMI at an appropriate timing
FR_UC003_016_VS	The application at the vehicle ITS station may further broadcast its itinerary to pass the intersection

Table 3
List of common facilities

Classification	Identifier	Facility name	Short description
Management	CF001	Traffic class management	Manage assignment of traffic class value for the higher layer messages
	CF002	ITS-S ID management	Manage ITS-S identifiers used by the application and the facilities layer
	CF003	AID management	Manage the application ID used by the application and the facilities layer
	CF004	Security access	Deal with the data exchanged between the application and facilities layer with the security entity
Application support	CF005	HMI support	Support the data exchanges between the applications and HMI devices
	CF006	Time service	Provide time information and time synchronization service within the ITS-S
	CF007	Application/facilities status management	Manage the functioning of active applications and facilities within the ITS-S
	CF008	SAM processing	Support the transmission and receiving of the service announcement message (SAM)
Information support	CF009	Station type/capabilities	Manage the ITS-S type and capabilities information
	CF010	ITS-S positioning service	Calculate the real time ITS-S position and provides the information to the applications/facilities layers
	CF011	Location referencing	Calculate the location referencing information and provide the data to the applications/facilities layers
	CF012	Common data dictionary	Data dictionary for messages
	CF013	Data presentation	Message encoding/decoding support
Communication support	CF014	Addressing mode	Select addressing mode for messages transmission
	CF015	Congestion control	Facilities layer decentralized congestion control functionalities

cilities. Common facilities (CF) (Table 3) are required for ITS station (ITS-S) operation and/or support for communication interoperability. Additionally, certain common facilities transfer cross layer information to the management and security entities.
The common facilities from Table 3 are identified by unique number CF#. For each facility a set of functions and interfaces is identified.
Function is denoted by an identifier [CF#_F#], where:

- CF# identifies of common facility,
- F# indicates of function number.

Interface is denoted an identifier [CF#_IN#], where:

- CF# identifies of common facility,
- IN# indicates of interface number.

Domain Facilities (DFs) are services and functions for one or more BSA applications or for one or more ITS station types. Domain facilities could be optional for other ITS applications and other ITS-S types. Table 4 provides list of domain facilities identified in standardization documents [7].

Domain facility is identified by unique number **DF#**. For each facility a set of functions and interfaces is defined. Function is denoted by an identifier **[DF#_F#]**, where:

- DF# identifies of domain facility,
- F# indicates a function number.

Interface is denoted by an identifier **[DF#_IN#]**, where:

- DF# identifies of domain facility,
- IN# indicates a interface number.

As an example, functional requirements two facilities are presented, which are the base for implementation of use case UC003: Intersection collision warning, such as requirements for DF001: DEN basic service and DF002: CA basic service.

2.3. Functional Requirements Identification Example

The domain facility DF001 executes Decentralized Environment Notification Message (DENM) protocol associated

Table 4
List of domain facilities

Classification	Identifier	Facility name	Short description
Application support	DF001	DEN basic service	Support the protocol processing of the DENM
	DF002	CA basic service	Support the protocol processing of the CAM
	DF003	EFCD	Aggregation of CAM/DENM data at the road side ITS-S and provide to the central ITS-S
	DF004	Billing and payment	Provide service access to billing and payment service provider
	DF005	SPAT basic service	Support the protocol processing of the Signal Phase and Timing Message
	DF006	TOPO basic service	Support the protocol processing of the Road Topology Message
	DF007	IVS basic service	Support the protocol processing of the In Vehicle Signage Message
	DF008	Community service user management	Manage the user information of a service community
Information support	DF009	Local dynamic map	Local Dynamic Map database and management of the database
	DF010	RSU management and communication	Manage the Road Side Units from the central ITS-S and communication between the central ITS-S and road side ITS
	DF011	Map service	Provide map matching functionality
Communication support	DF012	Session support	Support session establishment, maintenance and closure
	DF013	Web service support	High layer protocol for Web connection, SOA application protocol support
	DF014	Messaging support	Manage ITS services messages based on message priority and client services/use case requirements
	DF015	E2E geocasting	Deal with the disseminating of information to ITS vehicular and personal ITS stations based on their presence in a specified geographical area

with this message. DENM is used in cooperative road hazard applications mainly in order to inform other road users about detected events.

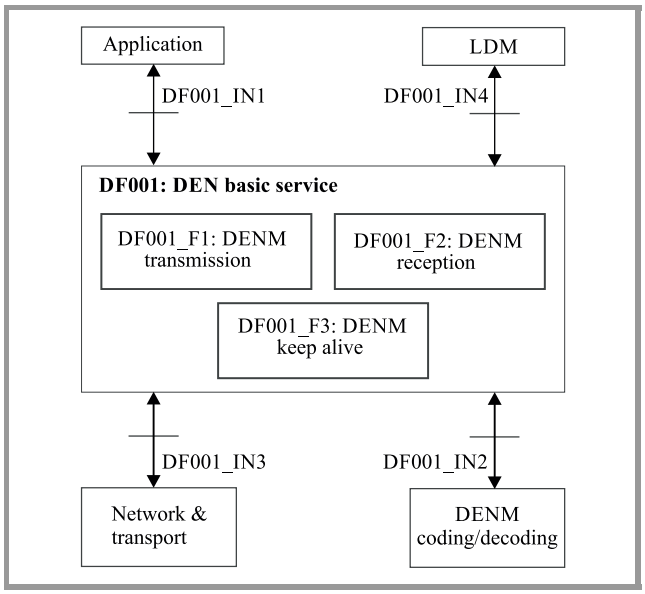

Fig. 1. Block diagram of DF001: DEN basic service according to ETSI TS 102 894-1.

The source of the DENM is the ITS station, which have detected an event. The application provides attributes data of detected event: type, duration, location, as well as DENM destination dissemination area to DEN basic service. The DEN service constructs the DENM and provides it to network and transport layer. At the reception, DEN service filters not valid messages. Further received information is provided to application directly or via common database (Local Dynamic Map – LDM). Keep alive function may forward valid messages to protect their dissemination in the case of dynamic events.

Figure 1 shows DEN service functional configuration and external interfaces [7].

Table 5 provides functional requirements and Table 6 provides interfaces to external components descriptions addressed to DEN basic service according to ETSI TS 102 894-1 [7].

2.4. Functional Requirements Example Set out for DF002 CA Basic Service

The Cooperative Awareness (CA) basic service is a facilities layer entity providing the management of facilities layer data, needed for ITS stations cooperation. It executes the protocol associated with CAM. In BSA, this

Table 5
Functional requirements for DF001: DEN basic service

Function	Requirements
[DF001_F1]	The function shall execute the DENM transmission protocol. It constructs a DENM when receiving a request from application, and initiates the DENM transmission. The DENM format shall be as specified in ETSI EN 302 637-3 [8]. The DENM transmission protocol shall include functionalities to enable the DENM initiation, DENM updates and DENM termination from originator ITS-S.
[DF001_F2]	The function shall execute the DENM reception protocol. It decodes a received DENM, manages its lifetime according to a validity time and provides the DENM content to the applications and/or to the LDM when requested. The DENM reception protocol shall include functionalities to discard the outdated DENM and to provide the update DENM content to the ITS applications.
[DF001_F3]	The function shall execute a forwarding of a DENM which is still valid within a specific area and specific duration (keep alive). This function is optional.

Table 6
Interfaces of DF001: DEN basic service

Interface	Related component	Direction	Information exchanged over the interface
[DF001_IN1]	Application, LDM or other facilities	In/out	In: Request from application for the transmission of new DENM, updated DENM or DENM termination, together with the data related to the detected event and the DENM dissemination requirements. Out: Content of the received DENM.
[DF001_IN2]	Data presentation	In/out	Data required for the DENM encoding/decoding, as supported by the data presentation common facility.
[DF001_IN3]	ITS network and transport layer	In/out	In: Received DENM content from the Network & Transport (N&T) layer. Out: DENM content to the N&T layer for DENM transmission.
[DF001_IN4]	LDM or other facilities	Out	Content of the received DENM.

Table 7
Functional requirements for DF002: CA basic service

Function	Requirements
[DF002_F1]	The function shall collect data required to construct a CAM. The CAM format shall be as specified in ETSI EN 302 637-2 [9].
[DF002_F2]	The function shall manage the CAM transmission frequency according to the congestion level.
[DF002_F3]	The function shall transmit the CAM to the networking and transport layer.
[DF002_F4]	The function shall process the received CAMs

facility is relevant to vehicle ITS-S and roadside ITS-S. It is expected that other ITS-S may use the CAM in the future.

CA basic service periodically constructs and transmits CAM. It cooperates with other facilities in order to collect the data needed for CAM. In case of CAM reception, the service decodes the message and transfer received data to the application and/or to LDM, which is common local facilities layer database. CAM is a heartbeat message of the facilities layer. Interval of CAM transmission may vary from several hundred milliseconds to one second. It depends on application requirements and/or network congestion level. Figure 2 shows CA service functional configuration and external interfaces [7].

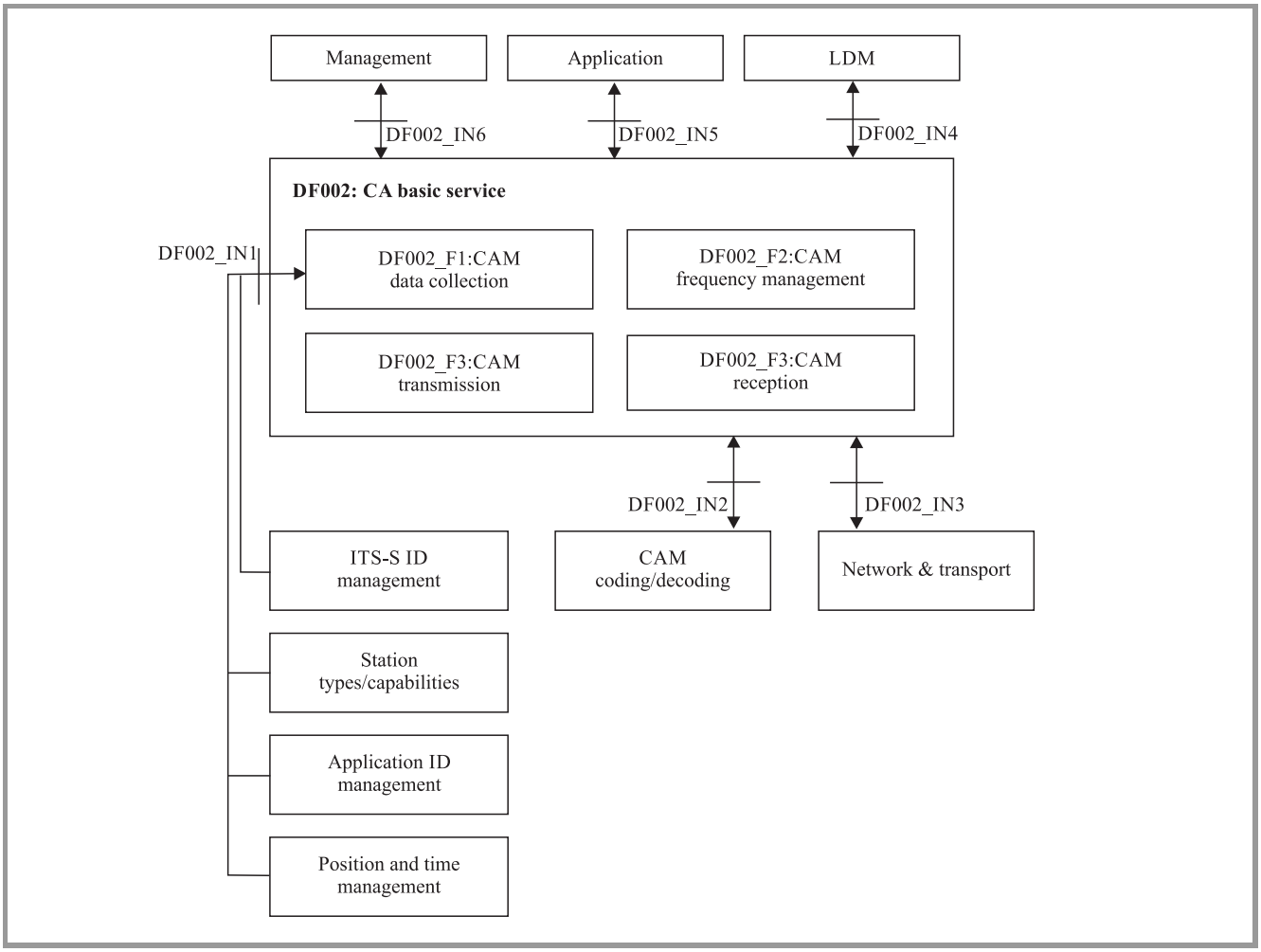

Fig. 2. Block diagram of DF002: CA basic service.

Table 8
Interfaces of DF002: CA basic service

Interface	Related component	Direction	Information exchanged over the interface
[DF002_IN1]	• station type/capabilities, • application ID management, • position and time management, • ITS-S ID management,	In	Data required for the construction of CAM: • station type, • in vehicle data (for vehicle CAM), • application ID information of CAM, • current position and time information of the ITS-S, • ITS-S ID information, • other information included in CAM as specified in ETSI EN 302 637-2 [9].
[DF002_IN2]	Data presentation	In/out	Data presentation and message encoding/decoding support.
[DF002_IN3]	Network & transport	In/out	Out: CAM delivered to network and transport layer for transmission; In: Received CAM delivered by the networking and transport layer.
[DF002_IN4]	LDM	Out	Content of the received CAMs to the LDM.
[DF002_IN5]	Application	In/out	In: Application requirements, if applicable; Out: Content of the received CAMs to the LDM and/or to the application.
[DF002_IN6]	Management	In/out	Data required by the management layer and/or information of the congestion level.

Table 7 provides functional requirements and Table 8 showsinterfaces to external components descriptions addressed to CA basic service [7].

3. Facility Layer Services Implementation

The implementations aspects of facilities, generally defined earlier, are shown here on the example of DEN and CA services.

It is worth to note that CA and DEN services are standardized in Europe and they are specified in EN class documents. It means that these documents were voted by European Union member state standardization bodies (i.e. Polski Komitet Normalizacji in Poland) and recognized as Polish Standards – PN-EN. It is the base for ITS solutions manufacturing unification and services interoperability operations, at least throughout Europe. The process of standard document recognition does not cover other document classes, i.e. Technical Specifications (TS) or Technical Report (TR).

It should be noted that this standard area is still during the work process – new documents are under preparation and old ones have new versions, some documents are not fully cohesive or there are differences among them. It involves some problems during implementation of the standardized services.

3.1. DEN Basic Service Implementation

DENM transfers information on the road events that could have impact on road user safety and traffic conditions. The event could have the following attributes: event type, event position, event detection time and time duration. This attributes may change over space and over time [9].

DEN basic service constructs and process DENM. DENM construction is initiated by ITS station application after event detection in order to inform about that other ITS stations. The message ready to distribution is transferred to network and transport layer. It triggers all communications facilities services. Usually DENM is distributed to ITS stations located in area of direct communication between different vehicles and between vehicles and roadside infrastructure.

In case of DENM received from network and transport layer, DEN basic service processes the message and presents the content to ITS application. The application can show information about danger or traffic conditions. Then the driver could react accordingly.

DENM transmission could be repeated when the event takes place or, in some cases, even when originating ITS station left the event location but event is not ended (e.g. the case of ice or fog). DEN basic service protocol was design to serve composed situations. For this purpose, the following DENM types were defined.

New DENM is generated by the DEN basic service after the event detection by originating ITS station. New DENM is denoted by new identifier and provides defined event attribute like position, type, detection time and others. Update DENM is generated by the same station, which had generated new DENM for the same event. It updates event information.

Cancellation DENM is generated by the same station which had generated new DENM for the same event. It informs on event termination. Negation DENM is generated by the ITS station, which is able to detect event termination, previously announced by another station.

DENM contains one common ITS Protocol Data Unit (PDU) header and several data containers, see Fig. 3.

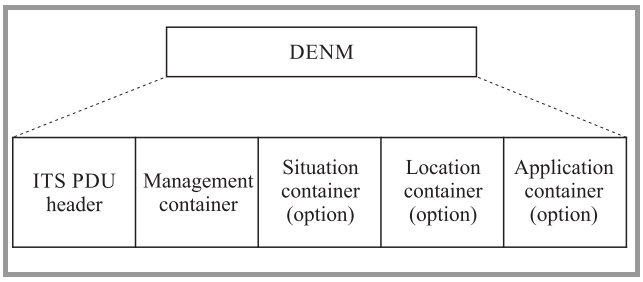

Fig. 3. General DENM structure.

ITS PDU header is common unit in all messages that includes protocol version information, message type and source ITS station identifier.

DENM work part consists of four data containers in fixed order for management, situation, location and application information.

Management container transfers information related to DENM management and DENM protocol. Situation container describes event type. Location container contains information on event location and position data. Application container contents uses case information required additionally and is not filled in previous containers.

Each container is composed of a sequence of optional or mandatory Data Elements (DE) and/or Data Frames (DF). DEs and DFs are mandatory unless specified otherwise. Detailed descriptions of all DE and DF in the CAM context are in normative annex B to PN-ETSI EN 302 637-3 [8]. DE and DF not defined in PN-ETSI EN 302 637-3 [8] should be searched in common data dictionary (i.e. [10]). Formal ASN.1 CAM specification is included in normative annex A to PN-ETSI EN 302 637-3 [8]. DENM basic service protocol operation formal specification is include in clause 8 of PN-ETSI EN 302 637-3 [8].

3.2. CA Service Implementation

CA basic service implements requirements and specifications described earlier. The PN-ETSI EN 302 637-2 [9] shows the service execution in more details. The service is constructed on the base of CAM processing.

CAMs are exchanged in ITS network between ITS stations, in order to maintenance of mutual knowledge and cooperation of vehicles on the common roads. CAM contains information about source ITS station attributes needed for actions of specific applications. Set of information depends on station type and information itself. This information could be used by applications for mapping of road situation, for prediction of the situation development and for calculation of risk.

For example ITS-S could calculate a risk of road collision between vehicles. The driver can receive the message, via HMI, and decide on specific actions. In case of automatic actions applied, the breaks could be activated automatically.

CAM contains one common ITS Protocol Data Unit (PDU) header, basic data container and many optional (conditional) data containers, see Fig. 4. ITS PDU header is common unit in all messages that includes protocol version information, message type and source ITS station identifier. Basic container include basic information on source ITS station. High frequency (HF) container includes information that is changing frequently. Low frequency (LF) container includes static or not frequently changed information of source ITS station. Special vehicle containers include information connected to specific role of vehicles represented by ITS station.

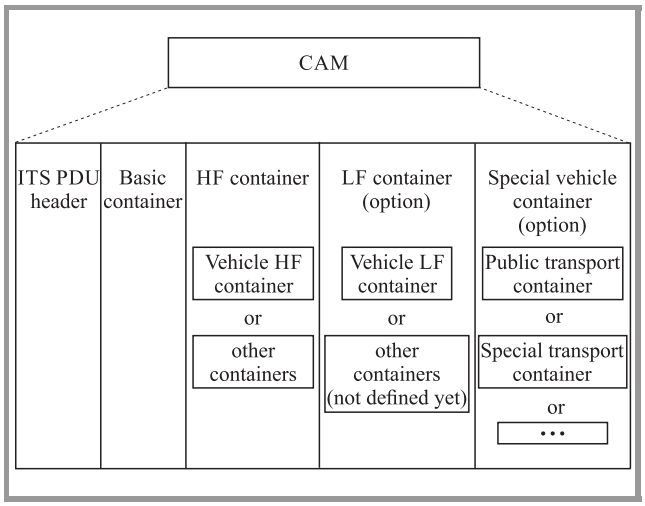

Fig. 4. General CAM structure.

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3.3. Common Solutions on Syntax and Data Dictionaries

There are some common methods of specifications applied to ITS services implementation.

Messages syntax is defined using ASN.1 notation according to ITU-T Recommendation X.680 (11/08)/ISO/IEC 8824-1) [11] and others from this series. For messages coding and decoding should be applied Packed Encoding Rules according to ITU-T Recommendation X.691/ISO/IEC 8825-2 [12]. Messages syntax, defined using above-mentioned rules, is formal and could be used as a part of software of service protocols and applications using the information transferred by the messages.

Information transferred by messages is located in containers in form of Data Elements and/or Data Frames. Data sources and destinations included in data elements are other facilities layer entities as well as applications. Syntax invokes all the data elements in specific order.

Common data dictionary is a tool for integration of DE and DF in all messages. Usually descriptions of all DEs and DFs in the specific message context are included in standardization documents of the message. DE and DF not defined in the message context should be taken from common data dictionary specified in ETSI TS 102 894-2 [10]. It covers the description of data meaning included in specific data elements. The dictionary includes also data elements specification in ASN.1 notation. It is possible to import the ASN.1 specification to message encoding procedures.

4. Summary

In this paper definition tool of ITS services and environment of their execution have been shown. They should allow an implementation that would assure services efficient execution. Implementation of facilities layer is important as it has an impact on the realization of many different services. Using standardized solutions, especially international, can assure that specific products may be designed, manufactured and provided with vehicles by different subjects and cooperate with each other as well as with road infrastructure in different countries.

Standardization documents and international product development are full of knowledge and solution proposals. There are many references to real experience. As presented, ITS services implementation and deployment require general knowledge of the final services and their execution environment.

One of the implementation tools is dissemination of concepts and solutions, as presented, in ITS professional environment. In some cases, it requires verification against implementation conditions. Some parts need to be more precise. In particular it is addressed to:

- definition and description methodology of specific solutions (including adequate terminology). It means needs of standards, including technical reports and technical specification localized in national and local law, business, administration and professional environments;
- verification of proposed solutions whether they are complete, capacious and they sense their applications. As an example see CAM content definitions for ITS stations other than vehicle stations;
- workout of missing solutions and/or solutions for specific requirements, such as data security and data privacy in the context of public road and transport operations;
- specification and making or purchase of tools for ITS solutions implementation, deployment and operations, e.g. ASN.1 notation and/or common data dictionary usage.

The standards have the particular role. Hence, there is no formal obligation for their application but mode of their preparation in international environment, that justify their treatment as a base for implemented solutions. Moreover, there is a need to track the standards development, where ITS is a nascent area where occur rapid changes in the standard requirements. See clause 3.4.5 in Rolling Plan for ICT Standardization in [13].
Still before implementation of selected ITS services, specific conditions have to be fulfilled. In particular the following:

- determination of real ITS services deployment strategy with its law and organization context of execution,
- indication of specific technical solutions, especially transport infrastructure (roads, vehicles), which assure efficient ITS services deployment.

European Commission has noticed that there is a need to discount earlier experience and practically support common implementation of C-ITS throughout Europe. At the first stage, a review report was prepared [14]. Key issues for C-ITS implementation are indicated and described in this report. Next stages of this platform activity are planned as answers for questions asked by C-ITS implementers and questions emerged by the current needs of ITS users.
The paper presented the framework of standards implementation. Common understanding of the ITS implementation processes is an essential for real cooperation of ITS.

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