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Intelligent transport systems — Cooperative systems — Roles and responsibilities in the context of cooperative ITS based on architecture(s) for cooperative systems

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Intelligent transport systems - Cooperative systems - Roles and responsibilities in the context of cooperative ITS based on architecture(s) for cooperative systems (ISO/TS 17427:2014)

Systèmes intelligents de transport - Systèmes coopératifs - Rôles et responsabilités dans le contexte des ITS fondés sur l'architecture de systèmes coopératifs (ISO/TS 17427:2014)

Intelligente Transportsysteme - Kooperative Systeme - Rollen und Verantwortlichkeiten im Zusammenhang von ITS basierten Architekturen von kooperativen Systemen (ISO/TS 17427:2014)

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Foreword

This document (CEN ISO/TS 17427:2014) has been prepared by Technical Committee ISO/TC 204 "Intelligent transport systems" in collaboration with Technical Committee CEN/TC 278 “Intelligent transport systems” the secretariat of which is held by DIN.

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Foreword

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

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Introduction

Cooperative-ITS (C-ITS) are a promising and remarkable advancement of Intelligent Transport Systems (ITS). Numerous cooperative applications are specified that open up new possibilities to make traffic safer, more efficient and smarter. Technologies are developed and improved to realize and support those new services and applications. But, to finally implement C-ITS and to achieve the benefits of more safety and better mobility, various actors from different industries will have to cooperate with each other in a completely new way. Actors that did not collaborate so far will have to find a way to do so. This requires a precise definition and assignment of behaviours, responsibilities and liabilities. Therefore a general, abstract organizational architecture with the description of the single roles, their behaviour and the corresponding responsibilities is the essential basis for the deployment of C-ITS.

The organizational architecture itself with the description of the roles and responsibilities is a crucial part of the whole C-ITS architecture. The organizational architectural viewpoint has extensive influences on the deployment and implementation of C-ITS.

This document describes the high level roles and responsibilities that enable C-ITS Service provision.

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Intelligent transport systems — Cooperative systems — Roles and responsibilities in the context of cooperative ITS based on architecture(s) for cooperative systems

1 Scope

This Technical Specification describes the (non-actor specific) roles and responsibilities required to deploy and operate Cooperative-ITS (C-ITS). The organizational architecture described in this document is to be used for a fully operational system. The Technical Specification is couched in terms of an organizational or enterprise viewpoint, as defined in ISO/IEC 10746 Open Distributed Processing.[1]

This Technical Specification is applicable to all types of road traffic of all classes. The description of roles is completely technology agnostic and, in terms of C-ITS communication modes, embraces vehicle-vehicle communications, vehicle-infrastructure communications and infrastructure-infrastructure communications.

This Technical Specification provides a methodology for the identification of service specific roles and their corresponding responsibilities based on a process oriented approach. Additionally, the defined methodology is used to identify the roles and responsibilities for C-ITS, in general. Both the methodology, as well as, the roles and responsibilities for C-ITS are deduced from the reference model: Open Distributed Processing (ISO/IEC 10746).[1] Open Distributed Processing offers five viewpoints of which the enterprise viewpoint corresponds with the organizational architecture and the roles and responsibilities.

This Technical Specification separates C-ITS roles into 'external' and 'internal'. Those considered to be internal are all roles set up for the sole purpose of C-ITS and those considered to be external are all roles involved in C-ITS but not set up for the sole purpose of C-ITS.

This Technical Specification describes high-level architectural viewpoint on C-ITS. It can be used as a blueprint when implementing C-ITS and the corresponding organizational structures. The characteristics of C-ITS entail a huge number of data/information exchanges. Therefore, the implementation of the organizational architecture stringently needs to respect privacy and data protection, as defined in ISO/TR 12859 and in the national laws and regulations (where instantiated). Privacy and data protection affect all roles defined in this Technical Specification and due to these characteristics, all actors occupying roles in C-ITS need to respect the corresponding standards and regulations.

2 Normative references

The following referenced documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 10746:1996, *Information technology — Open Distributed Processing — Reference model*

ISO 14817:2002, *Transport information and control systems — Requirements for an ITS/TICS central Data Registry and ITS/TICS Data Dictionaries*

ISO/TS 17419, *Intelligent transport systems — Co-operative systems — Classification and management of ITS applications in a global context"*

ISO/TS 17931, *Intelligent transport systems — Extension of map database specifications for Local Dynamic Map for applications of Cooperative ITS*

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ISO/IEC 19501:2005, *Information technology — Open Distributed Processing — Unified Modeling Language (UML) Version 1.4.2*

ISO 21217:2013, *Intelligent transport systems — Communications access for land mobiles (CALM) — Architecture*

ETSI/TS 102-637:2011, *Intelligent Transport Systems (ITS); Vehicular Communications Basic Set of Applications*

3 Terms and definitions

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

3.1
action
something which happens

[SOURCE: ISO/IEC 10746-2, see Bibliography reference 2]

3.2
actor
user playing a coherent set of roles when interacting with the system within a particular use case

[SOURCE: ISO 24014-1:2007, see Bibliography reference 6]

3.3
application
mechanism of delivering some or all parts of an *ITS service* (3.23)

[SOURCE: ISO/TR 17465-1, see Bibliography reference 18]

3.4
behaviour
collection of *actions* (3.1) with a set of constraints on when they may occur

[SOURCE: ISO/IEC 10746-2, see Bibliography reference 2]

3.5
community
configuration of *objects* (3.13) formed to meet an objective

[SOURCE: ISO/IEC 10746-3, see Bibliography reference 3]

3.6
cooperative-ITS
C-ITS
DEPRECATED: cooperative systems
subset 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

Note 1 to entry: As an alternative to a “subset”, cooperative-ITS could be viewed as a “paradigm” in overall ITS.

[SOURCE: ISO/TR 17465-1, see Bibliography reference 18]

3.7
enterprise object
object (3.13) in *enterprise viewpoint* (3.10)

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3.8
external enterprise object
enterprise object (3.7) involved in C-ITS but not set up for the only purpose of C-ITS

[SOURCE: ISO/TS 17574:2009, see Bibliography reference 4]

3.9
internal enterprise object
complementary to *external enterprise object* (3.8)

3.10
enterprise viewpoint
a viewpoint on an ODP system and its environment that focuses on the purpose, scope and policies for that system

[SOURCE: ISO/IEC 10746-3, see Bibliography reference 3]

3.11
infrastructure
system of facilities, equipment and *ITS services* (3.23) that is needed for the operation of an organization

Note 1 to entry: Specifically in the case of C-ITS the most stationary part of C-ITS incorporating sensors, actuators, static *ITS Station(s)* (3.12).

[SOURCE: ISO 9000:2005, see Bibliography reference 7]

3.12
ITS station
entity in a communication network capable of communicating with other similar entities

Note 1 to entry: From an abstract point of view, the term "ITS station" refers to a set of functionalities. The term is often used to refer to an instantiation of these functionalities in a physical unit. Often the appropriate interpretation is obvious from the context. The proper name of physical instantiation of an ITS-S is ITS station unit (ITS-SU).

[SOURCE: ISO 21217:2010, see Bibliography reference 10]

3.13
object
model of an entity

Note 1 to entry: An object is characterized by its *behaviour* (3.4) and dually by its state. An object is distinct from any other object. An object is encapsulated, i.e. any change in its state can only occur as a result of an internal *action* (3.1) or as a result of an interaction with its environment.

[SOURCE: ISO/IEC 10746-2, see Bibliography reference 2]

3.14
process
process that describes a sequence of *actions* (3.1)

Note 1 to entry: A process can also be a set of interrelated or interacting activates which transform inputs into outputs.[8]

[SOURCE: ISO 9000:2005, see Bibliography reference 7]

3.15
process chain
sequence of processes (3.14) that wait in the background for an event

Note 1 to entry: Some of these *processes* (3.14) trigger a separate event that can start other *processes* (3.14) in turn

[SOURCE: SAP Help Portal, see Bibliography reference 9]

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3.16
sequential process
process (3.14) based on sequence of *actions* (3.1) executed

3.17
(data) lifecycle process
process (3.14) based on data element transformation

3.18
responsibility
being accountable or answerable, as for an entity, function, system, security service or obligation

EXAMPLE A responsibility might be a legally backed assignment of *actions* (3.1) to a *role* (3.20).

[SOURCE: ISO/TS 17574:2009, see Bibliography reference 4]

3.19
roadside unit
implementation of roadside *ITS Station* (3.12) combined with other roadside equipment

EXAMPLE Sensors, actuator.

3.20
role
identifies a *behaviour* (3.4) to be associated with one of the component objects

[SOURCE: ISO/IEC 10746-2, see Bibliography reference 2]

3.21
sub-role
subordinate *role* (3.20) consisting of a defined fragment of the superior *role* (3.20)

3.22
scenario
general description of activities between (possible) participating *actors* (3.2)

3.23
ITS service
functionality provided to users of intelligent transport systems designed to increase safety, sustainability, efficiency, and/or comfort

Note 1 to entry: This definition also appears in the latest version of ISO 21217.

3.24
ITS service in push mode
ITS service (3.23) operating on data delivered without request by an actor or its system

3.25
service in pull mode
ITS service (3.23) actively requesting the data that is required for the service operation

3.26
stakeholder
individual or organization having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations

[SOURCE: ISO/IEC 12207:2008, see Bibliography reference 5]

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4 Symbols (and abbreviated terms)

C-ITS	Cooperative ITS
GNSS	Global Navigation Satellite System
HMI	Human Machine Interface
ITS	Intelligent Transport Systems
LDM	Local Dynamic Map
PKI	Public Key Infrastructure
ODP	Open Distributed Processing

5 Introduction and theoretical framework

5.1 Transferring ODP to roles and responsibilities for C-ITS

Cooperative-ITS (C-ITS) features the characteristics of a distributed system with its partition onto multiple *ITS stations* (3.12). Hence methodologies for the description of distributed systems are consulted when describing the overall architecture of C-ITS and its different viewpoints. For the description of the organisational architecture as one of the viewpoints of C-ITS, the concept of Open Distributed Processing[1],[2],[3] is applied. The organisational architecture corresponds with the *enterprise viewpoint* (3.10) in ODP, defining the "purpose, scope and policies governing the activities of the specified system within the organization of which it is part". Conveyed to C-ITS, this Technical Specification is part of the organizational architecture for C-ITS and focuses on the description of C-ITS specific *roles* (3.20) and *responsibilities* (3.18).

Following the concept and terminology of ODP for the description of the *roles* (3.20) and *responsibilities* (3.18), C-ITS can be described as a *community* (3.5) composed of *external* and *internal enterprise objects* (3.8, 3.9) (see Figure 1) with the objective of providing C-ITS with its benefits regarding traffic safety, traffic efficiency, comfort and ecologic mobility to the user. *External enterprise objects* (3.8) are involved in C-ITS but are not set up for the sole purpose of C-ITS. Therefore this document limits itself to the identification of roles and responsibilities of *external enterprise objects* (3.8).

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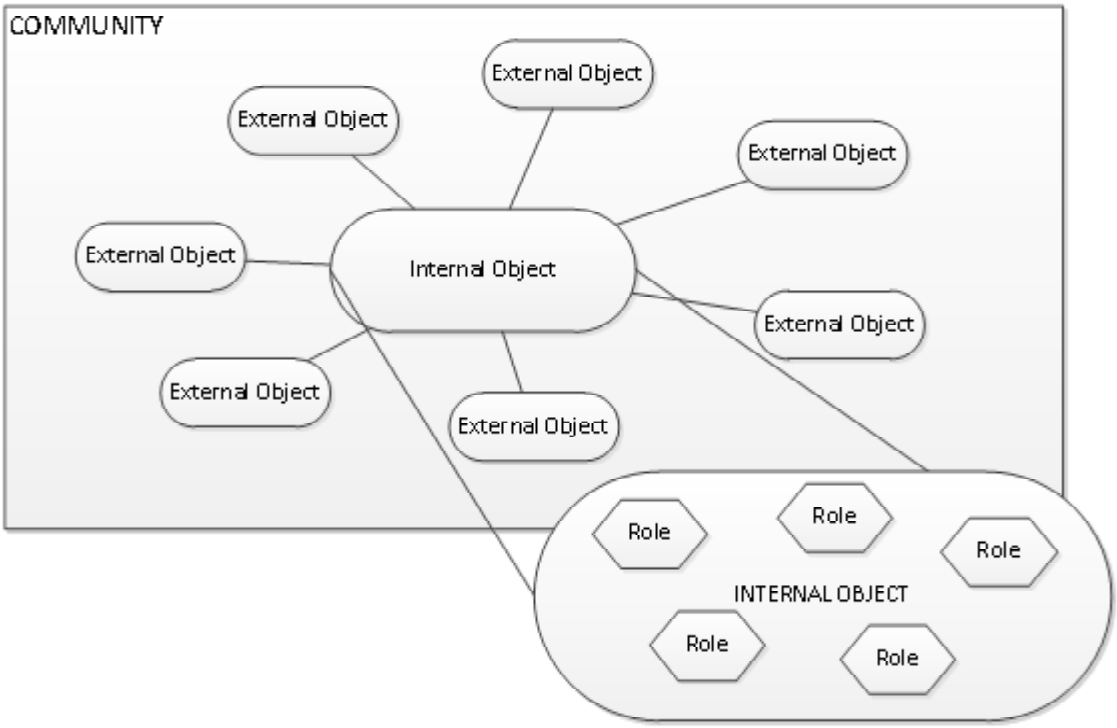

Figure 1 — Relationship between Community, Internal and External Enterprise Objects and Roles

5.2 External Enterprise Objects

C-ITS, as *internal enterprise object* (3.9), is connected with various *external enterprise objects* (3.8). The diagram (Figure 2) illustrates the *external enterprise objects* (3.8) and their interfaces to the *internal enterprise object* (3.9). Figure 2 shall illustrate the variety of parties (*external enterprise objects*) involved in C-ITS. The *external enterprise objects* (3.8) comprise examples from different levels.

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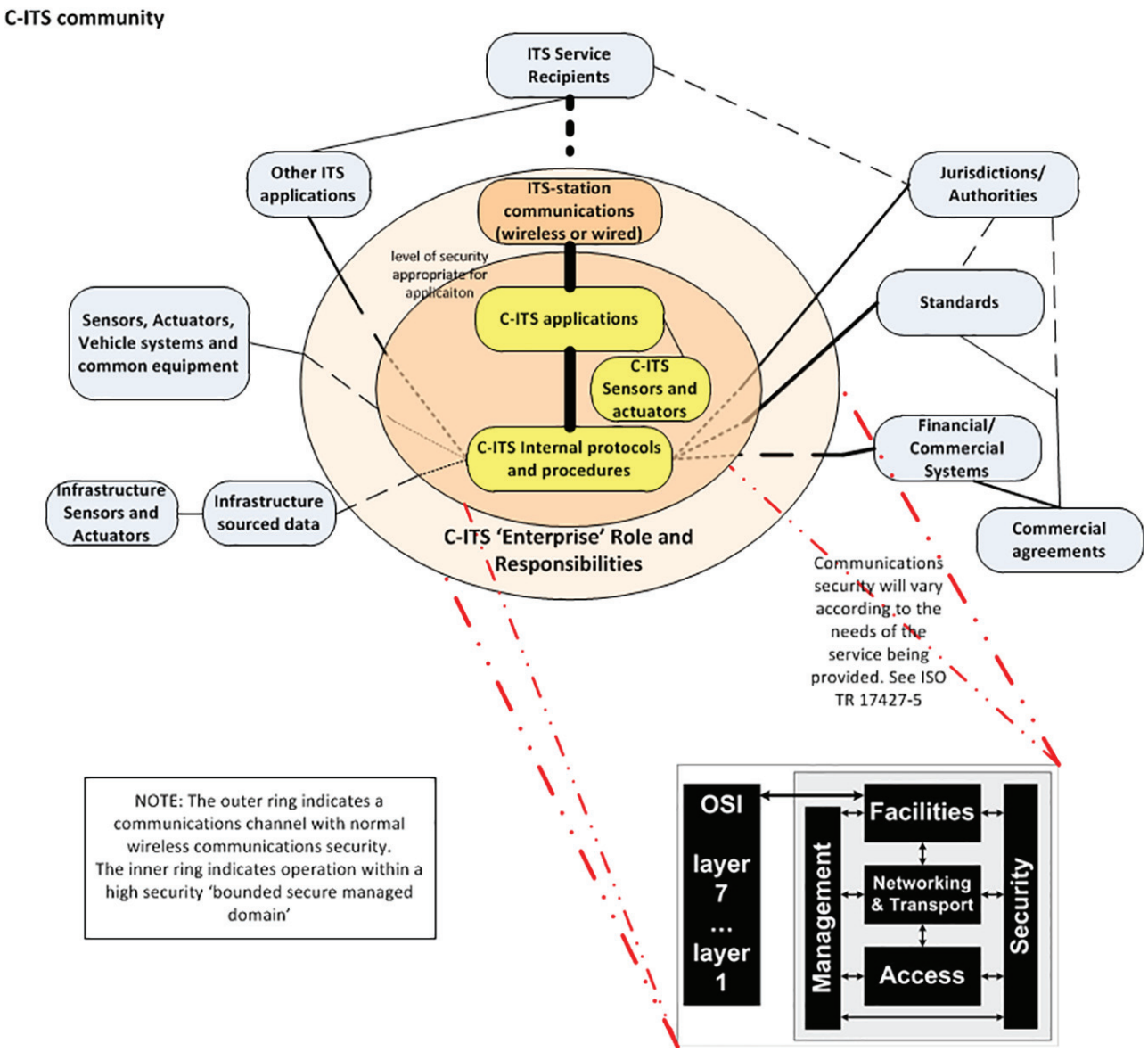

Figure 2 — External and Internal Enterprise Objects in a C-ITS Community

From the *enterprise objects* (3.5) displayed in Figure 2, the following are closely connected with C-ITS and rather have an external-internal status:

— Telecommunication systems;

— Certification;

— Standardization bodies;

— Authorities.

Criteria for the categorization of "external-internal" is that the *external enterprise objects* (3.8) are deeply involved in C-ITS and partially exhibit C-ITS specific *roles* (3.20). More details are given in Clause 6. The standard functionalities that *external enterprise objects* (3.8) provide are documented in the respective standards referenced in Clause 6.

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Additionally, as shown in Figure 2, C-ITS has interfaces with other ITS systems. These are not explicitly denominated in this Technical Specification.

5.2.1 Internal Enterprise Objects

C-ITS, as *internal enterprise object* (3.9), consists of a set of specific *roles* (3.20) that are identified and described in the subsequent Clauses. The methodology that describes how these roles and responsibilities originally were identified and verified can be found in Annex A.

6 Roles and responsibilities

6.1 Introduction

All *roles* (3.20) and the corresponding *responsibilities* (3.18) identified through use of the methodology described in Annex A are described in the following subclauses.

6.1.1 Generic description of organizational architecture

In the generic view of the organizational architecture four major *roles* (3.20) were identified (Figure 3):

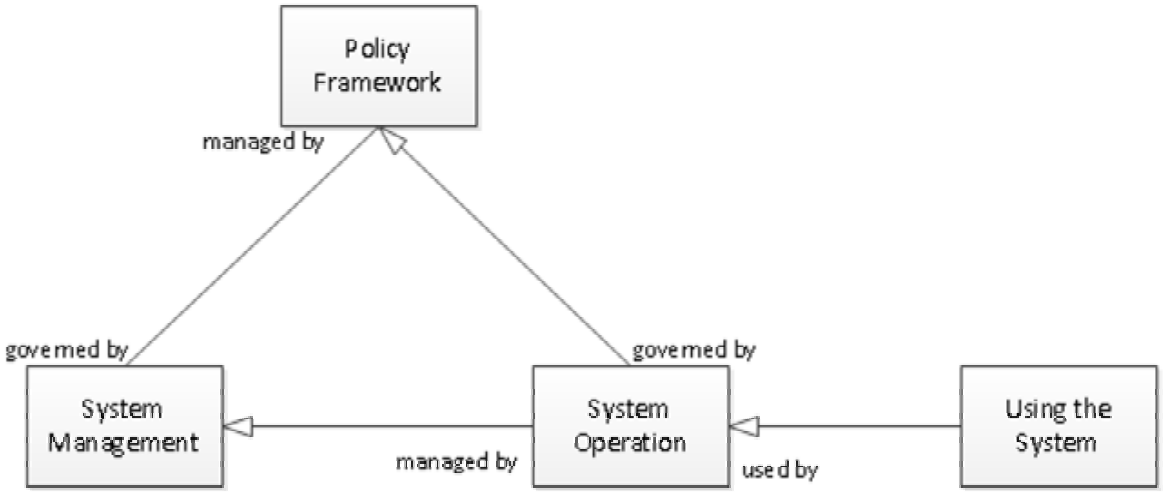

Figure 3 — Global description of Organisational Architecture

6.1.2 System operation

The *role* (3.20) "'System operation" is responsible for the proper execution of the *applications* (3.3) that provide an end-to-end *ITS service*(s) (3.23). This includes reliability for the coordination, organization and execution of the whole *process* (3.14) from initial data collection to the presentation of the final service result. One of the major interfaces of this *role* (3.20) is with the *actor*(s) (3.2) of the *role* (3.20) "Using the service" who receive(s) the service result.

Relationships with other *roles* (3.20):

The *role* (3.20) "System operation" is connected with the *role* (3.20) "System management". In this relationship, denominated with the term "managed by" in Figure 3, the *actor*(s) (3.2) with the *role* (3.20) "System management" provide supporting functionalities to the *actor*(s) (3.2) with the *role* (3.20) "System operation". This mainly includes functionalities enabling and facilitating the "System management" *behaviour* (3.4) and *responsibilities* (3.18).

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The *role* (3.20) "'System operation" is connected with the *role* (3.20) "Policy framework". In this relationship, denominated with the term "governed by" in Figure 3, the *actor*(s) (3.2) with the *role* "Policy framework" provide policies and regulations as well as their enforcement to the *actor*(s) (3.2) with the *role* (3.20) "System operation".

The *role* (3.20) "System operation" is connected with the *role* (3.20) "Using the system". In this relationship, denominated with the term "used by" in Figure 3, the *actor*(s) (3.2) with the *role* (3.20) "System operation" provide the achieved results to the *actor*(s) (3.20) with the *role* (3.20) "Using the system". The *role* (3.20) "Using the system" make(s) use of these results.

6.1.3 Using the system

The *role* (3.20) "Using the system" is responsible to perform an appropriate reaction to the service result received from the *actors* (3.20) with *role* (3.20) "System operation". The *role* (3.20) "Using the system" might stimulate the *role* (3.20) "System operation" (trigger an *ITS service* (3.23)).

6.1.4 System management

The *role* (3.20) "System management" is responsible to fulfil all required management activities within the system, this especially includes activities supporting "System operation". Additional *actions* (3.1) are the management of the "Policy framework" activities.

Relationship with other *roles* (3.20):

The *role* (3.20) "System management" is connected with the *role* (3.20) "Policy framework", in this relationship, denominated with the term "managed by" in Figure 3, the *actor(s)* (3.2) with *role* (3.20) "System management" provide supporting functionalities to the *actor(s)* (3.2) with the *role* (3.20) "Policy framework". This mainly includes functionalities enabling and facilitating the "Policy Framework" *behaviour* (3.4) and *responsibilities* (3.18). Additionally the *actor(s)* (3.2) with the *role* (3.20) "Policy framework" provide(s) policies and regulations as well as their enforcement to the *actor(s)* (3.2) with the *role* (3.20) "System management". This is denominated with the term "governed by" in Figure 3.

6.1.5 Policy framework

The *role* (3.20) "Policy framework' is responsible for all governing and institutional activities required in the system.

Relationship with other *Roles* (3.20):

See above ("System operation", "System management"). Relationships of role (3.20) "Policy Framework" with role (3.20) "System Operation" and role (3.20) "System Management" have already been given in subclauses 6.2.1 and 6.2.3.

The three main *roles* (3.20) "System operation", "System management" and "Policy framework" are detailed with *sub-roles*. Those are described in the following subclauses. The *role* (3.20) "Using the service" is not further detailed, a more detailed description of its *responsibilities* is appended.

6.2 General responsibilities of actors involved in C-ITS

6.2.1 Registration and authorization

Prior to the use of the system each *role* (3.20) and, therefore each *actor* (3.2), shall be responsible to participate in activities related to the request of access permission. This includes both registration and authorization:

— Registration – defined as registration to the system itself, necessary prior to the first use of the system (compare with sign-up):

  — issue request for registration to the system,

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