INTERNATIONAL STANDARD

ISO 14813-5

Second edition
2020-01

Intelligent transport systems — Reference model architecture(s) for the ITS sector —

Part 5: Requirements for architecture description in ITS standards

Systèmes intelligents de transport (ITS) — Architecture(s) de modèle de référence pour le secteur ITS —

Partie 5: Exigences pour la description d'architecture dans les normes ITS

Reference number
ISO 14813-5:2020(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Foreword

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

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

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

This second edition cancels and replaces the first edition (ISO 14813-5:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

— clarifies the scope of standards to which this document applies;

— clarifies and renames the types of architectures used within the ITS community and their relationships with each other;

— removes details related to planning and deployment architectures;

— clarifies requirements and provides examples of text that should be included within ITS interface standards.

A list of all parts in the ISO 14813 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

"Architecture" is implicit in any construction, be it of a physical entity (such as a building), an operational entity (such as a company or organisation), a system entity (such as a software system), or a business entity (such as a commercial business operation). While it may be stated that every entity has an architecture, that architecture may be an explicit construction as a result of a deliberate design process, or it may be the implicit result of an unplanned series of events, and sometimes the combination of both.

In the "system" domain, "architecture" can be defined as "fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution (ISO/IEC/IEEE 42010:2011, 3.2). In order for this definition to be successful there needs to be a standard way of describing the system concepts and properties.

Intelligent transport systems (ITS) are systems deployed in transportation environments to improve both the driving experience, and the safety and security of drivers, passengers and pedestrians. ITS can also assist in the labour, energy, environmental, and cost efficiency of transportation systems. It is a feature of most ITS that their architecture involves the collection, use and exchange of information/data within and between software systems which affect or control the behaviour of physical equipment in order to provide a service to the actors involved in, or interacting with, the transport sector.

ITS services are developing and changing rapidly and have to make provision not only for interaction with other services, but with migration from one technology generation to later iterations. In order to support this and to obtain compatibility and/or interoperability and to eliminate contention, the systems need to co-exist and operate within a known and supportive architectural framework. This document is designed to aid these objectives and to enable maximum interoperability, efficiency, and migration capability by defining an explicit process for describing ITS reference architectures for use within ITS International Standards using an explicit process.

The word “architecture” has been used in an informal manner to mean a variety of different concepts, and in formal architecture design there are differing methodologies and opinions as to their suitability for use in ITS itself and standards design. This has limited the effective communication in the ITS sector by causing uncertainty as to the meaning of the word “architecture” when it is used. A second function of this document is to provide consistent terminology to be used in describing architectural aspects of ITS standards and provide a consistent form for describing an ITS reference architecture in standards in the ITS sector.

This document does not give preference to any one methodology for architecture development and description, it assumes that the consideration of architecture is an explicit process that takes into account the interrelationships and interoperability of ITS and that an architecture description is provided within ITS standards. It also assumes that the architecture aspects of ITS standards are described explicitly in each and every ITS standard and that all standards are related to one or more ITS service(s) that they are designed to enable or support.

Intelligent transport systems — Reference model architecture(s) for the ITS sector —

Part 5: Requirements for architecture description in ITS standards

1 Scope

An intelligent transport system (ITS) reference architecture is a tool that describes how an ITS delivers one or more ITS services. It includes a high-level description of the major elements and the interconnections among them that are needed for the service(s) to be provided to stakeholders. It provides the framework around which the interfaces, specifications, and detailed ITS designs can be standardized within ITS standards.

By contrast, ITS standards are often focused on design details. While the development of these standards may be initiated by a single ITS user need, they are often (and properly) written in a generic format that allows for application in a broad array of contexts. However, this can present a challenge to the reader in understanding the original purpose of a standard and whether the standard is intended for other environments.

This document defines documentation rules for standards that define interfaces between or among system elements of an ITS reference architecture. This includes:

a) requirements for documenting aspects of the ITS reference architecture;

b) terminology to be used when documenting or referencing aspects of the ITS reference architecture.

In compiling this document, the authors have assumed that contemporary systems engineering practices are used. Such practices are not defined within this document.

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.

ISO/IEC 8824-1, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation — Part 1*

ISO/IEC 9834-1, *Information technology — Procedures for the operation of object identifier registration authorities: General procedures and top arcs of the international object identifier tree — Part 1*

ISO/IEC 11179-3, *Information technology — Metadata registries (MDR) — Part 3: Registry metamodel and basic attributes*

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

ISO/IEC/IEEE 42010:2011, *Systems and software engineering — Architecture description*

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
architecture
<system> fundamental concepts or properties of a system in its environment embodied in its *elements* (3.10), relationships, and in the principles of its design and evolution

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.2]

3.2
architecture description
AD
work product used to express an *architecture* (3.1)

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.3]

3.3
architecture model
work product representing one or more *architecture views* (3.4) and expressed in a format governed by a *model kind* (3.18)

3.4
architecture view
work product expressing the *architecture* (3.1) of a system from the perspective of specific system *concerns* (3.8)

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.5]

3.5
architecture viewpoint
work product establishing the conventions for the construction, interpretation and use of *architecture views* (3.4) to frame specific system *concerns* (3.8)

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.6]

3.6
communications view
architecture view (3.4) from the *communications viewpoint* (3.7)

3.7
communications viewpoint
architecture viewpoint (3.5) used to frame communication interface concerns, including all layers of the OSI stack and related management and security issues

3.8
concern
<system> interest in a system relevant to one or more of its *stakeholders* (3.25)

Note 1 to entry: A concern pertains to any influence on a system in its environment, including developmental, technological, business, operational, organizational, political, economic, legal, regulatory, ecological and social influences.

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.7]

3.9
deployment architecture
project architecture
low-level architecture
design-level architecture
architecture (3.1) that provides a vision of a specific deployment of a system within a geographic area

Note 1 to entry: Experts use a variety of terms to describe this concept; ISO/TC 204 prefers the term “deployment architecture”.

3.10
element
<system> component member of an *architecture* (3.1)

3.11
functional view
architecture view (3.4) from the *functional viewpoint* (3.12)

3.12
functional viewpoint
architecture viewpoint (3.5) used to frame the functionality concerns, including the definition of processes that perform transport functions and data flows shared between these processes

3.13
information exchange
information flow (3.14) from a *physical object* (3.19) acting as an information source and sent to another physical object acting as an information sink

3.14
information flow
information that is exchanged between *physical objects* (3.19)

3.15
intelligent transport system
ITS
technology system that is designed to benefit a surface transport system

3.16
interface
<system> boundary between two elements of a system or between two systems

3.17
ITS reference architecture
reference architecture (3.23) for one or more ITS *services* (3.24)

3.18
model kind
conventions for a type of modelling

Note 1 to entry: Examples of model kinds include data flow diagrams, class diagrams, Petri nets, balance sheets, organization charts and state transition models.

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.9]

3.19
physical object
element (3.10) within the *physical view* (3.20) of an *ITS reference architecture* (3.17) that represents a physical entity that interacts with other physical entities in the provision of ITS *services* (3.24)

3.20
physical view
architecture view (3.4) from the *physical viewpoint* (3.21)

3.21
physical viewpoint
architecture viewpoint (3.5) used to frame system engineering concerns

Note 1 to entry: System engineering concerns include the definitions of physical entities, the assignment of functionality to physical entities, the interfaces among these physical entities, and security and privacy concerns related to those entities and their interfaces.

3.22
planning architecture
regional architecture
high-level architecture
architecture (3.1) that provides a long-term vision of system *elements* (3.10) that may be deployed and managed by different projects and/or entities within a geographic area

Note 1 to entry: The term “regional architecture” is widely used within the US, but “regional” becomes rather ambiguous when applied to international standards. The term “high-level architecture” is also sometimes used, but the ISO/TC 204 preferred term is “planning architecture”.

3.23
reference architecture
template solution for an *architecture* (3.1) for a particular domain

Note 1 to entry: A reference architecture, as used to develop standards and generic rules, is not specific to any single location while planning and deployment architectures are typically specific to a location.

3.24
service
<ITS> performance of one or more tasks that fulfils an *ITS user need* (3.26) for an ITS user

3.25
stakeholder
<system> individual, team, organization, or classes thereof, having an interest in a system

[SOURCE: ISO/IEC/IEEE 42010:2011, 3.10]

3.26
user need
<ITS> need of an entity external to the *intelligent transport system* (3.15) for a surface transport system benefit that can be met with the use of a technology system

4 Symbols and abbreviated terms

ARC-IT	Architecture Reference for Cooperative and Intelligent Transportation
CEN	European Committee for Standardization
CIDCR	Central ITS Data Concept Registry
CVRIA	Connected Vehicle Reference Implementation Architecture
FRAME	European ITS Framework Architecture
HARTS	Harmonised Architecture Reference for Technical Standards
ITS	Intelligent Transport System

5 Conformance

There are no specific conformance tests specified within or associated with this document.

Developers of International Standards are, however, required to describe the reference architecture of the system to which their deliverable relates or to reference other International Standards or publicly available documents that provide such a description.

NOTE While this document is intended to define requirements for documenting reference architectures within standards, much of the content can also assist implementers of ITS in their documentation of planning architectures and deployment architectures.

6 Background and general information

6.1 General

Architectures have been used as a part of the ITS implementation process for over 20 years. They provide stakeholders with a clear understanding of how ITS services are to be delivered so that informed decisions can be made as early as possible in the ITS implementation process. While the content, format, viewpoints, and other details of architectures have evolved over time to better meet industry needs; this section provides an overview of the current best practices.

6.2 Levels of abstraction

Within the ITS industry, architectures are often presented in three distinct levels of abstraction as depicted in Figure 1.

Reference architectures reflect the requirements set forth by the industry-wide stakeholder community. These architectures provide a relatively generic template that characterizes how ITS elements typically interact with one another to provide services that are widely deployed. At this level of abstraction, system elements are entirely conceptual – they describe types of elements that might be deployed. Because a reference architecture represents typical deployments, it is useful for identifying interfaces between system elements that can be standardized.

Planning architectures are intended to address stakeholder concerns in developing a long-term vision (e.g. 5 to 20 years) of ITS deployments within a geographic area at a level that facilitates project planning. At this level of abstraction, the architecture identifies the specific system elements to be deployed and identifies which elements and ITS services are existing, if any, and which are merely planned. Ideally, the planning architecture should be used as the primary source for the deployment plans (e.g. timeframe) for each planned system element. Planning architectures should generally be derived from a reference architecture in order to benefit from the previous work and standardization, but the derivation process will typically omit some ITS services that are not envisioned for the region while perhaps also adding new ITS services that are specific to the region.

Deployment architectures are intended to address local stakeholder concerns related to a specific deployment project. At this level of abstraction, the architecture must identify the system elements that will be separately procured and identify how these system elements will interface with one another (ideally using some set of the standards created in response to the associated reference architecture). Deployment architectures should generally be derived from a planning architecture to provide consistency with the long-term vision but will generally only depict the subset of the planning architecture that is to be deployed as a part of the project.

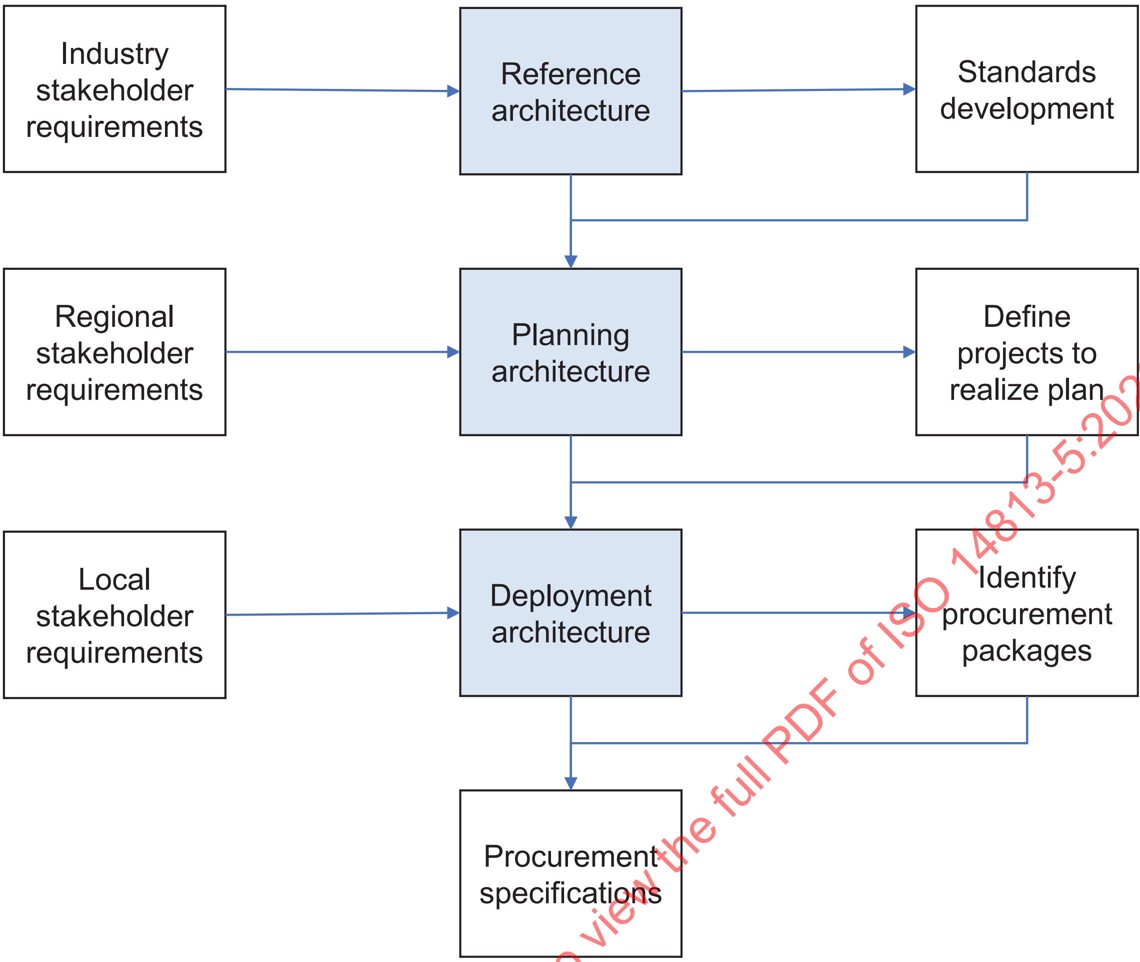

Figure 1 — Architecture levels of abstraction

Deployment architectures are used as the basis for developing procurement specifications for each of the separately procured system elements.

6.3 Viewpoints

Modern architecture descriptions should adhere to the principles in ISO/IEC/IEEE 42010, which recommends defining an architecture through the use of multiple architecture views, where each view is governed by an architecture viewpoint that defines a set of rules for framing a group of stakeholder concerns through the use of one or more architecture models. The complete architecture is defined by the sum of all views adhering to these viewpoints.

Since ITS reference architectures have gradually evolved since the early 1990s, there are a variety of modelling techniques employed in relevant architectures. Annex B provides a recommended set of modelling conventions for the three viewpoints defined in this document.

NOTE Since this document is focused on architecture descriptions within ITS standards and ITS standards should be based on ITS reference architectures, this document is only concerned with the viewpoints and modelling conventions related to ITS reference architectures. Planning and deployment architectures can include additional viewpoints, which are beyond the scope of this document.

7 Requirements

7.1 Architecture description

All ITS-related International Standards shall include a section that provides a description of the part(s) of an ITS reference architecture where the content of the standard is to be used.

The entirety of the architecture description may be embedded within the standard or referenced in an external publicly available source, such as a website. The architecture description may be contained in the body of the standard or in an informative annex. In most cases, the architecture description should be presented as informative information and not preclude the use of the standard for other purposes.

The architecture description shall include information detailing the vision and mission to be achieved by applying the standard, together with a description of the architectural aspects of the standard; the information shall include all of the components identified in 7.2. Such information may appear in either the Scope or Requirements sections and in whatever format considered appropriate by the authors.

7.2 Architecture description elements

7.2.1 Architecture scope

The architecture description shall indicate the scope of ITS services considered by the reference architecture; the complete reference architecture may be embedded in the standard or may be an informative reference to an external source.

EXAMPLE A standard can choose to reference the Harmonized Architecture Reference for Technical Standards (HARTS) by referring to the HARTS website at http://htg7.org.

7.2.2 Services

The clause(s) that describe the services to which the ITS International Standard relates shall provide an overall description of what the ITS implementation will deliver incorporating operational concepts and user requirements, together with its known inter-relationships with other systems, some of which may be outside the ITS domain.

NOTE The relevant ITS service domains, service groups and services from ISO 14813-1 can be used as a starting point for the definition of these services in the absence of any other defined services.

7.2.3 Functional view of interface

The architecture description shall describe the functional view of the interface(s) that the standard is intended to address. Standards that only define lower layers of the communications stack will typically address functionality not directly defined in the referenced architecture, but the standard can still describe what this functionality is and how it relates to the broader design. Standards that address ITS services should identify the specific functionality from the reference architecture that the standard claims to address.

A clause shall describe the nature of the system based on the required input data, control and processing functions and data or information to be output. The interrelations between these aspects shall also be described. Both descriptions shall be independent of any reference to particular hardware or software technologies.

Where possible, data descriptions shall refer to the data concepts already included in the Central ITS Data Concept Repository (CIDCR) being provided for use by ISO TC 204 and CEN TC 278. If a reference is not possible, then a new data concept shall be created and submitted for inclusion in the CIDCR.

7.2.4 Physical view of interface

Following the explanation of the functionality, this description shall allocate it, in generic terms, to physical entities that are easily traced to physical objects within the referenced ITS reference architecture (e.g. HARTS). These references should be as expansive as possible given the context of the standard, i.e. if the standard is targeted only for use in the context of a particular service or class of system, then that system shall be referenced, but if the standard is not so narrowly targeted, then the standard shall reference classes of physical objects to which the standard may apply, e.g. Centre-to-Field.

Although the configuration(s) of the physical entities shall be described in system terms, they shall not be specific to any particular location.

The architecture description shall describe the physical view of the interface(s) that the standard is intended to address. Depending on the exact nature of the standard, the interface may relate to a specific interface, such as an information exchange, depicted in the architecture or may relate to a more abstract interface that is realized by multiple information triples. The interface description may be accompanied by a figure, if deemed appropriate. When included, it is recommended that figures use the modelling conventions defined in Annex B.

7.2.5 Communications view of interface

7.2.5.1 Overview

This shall provide a high-level description of the communications requirements necessary for whatever information exchanges are defined in the standard. This should not include any specification of particular protocols unless there is a clear dependency, though informative content describing expectations is reasonable. In most cases, this section should reference other standards, and like the physical view, it should be as expansive as possible.

The architecture description shall describe the communications view of the interface(s) that the standard is intended to address. Typically, the communications view should depict the complete ITS-S reference architecture and indicate where the subject standard resides within this model while also indicating the other standards that might typically be deployed with it. The text accompanying the figure shall explain the relationships with other standards.

7.2.5.2 Security and data protection

The architecture description shall explain how security and data protection will be provided for the interface and physical objects. This will often be achieved by providing a confidentiality, integrity, and availability (CIA) analysis within the standard, which will generate the security and privacy requirements for the interface.

7.3 Usage of terms

In order to avoid confusion, an architecture description in an ITS deliverable shall not define new definitions for any terms already defined within the following standards:

a) ISO/IEC 8824-1;

b) ISO/IEC 9834-1;

c) ISO/IEC 11179-3;

d) ISO/IEC 19501;

e) ISO/IEC/IEEE 42010.

NOTE At the time that this document was prepared, ISO/TS 14812 was under development. The development of any new terms should be coordinated with the ISO/TS 14812 development efforts.

Annex A
(informative)

Example usage

A.1 Overview

While 7.2 affords the standards document author freedom to structure the document according to the particular needs relevant to that standard, some examples may be useful to users. This annex includes examples that might serve for standards that are chiefly structured as a data dictionary, an application interface specification, and an underlying interface specification.

A.2 Data dictionary example

The first example is for a standard that defines a data for use by various protocols. An example scope (Section 1) for such a standard is provided in Figure A.1 while its supporting information is provided in Figure A.2.

Example Scope from Data Dictionary Standard

1 Scope

This standard's scope is limited to defining data for management and control of roadside, electronic message signs. Message signs are field devices that can be managed through a defined interface. The manager of the message sign might be a central system, another field device, a maintenance laptop, or any other device that supports the defined interface.

The message sign must have a connection to the manager and may have any number of connections to other ITS-S or external systems.

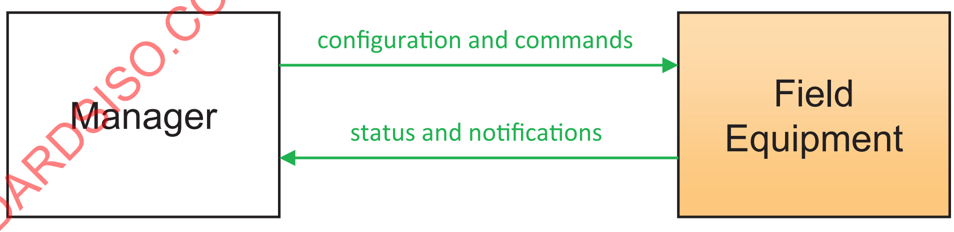

Figure X: Physical view of interface

Figure A.1 — Example scope for a data dictionary standard

Example of Annex A from Figure A-1
(informative)
Architecture Description

A.1 Architecture reference

This standard addresses technical details identified within the Harmonised Architecture Reference for Technical Standards (HARTS). The scope of this architecture is described at http://htg7.org/html/analysis/servicepackages.html.

A.2 Functional view of interface

This standard is concerned with defining the data concepts used to manage a message signs; the scope of this standard does not define the logic used to manage the message sign or the protocols used to exchange the defined data elements; however, the data concepts defined in this standard have been defined with the assumption that they would be exchanged using an SNMP-like interface.

A.3 Physical view of interface

This standard addresses interfaces between a “message sign” and the physical objects that might manage it, typically “centres” and other “field equipment” objects. Specific information flows considered within the scope of this standard include:

- Roadway dynamic signage data: Information used to initialize, configure, and control dynamic message signs. This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these devices.
- Roadway dynamic signage status: Current operating status of dynamic message signs.

A.4 Communications view of interface

A.4.1 Overview

This standard addresses the data within the application entity of the ITS-S architecture reference model as depicted in Figure Y.

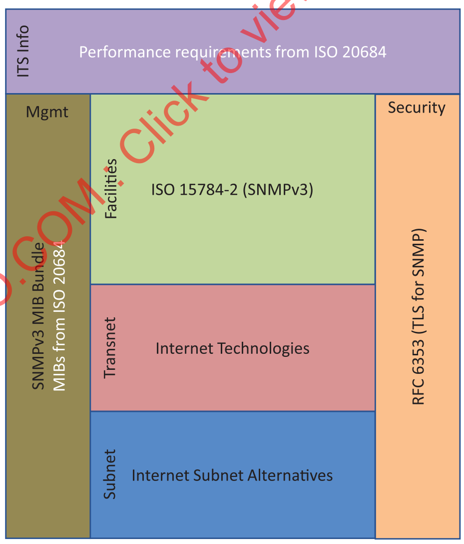

Figure Y: Communications view of interface

A.5 Security and data protection

Authentication and authorization are dependent on Datagram Transport Layer Security (DTLS)/Transport Layer Security (TLS) coupled with either X.509 or IEEE 1609.2 certificates. Encryption can be provided as needed using any encryption method with a registered OBJECT IDENTIFIER.

Figure A.2 — Example architecture description for a data dictionary standard

A.3 ITS application specification example

The second example is for a standard that defines an ITS application specification. An example scope (Section 1) for such a standard is provided in Figure A.3 while its supporting information is provided in Figure A.4.

Example Scope from ITS application specification standard

1 Scope

This standard's scope is limited to defining the minimal set of functional, performance, and related requirements for an electronic, roadside message sign to provide an interoperable interface with a remote manager. The manager of the message sign might be a central system, another field device, a maintenance laptop, or any other device that supports the defined interface.

The message sign must have a connection to the manager and may have any number of connections to other ITS-S or external systems.

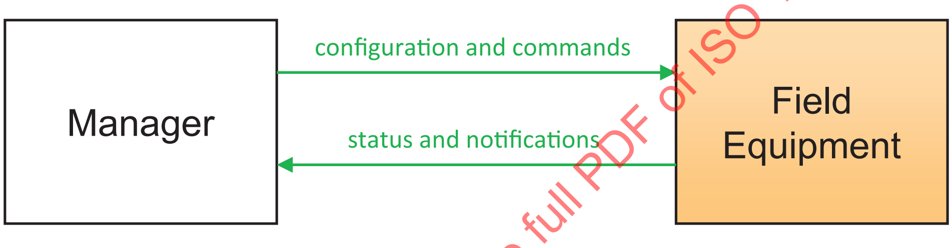

Figure X: Physical view of interface

Figure A.3 — Example scope for an ITS application specification standard

Example of Annex A from Figure A-3
(informative)
Architecture Description

A.1 Architecture reference

This standard addresses technical details identified within the Harmonised Architecture Reference for Technical Standards (HARTS). The scope of this architecture is described at http://htg7.org/html/analysis/servicepackages.html.

A.2 Functional view of interface

This standard is concerned with defining the functional, performance, and related requirements for a message sign; the scope of this standard does not define the logic used by the manager to decide timing or content of the messages to display or the protocols used to exchange the defined data elements. Specific HARTS processes included within the scope of this standard include:

- Roadway traffic information dissemination

A.3 Physical view of interface

This standard addresses interfaces between a "message sign" and the physical objects that might manage it, typically "centres" and other "field equipment" objects. Specific information flows considered within the scope of this standard include:

- Roadway dynamic signage data: Information used to initialize, configure, and control dynamic message signs. This flow can provide message content and delivery attributes, local message store maintenance requests, control mode commands, status queries, and all other commands and associated parameters that support remote management of these devices.
- Roadway dynamic signage status: Current operating status of dynamic message signs.

A.4 Communications view of interface

A.4.1 Overview

This standard addresses the implied functionality and performance characteristics of the application entity of the ITS-S architecture reference model as depicted in Figure Y.

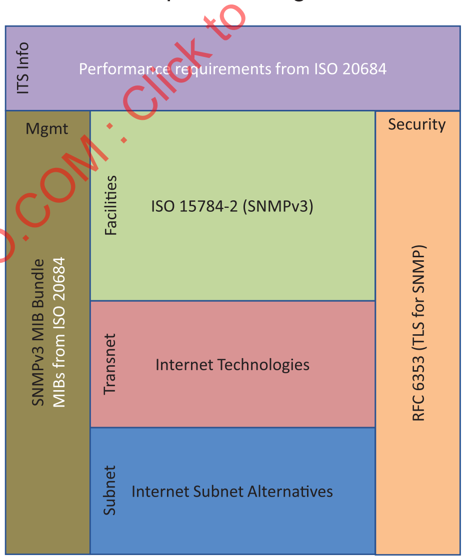

Figure Y: Communications view of interface

A.5 Security and data protection

Authentication and authorization are dependent on Datagram Transport Layer Security (DTLS)/Transport Layer Security (TLS) coupled with either X.509 or IEEE 1609.2 certificates. Encryption can be provided as needed using any encryption method with a registered OBJECT IDENTIFIER.

Figure A.4 — Example architecture description for a data dictionary standard

A.4 Underlying interface specification example

The final example is for a standard that defines a facilities layer protocol. An example scope (Section 1) for such a standard is provided in Figure A.5 while a supporting annex (Annex A) is provided in Figure A.6.

Example Scope from Facilities Layer Standard

1 Scope

This standard's scope is limited to the interface between a manager and field equipment. The manager may be of any type but is typically either a centre or field equipment physical object. The field equipment must have a connection to the manager and may have any number of connections to other ITS-S or external systems.

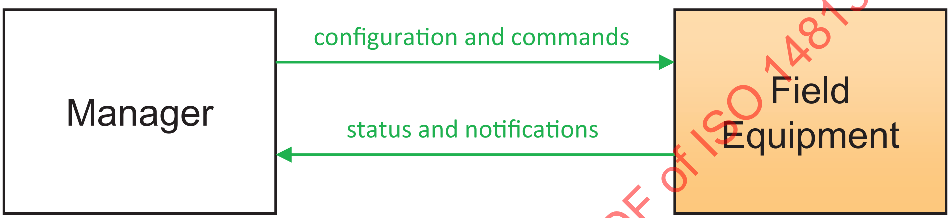

Figure X: Physical view of interface

Figure A.5 — Example scope for a Facilities Layer standard

Example of Annex A from Figure A-5
(informative)
Architecture Description

A.1 Architecture reference

This standard addresses technical details identified within the Harmonised Architecture Reference for Technical Standards (HARTS). The scope of this architecture is described at http://htg7.org/html/analysis/servicepackages.html.

A.2 Functional view of interface

This standard is concerned with the session, presentation, and application layers of the OSI reference model; the scope of this standard defines the operation of these layers as well as data used to manage the operation of these layers but does not include the core functionality of the field equipment. This standard addresses how field equipment accepts and responds to messages. This standard defines two mechanisms by which the management station interacts with the field equipment: setting content (settings, configuration, etc.), and getting content (data, configuration, etc.).

A.3 Physical view of interface

This standard addresses interfaces between “field equipment” and the physical objects that manage them, typically “centres” and other “field equipment” objects.

A.4 Communications view of interface

A.4.1 Overview

This standard addresses the Facilities Layer of the ITS-S architecture reference model as depicted in Figure Y.

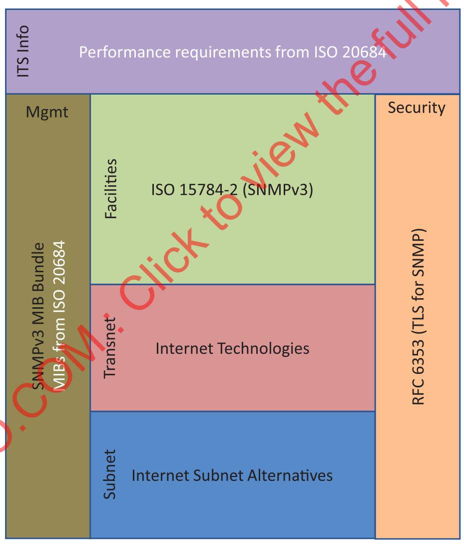

Figure Y: Communications view of interface

A.5 Security and data protection

Authentication and authorization are dependent on Datagram Transport Layer Security (DTLS)/Transport Layer Security (TLS) coupled with either X.509 or IEEE 1609.2 certificates. Encryption can be provided as needed using any encryption method with a registered OBJECT IDENTIFIER. Authentication is supplemented within the application according to RFC 6353.

Figure A.6 — Example architecture description for a Facilities Layer standard

Annex B
(informative)

Recommended architectural model conventions

B.1 Functional viewpoint

The functional viewpoint addresses the analysis of abstract functional elements and their logical interactions rather than engineering concerns of how functions are implemented, where they are allocated, how they transfer information, which protocols are used, and what method is used to implement them.

The functional viewpoint focuses on the behaviour, structure, and interaction of the functions performed within the C-ITS environment.

The behaviour of a function (i.e. process) is the set of actions performed by this element to achieve an objective. A process performs actions to achieve an application objective or to support actions of another process. This may involve data collection, data transformation, data generation or processing in performing those actions. Functional views define processes to control and manage system behaviour, such as monitoring, and other active control elements that are part of describing the functional behaviour of the system. They also describe data processing functions, data stores and the logical flows of information among these elements.

This functional viewpoint is based on the work of Hatley/Pirbhai and is consistent with the content in HARTS, the Connected Vehicle Reference Implementation Architecture (CVRIA), the Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT, aka the US National ITS Architecture), European ITS Framework Architecture (FRAME), and other major ITS reference architectures.

Figure B.1 provides a sample functional view diagram from FRAME.

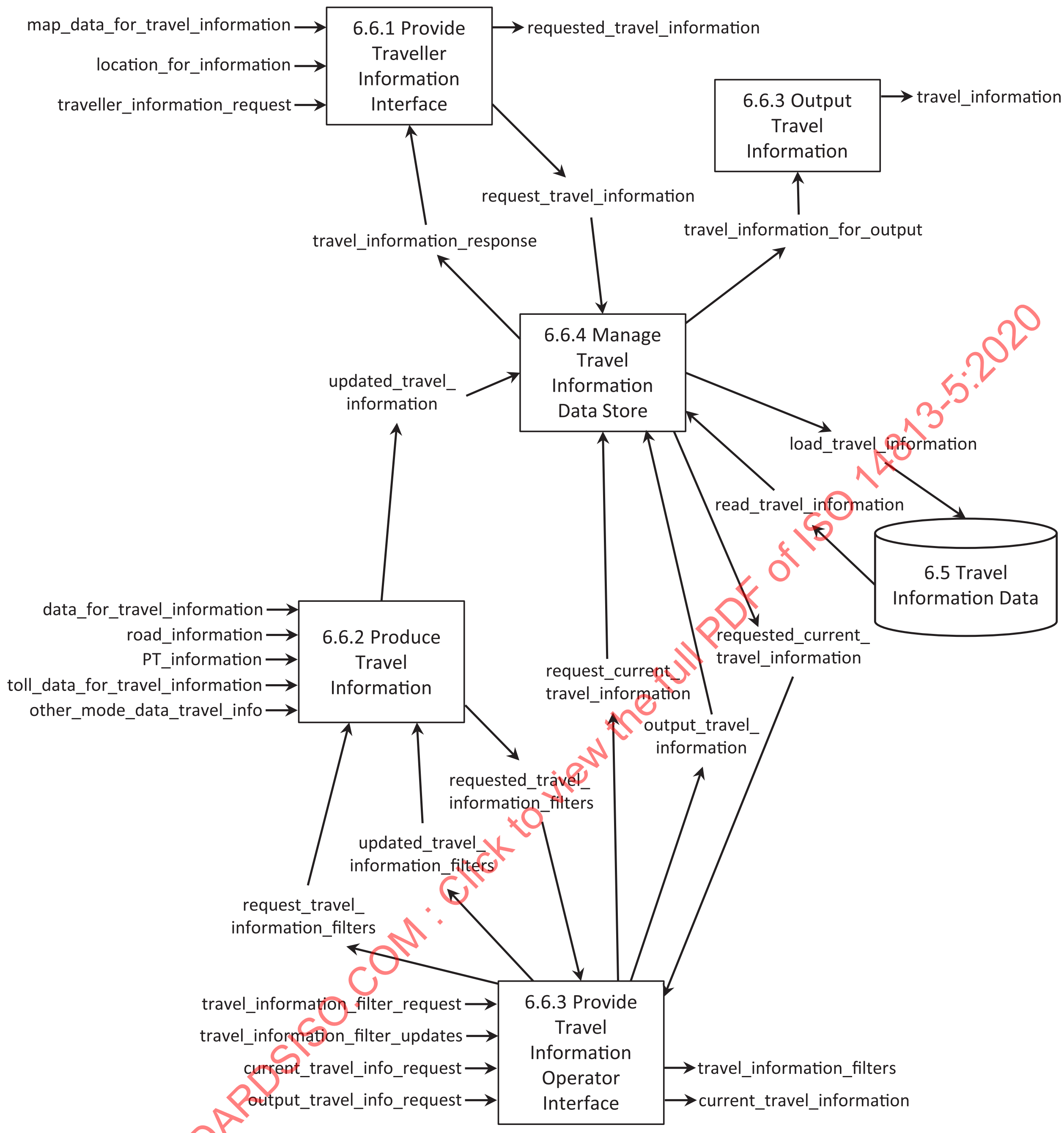

Figure B.1 — Example functional view diagram from FRAME

B.2 Physical viewpoint

The physical viewpoint represents physical elements that operate in the mobile environment, the field, and the back office, where connections between elements and interactions with the external environment are considered. The physical viewpoint deals with the composition of these physical objects (including application servers, data stores, network components, mobile and non-mobile transportation elements, and wired and wireless links), their physical connections and interactions, and the allocation of functionality to those elements.

Each physical view diagram includes physical objects that participate in providing and accomplishing a set of one or more ITS services. Figure B.2 provides a sample physical view diagram for Transit Signal Priority.