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Transport Information and control systems — Data interfaces between centres for transport information and control systems —

Part 1: Message definition requirements

Systèmes de commande et d'information des transports — Interfaces de données entre les centres pour systèmes de commande et d'information des transports —

Partie 1: Exigences relatives à la définition du message

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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ISO 14827-1 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems,* Working group 9, with the collaboration of:

— European Road Transport Telematics Implementation Co-ordination Organisation (ERTICO);

— Comite Europeen de Normalisation (CEN);

— American Association of State Highway and Transportation Officials (AASHTO);

— Institute of Transportation Engineers (ITE); and

— National Electrical Manufacturers' Association (NEMA).

ISO 14827 consists of the following parts, under the general title *Transport information and control systems — Data interfaces between centres for transport information and control systems*:

— *Part 1: Message definition requirements*

— *Part 2: DATEX-ASN*

Introduction

In the 1980s and 1990s, transport networks became increasingly congested and computer technologies were deployed to more efficiently manage the limited transport network. As these systems were deployed, it became increasingly important to integrate nearby systems to properly provide the required services.

One of the first efforts to standardize the interface between transport control centres was a European Union effort led by the DATEX Task Force. In May 1993, this group was established as a horizontal activity to coordinate the diverging developments which were ongoing within the framework of the Advanced Transport Telematics (ATT) Programme. Within the ATT Programme, three different data exchange systems were developed, namely INTERCHANGE, EURO-TRIANGLE and STRADA. The group produced a set of basic tools to meet existing needs, including a common Data Dictionary, a common set of EDIFACT messages and a common Geographical Location Referencing system.

The initial solution provided a common interface which satisfied the basic requirements of existing systems and was named the Data Exchange Network (DATEX-Net) Specifications for Interoperability. During the initial efforts to deploy this standard, there was a growing sense that the message structure should be better organized and should be defined using Abstract Syntax Notation One (ASN.1) rather than EDIFACT.

ASN.1 presents a standard notation for the definition of data types and values. A data type is a class of information (for example, numeric, textual, still image or video information). A data value is an instance of such a class. ASN.1 defines several basic types and their corresponding values, and rules for combining them into more complex types and values. These types and values can then be encoded into a byte stream according to any of several standardized encoding rules.

Efforts to standardize communications between transport control centres were also underway in other parts of the world. In 1997, all of these efforts began to merge, with the United States developing the initial draft of the ASN.1 structures for the Data Exchange in Abstract Syntax Notation (DATEX-ASN). These structures, called data packets, were then placed within a procedural context and submitted to the ISO standardization process.

A portion of the submittal dealt with the specification of messages. As this portion of the document could apply to various protocols, it was placed in ISO 14827-1. The remainder of the original submittal formed the basis of the Application Layer protocol and was placed in ISO 14827-2. Thus, Part 2 defines only one way to implement the messages that are specified in the format defined by Part 1.

Due to the flexibility required by the rapidly developing Transport Information and Control Systems environment, the resulting International Standard uses a very generic structure. Thus, although initially intended to be an International Standard for TICS, it is flexible enough to be used for virtually any data exchange.

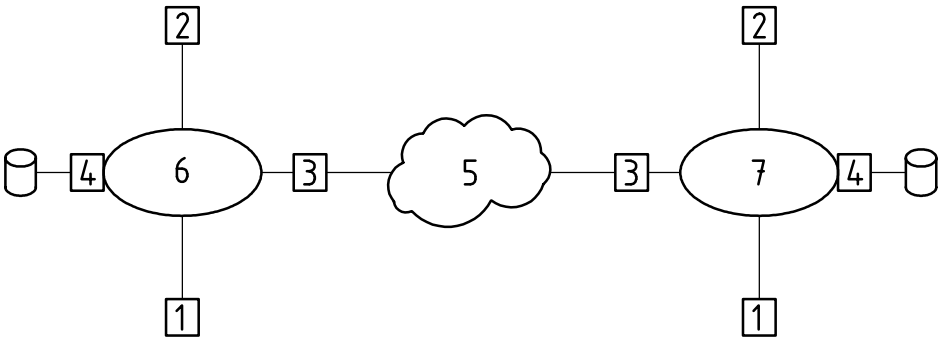
Transport Information and control systems — Data interfaces between centres for transport information and control systems —

Part 1:
Message definition requirements

1 Scope

This part of ISO 14827 defines the format that should be used to document those end-application messages that are to be exchanged between and among central systems. The format is protocol-independent to the extent practical. For example, this one format can be used to define data exchanges that may apply to DATEX-ASN, CORBA, or other application protocols.

In general, each system can be viewed as consisting of the interfaces as shown in Figure 1:



Key

1 application interface
2 operator interface
3 communication interface
4 database interface
5 communications cloud
6 client system
7 server system

NOTE The communications cloud between the systems may be complex or simple.

Figure 1 — System interface

This part of ISO 14827 deals only with the communication interface and is at a very high level. Other parts define how end-application messages can be exchanged using various application layer protocols.

While this part of ISO 14827 has been designed to meet the unique requirements of a TICS environment, it has been designed in a generic fashion and thus could be used for other data exchanges as well.

2 Normative references

The following referenced documents are indispensable for the application 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 7498-4, *Information processing systems — Open Systems Interconnection — Basic Reference Model — Part 4: Management framework*

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

ISO/IEC 8824-2, *Information technology — Abstract Syntax Notation One (ASN.1) — Information object specification*

ISO/IEC 8825-1, *Information technology — ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 8825-2, *Information Technology — ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)*

ISO 9735, *Electronic data interchange for administration, commerce and transport (EDIFACT) — Application level syntax rules*

3 Terms and definitions

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

3.1
application layer
top layer of the OSI seven-layer model as defined in ISO/IEC 7498-4

NOTE This layer defines the structure and format of the data packet content along with the rules and procedures for exchanging data packets.

3.2
center
any computer or network that is required to meet a standardized communications interface over a fixed-point communications network, regardless of whether the “center” is the only system within the building or just one of many, or even if the “center” is located in the field

NOTE This part of ISO 14827 only deals with communications that are between “centers”.

3.3
client
computer or application which requests and accepts data from a server computer or application using some kind of protocol

3.4
command
data packet which is prepared by one system in order to control some function(s) of another system

NOTE Commands may be conveyed as a subscription (request) or publication (reply) depending on the design of the specific data exchange.

3.5
data packet
entity of data that can be sent between end-application systems in order to exchange information

NOTE A data packet relates to the Application Layer of the OSI stack and may be broken into several pieces by lower layer protocols.

3.6
end application message
message
data structure that has been associated with a specific meaning and which, when properly sent in a data packet, an instance of the structure can convey information between systems

NOTE A data structure might, for example, be specified to include a list of speeds from detector stations. This one data structure could be used to specify the content of several messages (e.g. the list of current speeds being detected, the list of stored speeds that will trigger a congestion warning if current values fall below the indicated level, or a request for a list of locations where the current speed is less than the indicated speed). An instance of the message would then contain actual values.

3.7
message instance
specific instance of an end application message

3.8
message specification
documentation defining the meaning of a message, the result of applying this part of ISO 14827 to a specific message

3.9
profile
International Standard that defines rules by only combining requirements of other International Standard

EXAMPLE An application profile is a profile that specifies the application, presentation, and session layers by referencing a group of other International Standards.

3.10
protocol
set of formal rules describing how to transmit data, especially across a network

3.11
publication
reply
data which have been prepared by a server, usually in response to a subscription

NOTE In some cases, a publication may be termed a “reply” or a “response”.

3.12
server
computer or application which receives and responds to requests for data from client computers or applications using some kind of protocol

3.13
subscription
request
data packet which is prepared by a client in order to request current or future publication(s)

NOTE In some cases, a subscription may be termed a “request”.

4 Symbols and abbreviated terms

ASN.1 Abstract Syntax Notation 1 (ISO/IEC 8824-1 and ISO/IEC 8824-2)

BER Basic Encoding Rules (ISO/IEC 8825-1)

CORBA Common Object Request Broker Architecture

DATEX-ASN	Data Exchange in Abstract Syntax Notation
EDIFACT	Electronic Data Interchange for Administration, Commerce and Transport (ISO 9735)
OID	Object Identifier
OSI	Open Systems Interconnect
PER	Packed Encoding Rules (ISO/IEC 8825-2)
TICS	Transport Information and Control Systems

5 Requirements

This part of ISO 14827 provides a standardized format that can be used to define end application messages for multiple application protocols; each application protocol has its own unique set of services. In order to provide a practical definition of messages, a number of assumptions were made about the services provided by the lower layers of the protocol stack and overall design concepts. These assumptions are documented in this clause.

NOTE Nothing in this part of ISO 14827 removes the agency responsibility to ensure that the message does not contravene any legal obligation placed upon them by the laws of the respective countries.

5.1 Two-way data exchange

This part of ISO 14827 assumes that the protocol provides for request-reply style of communications where the reply may be in a different format than the request. Further, it recognizes that some protocols allow for a series of replies to a single request; thus, it has been designed to allow for this operation as well. It assumes that requests are unsolicited and replies are almost always solicited. It assumes that there is only one type of initial reply that can be received for a given request, and only one type of subsequent reply for requests allowing multiple replies.

If a system wishes to send an unsolicited notice for which no reply is needed (other than guaranteed delivery), it should be specified as a publication.

5.2 High-level definition

This part of ISO 14827 only provides a high-level definition of messages. Different protocols will implement this exchange in different ways. Rules for implementing these messages in a given protocol shall either be defined in the protocol documentation or in an application profile. An end application profile may also be required in order to identify unambiguously specific rules for a specific message.

For example, a reply that can occur multiple times would probably be mapped to a publication data packet in DATEX-ASN, while it would likely be mapped to a method call in CORBA.

5.3 Definitions define expected functionality

Within the context of this part of ISO 14827, a message implies a level of functionality within a system. The precise functionality required by a specific message shall be documented in the definition attribute.

For example, if system A requests a trip itinerary from point X to point Z, system B should respond with the requested data (or appropriate error value). Thus, one of the functional requirements imposed on system B is that it must respond with the requested data (presumably a listing of alternative routes). Other requirements may also be imposed (e.g. whether the alternatives consider any mode of travel). This part of ISO 14827 defines such functionality by associating a publication with each request; specific messages should indicate additional semantics (e.g. valid modes of travel) as appropriate.

5.4 Timing and other issues

This part of ISO 14827 does not explicitly address timing issues; however, implementers should be aware that many messages require certain performance levels that some protocols may not be able to meet.

5.5 Additional attributes

This part of ISO 14827 defines those attributes that are required to ensure an unambiguous data exchange while still remaining relatively protocol generic. These attributes shall be defined for each message as indicated. Other attributes may be documented, if desired.

For example, ISO 14817-3 defines a classification scheme for managing message lists, among other attributes. Other International Standards may define attributes required for mapping the message to a specific protocol. A message conforming to this part of ISO 14827 may also include any such attributes, as long as the required attributes defined in this part of ISO 14827 are also provided.

6 Message definition requirements

An end application message conforming to this part of ISO 14827 shall be formally defined with the attributes defined in the following subclauses. Annex A provides the formal ASN.1 information object specification used to document these attributes.

6.1 Name

Each message shall be assigned a unique, descriptive name. This name may be used by some protocols for identification purposes.

6.2 Definition

Each message shall be assigned a formal, textual definition. The textual definition may reference figures and other information as appropriate. The definition shall provide a meaningful description of the message and clearly indicate the functionality required by the end system.

If the message can be used in an event-driven mode, the definition will define what constitutes an event.

6.3 Remarks

The message specification may also include additional remarks. Such remarks shall not be considered normative, but can be written to provide a better understanding of the message or to provide supplemental information for the reader.

6.4 Message body

The message body shall be completely defined within this field, as an ASN.1 type using the notation as defined in ISO/IEC 8824-1.

NOTE This allows a consistent methodology for documenting the data; it does not imply the use of ASN.1 encoding rules. A protocol may select any of the ASN.1 encoding rules or use other rules and procedures (e.g. as defined for EDIFACT and CORBA).

6.5 Message type

The message type shall indicate if the message defines a subscription or publication message structure. Subscription message specifications shall include the “subscription-type”, “initial publication”, and “subsequent publications” attributes. Publication message specifications shall not include these attributes.

6.6 Subscription type

The subscription type shall be included in the message specification if the message type is “subscription”. This attribute indicates under what modes the message may be used, as follows:

— single: An instance of this message shall only be valid when the request is for a single response. The response will be indicated by the “initial publication” attribute.

— event-driven: An instance of this message shall only be valid when the request is for event-driven notification. Upon receipt, an instance of the “initial publication” shall be sent, and when the defined event is detected, an instance of the “subsequent publications” shall be sent. The event shall be defined within the definition attribute.

— periodic: An instance of this message shall only be valid when the request is for periodic updates. Upon receipt, the receiver shall send an instance of the “initial publication” and the server shall periodically send “subsequent publications” updates according to the rules of the specific protocol.

— single-or-event: An instance of this message shall only be valid if the subject request is for a single response or if the subject request is for an event-driven response; an instance of this message may not be sent as a periodic request. The mode (either single or event) shall be explicitly indicated within the message instance. The action of the receiving system shall be as appropriate given the mode of the message instance.

— single-or-periodic: An instance of this message shall only be valid if the subject request is for a single response or if the subject request is for a periodic response; an instance of this message may not be sent as an event-driven request. The mode (either single or periodic) shall be explicitly indicated within the message instance. The action of the receiving system shall be as appropriate given the mode of the message instance.

— event-or-periodic: An instance of this message shall only be valid if the subject request is for an event-driven response or a periodic response; an instance of this message may not be sent to request a single response. The mode (either event or periodic) shall be explicitly indicated within the message instance. The action of the receiving system shall be as appropriate given the mode of the message instance.

— single-event-periodic: An instance of this message may request a single response, an event-driven response, or a periodic response. The mode (either single, event or periodic) shall be explicitly indicated within the message instance. The action of the receiving system shall be as appropriate given the mode of the message instance.

6.7 Initial publication

The initial publication attribute shall only be included in the specification of subscription messages. It shall define the message that will be transmitted upon receipt of the associated subscription.

6.8 Subsequent publications

The subsequent publications attribute shall only be included in the specification of subscription messages that are not of message type “single”. It shall define the publication message that will be transmitted for all subsequent messages after the initial publication.

6.9 Id

Each message shall be assigned a globally unique, ASN.1 object identifier in the Id field. Some protocols may use this identifier to identify the message type rather than the message name.

Annex A
(normative)

Information object specification

A.1 General

```
ISO 14827-MESSAGE ::= CLASS {
&name                          PrintableString (SIZE (0..255))
&definition                PrintableString (SIZE (0..65535))
&remarks                   PrintableString (SIZE (0..2000))     OPTIONAL
&MessageBody
&messageType                   ENUMERATED {publication, subscription}
&subscriptionType              ENUMERATED {single, event-driven, single-or-event,
periodic, single-or-periodic, event-or-periodic,
single-event-periodic}     OPTIONAL
&initialPublication PrintableString (SIZE (0..255))  OPTIONAL
&subsequentPublications    PrintableString (SIZE (0..255))  OPTIONAL
&id                            OBJECT IDENTIFIER
}
WITH SYNTAX {
NAME                       &name
DEFINITION                     &definition
[REMARKS                       &remarks]
MESSAGE BODY                   &MessageBody
MESSAGE TYPE                   &messageType
[SUBSCRIPTION TYPE         &subscriptionType]
[INITIAL-PUBLICATION           &initialPublication]
[SUBSEQUENT-PUBLICATIONS   &subsequentPublications]
ID                 &id
}
```

Annex B
(informative)

Examples

B.1 Request employee list

A simple message may not contain any data at all. For example, a message to request a list of all employees does not need to contain any information other than the identifier.

```
requestEmployeeList ISO 14827-MESSAGE ::= {
NAME                          "Request Employee List"
DEFINITION                       "Requests the current list of employees as stored
                                 in the database."
MESSAGE BODY                      NULL
MESSAGE TYPE                      subscription
SUBSCRIPTION TYPE                 single
INITIAL-PUBLICATION           publicationEmployeeList
ID                                {iso(1) std(0) 14827 part1(1) examples(1) 1}
}
```

B.2 Request employees by title

A more sophisticated request may contain a parameter to identify the types of employees for which information is being requested. In this case, the message body would define the data structure used to indicate the type of employee.

```
EmployeeType ::= UTF8String (SIZE (0..64))

requestEmployeeListByType ISO 14827-MESSAGE ::= {
NAME               "Request Employee List by Type"
DEFINITION                    "Requests the current list of employees stored in
                              the database who have a title matching one of
                              those contained in the message body."
MESSAGE BODY           SEQUENCE OF EmployeeType
MESSAGE TYPE           subscription
SUBSCRIPTION TYPE          single
INITIAL-PUBLICATION    publicationEmployeeList
ID                 {iso(1) std(0) 14827 part1(1) examples(1) 2}
}
```

B.3 Employee list reply

Although a subscription must indicate exactly what publication is allowed, the same publication may be used to respond to multiple subscriptions. For example, the following publication was previously specified for each of the above messages. This example also indicates that the message body can be defined within the message specification, in addition to being a reference as used in the above example.

```
publicationEmployeeList ISO 14827-MESSAGE ::= {
NAME                "Employee List"
DEFINITION                      "Provides a listing of selected employees."
MESSAGE BODY            SEQUENCE OF SEQUENCE
                                {
                                employee-FirstName UTF8String,
                                employee-LastName      UTF8String
                                }
MESSAGE TYPE            publication
ID                      {iso(1) std(0) 14827 part1(1) examples(1) 3}
}
```

B.4 Request employee updates

A final example indicates how a message might be defined to not only request the initial list of employees, but also request updates when new employees are hired.

```
requestEmployeeUpdateList ISO 14827-MESSAGE ::= {
NAME                "Request Employee Update List"
DEFINITION                      "Requests the current list of employees as stored
                                in the database and, if the event-driven mode is
                                selected, updates as new employees are hired. If
                                the event-driven mode is selected for a given
                                instance of this message, a subsequent publication,
                                containing only the new name, shall be sent every
                                time a new employee is added."
MESSAGE BODY            NULL
MESSAGE TYPE            subscription
SUBSCRIPTION TYPE           single-or-event
INITIAL-PUBLICATION     publicationEmployeeList
SUBSEQUENT-PUBLICATIONS         publicationEmployee
ID                  {iso(1) std(0) 14827 part1(1) examples(1) 4}
}
```

Annex C
(informative)

Concept of operations

This part of ISO 14827 provides a mechanism to specify messages at an abstract level. The actual implementation of these messages will be defined by other International Standards.

For example, ISO 14827-2 (DATEX-ASN) defines one way to exchange these messages. In this protocol, a subscription would be sent across the interface within a DATEX-ASN subscription data packet. However, other International Standards could define how to exchange this data via a CORBA interface. Such an International Standard may equate each subscription with a method call and each publication with the response to the method call.

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