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Space data and information transfer systems — Space link extension — Application program interface for transfer services — Core specification

Systèmes de transfert des informations et données spatiales — Extension de liaisons spatiales — Interface du programme d'application pour les services de transfert — Spécification de base

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Foreword

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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 (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).

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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 the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 914.0-M-2 Cor.1, August 2016) and was adopted (without modifications) by Technical Committee ISO/TC 20, *Space vehicles,* Subcommittee SC 13, *Space data and information transfer systems*.

This third edition cancels and replaces the second edition (ISO 18441:2016), which has been technically revised.

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

— references CCSDS 913.1-B for one-way hash function algorithm and removes reference to Secure Hash Algorithm standard.

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.

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1 INTRODUCTION

1.1 PURPOSE OF THIS RECOMMENDED PRACTICE

The purpose of this Recommended Practice is to define a C++ Application Program Interface (API) for CCSDS Space Link Extension (SLE) Transfer Services, which is independent of any specific technology used for communications between an SLE service user and an SLE service provider.

This API is intended for use by application programs implementing SLE services. It can be configured to support SLE service user applications or SLE service provider applications.

This API is also intended to simplify the implementation of gateways that are required to achieve interoperability between SLE service provider and SLE service user applications using different communications technologies.

Using this Application Program Interface Recommended Practice, API implementations (software packages) able to run on specific platforms can be developed. Once developed, such a package can be supplied to new users of SLE services for integration with their user or production facilities, thus minimizing their investment to buy into SLE support.

1.2 SCOPE

1.2.1 ITEMS COVERED BY THIS RECOMMENDED PRACTICE

This Recommended Practice defines the Application Program Interface in terms of:

a) the components that provide the services of the API;

b) the functionality provided by each of the components;

c) the interfaces provided by each of the components; and

d) the externally visible behavior associated with the interfaces exported by the components.

It does not specify:

a) individual implementations or products;

b) the internal design of the components; and

c) the technology used for communications.

This Recommended Practice defines those aspects of the Application Program Interface, which are common for all SLE service types or for a subset of the SLE service types, e.g., all return link services or all forward link services. It also defines a framework for specification of service type-specific elements of the API. Service-specific aspects of the API are defined by supplemental Recommended Practice documents for SLE return link services (references [10], [11], and [12]) and SLE forward link services (references [13] and [14]).

This Recommended Practice for the Application Program Interface responds to the requirements imposed on such an API by the CCSDS SLE transfer service Recommended Standards that were available when this Recommended Practice was released.

1.2.2 CONFORMANCE TO CCSDS RECOMMENDED STANDARDS

This version of the SLE API Recommended Practice conforms to the CCSDS Recommended Standards for Space Link Extension Services, referenced in 1.7, with the exception of the following optional features:

a) The negotiation procedure for version numbers in the BIND operation is not supported. If the responder does not support the version number identified in the BIND Invocation, it responds with a BIND Return containing a negative result and the diagnostic 'version number not supported'. The responder does not propose an alternative version number.

b) Provider-initiated binding, specified by CCSDS Recommended Standards for return link services is not included in this Recommended Practice. The management parameters that specify the bind initiative are supported to simplify addition of this procedure in later versions.

1.3 APPLICABILITY

The Application Program Interface specified in this document supports three generations of SLE Transfer Service specifications, namely:

a) Generation 1 covering the services RAF, RCF, and FCLTU identified by the version number 1 in the BIND operation, as specified by references [C1], [C2], and [C3];

b) Generation 2 covering

   1) the services RAF, RCF, and FCLTU identified by the version number 2 in the BIND operation, as specified by references [J9], [J10], and [J12];

   2) the services ROCF and FSP identified by the version number 1 in the BIND operation, as specified by references [J11] and [J13];

c) Generation 3 covering the services RAF, RCF, ROCF, FCLTU, and FSP identified by the version number 4 in the BIND operation, as specified by references [4], [5], [6], [7], and [8].

Support for Generation 1 and Generation 2 of these services is included for backward compatibility purposes for a limited time and may not be continued in future versions of this specification. Support for Generation 1 (i.e., version 1 of the RAF, RCF and CLTU services) implies that SLE API implementations of this specification are able to interoperate with peer SLE systems that comply with the specification of the Transport Mapping Layer (TML) in 'Specification of a SLE API Proxy for TCP/IP and ASN.1', ESOC, SLES-SW-API-0002-TOS-GCI, Issue 1.1, February 2001. For Generation 2 and 3 of these services, SLE API implementations of this specification are able to interoperate with peer SLE systems that comply with the specification of the Transport Mapping Layer (TML) in reference [9].

Provisions within this Recommended Practice that are specific for one or more generations are marked as follows:

– [Gn:] for provisions specific to Generation n;

– [Gn,m:] for provisions specific to Generation n and Generation m.

Provisions that apply to all generations are not marked.

1.4 RATIONALE

This Recommended Practice describes the services provided by a software package implementing the API to application software using the API. It specifies the mapping of the SLE Transfer Services specifications to specific functions and parameters of the SLE API. It also specifies the distribution of responsibility for specific functions between SLE API software and application software. The distribution of responsibility has been defined with due consideration for reusability of software packages implementing the SLE API.

The goal of this Recommended Practice is to create a guide for interoperability between

a) software packages implementing the SLE API; and

b) application software using the SLE API.

This interoperability guide also allows exchangeability of different products implementing the SLE API, as long as they adhere to the interface specification of this Recommended Practice.

1.5 DOCUMENT STRUCTURE

1.5.1 OVERVIEW

This Recommended Practice is organized in two parts and a set of annexes.

1.5.1.1 Part I—The Descriptive Part

The descriptive part presents the API Model in section 2 using the Unified Modeling Language (UML) (see reference [J6]).

1.5.1.2 Part II—The Prescriptive Part

The prescriptive part contains the specification of the API. In case of any discrepancies between the descriptive part and the prescriptive part, the specifications in the latter shall apply.

Section 3 contains detailed specifications of the API components and of the interfaces that must be provided by the application.

Section 4 defines the state tables that must be implemented by the API.

1.5.1.3 Annexes

Annex A contains the detailed declaration of the C++ interfaces, which are common for all SLE service types.

Annex B lists the result codes that are used by the API.

[G1:] For version 1 of the services RAF, RCF, and CLTU, annex C defines a standard ASCII representation for the service instance identifier and lists the attribute identifiers and abbreviations that are valid for the service instance identifier.

[G2,3:] For later versions of these services and all other services, these specifications are provided by the applicable CCSDS Recommended Standards.

Annex D describes the design patterns and conventions that shall be applied to API components. The specifications in this annex are also relevant for the application software using the API.

Annex E defines requirements for software products claiming conformance with this Recommended Practice.

Annex F describes the interaction of API components, showing several use cases.

Annex G provides cross-references between interfaces provided by API components and interfaces used by API components.

Annex H contains an index to definitions.

Annex I explains all acronyms used in this Recommended Practice.

Annex J lists informative reference documents.

1.5.2 DOCUMENTATION TREE FOR SLE SERVICES AND SLE API

This Recommended Practice is based on the cross support model defined in the SLE Reference Model (reference [3]). The SLE services constitute one of the three types of Cross Support Services:

a) Part 1: SLE Services;

b) Part 2: Ground Domain Services; and

c) Part 3: Ground Communications Services.

The SLE services are further divided into SLE Service Management and SLE Transfer Services.

NOTE – In reference [3], SLE transfer services are identified; however, the complete service specifications will be provided in separate Recommended Standards.

This Recommended Practice describes how the functions of an SLE transfer service provider or user can be implemented in a software package for the purpose of providing or using one or several SLE transfer services. It is part of a suite of documents specifying the API for SLE transfer services:

a) Core Specification of the Application Program Interface for Transfer Services (this Recommended Practice);

b) a set of Application Program Interfaces for specific Transfer Services; and

c) Internet Protocol for Transfer Services.

The basic organization of the SLE services and SLE API documentation is shown in figure 1-1. The various documents are described in the following paragraphs.

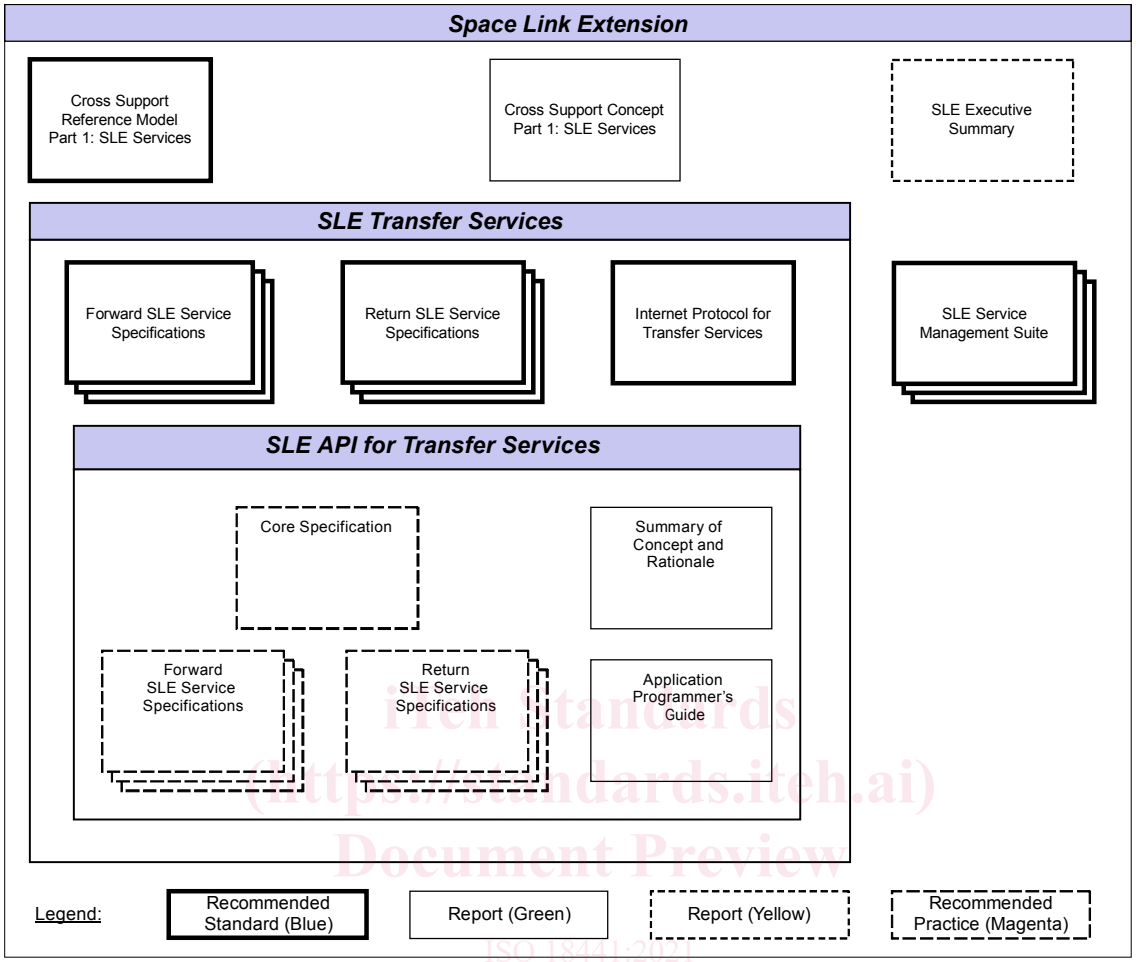

Figure 1-1: SLE Services and SLE API Documentation

a) *Cross Support Reference Model—Part 1: Space Link Extension Services*, a Recommended Standard that defines the framework and terminology for the specification of SLE services.

b) *Cross Support Concept—Part 1: Space Link Extension Services*, a Report introducing the concepts of cross support and the SLE services.

c) *Space Link Extension Services—Executive Summary*, an Administrative Report providing an overview of Space Link Extension (SLE) Services. It is designed to assist readers with their review of existing and future SLE documentation.

d) *Forward SLE Service Specifications*, a set of Recommended Standards that provide specifications of all forward link SLE services.

e) *Return SLE Service Specifications*, a set of Recommended Standards that provide specifications of all return link SLE services.

f) *Internet Protocol for Transfer Services*, a Recommended Standard providing the specification of the wire protocol used for SLE transfer services.

g) *SLE Service Management Specifications*, a set of Recommended Standards that establish the basis of SLE service management.

h) *Application Program Interface for Transfer Services—Core Specification*, this document.

i) *Application Program Interface for Transfer Services—Summary of Concept and Rationale*, a Report describing the concept and rationale for specification and implementation of a Application Program Interface for SLE Transfer Services.

j) *Application Program Interface for Return Services*, a set of Recommended Practice documents specifying the service-type specific extensions of the API for return link SLE services.

k) *Application Program Interface for Forward Services*, a set of Recommended Practice documents specifying the service-type specific extensions of the API for forward link SLE services.

l) *Application Program Interface for Transfer Services—Application Programmer's Guide*, a Report containing guidance material and software source code examples for software developers using the API.

1.6 DEFINITIONS

1.6.1 DEFINITION OF TERMS USED IN THIS DOCUMENT

1.6.1.1 Definitions from the SLE Reference Model

This Recommended Practice makes use of the following terms defined in reference [3]:

a) invoker;

b) offline delivery mode;

c) online delivery mode;

d) operation;

e) performer;

f) service provider (provider);

g) service user (user);

h) SLE protocol data unit (SLE-PDU);

i) SLE transfer service instance (service instance);

j) SLE transfer service production (service production);

k) SLE transfer service provision (service provision);

l) SLE transfer service provision period (provision period).

1.6.1.2 Definitions from the ISO Abstract Service Definitions and Conventions

This Recommended Practice makes use of the following terms defined in reference [19]:

a) initiator;

b) responder.

1.6.1.3 Definitions from SLE Transfer Service Specifications

This Recommended Practice makes use of the following terms defined in references [4], [5], [6], [7], and [8]:

a) association;

b) communications service;

c) confirmed operation;

d) invocation;

e) parameter (of an operation);

f) port identifier;

g) return;

h) unconfirmed operation.

1.6.1.4 Additional Definitions

1.6.1.4.1 General

For the purpose of this Recommended Practice, the following definitions also apply:

1.6.1.4.2 Component

A software module, providing a well-defined service via a set of interfaces. In this document the term component is used only to refer to the API components defined by this Recommended Practice.