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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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ISO 18441 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 914.0-M-2, September 2015) and was adopted (without modifications except those stated in clause 2 of this International Standard) by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 13, *Space data and information transfer systems*.

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This second edition cancels and replaces the first edition (ISO 18441:2013), which has been technically revised.

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CCSDS Recommendations take two forms: **Recommended Standards** that are prescriptive and are the formal vehicles by which CCSDS Agencies create the standards that specify how elements of their space mission support infrastructure shall operate and interoperate with others; and **Recommended Practices** that are more descriptive in nature and are intended to provide general guidance about how to approach a particular problem associated with space mission support. This **Recommended Practice** is issued by, and represents the consensus of, the CCSDS members. Endorsement of this **Recommended Practice** is entirely voluntary and does not imply a commitment by any Agency or organization to implement its recommendations in a prescriptive sense.

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DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 914.0-M-1	Space Link Extension—Application Program Interface for Transfer Services—Core Specification, Recommended Practice, Issue 1	October 2008	Original issue, superseded
CCSDS 914.0-M-2	Space Link Extension—Application Program Interface for Transfer Services—Core Specification, Recommended Practice, Issue 2	September 2015	Current issue: – updates text to accommodate changes in current versions of SLE service specifications; – differentiates applicability by SLE service specification version; – updates references.

NOTE – Substantive changes from the previous issue are marked with change bars in the inside margin.

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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.

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1.2 SCOPE

1.2.1 ITEMS COVERED BY THIS RECOMMENDED PRACTICE

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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]).

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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.

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1.3 APPLICABILITY

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

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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].

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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.

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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.

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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.

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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.

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1.5.1.3 Annexes

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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.

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