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Space data and information transfer systems — Space link extension — Internet protocol for transfer services

Systèmes de transfert des informations et données spatiales — Extension de liaisons spatiales — Protocole Internet pour services de transfert

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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. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

ISO 18440 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 913.1-B-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*.

This second edition cancels and replaces the first edition (ISO 18440:2013), which has been technically revised.

STATEMENT OF INTENT

The Consultative Committee for Space Data Systems (CCSDS) is an organization officially established by the management of its members. The Committee meets periodically to address data systems problems that are common to all participants, and to formulate sound technical solutions to these problems. Inasmuch as participation in the CCSDS is completely voluntary, the results of Committee actions are termed **Recommended Standards** and are not considered binding on any Agency.

This **Recommended Standard** is issued by, and represents the consensus of, the CCSDS members. Endorsement of this **Recommendation** is entirely voluntary. Endorsement, however, indicates the following understandings:

- o Whenever a member establishes a CCSDS-related **standard**, this **standard** will be in accord with the relevant **Recommended Standard**. Establishing such a **standard** does not preclude other provisions which a member may develop.

- o Whenever a member establishes a CCSDS-related **standard**, that member will provide other CCSDS members with the following information:

  -- The **standard** itself.

  -- The anticipated date of initial operational capability.

  -- The anticipated duration of operational service.

- o Specific service arrangements shall be made via memoranda of agreement. Neither this **Recommended Standard** nor any ensuing **standard** is a substitute for a memorandum of agreement.

No later than five years from its date of issuance, this **Recommended Standard** will be reviewed by the CCSDS to determine whether it should: (1) remain in effect without change; (2) be changed to reflect the impact of new technologies, new requirements, or new directions; or (3) be retired or canceled.

In those instances when a new version of a **Recommended Standard** is issued, existing CCSDS-related member standards and implementations are not negated or deemed to be non-CCSDS compatible. It is the responsibility of each member to determine when such standards or implementations are to be modified. Each member is, however, strongly encouraged to direct planning for its new standards and implementations towards the later version of the Recommended Standard.

FOREWORD

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CCSDS has processes for identifying patent issues and for securing from the patent holder agreement that all licensing policies are reasonable and non-discriminatory. However, CCSDS does not have a patent law staff, and CCSDS shall not be held responsible for identifying any or all such patent rights.

Through the process of normal evolution, it is expected that expansion, deletion, or modification of this document may occur. This Recommended Standard is therefore subject to CCSDS document management and change control procedures, which are defined in *Organization and Processes for the Consultative Committee for Space Data Systems* (CCSDS A02.1-Y-4). Current versions of CCSDS documents are maintained at the CCSDS Web site:

http://www.ccsds.org/

Questions relating to the contents or status of this document should be sent to the CCSDS Secretariat at the e-mail address indicated on page i.

At time of publication, the active Member and Observer Agencies of the CCSDS were:

Member Agencies

- Agenzia Spaziale Italiana (ASI)/Italy.
- Canadian Space Agency (CSA)/Canada.
- Centre National d'Etudes Spatiales (CNES)/France.
- China National Space Administration (CNSA)/People's Republic of China.
- Deutsches Zentrum für Luft- und Raumfahrt (DLR)/Germany.
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- Austrian Space Agency (ASA)/Austria.
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DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 913.1-B-1	Space Link Extension—Internet Protocol for Transfer Services, Recommended Standard, Issue 1	September 2008	Original issue, superseded
CCSDS 913.1-B-2	Space Link Extension—Internet Protocol for Transfer Services, Recommended Standard, Issue 2	September 2015	Current issue: – changes the recommended algorithm for secure one-way hash function from SHA-1 to SHA-256; – 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

The Space Link Extension (SLE) Reference Model (reference [1]) identifies a set of SLE Transfer Services that enable missions to send forward space link data units to a spacecraft and to receive return space link data units from a spacecraft. A subset of these services is specified by the SLE Transfer Service Recommended Standards (references [2], [3], [4], [5], and [6]). The SLE Transfer Service Recommended Standards specify

a) the operations necessary to provide the transfer service;

b) the parameter data associated with each operation;

c) the behaviors that result from the invocation of each operation; and

d) the relationship between, and the valid sequence of, the operations and resulting behaviors.

However, they deliberately do not specify the methods or technologies required for communications.

The purpose of this Recommended Standard is to define a protocol for transfer of SLE Protocol Data Units (PDUs) defined in the SLE Transfer Service Recommended Standards using the Internet protocols TCP (Transmission Control Protocol, reference [7]) and IP (Internet Protocol, reference [8]) for data transfer and the Abstract Syntax Notation One (ASN.1, references [9] and [10]) for data encoding. This protocol is referred to as the Internet SLE Protocol One (ISP1).

1.2 SCOPE

This Recommended Standard defines a protocol for transfer of SLE PDUs between an SLE user and an SLE provider system in terms of:

a) the procedures used to establish and release associations;

b) the messages exchanged on an established association;

c) the procedures used to monitor the status of data communication connections; and

d) the methods used to ensure that data are converted between different formats and representations on different platforms.

It does not specify:

a) individual designs, implementations, or products;

b) the configuration of the data communications infrastructure, including configuration of the TCP and IP protocols;

c) the means by which addresses (IP addresses and TCP port numbers) are agreed, assigned, and communicated.

This Recommended Standard responds to the requirements imposed by the Recommended Standards for SLE transfer services that were available when this Recommended Standard was released. The protocol specified in this Recommended Standard conforms to the requirements on data communication services set forth in those Recommended Standards.

1.3 APPLICABILITY

1.3.1 APPLICABILITY OF THIS RECOMMENDED STANDARD

This Recommended Standard provides a basis for the development of real systems that implement the Internet SLE Protocol. It is applicable for systems acting as an SLE service user or SLE service provider.

1.3.2 LIMITS OF APPLICABILITY

This Recommended Standard specifies the Internet SLE Protocol that may be applied by an SLE System for inter-Agency cross support. It is neither a specification of, nor a design for, real systems that may be implemented for the control and monitoring of existing or future missions.

1.4 RATIONALE

The goal of this Recommended Standard is to create a standard for interoperability between the tracking stations and/or ground data handling systems of various agencies and the users of SLE transfer services based on the technologies TCP/IP and ASN.1.

1.5 DOCUMENT STRUCTURE

1.5.1 ORGANIZATION

This document is organized as follows:

a) section 1 presents the purpose, scope, applicability and rationale of this Recommended Standard and lists the definitions, conventions, and references used throughout the Recommended Standard;

b) section 2 describes the Internet SLE Protocol by means of an architectural model identifying individual protocol layers and the interfaces to higher layers;

c) section 3 specifies the messages exchanged via ISP1 and the procedures to be applied for connection establishment and release and for data transfer;

d) section 4 specifies the state table for the protocol;

e) annex A provides ISP1-specific diagnostic codes for the SLE PEER-ABORT operation;

f) annex B describes differences with earlier implementations of ISP1;

g) annex C lists all terms used in this document and identifies where they are defined;

h) annex D lists all acronyms used within this document;

i) annex E contains a list of informative reference documents.

1.5.2 SLE SERVICES DOCUMENTATION TREE

This Recommended Standard is part of a suite of documents specifying the SLE services. The SLE services constitute one of the three types of Cross Support Services:

a) Part 1: SLE Services;

b) Part 2: Ground Domain Services;

c) Part 3: Ground Communications Services.

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

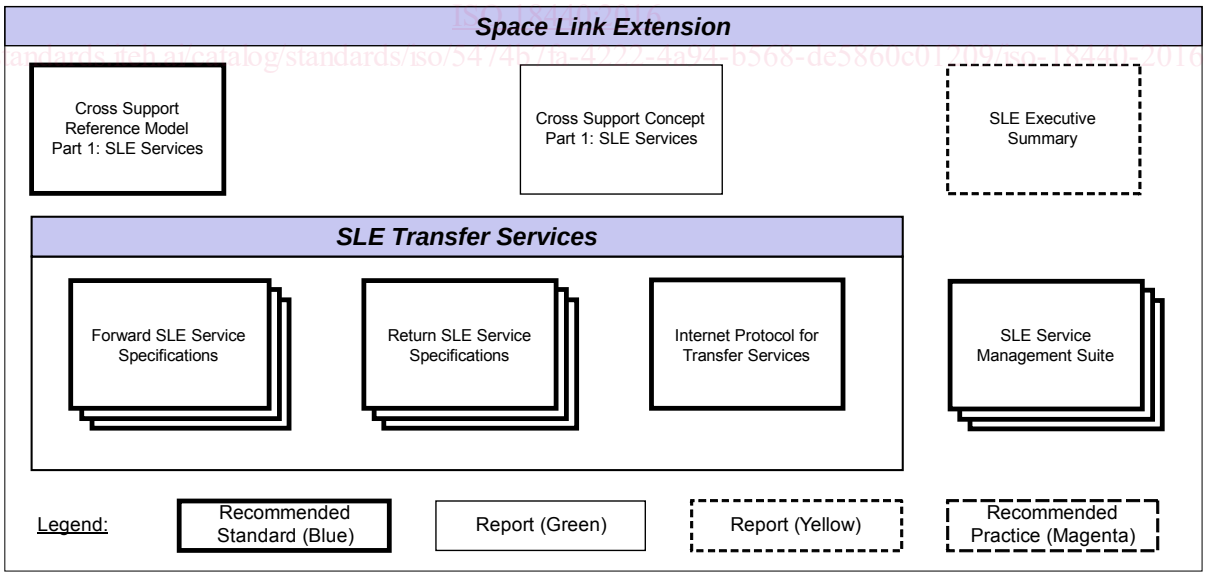

Figure 1-1: SLE Services and SLE API Documentation

a) *Cross Support Concept—Part 1: Space Link Extension Services* (reference [E1]), a Report introducing the concepts of cross support and the SLE services;

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

c) *Forward SLE Service Specifications*, a set of Recommended Standards that will provide specification of all forward link SLE services;

d) *Return SLE Service Specifications*, a set of Recommended Standards that will provide specification of all return link SLE services;

e) *Internet Protocol for Transfer Services*, this Recommended Standard;

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

1.6 DEFINITIONS, NOMENCLATURE, AND CONVENTIONS

1.6.1 DEFINITIONS

1.6.1.1 Definitions from the SLE Reference Model

This Recommended Standard makes use of the following terms defined in reference [1]:

a) initiator;

b) operation;

c) responder;

d) service user (user);

e) service provider (provider);

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

g) SLE transfer service instance (service instance).

1.6.1.2 Definitions from SLE Transfer Service Specifications

This Recommended Standard makes use of the following terms defined in references [2], [3], [4], [5], and [6]:

a) association;

b) communications service;

c) confirmed operation;

d) invocation;