The Consultative Committee for Space Data Systems

Draft Recommendation for
Space Data System Practices

SPACECRAFT ONBOARD INTERFACE SERVICES—SUBNETWORK PACKET SERVICE

DRAFT RECOMMENDED PRACTICE

CCSDS 851.0-P-1.1

PINK BOOK

March 2019

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FOREWORD

This document is a technical **Recommended Practice** for use in developing flight and ground systems for space missions and has been prepared by the **Consultative Committee for Space Data Systems** (CCSDS). The *Subnetwork Packet Service* described herein is intended for missions that are cross-supported between Agencies of the CCSDS, in the framework of the Spacecraft Onboard Interface Services (SOIS) CCSDS area.

This **Recommended Practice** specifies a set of related services to be used by space missions to transfer data over an onboard subnetwork. The SOIS Subnetwork Packet Service can support various transport and network protocols like TCP/IP and can directly support applications that only need to use a single subnetwork. The SOIS Subnetwork Packet Service provides quality of service features and also provides a common service interface regardless of the particular type of data link being used for communication.

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PREFACE

This document is a draft CCSDS Recommended Practice. Its 'Pink Book' status indicates that the CCSDS believes the document to be technically mature and has released it for formal review by appropriate technical organizations. As such, its technical contents are not stable, and several iterations of it may occur in response to comments received during the review process.

Implementers are cautioned **not** to fabricate any final equipment in accordance with this document's technical content.

DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 851.0-M-1	Spacecraft Onboard Interface Services—Subnetwork Packet Service, Recommended Practice, Issue 1	December 2009	Original issue
CCSDS 851.0-P-1.1	Spacecraft Onboard Interface Services—Subnetwork Packet Service, Draft Recommended Practice, Issue 1.1	March 2019	Current draft update (note)

NOTE – Changes from the original issue are too numerous to permit meaningful markup.

CONTENTS

1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This document is one of several CCSDS Spacecraft Onboard Interface Services (SOIS) Area documents specifying SOIS-compliant services to be provided by onboard subnetworks.

The purpose of this Recommended Practice is to define services and service interfaces provided by the SOIS Subnetwork Packet Service. Its scope is to specify the service only and not to specify methods of providing the service over a variety of onboard data links. Specifically, the Service Access Point (SAP) primitives and parameters are defined so that a user application can send packets across a subnetwork service provider.

This document conforms to the principles set out in the Spacecraft Onboard Interface Services Green Book (reference [C1]) and is intended to be applied together with it. The convergence layer protocols that provide this service are to be documented for individual subnetwork implementations and can be in the purview of individual missions, agencies, or the CCSDS, depending on future circumstance.

1.2 APPLICABILITY

This document applies to any mission or equipment claiming to provide a CCSDS SOIS-compliant Packet Service. It may be used in conjunction with the SOIS Electronic Data Sheet (SEDS) and SOIS Dictionary of Terms (DoT) to develop systems in a machine readable format so that software tools may be applied to populate system profile values, transform to different software architecture or simulator formats, generate system configurations, and create human readable documents (see references [C4] and [C5]).

1.3 RATIONALE

SOIS provides service interface specifications in order to promote interoperability and development reuse via peer-to-peer and vertical standardization.

1.4 DOCUMENT STRUCTURE

The document has five major sections and three annexes:

- section 1 (this section), containing administrative information, definitions, and references;
- section 2, describing general concepts and assumptions;
- section 3, containing the Subnetwork Packet Service specification;
- section 4, containing the Management Information Base (MIB) for the service;
- annex A contains a SOIS Subnetwork Packet Service implementation conformance statement proforma;

– annex B discusses security considerations;

– annex C contains informative references.

1.5 CONVENTIONS AND DEFINITIONS

1.5.1 BIT NUMBERING CONVENTION AND NOMENCLATURE

In this document, the following convention is used to identify each bit in an *N*-bit field. The first bit in the field to be transmitted (i.e., the most left justified when drawing a figure) is defined to be 'Bit 0'; the following bit is defined to be 'Bit 1', and so on up to 'Bit *N*–1'. When the field is used to express a binary value (such as a counter), the Most Significant Bit (MSB) shall be the first transmitted bit of the field, that is, 'Bit 0' (see figure 1-1).

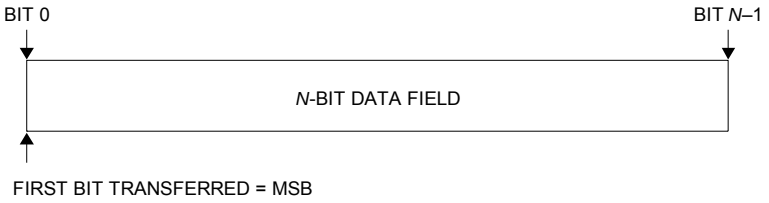

Figure 1-1: Bit Numbering Convention

In accordance with modern data communications practice, spacecraft data fields are often grouped into eight-bit 'words' widely known as bytes. Throughout this Recommended Practice, such eight-bit words are called 'octets'.

The numbering for octets within a data structure starts with zero. By CCSDS convention, any 'spare' bits are permanently set to '0'.

1.5.2 DEFINITIONS

1.5.2.1 General

For the purpose of this document, the following definitions apply:

1.5.2.2 Definitions from the Open Systems Interconnection Basic Reference Model

This document is defined using the style established by the Open Systems Interconnection (OSI) Basic Reference Model (reference [C3]). This model provides a common framework for the development of standards in the field of systems interconnection.

The following terms used in this Recommended Practice are adapted from definitions given in reference [C3]**:**

layer: A subdivision of the architecture, constituted by subsystems of the same rank.

protocol control information, PCI: Information that is added by a layer for interpretation only by the corresponding layer. PCI is stripped off by the interpreting layer before passing to higher layers.

protocol data unit, PDU: A unit of data specified in a protocol and consisting of Protocol Control Information (PCI) and possibly user data.

service: The capability of a layer (service provider) together with the layers beneath it, which is provided to the service users.

service access point, SAP: The point at which a PDU is passed to the layer beneath it, which is provided to the service users.

service data unit, SDU: An amount of data whose identity is preserved when transferred between peer packet service user entities and that is not interpreted by the SOIS subnetwork service provider entities.

subnetwork: (1) An abstraction of a collection of equipment and physical media, such as a local area network or a data bus, which forms an autonomous whole and can be used to interconnect real systems for the purpose of data transfer. (2) A **subnet** (see 1.5.2.3, below.)

user data: The data transferred between Packet service entities on the behalf of the Packet service user entities: Application, Application Support layer, Subnetwork layer.

NOTE – Data processing in the OSI BRM between two compliant devices is performed as follows:

Data to be sent is composed into a PDU at the top layer (N) and sent down to the next layer (N−1), where it is interpreted as an SDU.

Layer N−1 concatenates it with a header, footer, or both (PCI), to make it an N−1 PDU and passes it down to the next lower layer (N−2).

This process continues until the data reaches the lowest layer and is transmitted.

At the receiving end, the process is reversed, and the headers and footers are stripped off as the data is passed up the layers to the top layer, where the data that is ready for processing arrives.

The relationships among PDU, SDU, and PCI is shown in figure 1-2.

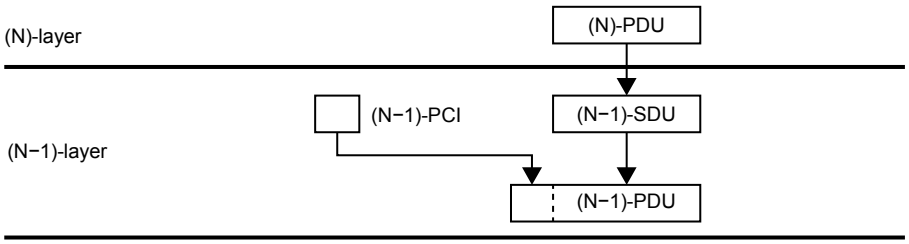

Figure 1-2: Relationship between PDU, SDU, and PCI

1.5.2.3 Terms Defined in this Recommended Practice

For the purposes of this Recommended Practice, the following definitions also apply. Many other terms that pertain to specific items are defined in the appropriate sections.

channel: Identifier for a logical data connection over a multiplexed physical medium.

NOTE – A channel can be a list of time slots in a time division multiplexed system or a bandwidth limit in a bandwidth division multiplexed system. The subnetwork resources required for the communication can also be defined to allow simultaneous use of non-conflicting resources on subnetworks that support this feature.

configuration parameter: A value that specifies an attribute or control parameter specific to a particular subnetwork. These parameters are defined in a subnetwork SEDS package file.

error: A data bit received with the inverse value from that with which it was sent.

flow-identifier, FLOW-ID: An identifier used by the PS interface to associate a PS user's PDU with the underlying subnet configuration, including subnet ID, addressing, QoS, and protocol ID, so that the delivery of a packet between applications over a SOIS subnet may occur.

maximum transmission unit, MTU: Maximum size of data that a data link can transmit as a single PDU.

NOTE – The MTU is required to ensure that different sources of data get fair access to the transmission medium by multiplexing traffic on a packet-by-packet basis. SDUs larger than the MTU will be segmented into smaller PDUs.

octet: An eight-bit word.

NOTE – An eight-bit word is commonly referred to as a byte.

packet: An arbitrary integer number of octets.

NOTE – The SDU for the packet service takes the form of a packet.

priority: Transmit precedence of an SDU relative to other SDUs.

quality of service, QoS: Composed of four parts: retransmission mechanism, resource reservation, priority, and in-order delivery (sequence preservation).

resource reservation: A description of the reservation of data-link bandwidth. The options are: best effort, which indicates no reservation of network bandwidth; rate constrained, which indicates reservation of network bandwidth but without hard determinism (jitter not tightly bounded); and deterministic, which indicates scheduled bandwidth according to a system-wide schedule that is pre-allocated in time within a tight jitter constraint.

subnet: (1) A data link protocol used for spacecraft onboard communication. (2) A **subnetwork** (see 1.5.2.2, above).

subnet management information base, subnet MIB: A collection of SEDS subnet configuration items and status (error counter, etc.) for the local Subnetwork Packet Service.

1.6 NOMENCLATURE

1.6.1 NORMATIVE TEXT

The following conventions apply for the normative specifications in this Recommended Standard:

a) the words ‘shall’ and ‘must’ imply a binding and verifiable specification;

b) the word ‘should’ implies an optional, but desirable, specification;

c) the word ‘may’ implies an optional specification;

d) the words ‘is’, ‘are’, and ‘will’ imply statements of fact.

NOTE – These conventions do not imply constraints on diction in text that is clearly informative in nature.

1.6.2 INFORMATIVE TEXT

In the normative sections of this document, informative text is set off from the normative specifications either in notes or under one of the following subsection headings:

– Overview;

– Background;

– Rationale;

– Discussion.

1.7 REFERENCES

This Recommended Practice contains no normative references. Informative references are contained in annex C.

2 OVERVIEW

2.1 FUNCTION

The SOIS Subnetwork Packet Service transfers Service Data Units, which comprise variable length, delimited octet strings, from one endpoint on a data link/subnetwork to another endpoint on the same data link/subnetwork, using the SOIS data link functions to move the information across the data link/subnetwork.

2.2 CONTEXT

The SOIS Subnetwork layer provides for the movement of an SDU over a subnetwork to a variety of user applications, Space Internet Services (SIS), and others. The service may be provided over a variety of data links, and the method of such provision is outside the scope of this document.

Data to be transported is passed to the Subnetwork Packet Service via the Subnetwork Packet Service interface along with parameters, one being the FLOW-ID that is used to map the data to be transported to a specific subnetwork type, subnetwork instance, and subnetwork configuration. As shown in figure 2-1, the Packet Service is one of a number of services that may be provided by the SOIS Subnetwork.

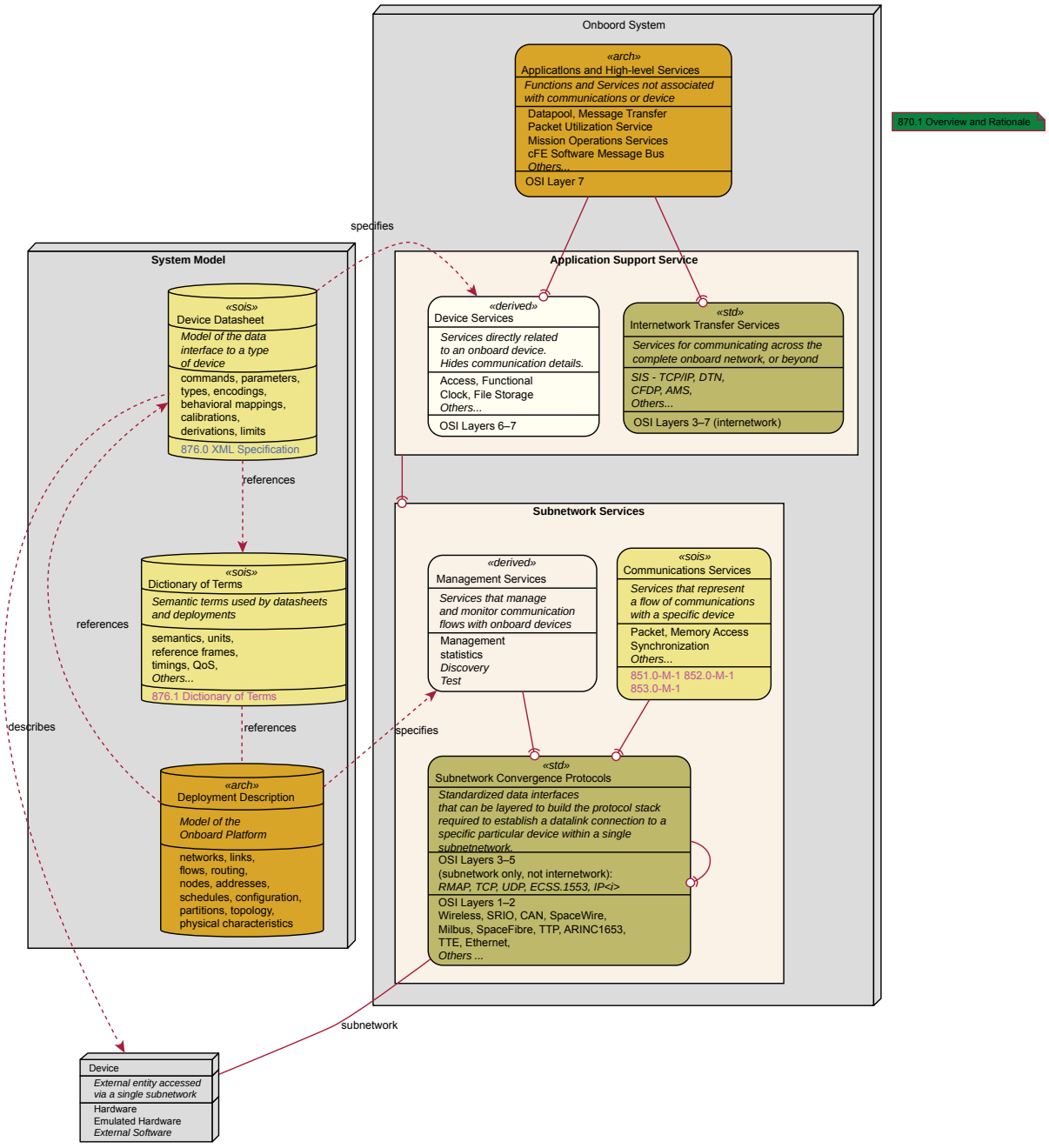

Figure 2-1: Subnetwork Packet Service Context

The Subnetwork Packet Service makes use of the data link to transfer data and control information. A variety of data links may be suited to provision the service, and the strategy for such service provisions is outlined in reference [C1].

A Subnetwork Management function is also provided for configuring, managing, and collecting status information from the Subnetwork Packet Service. This consists of a

Subnetwork MIB, which is used to configure and read the status from subnetwork implementations. Some Subnetwork MIB items are technology independent and some are implementation specific. The technology independent Subnetwork MIB items will be documented by the SOIS Dictionary of Terms process.

2.3 ASSUMPTIONS

The following assumptions have been made in designing the SOIS Subnetwork Packet Services:

- SOIS Subnetwork Packet Service is made available to protocol entities in the Application Support Services/Application and high-level services layers.
- SOIS Subnetwork Packet Service may deliver SDUs to the destination in a different order from that in which they are produced by the source (within the channel, if applicable, and within a priority value). This is dependent upon the subnetwork selected. Some subnetworks are designed to deliver SDUs in the order in which they are produced by the source (within the channel if applicable and within a priority value). The selection of the appropriate subnetwork is a system-level decision based upon the requirements.
- SOIS Subnetwork Packet Service delivers error-free SDUs to the Application Support/Application and high-level service layers.
- SOIS Subnetwork Packet Service rejects an SDU if larger than the subnetwork (lower level) convergence layer protocol MTU size per FLOW-ID.

2.4 QUALITY OF SERVICE

The requested QoS is indicated by the FLOW-ID parameter. The FLOW-ID is also used to indicate other items for an SDU, such as subnetwork type, subnetwork instance, and subnetwork configurable items (e.g., QoS, channel) on a per-SDU basis. There are four aspects defined for Packet Service QoS. They are as follows:

- retransmission mechanism;
- resource reservation, which describes the reservation of data link bandwidth; options are as follows:
  - best effort—no reservation of network bandwidth,
  - rate constrained—reservation of network bandwidth but without hard determinism (jitter not tightly bounded),
  - determinism—scheduled bandwidth according to a system-wide schedule that is preallocated in time within a bounded jitter constraint;
- priority—value to indicate the precedence of a channel to be sent on the network;

– in-order delivery (sequence preservation)—PDUs are delivered to the upper layer (across Packet Service SAP) in the same order in which they were presented to the Packet Service by the sending end upper-layer application (other side of the data link).

Sequence preservation within a channel or at a priority level is dependent upon the subnetwork type selected. Some subnetworks are sequence preserving, and some are not.

3 SUBNETWORK PACKET SERVICE

3.1 SERVICE PARAMETERS

3.1.1 GENERAL

The Subnetwork Packet Service shall use the parameters defined in 3.1.2 to 3.1.6.

3.1.2 DATA

The Data parameter shall be used as the SDU of the SOIS Subnetwork Packet Service and shall be the payload of the packet to be sent by the Packet Service.

NOTE – The Packet Service views the SDU as a simple byte array and does not interpret the contents in any way. The Packet Service PCI will encapsulate the SDU to make it a Packet Service PDU. The PCI added is subnetwork-protocol specific and typically corresponds to the packet header (and footer, optionally) for the specific data link protocol. The PCI contents will be mapped from the FLOW-ID and the data-link-specific standardized subnet MIB items.

3.1.3 LENGTH

The Length parameter shall be used to indicate the number of bytes of the Subnetwork SDU passed from the Application Support Services layer or Application high-level services layer.

NOTE – The SDU is the packet payload passed to the subnetwork for transport.

3.1.4 FLOW-ID

The FLOW-ID parameter shall be used to cause the Packet Service to look up the required subnetwork configuration settings in order to deliver a user PDU over a subnetwork.

NOTE – The configuration parameters for a user PDU are dependent upon the subnetwork type and can include the following:

- subnetwork identifier;
- subnetwork instance;
- destination address;
- source address;
- protocol identifier;
- payload identifier;
- MTU;

– channel identifier—may be the network slot number for a Time Division Multiplexed Access (TDMA) scheme, Virtual Channel (VC) to indicate multiplexed physical layer, or subaddress scheme to specify, for example, a function within a device;

– quality of service—identifies retransmission mechanism (or lack thereof), resource reservation (best effort, rate constrained, deterministic), and priority level for switching information such as destination address or VC that may be arbitrated.

3.1.5 TRANSACTION-ID

The Transaction-ID parameter shall be used to associate the exact instance of a user PDU service request with the status indication for that transaction, if applicable.

3.1.6 FAILURE METADATA

3.1.6.1 The Failure Metadata parameter shall be used to indicate the status of a packet transmission back to a user of the Subnetwork Packet Service if supported by the subnetwork and if configured to do so.

3.1.6.2 The Failure Metadata shall be a block of opaque data that is passed to the user for interpretation.

3.2 PACKET SERVICE PRIMITIVES

The SOIS Subnetwork Packet Service primitives shall use the parameters defined in 3.1.2 to 3.1.6.

3.2.1 GENERAL

3.2.1.1 The SOIS Subnetwork Packet Service shall use the following primitives:

a) PACKET_SEND.request (which requests to send an SDU), as specified in 3.2.2;

b) PACKET_RECEIVE.indication (which indicates that a packet has been received, and which passes the corresponding SDU to the user), as specified in 3.2.3;

c) PACKET_FAILURE.indication (which indicates a failure detected by the subnetwork if possible), as specified in 3.2.4.

3.2.1.2 A data system may implement only one of the following two primitives: PACKET_SEND.request or PACKET_RECEIVE.indication.

NOTE – In this case, the data system is only capable of simplex packet communication.

3.2.1.3 A data system implementing the Subnetwork Packet Service shall implement the PACKET_FAILURE.indication primitive if applicable, that is, if the subnetwork has the ability to detect transmission failure.

3.2.2 PACKET_SEND.REQUEST

3.2.2.1 Function

The **PACKET_SEND.request** primitive shall be used to request the service to send an SDU to a destination protocol entity that is a user of the service.

NOTE – The SDU may be assigned a priority level (part of QoS mapped by FLOW-ID) to indicate the precedence the SDU has with respect to other SDUs in the subnetwork queue.

3.2.2.2 Semantics

The **PACKET_SEND.request** primitive shall use the following semantics, with the meaning of the parameters defined in 3.2.2.5:

PACKET_SEND.request (*FLOW-ID, Data, Length, Transaction-ID*)

3.2.2.3 When Generated

The **PACKET_SEND.request** primitive shall be passed to the SOIS Subnetwork Packet Service provider to request that the Data be sent.

3.2.2.4 Effect on Receipt

Receipt of the **PACKET_SEND.request** primitive shall cause the SOIS Subnetwork service provider to encapsulate the SDU and to issue a PDU over the underlying data link/subnetwork with the attributes defined by the MIB FLOW-ID mapping.

3.2.2.5 Discussion—Additional Comments

The FLOW-ID parameter is used to map to the packet addressing and QoS attributes that are defined by the subnetwork configuration parameters. Any channel associations, such as VC, are indicated within a particular FLOW-ID.

The Length parameter is the length of the SDU stored in memory.

The Transaction-ID parameter is used to associate the particular instance of the packet SDU with a potential **PACKET_FAILURE.indication** primitive. This is used if the subnetwork has the ability to detect packet failure.

3.2.3 PACKET_RECEIVE.INDICATION

3.2.3.1 Function

The **PACKET_RECEIVE.indication** primitive shall be used to pass the contents of a received packet service PDU to the user protocol entity.

3.2.3.2 Semantics

The **PACKET_RECEIVE.indication** primitive shall use the following semantics, with the meaning of the parameters specified in 3.2.3.5:

PACKET_RECEIVE.indication (*FLOW-ID, Data, Length*)

3.2.3.3 When Generated

The **PACKET_RECEIVE.indication** primitive shall be issued by the service provider to the receiving application on receipt of a Data PDU.

3.2.3.4 Effect on Receipt

The response of the user entity to a **PACKET_RECEIVE.indication** primitive is unspecified.

3.2.3.5 Discussion—Additional Comments

The FLOW-ID parameter is used to map to the packet addressing, the QoS attributes that are defined by the subnetwork management items, and any other parameters, as required. Any channel associations such as a VC are indicated within a particular FLOW-ID.

The Length parameter is the length of the SDU stored in memory.

The Data parameter shall provide the data received by the packet protocol entity and directed to the specified user entity.

3.2.4 PACKET_FAILURE.INDICATION

3.2.4.1 Function

3.2.4.1.1 The **PACKET_FAILURE.indication** primitive shall be used to indicate to the user entity that a **PACKET_SEND.request** failed to deliver the Packet SDU.

3.2.4.1.2 The association for which **PACKET_SEND.request** failed shall be indicated by the Transaction-ID parameter (same value as the Transaction-ID of the **PACKET_SEND.request**).

3.2.4.2 Semantics

The **PACKET_FAILURE.indication** primitive shall use the following semantics, with the meaning of the parameters specified in 3.2.4.5:

PACKET_FAILURE.indication (*FLOW-ID, Transaction-ID, Failure Metadata*)

3.2.4.3 When Generated

The **PACKET_FAILURE.indication** primitive shall be issued by the service provider to the service user when, for whatever reason, it has proved impossible to satisfy the service request.

3.2.4.4 Effect on Receipt

The effect of receipt of the **PACKET_FAILURE.indication** primitive is unspecified.

NOTE – It may be that the user entity attempts to send the packet SDU again or by a redundant path.

3.2.4.5 Discussion—Additional Comments

The FLOW-ID parameter is used to associate the packet addressing and QoS attributes that are stored in the subnetwork configuration. Any channel associations such as VC are indicated within a particular FLOW-ID.

The Transaction-ID parameter is used to associate the particular instance of the packet send with the **PACKET_FAILURE.indication** primitive.

The Failure Metadata is subnetwork and implementation specific. Any additional information as to why the failure occurred may be found by the user entity by interrogating the subnetwork configuration.

4 MANAGEMENT INFORMATION BASE

4.1 OVERVIEW

SOIS conforms to the established consensus within CCSDS regarding management concepts.

A Management Information Base (MIB) description will be mandatory for inclusion in any protocol specification claiming to implement SOIS services and will include parameters, databases, and actions necessary to inform operation of the protocols and provide status. The method of access to the MIB by the management system is undefined and may be a combination of preconfigured code, local configuration, or remote management via management protocol and local agent.

Management functions within the SOIS architecture configure the SOIS services with respect to addressing and QoS (e.g., reserving resources and allocating a channel identifier for those resources), as well as informing user applications about attributes of the configured service (e.g., informing the user applications about the existence of a channel and the resources reserved for it).

There is currently no Management Information Base (MIB) associated with this service. All management items are associated with the protocol providing the service. However, guidance is provided as to MIB contents in 4.3.

4.2 SPECIFICATIONS

Any protocol claiming to provide this service in a SOIS-compliant manner shall publish its MIB as part of the protocol specification.

NOTE – For the purpose of the Subnetwork Packet Service, the subnetworks that use the SOIS Packet Service have a configuration that needs to map to the service primitives and parameters. The collection of all such parameters is referred to as the Subnetwork MIB.

4.3 MIB GUIDANCE

4.3.1 DISCUSSION

The FLOW-ID is used to map to Subnetwork MIB terms to configure an implementation. These Subnetwork MIB terms are captured by the DoT to be used by any implementation of that network type (reference [C5]). Then the SOIS EDS may be easily interpreted for different implementations (reference [C4]).

4.3.2 RECOMMENDATIONS

4.3.2.1 The DoT should include only terms common to any subnetwork implementations that utilize the subnetwork standard.

NOTE – Terms that are specific to a specific implementation do not need to be defined in the DoT. The Subnetwork configuration is required to move Subnetwork SDUs across the data link (subnetwork) to the destination.

4.3.2.2 The MIB of the protocol providing the Packet Service should consider the following aspects:

- addressing (Destination and Source);
- QoS parameters;
- Failure Metadata semantics;
- MTU size.

NOTE – These aspects are not in any way an indication of the complete contents of a MIB for a protocol providing the Packet Service, but are offered as guidance as to those aspects of the MIB that may relate to the Packet service interface.

ANNEX A

SOIS SUBNETWORK PACKET SERVICE IMPLEMENTATION CONFORMANCE STATEMENT PROFORMA

(NORMATIVE)

A1 INTRODUCTION

For any protocol specification claiming to provide this service, this proforma shall be completed, giving details of the capabilities of the specification, and made available to any party evaluating the use of the specification to which the completed proforma refers. It should be noted that a valid implementation may implement only the send primitive or the receive primitive; that is, a valid implementation does not have to have both send and receive primitives.

A2 ABBREVIATIONS AND CONVENTIONS

Feature Column

The feature column contains a brief descriptive name for a feature. It implicitly means "Is this feature supported by the implementation?"

Status Column

The status column uses the following notations:

M	mandatory.
O	optional.
O.<n>	support of at least one of the group of options labeled by the same numeral <n> is required.

A3 SPECIFICATION INFORMATION

Convergence Protocol Specification Identification	
Convergence Protocol Specification Version	
Underlying Data Link Protocol	
Underlying Data Link Protocol Version	

A4 REQUIREMENTS LIST

A4.1 GENERAL

Feature	Status	Support
Parameters		
FLOW-ID	M	Integer
Transaction-ID	M	Integer
Length	M	Integer in octets
Failure Metadata	O	
Primitives		
PACKET_SEND.request	O.1	
PACKET_RECEIVE.indication	O.1	
PACKET_FAILURE.indication	O	

O.1 At least one of these primitives must be implemented

A4.2 FLOW-ID MAPPED CONVERGENCE LAYER INFORMATION

Feature	Status	Support
MTU Size	M	In octets
Subnetwork Identifier	M	Integer
Subnetwork Instance	M	Integer
Destination Address	M	Integer
Source Address	O	Integer
Protocol Identifier	O	Integer
Payload Identifier	O	Integer
Quality of Service	M	(See A4.3)

A4.3 QUALITY OF SERVICE INFORMATION

Feature	Status	Support
Retransmission Mechanism	O	Boolean
Resource Reservation	M.1	Enumeration (see A4.4)
Priority Level	O	Integer
Sequence Preservation	O	Boolean

M.1 At least one enumerated value in A7 must be specified.

A4.4 RESOURCE RESERVATION ENUMERATION INFORMATION

Feature	Status	Support
Best Effort	O.2	Integer/String
Rate Constrained	O.2	Integer/String
Deterministic	O.2	Integer/String

O.2 At least one of these QoS resource reservation types must be implemented.

A5 GENERAL RESOURCE RESERVATION INFORMATION

NOTE – Applies to all Resource Reservation Enumeration options.

Feature	Status	Support
Virtual Channel Number	O	Integer
Channel Number	O	Integer

ANNEX B

SECURITY CONSIDERATIONS

(INFORMATIVE)

B1 SECURITY BACKGROUND

The SOIS services are intended for use with protocols that operate solely within the confines of an onboard subnet. It is therefore assumed that SOIS services operate in an isolated environment that is protected from external threats. Any external communication is assumed to be protected by services associated with the relevant space-link protocols. The specification of such security services is outside the scope of this document.

B2 SECURITY CONCERNS

At the time of writing, there are no identified security concerns. If confidentiality of data is required within a spacecraft it is assumed that it is applied at the Application layer. More information regarding the choice of service and where it can be implemented can be found in reference [C2].

B3 POTENTIAL THREATS AND ATTACK SCENARIOS

Potential threats and attack scenarios typically derive from external communication and are therefore not the direct concern of the SOIS services, which make the assumption that the services operate within a safe and secure environment. It is assumed that all applications executing within the spacecraft have been thoroughly tested and cleared for use by the mission implementer. Confidentiality of applications can be provided by Application layer mechanisms or by specific implementation methods such as time and space partitioning. Such methods are outside the scope of SOIS.

B4 CONSEQUENCES OF NOT APPLYING SECURITY

The security services are outside the scope of this document and are expected to be applied at layers above or below those specified in this document. If confidentiality is not implemented, science data or other parameters transmitted within the spacecraft might be visible to other applications resident within the spacecraft, resulting in disclosure of sensitive or private information.

ANNEX C

INFORMATIVE REFERENCES

(INFORMATIVE)

[C1] *Spacecraft Onboard Interface Services*. Issue 2. Report Concerning Space Data System Standards (Green Book), CCSDS 850.0-G-2. Washington, D.C.: CCSDS, December 2013.

[C2] *The Application of CCSDS Protocols to Secure Systems*. Issue 2. Report Concerning Space Data System Standards (Green Book), CCSDS 350.0-G-2. Washington, D.C.: CCSDS, January 2006.

[C3] *Information Technology—Open Systems Interconnection—Basic Reference Model: The Basic Model*. 2nd ed. International Standard, ISO/IEC 7498-1:1994. Geneva: ISO, 1994.

[C4] *Spacecraft Onboard Interface Services—XML Specification for Electronic Data Sheets*. Issue 3. Draft Recommendation for Space Data System Standards (Red Book), CCSDS 876.0-R-3. Washington, D.C.: CCSDS, August 2018.

[C5] *Spacecraft Onboard Interface Services—Specification for Dictionary of Terms for Electronic Data Sheets*. Issue 2. Draft Recommendation for Space Data System Practices (Red Book), CCSDS 876.1-R-2. Washington, D.C.: CCSDS, June 2016.

[C6] *Electronic Data Sheets and Common Dictionary of Terms—Overview and Rationale*. Report Concerning Space Data System Standards. Forthcoming.

NOTE – Normative references are listed in 1.6.