BS ISO 18426:2013

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Space data and information transfer systems — Spacecraft Onboard Interface Services — Subnetwork Memory Access Service

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A list of organizations represented on this committee can be obtained on request to its secretary.

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INTERNATIONAL STANDARD

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Space data and information transfer systems — Spacecraft Onboard Interface Services — Subnetwork Memory Access Service

Systèmes de transfert des informations et données spatiales — Services d'interfaces à bord des véhicules spatiaux — Service d'accès à la mémoire par sous-réseau

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
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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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INTERNATIONAL STANDARD **ISO 18426:2013(E)**

Space data and information transfer systems — Spacecraft Onboard Interface Services — Subnetwork Memory Access Service

1 Scope

This International Standard is one of a family of documents specifying the SOIS-compliant services to be provided by onboard subnetworks.

The purpose of this International Standard is to define services and service interfaces provided by the SOIS Subnetwork Memory Access 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.

This International Standard conforms to the principles set out in the Spacecraft Onboard Interface Services Green Book and is intended to be applied together with it. The protocols which provide this service are to be documented for individual links, and this can be in the purview of individual missions, agencies, or CCSDS, depending on future circumstance.

The scope and field of application are furthermore detailed in subclause 1.2 of the enclosed CCSDS publication.

2 Requirements

Requirements are the technical recommendations made in the following publication (reproduced on the following pages), which is adopted as an International Standard:

CCSDS 852.0-M-1, December 2009, Spacecraft Onboard Interface Services — Subnetwork Memory Access Service.

For the purposes of international standardization, the modifications outlined below shall apply to the specific clauses and paragraphs of publication CCSDS 852.0-M-1.

Pages i to v

This part is information which is relevant to the CCSDS publication only.

3 Revision of publication CCSDS 852.0-M-1

It has been agreed with the Consultative Committee for Space Data Systems that Subcommittee ISO/TC 20/SC 13 will be consulted in the event of any revision or amendment of publication CCSDS 852.0-M-1. To this end, NASA will act as a liaison body between CCSDS and ISO.

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Recommendation for Space Data System Practices

SPACECRAFT ONBOARD INTERFACE SERVICES—SUBNETWORK MEMORY ACCESS SERVICE

RECOMMENDED PRACTICE

CCSDS 852.0-M-1

MAGENTA BOOK
December 2009

AUTHORITY

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This document has been approved for publication by the Management Council of the Consultative Committee for Space Data Systems (CCSDS) and represents the consensus technical agreement of the participating CCSDS Member Agencies. The procedure for review and authorization of CCSDS documents is detailed in the *Procedures Manual for the Consultative Committee for Space Data Systems*, and the record of Agency participation in the authorization of this document can be obtained from the CCSDS Secretariat at the address below.

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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 **Recommendations** and are not in themselves considered binding on any Agency.

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.

No later than five years from its date of issuance, this **Recommended Practice** 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 cancelled.

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

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 Memory Access 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 service to be used by space missions to directly access memory locations distributed over an onboard subnetwork. The SOIS Subnetwork Memory Access Service is a simple service which may be used to read from or write to memory locations or memory blocks held in data systems or in unsophisticated devices. The service interface is only present in the data system invoking the service. The SOIS Subnetwork Memory Access Service provides a common service interface regardless of the particular type of data link being used for communication.

Through the process of normal evolution, it is expected that expansion, deletion, or modification of this document may occur. This Recommended Practice is therefore subject to CCSDS document management and change control procedures, which are defined in the *Procedures Manual for the Consultative Committee for Space Data Systems*. 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 addressed to the CCSDS Secretariat at the address indicated on page i.

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

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DOCUMENT CONTROL

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CONTENTS

Section Page

1 INTRODUCTION 1-1

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT 1-1
1.2 APPLICABILITY 1-1
1.3 RATIONALE 1-1
1.4 DOCUMENT STRUCTURE 1-1
1.5 CONVENTIONS AND DEFINITIONS 1-2
1.6 DOCUMENT NOMENCLATURE 1-4
1.7 REFERENCES 1-4

2 OVERVIEW 2-1

2.1 FUNCTION 2-1
2.2 CONTEXT 2-1
2.3 ASSUMPTIONS 2-2
2.4 QUALITY OF SERVICE 2-2
2.5 SECURITY 2-3

3 SUBNETWORK MEMORY ACCESS SERVICE 3-1

3.1 SERVICE PARAMETERS 3-1
3.2 MEMORY ACCESS SERVICE PRIMITIVES 3-3

4 MANAGEMENT INFORMATION BASE 4-1

4.1 OVERVIEW 4-1
4.2 SPECIFICATIONS 4-1

5 SERVICE CONFORMANCE STATEMENT PROFORMA 5-1

ANNEX A INFORMATIVE REFERENCES A-1

Figure

1-1 Bit Numbering Convention 1-2
2-1 Subnetwork Memory Access Service Context 2-1

1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This document is one of a family of documents specifying the SOIS-compliant services to be provided by onboard subnetworks.

The purpose of this document is to define services and service interfaces provided by the SOIS Subnetwork Memory Access 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.

This document conforms to the principles set out in the Spacecraft Onboard Interface Services Green Book (reference [A1]) and is intended to be applied together with it. The protocols which provide this service are to be documented for individual links, and this can be in the purview of individual missions, agencies, or CCSDS, depending on future circumstance.

1.2 APPLICABILITY

This document applies to any mission or equipment claiming to provide a CCSDS SOIS-compliant Subnetwork Memory Access Service.

1.3 RATIONALE

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

1.4 DOCUMENT STRUCTURE

The document has five major sections:

- this section, containing administrative information, definitions and references;
- section 2, describing general concepts and assumptions;
- section 3, containing the Subnetwork Memory Access Service specification;
- section 4, containing the Management Information Base (MIB) for the service;
- section 5, comprising a Service Conformance Statement Proforma.

In addition, annex A 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, i.e., 'Bit 0' (see figure 1-1).

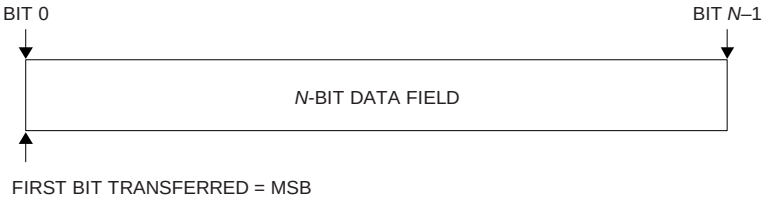

Figure 1-1: Bit Numbering Convention

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 an eight-bit word is called an 'octet'.

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 (OSI) Basic Reference Model

This document is defined using the style established by the Open Systems Interconnection (OSI) Basic Reference Model (reference [A3]). 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 [A3]:

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

memory access service access point (MASAP): the point at which SOIS Memory Access service is provided by a Memory Access service entity to a Memory Access service user entity.

memory access service access point address (MASAP Address): a Memory Access service address that is used to identify a single MASAP.

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

protocol ID: identifier which uniquely identifies a SOIS Subnetwork user within a data system.

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

subnetwork: an abstraction of a collection of equipment and physical media, such as a local area network or a data bus, which forms and autonomous whole and can be used to interconnect real systems for the purpose of data transfer.

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 subnetwork resources associated with a resource reservation.

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.

data system: addressable entity, situated in a subnet, which hosts an instance of the subnetwork protocols, subnetwork services, and subnetwork users.

NOTE – The subnetwork users are uniquely identifiable in a subnetwork by a combination of data system address and a protocol ID. A data system is typically a computer or a device.

data system address: identifier which uniquely identifies a data system in a subnetwork.

NOTE – The data system address can be referred to as a destination address or a source address depending on the context of its invocation at the subnetwork service interface.

octet: eight-bit word.

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

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

quality of service (QoS): ability of a communication system to provide predictable and differentiated services.

NOTE – Quality of service for a communication service can be characterised in terms of important features relevant to that communications service, for example: reliability, transmission rate, effective bandwidth and latency, error rate.

1.6 DOCUMENT NOMENCLATURE

The following conventions apply throughout this Recommended Practice:

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.

1.7 REFERENCES

The following documents contain provisions which, through reference in this text, constitute provisions of this Recommended Practice. At the time of publication, the editions indicated were valid. All documents are subject to revision, and users of this Recommended Practice are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below. The CCSDS Secretariat maintains a register of currently valid CCSDS Documents.

None.

NOTE – Informative references are contained in annex A.

2 OVERVIEW

2.1 FUNCTION

The SOIS Subnetwork Memory Access Service provides a means for a user entity to retrieve or change data located in memory hosted by a node on a data link/subnetwork.

2.2 CONTEXT

The SOIS Subnetwork Layer provides the Memory Access Service to user applications. The service can be provided over a variety of data links, and the method of such provision is not in the scope of this document.

As shown in figure 2-1**,** the service is one of a number of services which can be provided by the SOIS Subnetwork.

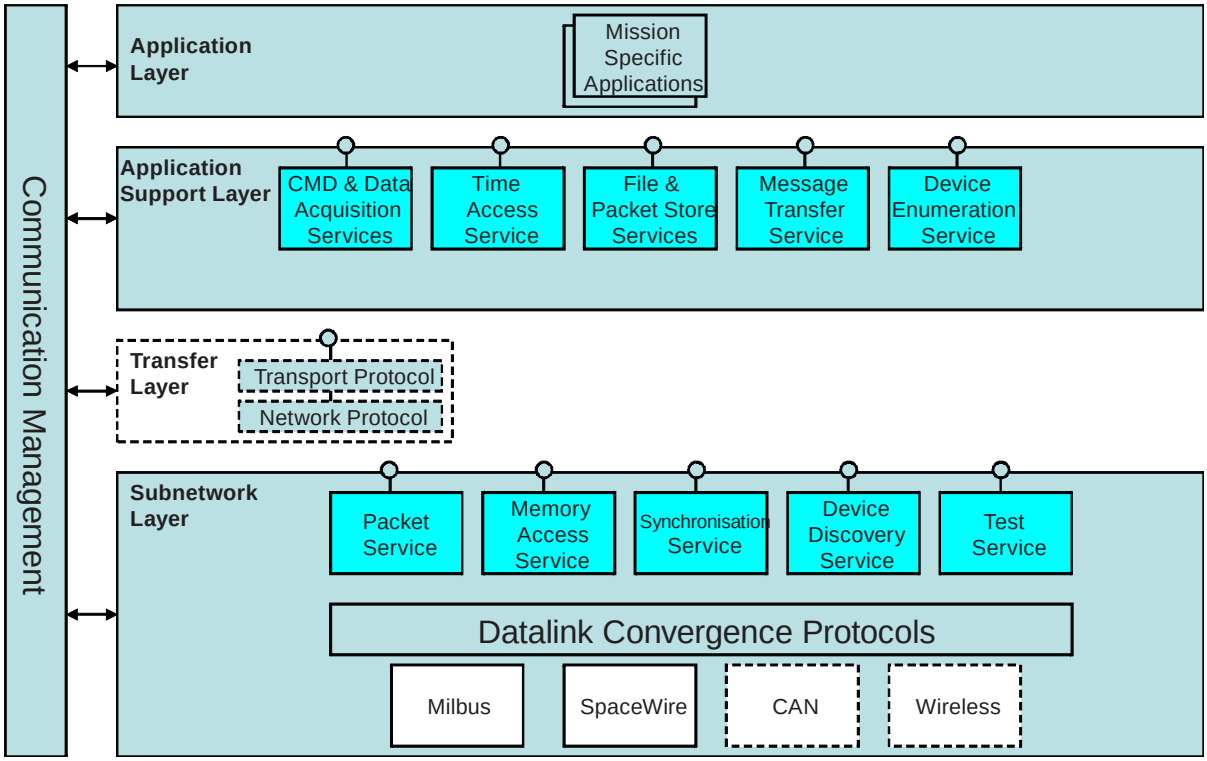

Figure 2-1: Subnetwork Memory Access Service Context

The Subnetwork Memory Access Service makes use of the data link to transfer data and control information. A variety of data links can be suited to provision of the service and the strategy for such service provision is outlined in reference [A1].

The Memory Access Service is provided only to the application entity invoking the service. The method of changing or retrieving the data in memory is data-link layer specific.

2.3 ASSUMPTIONS

The following assumptions have been made in designing the SOIS Subnetwork Memory Access Service:

- The SOIS Subnetwork Memory Access Service is provided across single subnetworks.
- The SOIS Subnetwork Memory Access Service is made available to protocol entities in the Transfer, Application Support, and User Application Layers.

2.4 QUALITY OF SERVICE

The quality of service aspects of the SOIS Subnetwork Memory Access Service are:

- Resource Reservation;
- Priority;
- Acknowledgement;
- Verification;
- Authorisation.

Resource Reservation uses a channel that defines the resources that are used to transmit the PDUs which provide the Memory Access Service. The channelisation is common across all SOIS subnetwork services. In the case of a READ operation, the channel specifies the reserved resources for the PDUs implementing the READ request as well as the return data product. Channel selection can be performed explicitly by the service user via a channel parameter in the service primitives or can be allocated by management on, for instance, a per-Memory Access Service Access Point (MASAP) basis.

A priority parameter is provided to signal the importance of the data to the service. Where Resource Reservation is invoked the priority level is interpreted within a channel.

Acknowledgement is invoked to request that the results of a remote memory access WRITE operation are acknowledged to the user entity.

Verification allows for data to be verified at the remote data system before being written to a remote memory location.

Authorisation ensures that the user entity has permission to access the remote memory location.

2.5 SECURITY

2.5.1 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 which 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.

2.5.2 SECURITY CONCERNS

The Memory Access service incorporates an authorisation facility. This protects specific memory locations from access by unauthorised users.

If confidentiality of data is required within a spacecraft it is assumed 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 [A2].

2.5.3 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.

2.5.4 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.

3 SUBNETWORK MEMORY ACCESS SERVICE

3.1 SERVICE PARAMETERS

3.1.1 GENERAL

The Subnetwork Memory Access Service shall use the parameters specified in 3.1.2 to 3.1.15.

3.1.2 MEMORY ACCESS SERVICE ACCESS POINT ADDRESS

The Memory Access Service Access Point (MASAP) Address shall identify the SAP Address that identifies the user entity that wishes to invoke the Memory Access Service.

3.1.3 DESTINATION ADDRESS

The Destination Address parameter shall define the data system where the memory is located.

NOTE – The Destination Address is a logical address which is local to the subnetwork.

3.1.4 TRANSACTION IDENTIFIER

The Transaction Identifier parameter shall be a value, assigned by the invoking user entity, which is subsequently used to associate indication primitives with the causal request primitives.

3.1.5 MEMORY ID

The Memory ID parameter shall identify a logical memory space containing the requested address(es).

NOTE – It can distinguish between, e.g., volatile, non-volatile and read-only memory areas or between memories connected to different processing elements.

3.1.6 START MEMORY ADDRESS

The Start Memory Address parameter shall define the start address at which the invoking entity requires to access memory for the purpose of changing or retrieving data.

3.1.7 SIZE

The Size parameter shall enumerate the amount of data to be changed or retrieved.

3.1.8 MASK

The Mask parameter shall indicate which data are to be changed and which are not be changed in a read/modify/write operation. The size of the Mask parameter is defined by the Size parameter.

3.1.9 DATA

The Data parameter shall provide the value(s) which is (are) required to be written to memory in a write operation or the returned value(s) of the data in response to a read operation.

3.1.10 CHANNEL

The Channel parameter shall fully specify an end-to-end resource reservation for a subnetwork communication, as follows:

a) For time division multiplexed (scheduled) systems, the Channel identifies a list of time slots that can be used to support transmission of the channel data.

b) For systems based on bandwidth reservation, the Channel identifies the percentage of subnetwork resources that can be used to support the transmission.

NOTE – The time-slot allocation or bandwidth reservation for each channel is defined by management parameters of the protocol providing the Memory Access Service.

3.1.11 PRIORITY

The Priority parameter shall be used as follows:

a) If resource reservation is not present, the Priority parameter indicates the importance of the data to the system.

b) Where Resource Reservation is invoked the priority level is interpreted within a channel.

3.1.12 ACKNOWLEDGE

The Acknowledge parameter shall be used to request that the outcome of the requested operation be acknowledged to the user entity.

3.1.13 AUTHORISATION

The Authorisation parameter shall be used to inform at the remote memory whether or not the user entity is authorised to perform the requested operation.

3.1.14 VERIFICATION

The Verification flag shall be used to request that data be first checked for errors in transmission before being written to memory.

3.1.15 RESULT METADATA

The Result Metadata parameter shall provide information generated by the Subnetwork Memory Access Service provider to the service invoking entity to provide information related to the successful or failed result of a memory access operation.

3.2 MEMORY ACCESS SERVICE PRIMITIVES

3.2.1 GENERAL

The SOIS Subnetwork Memory Access Service shall use the following five primitives:

a) READ.request (which requests the subnetwork service provider to retrieve the contest of memory), as specified in 3.2.2;

b) READ.indication (which returns the retrieved contents of memory), as specified in 3.2.3;

c) WRITE.request (which request the subnetwork service provider to change the contents of memory), as specified in 3.2.4;

d) READ/MODIFY/WRITE.request (which invokes an atomic Read/Modify/Write cycle at the remote memory), as specified in 3.2.5;

e) MEMORY_ACCESS_RESULT.indication (which informs a user of the result of a memory access operation), as specified in 3.2.6.

3.2.2 READ. REQUEST

3.2.2.1 Function

The READ.request primitive shall be used to request the service to retrieve the contents of memory from specific locations(s) in a specific memory resident at a specific subnetwork location.

3.2.2.2 Semantics

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

> **READ.request** (MASAP Address, Destination Address, Transaction ID, Memory ID, Start Memory Address, Size, Priority, Channel, Authorisation (optional))

3.2.2.3 When Generated

The **READ.request** primitive shall be passed to the SOIS Subnetwork Memory Access Service provider to request that memory data be retrieved.

3.2.2.4 Effect on Receipt

Receipt of the **READ.request** primitive shall cause the SOIS Subnetwork service provider to retrieve the memory data.

3.2.2.5 Additional Comments

a) The MASAP Address parameter shall identify the invoking user entity.

b) The Destination Address parameter shall identify the data system where the memory is located.

c) The Transaction ID parameter shall be assigned by the invoking user identity.

d) The Memory ID parameter shall identify the memory to be accessed at the destination node.

e) The Start Memory Address parameter shall identify the start address, in the memory, of the requested data.

f) The Size parameter shall indicate the amount of requested data.

g) The Priority parameter shall indicate, when resource reservation is not invoked, the level of precedence to be given to the returned data compared to other PDUs on the subnetwork.

   NOTE – It is not used when Resource Reservation is invoked.

h) The Channel parameter shall provide the identifier of the set of reserved resources that are to be used for the request when Resource Reservation is invoked.

i) The Authorisation value parameter shall provide a key to be checked at the remote memory to determine whether the user entity is authorised to perform the operation, such that if authentication fails then data will not be returned and the failure will be notified via the Result Metadata parameter in the READ.indication.

3.2.3 READ.INDICATION

3.2.3.1 Function

The **READ.indication** shall be used to pass the retrieved memory data to the user entity.

3.2.3.2 Semantics

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

> **READ.indication** (MASAP Address, Destination Address, Transaction ID, Memory ID, Start Memory Address, Size, Priority, Channel, Data, Result Metadata)

3.2.3.3 When Generated

The **READ.indication** primitive shall be issued by the service provider to the receiving application on receipt of a PDU (or set of PDUs) containing the memory data.

3.2.3.4 Effect on Receipt

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

3.2.3.5 Additional Comments

a) The MASAP Address parameter shall identify the user entity receiving the memory data.

b) The Destination Address parameter shall identify the data system where the memory, from which the data was retrieved, is located.

c) The Transaction ID parameter shall have the same value is that passed in the invoking request primitive.

d) The Memory ID parameter shall identify the memory which was accessed at the destination node.

e) The Start Memory Address parameter shall identify the start address, in the memory, of the requested data.

f) The Size parameter shall indicate the amount of retrieved data.

g) The Priority or Channel parameters shall be passed to define the Priority or Channel in which sequence preservation is provided.

h) The Data parameter shall provide the data which was located at the requested memory addresses, being invalid or null in the case of a failed read request.

i) The Result Metadata parameter shall provide information about the success or failure of the requested read or read/modify/write operation.

3.2.4 WRITE. REQUEST

3.2.4.1 Function

The **WRITE.request** primitive shall be used to request the service to change the contents of memory at specific location(s) in a specific memory resident at a specific subnetwork location.

3.2.4.2 Semantics

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

> **WRITE.request** (MASAP Address, Destination Address, Transaction ID, Memory ID, Start Memory Address, Size, Priority, Channel, Data, Acknowledge (optional), Authorisation (optional), Verification (optional))

3.2.4.3 When Generated

The **WRITE.request** primitive shall be passed to the SOIS Subnetwork Memory Access Service provider to request that data in memory be changed.

3.2.4.4 Effect on Receipt

Receipt of the **WRITE.request** primitive shall cause the SOIS Subnetwork service provider to change the data located in the specified memory location(s).

3.2.4.5 Additional Comments

a) For security and network integrity reasons, the mission designer may chose not to allow certain data systems to have access to the **WRITE.request** primitive.

b) The Destination Address parameter shall identify the data system where the memory, where the data is to be changed, is located.

c) The Transaction ID parameter shall be assigned by the invoking user identity.

d) The MASAP Address parameter shall identify the invoking user entity.

e) The Memory ID parameter shall identify the memory which is to be accessed at the destination data system.

f) The Start Memory Address parameter shall identify the start address, in the memory, of the data to be changed.

g) The Size parameter shall indicate the amount of data to be written.

h) The Priority parameter shall indicate, if resource reservation is not invoked, the level of precedence to be given to the data compared to other PDUs on the subnetwork.

NOTE – It is not used when resource reservation is invoked.

i) The Channel parameter shall provide the identifier of the set of reserved resources that are to be used to send the data and to return any acknowledgment when resource reservation is invoked.

j) The Data parameter shall provide the data which is to be inserted into the requested memory addresses.

k) The Acknowledge parameter shall be used to request that the outcome of the operation be acknowledged via a **MEMORY_ACCESS_RESULT.indication** primitive to the user entity.

l) The Authorisation value parameter shall provide a key to be checked at the remote memory to determine whether the user entity is authorised to perform the operation.

m) The Verification flag shall be used to request that the integrity of the data be checked before being written to memory.

3.2.5 READ/MODIFY/WRITE. REQUEST

3.2.5.1 Function

The **READ/MODIFY/WRITE.request** primitive shall be used to request the service to retrieve the contents of memory from specific locations(s) in a specific memory resident at a specific subnetwork location and to modify that data whilst blocking attempts by other entities to modify it.

NOTE – It provides an atomic operation.

3.2.5.2 Semantics

The **READ/MODIFY/WRITE.request** primitive shall use the following semantics, with the meaning of the parameters specified in 3.2.5.5:

> **READ/MODIFY/WRITE.request** (MASAP Address, Destination Address, Transaction ID, Memory ID, Memory Address, Size, Mask, Priority, Channel, Data, Acknowledge (optional), Authentication (optional), Verification (optional))

3.2.5.3 When Generated

The **READ/MODIFY/WRITE.request** primitive shall be passed to the SOIS Subnetwork Memory Access Service provider to request that an atomic read/modify/write operation be performed at the memory address.

3.2.5.4 Effect on Receipt

a) Receipt of the **READ/MODIFY/WRITE.request** primitive shall cause the SOIS Subnetwork service provider at the Destination Address to retrieve the values of the memory data specified by the Memory ID, Memory Address, and Size, and to replace the data bits in this range identified by bits set to true in the Mask with the corresponding bits in the Data field, in such a way that the resulting memory in the destination system corresponds to the following sequence of operations (where DM is the Data Memory):

DM_after = (DM_before AND (NOT Mask)) OR (Data AND Mask)

NOTE – The value DM_before is returned to the MASAP via a **READ.indication**.

b) The SOIS Subnetwork service shall ensure that the read, modify, and write operations are completed atomically.

3.2.5.5 Additional Comments

a) The MASAP Address parameter shall identify the invoking user entity.

b) The Destination Address parameter shall identify the data system where the memory is located.

c) The Transaction ID parameter shall be assigned by the invoking user identity.

d) The Memory ID parameter shall identify the memory to be accessed at the destination node.

e) The Start Memory Address parameter shall identify the start address, in the memory, of the requested data.

f) The Size parameter shall indicate the amount of data to be written.

g) The Mask parameter shall indicate which data is to be modified as specified in 3.2.5.4 a).

h) The Priority parameter shall indicate, if resource reservation is not invoked, the level of precedence to be given to the data compared to other PDUs on the subnetwork.

NOTE – It is not used when Resource Reservation is invoked.

i) The Channel parameter shall provide the identifier of the set of reserved resources that are to be used to send the data when Resource Reservation is invoked.

j) The Data parameter shall provide the data to be inserted into the requested memory addresses.

k) The Acknowledge parameter shall be used to request that the outcome of the operation be acknowledged via a MEMORY_ACCESS_RESULT.indication primitive to the user entity.

l) The Authentication parameter shall provide a key to be checked at the remote memory to determine whether the user entity is authorised to perform the operation.

m) The Verification flag shall be used to request that the integrity of the data be checked before being written to memory.

3.2.6 MEMORY_ACCESS_RESULT.INDICATION

3.2.6.1 Function

The **MEMORY_ACCESS_RESULT.indication** primitive shall be used to return the result of a memory write or read/modify/write operation to the user entity which invoked a request with the acknowledge parameter set to true.

3.2.6.2 Semantics

The **MEMORY_ACCESS_RESULT.indication** primitive shall use the following semantics, with the meaning of the parameters specified in 3.2.6.5:

> **MEMORY_ACCESS_**R**ESULT.indication** (MASAP Address, Destination Address, Transaction ID, Memory ID, Start Memory Address, Size, Result Metadata)

3.2.6.3 When Generated

The **MEMORY_ACCESS_RESULT.indication** primitive shall be issued by the service provider to the service user as a result of an acknowledgement having been requested in a **WRITE.request** or **READ/MODIFY/WRITE.request** primitive.

3.2.6.4 Effect on Receipt

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

3.2.6.5 Additional Comments

a) The MASAP Address parameter shall identify the user entity receiving the memory data.

b) The Destination Address parameter shall identify the data system where the memory, from which the data was retrieved, is located.

c) The Transaction id parameter shall have the same value is that passed in the invoking request primitive.

d) The Memory ID parameter shall identify the memory which was accessed at the destination node.

e) The Start Memory Address parameter shall identify the start address, in the memory, of the requested data.

f) The Size parameter shall indicate the amount of retrieved data.

g) The Result Metadata parameter shall provide information about the success or failure of the requested write operation.

4 MANAGEMENT INFORMATION BASE

4.1 OVERVIEW

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.

4.3 MIB GUIDANCE

The MIB of the protocol providing the Memory Access service should consider the following aspects:

- allowable priority levels per MASAP Address;
- allowable channelisation per MASAP Address;
- allowable priorities per channel;
- resource allocation per channel;
- Result Metadata semantics;
- managed allocation of MASAP Addresses to:
  - priority,
  - channel,
  - service class.

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

5 SERVICE CONFORMANCE STATEMENT PROFORMA

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.

Service Conformance Statement SOIS Subnetwork Memory access Service

Implementation Information

Protocol Specification Identification	
Version	
Underlying Data Link	

Mandatory Features

READ.request	√
READ.indication	√

Optional Features

WRITE.request	
READ/MODIFY/WRITE.request	
MEMORY_ACCESS_RESULT.indication	
Acknowledgement	
Authentication	
Verification	
Resource Reservation	
Priority	

Other Information

Priority Levels	
Channelisation	
Result Metadata	

ANNEX A

INFORMATIVE REFERENCES

[A1] *Spacecraft Onboard Interface Services*. Report Concerning Space Data System Standards, CCSDS 850.0-G-1. Green Book. Issue 1. Washington, D.C.: CCSDS, June 2007.

[A2] *The Application of CCSDS Protocols to Secure Systems*. Report Concerning Space Data System Standards, CCSDS 350.0-G-2. Green Book. Issue 2. Washington, D.C.: CCSDS, January 2006.

[A3] *Information Technology—Open Systems Interconnection—Basic Reference Model: The Basic Model*. International Standard, ISO/IEC 7498-1:1994. 2nd ed. Geneva: ISO, 1994.

NOTE – Normative references are listed in 1.7.

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