BS ISO 20107:2015

BSI Standards Publication

Space data and information transfer systems — Spacecraft onboard interface services — Device virtualization service

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of ISO 20107:2015.

The UK participation in its preparation was entrusted to Technical Committee ACE/68, Space systems and operations.

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

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2015

ISBN 978 0 580 87575 5

ICS 49.140

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2015.

Amendments/corrigenda issued since publication

Date	Text affected

INTERNATIONAL STANDARD

ISO 20107

First edition
2015-08-15

Space data and information transfer systems — Spacecraft onboard interface services — Device virtualization service

Systèmes de transfert des informations et données spatiales — Services d'interfaces à bord des véhicules spatiaux — Service de virtualisation des périphériques

Reference number
ISO 20107:2015(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 20107 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 871.2-M-1, March 2014) 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*.

The Consultative Committee for Space Data Systems

Recommendation for Space Data System Practices

SPACECRAFT ONBOARD INTERFACE SERVICES— DEVICE VIRTUALIZATION SERVICE

RECOMMENDED PRACTICE

CCSDS 871.2-M-1

MAGENTA BOOK
March 2014

AUTHORITY

Issue:	Magenta Book, Issue 1
Date:	March 2014
Location:	Washington, DC, USA

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 *Organization and Processes 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.

This document is published and maintained by:

CCSDS Secretariat
Space Communications and Navigation Office, 7L70
Space Operations Mission Directorate
NASA Headquarters
Washington, DC 20546-0001, USA

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 three 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 canceled.

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 Device Virtualisation 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 access and manage files and packets within a spacecraft subnetwork. The Device Virtualisation Service provides a common service interface regardless of the particular type of data link or protocol 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 *Organization and Processes for the Consultative Committee for Space Data Systems* (CCSDS A02.1-Y-3). 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:

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.
- European Space Agency (ESA)/Europe.
- Federal Space Agency (FSA)/Russian Federation.
- Instituto Nacional de Pesquisas Espaciais (INPE)/Brazil.
- Japan Aerospace Exploration Agency (JAXA)/Japan.
- National Aeronautics and Space Administration (NASA)/USA.
- UK Space Agency/United Kingdom.

Observer Agencies

- Austrian Space Agency (ASA)/Austria.
- Belgian Federal Science Policy Office (BFSPO)/Belgium.
- Central Research Institute of Machine Building (TsNIIMash)/Russian Federation.
- China Satellite Launch and Tracking Control General, Beijing Institute of Tracking and Telecommunications Technology (CLTC/BITTT)/China.
- Chinese Academy of Sciences (CAS)/China.
- Chinese Academy of Space Technology (CAST)/China.
- Commonwealth Scientific and Industrial Research Organization (CSIRO)/Australia.
- Danish National Space Center (DNSC)/Denmark.
- Departamento de Ciência e Tecnologia Aeroespacial (DCTA)/Brazil.
- European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)/Europe.
- European Telecommunications Satellite Organization (EUTELSAT)/Europe.
- Geo-Informatics and Space Technology Development Agency (GISTDA)/Thailand.
- Hellenic National Space Committee (HNSC)/Greece.
- Indian Space Research Organization (ISRO)/India.
- Institute of Space Research (IKI)/Russian Federation.
- KFKI Research Institute for Particle & Nuclear Physics (KFKI)/Hungary.
- Korea Aerospace Research Institute (KARI)/Korea.
- Ministry of Communications (MOC)/Israel.
- National Institute of Information and Communications Technology (NICT)/Japan.
- National Oceanic and Atmospheric Administration (NOAA)/USA.
- National Space Agency of the Republic of Kazakhstan (NSARK)/Kazakhstan.
- National Space Organization (NSPO)/Chinese Taipei.
- Naval Center for Space Technology (NCST)/USA.
- Scientific and Technological Research Council of Turkey (TUBITAK)/Turkey.
- South African National Space Agency (SANSA)/Republic of South Africa.
- Space and Upper Atmosphere Research Commission (SUPARCO)/Pakistan.
- Swedish Space Corporation (SSC)/Sweden.
- Swiss Space Office (SSO)/Switzerland.
- United States Geological Survey (USGS)/USA.

DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 871.2-M-1	Spacecraft Onboard Interface Services—Device Virtualization Service, Recommended Practice, Issue 1	March 2014	Original issue

CONTENTS

1 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This document is one of a family of documents specifying the Spacecraft Onboard Interface Services (SOIS)-compliant service to be provided in support of applications.

This document defines the SOIS Device Virtualisation Service (DVS). The definition encompasses specification of the service interface exposed to onboard software (user applications and libraries) as well as the conceptual mapping of the DVS primitives to the protocols implementing such services.

The SOIS DVS is for use by onboard software to provide a standard interface between onboard software applications and flight hardware such as sensors and actuators.

1.2 APPLICABILITY

This document applies to any mission or equipment claiming to provide a CCSDS SOIS-compatible DVS.

1.3 RATIONALE

SOIS provide service interface specifications in order to promote commonality of functionality amongst systems implementing well-defined services. These interfaces do not dictate implementation of interfaces or protocols supporting the services.

1.4 DOCUMENT STRUCTURE

This document has four major sections:

– this section, containing administrative information, definitions, and references;

– section 2, containing general concepts and assumptions;

– section 3, containing the Device Virtualisation Service, in terms of the service provided, services expected from underlying layers, and the service interface;

– section 4, containing the Management Information Base (MIB) for this service.

In addition, one normative and three informative annexes are provided:

– annex A, comprising a Protocol Implementation Conformance Statement Proforma;

– annex B, discussing security considerations relating to the specifications of this document;

– annex C, containing a list of acronyms;

– annex D, containing a list of informative references.

1.5 CONVENTIONS AND DEFINITIONS

1.5.1 DEFINITIONS

1.5.1.1 General

For the purpose of this document the following definitions apply.

1.5.1.2 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 [D2]). 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 [D2]:

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

service: Capability of a layer, and the layers beneath it (service providers), provided to the service users at the boundary between the service providers and the service users.

1.5.2 TERMS DEFINED IN THIS RECOMMENDED PRACTICE

For the purposes of this Recommended Practice, the following definitions also apply.

application: Any component of the onboard software that makes use of the Device Virtualisation Service. This includes flight software applications and higher-layer services.

NOTE – Such components include flight software applications and higher-layer services.

device: Real hardware component of the spacecraft or a single register within such a component.

NOTE – Examples of such components are sensors and actuators.

timestamp: Time associated with a value.

NOTES

1 The format of a timestamp is implementation-specific.

2 The timestamp may indicate the time the value was generated by the device, emitted by the device or acquired by the service. This is implementation-specific.

value: Formatted atomic unit of data that is acquired from or used as a command to a device.

value identifier: Abstract identification of a value.

NOTE – The format of a value identifier is implementation-specific.

Virtual Device Identifier: Abstract identification of a device.

NOTE – The format of a Virtual Device Identifier is implementation-specific.

1.6 NOMENCLATURE

1.6.1 NORMATIVE TEXT

The following conventions apply for the normative specifications in 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.

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

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

[1] *Spacecraft Onboard Interface Services—Device Access Service*. Issue 1. Recommendation for Space Data System Practices (Magenta Book), CCSDS 871.0-M-1. Washington, D.C.: CCSDS, March 2013.

NOTE – Informative references are contained in annex D.

2 OVERVIEW

2.1 CONTEXT

The SOIS Device Virtualisation Service is defined within the context of the overall SOIS architecture (reference [D3]) as one of the Command and Data Acquisition services of the Application Support Layer, as illustrated in figure 2-1.

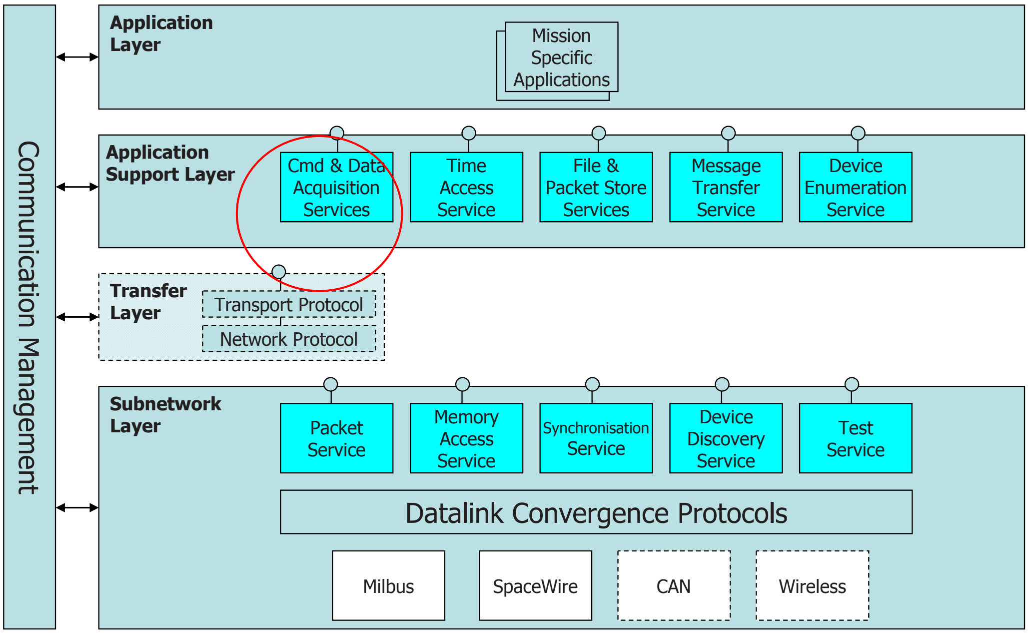

Figure 2-1: Command and Data Acquisition Services Context

The relationship between the DVS and the other Command and Data Acquisition services is illustrated in figure 2-2.

The DVS provides applications with functional interfaces to devices, abstracted from the protocols used for accessing the devices and the data encodings used in those protocols. This is in contrast to the Device Access Service (DAS) that provides applications with raw interfaces to devices, only abstracted from the subnetwork protocols used for exchanging data with the devices.

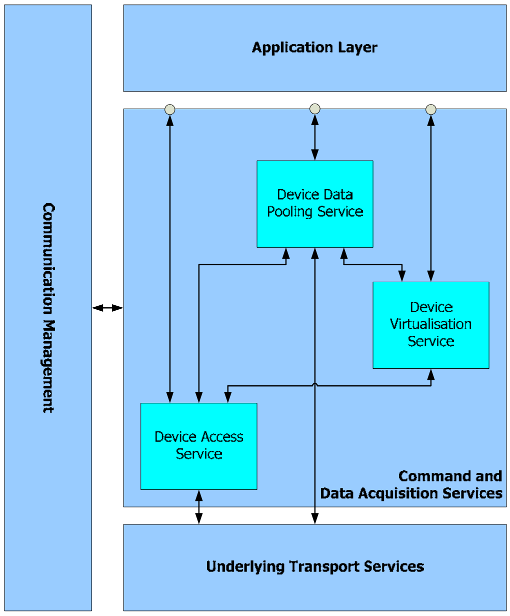

Figure 2-2: Relationship between Command and Data Acquisition Services

2.2 DEVICE TYPES AND FUNCTIONAL INTERFACES

2.2.1 GENERAL

In the DVS, physical devices are characterised by the *functional interfaces* they provide to applications, each of which has a defined set of value identifiers which may be used to command or acquire data from the device. Data value types may be simple, such as integer value, or they may be complex, structured types. In this way, each functional interface effectively defines a virtual image which may be used to access a device. Different physical devices are known as *device types*; for each device type the service will provide one or more functional interfaces. In this way, a device type is abstracted into a generic, virtual image.

2.2.2 VALUE TYPES

Each value in a functional interface has associated syntactic, e.g., data type, and semantic, e.g., measurement unit and instance, information. This information is necessary to allow the application/application developer to format commands and interpret acquired data. Whilst this information is part of a device's functional interface, it is implicit in the abstract service interface specified in this Recommended Practice and associated through the value identifier.

An implementation may resolve the syntactic information into explicit programming language data types, e.g., in ANSI C use of a 32-bit unsigned integer for the value, with APIs for each data type or run-time polymorphism/type casts.

An implementation may also resolve the semantic information into explicit programming language data types, e.g., in ANSI C two separately named type definitions, both of a 32-bit unsigned integer, but representing different values. Further, the semantic information can be resolved into a set of named values for a value with a discrete set of data values, e.g., ANSI C constants.

Such syntactic and semantic information on a value can be catalogued in paper or electronic form, e.g., an Interface Control Document or an Electronic Data Sheet, and be made available at design- and development-time to the application developer. It is possible that this can also be made available at runtime for generic, data-driven applications.

2.2.3 DEVICE ACCESS CONTROL PROCEDURE

The DVS is responsible for translating the required behaviour at the functional interface to that provided by the underlying service, which is likely to be specific to the device type. The underlying service is expected to offer one or more interfaces which provide direct access to the device functions in a manner specific to the device type. As indicated in figure 2-2, it is expected that the DVS will use the Device Access Service (DAS) (reference [1]) as its underlying service. The sequence of underlying service operations necessary to provide the behaviour expected of a particular generic interface is referred to as the Device Abstraction Control Procedure (DACP).

The DACP may consist of multiple commands and data acquisitions using DAS to provide individual functions of the functional interface. Conversely, should the functional interface of a device be directly supported by the device, the DACP can be null. As an intermediate, the DACP may simply provide conversions between device-specific value encodings and standardised engineering units, e.g., SI.

2.2.4 STANDARDISATION AND EXTENSIBILITY

The DVS is designed to be extensible through the use of generic (i.e., standard) and device-specific (i.e., non-standard) device functional interfaces:

– A new generic device functional interface may be defined for a class of devices, e.g., star trackers or reaction wheels, which may then be provided by a virtual device.

– A new device-specific device functional interface may be defined, especially for a given device type, which may then be provided by a virtual device. This technique can permit a virtual device to expose features specific to a device type in a more generic way (e.g., using standard engineering units), e.g., converting the current measured through a thermistor to the calibrated temperature in degrees Celsius.

– A generic or device-specific device functional interface may be extended through the addition of value identifiers to generate a more specialised interface which is still compatible with the interface being extended, e.g., a particular star tracker that supports the generic functional interface but has additional device-specific functions.

– Finally, a virtual device may provide multiple device functional interfaces, permitting groups of generic or device-specific device functional interfaces to be combined, e.g., a particular star tracker may also support a camera function so that it supports both the star tracker and the camera generic functional interfaces.

Together, this provides a *flexible* and *extensible framework* for accessing the functions of device classes and types. This is analogous to class and interface hierarchies and inheritance from the object-oriented design paradigm of software engineering.

Generic functional interface standardisation is outside the scope of this Recommended Practice. A library of generic functional interfaces will be maintained outside this document, supported by a Common Dictionary of Terms, i.e., standardised syntactic and semantic value information.

2.3 PURPOSE AND OPERATION OF THE DEVICE VIRTUALISATION SERVICE

The DVS provides a consistent, standard interface to onboard software; the interfaces are described by sets of primitives and related parameters.

From the application software perspective, use of the DVS will result in onboard software that is more portable, easier to develop, and more tolerant to changes in the spacecraft hardware configuration.

From the spacecraft platform implementers’ perspective, use of the DVS will make it easier to control the access to shared hardware resources.

The DVS is operated using service requests and service indications passed between the service user and the service provider.

3 SERVICE DEFINITION

3.1 PROVIDED SERVICE

3.1.1 GENERAL

3.1.1.1 The DVS shall enable a user entity to access (i.e., commanding of and acquiring data from) a device on demand, regardless of its location, using a virtual logical identifier to identify the device and a logical identifier to identify the value.

3.1.1.2 The service shall map information associated with the request onto the parameters of the underlying service access point.

NOTE – E.g., the necessary parameters for the DAS, as specified in reference [1].

3.1.2 DATA ACQUISITION

3.1.2.1 For data acquisition, the service shall take the appropriate action to acquire the value from the specified device and return it to the application.

3.1.2.2 The format of the value acquired from the device shall be preserved regardless of any encapsulation.

NOTE – In order to transfer this value from a remotely located device, the value may be encapsulated within another data structure, e.g., to be transferred across an underlying bus.

3.1.3 COMMANDING (OPTIONAL)

3.1.3.1 For commanding, the value to be sent to the specified device is provided as a parameter by the application, and the service shall preserve the format of this data so that it is received by the device exactly as it is provided.

NOTE – In order to transfer this value to a remotely located device, the value may be encapsulated within another data structure, e.g., to be transferred across an underlying bus.

3.1.3.2 In the cases where a command operation on a device elicits a response from the device, the response value shall be returned to the application.

3.2 EXPECTED SERVICES FROM UNDERLYING LAYERS

The service that the DVS expects from the underlying services is the DAS, as specified in reference [1], to obtain access to the physical device.

3.3 SERVICE PARAMETERS

3.3.1 GENERAL

The DVS shall use the parameters specified in 3.3.2 through 3.3.7.

3.3.2 TRANSACTION IDENTIFIER

3.3.2.1 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.

NOTE – The user entity is thus able to correlate all indications and confirmations with the originating service request.

3.3.2.2 Transaction Identifier shall be unique within the user application entity.

3.3.3 RESULT METADATA

The Result Metadata parameter shall be used to provide information generated by the DVS provider to the service invoking entity to provide information related to the successful or failed result of a device access operation.

NOTE – The parameter can also include other information indicating failure conditions, e.g., that the specified request could not be serviced within the managed timeout period or the DVS is not functioning correctly.

3.3.4 VIRTUAL DEVICE IDENTIFIER

The Virtual Device Identifier parameter shall be used to logically identify a device from which data is to be acquired or to which a command is to be sent.

3.3.5 VALUE IDENTIFIER

3.3.5.1 The Value Identifier parameter shall be used to logically identify a value to be acquired from the device or a command value to be sent to the device.

3.3.5.2 The set of valid Value Identifiers for a device shall be the union of the sets of Value Identifiers contained in all the interfaces provided by the device.

3.3.5.3 The Value Identifier shall identify the type of the corresponding value which may be a complex, structured type.

3.3.5.4 The Value Identifier shall identify the engineering units of the corresponding value (if applicable).

3.3.5.5 The Value Identifier shall identify the semantic meaning of the corresponding value.

3.3.6 VALUE

The Value parameter shall be used to state the value acquired from or previously asynchronously emitted by the device, or the command value that is to be sent to the device. The value shall be of the type identified by the corresponding Value Identifier, which may be a complex, structured type.

3.3.7 TIMESTAMP

3.3.7.1 The timestamp parameter shall be used to indicate a time associated with a value.

3.3.7.2 The timestamp may indicate the time the value was generated by the device, emitted by the device, or acquired by the service. This is implementation-specific.

3.4 DEVICE VIRTUALISATION SERVICE PRIMITIVES

3.4.1 GENERAL

3.4.1.1 The DVS interface shall implement the following primitives:

a) ACQUIRE_FROM_DEVICE.request, as specified in 3.4.2.

b) ACQUIRE_FROM_DEVICE.indication, as specified in 3.4.3.

3.4.1.2 Optionally, the DVS interface may implement the following primitives:

a) COMMAND_DEVICE.request, as specified in 3.4.4.

b) COMMAND_DEVICE.indication, as specified in 3.4.5.

3.4.2 ACQUIRE_FROM_DEVICE.REQUEST

3.4.2.1 Function

The **ACQUIRE_FROM_DEVICE.request** primitive shall be passed to the SOIS DVS provider to request that a data value be acquired from a device.

3.4.2.2 Semantics

The **ACQUIRE_FROM_DEVICE.request** primitive shall use the following semantics, with the meaning of the parameters specified in 3.3.

ACQUIRE_FROM_DEVICE.request (Transaction Identifier,
Virtual Device Identifier, Value Identifier)

3.4.2.3 When Generated

The **ACQUIRE_FROM_DEVICE.request** primitive shall be passed to the SOIS DVS provider to request that a data value be acquired from a device.

3.4.2.4 Effect on Receipt

3.4.2.4.1 Receipt of the **ACQUIRE_FROM_DEVICE.request** primitive shall cause the SOIS DVS provider to acquire a data value from a device.

3.4.2.4.2 Depending upon the nature of the device, the data value acquired shall be either a value directly acquired from the device or the value most recently asynchronously emitted by the device.

3.4.3 ACQUIRE_FROM_DEVICE.INDICATION

3.4.3.1 Function

The **ACQUIRE_FROM_DEVICE.indication** primitive shall be used to pass the acquired data to the user entity.

3.4.3.2 Semantics

The **ACQUIRE_FROM_DEVICE.indication** primitive shall use the following semantics, with the meaning of the parameters specified in 3.3.

ACQUIRE_FROM_DEVICE.indication (Transaction Identifier, Value, Result Metadata, Timestamp (optional))

3.4.3.3 When Generated

3.4.3.3.1 The **ACQUIRE_FROM_DEVICE.indication** primitive shall be issued by the service provider to the receiving user entity in response to an ACQUIRE_FROM_DEVICE.request.

NOTE – This primitive:

- contains the value directly acquired from or, where an asynchronously emitted value is requested, the value previously emitted by the device, and
- provides metadata concerning whether the request was executed successfully or not.

3.4.3.3.2 Optionally, the **ACQUIRE_FROM_DEVICE.indication** primitive may be issued by the service provider to the receiving user entity in response to an asynchronously emitted value received by the DVS.

3.4.3.4 Effect on Receipt

The response of the user entity to an **ACQUIRE_FROM_DEVICE.indication** primitive is unspecified.

3.4.4 COMMAND_DEVICE.REQUEST

3.4.4.1 Function

The **COMMAND_DEVICE.request** primitive shall be used to request the service to command a device.

3.4.4.2 Semantics

The **COMMAND_DEVICE.request** primitive shall use the following semantics, with the meaning of the parameters specified in 3.3.

COMMAND_DEVICE.request (Transaction Identifier, Virtual Device Identifier, Value Identifier, Value)

3.4.4.3 When Generated

The **COMMAND_DEVICE.request** primitive shall be passed to the SOIS DVS provider to request that a command value be sent to a device.

3.4.4.4 Effect on Receipt

Receipt of the **COMMAND_DEVICE.request** primitive shall cause the SOIS DVS provider to send a command value to the device.

3.4.5 COMMAND_DEVICE.INDICATION

3.4.5.1 Function

The **COMMAND_DEVICE.indication** primitive shall be used to pass the response to a command to a device to the user entity.

3.4.5.2 Semantics

The **COMMAND_DEVICE.indication** primitive shall use the following semantics, with the meaning of the parameters specified in 3.3.

COMMAND_DEVICE.indication (Transaction Identifier, Result Metadata)

3.4.5.3 When Generated

The **COMMAND_DEVICE.indication** primitive shall be issued by the service provider to the receiving user entity in response to a COMMAND_DEVICE.request.

3.4.5.4 Effect on Receipt

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

3.4.5.5 Discussion

The Result Metadata parameter can also contain other information indicating failure conditions such as Device or Value Identifier resolution failure or an inability to write to the device. It may also contain ancillary information that is returned by the device in response to the command.

Not all devices will produce a response when a command value is sent to them. As specified in section 4, the Device and Value Identifier Resolution Table indicate to the service whether a specific device will generate a response or not. Where a device does not generate a response, a COMMAND_DEVICE.indication can indicate only that the command was successfully sent or that there was an error at the sending side; there can be no indication of whether the command was received by the device or successfully acted upon.

4 MANAGEMENT INFORMATION BASE

4.1 OVERVIEW

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

4.2 SPECIFICATIONS

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

4.3 MIB GUIDANCE

The MIB of the protocol providing the DVS should consider the following aspects:

Device and Value Identifier Resolution Table, as specified in 4.4.

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

4.4 DEVICE AND VALUE IDENTIFIER RESOLUTION TABLE

4.4.1 The **Device and Value Identifier Resolution Table** shall contain a set of managed parameters that map logical device and value identifiers onto individual underlying services and their associated available addressing mechanisms.

4.4.2 The table specified in 4.4.1 should indicate to the service whether or not a specific device will generate a response.

4.4.3 Any entity managing the service should be able to:

a) access the table specified in 4.4.1; and

b) update it to reflect changes in the flight hardware configuration and relocation of devices.

NOTE – Whether the Device and Value Identifier Resolution Table can be updated dynamically during service operation is not specified here. This question is an implementation issue to be decided according to the needs of the particular mission for which the service implementation is being developed.

ANNEX A

DEVICE VIRTUALIZATION SERVICE PROTOCOL IMPLEMENTATION CONFORMANCE STATEMENT PROFORMA

(NORMATIVE)

A1 INTRODUCTION

This annex provides the Protocol Implementation Conformance Statement (PICS) Requirements List (RL) for implementation of the DVS, CCSDS 871.2-M-1, March 2014. The PICS for an implementation is generated by completing the RL in accordance with the instructions below. An implementation shall satisfy the mandatory conformance requirements of the base standards referenced in the RL.

The RL in this annex is blank. An implementation's complete RL is called a PICS. The PICS states which capabilities and options of the services have been implemented. The following can use the PICS:

– The service implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight;

– The supplier and acquirer or potential acquirer of the implementation, as a detailed indication of the capabilities of the implementation, stated relative to the common basis for understanding provided by the standard PICS proforma;

– The user or potential user of the implementation, as a basis for initially checking the possibility of interoperability with another implementation;

– A service tester, as a basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A2 NOTATION

The following are used in the RL to indicate the status of features:

<u>Status Symbols</u>

M	mandatory
O	optional

<u>Support Column Symbols</u>

The support of every item as claimed by the implementer is stated by entering the appropriate answer (Y, N or N/A) in the Support column:

Y	Yes, supported by the implementation
N	No, not supported by the implementation
N/A	Not applicable

A3 REFERENCED BASE STANDARDS

The base standards references in the RL are:

– Device Virtualisation Service – this document.

A4 GENERATION INFORMATION

A4.1 IDENTIFICATION OF PICS

Ref	Question	Response
1	Date of Statement (DD/MM/YYYY)	
2	PICS serial number	
3	System Conformance statement cross-reference	

A4.2 IDENTIFICATION OF IMPLEMENTATION UNDER TEST (IUT)

Ref	Question	Response
1	Implementation name	
2	Implementation version	
3	Special configuration	
4	Other information	

A4.3 IDENTIFICATION

Ref	Question	Response
1	Supplier	
2	Contact Point for Queries	
3	Implementation name(s) and Versions	
4	Other information necessary for full identification, e.g., name(s) and version(s) for machines and/or operating systems: System Name(s)	

A4.4 SERVICE SUMMARY

Ref	Question	Response
1	Service Version	
2	Addenda implemented	
3	Amendments implemented	
4	Have any exceptions been required? NOTE – A YES answer means that the implementation does not conform to the service. Non-supported mandatory capabilities are to be identified in the PICS, with an explanation of why the implementation is non-conforming.	Yes ______ No ______

A4.5 INSTRUCTIONS FOR COMPLETING THE RL

An implementer shows the extent of compliance to the protocol by completing the RL; that is, compliance to all mandatory requirements and the options that are not supported are shown. The resulting completed RL is called a PICS. In the Support column, each response shall be selected either from the indicated set of responses or it shall comprise one or more parameter values as requested. If a conditional requirement is inappropriate, N/A shall be used. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference X*i*, where *i* is a unique identifier, to an accompanying rationale for the non-compliance.

A5 GENERAL/MAJOR CAPABILITIES

Service Feature	Reference (Red Book)	Status	Support
ACQUIRE_FROM_DEVICE.request	3.4.2	M	
ACQUIRE_FROM_DEVICE.indication	3.4.3	M	
COMMAND_DEVICE.request	3.4.4	O	
COMMAND_DEVICE.indication	3.4.5	O	
Timestamp parameter	3.3.7	O	

A6 UNDERLYING LAYERS PROVIDING SERVICES TO IMPLEMENTATION

This subsection provides identification of the underlying layers providing services to the implementation.

Service Feature	Reference	Status	Support
Device Access Service	3.2	M	

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 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 out of 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 it is applied at the Application Layer. For more information regarding the choice of service and where it can be implemented, see reference [D4].

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 out of 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.

B5 RELIABILITY

While it is assumed that the underlying mechanisms used to implement the devices operate correctly, the DVS make no assumptions as to their reliability.

ANNEX C

ACRONYMS

(INFORMATIVE)

CCSDS	Consultative Committee for Space Data Standards
DAS	Device Access Service
DVS	Device Virtualisation Service
DACP	Device Abstraction Control Procedure
ID	Identifier
MIB	Management Information Base
OSI	Open Systems Interconnection
SAP	Service Access Point
SOIS	Spacecraft Onboard Interface Services

ANNEX D

INFORMATIVE REFERENCES

(INFORMATIVE)

[D1] *Organization and Processes for the Consultative Committee for Space Data Systems*. Issue 3. CCSDS Record (Yellow Book), CCSDS A02.1-Y-3. Washington, D.C.: CCSDS, July 2011.

[D2] *Information Technology—Open Systems Interconnection—Basic Reference Model: The Basic Model*. 2nd ed. International Standard, ISO/IEC 7498-1:1994. Geneva: ISO, 1994.

[D3] *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.

[D4] *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.

NOTE – Normative references are listed in 1.6.

ICS 49.140

Price based on 22 pages

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

bsi.

...making excellence a habit.™