

Space data and information transfer systems — Data entity dictionary specification language (DEDSL) — Abstract syntax

ICS 49.140

National foreword

This British Standard reproduces verbatim ISO 21961:2003 and implements it as the UK national standard.

The UK participation in its preparation was entrusted by Technical Committee ACE/68, Space systems and operations, to Subcommittee ACE/68/-/7, Space data and information transfer systems, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Cross-references

The British Standards which implement international publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the ISO title page, pages ii and iii, a blank page, pages 1 to 101 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 25 June 2003

© BSI 25 June 2003

ISBN 0 580 42106 6

INTERNATIONAL STANDARD

ISO
21961

First edition
2003-03-15

Space data and information transfer systems — Data entity dictionary specification language (DEDSL) — Abstract syntax

*Systèmes de transfert des informations et données spatiales —
Langage de spécification pour le dictionnaire d'entités de données —
Syntaxe abrégée*



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.

International Standard ISO 21961 was prepared by the Consultative Committee for Space Data Systems (CCSDS) (as CCSDS 647.1-B-1, June 2001) 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*.

Space data and information transfer systems — Data entity dictionary specification languages (DEDSL) — Abstract syntax

1 Scope

This International Standard gives requirements and defines the abstract syntax for a specification language to be used in the creation of a data entity dictionary (DED).

The scope and field of application are furthermore detailed in subclauses 1.1 and 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 647.1-B-1, June 2001, *Data entity dictionary specification language (DEDSL) — Abstract syntax (CCSD0011)*.

For the purposes of international standardization, the modifications outlined below shall apply to the specific clauses and paragraphs of publication CCSDS 647.1-B-1.

Pages i to v

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

Page 1-7

Add the following information to the references indicated in 1.6:

- [1] Document CCSDS 620.0-B-2, May 1992, is equivalent to ISO 12175:1994.
- [2] Document CCSDS 643.0-B-1, November 1992, is equivalent to ISO 14962:1997.
- [4] Document CCSDS 630.0-B-1, June 1993, is equivalent to ISO 13764:1996.

Update the following reference as follows:

- [6] ISO/IEC 8859-1:1998, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

Page C-1

Update and add the following information to the references in Annex C as follows:

[C2] Document CCSDS 644.0-B-2, November 2000, is equivalent to ISO 15889:2003.

[C8] Document CCSDS 301.0-B-3, January 2002, is equivalent to ISO 11104:—¹⁾.

[C11] ISO/IEC 11179-3:2003, *Information technology — Metadata registries (MDR) — Part 3: Registry metamodel and basic attributes*

Delete the following reference:

[C10] It is cited for normative purposes and is given in 1.6, page 1-7 (see reference [7]).

3 Revision of publication CCSDS 647.1-B-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 647.1-B-1. To this end, NASA will act as a liaison body between CCSDS and ISO.

1) To be published. (Revision of ISO 11104:1991)

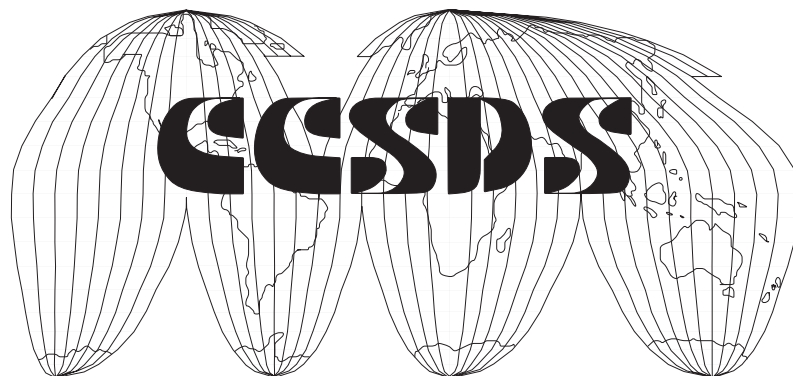
Consultative Committee for Space Data Systems

RECOMMENDATION FOR SPACE
DATA SYSTEM STANDARDS

DATA ENTITY DICTIONARY
SPECIFICATION LANGUAGE (DEDSL)—
ABSTRACT SYNTAX
(CCSD0011)

CCSDS 647.1-B-1
BLUE BOOK

June 2001



(Blank page)

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

AUTHORITY

Issue:	Blue Book, Issue 1
Date:	June 2001
Location:	Oxfordshire, England

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 Recommendations is detailed in [C1], 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
Program Integration Division (Code MT)
National Aeronautics and Space Administration
Washington, DC 20546, USA

STATEMENT OF INTENT

The Consultative Committee for Space Data Systems (CCSDS) is an organisation officially established by the management of member space Agencies. 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 considered binding on any Agency.

This **Recommendation** is issued by, and represents the consensus of, the CCSDS Plenary body. Agency endorsement of this **Recommendation** is entirely voluntary. Endorsement, however, indicates the following understandings:

- o Whenever an Agency establishes a CCSDS-related **standard**, this **standard** will be in accord with the relevant **Recommendation**. Establishing such a **standard** does not preclude other provisions which an Agency may develop.
- o Whenever an Agency establishes a CCSDS-related **standard**, the Agency will provide other CCSDS member Agencies with the following information:
 - The **standard** itself.
 - The anticipated date of initial operational capability.
 - The anticipated duration of operational service.
- o Specific service arrangements shall be made via memoranda of agreement. Neither this **Recommendation** nor any ensuing **standard** is a substitute for a memorandum of agreement.

No later than five years from its date of issuance, this **Recommendation** 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 **Recommendation** is issued, existing CCSDS-related Agency standards and implementations are not negated or deemed to be non-CCSDS compatible. It is the responsibility of each Agency to determine when such standards or implementations are to be modified. Each Agency is, however, strongly encouraged to direct planning for its new standards and implementations towards the later version of the Recommendation.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

FOREWORD

This Recommendation is a technical Recommendation that provides a model and language to increase the standardisation of the expression of semantic concepts that are to be carried with data. These semantic concepts are given standard names, and a standard way of expressing them is also provided. The semantic information may be conveyed either in a computer-processable manner or via conventional (e.g., paper) documentation.

Through the process of normal evolution, it is expected that expansion, deletion or modification to this document may occur. This Recommendation is therefore subject to CCSDS document management and change control procedures defined in reference [C1]. Current versions of CCSDS documents are maintained at the CCSDS Web site:

<http://www.ccsds.org/>

Questions relative to the contents or status of this document should be addressed to the CCSDS Secretariat at the address indicated on page i.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

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

Member Agencies

- Agenzia Spaziale Italiana (ASI)/Italy.
- British National Space Centre (BNSC)/United Kingdom.
- Canadian Space Agency (CSA)/Canada.
- Central Research Institute of Machine Building (TsNIIMash)/Russian Federation.
- Centre National d’Etudes Spatiales (CNES)/France.
- Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)/Germany.
- European Space Agency (ESA)/Europe.
- Instituto Nacional de Pesquisas Espaciais (INPE)/Brazil.
- National Aeronautics and Space Administration (NASA HQ)/USA.
- National Space Development Agency of Japan (NASDA)/Japan.

Observer Agencies

- Austrian Space Agency (ASA)/Austria.
- Central Research Institute of Machine Building (TsNIIMash)/Russian Federation.
- Centro Tecnico Aeroespacial (CTA)/Brazil.
- Chinese Academy of Space Technology (CAST)/China.
- Commonwealth Scientific and Industrial Research Organization (CSIRO)/Australia.
- Communications Research Laboratory (CRL)/Japan.
- Danish Space Research Institute (DSRI)/Denmark.
- European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)/Europe.
- European Telecommunications Satellite Organization (EUTELSAT)/Europe.
- Federal Service of Scientific, Technical & Cultural Affairs (FSST&CA)/Belgium.
- Hellenic National Space Committee (HNSC)/Greece.
- Indian Space Research Organization (ISRO)/India.
- Industry Canada/Communications Research Centre (CRC)/Canada.
- Institute of Space and Astronautical Science (ISAS)/Japan.
- Institute of Space Research (IKI)/Russian Federation.
- KFKI Research Institute for Particle & Nuclear Physics (KFKI)/Hungary.
- MIKOMTEK: CSIR (CSIR)/Republic of South Africa.
- Korea Aerospace Research Institute (KARI)/Korea.
- Ministry of Communications (MOC)/Israel.
- National Oceanic & Atmospheric Administration (NOAA)/USA.
- National Space Program Office (NSPO)/Taipei.
- Swedish Space Corporation (SSC)/Sweden.
- United States Geological Survey (USGS)/USA.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

DOCUMENT CONTROL

Document	Title and Issue	Date	Status
CCSDS 647.1-B-1.	Data Entity Dictionary Specification Language (DEDSL)—Abstract Syntax	June 2001	Original Issue

CONTENTS

<u>Section</u>	<u>Page</u>
1 INTRODUCTION.....	1-1
1.1 PURPOSE AND SCOPE	1-1
1.2 APPLICABILITY	1-2
1.3 RATIONALE	1-2
1.4 DOCUMENT STRUCTURE	1-3
1.5 DEFINITIONS	1-4
1.6 REFERENCES	1-7
 2 OVERVIEW	 2-1
2.1 GENERAL	2-1
2.2 USES OF DATA ENTITY DICTIONARIES	2-1
2.3 APPLICATION OF THE DEDSL	2-6
2.4 REGISTERING DED	2-8
 3 DESCRIPTORS OF A DATA ENTITY ATTRIBUTE.....	 3-1
3.1 GENERAL	3-1
3.2 LIST OF DESCRIPTORS	3-1
3.3 ATTRIBUTE_NAME	3-3
3.4 ATTRIBUTE_DEFINITION	3-4
3.5 ATTRIBUTE_OBLIGATION	3-5
3.6 ATTRIBUTE_CONDITION	3-6
3.7 ATTRIBUTE_MAXIMUM_OCCURRENCE	3-6
3.8 ATTRIBUTE_VALUE_TYPE	3-7
3.9 ATTRIBUTE_MAXIMUM_SIZE	3-9
3.10 ATTRIBUTE_ENUMERATION_VALUES	3-10
3.11 ATTRIBUTE_COMMENT	3-10
3.12 ATTRIBUTE_INHERITANCE	3-11
3.13 ATTRIBUTE_DEFAULT_VALUE	3-11
3.14 ATTRIBUTE_VALUE_EXAMPLE	3-12
3.15 ATTRIBUTE_SCOPE	3-12
 4 DATA ENTITY ATTRIBUTES AND DATA ENTITY DICTIONARY ATTRIBUTES	 4-1

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

4.1	CONCEPT DEFINITIONS	4-1
4.2	GENERAL VIEW OF THE STANDARD ATTRIBUTES	4-2
4.3	STANDARD ATTRIBUTES FOR DATA ENTITY DICTIONARIES	4-4
4.4	STANDARD ATTRIBUTES FOR DATA ENTITIES	4-13
4.5	USER-DEFINED ATTRIBUTES	4-34
4.6	RELATIONSHIP RULES	4-37
5	IMPLEMENTATION GUIDELINES	5-1
6	DEDSL CONFORMANCE: ABSTRACT DEDSL (ADID = CCSD0011).....	6-1
6.1	GENERAL	6-1
6.2	CONFORMANCE LEVEL 1: BASE COMPLIANCE	6-1
6.3	CONFORMANCE LEVEL 2: FULL COMPLIANCE	6-1
ANNEX A	DEDSL EXAMPLES	A-1
ANNEX B	MAPPING OF THE CONCEPTS BETWEEN THIS RECOM- MENDATION AND THE ISO/IEC 11179-3:1994 STANDARD	B-1
ANNEX C	INFORMATIVE REFERENCES.....	C-1

Figure

2-1	Organisation of the Data Product Product_X.....	2-2
2-2	Organisation of the Data Product Product_Y.....	2-3
2-3	Organisation of the DED Relative to Product_X and Product_Y.....	2-4
2-4	“Uses some models of” Links between Data Product Dictionaries	2-6

Table

2-1	Comparison of Community DED and Product DED Descriptions	2-5
3-1	General Descriptors.....	3-2
4-1	Data Entity Dictionary Attributes	4-2
4-2	Data Entity Attributes	4-3

Example

3-1	Elementary Type	3-7
3-2	Ordered List of Elementary Types.....	3-8
3-3	Ordered List of the Same Elementary Type.....	3-8
3-4	Use of Entity_Type	3-8
3-5	Use of Choice.....	3-8

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

CONTENTS (continued)

<u>Example</u>	<u>Page</u>
3-6 Use of Attribute_Maximum_Size	3-9
3-7 Use of Attribute_Enumeration_Values	3-10
4-1 Defining User-Defined Attribute	4-35
4-2 Defining User-Defined Attribute with an External Reference.....	4-35
4-3 Usage of a User-Defined Attribute	4-36

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document provides an extensible way of defining data entity dictionaries.

A Data Entity is a concept that can, or does, take on one or more values. Semantics of a data entity, such as a text definition of its meaning, are defined by attributes. The purpose of this Recommendation is to define a language for specifying a dictionary which describes semantics for a collection of data entities—it does not define a specific dictionary.

A dictionary is understood as a mechanism that is able to organise a set of information in a consistent and easily understandable manner, and it is commonly used by humans to look up the meaning of words used in natural languages. Similarly, a Data Entity Dictionary (DED) is used by humans and systems to look up the definition, and other attributes, of data entities used in the definition and generation of data products.

This document defines the abstract definition of the semantic information that is required to be conveyed and presents the specification in a layered manner (attributes, entities, dictionaries). This is done so that the actual technique used to convey the information is independent of the information content and, therefore, the same abstract standard can be used within different formatting environments. This also permits the semantic information to be translated to different representations as may be needed when data are transferred across different domains.

This Recommendation defines the concepts of name, definition, units, and a small set of other standard attributes so that they may be used consistently in the formation of data entity dictionaries. Given the wide variety of data entities that may need to be described, only a few of the attributes are made mandatory by this Recommendation.

The method used to define standard attributes can also be used to extend the set of attributes beyond the standard ones provided within this Recommendation.

Several classes of data entities are defined. These classes allow making a distinction between the abstract data entities—the models—and the concrete data entities—the data fields in a data product.

This Recommendation is strongly based on the International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) Specification and standardisation of data elements (reference [C11]) with which it is widely consistent for all semantic aspects. **However this Recommendation does not require knowledge of reference [C-11] in order to be understood.**

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX**1.2 APPLICABILITY**

This Recommendation is intended to be used by implementers of a concrete syntax for Data Entity Dictionaries. Such dictionaries could then be used for example:

- by data producers to construct dictionaries that describe, in a more formal manner, data entities within their data products;
- by data users to understand data received from data producers who have used this Recommendation to construct their dictionaries;
- by an organisation that mandates the attributes used to define each entity description in dictionaries used within that organisation;
- by a particular community, such as Earth observation, space physics, archives, etc., to establish a degree of standardisation for the contents of any data entity dictionary associated or not with a data product (this would be done by using this Recommendation to define a community-wide data entity dictionary);
- by organisations and communities to exchange the contents of a data entity dictionary in a standardised manner, i.e., to facilitate interoperability.

1.3 RATIONALE

A given data entity may take on a range of values that are represented differently within different formats, including such generic formats Hierarchical Data Format (HDF) (reference [C-6]), Common Data Format (CDF) (reference [C-7]), or in native formats. However there is information about that data entity, such as its definition and other semantic attributes, which is independent of the values and their representation in any given format.

Part of this information can be expressed in a data entity dictionary, and this dictionary can be expressed in many different ways. For example, it may be expressed in natural language paragraphs within a document that accompanies a data product. It may be partially expressed by attributes defined within generic or native data product formats, while the rest may be in other documents. The concepts used in the description of the data entities may vary widely, or subtly. These concepts may not be documented at all.

Therefore, individuals and organisations that need to receive and understand a variety of data products may waste considerable effort in attempting to understand the data entities comprised by each data product. This also greatly hinders the use of generic tools that can assist in the recognition and presentation of this information in a way that various individuals and organisations find most understandable.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

To begin to address these issues across broad organisation and community disciplines, it is first necessary to define a set of standard concepts that can be used in the formation of data entity dictionaries within those disciplines, and in the mapping of different dictionary concepts between disciplines. To facilitate the creation of generic tools, it is also necessary to define a standard representation for the standard concepts. This Recommendation defines a small number of concepts, in terms of attribute descriptors and standard attributes, which are intended to be broadly applicable.

Finally, this Recommendation provides additional standardised functionalities allowing the expression of relationships between entities in a dictionary, as well as definitions of inter-relationships between dictionaries.

1.4 DOCUMENT STRUCTURE

The document is structured as follows:

- Section 2 provides an overview of the data entity dictionary concept and describes through examples how this Recommendation may be used. It also provides a context enabling a better understanding of the standard specified in sections 3 and 4.
- Section 3 specifies the standard descriptors which shall be used to define the attributes of data entities as well as of data entity dictionaries.
- Section 4 specifies the standard attributes to be used to define data entities and data entity dictionaries. It also presents the method to define user-defined attributes and the implementation guidelines.
- Section 5 discusses implementation guidelines.
- Section 6 discusses levels of conformance with this Recommendation.
- Annex A provides examples implementing the concepts described in sections 3 and 4.
- Annex B provides the mapping of the concepts between this Recommendation and the ISO/IEC 11179-3:1994 standard (reference [C-11]).
- Annex C provides a list of references that may be valuable to the user of this Recommendation as background material or as implementation guidelines for using this Recommendation.

1.5 DEFINITIONS

1.5.1 ACRONYMS AND ABBREVIATIONS

This subsection defines the acronyms and abbreviations used throughout this Recommendation:

ADID	Authority and Description Identifier
ASCII	American Standard Code for Information Interchange
CCSDS	Consultative Committee for Space Data Systems
CDF	Common Data Format
DDL	Data Definition Language
DED	Data Entity Dictionary
DEDSL	Data Entity Dictionary Specification Language
EAST	Enhanced Ada SubseT
FITS	Flexible Image Transport System
HDF	Hierarchical Data Format
ID	Identifier
ISO	International Organization for Standardization
LVO	Label Value Object
MACAO	Member Agency Control Authority Office
PVL	Parameter Value Language
SFDU	Standard Formatted Data Unit
XML	eXtended Mark-up Language

1.5.2 GLOSSARY OF TERMS

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

Attribute	A piece of information that describes a Data Entity or Dictionary Entity. This information characterizes or enhances the understanding of the data that is described. Attributes are used to define the semantics of data entities.
Attribute Descriptor	A piece of information that describes an attribute. This document specifies a set of descriptors for attribute description.
Attribute Value	A value associated with an attribute instance.
Composite Data Entity	A data entity which consists of a combination of various other elementary and composite entities.
Constant	A named constant value that is used within a dictionary but is not part of the data themselves. Use of constants enables data entity dictionaries to specify values which will be used by several projects or within a domain (astronomy constants, image size, etc).

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

Data Entity	A concept that can, or does, take on one or more values. The concept, and optionally constraints on the representation of its value, are defined by attributes and their values.
Data Entity Dictionary	A collection of semantic definitions of various data entities, together with a few mandatory and optional attributes about the collection as a whole. Data entity dictionaries may be just for a single product, i.e., all the data entities within a single product are described in a corresponding single dictionary, or the data entity dictionary may be a discipline-oriented dictionary that holds a number of previously defined data entity definitions which may be used by data designers and users as references. Some parts of a dictionary are optional. In practical terms the dictionary could be a file or a Standard Formatted Data Unit (SFDU) Label-Value Object (LVO) value field (references [1] and [C-4]). Within this Recommendation, the expression ‘data entity dictionary’ can refer either to the notion of data entity dictionaries or to a data entity dictionary instance. A data entity dictionary is also an entity, called Dictionary Entity.
Data Product	A collection of one or more data items that are packaged for or by a specific application.
Defaulted	Indication of an attribute or descriptor value that is understood when the attribute or descriptor is not explicitly included in the containing definition.
Descriptor Name	An Identifier that is the name of the descriptor.
Descriptor Type	The characterization of the descriptor value; e.g., text, identifier, integer.
Elementary Data Entity	A data entity whose data type is elementary, that is, Integer, Real, Text or Enumerated.
Enumerated	A set containing a restricted number of discrete values, where each discrete value is named and unique within the set.
Identifier	A sequence of characters that designates something.
Inter-operability Constraints	Set of constraints enabling an easier exchange of dictionaries using different DEDSL implementations.
Model	A data entity described independently from any instance in a data product, and corresponding to a re-usable data entity definition, from which other data entities may inherit the attributes and apply some specialization rules.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

Semantics	Information that defines the meaning rather than the physical representation of data. Semantics potentially cover a very large domain, from the simple domain, such as the units of one data entity, to a more complex one, such as the relationship between one data entity and another.
Standard Attribute	One of the attributes defined within this Recommendation.
Syntax	Information defining the physical representation of data. It includes the structural arrangement of the fields within the data on the exchanged media.
Text	A delimited sequence of characters. The set of allowed characters is defined in the Data Entity Dictionary.
User Defined Attribute	An attribute that is defined by a particular user or project and after definition is then used in the same manner as a Standard Attribute within that data entity dictionary.

1.5.3 NOMENCLATURE

The following conventions apply throughout this Recommendation:

- a) the words ‘shall’ and ‘must’ imply 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.

1.5.4 CONVENTIONS

Convention 1:

No **Identifiers** or encoding values in the document are case-sensitive.

Convention 2:

The words which appear in bold characters throughout this Recommendation correspond to the keywords or the major concepts of this Recommendation.

For example, when defining the descriptors, the descriptor name as well as the descriptor type and sometimes the predefined values of the type are in bold characters to enlighten the definition. This convention also applies when defining the attributes (respectively attribute name and attribute value type).

Convention 3:

Text values are delimited by quotes in the examples for clarity.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

Convention 4:

Parentheses are used to delimit ordered lists, with commas used to separate the elements of the list.

Convention 5:

Interoperability constraints are a set of constraints enabling an easier exchange of dictionaries using different DEDSL implementations and may appear within the description of the descriptors and attributes specified by this Recommendation. For example, they may refer to the size of the value of an attribute or the coding values of a descriptor. Interoperability constraints determine the two levels of conformance identified in section 6. Interoperability constraints are introduced by the title '*Interoperability Constraints*'.

1.6 REFERENCES

The following documents contain provisions (through references within this text) which constitute provisions of this Recommendation. At the time of the publication the indicated editions were valid. All documents are subject to revision, and users of this Recommendation 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 available CCSDS Recommendations.

- [1] *Standard Formatted Data Units—Structure and Construction Rules*. Recommendation for Space Data System Standards, CCSDS 620.0-B-2. Blue Book. Issue 2. Washington, D.C.: CCSDS, May 1992. (ISO 12175)
- [2] *ASCII Encoded English (CCSD0002)*. Recommendation for Space Data System Standards, CCSDS 643.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, November 1992. (ISO 14962)
- [3] *Information Processing—Representation of numerical values in character strings for information interchange*. ISO 6093-1985. Geneva: ISO, 1985.
- [4] *Standard Formatted Data Units—Control Authority Procedures*. Recommendation for Space Data System Standards, CCSDS 630.0-B-1. Blue Book. Issue 1. Washington, D.C.: CCSDS, June 1993. (ISO 13764)
- [5] *Codes for the Representation of Names of Languages*. ISO 639-2 -1998. Geneva: ISO, 1998.
- [6] *Information Processing—8-Bit Single-Byte Coded Graphic Character Sets—Part 1: Latin Alphabet No. 1*. International Standard, ISO 8859-1:1987. Geneva: ISO, 1987.
- [7] *Information Processing—Representation of SI and Other Units in Systems with Limited Character Sets*. International Standard, ISO 2955-1983. Geneva: ISO, 1983.

(Blank page)

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

2 OVERVIEW

2.1 GENERAL

As discussed in subsection 1.1, a Data Entity Dictionary is used by humans and systems to look up the definition and other attributes of data entities. This section discusses some of the primary uses of data entity dictionaries and presents a basic example of DEDSL usage.

Other detailed examples are given in annex A.

2.2 USES OF DATA ENTITY DICTIONARIES

2.2.1 PRODUCT DATA ENTITY DICTIONARIES

So that its contained data can be extracted, a data product can appear with a formatting standard (e.g., Flexible Image Transport System [FITS]), or a self-describing format (e.g., CDF, HDF, etc.) or a Data Definition Language (e.g., EAST). This syntactic information may not be easy to understand and a formal definition of additional semantics may be necessary, which leads to the definition of a product Data Entity Dictionary.

Figure 2-1 shows the structure of the data product (**PRODUCT_X**). It is made up of a header (**HEADER**) and an image (**DATA_1**). The header contains a product identifier (**PRODUCT_ID**), information about the station, which has acquired the data, (**ACQ_STATION**), information about the acquisition time (**ACQ_TIME**), and information necessary for the processing of the image, e.g., the centre coordinates [**CENTRE_COORD** (**LATITUDE** and **LONGITUDE**)]. Its physical description, possibly expressed using a DDL, may not be readily understandable to all readers because it includes a specification to the bit level. It is also useful to have a quick overview of the product and to have additional semantic information. Therefore, the definition of a product data entity dictionary (**PRODUCT_X DED**) will bring this necessary information and perspective.

Within this data entity dictionary additional information can be given to more precisely define:

- the definition of each data entity;
- the kinds of values used for the centre coordinates **LATITUDE** and **LONGITUDE**.

The values of **LATITUDE** are defined relative to the Equator and range from -90.000 to +90.000, while the values of **LONGITUDE** are defined to be relative to Greenwich and range from -180.00 to +180.00. The units used to express the values are to be in degrees. All this information may be included in the data entity dictionary.

These pieces of semantic information correspond to the existing data entities of the product.

Consequently, the **PRODUCT_X DED** will contain the semantic descriptions of the following data entities:

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

- HEADER;
- PRODUCT_ID;
- ACQ_STATION;
- ACQ_TIME;
- CENTRE_COORD;
- LATITUDE;
- LONGITUDE;
- DATA_1.

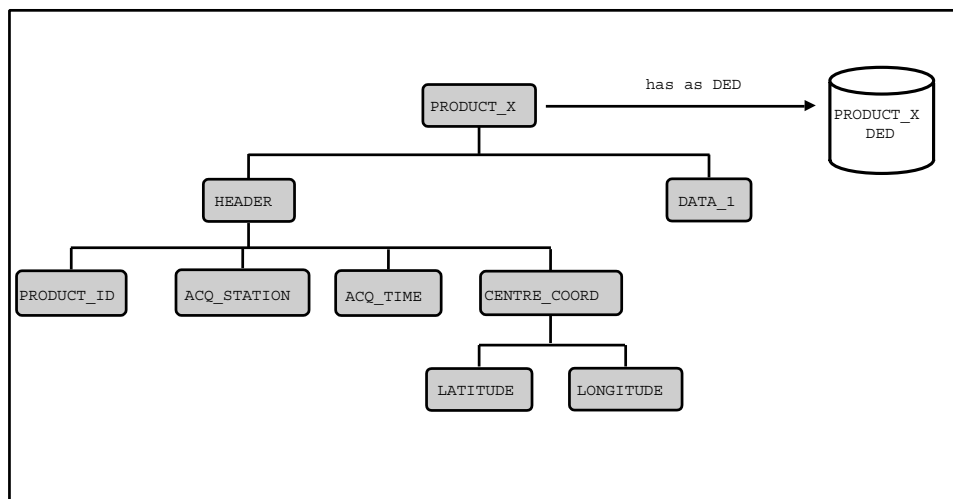


Figure 2-1: Organisation of the Data Product Product_X

Figure 2-2 shows the structure of another data product (**PRODUCT_Y**). It is made up of the product identifier (**PRODUCT_ID**), the centre coordinates (e.g., a latitude, a longitude) and the acquired image (**DATA_2**). A data product dictionary (**PRODUCT_Y DED**) can also be defined for **PRODUCT_Y** in the same way as for **PRODUCT_X**.

Consequently, the **PRODUCT_Y DED** will contain the semantic descriptions of the following data entities:

- PRODUCT_ID;
- LATITUDE;
- LONGITUDE;
- DATA_2.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

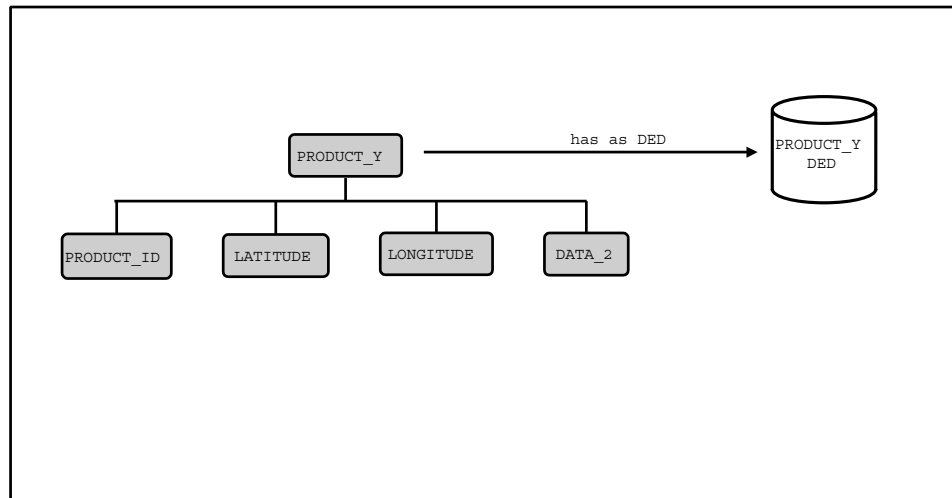


Figure 2-2: Organisation of the Data Product Product_Y

Looking at the two previously described data products it seems convenient to define **PRODUCT_Y DED** by re-using some data entity descriptions of **PRODUCT_X DED**.

The data entity descriptions which seem common to both data products are **PRODUCT_ID**, **LATITUDE** and **LONGITUDE**.

Therefore the data product dictionary **PRODUCT_X** can be modified so that those data entity descriptions become re-usable **models**. These models are abstract data descriptions to which concrete descriptions, i.e., corresponding to data entities within the data product, can refer. Then the DED associated with **PRODUCT_Y** can refer to the DED associated with **PRODUCT_X** for the definition of some of its semantic descriptions using the models of the **PRODUCT_X DED**.

Consequently, the **PRODUCT_X DED** will contain data entity descriptions corresponding to abstract definitions (models) and named as follows:

- **PRODUCT_ID_MODEL**;
- **LATITUDE_MODEL**;
- **LONGITUDE_MODEL**.

The **PRODUCT_X DED** will still contain the semantic descriptions corresponding to the following data entities, but with references to the newly defined models:

- **HEADER**;
- **PRODUCT_ID**, inheriting from the model **PRODUCT_ID_MODEL**;
- **ACQ_STATION**;
- **ACQ_TIME**;

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

- CENTRE_COORD;
- LATITUDE, inheriting from the model LATITUDE_MODEL;
- LONGITUDE, inheriting from the model LONGITUDE_MODEL;
- DATA_1.

The **PRODUCT_Y DED** will still contain the semantic descriptions corresponding to the following data entities, but with references to the newly defined models:

- PRODUCT_ID, inheriting from the model PRODUCT_ID_MODEL;
- LATITUDE, inheriting from the model LATITUDE_MODEL;
- LONGITUDE, inheriting from the model LONGITUDE_MODEL;
- DATA_2.

Figure 2-3 presents the resulting organisation between both DEDs as they are used to support **PRODUCT_Y**.

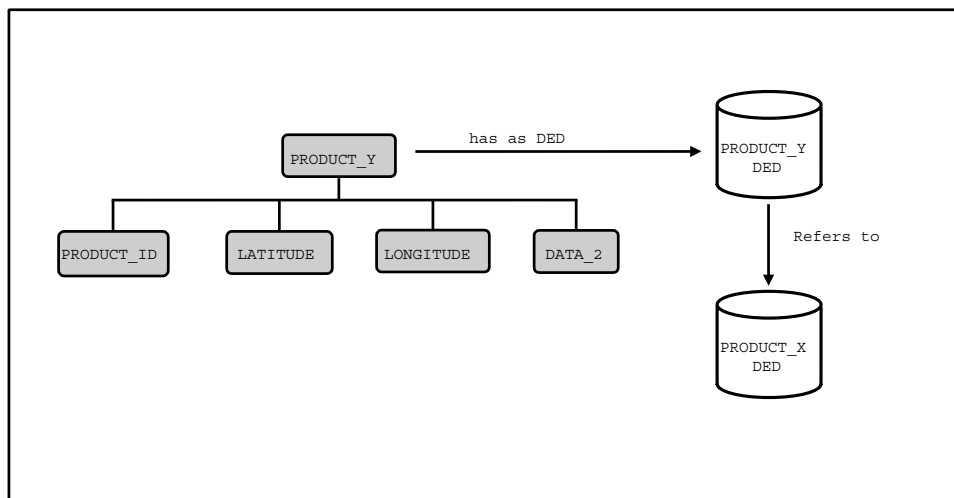


Figure 2-3: Organisation of the DED Relative to Product_X and Product_Y

2.2.2 COMMUNITY DATA ENTITY DICTIONARIES

The project or the data designer may consider that a community dictionary is necessary because there are several data products related to the same kind of data.

Looking at the two products given as examples, they may decide that the community data entity dictionary should include the following entities which frequently appear: **PRODUCT_ID**, **ACQ_STATION**, **ACQ_TIME**, **LATITUDE** and **LONGITUDE**.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

This community DED will contain a normalized description of these entities which can then be considered as **models**. Data entities being latitudes and longitudes and appearing within other data products will then have the same associated semantic information whenever they inherit from these normalized descriptions.

The other data entities only appearing in a data product such as **DATA_1**, **DATA_2** and **CENTRE_COORD** are local definitions.

The purpose of a community dictionary is to provide, across different data products, a standard or normalized definition of data entities.

Table 2-1 shows an example of mapping of the community DED entries into data product DED entries for the data products shown in figures 2-1 and 2-2, according to the choices made by the project or data designers.

Table 2-1: Comparison of Community DED and Product DED Descriptions

Concept	Data Type	Found in Community DED	Found in PRODUCT_X DED	Found in PRODUCT_Y DED
HEADER	Composite	no	yes	no
PRODUCT_ID	Text	yes	yes	yes
ACQ_STATION	Enumeration	yes	yes	no
ACQ_TIME	Composite	yes	yes	no
CENTRE_COORD	Composite	no	yes	no
LATITUDE	Real	yes	yes	yes
LONGITUDE	Real	yes	yes	yes
DATA 1	Composite (Array of 16-bit integers)	no	yes	no
DATA 2	Composite (Array of real numbers)	no	no	yes

Supposing that the project has defined its community dictionary, when it defines a new data product or for example when it rewrites the dictionary related to **PRODUCT_X** (in figure 2-1), it can decide to define the **HEADER** entity on the basis of **PRODUCT_ID**, **ACQ_STATION** and **ACQ_TIME**, which inherit from the corresponding data entities in the community dictionary,

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

i.e., which then have the same properties as the model data entities. The project can also decide to define the **CENTRE_COORD** entity on the basis of the **LATITUDE** and **LONGITUDE** entities, which inherit from the corresponding data entities in the community dictionary. The **DATA1** entity does not inherit from a specific data entity described in the community DED, as it appears to be a kind of data only appearing in the data product **PRODUCT_X**.

The same policy can be applied to **PRODUCT_Y** of figure 2-2.

Therefore we can consider the links ‘uses some models of’, in figure 2-4, among the three data entity dictionaries. A ‘uses some models of’ link between **PRODUCT_X DED** and the domain DED means that some data entities of **PRODUCT_X** inherit from corresponding data entities contained in the domain DED.

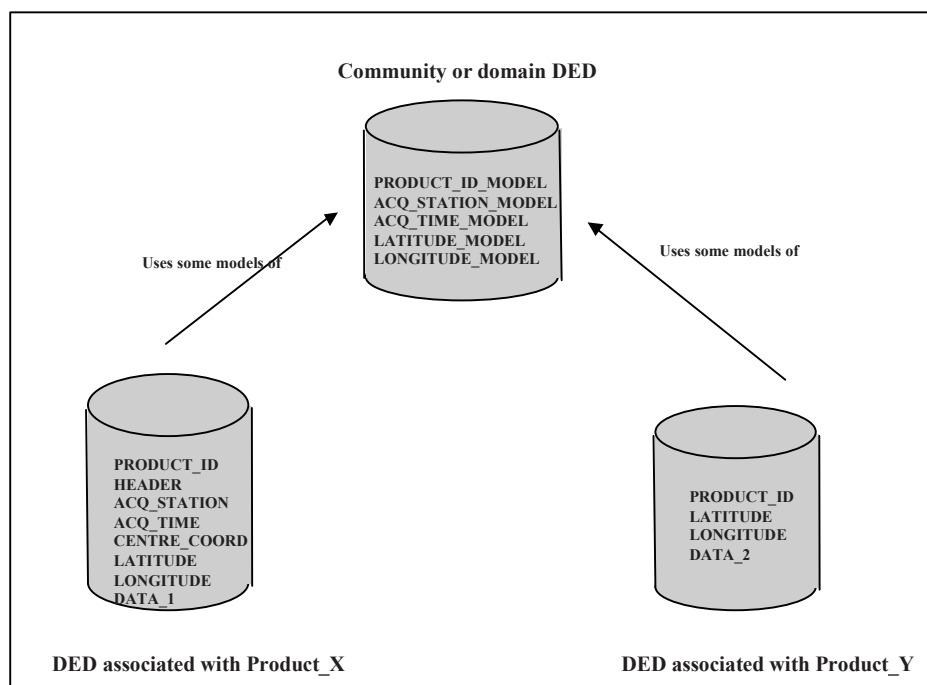


Figure 2-4: ‘Uses some models of’ Links between Data Product Dictionaries

2.3 APPLICATION OF THE DEDSL

2.3.1 GENERAL

As demonstrated in the previous section, there are two major uses for dictionaries:

- to describe a data product semantically;
- to build up and define a community DED.

CCSDS RECOMMENDATION FOR DEDSL—ABSTRACT SYNTAX

This Recommendation focuses on developing standard names and descriptions for the concepts required for Data Entity Dictionaries, and formally defines the concepts of name, definition, units, and a small set of other attributes so they may be used consistently in the formation of data entity dictionaries. A method is also provided to permit the set of attributes to be extended beyond the standard ones provided within this Recommendation.

This formal definition enables the definition of generic tools to assist producers in creating documented products, and to assist consumers in understanding the products they receive.

2.3.2 PRODUCT DATA ENTITY DICTIONARIES

A product DED is a means for an organisation to present the semantics necessary for a good understanding of a managed data product. A product DED is dependent of the data product description. However, an enhanced understanding is only possible when the semantics associated with the products are presented in a common, i.e., standardised way.

Therefore, this Recommendation provides a foundation for the creation of a product DED by providing a basic set of concepts for data entity descriptions. This Recommendation also provides the formal methods to describe relationships among the data entities of the product DEDs.

2.3.3 COMMUNITY DATA ENTITY DICTIONARIES

A community DED is also a means for an organisation to gain some degree of control/standardisation over the data descriptions created by member data producers. Unlike product data entity dictionaries, these community DED are not used in conjunction with a specific product description technique. They are independent of the specific implementation of products. Examples of uses of community DED include:

- the creation of a standard data entity dictionary by an organisation that mandates the attributes defining each entity description in dictionaries used within that organisation;
- the creation of a community DED by a particular community (e.g., planetary science, astrophysics, etc.), to establish a degree of standardisation for the contents of any data entity dictionary associated with a data product from that community.

This Recommendation provides a foundation for the creation of community DED and also provides the formal methods to describe relationships among data entities of multiple data entity dictionaries.