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Space data and information transfer systems — Producer-Archive Interface Specification (PAIS)

Systèmes de transfert des informations et données spatiales — Spécification de l'interface entre producteur et archives (PAIS)

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Recommendation for Space Data System Standards

PRODUCER-ARCHIVE INTERFACE SPECIFICATION (PAIS)

RECOMMENDED STANDARD

CCSDS 651.1-B-1

BLUE BOOK
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FOREWORD

This Recommended Standard is a technical Recommendation providing the abstract syntax and an XML implementation of descriptions of data to be sent to an archive. These descriptions are negotiated agreements between the data Producer and the Archive that facilitate production of agreed data by the Producer and validation of received data by the Archive. This Recommended Standard includes an abstract syntax for describing how these data will be aggregated into packages for transmission and one concrete implementation for the packages based on the XML Formatted Data Unit (XFDU) standard (see reference [1]). This will fulfill parts of the process defined in the *Producer Archive Ingest Methodology Abstract Standard (PAIMAS)* (see reference [2]).

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DOCUMENT CONTROL

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CCSDS 651.1-B-1	Producer-Archive Interface Specification (PAIS), Recommended Standard, Issue 1	February 2014	Original issue

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1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this Recommended Standard is to provide a standard method for formally defining the digital information objects to be transferred by an information Producer to an Archive and for effectively packaging these objects in the form of **Submission Information Packages (SIPs).** This supports effective transfer and validation of SIP data.

This Recommended Standard fits into the context defined by:

– The *Reference Model for an Open Archival Information System (OAIS)* Recommended Standard (see reference [3]).

– The *Producer-Archive Interface Methodology Abstract Standard* (PAIMAS) Recommended Standard (see reference [2]).

– The *XML Formatted Data Unit (XFDU) Structure and Construction Rules* Recommended Standard (see reference [1]).

The PAIMAS Recommended Standard (see reference [2]) defines a methodology based on the four following phases: Preliminary, Formal Definition, Transfer, Validation.

This Recommended Standard applies specifically to the implementation of the main part of the Formal Definition Phase and the Transfer Phase, taking into account part of the Validation Phase.

The proposed implementation should help in the automation and management of the Transfer and Validation Phases.

The proposed implementation may also be used, to some extent, for the Preliminary Phase.

This Recommended Standard does not exclude other PAIMAS implementation Recommended Standards.

1.2 APPLICABILITY

The implementation defined in this document applies to any **Producer-Archive Project**. It is specifically applicable to those organizations and individuals who create information that may need Long-Term Preservation and to organizations making information available for the Long Term.

This application is relevant only if both partners in the Producer-Archive Project agree with a shared implementation as defined in this document.

1.3 RATIONALE

This Recommended Standard aims at overcoming significant difficulties encountered during transactions between information Producers and the Archives.

Regarding the Formal Definition Phase, this Recommended Standard should enable:

– the Producer to share with the Archive a sufficiently precise, unambiguous definition of the different Digital Objects to be produced and transferred, including possibly the order in which they should be transferred;

– the Archive to ensure there is sufficient information to process the Digital Objects which will be received.

Regarding the Transfer Phase, this Recommended Standard should enable a precise definition of the SIPs to be exchanged.

Regarding the Validation Phase, this Recommended Standard should enable the use of tools for systematically validating that the Digital Objects received are those expected, and that they conform to the level of detail previously agreed.

1.4 CONFORMANCE

An xml implementation is considered 'Description Conformant' if it conforms to the corresponding semantics and implementation specifications defined in sections 3 and 4.

A concrete SIP implementation is considered 'Abstract SIP Conformant' if it conforms to the semantic specification of section 5.

A concrete SIP implementation is considered 'XFDU PAIS SIP Conformant' if it conforms to the semantic specification of section 5 and the implementation specification of section 6.

Concrete SIP implementations in formats other than XFDU are allowed. They will not be considered 'XFDU PAIS SIP Conformant', but they could be 'Abstract SIP Conformant'. It is possible that additional concrete PAIS SIP implementations may be standardized in the future.

1.5 DOCUMENT STRUCTURE

1.5.1 HOW TO READ THIS DOCUMENT

All readers should study subsections 1.1 (Purpose and Scope), 1.2 (Applicability), and 1.4 (Conformance) in order to understand the objectives and applicability of this Recommended Standard.

Readers seeking an overview of the specification should also read section 2 (Overview).

Those who will implement the specification should read the entire document.

NOTE – A working knowledge of the concepts defined in the PAIMAS (reference [2]), and of the XFDU structure and construction rules (reference [1]) may be helpful in order to understand this Recommended Standard.

1.5.2 ORGANIZATION BY SECTION

Section 0 defines the purpose, scope, applicability, rationale and definitions for terminology used in this Recommended Standard. It also specifies what is required for conformance to this standard.

Section 2 contains a general overview of the specification. This overview describes the general framework of the PAIS using terms and concepts from reference [2]. It addresses a formal description of the Data Objects for transfer and the creation and validation of the SIPs containing those Data Objects.

Section 3 analyzes in detail the model of the Data Objects to be transferred by the Producer to the Archive. These Data Objects are organized into collections and Transfer Objects that are described in detail. Each description is divided into an abstract view, followed by the implementation view (partial schemas).

Section 4 describes the two different constraints that apply to the SIPs. The first one specifies the content authorized for each type of SIP. The second one specifies, if necessary, in which order the SIPs must be delivered. Each part is divided into an abstract view, followed by the implementation view (partial schemas).

Section 5 describes in detail the different SIP organizing entities, called containers.

Section 6 specifies a concrete SIP implementation using the XFDU (reference [1], partial schemas), and explains how it maps to the XFDU XML schema.

The annexes listed here are normative or informative:

- Annex A contains the full XML schemas for this specification and is normative. XML schema diagrams are presented throughout other sections of the book. If an XML schema diagram differs from the schema, the schema is considered to be the ruling entity.

- Annex B is a legend for symbols for the XML Authority Diagrams that appears in sections 3 to 6 of this document and is informative.

- Annex C contains the informative references.

- Annex D provides a table showing the management of the different identifiers defined in this document and is informative.

– Annex E discusses Security, Space Assigned Numbers Authority (SANA), and Patent Considerations and is informative.

– Annex F provides an example SIP, with Descriptors, and the mapping of the SIP to the XFDU, and is informative.

1.6 DEFINITIONS

1.6.1 ACRONYMS AND ABBREVIATIONS

This subsection defines the acronyms and abbreviations which are used throughout this Recommended Standard:

AIP	Archival Information Package
CCSDS	Consultative Committee for Space Data Systems
CCSDS CA	CCSDS Control Authority
CRC	Cyclic Redundancy Check
DED	Data Entity Dictionary
DTD	Document Type Definition
FTP	File Transfer Protocol
GB	Gigabyte
ID	Identifier
IETF	Internet Engineering Task Force
ISO	International Organization for Standardization
KB	Kilobyte
MB	Megabyte
MIME	Multipurpose Internet Mail Extensions
MOT	Model of Objects for Transfer
OAIS	Open Archival Information System
PAIMAS	Producer Archive Interface Methodology Abstract Standard
PAIS	Producer-Archive Interface Specification
PB	Petabyte
SIP	Submission Information Package
TB	Terabyte
TOTD	Transfer Object Type Descriptor
URL	Universal Resource Locator
XFDU	XML Formatted Data Unit
XML	eXtensible Markup Language

1.6.2 GLOSSARY OF TERMS

OAIS terminology as defined in references [2] is used throughout this recommendation. Following is a short glossary of the OAIS terminology indispensable for this document. The terminology used is fully defined in references [2], [3], and [C3], except for the definitions printed in italics which are defined in this document. Only brief definitions are provided here. This terminology does not seek to replace existing terminology in the various domains related to archiving. Each domain should be able to apply this methodology while retaining their specific terminology. When first used in the following sections, the terms defined in the terminology are shown in bold.

Moreover, it is assumed that it is not necessary for the Producer to know and understand the information model and the typology of the OAIS information categories in detail, such as Content Information, Representation Information, Preservation Description Information, etc. Indeed, it is the Archive's task to create AIPs from the SIPs transferred and thus to establish the suitable link between a given object coming from the Producer and any particular information category in the AIP within which this object will be inserted. To establish a dialog, the Producer and the Archive must agree on a common terminology and a common understanding of the associated concepts.

Archive: An organization that intends to preserve information for access and use by a Designated Community.

Collection Descriptor: A set of attributes that describes a view of a single collection of data and that identifies the parent collection of which it is a part.

Data Object: Either a Physical Object or a Digital Object.

Data Object Type: A set of characteristics describing a Data Object (such as the size of this object and the description of its content). Typically there will be multiple Data Objects conforming to the same Data Object Type.

Descriptor: Either a Collection Descriptor or a Transfer Object Type Descriptor.

Descriptor Model: A model that defines the mandatory and optional attributes needed for a Collection Descriptor or a Transfer Object Type Descriptor.

Digital Object: An object composed of a set of bit sequences.

Fixity Information: The information which documents the mechanisms that ensure that the Content Information Object has not been altered in an undocumented manner. An example is a Cyclical Redundancy Check (CRC) code for a file.

Information: Any type of knowledge that can be exchanged. In an exchange, it is represented by data. An example is a string of bits (the data) accompanied by a description of how to interpret a string of bits as numbers representing temperature observations measured in degrees Celsius (the Representation Information).

Information Package: A conceptual container composed of optional Content Information and optional associated Preservation Description Information. Associated with this Information Package is Packaging Information used to delimit and identify the Content Information and Package Description Information used to facilitate searches for the Content Information.

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 (see reference [C3]).

Model of Objects for Transfer (MOT): The set of all Descriptors for a given Producer-Archive Project. It is used jointly by the Producer and the Archive to provide a common and understandable hierarchical view of the Producer's Data Objects to be transferred and their organization into collections, and it supports possible additional relationships among them. The hierarchy may be viewed as a tree having leaf and non-leaf nodes. The Data Objects to be transferred, organized as 'Transfer Objects,' are represented by the leaves of the MOT. Thus the nodes of the MOT have a different meaning depending on whether they are leaves or not:

– *A leaf node corresponds to a single Transfer Object Type and therefore one exists for each Transfer Object Type Descriptor.*

– *A non-leaf node corresponds to a collection view of Transfer Object Types, or of a collection of collections. A non-leaf node exists for each Collection Descriptor.*

Producer: The role played by those persons or client systems who provide the information to be preserved. This can include other OAISes or internal OAIS persons or systems.

Producer-Archive Project: A Producer-Archive Project is a set of activities and the means used by the information Producer as well as the Archive to ingest a given set of information into the Archive.

Submission Agreement: The agreement reached between an OAIS and the Producer that specifies a data model, and any other arrangements needed, for the Data Submission Session. This data model identifies format/contents and the logical constructs used by the Producer and how they are represented on each media delivery or in a telecommunication session.

Submission Information Package (SIP): An Information Package that is delivered by the Producer to the OAIS for use in the construction or update of one or more AIPs and/or the associated Descriptive Information.

Transfer Object: A set of one or more Transfer Object Groups containing at least one Data Object that are to be transferred to the Archive.

Transfer Object Group: A set of zero or more Data Objects and zero or more Transfer Object Groups.

Transfer Object Group Type: A set of characteristics describing a Transfer Object Group. Typically there can be multiple Transfer Object Groups conforming to the same Transfer Object Group Type.

Transfer Object Type: A set of characteristics describing a Transfer Object (such as the size of this object, the description of its content, and its makeup in terms of one or more Data Object Types). Typically there can be multiple Transfer Objects conforming to the same Transfer Object Type.

Transfer Object Type Descriptor: A set of attributes that describes a Transfer Object Type and that identifies the parent collection of which it is a part.

1.7 NOMENCLATURE

1.7.1 NORMATIVE TEXT

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

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

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

c) the word 'may' implies an optional specification;

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

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

1.7.2 INFORMATIVE TEXT

In the normative sections of this document (sections 3-6), informative text is set off from the normative specifications either in notes or under one of the following subsection headings:

– Overview;

– Background;

– Rationale;

– Discussion.

1.8 REFERENCES

The following documents contain provisions which, through reference in this text, constitute provisions of this Recommended Standard. At the time of publication, the editions indicated were valid. All documents are subject to revision, and users of this Recommended Standard 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 Recommended Standards.

[1] *XML Formatted Data Unit (XFDU) Structure and Construction Rules*. Issue 1. Recommendation for Space Data System Standards (Blue Book), CCSDS 661.0-B-1. Washington, D.C.: CCSDS, September 2008. [Equivalent to ISO 13527:2010.]

[2] *Producer-Archive Interface Methodology Abstract Standard*. Issue 1. Recommendation for Space Data System Practices (Magenta Book), CCSDS 651.0-M-1. Washington, D.C.: CCSDS, May 2004. [Equivalent to ISO 20652:2006.]

[3] *Reference Model for an Open Archival Information System (OAIS)*. Issue 2. Recommendation for Space Data System Practices (Magenta Book), CCSDS 650.0-M-2. Washington, D.C.: CCSDS, June 2012. [Equivalent to ISO 14721:2012.]