The PDS4 Information Model (IM)

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New planetary products, tools, data and services
Tuesday June 13, 8:55 am
Information Model Overview

• Developed using:
  – lessons learned from 20 years worth of archiving
  – best practices for information model development

• Foundational principles adopted from:
  – Open Archival Information System (OAIS) Reference Model - ISO 14721 - Foundational Principles
  – W3C XML (Extensible Markup Language) - Rules for encoding documents electronically.

• Drives the PDS4 infrastructure by providing:
  – the representation of concepts and their relationships, constraints, rules, and operations
  – a sharable, stable, and organized structure of information requirements.
  – formal definitions that are suitable for configuring and generating code.
Views

Community’s View

Information Modeler’s View

Repository View

Product

Tagged Data Object

(Information Object)

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Describes

Data Object
Roles

- Defines the:
  - data structure (format)
  - science interpretation of the data
  - context within which the data was captured, processed, and archived
  - relationships between the data

acquired from domain experts from each of the science disciplines

- Provides a multilevel governance framework
  - Common dictionary provides core definitions
  - Discipline and mission level extensions
  - Governance authority resides with dictionary Stewards

- Provide a single authoritative source for the data standards
- Remains independent of its implementation.
IM Software

• Information Model Tool (IMTool)
  • *Builds the IM master database from a protégé object model, protégé data dictionary database, and configuration files.*
  • *Extracts the database content and converts it to system files in various formats for system configuration.*

• Local Data Dictionary Tool (LDDTool) -- IMTool –l
  • *Accepts one or more Local Data Dictionary (LDD) definition files (Ingest_LDD).*
  • *Validates the syntax, semantics, and modeling approach*
  • *Ingests the LDD(s) into the master database*
  • *Checks consistency against the Common dictionary*
  • *Writes system files*
• Delivered to I&T on March 31, 2017.
• Documents and artifacts available on PDS4 web site
  – *Information Model Specification (HTML)*
  – *Release Notes*
  – *Data Dictionary (HTML and PDF)*
  – *XML Schema and Schematron*
  – *System files in various formats*
    • JSON, XMI/UML, RDF/OWL
  – *Updated Namespace Registry*
Changes

• Common Dictionary
  – Made the ASCII numeric data types boundaries more precise

• Other changes
  – Product_SIP_Deep_Archive
  – Property Maps
  – JSON file
  – Documents
SCR metrics over time
Common Dictionary

![Chart showing SCR metrics over time for years 2013 to 2017 with a peak in 2014.](chart-area)
Dictionary Governance

• Registration Authority is an entity that has the authority and responsibility to govern one or more dictionaries.

• Steward is an entity consisting of a group of domain experts that is given authority and responsibility by a Registration Authority to govern (i.e., create and manage) one or more dictionaries within a domain area.
  – One member of the group is identified as a primary steward.
  – The steward in general can create one or more namespaces within a domain.

• Namespace is a “container” for a logical grouping under a single identifier of classes and attributes.
IM Governance

Registration Authority
Steward
governs

Common
pds:

Discipline
disp: rings: img: geom: cart:

Mission
ladee: mvn: mgs: insight: orex:

ISO 14721:2003 - Open Archival Information System (OAIS) Reference Model
# Model Components

## Common, Discipline and Mission Dictionaries

<table>
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<tr>
<th>Registration Authority</th>
<th>Steward Id</th>
<th>Namespace Id*</th>
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<td>Mission</td>
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</table>
Dictionary Governance

• Dictionary
  – Name: Common
  – Registration Authority: 0001_NASA_PDS_1
  – Steward_id: pds
  – Steward¹: PDS EN Node
  – Namespace_id: pds
  – Namespace: http://pds.nasa.gov/pds4/pds/v1

• Dictionary
  – Name: Geometry
  – Registration Authority: 0001_NASA_PDS_1
  – Steward_id: geo
  – Steward¹: PDS GEO Node
  – Namespace_id: geom
  – Namespace: http://pds.nasa.gov/pds4/geom/v1

¹ The primary governance entity within the stewardship group
IM V1.9.0.0 Release Schedule

Last DDWG meeting for SCR review is August 3, 2017.

1. Aug 17, 2017 – All SCRs to be implemented have been identified

   - Release IM to development directory
   - Internal testing
   - Fix bugs

3. Aug 31 – 13, 2017 – EN, DN, and IPDA testing
   - Release IM to development directory
   - Perform regression testing at EN

4. Sep 14 - 28, 2017 – Prepare IM for release to System I&T

5. Sep 29, 2017 – Release IM to release directory
   - “Start of Build” and System I&T
   - IM is frozen

6. System I&T - System Testing

7. System Release Build
Summary

- The PDS4 Information Model and Standards are being used successfully
  - *Have been adopted by the International Planetary Data Alliance (IPDA).*

- Still work to be done
  - *Discipline Dictionaries*
  - *Leverage the IM in system development*
    - Configuration of search engines and other services
    - Development of model-driven software

- Desk Assessment of PDS4 against ISO 16363 found that 92% of the metrics of the ISO 16363 standard were satisfied
  - 80% of the metrics for Governance and Organizational Viability
  - 95% of the metrics for Digital Object Management
  - 96% of the metrics for Infrastructure and Security Risk Management.
Thank You

Questions and Answers

PDS homepage: https://pds.nasa.gov/

Acknowledgements - This research was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.
Backup
Definitions

• “An information model is a representation of concepts, relationships, constraints, rules, and operations to specify data semantics for a chosen domain of discourse.” ¹

• It provides a sharable, stable, and organized structure of information requirements or knowledge for the domain context.

Summary of Changes to Standards Reference (SR)

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<th>Change Description</th>
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<tr>
<td>CCB-171</td>
<td>Revised definitions of ASCII_Integer, ASCII_NonNegative_Integer, and ASCII_Real.</td>
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ALL CHANGES were captured in Change Log and reviewed by Document Review Team
# Summary of Changes to Data Provider’s Handbook (DPH)

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<td>CCB-98</td>
<td>Choose most specific class available to describe an object.</td>
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<tr>
<td>CCB-146, CCB-160</td>
<td>Added “ros” and “jaxa” as valid agencies for context product LIDs.</td>
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<td>n/a</td>
<td>Incorporated comments from Ed Guinness, Matt Tiscareno, Santa Martinez, Lev Nagdimunov, Dick Simpson, Ron Joyner, and Richard Chen.</td>
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<tr>
<td>n/a</td>
<td>Completely reorganized sections in main text and appendices. Rewrote existing text and added sections. Moved detailed instructions to appendices. The goal has been to make the flow of information more logical in the order of presentation and in the level of detail for the non-expert reader. The Appendix on Creating and Using Local Data Dictionaries has not been rewritten. It needs special attention. Consider making it a separate document.</td>
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## Dictionary Consistency

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1 A dictionary stack consists of a known set of consistent dictionaries available for PDS4 product.
Dictionary Governance

ISO¹ Standard Governance Entities

- Registration Authority
- Steward
- Namespace

¹ ISO 14721:2003 - Open Archival Information System (OAIS) Reference Model