Ingest LDD

Users Guide

Version 1.3.0

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# Change Log

## Version 1.3.0

| **Date** | **Section(s)** | **Changes(s)** |
| --- | --- | --- |
| 2014-04-16 | Change Log | First draft |
| 2015-11-4 | 4.1.6 | Added Property\_Maps |
| 2021-02-24 | 3.5 | Add Auto-generate Data Dictionary Documentation |

# 1 Introduction

The *Ingest LDD* schema is defined in the PDS4 Information Model (IM) and is used to define local data dictionaries. Once a local data dictionary is defined it can be ingested into the IM and the PDS4 Data Dictionary Data Base (DDDB). A local data dictionary at the discipline level is required to be ingested. A dictionary at the mission level can optionally be ingested.

The PDS4 Information Model (IM) is the fundamental reference for PDS4 structure; its requirements can be validated automatically using eXtensible Markup Language (XML) schemas.

The PDS4 Data Dictionary Data Base (DDDB) is the fundamental reference for definitions of classes and attributes.

## 1.1 Purpose

This document describes the elements of *Ingest LDD* and how they are used to create a local data dictionary.

*Ingest LDD* is both an XML schema defined in the PDS4 IM and an XML template generated from the schema. The *Ingest LDD* template is used during the design of a local data dictionary to capture the components of the local data dictionary.

## 1.2 Scope

The *Ingest LDD* Users Guide applies to local data dictionaries at the discipline and mission levels of the PDS. The *Ingest LDD* constrains the design of a local data dictionary so that it is consistent with the core PDS4 IM and DDDB and all controlling standards documents.

## 1.3 Audience

The Ingest LDD Users Guide is intended primarily to serve the community of scientists and engineers responsible for creating local data dictionaries for the PDS4 Information Model. These new dictionaries augment the common model and have their own stewards and unique namespaces. The audience includes personnel at PDS discipline and data nodes, principal investigators and their staffs, and ground data system engineers. The document will be most useful to people who have prior experience with the PDS Information Model and modeling practices.

## 1.4 Document Organization

The Ingest LDD Users Guide is divided into four parts. The first is this part. The second provides detailed information on the components of Ingest LDD. The third describes special considerations for building a local data dictionary. The final part is an example of a completed Ingest\_LDD template.

## 1.5 External Standards

External standards, which apply to this document and to PDS4-compliant data, include the following:

International Standards Organization (ISO)

* ISO/IEC 11179-3:2003 *Metadata registries (MDR) – Part 3: Registry metamodel and basic attributes*
* ISO/IEC 19757-3:2006 *Information technology -- Document Schema Definition Languages (DSDL) -- Part 3: Rule-based validation -- Schematron*

World Wide Web Consortium (W3C)

* *Extensible Markup Language (XML) 1.0* (Fifth Edition)
* *W3C XML Schema Definition Language (XSD) 1.1 Part 1: Structures* (W3C, 2012a)
* W3C XML Schema Definition Language (XSD) 1.1 Part 2: Datatypes (W3C, 2012b)

## 1.6 Document Availability

PDS4 documents governing archive preparation are available online at:

<http://pds.nasa.gov/pds4/doc/>

For questions concerning these documents, contact any PDS data engineer or contact the PDS Operator at [pds\_operator@jpl.nasa.gov](mailto:pds_operator@jpl.nasa.gov) or 818-393-7165.

Associated schemas for current and past versions of PDS4 can be found at

<http://pds.nasa.gov/pds4/schema/released/>

# 2 Ingest LDD

An *Ingest LDD* template is used during the design of a local data dictionary to capture the components of the local data dictionary. In the following sections each class is described as a series of attribute definitions[[1]](#footnote-1). If the class has component classes, these are referenced by name. The component classes are each defined in their own section.

Note that the *Ingest\_LDD*, *DD\_Attribute*, and *DD\_Class* classes described in this section are strictly classified as meta-classes since they are being used to define classes at the user level. Likewise the *comment*, *name*, and *description* attributes are strictly classified as meta-attributes since they are used in the meta-classes. This distinction is important to keep in mind while discussiong the Ingest\_LDD template since the meta-class uses meta-attributes to define user level classes and attributes. However for the remainder of this document and for simplicity the simpler terms *attribute* and *class* will be used.

Finally there are special considerations for selected attributes. For example, attributes defined in an external dictionary can be referenced as a component when defining a class. The mechanism for distinguishing local from external attributes is described in section three.

# 2 Ingest LDD Components

## 2.1 Ingest LDD

The *Ingest\_LDD* schema is used to define a new local data dictionary. The *Ingest\_LDD* class is the header for the dictionary.



## 

## 2.2 DD\_Attribute

The *DD\_Attribute* class is used to define an attribute for the local data dictionary. All attributes should be defined before any class is defined. Each attribute is subsequently referenced in the class definitions zero or more times. Within a class, an attribute is indicated as Optional if its minimum and maximum cardinalities are 0:1. An attribute is indicated as Required if its minimum and maximum cardinalities are 1:1. For example “comment” is an Optional attribute which may be omitted when completing a DD\_Attribute class.



### 2.2.1 Internal\_Reference

The Internal Reference class is used to reference a product in a PDS4 registry. Either the LID or the LIDVID of the product, but not both, may be used.



### 2.2.2 Terminological\_Entry

The Terminological Entry class is used to provide an alternate name and definition.



### 2.2.2.1 Internal\_Reference\_Extended

The Internal\_Reference\_Extended provides a reference to documents or resources that are external to a PDS4 registry.



### 2.2.3 DD\_Value\_Domain

The DD\_Value\_Domain class is used to define the data type and value constraints for a DD\_Attribute.



## 2.2.3.1 DD\_Permissible\_Value

The DD\_Permissible\_Value class is used to define the permissible values and value meanings for an attribute.



## 2.3 DD\_Class

The DD\_Class class is used to define a new class for the local data dictionary. Once all attributes are defined, the classes are defined by referencing their component attributes and classes through the DD\_Association class. Each attribute or class can be referenced zero or more times.



## 2.3.1 DD\_Association

The DD\_Association class is used to relate a class to each of its components. The sequence order of the DD\_Association classes is the order assigned to the components.



## 2.4 DD Rule

The DD\_Rule class is used to define a rule for validating constraints.



## 2.4.1 DD Rule Statement

The DD\_Rule\_Statement class is used to define a rule for validating constraints.



## 2.5 Property Maps

The Property Maps class defines a collection of one or more related Property Map(s). Each Property Map is an association of one or more parameter/value pairs to a single attribute defined in the Information Model. The purpose of a Property Map is to augment an attribute’s definition with additional information, for example a synonym from another model.



## 2.5.1 Property Map

The Property Map class defines a table consisting of a set of data elements and their values. Each Property Map is an association of one or more parameter/value pairs to a single attribute defined in the Information Model. The purpose of a Property Map is to augment an attribute’s definition with additional information, for example a synonym from another model.



## 2.5.1.1 Property Map Entry

The property map entry consists of a property name and one or more values. The purpose of a Property Map Entry is to augment an attribute’s definition with a single item of additional information, for example a synonym from another model.



# 3 Special Considerations

## 3.1 References to Attributes or Classes from Other Namespaces

In DD\_Association, an attribute or a class can be referenced from another namespace. The reference is provided as a value of local\_identifier and consists of the namespace followed by a period ‘.’ followed by the name of the attribute or class. In the case of an attribute, assume that the attribute definition is generic and has not been restricted in the referenced namespace.



## 3.2 Restrictions of Attributes from Other Namespaces

In DD\_Attribute, an attribute from an external namespace can be restricted and used in this namespace. The name of the attribute may or may not change. The local attribute definition takes precedence over the definition of the external attribute. The reference to the external attribute is provided as a value of local\_identifier and consists of the unique identifier of the attribute. This identifier consists of the class namespace id, class name, attribute namespace id, and attribute name, each delimted by a period ‘.’.



## 3.3 Allowing a Choice Between Several Attributes or Classes

In DD\_Association a choice between several attributes or classes can be indicated by including the special token *XSChoice#* as a value of local\_identifier. All remaining values of local\_identifier, attribute or class names, will subsequently be grouped in a choice block.



## 3.4 Allowing Any Attribute or Class

In DD\_Association the special token *XSAny#* used as a value of local\_identifier indicates that any attribute or class can be added and that they will not be verified as required or optionoal members. Any remaining values of local\_identifier, attribute or class names, will subsequently be grouped in the *Any* block.



## 3.5 Auto-generate Data Dictionary Documentation

See Github Wiki describing the process for doing this: <https://github.com/NASA-PDS/pds4-information-model/wiki/Generating-Data-Dictionary-Documentation>

# 4 Examples

## 4.1 Display Local Data Dictionary

The *Display* dictionary describes how to display Array data on a display device. In the following example, snippets of the dictionary have been inserted.

### 4.1.1 Ingest\_LDD – The header for the local data dictionary

The Ingest\_LDD class provides general information about the local data dictionary. The names\_space\_id and ldd\_version\_id in particular are used to name the resulting files, for example the XML schema file.

</Ingest\_LDD>

<name>Display</name>

<ldd\_version\_id>1.1.0.0</ldd\_version\_id>

<full\_name>Elizabeth D. Rye</full\_name>

<steward\_id>img</steward\_id>

<namespace\_id>disp</namespace\_id>

<comment>This dictionary describes how to display Array data on a display

device.</comment>

<last\_modification\_date\_time>2014-02-21T20:12:59Z</last\_modification\_date\_time>

### 4.1.2 DD\_Attribute – Defining an attribute

DD\_Attribute is used to define an attribute. The two instances of DD\_Attribute provide below define a standard attribute that accepts a simple token as a value and an attribute that has set of permissible values, respectively.

<DD\_Attribute>

<name>horizontal\_display\_axis</name>

<version\_id>1.0</version\_id>

<local\_identifier>disp.horizontal\_display\_axis</local\_identifier>

<nillable\_flag>false</nillable\_flag>

<submitter\_name>Elizabeth D. Rye</submitter\_name>

<definition>The horizontal\_display\_axis attribute identifies, by name,

the axis of an Array (or Array subclass) that is intended to be

displayed in the horizontal or "sample" dimension on a display

device. The value of this attribute must match the value of one, and

only one, axis\_name attribute in an Axis\_Array class of the

associated Array.</definition>

<DD\_Value\_Domain>

<enumeration\_flag>false</enumeration\_flag>

<value\_data\_type>ASCII\_Short\_String\_Collapsed</value\_data\_type>

<unit\_of\_measure\_type>Units\_of\_None</unit\_of\_measure\_type>

</DD\_Value\_Domain>

</DD\_Attribute>

<DD\_Attribute>

<name>horizontal\_display\_direction</name>

<version\_id>1.0</version\_id>

<local\_identifier>disp.horizontal\_display\_direction</local\_identifier>

<nillable\_flag>false</nillable\_flag>

<submitter\_name>Elizabeth.D.Rye</submitter\_name>

<definition>The horizontal\_display\_direction attribute specifies the

direction across the screen of a display device that data along the

horizontal axis of an Array is supposed to be displayed.</definition>

<DD\_Value\_Domain>

<enumeration\_flag>true</enumeration\_flag>

<value\_data\_type>ASCII\_Short\_String\_Collapsed</value\_data\_type>

<unit\_of\_measure\_type>Units\_of\_None</unit\_of\_measure\_type>

<DD\_Permissible\_Value>

<value>Left to Right</value>

<value\_meaning>The lowest indexed element along an array axis should be displayed at the left edge of a display device and elements with higher indices should be displayed further to the right. Note that this is the standard display direction for most major image formats.</value\_meaning>

</DD\_Permissible\_Value>

<DD\_Permissible\_Value>

<value>Right to Left</value>

<value\_meaning>The lowest indexed element along an array axis should be displayed at the right edge of a display device and elements with higher indices should be displayed further to the left. Note that virtually no image display formats use this display direction. Use this only when deliberately mirroring the image around the vertical axis.</value\_meaning>

</DD\_Permissible\_Value>

</DD\_Value\_Domain>

</DD\_Attribute>

### 4.1.3 DD\_Class – Defining a class

DD\_Class is used to define a class. The namespace\_id of the class is inherited from the Ingest\_LDD class. The local\_identifier is used if necessary to reference the class in this XML file however it has no role in the resulting files, for example the XML schema file.

<DD\_Class>

<name>Display\_Direction</name>

<version\_id>1.0</version\_id>

<local\_identifier>disp.Display\_Direction</local\_identifier>

<submitter\_name>Elizabeth D. Rye</submitter\_name>

<definition>The Display\_Direction class specifies how two of the

dimensions of an Array object should be displayed in the vertical

(line) and horizontal (sample) dimensions of a display

device.</definition>

### 4.1.4 DD\_Association – Relating the components to the class

DD\_Association is used to relate the components to the class. The attribute local\_identifier is used to reference either an attribute or a class that is defined in this XML file. The reference\_type attribute indicates the type of the relationship. The minimum\_occurrences and the maximum\_occurences indicate whether the component is optional or required. As and example of a special consideration, in the following, the attribute *comment* is being referenced from the pds namespace. This is inferred since the value of local\_identifier is not present in this XML file.

<DD\_Association>

<local\_identifier>pds.comment</local\_identifier>

<reference\_type>attribute\_of</reference\_type>

<minimum\_occurrences>0</minimum\_occurrences>

<maximum\_occurrences>1</maximum\_occurrences>

</DD\_Association>

<DD\_Association>

<local\_identifier>disp.horizontal\_display\_axis</local\_identifier>

<reference\_type>attribute\_of</reference\_type>

<minimum\_occurrences>1</minimum\_occurrences>

<maximum\_occurrences>1</maximum\_occurrences>

</DD\_Association>

<DD\_Association>

<local\_identifier>disp.horizontal\_display\_direction</local\_identifier>

<reference\_type>attribute\_of</reference\_type>

<minimum\_occurrences>1</minimum\_occurrences>

<maximum\_occurrences>1</maximum\_occurrences>

</DD\_Association>

...

</DD\_Class>

### 4.1.5 DD\_Rule – Defining a rule

DD\_Rule is used to define a rule for validating constraints. The following validates that if the Display\_Direction class is in the label then it must be contained in the Display\_Settings class.

<DD\_Rule>

<local\_identifier>Display\_Direction\_Display\_Settings</local\_identifier>

<rule\_context>pds:Discipline\_Area</rule\_context>

<DD\_Rule\_Statement>

<rule\_type>Assert</rule\_type>

<rule\_test>if (disp:Display\_Direction) then (disp:Display\_Settings/disp:Display\_Direction) else true()</rule\_test>

<rule\_message>Display Dictionary: If the Display\_Direction class is in the label, it must be contained in a Display\_Settings class.</rule\_message>

</DD\_Rule\_Statement>

</DD\_Rule>

</Ingest\_LDD>

### 4.1.6 Property\_Maps - Defining a Property\_Maps

The Property Maps class defines a collection of one or more related Property Maps. Each Property Map is an association of one or more parameter/value pairs to a single attribute defined in the Information Model. The purpose of a Property Map is to augment an attribute’s definition with additional information, for example a synonym from another model.

<Property\_Maps>

<identifier>img\_property\_map\_definitions</identifier>

<namespace\_id>img</namespace\_id>

<property\_map\_type>Synonym</property\_map\_type>

<property\_map\_subtype>PDS3 Keyword</property\_map\_subtype>

<Property\_Map>

<identifier>0001\_NASA\_PDS\_1.pds.Property\_Map.

img.Instrument\_Compression\_Parameters.img.

instrument\_compression\_block\_size\_x</identifier>

<model\_object\_id>0001\_NASA\_PDS\_1.img.

Instrument\_Compression\_Parameters.img.

instrument\_compression\_block\_size\_x</model\_object\_id>

<model\_object\_type>Attribute</model\_object\_type>

<instance\_id>xpath to an XML label instance if needed</instance\_id>

<description>IMG instrument\_compression\_block\_size\_x definitions</description>

<Property\_Map\_Entry>

<property\_name>PDS3 Keyword</property\_name>

<property\_value>INST\_CMPRS\_BLK\_SIZE</property\_value>

</Property\_Map\_Entry

</Property\_Map>

<Property\_Map>

<identifier>0001\_NASA\_PDS\_1.pds.Property\_Map.img.

Instrument\_Compression\_Parameters.img.

instrument\_compression\_block\_size\_y</identifier> <model\_object\_id>0001\_NASA\_PDS\_1.img.Instrument\_Compression\_Parameters.img.

instrument\_compression\_block\_size\_y</model\_object\_id>

<model\_object\_type>Attribute</model\_object\_type>

<instance\_id>xpath to an XML label instance if needed</instance\_id>

<description>IMG instrument\_compression\_block\_size\_y definitions</description>

<Property\_Map\_Entry>

<property\_name>PDS3 Keyword</property\_name>

<property\_value>INST\_CMPRS\_BLK\_SIZE</property\_value>

</Property\_Map\_Entry>

</Property\_Map>

<Property\_Maps>

1. Note that the classes *Ingest\_LDD*, *DD\_Attribute*, and *DD\_Class* described in this section are strictly classified as meta-classes since they are being used to define classes at the *user* level. Likewise the attributes *comment*, *name*, and *description* are strictly classified as meta-attributes since they are used in the meta-classes. This distinction is important to keep in mind while discussiong the Ingest\_LDD template since the meta-class uses meta-attributes to define the *user* level classes and attributes. However for the remainder of this document and for simplicity the simpler terms *attribute* and *class* will be used. [↑](#footnote-ref-1)