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LDDTool, Ingest_LDD, and Dictionary Stacks

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PDS Technical Session

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Topics

- LDDTool
- Ingest_LDD
- Dictionary Stacks

LDDTool
Purpose: Load/Validate a Dictionary

- **LDDTool – Local Data Dictionary (LDD) Tool**
  - *Performs a temporary load of a dictionary into the Master Information Model (dictionary) Database*
  - *Process*
    - Accepts one or more Ingest_LDD files.
    - Parses and merges each file into the Information Model database
    - Validates and reports errors
    - Write XML Schema, Schematron, XML Label, JSON, and other files

- **LDDTool is the same software as IMTool**
  - *Run IMTool software using "-l" argument*

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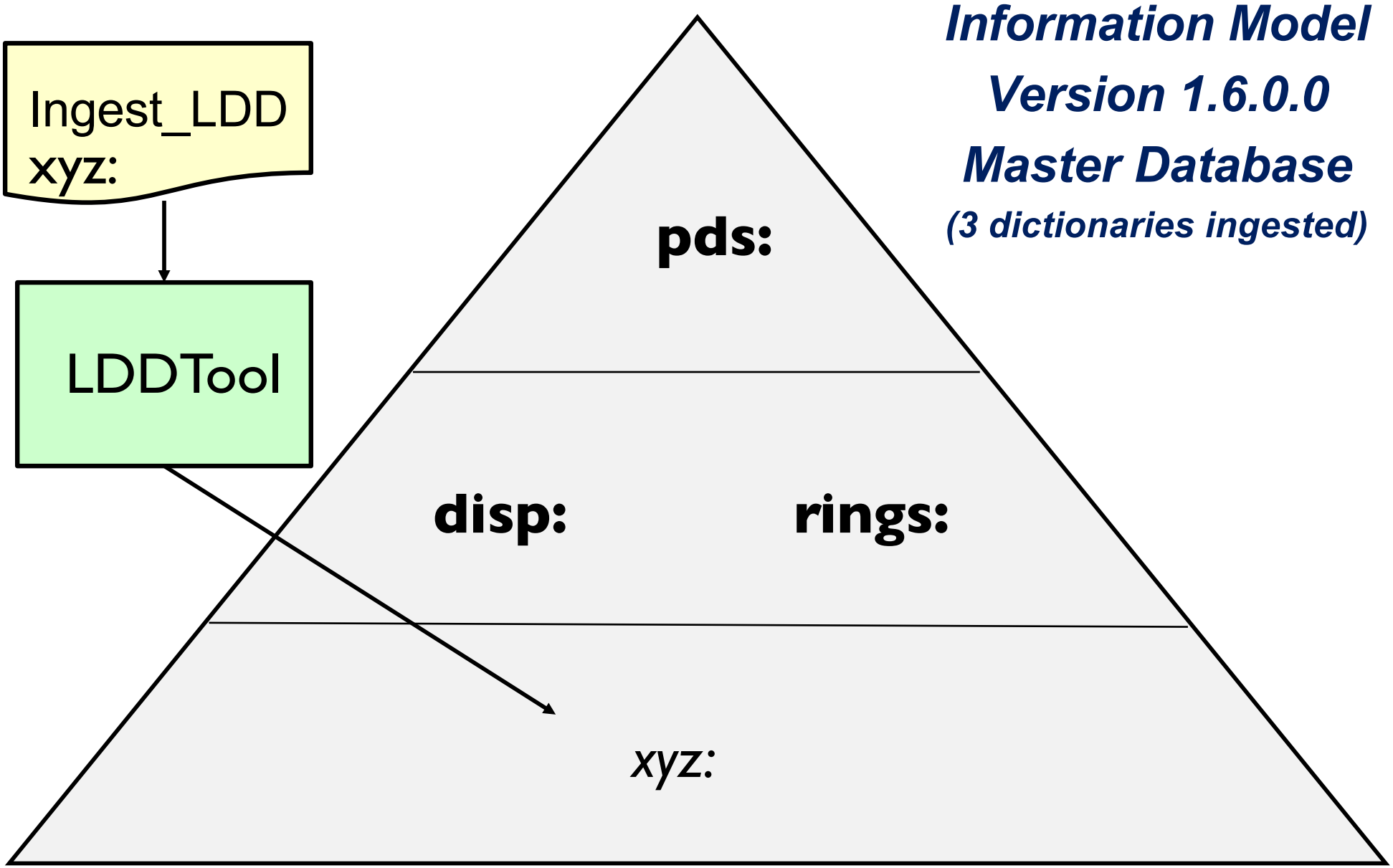
Temporary Load of a Dictionary into the IM Database



Information Model
Version 1.6.0.0
Master Database
(3 dictionaries ingested)

LDDTool Output

- IngestLDDTool_XSD_1310.xsd – XML Schema
- IngestLDDTool_XSD_1310.sch - Schematron
- IngestLDDTool_XSD_1310.xml – PDS4 Label

- IngestLDDTool_XSD_1310.txt – Process Log
  - Errors and Warnings

- IngestLDDTool_XSD_1310.JSON – JSON formatted file
  - Contains the contents of the IM database
    - Common and all ingested discipline and mission dictionaries.

Other Details

- Version Id of the local dictionary is set in Ingest_LDD
  - *Default is the IM version id*
- -c option defines classes as xs:elements
- -a option defines attributes as xs:elements
- -J write the database to a JASON formatted file
- -M generate files with “Mission” included in the targetNamespace
- -n, write nuance property maps to LDD schema annotation in JSON
- -s , use local namespace + information model version as output file names
- filename(s) – other referenced local dictionaries

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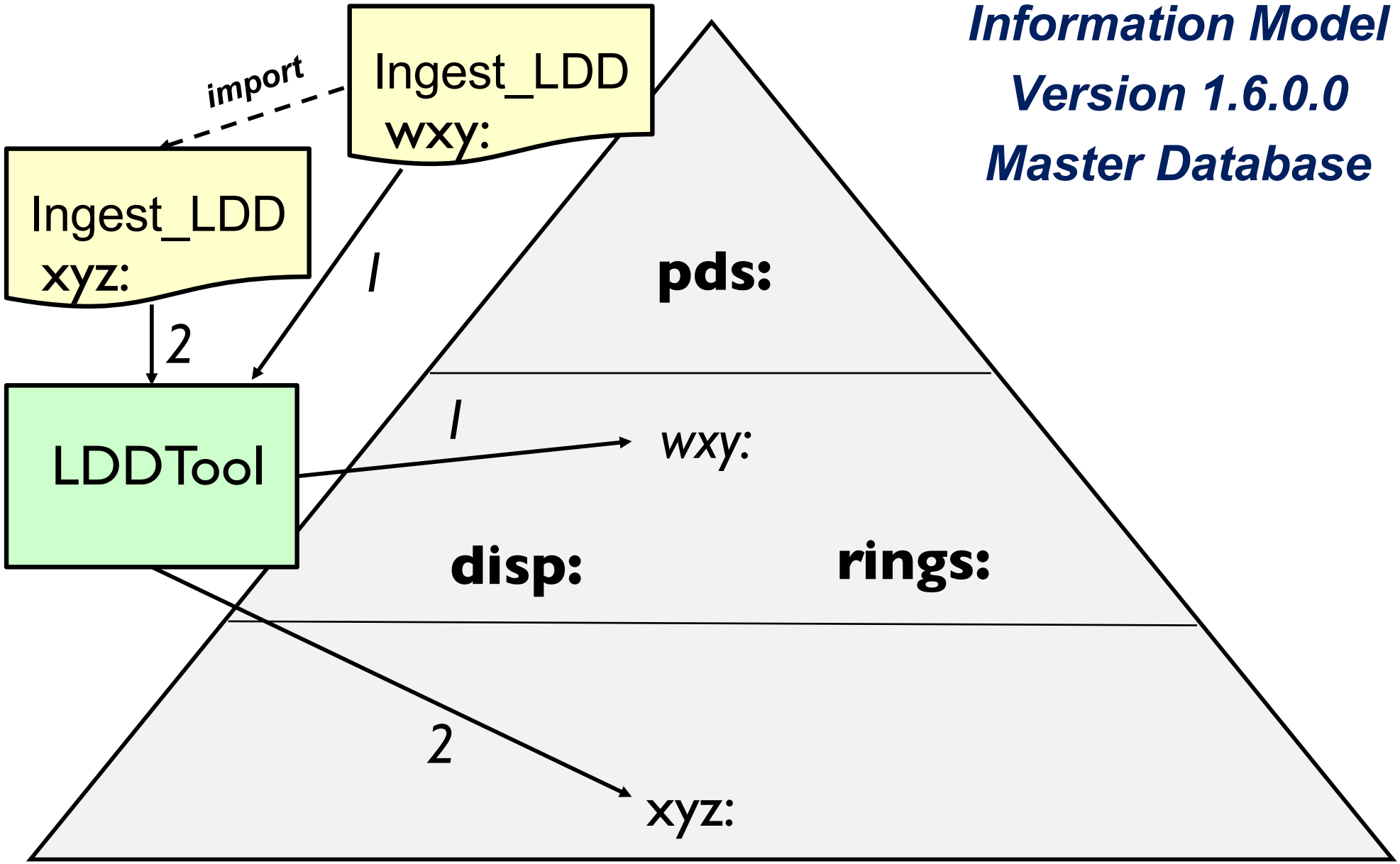
Ingest of an Mission LDD that imports a Discipline LDD



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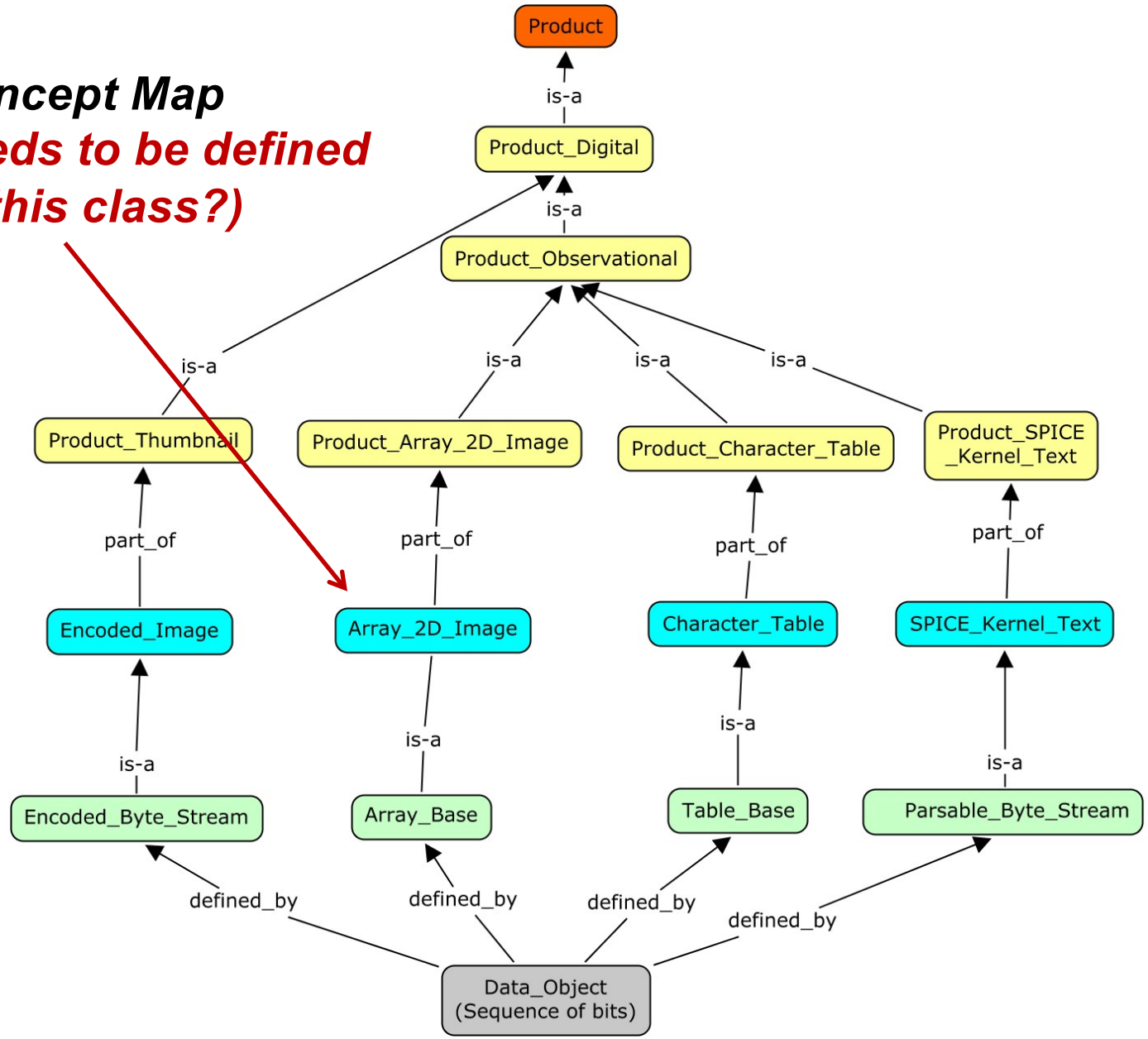
Ingest_LDD
Purpose: Define Classes

Concept Map
(What needs to be defined for this class?)



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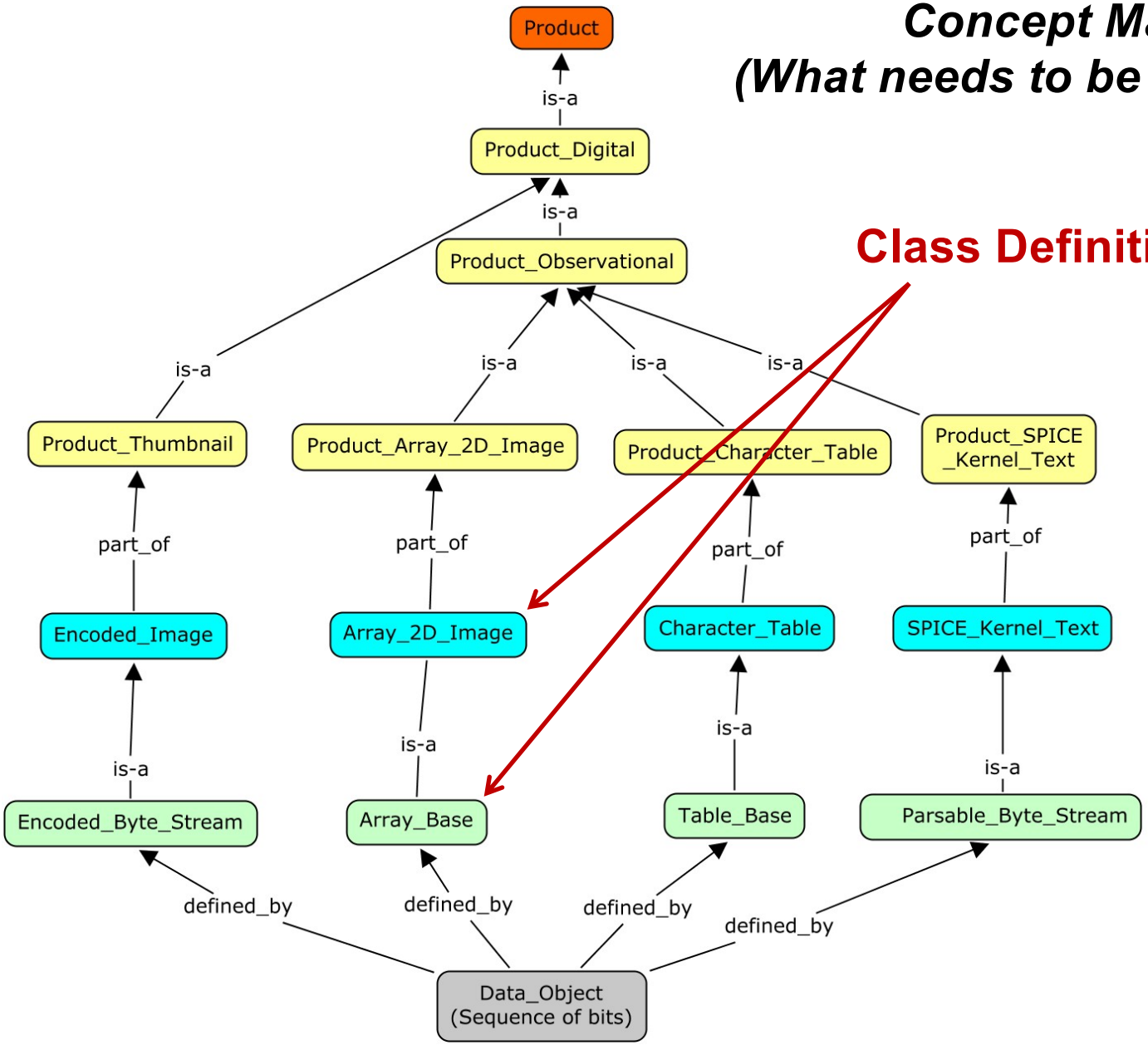
Ingest_LDD
Purpose: Define Classes

Concept Map
(What needs to be defined?)

Class Definitions



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Ingest_LDD
Purpose: Define Classes

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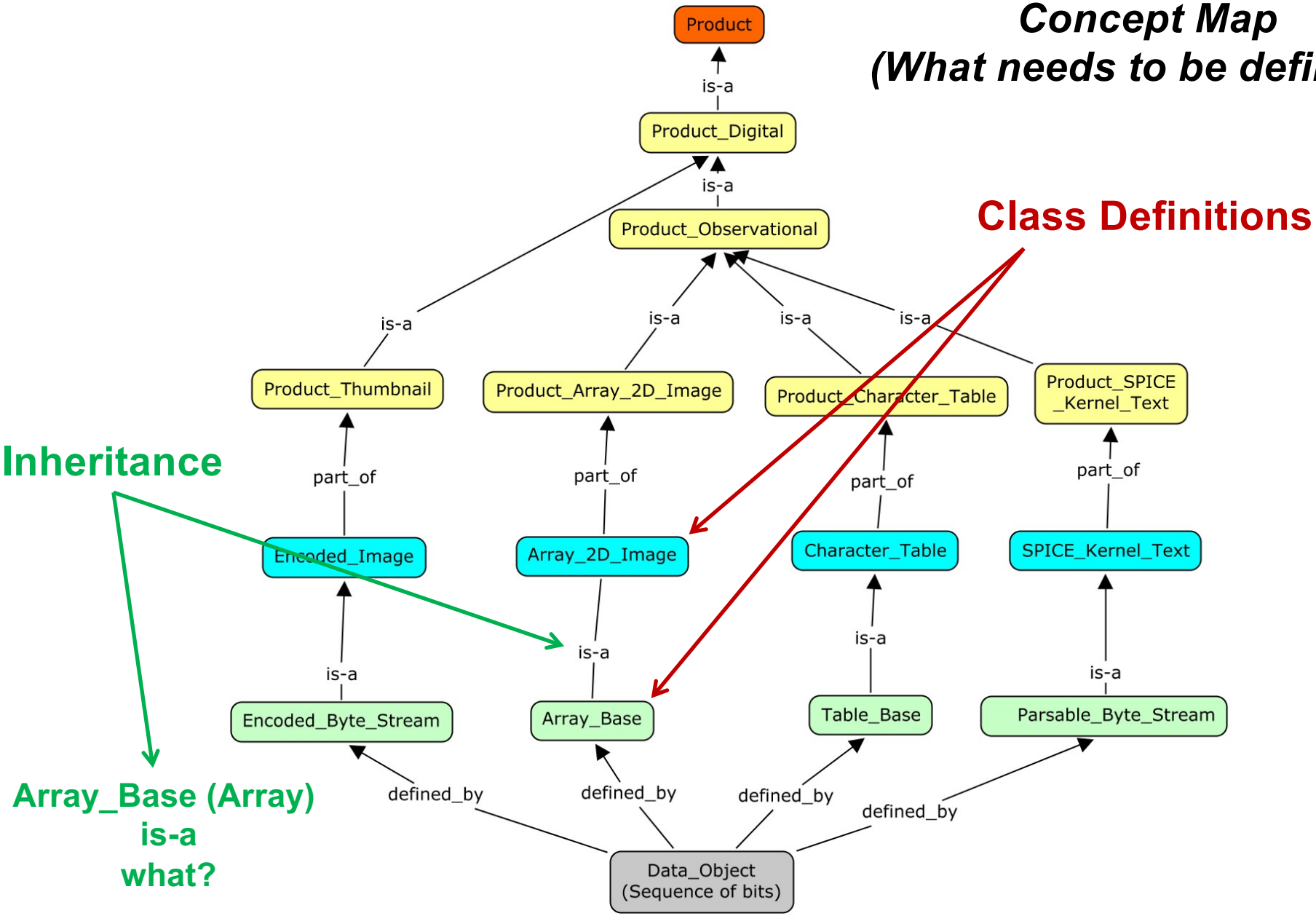
(What needs to be defined?)



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Ingest_LDD
Purpose: Define Classes

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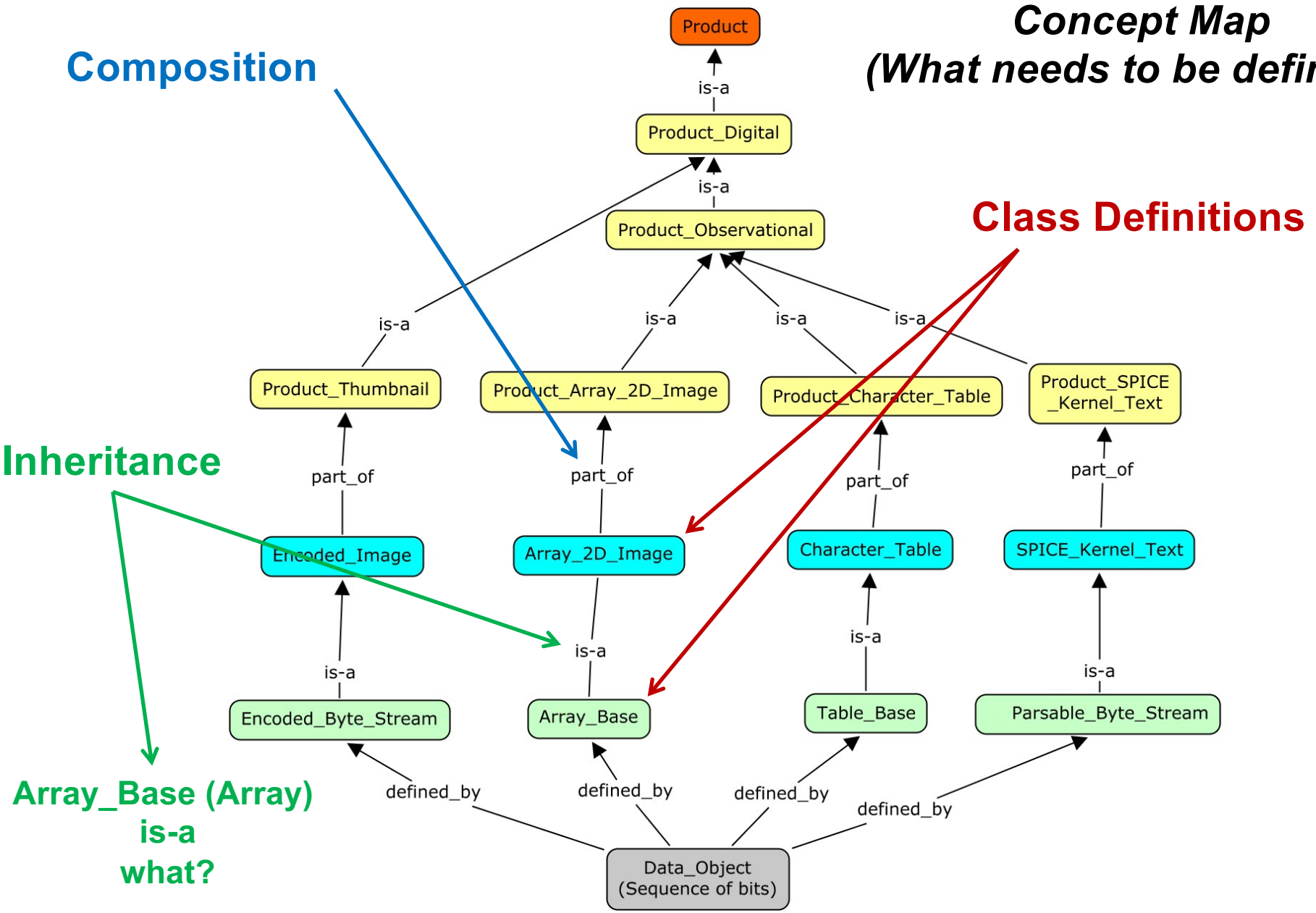

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PDS4 XML Label
Array_2D_Image Class

```
<Product_Observational
  <Identification_Area>
    <logical_identifier>urn:nasa:pds:example.dph.sampleproducts:exampleproducts:array2d_image …
    <version_id>1.0</version_id>
    <title>MARS PATHFINDER LANDER Experiment</title>

    <Array_2D_Image>
      <local_identifier>MPFL-M-IMP_IMG_GRAYSCALE</local_identifier>
      <offset unit="byte">0</offset>
      <axes>2</axes>
      <axis_index_order>Last Index Fastest</axis_index_order>

      <Element_Array>
        <data_type>UnsignedMSB2</data_type>
        <unit>data number</unit>
        <scaling_factor>1</scaling_factor>
        <value_offset>0</value_offset>
      </Element_Array>
      <Axis_Array>
        <axis_name>Line</axis_name>
        <elements>248</elements>
        <sequence_number>1</sequence_number>
      </Axis_Array>
```

How is the class Array_2D_Image defined?

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Protégé Model of *Array_2D_Image*

Classes | Slots | Forms | Instances | Queries

CLASS BROWSER

For Project: UpperModel_160730_exposure

Class Hierarchy

- :THING
  - :SYSTEM-CLASS
  - Data_Object
  - Data_Type
  - Product
  - Product_Components
  - Tagged_Digital_Child
  - Tagged_Digital_Object
    - Byte_Stream
      - Array
        - Array_1D
        - Array_2D
          - Array_2D_Image
          - Array_2D_Map
          - Array_2D_Spectrum
        - Array_3D
      - Encoded_Byte_Stream
      - Parsable_Byte_Stream
      - Table_Base
    - File
  - Tagged_NonDigital_Child

CLASS EDITOR

For Class: Array_2D_Image (instance of :STANDARD-CLASS)

Name: Array_2D_Image

Document: The Array 2

Role: Concrete

Template Slots

Name	Cardinality	Type	
associated_Special_Constants	single	Instance of Special_Constants	
associated_Statistics	single	Instance of Object_Statistics	
axes	required single	Integer	value=2
axis_index_order	required single	String	value=Last Index Fastest
data_object	required single	Instance of Digital_Object	
description	single	String	
has_Axis_Array	required multiple (2:...	Instance of Axis_Array	
has_Display_2d_Image	single	Instance of Display_2D_Image	
has_Element_Array	required single	Instance of Element_Array	
local_identifier	single	String	
local_internal_reference	multiple	Instance of Local_Internal_Reference	
name	single	String	
offset	required single	Integer	

Class Definition

Inheritance

Composition

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PDS4 XML Schema Array_2D_Image Class

Array_2D_Image is-a Array; It inherits everything from Array

```
<xs:complexType name="Array">
  <xs:annotation>
    <xs:documentation>The Array class defines a homogeneous N-dimensional array of scalars. …
  </xs:annotation>
  <xs:complexContent>
    <xs:extension base="pds:Byte_Stream">
      <xs:sequence>
        <xs:element name="offset" type="pds:offset" minOccurs="1" maxOccurs="1"> </xs:element>
        <xs:element name="axes" type="pds:axes" minOccurs="1" maxOccurs="1"> </xs:element>
        <xs:element name="axis_index_order" type="pds:axis_index_order" minOccurs="1“ …
        <xs:element name="description" type="pds:description" minOccurs="0" maxOccurs="1"> …
        <xs:element name="Element_Array" type="pds:Element_Array" minOccurs="1“  …
        <xs:element name="Axis_Array" type="pds:Axis_Array" minOccurs="1“ …
          …
```

Class Definition (xs:_type

Inheritance

Composition

```
<xs:complexType name="Array_2D">
  <xs:annotation>
    <xs:documentation>The Array 2D class is the parent class for all two dimensional array based classes. …
    <xs:restriction base="pds:Array">
```

```
<xs:complexType name="Array_2D_Image">
  <xs:annotation>
    <xs:documentation>The Array 2D Image class is an extension of the Array 2D class and defines a …  <xs:extension
base="pds:Array_2D">
```

Ingest_LDD Model of *Array (1)*

Dictionary (definition)

Composition (definition)

```
<Ingest_LDD>
  <name>Array</name>
  <ldd_version_id>1.0.0.0</ldd_version_id>
  <full_name>DDWG</full_name>
  <steward_id>pds</steward_id>
  <namespace_id>pds</namespace_id>
  <comment>A dictionary to define the Array class.</comment>

  <DD_Attribute>
    <name>offset</name>
    <version_id>1.0</version_id>
    <local_identifier>offset</local_identifier>
    <nillable_flag>false</nillable_flag>
    <submitter_name>DDWG</submitter_name>
    <definition>The offset attribute provides the displacement of the object starting …</definition>
    <DD_Value_Domain>
      <enumeration_flag>false</enumeration_flag>
      <value_data_type>ASCII_Integer</value_data_type>
      <unit_of_measure_type>Units_of_Storage</unit_of_measure_type>
    </DD_Value_Domain>
  </DD_Attribute>
```

Ingest_LDD Model of *Array (2)*

```
<DD_Class>
<name>Array</name>
<version_id>1.0</version_id>
<local_identifier>Array</local_identifier>
<submitter_name>DDWG</submitter_name>
<definition> The Array class defines a homogeneous N-dimensional array of … </definition>
<DD_Association>
   <local_identifier>offset</local_identifier>
   <reference_type>attribute_of</reference_type>
   <minimum_occurrences>1</minimum_occurrences>
   <maximum_occurrences>1</maximum_occurrences>
</DD_Association>
<DD_Association>
   <local_identifier>Byte_Stream</local_identifier>
   <reference_type>parent_of</reference_type>
<DD_Rule>
<local_identifier>pds:Array/pds:offset</local_identifier>
<rule_context>pds:Array/pds:offset</rule_context>
<DD_Assert>
  <test>@unit = ('byte')</test>
  <message>The attribute @unit must be equal to one of the following values 'byte'.</message>
</DD_Assert>
</DD_Rule>
```

Class Definition

Composition (association)

Inheritance

Rule

Other Details

- Choice
  - *<local_identifier> in DD_Association contains "*XSChoice#*"*
- Any
  - *<local_identifier> in DD_Association contains "*XSAny#*"*
- References to attributes or classes in external namespaces
  - *Name in <local_identifier> is prefixed with the external namespace id using dot notation. E.g., "pds.offset"*

Dictionary Stack
Purpose: Information Resource

- **A dictionary stack is a "list" of dependent and consistent dictionaries.**
- "Dependency" results from the use of xs:import.
- "Consistency" results from either LDDTool and/or Oxygen validation.
- Dictionary version id is documentation.
  - *version="1.4.0.0"*
- xs:schemaLocation is provenance.
  - *<xs:import namespace="http://pds.nasa.gov/pds4/pds/v1" schemaLocation="http://pds.nasa.gov/pds4/pds/v1/PDS4_PDS_1301.xsd"/>*

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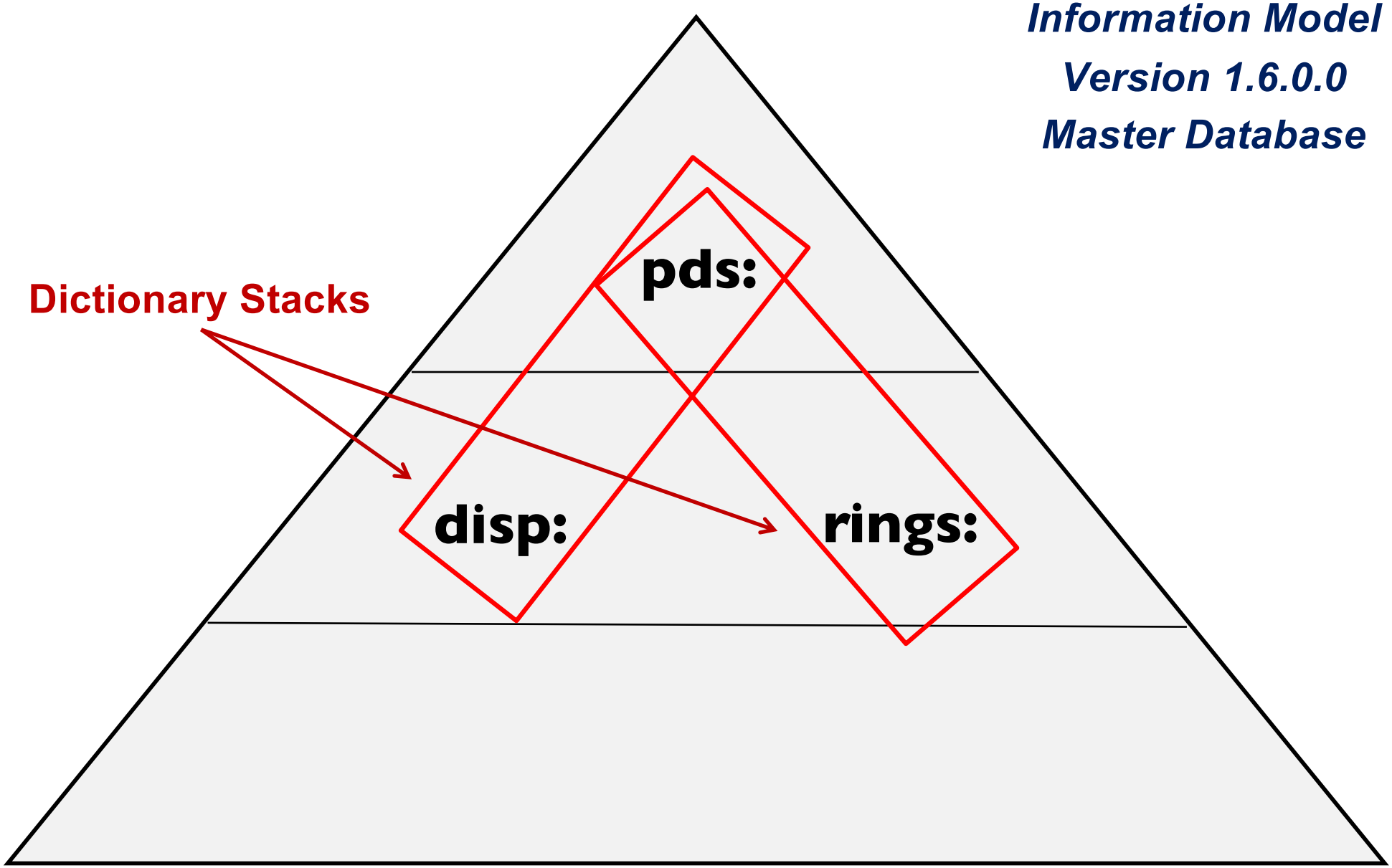
Dictionary Stacks
(LDDs Permanently Ingested)

Information Model
Version 1.6.0.0
Master Database



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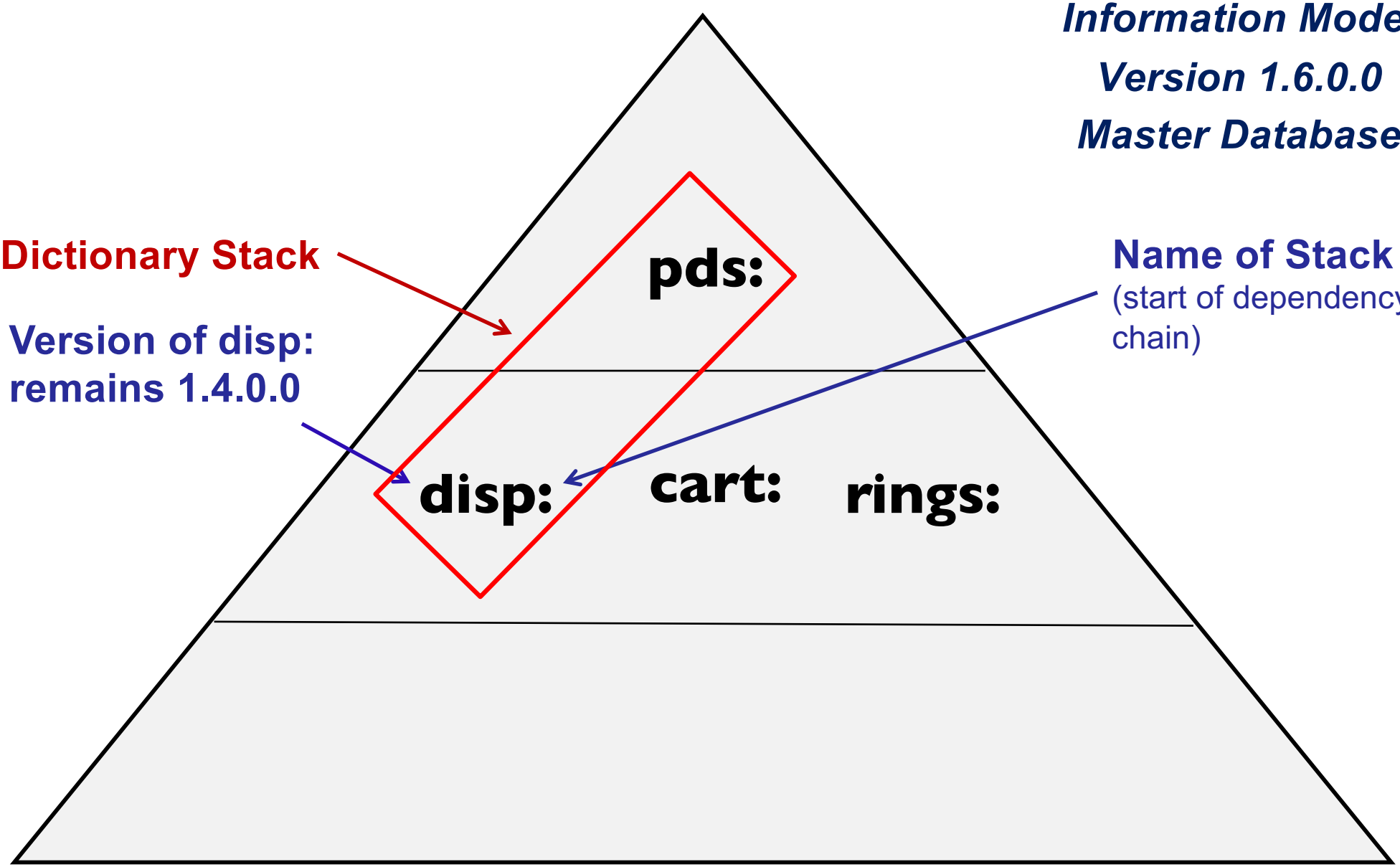
Dictionary Stack Details

Information Model
Version 1.6.0.0
Master Database

Dictionary Stack

Version of disp: remains 1.4.0.0

Name of Stack
(start of dependency chain)



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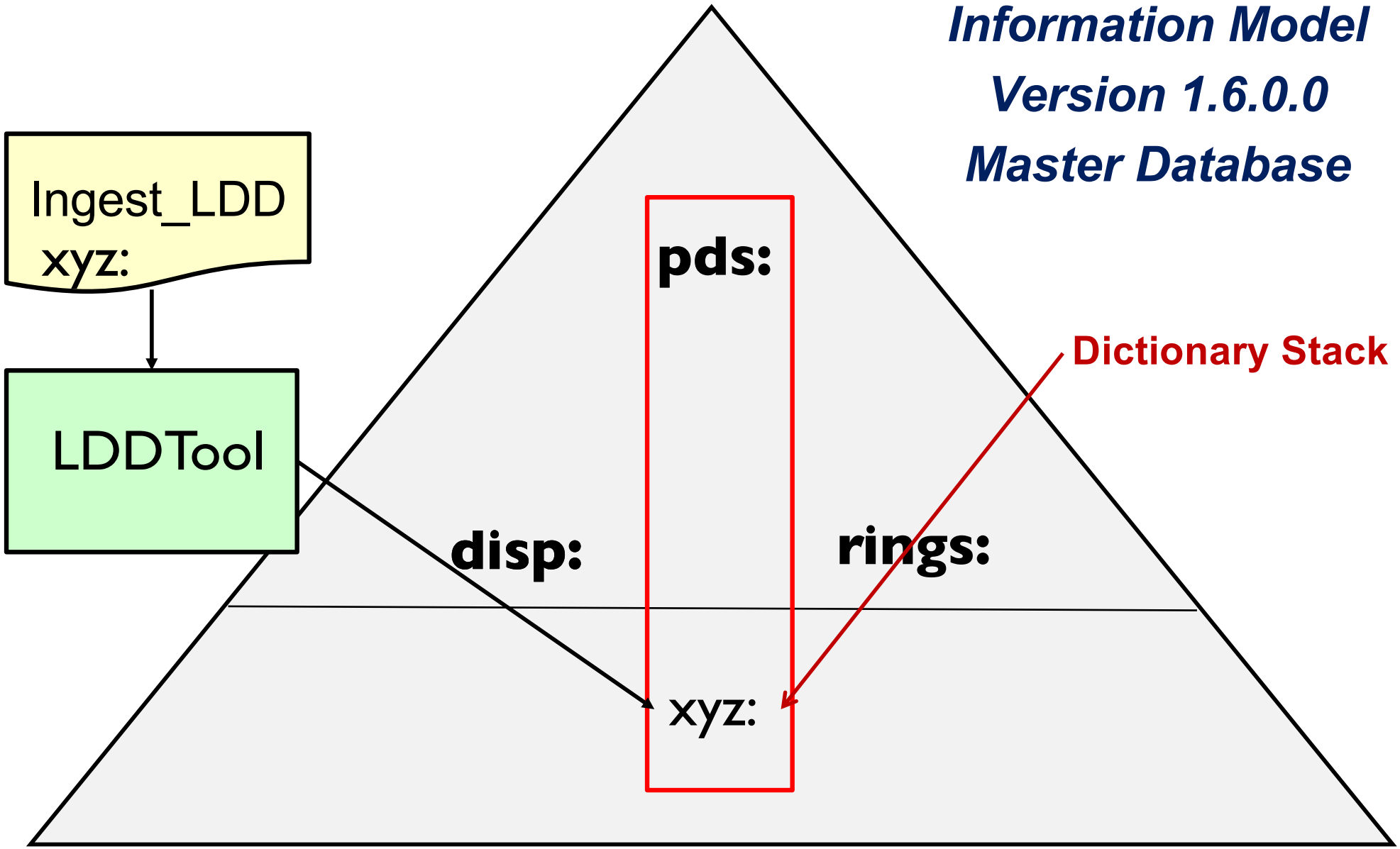
Dictionary Stack
(LDD Temporarily Ingested)



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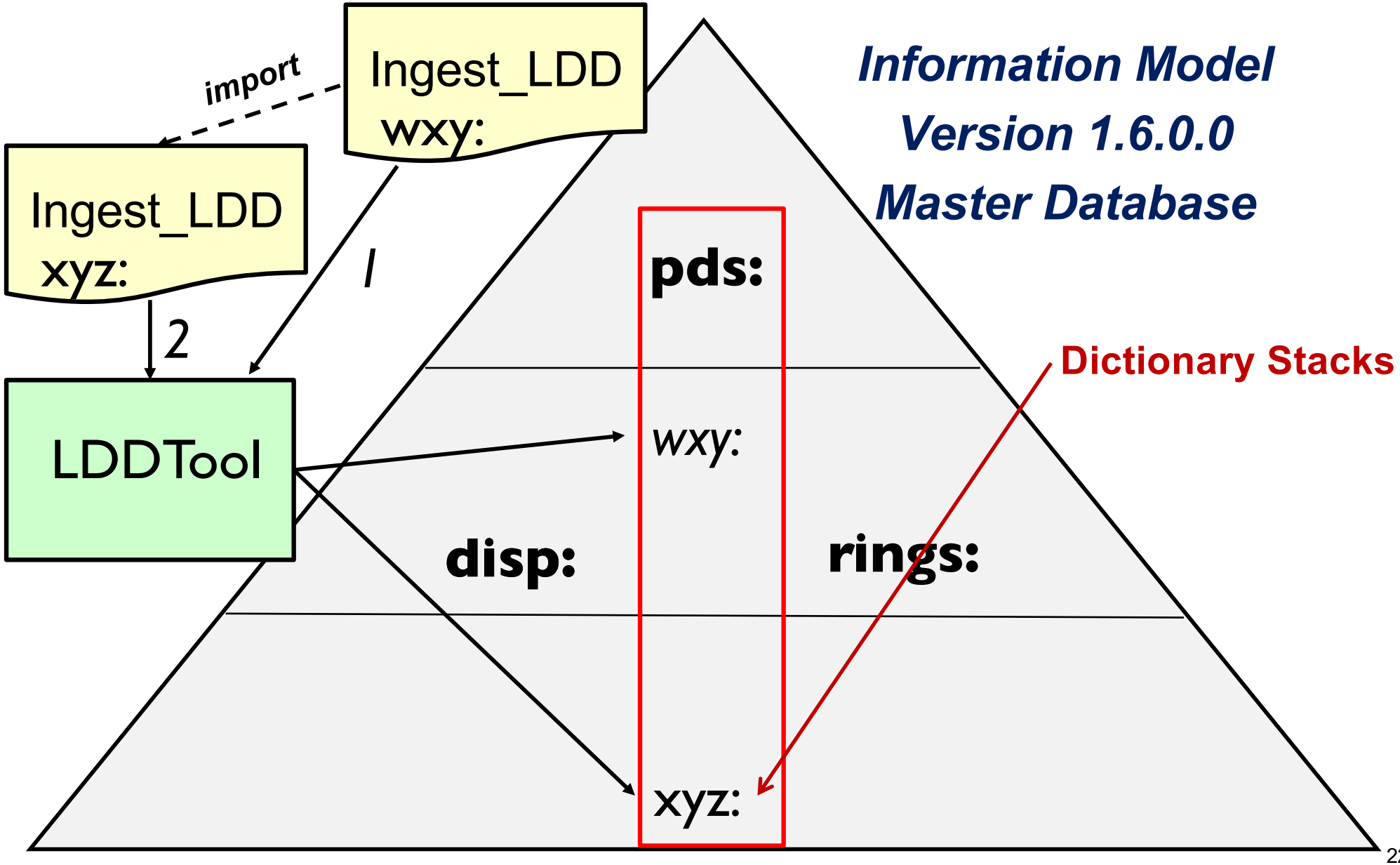
Dictionary Stack (LDDs Temporarily Ingested)



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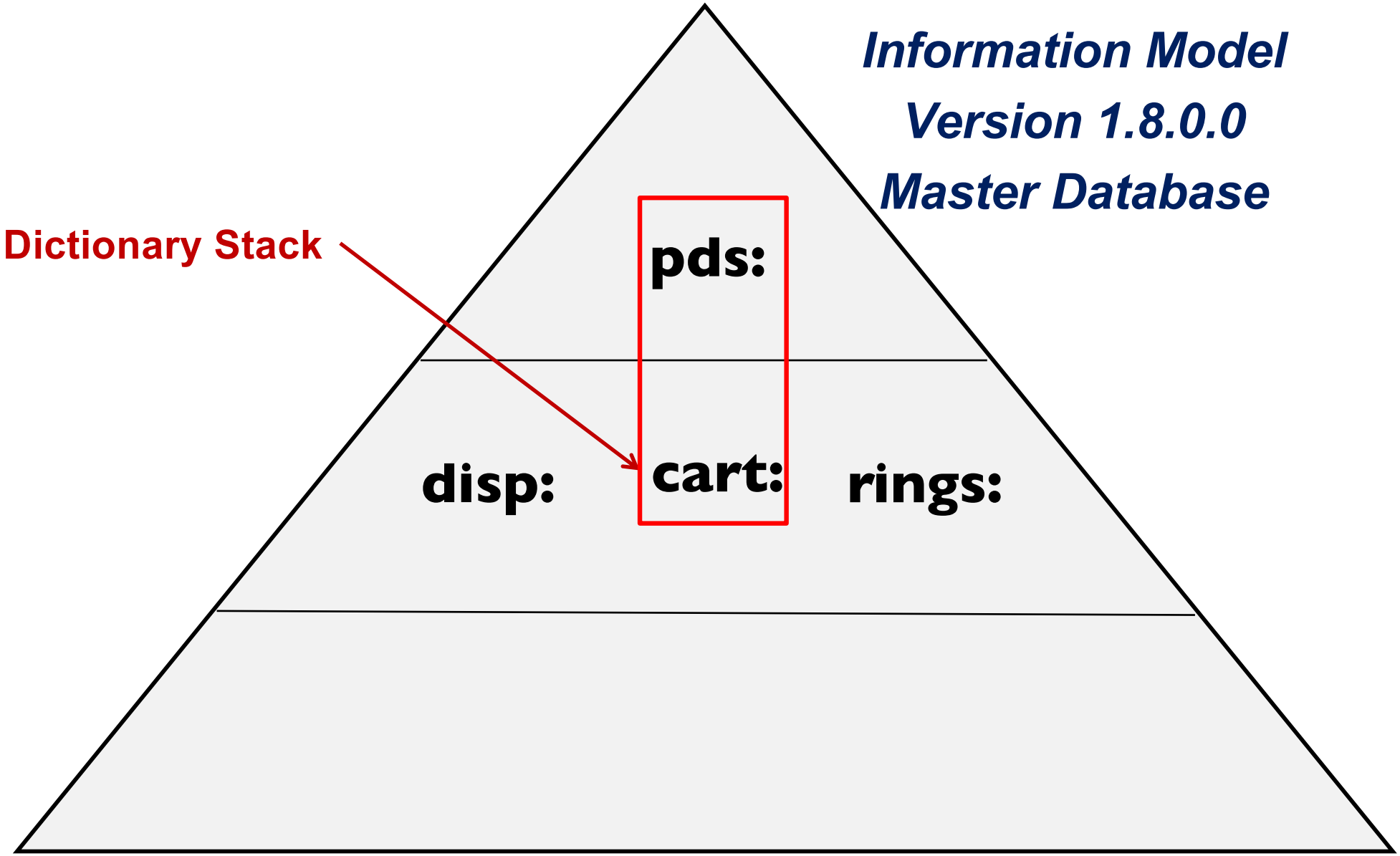
Dictionary Stack (Proposed)



LDDTool
Document Stack Written to Schema

```
<!-- PDS4 XML/Schema for Name Space Id:disp  Version:1.4.0.0 - Fri Sep…
<!-- Generated from the PDS4 Information Model Version 1.7.0.0 - …
<!-- *** This PDS4 product schema is an operational deliverable. ***   -->
<!--                                                                    -->
<!--                Dictionary Stack                                    -->
<!-- 1.7.0.0 - pds: - Common Dictionary - N/A                           -->
<!-- 1.4.0.0 - disp: - Display - IngestLDDTool.xml                      -->
<!--                                                                    -->
```

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Dictionary Stack Registry

PDS4 Dictionary Stacks			A dictionary stack consists of the set of consistent dictionaries necessary to validate a PDS4 product la		
	Stack Identifier	**Stack Contents**	**URL**	**Cross Discipline**	**Description**
Common					
Display	PDS4_DISP_1100	PDS4_PDS_1400			
		PDS4_DISP_1100	https://pds.jpl.nasa.gov/pds4/disp/v1/PDS4_DISP_1100.xsd	Yes	This dictionary describes how to display
Cartography	PDS4_CART_1500	PDS4_PDS_1500			
		PDS4_CART_1500	https://pds.jpl.nasa.gov/pds4/cart/v1/PDS4_CART_1500.xsd	Yes	This dictionary describes how to display

Legend	7/14/2016
Latest Version	
Prior Version In-Used	
Development Version	

Thank You!