XML Binding from the DDI Model

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# Introduction

This document presents the mapping rules from the XML export from Drupal to the XML schema deliverables. This process is split into two steps. First an intermediate reduction is produced as a second XMI file that focuses on what is the best implementation of the platform independent model in XSD. Second the actual XML schemas are created.

# Rules for the Platform Specific Model – PSM

For the reason of getting a simple XML schema definition, with the least possible amount of XSD expressions without losing validation capability, some reductions are made to the exported model from Drupal. This includes at first that all inheritance relationship between classes will be erased., so that all classes become completely independent entities. Therefore, abstract classes will not be transferred into the PSM for schema, except, when there is an association pointing to this abstract class. They will become an empty element and type definition as entry point for a substitution group later in the schema.

The XMI export is therefore reduces as follows:

1. The overall structure with its steering data for XMI is copied to the new XMI file. This includes also the two model layers for library packages and views. The library model is created, all its properties and documentation are copied. The views model is copied entirely as it is.
2. All library packages will be created, all their attributes and documentation are copied.
3. All <packagedElements xmi:type=”uml:Enumeration”> and <packagedElements xmi:type=”uml:DataType”> are copied. They usually just appear within the package “ComplexDataTypes”.
4. All <packagedElements xmi:type=”uml:Class” isAbstract=”true”> are created to ensure the information about the inheritance line. All their attributes and documentation and the generalization child node are copied, no other children will be transferred here.
5. All <packagedElements xmi:type=”uml:Class” isAbstract!=”true”> are created, all their attributes and documentation are copied.
   1. All children <ownedAttribute> from all superclasses (referenced by <generalization general=”xyz”/>) are transferred fi there was no other property on the inheritance path so far with the same name (overriding properties). This means, that properties and associations from superclasses will appear before the directly owned ones. The ownedAttributes will also be transferred, if they come from abstract classes.  
      Properties will be copied. Associations are created, all attributes except “xmi:id” and “association” are copied. “xmi:id” and “association” are created with treir content changed to replace the superclass name with the processed class name. The child <type> is copied, the children <lowerValue> and <upperValue> are created and their attributes are copied, except “xmi:id”, which is handled the same way as for the parent node.  
      The only exception of this will be <ownedAttribute name=”realizes”>.
   2. All children <ownedAttribute name=”realizes”> are treated the same way as superclasses. They act as indicators for the implementation of a certain pattern like collection/member
   3. All children <ownedAttribute name!=”realizes”> are copied.
6. After each <packagedElements xmi:type=”uml:Class” isAbstract!=”true”> handled, all needed <packagedElements xmi:type=”uml:Association”> are created:
   1. All associations from superclasses are created. All attributes except “xmi:id” are copied. “xmi:id” is created with its content changed to replace the superclass name with the processed class name. All children are created and treated to replace the superclass name also. This will also include associations from abstract classes.
   2. All associations directly related to the processed class are copied.
7. The <xmi:Extension>, containing the documentation content on property level, is created, all its attributes are copied.
8. The documentation content for all packages and views is copied.
9. With an iteration over all classes, processed within the packages, the field level documentation will be created for each of these classes:
   1. <element> is created, all according attributes are copied. All according children are copied.
   2. All <attributes><attribute> children of extension nodes according to the processed classes superclasses are transferred including the renaming.

# High-Level XML Constructs – XML schema files

All DDI classes will run under the same namespace. This namespace will also be used for every view schema that is created. The Output of the transformation of XMI into XML schema will therefore be one file to contain the entire library of classes in the published model and one file for each view to contain all classes needed in this view.

1. Packages are identified by <packagedElement xmi:type=”uml:Package”> that is a child node under <packagedElement xmi:id=”ddi4\_model”>. They are just used to distinguish between the complex data type and primitives on one side and the content driven classes on the other side.
2. In every schema file containing a view, all classes are inserted, that are needed for this view. This includes everything from ComplexDataTypes as well as all classes being referenced in the view directly.
3. The Classes from the package with the name “ComplexDataTypes” are handled slightly different. Details within the section “Class-Level Mappings”. Also, while processing this package, a complexType is defined, named ReferenceType, to serve as the prototype of all further references from one class to another.
4. Every schema file will contain a definition (complexType and element) of a root element that is always named DDI. This element will at first contain an unbound choice of the class level elements allowed in the schema. In case of the library schema, this will be all published classes. For a view, this will be just the referenced classes. Secondly, the root element carries an attribute named “type” that is set to a fixed value for a view schema. This value will be the name of the view.

# Class-Level Mappings

1. **Classes:** <packagedElement xmi:type=”uml:class”> with **no** attribute isAbstract=”true” corresponds to the generation of several things:
   1. A global element with the same name as the XMI name attribute, and of the complex type declared in the next step.
   2. A complex type using a concatenation of the name attribute and the string “Type”. Within its complexContent this will contain an unbounded choice with an element definition for each <ownedAttribute xmi:type=”uml:Property”> following the next step. No extention base is set.
   3. Both the element and the complexType will also contain an xs:annotation/xs:documentation with the content of xmi:Extension/elements/element this the name of the class as content of the xmi:idref attribute. The class level documentation is there contained in properties/@documentation
2. **Associations to other DDI Classes:** If a child <ownedAttribute xmi:type=”uml:Property”> has an aggregation or association attribute, then resolve the ID in the association attribute, and take the value of the name attribute from the resolved XMI element. The name will now be the name of a new element. The type of this element is defined inline, extending ReferenceType by an attribute name typoOfClass, that enumerates all possible target classes. The list of target classes is created by iterating over the generalization references starting with the reference from the ownedAttributes type/@xmi:idref. The DDI referencing elements will always take their minOccurs and maxOccurs values from the value attribute of the <lowerValue> and <upperValue> XML elements (a value of “-1” means the maxOccurs has a value “unbounded”.   
     
   Example:   
   <xs:element name="AgentAssociation" minOccurs="0" maxOccurs="1">  
    <xs:complexType>  
    <xs:complexContent>  
    <xs:extension base="ReferenceType">  
    <xs:attribute name="typeOfClass" use="required">  
    <xs:simpleType>  
    <xs:restriction base="xs:NMTOKEN">  
    <xs:enumeration value="Individual"/>  
    <xs:enumeration value="Machine"/>  
    <xs:enumeration value="Organization"/>  
    </xs:restriction>  
    </xs:simpleType>  
    </xs:attribute>  
    </xs:extension>  
    </xs:complexContent>  
    </xs:complexType>  
   </xs:element>
3. **Properties:** If a child <ownedAttribute xmi:type=”uml:Property”> has no aggregation and association attribute the type for the generated element has to be determined whether it is part of extended primitive definitions in DDI Core or Utility by the name attribute or one of the primitives already defined in XML schema, using the <type xmi:type="???"/> child of ownedAttribute. Cardinalities are handled the same way as for associations. The only exceptions from this are properties to be identified as language definitions (<type xmi:type="xs:language"/>). Those properties will become attributes to the defining complex type of ref xml:lang or of the type xs:language and then keeping their name.
4. **Documentation:** Both properties and references will contain field level documentation read from xmi:Extension/elements/element/attributes/attribute with the name equal to the ownedAttribute name
5. **Classes in the package “ComplexDataTypes”:** All properties (except a property named “content”) will become attributes to a complexType with simpleContent of the same type as the property “content”, if this class fulfills the following characteristics:
   1. It and its super classes include no associations.
   2. It or its superclasses have a property named “content”, that is not of type “anyURI” or “xhtml:BlkNoForm.mix”.

# Naming conventions and name transformations

* In Drupal, all class name are written in upper camel case. All properties and associations are written in lower camel case.
* Within the transformation to XSD, all names of properties and associations are transformed to upper camel case, to fulfill the conventions of XML. In some cases, underscores and colons are erased, if they appear.