```
<?xml version='1.0' encoding="UTF-8"?>
<!-- <!DOCTYPE schema SYSTEM "structures.dtd"> -->
<!DOCTYPE schema PUBLIC "-//W3C/DTD XML Schema Version 1.0//EN"
                        "http://www.w3.org/XML/Group/1999/09/23-
xmlschema/structures/structures.dtd">
<!-- ====================== GLIF3 Schema ========================
This schema has been tested with IBM's XML Parser XML4J Version 3
Early Access Release. This parser is compliant with the W3C Schema
Definition Draft of 24th September 1999.
Parser available from http://www.alphaworks.ibm.com/tech/xml4j

Several tricks and hacks were used to overcome deficiences of
the current drafts of the schema specification in terms of object-orientation.
These are discussed in the comments immediately following.

Aziz Boxwala
15th December 1999
============================================================== -->
<!-- HANDLING INHERITANCE
All classes are created as model groups and attribute groups (e.g.,
<modelGroup name="Supplemental_Material_E">
<attrGroup name="Supplemental_Material_A">  ).
Naming a model group enables reuse, since now, the model group can be reffered
to by using modelGroupRef (e.g.,
<modelGroup name="Local_Material_E">
  <modelGroupRef name="Supplemental_Material_E"/>
</modelGroup>).
An attribute group is a group of attributes that are given a name. This
enables their incorporation into an archetype as a whole group, by using
attGroupRef (e.g.,
<attrGroup name="Local_Material_A">
  <attrGroupRef name="Supplemental_Material_A"/>
</attrGroup>  ).

Abstract classes need no further work. Concrete classes are implemented
as elements using the model groups. Archetype elements are elements that allow
elements in their content and/or may carry attributes.

Model groups of sub-classes inherit from model group of base classes.
This is done by adding the modelGroupRef of the immediate parent class
to the modelGroup of the baseClass. Attributes are similarly inherited.
-->

<!-- HANDLING POLYMORPHISM

Polymorphism is needed to include elements of an entire class hierarchy, e.g.,
The Supplemental Material hierarchy must include Local_Material and
WWW_Material.

This is handled by creating a new modelGroup called Base_Class_Type, e.g.,
Supplemental_Material_Type. The base class type includes references to the
SubClass Type.
<modelGroup name="Supplemental_Material_Type" order="choice">
  <element ref="WWW_Material"/>
  <element ref="Local_Material"/>
</modelGroup>
(choice means "one of the the following". So in the above example, each
```

```
Supplemental Material is either a local material or a www material).

The Subclass Type group includes the subclass element plus
references to SubSubClass Type.
<element name="material" type="string"/>
<modelGroup name="Local_Material_E">
  <modelGroupRef name="Supplemental_Material_E"/>
  <element ref="material" minOccurs="0" maxOccurs="1"/>
</modelGroup>

<attrGroup name="Local_Material_A">
  <attrGroupRef name="Supplemental_Material_A"/>
</attrGroup>

<element name="Local_Material">
  <archetype>
     <modelGroupRef name="Local_Material_E"/>
     <attrGroupRef name="Local_Material_A"/>
  </archetype>
</element>

-->

<!-- DEALING WITH OBJECT REFERENCES

ODIF supports inclusion of references (pointer s) to objects instead of the
actual object itself. The schema below has a similar facility. For each concrete
class, a new element type is created. This element type is empty except for one
attribute called ref that is of type IDREF. An attribute gro up called
Element_Ref_A with this attribute has been included in the schema for all
classes
to use in their archetype.
e.g.,
<attrGroup name="Element_Ref_A">
  <attribute name="ref" type="IDREF"/>
</attrGroup>

<element name="Local_Material_Ref" >
  <archetype content="empty">
    <attrGroupRef name="Element_Ref_A"/>
  </archetype>
</element>

Note that while validating, XML parsers can check if an object with the ID being
referred to by the ref attribute exists. The parsers do not test th e type of the
referenced object. This step must be performed by the application.

In order to deal with polymorphism with references, a Base_Class_Ref_Type group
is created similar to the Base_Class_Type group discussed in the previous
section.
e.g.,
<modelGroup name="Supplemental_Material_Ref_Type" order="choice">
  <element ref="WWW_Material_Ref"/>
  <element ref="Local_Material_Ref"/>
</modelGroup>

In addition, a Base_Class_Element group is also created for including objects or
```

their references.
e.g.,
<modelGroup name="Supplemental_Material_Element" order="choice">
   <modelGroupRef name="Supplemental_Material_Type"/>
   <modelGroupRef name="Supplemental_Material_Ref_Type"/>
</modelGroup>

-->

<!-- DEFINING SLOTS (ATTRIBUTES)
Until now we described how to define GLIF classes. This enables the defintion of the types of the GLIF slots. We also need to define XML classes for each GLIF slot name. For example, if a GLIF class contains a slot named "didactics" (of type Suuplemental Material), we need to define an XML element named "didactics".
<element name="didactics">
  <archetype>
      <modelGroupRef name="Supplemental_Material_Element" minOccurs="0" maxOccurs="*"/>
  </archetype>
</element>
-->

<!-- THE INSTANCES FILE
A "ref" in the schema is replaced, in the instances file, by the element that follows the "ref=" in the schema file. For example, a Guideline element is defined in the
schema to contain:
<element ref="author" minOccurs="0" maxOccurs="*"/>
The author element is defined by the schema to be:
<element name="author" type="string"/>
So, in the instances file we have:
<Guideline xmlns="GLIFSchema.xsd">
  <author>Aziz Boxwala</author>
</Guideline>

A modelGroupRef in the schema, is replaced, in the instances file by tracing the referenced class back, until a "ref" is reached (an element is traced). For example, a guideline in the schema has a modelGroupRef to Supplemental material type. This allows to "globally" define Supplemental Material (see A8 and A7), instead of defining the Supplemental Material within the defintion of the guideline's didactics (as is done in the instances file for supplemental material
A3 and A2).
In the schema, start with the line
<modelGroupRef name="Supplemental_Material_Type" minOccurs="0" maxOccurs="*"/>
that specifies that a guideline can reference Supplemental_Material_Type, and go back to the definition of Supplemental_Material_Type. You will see:
<modelGroup name="Supplemental_Material_Type" order="choice">
  <element ref="WWW_Material"/>
  <element ref="Local_Material"/>
</modelGroup>
Let's choose WWW material. This means that in the instances file, you will put a WWW Material element (remember that whenever you encounter a "ref" in the schema,
then in the instances file you replace it with the element that follows the "ref="
of the schema file).

```
So you end up with:
<WWW_Material id="A8">
  ...
</WWW_Material>
defined "globally" within the guideline.

-->


<schema>
<!--Schema version='0.000001'-->
<!-- Got to figure out how to include schema for basic datatypes
such as string -->


<!-- ======================================================  -->
<!-- ========= TOP-LEVEL DEFINITIONS ==========  -->
<!-- ========================================================  -->

<element name="name" type="string"/>

<!-- ************************************ -->
<!-- Guideline model entity abstract class   -->
<!-- ************************************ -->
<modelGroup name="Guideline_Model_Entity_E">
  <!-- The name property -->
  <element ref="name" minOccurs="0" maxOccurs="1"/>
</modelGroup>

<attrGroup name="Guideline_Model_Entity_A">
  <!-- The id attribute -->
  <attribute name="id" type="ID"/>
</attrGroup>

<attrGroup name="Element_Ref_A">
  <attribute name="ref" type="IDREF"/>
</attrGroup>

<!-- ======================================================  -->
<!-- ========= SUPPLEMENTAL MATERIAL DEFINITIONS ==========  -->
<!-- ========================================================  -->

<!-- ************************************ -->
<!-- Supplemental material abstract class    -->
<!-- ************************************ -->

<!--<element name="label" type="string"/>-->
<!-- Datatype mime_type to be defined -->
<element name="MIME_type" type="string"/>

<modelGroup name="Supplemental_Material_E">
  <modelGroupRef name="Guideline_Model_Entity_E"/>
<!--  <element ref="label"/> -->
  <element ref="MIME_type"/>
</modelGroup>
<attrGroup name="Supplemental_Material_A">
  <attrGroupRef name="Guideline_Model_Entity_A"/>
```

```
</attrGroup>

<!-- ************************************ -->
<!-- Local material class                 -->
<!-- ************************************ -->

<element name="material" type="string"/>
<modelGroup name="Local_Material_E">
  <!-- Inherit from supplemental material -->
  <modelGroupRef name="Supplemental_Material_E"/>
  <element ref="material" minOccurs="0" maxOccurs="1"/>
</modelGroup>

<attrGroup name="Local_Material_A">
  <attrGroupRef name="Supplemental_Material_A"/>
</attrGroup>

<element name="Local_Material">
  <archetype>
     <modelGroupRef name="Local_Material_E"/>
     <attrGroupRef name="Local_Material_A"/>
  </archetype>
</element>

<!-- ************************************ -->
<!-- WWW material class                   -->
<!-- ************************************ -->

<element name="url" type="uri"/>

<modelGroup name="WWW_Material_E">
  <!-- Inherit from supplemental material -->
  <modelGroupRef name="Supplemental_Material_E"/>
  <element ref="url" minOccurs="0" maxOccurs="1"/>
</modelGroup>

<attrGroup name="WWW_Material_A">
  <attrGroupRef name="Supplemental_Material_A"/>
</attrGroup>

<element name="WWW_Material">
  <archetype>
     <modelGroupRef name="WWW_Material_E"/>
     <attrGroupRef name="WWW_Material_A"/>
  </archetype>
</element>


<modelGroup name="Supplemental_Material_Type" order="choice">
  <element ref="WWW_Material"/>
  <element ref="Local_Material"/>
</modelGroup>

<element name="Local_Material_Ref">
  <archetype content="empty">
    <attrGroupRef name="Element_Ref_A"/>
  </archetype>
```

```
</element>

<element name="WWW_Material_Ref">
  <archetype content="empty">
    <attrGroupRef name="Element_Ref_A"/>
  </archetype>
</element>

<modelGroup name="Supplemental_Material_Ref_Type" order="choice">
  <element ref="WWW_Material_Ref"/>
  <element ref="Local_Material_Ref"/>
</modelGroup>

<modelGroup name="Supplemental_Material_Elemen t" order="choice">
   <modelGroupRef name="Supplemental_Material_Type"/>
   <modelGroupRef name="Supplemental_Material_Ref_Type"/>
</modelGroup>

<!--
  Define didactics to contain any of supplemental materials
-->
<element name="didactics">
  <archetype>
      <modelGroupRef name="Supplemental_Material_Element" minOccurs="0"
maxOccurs="*"/>
<!--     <element ref="Local_Material"  minOccurs="0" maxOccurs="*"/>
     <element ref="WWW_Material"    minOccurs="0" maxOccurs="*"/>  -->
  </archetype>
</element>

<!-- ======================================================  -->
<!-- ============ GUIDELINE STEP DEFINITIONS ==============  -->
<!-- ======================================================  -->

<!-- Example of polymorphism -->
<modelGroup name="Action_Step_Type" order="choice">
  <element ref="Action_Step"/>
  <!-- <modelGroupRef name="Action_Step_Subclass1_Type"/>
  <modelGroupRef name="Action_Step_Subclass1_Type"/>  -->
</modelGroup>

<modelGroup name="Action_Step_Ref_Type">
  <element ref="Action_Step_Ref"/>
  <!-- <modelGroupRef name="Action_Step_Subclass1_Type"/>
  <modelGroupRef name="Action_Step_Subclass1_Type"/>  -->
</modelGroup>

<modelGroup name="Guideline_Step_Type" order="choice">
  <modelGroupRef name="Action_Step_Type"/>
<!--  <modelGroupRef name="Decision_Step_Type"/>
  <modelGroupRef name="Branch_Step_Type"/>
  <modelGroupRef name="Synchronization_Step_Type"/>  -->
</modelGroup>

<modelGroup name="Guideline_Step_Ref_Type" order="choice">
  <modelGroupRef name="Action_Step_Ref_Type"/>
<!--  <modelGroupRef name="Decision_Step_Type"/>
```

```
  <modelGroupRef name="Branch_Step_Type"/>
  <modelGroupRef name="Synchronization_Step_Type"/>  -->
</modelGroup>

<modelGroup name="Guideline_Step_Element" order="choice">
  <modelGroupRef name="Guideline_Step_Type"/>
  <modelGroupRef name="Guideline_Step_Ref_Type"/>
</modelGroup>

<!-- ************************************ -->
<!-- Guideline Step abstract class        -->
<!-- ************************************ -->
<modelGroup name="Guideline_Step_E">
  <modelGroupRef name="Guideline_Model_Entity_E"/>
  <element ref="didactics" minOccurs="0" maxOccurs="1"/>
</modelGroup>

<attrGroup name="Guideline_Step_A">
  <attrGroupRef name="Guideline_Model_Entity_A"/>
</attrGroup>

<element name="description" type="string"/>

<element name="next_step">
  <archetype order="choice">
    <modelGroupRef name="Guideline_Step_Element"/>
  </archetype>
</element>

<!-- ************************************ -->
<!-- Action Step class                    -->
<!-- ************************************ -->
<modelGroup name="Action_Step_E">
   <modelGroupRef name="Guideline_Step_E"/>
    <!-- key value pair example -->
    <element ref="description" minOccurs="0" maxOccurs="1"/>
    <element ref="next_step"   minOccurs="0" maxOccurs="1"/>
</modelGroup>

<attrGroup name="Action_Step_A">
  <attrGroupRef name="Guideline_Step_A"/>
</attrGroup>

<element name="Action_Step">
  <archetype>
     <modelGroupRef name="Action_Step_E"/>
     <attrGroupRef name="Action_Step_A"/>
  </archetype>
</element>

<element name="Action_Step_Ref">
  <archetype content="empty">
    <attrGroupRef name="Element_Ref_A"/>
  </archetype>
</element>

<!-- ================================================== -->
```

```
<!-- ============= GUIDELINE  DEFINITION ==================  -->
<!-- ======================================================  -->


<!-- ************************************  -->
<!-- Guideline class                       -->
<!-- ************************************  -->
<element name="author" type="string"/>
<element name="title"  type="string"/>

<element name="Guideline">
  <archetype>
    <element ref="author" minOccurs="0" maxOccurs="*" />
    <element ref="title" minOccurs="0" maxOccurs="1"/>
    <element ref="didactics" minOccurs="0" maxOccurs="1"/>
    <modelGroupRef name="Supplemental_Material_Type" minOccurs="0"
maxOccurs="*"/>
    <modelGroupRef name="Guideline_Step_Type" minOcc urs="0" maxOccurs="*"/>
    <!-- <element ref="Action_Step" minOccurs="0" maxOccurs="*"/>  -->
    <attribute name="xmlns"/>
  </archetype>
</element>

</schema>
```