JAXB Tips and Tricks
Part 2
Generating Java Classes from XML Schema

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What is JAXB?

- Java Architecture for XML Binding
- Maps an XML Schema into Java Objects
  - Experimental support for DTD, RelaxNG and WSDL
  - Generates classes by default, but can specify existing target classes
- Generates a XML Schema from annotated Java Objects
- Saves programmers labor and debug time compared to manual parsing, especially as schemas evolve
History

- Version 1.0 released in 2003 as part of JSR 31
  - Marshalling and Unmarshalling code generated
- Version 2.0 released in 2006 as part of JSR 222 for Java 6
  - Reflection based marshalling and unmarshalling code - much cleaner
- Version 2.2 released in 2009
- Version 2.2.3 bundled with Java 7
- Version 2.2.8 bundled with Java 8
  - Support for 3rd party implementations of JAXB such as EclipseLink/MOXy
    - jaxb-impl.jar has to be on classpath not in endorsed directory or endorsed classpath
    - jaxb-api.jar in endorsed directory or endorsed classpath
- Latest release is 2.2.11
- JAXB has a git repository
Top 10 Reasons JAXB is a Fav!

1. Built into the JDK, but overridable with new versions or 3rd party implementations
2. Easy to use
3. Well documented
4. Logical API
5. Robust and Efficient implementation
6. Complete control of the fields that get serialized to XML
7. Handles mapping from XML Schema or Annotated Java classes
8. Community generated plugins to customize code generation
9. Good default mappings
10. Default mappings can be completely overridden
XML Schema to Java Classes
## Default XML Schema to Java Bindings

<table>
<thead>
<tr>
<th>XML Schema Data Type</th>
<th>Java Data Type (lower case indicates a primitive data type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>anySimpleType (for xsd:element of this type)</td>
<td>java.lang.Object</td>
</tr>
<tr>
<td>anySimpleType (for xsd:attribute of this type)</td>
<td>java.lang.String</td>
</tr>
<tr>
<td>base64Binary</td>
<td>byte[]</td>
</tr>
<tr>
<td>boolean</td>
<td>boolean or (Boolean)</td>
</tr>
<tr>
<td>byte</td>
<td>byte (or Byte)</td>
</tr>
<tr>
<td>date</td>
<td>java.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>dateTime</td>
<td>javax.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>decimal</td>
<td>java.math.BigDecimal</td>
</tr>
<tr>
<td>double</td>
<td>double (or Double)</td>
</tr>
<tr>
<td>duration</td>
<td>javax.xml.datatype.Duration</td>
</tr>
<tr>
<td>float</td>
<td>float (or Float)</td>
</tr>
<tr>
<td>g</td>
<td>java.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>hexBinary</td>
<td>byte[]</td>
</tr>
<tr>
<td>int</td>
<td>int (or Integer)</td>
</tr>
<tr>
<td>integer</td>
<td>java.math.BigInteger</td>
</tr>
<tr>
<td>long</td>
<td>long or (Long)</td>
</tr>
<tr>
<td>NOTATION</td>
<td>javax.xml.namespace.QName</td>
</tr>
<tr>
<td>Qname</td>
<td>javax.xml.namespace.QName</td>
</tr>
<tr>
<td>short</td>
<td>short (or Short)</td>
</tr>
<tr>
<td>string</td>
<td>java.lang.String</td>
</tr>
<tr>
<td>time</td>
<td>java.xml.datatype.XMLGregorianCalendar</td>
</tr>
<tr>
<td>unsignedByte</td>
<td>short (or Short)</td>
</tr>
<tr>
<td>unsignedInt</td>
<td>long (or Long)</td>
</tr>
<tr>
<td>unsignedShort</td>
<td>int</td>
</tr>
</tbody>
</table>
Generating Java Classes from Schema

xjc  -extension geometry.xsd -b geometry.xjb
Converting Java Classes from Schema

```
xjc geometry.xsd -b geometry.xjb
```

**Binding File**

```xml
<globalBindings>
  [ collectionType = "collectionType" ]
  [ fixedAttributeAsConstantProperty = "true" | "false" | "1" | "0" ]
  [ generateIsSetMethod = "true" | "false" | "1" | "0" ]
  [ enableFailFastCheck = "true" | "false" | "1" | "0" ]
  [ choiceContentProperty = "true" | "false" | "1" | "0" ]
  [ underscoreBinding = "asWordSeparator" | "asCharInWord" ]
  [ typesafeEnumBase = "typesafeEnumBase" ]
  [ typesafeEnumMemberName = "generateName" | "generateError" ]
  [ enableJavaNamingConventions = "true" | "false" | "1" | "0" ]
  [ bindingStyle = "elementBinding" | "modelGroupBinding" ]
  [ <javaType> ... </javaType> ]*
</globalBindings>
```
JAXB Binding File

```xml
<jaxb:bindings version="2.0" xmlns:xs="http://www.w3.org/2001/XMLSchema"
jaxb:extensionBindingPrefixes="xjc">
    <jaxb:bindings schemaLocation="geometry.xsd">
        <jaxb:globalBindings>
            <jaxb:serializable/>
            <xjc:javaType name="java.sql.Timestamp" xmlType="xs:dateTime" adapter="TimeConverter"/>
        </jaxb:globalBindings>
    </jaxb:bindings>
</jaxb:bindings>
```
Custom Mapping

- Color
- Polygons
- DateTime
- Wrapper Elements
Some Useful JAXB Plugins for Customizing Generated Java Classes from XML Schemas

- Fluent API Plugin - Generate fluent design pattern for setters
  - i.e. returns “this” for each setter so that “sets” can be chained as in:
    
    ```
    person.setFirstName(firstname).setLastName(lastName).setAddress(address);
    ```

- JAXB2 Basics Plugin - generates toString(), equals(), hashcode(), etc.

- Value Constructor - generates a constructor with arguments

- HyperJAXB3 - Generates JPA annotated classes
  
  http://confluence.highsource.org/display/HJ3/Home

- See https://java.net/projects/jaxb2-commons/pages/Home for more plugins

- JAK - Java API for KML - https://github.com/micromata/javaapiforkml
Converting XML to Java

StringReader reader = new StringReader(xmlString);
JAXBContext context = JAXBContext.newInstance(ObjectFactory.class);
ShapeList shape = (ShapeList)
context.createUnmarshaller().unmarshal(reader);
nillable vs. minOccurs=0?

- **Variants**
  - `<myElement attr1='true'>some content</myElement>`
  - `<myElement/>`
  - `<myElement xsi:nil='true'/>`
  - *Missing* `<myElement/>`
- minOccurs=1 will map to the Java primitive
- minOccurs=0 or nillable=true will map to the Object version of primitives
- minOccurs=0 and nillable=true will map to JAXBElement<Double>
Validating Against a Schema

- No validation by default
- JAXB tries to be forgiving when there is an extra field or missing field to help deal with version
- Just Unmarshaller.setValidating(true) to begin validating
Converting Java to XML

```java
JAXBContext context = JAXBContext.newInstance(ObjectFactory.class);

StringWriter stringWriter = new StringWriter();
Marshaller marshaller = context.createMarshaller();
mediator.setProperty("jaxb.formatted.output", Boolean.TRUE);
mediator.marshal(jaxbElement, stringWriter);
return stringWriter.toString();
```
Tips

1. Performance
   1. Cache the Threadsafe JAXBContext for much better performance - put in a static or singleton
   2. Marshallers and Unmarshallers are not Threadsafe so if performance is critical use pools of these

2. Don’t embed JAXB customizations in schema, put in a binding file

3. Good mapping requires iterations on schema, binding customizations and the resulting Java code
Schema Evolution/Versioning

- **Schema Versioning Approaches**
  - Add version as part of the namespace (don’t use a raw number)
  - Add a version field in the XML

- **Java package name generated from target namespace by default**
  - Advantage: Allows multiple versions of the schema to be handled in the same classloader
  - Disadvantage: Package names of consuming code has to be changed for new versions of the schema

- **Use a different classloader (e.g. Session Bean) for each version accessed through a common Java interface**
  - Advantage: Do not need to change consuming code
  - Disadvantage: Added complexity
XML Schema Editors

- http://deadlock.netbeans.org/hudson/job/xml/lastSuccessfulBuild/artifact/build/updates/updates.xml

- http://wiki.eclipse.org/index.php/Introduction_to_the_XSD_Editor
Current Deficits

1. Annotations/documentation doesn’t get translated to JavaDoc
2. Restrictions don’t get translated into validation code (MOXy may do this)
Questions?
Graphs using ID and IDREF