

NIEM UML Profile Tool Example – Health Condition

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Introduction

The NIEM UML Profile was balloted by OMG in June 2012. Participants are required to produce proof of concept demonstrations within 1 year of the ballot.

The profile is important because it defines the transformation between UML for defining canonical models and the platform specific derived exchange of payloads formatted in XML. The NIEM framework contains ontologies for the high level modeling as well as style for XML usage.

Tooling is intended to improve productivity by representing repetitive complexity in a simpler fashion so that the developer can achieve development faster. The tooling used here was MagicDraw with the recently developed NIEM-UML Profile plugin which is at beta version for release.

Initial experience is that the performance for making a change such as subsetting a NIEM type is very much faster (probably over 10 fold) using the desktop tool rather than forming a Wantlist and submitting it to the on-line NIEM tool.

Relevance to Health Exchange

Medical Condition was already in NIEM and cuts across multiple federal agencies and private sector organizations. It is relevant to first responders, immigration, law enforcement, disease management as well as health treatment. The challenge was to get the payload with significant detail for interoperability while retaining a simple and rigorous method.

The requirements were taken from standards for structure (C83), vocabulary (C154) and terminology (C80) so that an exchange could be converted in and out of CDA (HL7 Clinical Document Architecture) which has a different usage of XML.

The NIEM methodology was found to be similar to the HL7 HDF (HL7 Development Framework) used for HL7 v3 development but does not have the payload sizes associated with HL7 v3.

Model Structure

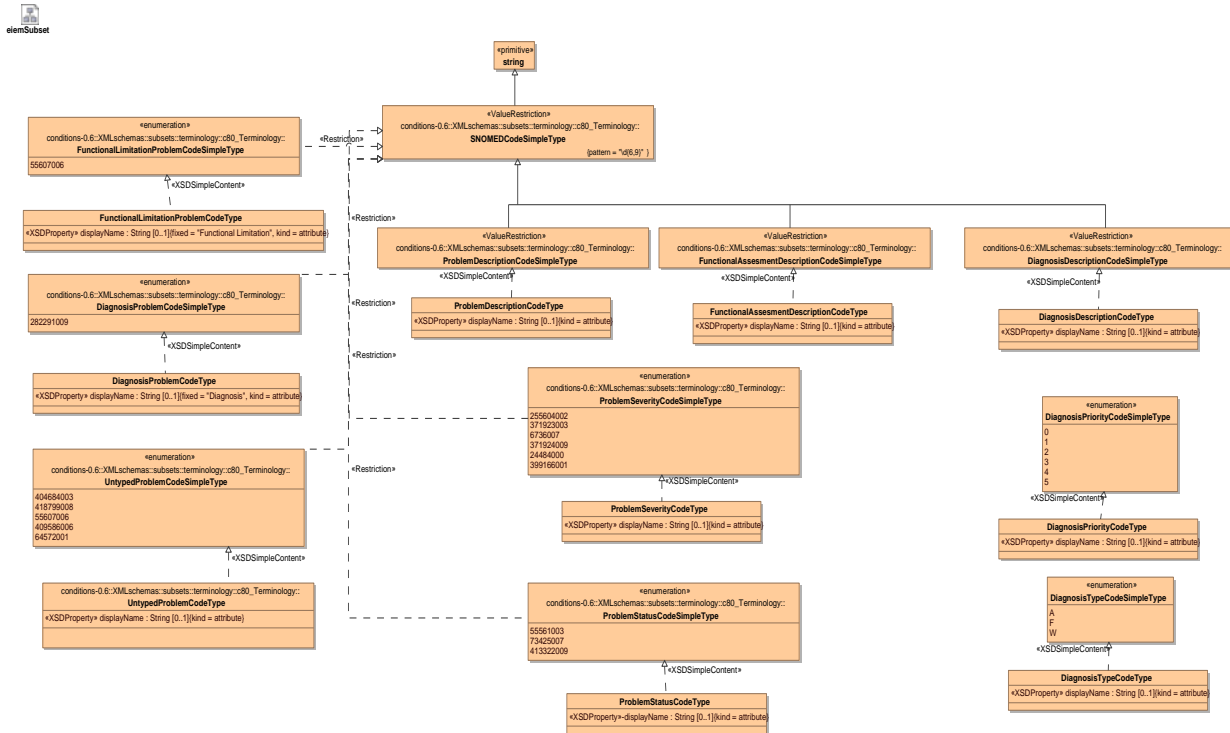
The model structure follows the NIEM EIEM (Enterprise Information Exchange Model) approach. A superset EIEM is defined and subsetted for each exchange that needs portions of it. The EIEM contains both the canonical structural model and terminologies used. A specific exchange therefore uses the subset of the canonical model and terminologies so that only relevant content is in the NIEM IEPD (Information Exchange Package Documentation). Likewise the niem-core concepts are subsetted for use in the exchange.

Terminology Binding

Terminology binding is the linking of a concept in the model to an allowed value set of codes. The value sets are rules applied to the code attribute in the model diagram above. Binding in this example is of two forms –

extensional – where the list of allowed codes in the value set is defined in the schema. This allows the XML schema to validate the code at run-time.

intensional – where the value set is declared but the codes are managed elsewhere either because the set is too large or because they change more frequently.



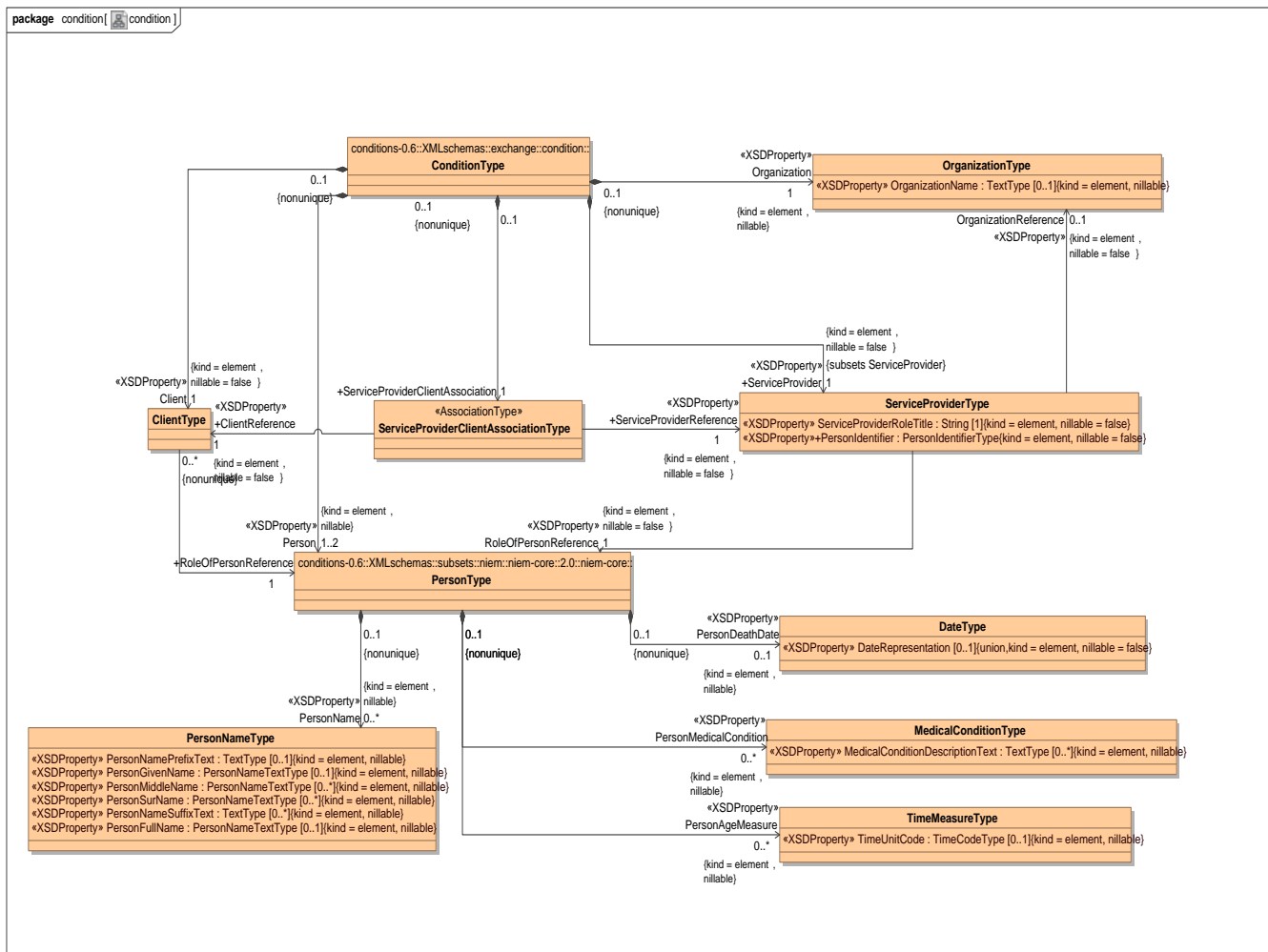
Value sets are implemented as NIEM Code Lists with the addition of the displayName.

Exchange Definition

The exchange payload is defined in the exchange represented by the container class for the payload “condition”.

The contained objects represent the elements which will carry the information and are a mixture of niem subset classes and niem-core classes (e.g. PersonType).

The instance of the payload (see the sample payload document) conforms to the condition exchange schema shown in the package relationships above. With all the relationships linked to the subset packages within control of the payload design it is possible to fine tune the payload for the purpose and yet maintain a rigorous conformance to elements within the niem superset.



State of the Example

The example has not taken long to develop since the XML version of the iepd had been explored previously and the theoretical UML version, developed manually against the NIEM-UML profile, was presented at OMG meetings in April and June 2012. The example was to try out the exchange with a tool that implemented the profile and understand more fully the direction and limitation on the modeling that this would imply.

It was also an opportunity to test a tool in the early stages to see how it would be used its ease of use.

The example model is validated by the tool for conformance to the NIEM Naming and Design Rules (NDR). A large number of warnings have been resolved and only about a dozen remain to be understood and remedied. Many of these warnings do not affect the generation of the schemas by the tool.

The generated schemas were validated in an XSD development environment and no errors are found.

The target sample exchange document was tested against the schemas and revealed a few unintended schema element options. These will be researched and remedied. It is not clear whether these are malformed model contents or problems with the tool.

Sample exchange document

```
<?xml version="1.0" encoding="UTF-8"?>
<tns:Condition xmlns:nc="http://niem.gov/niem/niem-core/2.0" xmlns:niem-xsd="http://niem.gov/niem/proxy/xsd/2.0"
xmlns:s="http://niem.gov/niem/structures/2.0"
xmlns:tns="http://demo.org/conditions" xmlns:tns1="http://demo.org/eiem/canonical"
xmlns:tns2="http://demo.org/terminology/c80_Terminology"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://demo.org/conditions
../XMLschemas/exchange/condition.xsd ">
  <tns1:ServiceProviderClientAssociation>
    <tns1:ClientReference s:ref="idvalue1" />
    <tns1:ServiceProviderReference s:ref="idvalue2" />
  </tns1:ServiceProviderClientAssociation>
  <tns1:Client s:id="idvalue1">
    <tns1:ClientIdentifier>
      <tns1:AssigningAuthority>2.16.840.1.113883.3.42.10001.100001.12</tns1:AssigningAuthority>
      <tns1:IdentificationID>12345678</tns1:IdentificationID>
    </tns1:ClientIdentifier>
    <tns1:RoleOfPersonReference s:ref="idvalue3" />
  </tns1:Client>
  <tns1:ServiceProvider s:id="idvalue2">
    <tns1:ServiceProviderRoleTitle>Primary Care Provider</tns1:ServiceProviderRoleTitle>
    <tns1:ContactInformation>
      <nc:ContactEmailID></nc:ContactEmailID>
      <nc:ContactMailingAddress>
        <nc:AddressFullText></nc:AddressFullText>
      </nc:ContactMailingAddress>
    </tns1:ContactInformation>
    <tns1:RoleOfPersonReference s:ref="idvalue0" />
    <tns1:OrganizationReference s:ref="idvalue4" />
    <tns1:PersonIdentifier>
      <nc:IdentificationID></nc:IdentificationID>
      <nc:IdentificationCategoryText></nc:IdentificationCategoryText>
    </tns1:PersonIdentifier>
  </tns1:ServiceProvider>
  <nc:Person s:id="idvalue0">
    <nc:PersonName>
      <nc:PersonFullName>Dr Bob</nc:PersonFullName>
    </nc:PersonName>
  </nc:Person>
  <nc:Person s:id="idvalue3">
    <tns1:AgeAtOnset>
      <nc:MeasurePointValue>62</nc:MeasurePointValue>
      <nc:TimeUnitCode>ANN</nc:TimeUnitCode>
    </tns1:AgeAtOnset>
    <nc:PersonDeathDate>
      <nc:DateTime>2010-07-12T00:00:00Z</nc:DateTime>
    </nc:PersonDeathDate>
    <tns1:Diagnosis>
      <tns2:DiagnosisProblemCode tns2:displayName="Diagnosis">282291009</tns2:DiagnosisProblemCode>
      <tns1:ProblemDate>
        <nc:StartDate>
          <nc:Date>2010-07-01</nc:Date>
        </nc:StartDate>
      </tns1:ProblemDate>
      <tns2:ProblemStatusCode tns2:displayName="Resolved">413322009</tns2:ProblemStatusCode>
      <tns2:DiagnosisDescriptionCode tns2:displayName="Ebola Virus Infection">10014074</tns2:DiagnosisDescriptionCode>
      <tns2:DiagnosisPriorityCode tns2:displayName="The primary diagnosis">1</tns2:DiagnosisPriorityCode>
      <tns2:DiagnosisTypeCode tns2:displayName="Final">F</tns2:DiagnosisTypeCode>
      <tns2:ProblemSeverityCode tns2:displayName="Fatal">399166001</tns2:ProblemSeverityCode>
    </tns1:Diagnosis>
    <nc:PersonName>
      <nc:PersonFullName>John Patient</nc:PersonFullName>
    </nc:PersonName>
  </nc:Person>
  <nc:Organization s:id="idvalue4">
    <nc:OrganizationName>The Local Hospital</nc:OrganizationName>
  </nc:Organization>
</tns:Condition>
```

Notice that the detection of a precise SNOMED-CT code “10014074” for Ebola Virus Infection could involve many people.

Further work

There are two areas for further work:

- Approach for validation that correct output can be generated – the avoidance of modeling pilot error and the testing approach for confidence that the generated output is good.
- User interface recommendations to provide automatic model consistency along with ease of use for the modeler.

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