

# TOLVEN WHITE PAPER

## Provenance and Clinical Context in Tolven Systems

“Provenance” (origin, source)<sup>i</sup> is one important aspect for establishing the context for clinical information that is instantiated in electronic health records and then exchanged with other systems. When users can trace the origin of information, they can make judgments about the reliability of that information. “The focus of the provenance resource is record keeping, audit and traceability, not clinical meaning.”<sup>ii</sup>

Clinical meaning is best established when the clinical context of particular information can be determined and transmitted. Some very simple examples of clinical context include the:

- ⌚ association of a clinical chemistry laboratory result with a reference range for that particular test
  - Result: Serum potassium 4.5 mEq/L
  - Normal range: 3.5 – 5.3 mEq/L
- ⌚ association of the attribute set used when documenting a clinical problem.
  - Problem: Nausea, moderate to severe
  - Severity attribute set: Mild, Mild to moderate, Moderate, Moderate to severe, Severe, Fatal

More complex examples of clinical context include

- ⌚ “reason for test” when ordering a procedure
  - Procedure: Electrocardiogram
  - Reason for test: Myocardial infarction
- ⌚ diagnosis for ordering a medication
  - Medication order: Synthroid .125 mg daily
  - Diagnosis: Hypothyroidism

## Tolven information processing and exchange

All Tolven projects including electronic health records for clinicians (EHRs), personal health records (PHRs) and health information exchange (HIE) instantiate granular information in harmony with the HL7 Reference Information Model (RIM). The RIM provides a framework for establishing data provenance as well as for clinical context. Tolven’s TRIM (template reference information model) adds some additional elements in order to effectively implement the RIM in our applications.

## TOLVEN WHITE PAPER

Starting on the upper left and moving toward the right, data is accepted from external applications and immediately stored as a “document” exactly as it was received. This document will always be available for exchange with other systems.

Tolven then calls each one of the processors that have been configured for a particular document type. The processor(s) that recognizes the document format can then parse that document using a technique of their choice (many are in XML format but that is not required). This process fosters semantic normalization because, at this point, the difference among different data sources sending in the same data can be resolved. For example, a serum sodium test may come from many different sources such as labs, clinics, and even the patient. Without disturbing the source document, the processor creates what Tolven calls “placeholders” which is a catch-all term representing the various kinds of data objects used in healthcare: patient, encounter, medication order, allergy, diagnosis, etc.

Placeholders are instantiated in harmony with the HL7 Reference Information Model, a discipline that facilitates further semantic interoperability. Key clinical information is thus redundantly stored in Tolven: once as the original document and then again as one or more placeholders. The link between placeholder and original document is always maintained to assure fidelity of context. Moreover, exchanging summary information, such as a CCD summary, includes faithful copies of the original documents that are associated with the particular placeholders (for example, MU 1 certification standards specified problems, medication allergies, medications, laboratory results, and procedures; all of these are “placeholders” in Tolven).

If a message is very simple, it may only create or update a single placeholder. Complex messages may affect many placeholders. For example, a lab result may affect only a single or small number of placeholders or a single type (lab result) whereas a CCD document may affect many placeholders of different types.

Insofar as provenance and clinical context information are contained in the inbound documents, RIM-based placeholders will include whatever information is available; in addition, a placeholder’s association with the original inbound document is preserved so that both placeholder and original document can be exchanged fulfilling Tolven’s obligation to preserve provenance and clinical context when transmitting clinical information to other systems.

After semantic processing, all affected placeholders are subject to rule processing. In Tolven, rules are used to maintain “truth” by reasoning over patient data with the affected placeholders in context. For example, when a lab result is received from a hospital and the rules determine that that lab result should be placed on a list of new lab results for a particular patient in his/her PHR account, then Tolven will add the item to the lab results portal in the appropriate PHR so that it can be viewed by the patient. All rules are stated in the positive so that if a rule does not support

## TOLVEN WHITE PAPER

an item being on such a list, then it will automatically be removed from that list. This style is called *truth maintenance*. Rules can be, and usually are, added for specific accounts to implement desired user interface and decision support behavior.

Rule consequences are not limited to lists. Outbound messages, such as for other EMRs, case management systems and utilization review systems, can also be triggered by rules. This allows for multiple approaches to integration with other systems. For example, data can be written to non-Tolven tables or to completely different databases.

Some external applications may only send data into the ecosystem (such as “Application a” above); other external applications (such as “Application d” above) may only be recipients of data from the ecosystem.

The lower section of the diagram shows how data from applications developed on the Tolven framework submit data to the ecosystem. All data from Tolven-based applications is formatted in an xml structure call a TRIM (Templated Reference Information Model). TRIMS are taken in and processed by the ecosystem in exactly the same way as messages from external systems. Tolven applications enforce the inclusion of provenance and clinical context information. When information created by a Tolven application is exchanged with other systems, placeholders and TRIMs associated with them provide provenance and clinical context.

Finally, when Tolven receives information from outside applications, it retains the “source” information so that it also can be included with subsequent transmissions of a placeholder and the original source document for that placeholder.

### Examples of TRIMs showing **provenance** and **clinical context** information

#### Example 1: Documenting a **patient problem**

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<trim xmlns="urn:tolven-org:trim:4.0">
  <extends>patientAct</extends>
  <name>docclin/evn/problem</name>
  <page>problemDoc.xhtml</page>
  <drilldown>problemDocclinDD.xhtml</drilldown>
  <menu>global:problemDocMenu</menu>
  <tolvenEventId accountId="37004" id="4072114" path="echr:patient-
859014:problem-4072114" application="echr" principal="tom.jones"
status="active" timestamp="20120825151542+0000"/>
  <reference>http://wikihit.org/wiki/index.php/Problem</reference>
  <application name="ephr">
    <instance>ephr:patient:problem</instance>
    <wip>ephr:activity:all</wip>
  </application>
</application name="echr">
```

## TOLVEN WHITE PAPER

```
<instance>echr:patient:problem</instance>
<wip>echr:activity:all</wip>
</application>
<transitions path="trim.act.statusCodeValue">
  <transition name="create" to="active">
    <label language="en">Active</label>
  </transition>
  <transition name="reviseActive" from="active" to="active">
    <label language="en">Revise</label>
  </transition>
  <transition name="suspendActive" from="active" to="inactive">
    <label language="en">Inactive</label>
  </transition>
  <transition name="suspendCompleted" from="resolved" to="inactive">
    <label language="en">Inactive</label>
  </transition>
  <transition name="nullifiedActive" from="active" to="nullified">
    <label language="en">Nullified</label>
  </transition>
  <transition name="nullifiedCompleted" from="resolved" to="nullified">
    <label language="en">Nullified</label>
  </transition>
  <transition name="completedActive" from="active" to="resolved">
    <label language="en">Resolved</label>
  </transition>
  <transition name="completedSuspend" from="inactive" to="resolved">
    <label language="en">Resolved</label>
  </transition>
</transitions>
<act classCode="DOCCLIN" moodCode="EVN">
  <statusCode>active</statusCode>
  <title>
    <ST>Problem Document</ST>
  </title>
  <text>
    <ST>Problem Document </ST>
  </text>
  <effectiveTime>
    <label>Time of Problem</label>
    <new datatype="TS" function="now"/>
    <TS>
      <value>20120825081542-0700</value>
    </TS>
  </effectiveTime>
  <participation name="dataEnterer" typeCode="ENT">
    <role classCode="ROL">
      <id>
        <II>
          <root>1.2.1.37004</root>
          <extension>tom.jones@tolvenhealth.com</extension>
        </II>
      </id>
    </role>
  </participation>
  <participation name="author" typeCode="AUT">
    <role classCode="ASSIGNED">
      <bind application="echr" phase="request">
```

## TOLVEN WHITE PAPER

```

        <list cardinality="multiple">
          <path>echr:admin:staff:all</path>
        </list>
      </bind>
    </id>
  </role>
</participation>
<participation name="subject" typeCode="SBJ">
  <role classCode="PAT">
    <bind application="echr">
      <placeholder>
        <path>echr:patient</path>
      </placeholder>
    </bind>
    <bind application="ephr">
      <placeholder>
        <path>ephr:patient</path>
      </placeholder>
    </bind>
    <id>
      <II>
        <root>1.2.1.37004</root>
        <extension>echr:patient-859014</extension>
      </II>
    </id>
    <player classCode="PSN" determinerCode="INSTANCE">
      <name>
        <label>Patient Name</label>
        <EN>
          <label>Legal Name</label>
          <use>L</use>
          <part>
<label>First Name</label>
<type>GIV</type>
<ST>Lawrence</ST>
          </part>
          <part>
<label>Middle Name</label>
<type>GIV</type>
<ST>Alan</ST>
          </part>
          <part>
<label>Last Name</label>
<type>FAM</type>
<ST>Wilson</ST>
          </part>
        </EN>
      </name>
      <livingSubject>
        <administrativeGenderCode>
          <label>Gender</label>
          <valueSet>genders</valueSet>
          <CE>
<code>Male</code>
<codeSystem>hl7</codeSystem>
          </CE>
        </administrativeGenderCode>

```

## TOLVEN WHITE PAPER

```

        <birthTime>
            <label>Date of Birth</label>
            <TS>
<value>1984-07-28 00:00:00.0</value>
            </TS>
        </birthTime>
    </livingSubject>
</player>
</role>
</participation>
<relationship name="encounter" direction="IN" typeCode="COMP">
    <act classCode="OBS" moodCode="EVN">
        <bind application="echr" phase="create">
            <placeholder bindAction="exist" optional="true">
                <path>echr:patient:encounter</path>
            </placeholder>
        </bind>
        <bind application="ephr" phase="create">
            <placeholder bindAction="exist" optional="true">
                <path>ephr:patient:encounter</path>
            </placeholder>
        </bind>
        <bind application="echr" phase="request">
            <list cardinality="single">
                <path>echr:patient:encounters:active</path>
            </list>
        </bind>
        <id>
            <II>
                <root>1.2.1.37004</root>
                <extension>echr:patient-859014:encounters:active-
4072109</extension>
            </II>
        </id>
        <title>
            <ST>Encounter</ST>
        </title>
    </act>
</relationship>
<relationship name="problem" direction="OUT" typeCode="COMP"
sequenceNumber="1" enabled="true">
    <act classCode="OBS" moodCode="EVN">
        <bind application="echr" phase="create">
            <placeholder bindAction="merge">
                <path>echr:patient:problem</path>
            </placeholder>
        </bind>
        <bind application="ephr" phase="create">
            <placeholder bindAction="merge">
                <path>ephr:patient:problem</path>
            </placeholder>
        </bind>
        <id>
            <II>
                <root>1.2.1.37004</root>
                <extension>echr:patient-859014:problem-
4072116</extension>

```

## TOLVEN WHITE PAPER

```
</II>
</id>
<code>
  <CD>
    <code>C0332139</code>
    <codeSystemName>UMLS</codeSystemName>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CD>
</code>
<title>
  <ST>Problem</ST>
</title>
<effectiveTime>
  <label>Time of Problem</label>
  <new datatype="TS" function="now"/>
  <TS>
    <value>20120824</value>
  </TS>
</effectiveTime>
<observation>
  <value>
    <CE>
      <displayName>Nausea (finding)</displayName>
      <code>73879007</code>
      <codeSystem>2.16.840.1.113883.6.96</codeSystem>
      <codeSystemName>SNOMED-CT</codeSystemName>
    </CE>
  </value>
</observation>
<participation name="author" typeCode="AUT">
  <role classCode="ASSIGNED">
    <bind application="echr" phase="request">
      <list cardinality="multiple">
<path>echr:admin:staff:all</path>
      </list>
    </bind>
  </role>
</participation>
<participation name="subject" typeCode="SBJ">
  <role classCode="PAT">
    <bind application="echr">
      <placeholder>
<path>echr:patient</path>
      </placeholder>
    </bind>
    <bind application="ephr">
      <placeholder>
<path>ephr:patient</path>
      </placeholder>
    </bind>
  </role>
</participation>
</II>
<root>1.2.1.37004</root>
<extension>echr:patient-859014</extension>
</II>
</id>
```

## TOLVEN WHITE PAPER

```

        <player classCode="PSN" determinerCode="INSTANCE">
            <name>
<label>Patient Name</label>
<EN>
    <label>Legal Name</label>
    <use>L</use>
    <part>
        <label>First Name</label>
        <type>GIV</type>
        <ST>Lawrence</ST>
    </part>
    <part>
        <label>Middle Name</label>
        <type>GIV</type>
        <ST>Alan</ST>
    </part>
    <part>
        <label>Last Name</label>
        <type>FAM</type>
        <ST>Wilson</ST>
    </part>
</EN>
            </name>
            <livingSubject>
<administrativeGenderCode>
    <label>Gender</label>
    <valueSet>genders</valueSet>
    <CE>
        <code>Male</code>
        <codeSystem>hl7</codeSystem>
    </CE>
</administrativeGenderCode>
<birthTime>
    <label>Date of Birth</label>
    <TS>
        <value>1984-07-28 00:00:00.0</value>
    </TS>
</birthTime>
            </livingSubject>
        </player>
    </role>
</participation>
    <participation name="dataEnterer" typeCode="ENT">
        <role classCode="ROL">
            <id>
                <II>
<root>1.2.1.37004</root>
<extension>tom.jones</extension>
                </II>
            </id>
        </role>
    </participation>
    <relationship name="severity" direction="OUT" typeCode="PERT">
        <act classCode="OBS" moodCode="EVN">
            <title>
                <ST>Severity</ST>
            </title>

```



## TOLVEN WHITE PAPER

```

                <observation>
                    <value>
<label>Severity</label>
<valueSet>severity</valueSet>
<CE>
    <displayName>Moderate to severe</displayName>
    <code>C1299393</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
                </value>
            </observation>
        </act>
    </relationship>
    <relationship name="course" direction="OUT" typeCode="PERT">
        <act classCode="OBS" moodCode="EVN">
            <title>
                <ST>Course</ST>
            </title>
            <observation>
                <value>
<label>Course</label>
<valueSet>course</valueSet>
<CE>
    <displayName>Acute</displayName>
    <code>C0205178</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
                </value>
            </observation>
        </act>
    </relationship>
    <relationship name="outcome" direction="OUT" typeCode="PERT">
        <act classCode="OBS" moodCode="EVN">
            <title>
                <ST>Outcome</ST>
            </title>
            <observation>
                <value>
<label>Outcome</label>
<valueSet>outcome</valueSet>
<CE>
    <displayName>Worsening</displayName>
    <code>C1546960</code>
    <codeSystem>HL7V2.5 W</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
                </value>
            </observation>
        </act>
    </relationship>
    <relationship name="treatment" direction="OUT"
typeCode="PERT">
        <act classCode="OBS" moodCode="EVN">
            <title>
                <ST>Treatment</ST>

```

## TOLVEN WHITE PAPER

```
        </title>
        <text>
            <ST></ST>
        </text>
    </act>
</relationship>
<relationship name="comments" direction="OUT" typeCode="PERT">
    <act classCode="OBS" moodCode="EVN">
        <title>
            <ST>Comments</ST>
        </title>
        <text>
            <ST>patient can no longer eat</ST>
        </text>
    </act>
</relationship>
<compute>
    <type>org.tolven.process.Copy</type>
    <property name="destination">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">#{trim.act.text.ST.value}</value>
    </property>
    <property name="source">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">#{trim.act.title.ST.value}
#{trim.act.observation.value.CE.displayName}</value>
    </property>
</compute>
</act>
</relationship>
<compute>
    <type>org.tolven.process.InsertAct</type>
    <property name="enabled">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:boolean">>false</value>
    </property>
    <property name="arName">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">problem</value>
    </property>
    <property name="arDirection">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">OUT</value>
    </property>
    <property name="arTypeCode">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">COMP</value>
    </property>
    <property name="template">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">problem/SCTID-73879007</value>
    </property>
```

## TOLVEN WHITE PAPER

```
<property name="action">
  <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">add</value>
</property>
<property name="position">
  <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">0</value>
</property>
</compute>
<compute>
  <type>org.tolven.process.RemoveDisabledAct</type>
  <property name="enabled">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:boolean">>false</value>
  </property>
  <property name="arName">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">problem</value>
  </property>
</compute>
</act>
<valueSet name="episodicity">
  <CE>
    <displayName>New episode</displayName>
    <code>C0565959</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
  <CE>
    <displayName>Ongoing episode</displayName>
    <code>C0580798</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
</valueSet>
<valueSet name="severity">
  <CE>
    <displayName>Mild</displayName>
    <code>C0547040</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
  <CE>
    <displayName>Mild to moderate</displayName>
    <code>C1299392</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
  <CE>
    <displayName>Moderate</displayName>
    <code>C0205081</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
</valueSet>
```

## TOLVEN WHITE PAPER

```
<displayName>Moderate to severe</displayName>
<code>C1299393</code>
<codeSystem>2.16.840.1.113883.6.56</codeSystem>
<codeSystemVersion>2007AA</codeSystemVersion>
</CE>
<CE>
  <displayName>Severe</displayName>
  <code>C0205082</code>
  <codeSystem>2.16.840.1.113883.6.56</codeSystem>
  <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
<CE>
  <displayName>Fatal</displayName>
  <code>C1302234</code>
  <codeSystem>2.16.840.1.113883.6.56</codeSystem>
  <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
</valueSet>
<valueSet name="course">
  <CE>
    <displayName>Acute</displayName>
    <code>C0205178</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
  <CE>
    <displayName>Chronic</displayName>
    <code>C0205191</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
  <CE>
    <displayName>Recurrent</displayName>
    <code>C0580798</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
</valueSet>
<valueSet name="outcome">
  <CE>
    <displayName>Sequelae</displayName>
    <code>C0543419</code>
    <codeSystem>HL7V2.5          S</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
  <CE>
    <displayName>Died</displayName>
    <code>C1546956</code>
    <codeSystem>HL7V2.5          D</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
  <CE>
    <displayName>Fully recovered</displayName>
    <code>C1546957</code>
    <codeSystem>HL7V2.5          F</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
</valueSet>
```

## TOLVEN WHITE PAPER

```
<CE>
  <displayName>Not recovering/unchanged</displayName>
  <code>C1546958</code>
  <codeSystem>HL7V2.5      N</codeSystem>
  <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
<CE>
  <displayName>Recovering</displayName>
  <code>C1546959</code>
  <codeSystem>HL7V2.5      R</codeSystem>
  <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
<CE>
  <displayName>Worsening</displayName>
  <code>C1546960</code>
  <codeSystem>HL7V2.5      W</codeSystem>
  <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
<CE>
  <displayName>Unknown</displayName>
  <code>C1556127</code>
  <codeSystem>HL7V2.5      U</codeSystem>
  <codeSystemVersion>2007AA</codeSystemVersion>
</CE>
</valueSet>
<valueSet name="encounterTemplate">
  <CE>
    <displayName></displayName>
    <code>C0389100</code>
    <codeSystem>2.16.840.1.113883.6.56</codeSystem>
    <codeSystemVersion>2007AA</codeSystemVersion>
  </CE>
</valueSet>
<field name="formType">
  <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">problems</value>
</field>
<field name="pageName">
  <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">problem</value>
</field>
</trim>
```

### Example 2: Documenting a **procedure**

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<trim xmlns="urn:tolven-org:trim:4.0">
  <extends>patientAct</extends>
  <name>pxDoc</name>
  <description>Procedure Document</description>
  <page>docclin.xhtml</page>
  <drilldown>docclinDD.xhtml</drilldown>
  <menu>global:pxDocMenu</menu>
```

## TOLVEN WHITE PAPER

```
<tolvenEventId accountId="6006" id="1166570" path="echr:patient-
880445:px-1166570" application="echr" principal="thomasjones"
status="completed" timestamp="20130603084309+0000"/>
<reference>http://wikihit.org/wiki/index.php/Procedure</reference>
<application name="ephr">
  <instance>ephr:patient:px</instance>
  <wip>ephr:activity:all</wip>
</application>
<application name="echr">
  <instance>echr:patient:px</instance>
  <wip>echr:activity:all</wip>
</application>
<transitions path="trim.act.statusCodeValue">
  <transition name="reviseActive" from="completed" to="completed">
    <label language="en">Revise</label>
  </transition>
  <transition name="nullifiedActive" from="completed" to="nullified">
    <label language="en">Entered in Error</label>
  </transition>
</transitions>
<act classCode="DOCCLIN" moodCode="EVN">
  <statusCode>completed</statusCode>
  <title>
    <ST>Procedure Document</ST>
  </title>
  <participation name="author" typeCode="AUT">
    <role classCode="ASSIGNED">
      <bind application="echr" phase="request">
        <list cardinality="multiple">
          <path>echr:admin:staff:all</path>
        </list>
      </bind>
    </role>
  </participation>
  <participation name="subject" typeCode="SBJ">
    <role classCode="PAT">
      <bind application="echr">
        <placeholder>
          <path>echr:patient</path>
        </placeholder>
      </bind>
      <bind application="ephr">
        <placeholder>
          <path>ephr:patient</path>
        </placeholder>
      </bind>
    </role>
  </participation>
  <id>
    <II>
      <root>1.2.1.6006</root>
      <extension>echr:patient-880445</extension>
    </II>
  </id>
  <player classCode="PSN" determinerCode="INSTANCE">
    <name>
      <label>Patient Name</label>
    </name>
  </player>
</act>
```

## TOLVEN WHITE PAPER

```
<label>Legal Name</label>
<use>L</use>
<part>
<label>First Name</label>
<type>GIV</type>
<ST>Jamie</ST>
</part>
<part>
<label>Middle Name</label>
<type>GIV</type>
<ST>Donna</ST>
</part>
<part>
<label>Last Name</label>
<type>FAM</type>
<ST>Bradley</ST>
</part>
</EN>
</name>
<livingSubject>
  <administrativeGenderCode>
    <label>Gender</label>
    <valueSet>genders</valueSet>
    <CE>
<code>Female</code>
<codeSystem>hl7</codeSystem>
    </CE>
  </administrativeGenderCode>
  <birthTime>
    <label>Date of Birth</label>
    <TS>
<value>19460819</value>
    </TS>
  </birthTime>
</livingSubject>
</player>
</role>
</participation>
<participation name="dataEnterer" typeCode="ENT">
  <role classCode="ROL">
    <id>
      <II>
        <root>1.2.1.6006</root>
        <extension>tom.jones@tolvenhealth.com</extension>
      </II>
    </id>
  </role>
</participation>
<relationship name="encounter" direction="IN" typeCode="COMP">
  <act classCode="OBS" moodCode="EVN">
    <bind application="echr" phase="create">
      <placeholder bindAction="exist" optional="true">
        <path>echr:patient:encounter</path>
      </placeholder>
    </bind>
    <bind application="ephr" phase="create">
      <placeholder bindAction="exist" optional="true">
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## TOLVEN WHITE PAPER

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        <path>ephr:patient:encounter</path>
    </placeholder>
</bind>
<bind application="echr" phase="request">
    <list cardinality="single">
        <path>echr:patient:encounters:active</path>
    </list>
</bind>
<id>
    <II>
        <root>1.2.1.6006</root>
        <extension></extension>
    </II>
</id>
<title>
    <ST>Encounter</ST>
</title>
</act>
</relationship>
<relationship name="procedure" direction="OUT" typeCode="COMP"
sequenceNumber="1" enabled="true">
    <act classCode="PROC" moodCode="EVN">
        <bind application="echr" phase="create">
            <placeholder bindAction="merge">
                <path>echr:patient:px</path>
            </placeholder>
        </bind>
        <bind application="ephr" phase="create">
            <placeholder bindAction="merge">
                <path>ephr:patient:px</path>
            </placeholder>
        </bind>
        <id>
            <II>
                <root>1.2.1.6006</root>
                <extension>echr:patient-880445:px-1166572</extension>
            </II>
        </id>
        <code>
            <CE>
                <displayName>Electrocardiogram</displayName>
                <code>89.52</code>
                <codeSystem>2.16.840.1.113883.6.104</codeSystem>
                <codeSystemName>ICD-9CM</codeSystemName>
            </CE>
        </code>
        <effectiveTime>
            <label>Start time</label>
            <new datatype="TS" function="now"/>
            <TS>
                <value>201306030143</value>
            </TS>
        </effectiveTime>
        <relationship name="procedureInfo" direction="OUT"
typeCode="COMP">
            <act classCode="OBS" moodCode="EVN">
                <observation>
```



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                <value>
<label>Additional Detail</label>
<ED>
    <value></value>
</ED>
                </value>
            </observation>
        </act>
    </relationship>
    <relationship name="diagnosis" direction="OUT"
typeCode="RSON" sequenceNumber="1">
        <act classCode="OBS" moodCode="EVN">
            <id>
                <II>
<root>1.2.1.6006</root>
<extension>echr:patient-880445:diagnosis-1166564</extension>
                </II>
            </id>
            <code>
                <CD>
<displayName>Diagnosis</displayName>
<code>C0011900</code>
<codeSystemName>UMLS</codeSystemName>
<codeSystemVersion>2012AA</codeSystemVersion>
                </CD>
            </code>
            <observation>
                <value>
<CE>
                <displayName>Acute myocardial infarction (disorder)</displayName>
                <code>90242006</code>
                <codeSystem>2.16.840.1.113883.6.96</codeSystem>
                <codeSystemName>SNOMED-CT</codeSystemName>
</CE>
                </value>
            </observation>
        </act>
    </relationship>
    <compute>

<type>org.tolven.process.InsertAssociatedPlaceholder</type>
    <property name="enabled">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:boolean">false</value>
    </property>
    <property name="arName">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">problem</value>
    </property>
    <property name="arDirection">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">OUT</value>
    </property>
    <property name="arTypeCode">
```

## TOLVEN WHITE PAPER

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        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">RSON</value>
        </property>
        <property name="template">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">associatedProblem</value>
        </property>
        <property name="placeholderList">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">echr:patient-880445:problems:activeAssociations</value>
        </property>
        <property name="placeholderPath">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string"></value>
        </property>
        <property name="action">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">add</value>
        </property>
        <property name="position">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">0</value>
        </property>
    </compute>
    <compute>

<type>org.tolven.process.InsertAssociatedPlaceholder</type>
        <property name="enabled">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:boolean">false</value>
        </property>
        <property name="arName">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">diagnosis</value>
        </property>
        <property name="arDirection">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">OUT</value>
        </property>
        <property name="arTypeCode">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">RSON</value>
        </property>
        <property name="template">
        <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">associatedDiagnosis</value>
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## TOLVEN WHITE PAPER

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        </property>
        <property name="placeholderList">
          <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">echr:patient-880445:diagnoses:currentAssociations</value>
        </property>
        <property name="placeholderPath">
          <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">echr:patient-880445:diagnosis-1166564</value>
        </property>
        <property name="action">
          <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">add</value>
        </property>
        <property name="position">
          <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">0</value>
        </property>
      </compute>
    </act>
  </relationship>
</compute>
  <type>org.tolven.process.InsertAct</type>
  <property name="enabled">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:boolean">>false</value>
  </property>
  <property name="enableAct">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:boolean">>true</value>
  </property>
  <property name="arName">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">procedure</value>
  </property>
  <property name="arDirection">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">OUT</value>
  </property>
  <property name="arTypeCode">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">COMP</value>
  </property>
  <property name="template">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">icd9procedure/89.52</value>
  </property>
  <property name="action">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">add</value>
  </property>
```

## TOLVEN WHITE PAPER

```
        <property name="position">
            <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema" xsi:type="xs:string">0</value>
        </property>
    </compute>
</act>
<field name="formType">
    <value xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xsi:type="xs:string">pxList</value>
</field>
</trim>
```

i <http://www.merriam-webster.com/dictionary/provenance>

ii <http://www.hl7.org/implement/standards/fhir/provenance-definitions.htm>