Health Data Management
with an Archetype Driven EHR System
in Low Resource Environments

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Introduction

• Based on diploma thesis “Design and prototypical implementation of an archetype based EHR system (EHRflex)”

• Held between May and October 2009 “Universidad Politécnica de Valencia”

• Has been enhanced since 2010 at the “Helmholtz Center Munich” (ByMedConnect)

• Since February 2010 OpenSource Project at “SourceForge”

• Technologies:
  • Web based Java application
  • GoogleWebToolkit adaption (GXT) for the user interface
  • XML database eXist
ISO 13606: „Electronic health record communication“

- Based on 15 years experience (GeHR and openEHR)

- Dual Model Approach

- **Information** – statements about specific entities
  - Blood pressure measurement: 120/80, patient was sitting

- **Knowledge** – statements which apply to all entities of a class
  - Pressure is taken in mmHg
  - Possible positions: Lying, Sitting, Staying and Unknown

- Semantically Interoperable
ISO 13606: Reference model

- Object oriented model
- Normally XML
- Represents properties of a health record

- **Generic structures to build blocks**
  - Folder, composition, section, entry, cluster and element

- **Specific data types**
  - Physical quantity, date, duration, coded text, URI, ...

- Structured information of a specific case
### Example „Anatomical Pathology Report“

#### Anatomical pathology report

<table>
<thead>
<tr>
<th>Patient:</th>
<th>Smith, John</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
<td>24 / 07 /2009</td>
</tr>
</tbody>
</table>

- **Macroscopic description:**
  - Two fragments of 0.1 cm
  - One fragment of 0.3 cm

- **Diagnostic:**
  - Chronic gastritis inflammation
  - Non atrophic chronic enteritis
ISO 13606: Archetype model

- Object oriented model
- Defined by a “Archetype Definition Language” (ADL)

- Adds knowledge
  - Translations, terminology, ...
- Constraints structure
  - Cardinality, existence, occurrences, ...
- Constraints values
  - Minimum, maximum, value list, ...

- Semantic description of clinical concepts
Archetype „Blood pressure“

Created with LinkEHR (OpenSource):
www.linkehr.com
ISO13606: LEGO analogy

Data structures
EHRflex: Goals

- Introduce ISO 13606 into the daily practice
- Visualization of the generic model for user interaction
- Clear and self-explanatory screen forms
- Empower clinicians to design their own content
- Review and evaluate the 13606 norm
Problems faced

- Support the generic dual model approach, but not losing usability
- Reference model represents *only* "information"
- Archetype model represents *only* "knowledge"

➢ User interface needs more specific information
- Other reference models for health records should be supported
Solution

- Method of resolution: Operational Template Model (OTM)
Operational Template Model

- Object oriented model
- Implemented in the used UI technology

- **Structures:**
  - StructureObject, List, Alternative
- **Data types:**
  - FieldList, Boolean, Integer, Real, CodedText, SimpleText

- Allows interaction with archetype based data
Method

- Transforming the OTM out of an Archetype and bind it directly to a form
Method

- Transformation the OTM into XML (any reference model)
Example: Google Health medication

CEN-EN13606-COMPOSITION.Medication.v1

<table>
<thead>
<tr>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPOSITION - Google Health Medication</td>
</tr>
<tr>
<td>ENTRY - ENTRY</td>
</tr>
<tr>
<td>ELEMENT - Medication</td>
</tr>
<tr>
<td>CODED_TEXT - CODED_TEXT</td>
</tr>
<tr>
<td>ELEMENT - How to take</td>
</tr>
<tr>
<td>SIMPLE_TEXT - SIMPLE_TEXT</td>
</tr>
<tr>
<td>ELEMENT - How many</td>
</tr>
<tr>
<td>SIMPLE_TEXT - SIMPLE_TEXT</td>
</tr>
<tr>
<td>ELEMENT - Strength</td>
</tr>
<tr>
<td>SIMPLE_TEXT - SIMPLE_TEXT</td>
</tr>
<tr>
<td>ELEMENT - How often</td>
</tr>
<tr>
<td>ELEMENT - Start date</td>
</tr>
<tr>
<td>DATE - DATE</td>
</tr>
<tr>
<td>ELEMENT - End date</td>
</tr>
<tr>
<td>DATE - DATE</td>
</tr>
<tr>
<td>ELEMENT - Status</td>
</tr>
<tr>
<td>alternative: SIMPLE_TEXT - SIMPLE_TEXT</td>
</tr>
<tr>
<td>alternative: SIMPLE_TEXT - SIMPLE_TEXT</td>
</tr>
<tr>
<td>ELEMENT - Comment</td>
</tr>
<tr>
<td>SIMPLE_TEXT - SIMPLE_TEXT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ontology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Add new data to: List of Entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication: A-MANTLE 12.54.7</td>
</tr>
<tr>
<td>How to take: To skin</td>
</tr>
<tr>
<td>How many: 1</td>
</tr>
<tr>
<td>Strength: Cream</td>
</tr>
<tr>
<td>How often: 3 times a day</td>
</tr>
<tr>
<td>Start date: 7/22/09</td>
</tr>
<tr>
<td>End date: 7/29/09</td>
</tr>
<tr>
<td>Status:</td>
</tr>
<tr>
<td>Currently taking this</td>
</tr>
<tr>
<td>Took this in the past</td>
</tr>
<tr>
<td>Comment: Cover only arms</td>
</tr>
</tbody>
</table>
Example: Google Health medication
Conclusion and Future Work

- Clinicians can define and use their own clinical concepts
- Widgets are useable despite the generic models of ISO 13606
- Data can be stored standard-conform in a database
- EHRflex modules are extendable for other standards

- Support of more archetype attributes and structures
- Implementation of an editing modus
- Enhancements of the Operational Template Model
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http://sourceforge.net/projects/ehrflex/
http://www.ehrflex.eu (DEMO)
http://www.en13606.eu