

i2b2 Ontology Representation based on SKOS

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Background

- The AKTIN project is a German national emergency department registry.
- i2b2 databases are used as local data warehouses in the hospitals.
- The concept data of the AKTIN datasets is imported from HL7 CDA documents based on a standardized and consented ontology.
- A solution for i2b2 ontology maintenance and distribution is required.
- No standard-based tools available to import terminologies (e.g. ICD10, CEDIS presenting complaint list) into the i2b2 ontology cell.

Methods

- Simple Knowledge Organization System (SKOS) is the W3C standard to represent knowledge.
- XSL is used to transform XML files or tabular terminology data.
- SKOS ontology can be loaded in any Resource Description Framework (RDF) engine (e.g. Apache Jena, OpenRDF).
- The RDF graph is traversed to obtain the necessary SQL insert statements for i2b2.
- XML-FO (via Apache FOP) is used to create a PDF documentation of the AKTIN ontology.

```
:EmergencyNote a skos:Concept ;
  skos:prefLabel "AKTIN EmergencyNote"@en ;
  skos:prefLabel "AKTIN Notaufnahmeprotokoll"@de ;
  dc:description "Top concept for EmergencyNote data (Tree)" ;

:ICD10GM a skos:Concept ;
  skos:inScheme :EmergencyNote ;
  skos:prefLabel "Abschlussdiagnosen"@de ;
  dc:description "Internationale statistische Klassifikation der Krankheiten und verwandter Gesundheitsprobleme" ;
  skos:narrower :ICD10GM_A00-A09;
  skos:narrower :ICD10GM_C00-C97;
  [...]

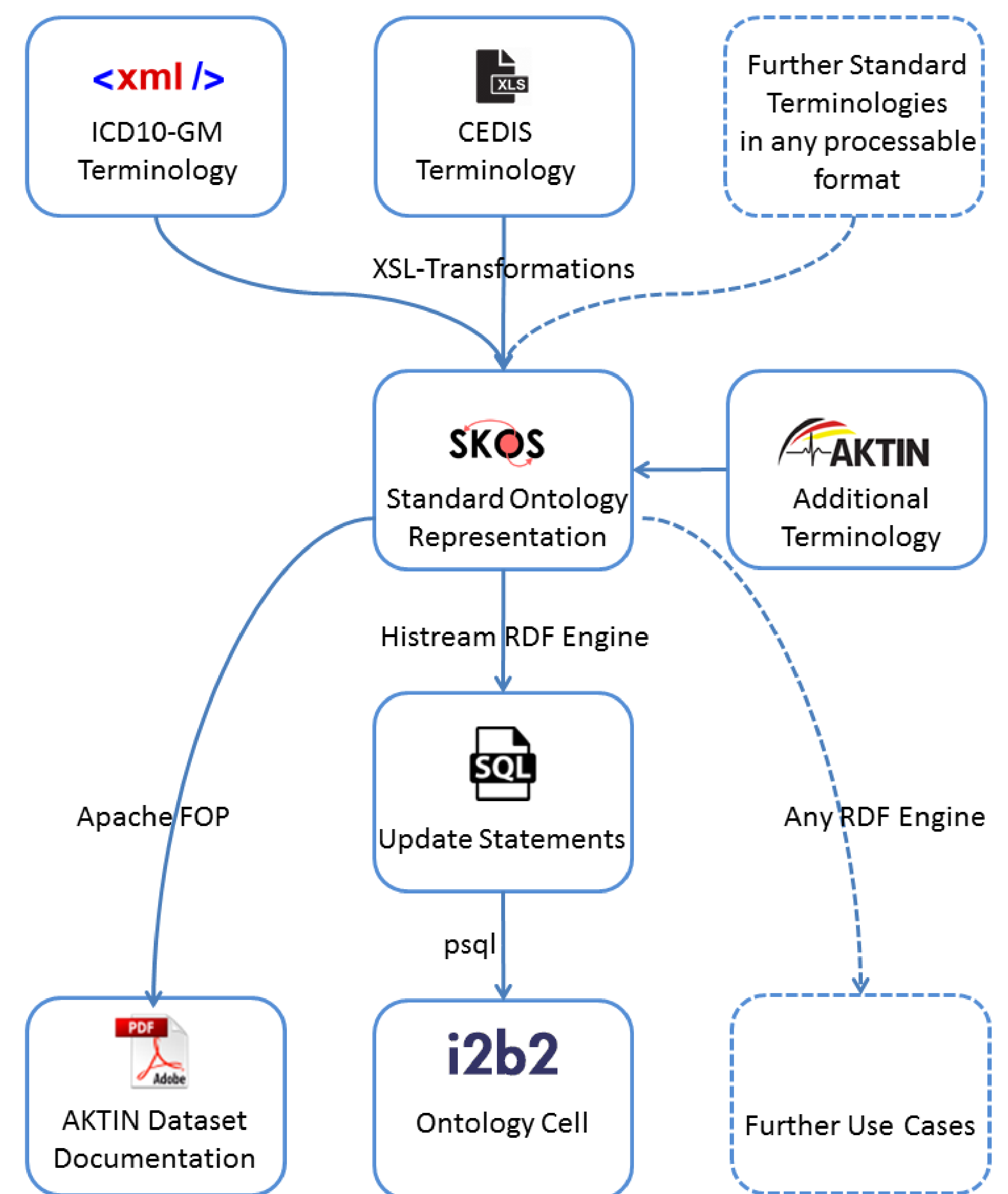
:ICD10GM_A00-A09 a skos:Concept ;
  skos:prefLabel "Infektiöse Darmkrankheiten"@de ;
  skos:narrower :ICD10GM_A00;
  skos:narrower :ICD10GM_A01;
  [...]

:ICD10GM_A00 a skos:Concept ;
  skos:prefLabel "Cholera"@de ;
  skos:notation "ICD10GM:A00";
  skos:narrower :ICD10GM_A00.0;
  skos:narrower :ICD10GM_A00.1;
  skos:narrower :ICD10GM_A00.9.

:ICD10GM_A00.0 a skos:Concept ;
  skos:prefLabel "Cholera durch Vibrio cholerae 0:1, Biovar ch";
  skos:notation "ICD10GM:A00.0".
  [...]

:Modifiedrankinscale a skos:Concept ;
  skos:inScheme :EmergencyNote ;
  skos:prefLabel "Modified Rankin Scale"@de ;
  dc:description "Modified Rankin scale" ;
  dwh:restriction dwh:Integer ;
  skos:notation "LOINC:75859-9" .
```

Examples from SKOS Ontology for AKTIN



Toolchain for Ontology Management

Results

- Converting proprietary terminology representation to SKOS is feasible via XSL.
- The complete AKTIN ontology information is available in a machine-readable form. It can easily be used by different systems and needs to be maintained only in SKOS.
- Use Case #1: Import the SKOS ontology into the i2b2 ontology cell.
- Use Case #2: Generating a human-readable PDF overview from the ontology.

Conclusion

- Careful application of standard formats and tools leads to a coherent workflow and less maintenance work.
- All proprietary or modified contents of the ontology need to be maintained in one place only.
- It is also possible to process the ontology with external standard tools like Protégé.
- This approach significantly reduces the work maintaining the ontology for AKTIN. It also increases the quality with only few manual steps to perform. This effectively prevents copy and paste errors and ensures, that the changes are deployed to all relevant parts of the project.

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