Semantics and Interoperability in a Reporting System for Infectious Disease Control

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Abstract. The *German Electronic Reporting System for Infectious Disease Control* (DEMIS) aims at creating a reliable, knowledge-based platform that provides services for respective experts and decision makers. This fast-responsive system enables reporting in accordance with legal requirements by the *German Law for Protection against Infection Act* (IFSG). DEMIS is built on several components, one of which is a semantic data and rule service component that we introduce in this paper.

Keywords: semantic technology, interoperability, eHealth standards, linked data service

1 Introduction

In case of an (disease) outbreak, the relevant data and information have to be reported in shortest time to the public health authorities in order to diminish the further spread by taking appropriate interventions and control measures. With regard to prevention and early detection, sophisticated approaches for forecasting and estimation of critical epidemiological situations are needed. The notification and reporting process follows in many countries the regulations of the national public health laws. In Germany, the relevant IFSG-law formulates rules and defines the frame for necessary actions to be undertaken, describes the duties for the obliged notifiers and specifies the notifiable evidence for pathogens and diagnoses that have to be reported in case of their occurrence. Infectious disease data are collected by the local health authorities from various sources, like microbiological labs, treating physicians and community facilities. The Robert Koch Institute (RKI) receives and analyzes these data of various communicable diseases in Germany[1].

2 Semantic component

The existing reporting system is maintained with help of a surveillance software, SurvNet, developed at RKI for the purpose of infectious and epidemiological case data collection

[1] http://goo.gl/eZ50HH

and analysis. The current surveillance software, should be enhanced by DEMIS system. DEMIS's main goal is to enable all notifiers to submit their information electronically and seamlessly. To support this process of data collection and transmission from various heterogeneous sources and to process the so obtained information sensibly the interoperability capabilities of the system have to be strengthened. This includes a machine consumable formulation of the semantic knowledge in the epidemiological field as well as a formalization of the involved rules to model the dependent processes according to this vocabulary. We propose a semantic component (see Fig. 1) that mainly provides the following functionality: 1. terminology and data service, 2. data curation and editing and 3. search and visualization. Our component can be accessed on different data security and trust levels, i.e. by internal users (epidemiological experts and decision makers) and secured services resp. by external users and public services.

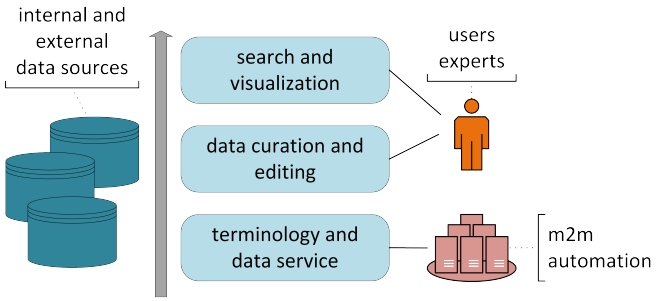

Fig. 1: DEMIS – semantic component, functionality view.

Within our component, the knowledge base with epidemiological concepts is maintained. It contains the relevant internal DEMIS ontologies as well as links to external knowledge. Aiming at enhancement of epidemiological data interoperability, we plan to automatically connect the existing concepts within a relevant e-health standard code, e.g. 'Pathogen' concept with ID 1.2.276.0.76.5.441 'Signifikante Pathogene' in HL7 (German edition), illustrated in following by SNOMED-CT ID:

```
@prefix sct: <www.ihtsdo.org/snomed-ct> .
@prefix demis: <rki.de/demis> .

sct:id:264418008 rdfs:label "Pathogenic organism"@en .
demis:OWLClass_Agens
      owl:equivalentClass demis:Pathogen ;
      rdf:type owl:Class ;
      rdfs:label "Agens"@de ;
```

In order to achieve the needed law compliance, the semantic component will be enriched with a rule component. Here the semantic concepts are used to formalize the processes and dependencies in a way that enables autonomous agents to process the information.

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