Extensibility in Semantic Web Description of Syndromic Surveillance Systems

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OBJECTIVE

A syndromic surveillance system which uses a semantic web description layer is more extensible than existing systems. This will be shown through the application of appropriate software metrics, as well as a case based review that targets three major system design components.

BACKGROUND

The semantic web is an emerging technology for expressing rich descriptions of a problem domain in the form of ontologies. An ontology provides a domain specific knowledge base for the communication and sharing of knowledge between various human and computer agents [1].

Application of this technology to the field of syndromic surveillance has seen success in an experimental environment through the BioSTORM project at the SMI labs at the Stanford University School of Medicine [2].

A flexible ontology based approach promises to reduce the technical barrier between theory and practice by allowing the quick introduction of data sources and algorithms and greater system transparency to health professionals.

METHODS

In order to allow the development of an end-to-end system, our focus has been on the creation of additional ontologies to describe methods of data manipulation, data processing algorithms, and output presentation techniques to compliment the ontologies provided by the BioSTORM project.

In order to compare and contrast the extensibility of a semantic web based system, it was compared to the EARS and RODS syndromic surveillance systems [3,4]. Two approaches were used. First, a set of software design metrics was applied to discover differences and similarities in terms of extensibility. Second, a case based review of common syndromic surveillance tasks has been performed for all three systems, where each use case corresponds to a different system design layer.

RESULTS

The BioSTORM ontologies have been extended, and the Semantic Web Assisted Syndromic Surveillance system (SWASS) has been completed which uses this ontology file as a metadata layer. Figure 1 provides a high level overview of data flow through the SWASS components which align with descriptions in the ontology.

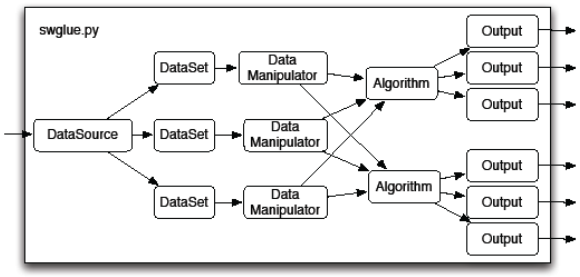

Figure 1 – Data flow between ontology concepts within the SWASS system.

The metrics analysis shows that SWASS matches or exceeds existing products across six measures of extensibility. The case based analysis shows that existing systems were not designed with extensibility in mind, and that SWASS is easier to maintain and extend.

CONCLUSIONS

A system based on the semantic web shows great flexibility and extensibility. Existing systems could be reworked to improve in this area, potentially with the adoption of a semantic web data layer.

The semantic web layer can be used to divide the system implementation details from actual system usage. This would allow domain experts to make decisions about functionality without the need to understand the details of the underlying implementation.

Designing a system based the semantic web encourages quality design that mimics the structure of the ontology. It also facilitates interoperability between various systems designed around a common ontology.

The semantic web while is still lacking in many standards, shows promise for providing a common description framework that could be of great value to the syndromic surveillance community.

REFERENCES

[1] M. Crubezy and M. A. Musen. Ontologies in Support of Problem Solving. 2003

[2] M. Crubezy, M. O'Connor, Z. Pincus, M. A. Musen, and D. L. Buckeridge. Ontology centered syndromic surveillance for bioterrorism. Intelligent Systems, IEEE, 20(5):26, 2005.

[3] CDC Early Aberration Reporting System (EARS), http://www.bt.cdc.gov/surveillance/ears/

[4] Realtime Outbreak and Disease Surveillance Laboratories, http://rods.health.pitt.edu/

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