

## 상호교류 헬스케어시스템을 위한 사용자정의 온톨로지 매핑

와자하트 알리 칸, 마크볼 후세인, 무하마드 아프잘, 이승룡, 정태충  
경희대학교 컴퓨터공학과

e-mail : { wajahat.alikhan, maqbool.hussain, muhammad.afzal, sylee}@oslab.khu.ac.kr, tcchung@khu.ac.kr

# Customized Ontology Mappings for Data Interoperability among Healthcare Systems

Wajahat Ali Khan, Maqbool Hussain, Muhammad Afzal, Sungyoung Lee and Tae Choong Chung  
Dept. of Computer Engineering, Kyung Hee University, Korea

### Abstract

*Accuracy of mappings is the key for achieving true interoperability among different healthcare systems. The initial step towards interoperable healthcare systems is compliancy with healthcare standards (HL7, openEHR, CEN 13606). Ontologies for these standards are developed that require ontology matching to generate generalized ontology mappings. Organizations conform to specific concepts of different standards based on their requirements. This step is called as conformance claims and is based on Personalized-Detailed Clinical Model. It invalidates some of the generalized mappings because of non-conformed concepts and leads to the necessity of the proposed technique of customized ontology mappings. These customized ontology mappings compliment the generalized ontology mapping to increase the level of accuracy of mappings and thus achieving data interoperability. The proposed system ensures quality of care to patients by timely delivery of healthcare information.*

## 1. Introduction

Healthcare community is facing challenge in the form of interoperability among different systems. Healthcare standards tend to provide certain level of interoperability among systems [1]. Although there are many standards for the same cause but still possess heterogeneities. HL7, openEHR and CEN13606 are few of the examples of EHR standards. There exist similarities between these standards as well as differences [2]. Ontologies for these standards are available online; therefore ontology matching techniques can be used to resolve some heterogeneity between them.

Ontology Matching is the solution for resolving semantic heterogeneity that exists between different systems [3]. Literature provides us information about various ontology matching systems that are used to generate mappings between ontologies of the same or different domains. GOMMA [4] and LogMap [5] are two ontology matching systems that provide higher level of F-Measure as compared to other systems. Matching is also performed by healthcare systems to achieve interoperability. Few of these systems include Poseacle Converter [6], Artemis [7] and PPEPR [8]. All the discussed systems focuses mostly on transformation based on generalized mappings and therefore there still remains room for improvement in accuracy of mappings.

We propose a system that caters customized mappings with generalized mapping as well to ensure highest level of accuracy. Also, organization requirements are taken into account as well thus generating customized mappings.

## 2. Customized and Generalized Ontology Mappings

Healthcare standard ontologies are developed based on reference model of each standard. These standards possess similarities as well as differences. Ontology matching tries to resolve the semantic heterogeneities between these standards by generating mappings between them. These mappings are generalized mappings as these does not takes into account organization's needs and requirements. We developed a system called SPHeRe<sup>1</sup> that is used to match different ontologies and generate mappings. These mappings are then stored in the Bridge Ontology which is a mapping representation technique. The generalized mappings generated need to include the organization's requirements therefore customized mappings are also required to achieve data interoperability. Customized Mappings are handled by our approach of P-DCM [9]. P-DCM identifies the conformance criteria of organizations and modifies the mappings accordingly. These mappings are accurate enough as these are generated by the involvement of the organization. Both customized and generalized mappings are stored in the Bridge ontology that will be used for ontology translation in future and also different standard format transformation. The proposed accuracy mapping engine combines both form of the mappings to achieve data level interoperability.

<sup>1</sup> <http://uclab.khu.ac.kr/sphere>

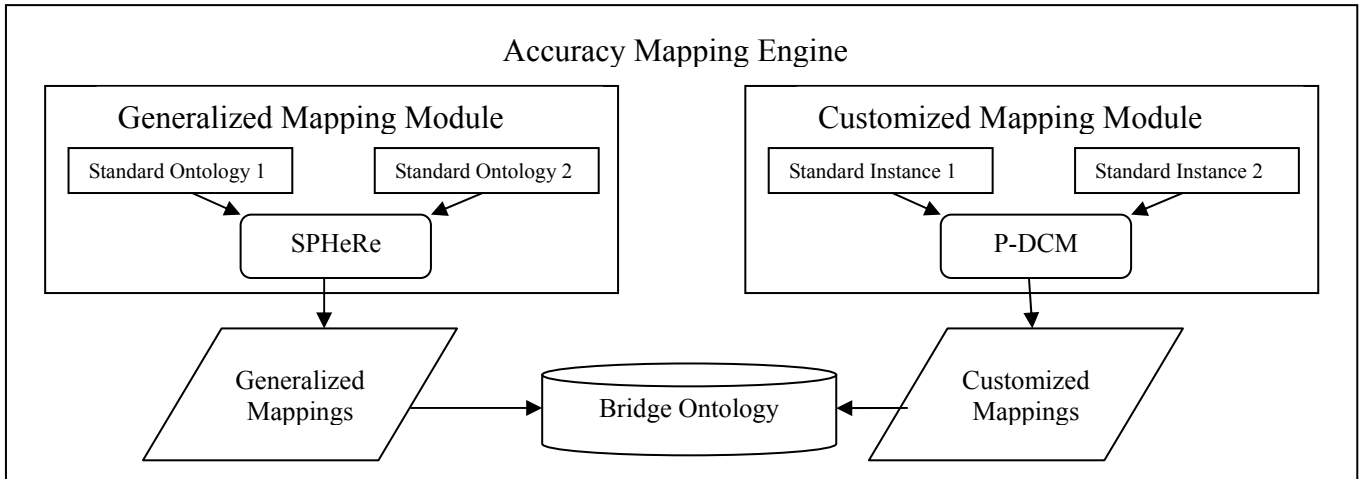


Figure 1: Accuracy Mapping Engine

### 3. Accuracy Mapping Engine

The proposed system applies ontology matching techniques to generate generalized and customized mappings and then storing it in Bridge Ontology as shown in Figure 1. Initially, the source and target standard ontologies are mapped by SPHeRe system in Generalized Mapping Module. Different ontology matching techniques are applied to find the alignments between these ontologies. These alignments are then stored in the bridge ontology. Bridge Ontology behaves as a mapping repository to be used for ontology translation while two systems want to communicate with each other. On the other hand, as the level of accuracy is not optimum, customized mappings are also required. Customized Mapping Module is responsible for the generation of customized mappings based on P-DCM. The P-DCM extracts information from the source and target standard instances and generates the customized mappings. These mappings are specifically based on the requirements of the organization. These customized mappings generated using P-DCM are also stored in the Bridge Ontology. When transformation is required specifically for an organization, customized mappings are given importance over generalized mappings. Both these mappings complement each other and increase the level of accuracy.

### 4. Conclusion

Information exchange in critical domains such as healthcare requires accuracy and timely delivery. Heterogeneous healthcare systems communication is dependent on the level of accuracy of mappings generated by the middleware system. Customized mappings in addition to generalized mappings ensure the level of accuracy required for interoperability among these heterogeneous healthcare systems.

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