



Contents lists available at ScienceDirect

Expert Systems with Applications

journal homepage: www.elsevier.com/locate/eswa

A network of ontology networks for building e-employment advanced systems[☆]

Boris Villazón-Terrazas, Jaime Ramírez^{*}, Mari Carmen Suárez-Figueroa, Asunción Gómez-Pérez

Ontology Engineering Group, Departamento de Inteligencia Artificial, Facultad de Informática, Universidad Politécnica de Madrid, Spain

ARTICLE INFO

Keywords:

Ontological engineering
Human resources management
Semantic interoperability

ABSTRACT

This paper presents the development of a network of ontology networks that enables data mediation between the Employment Services (ESs) participating in a semantic interoperability platform for the exchange of Curricula Vitae (CVs) and job offers in different languages. Such network is formed by (1) a set of local ontology networks that are language dependent, in which each network represents the local and particular view that each ES has of the employment market; and (2) a reference ontology network developed in English that represents a standardized and agreed upon terminology of the European employment market. In this network each local ontology network is aligned with the reference ontology network so that search queries, CVs, and job offers can be mediated through these alignments from any ES. The development of the ontologies has followed the methodological guidelines issued by the NeOn Methodology and is focused mainly on scenarios that involve reusing and re-engineering knowledge resources already agreed upon by employment experts and standardization bodies. This paper explains how these methodological guidelines have been applied for building e-employment ontologies. In addition, it shows that the approach to building ontologies by reusing and re-engineering agreed upon non-ontological resources speeds the ontology development, reduces development costs, and retrieves knowledge already agreed upon by a community of people in a more formal representation.

© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

Human resources managers have discovered that the Web can be a very effective communication vehicle. Although most businesses rely on diverse recruiting channels such as newspaper advertisements, online job exchange services, trade fairs, co-worker recommendations and human resources advisors, online personnel marketing is increasingly used because of their cost cutting results and efficacy. Public and private Employment Services (ES) are becoming more and more important for Public Administrations since their social implications on sustainability, workforce mobility and equal opportunities have a fundamental and strategic importance to both central and local Governments. Workforce mobility and political decisions in a Pan-European scope require wide European consortia to share and exchange employment information (mainly job offers and CVs written in different languages). This e-employment information system should involve different ESs that, in turn, manage their own repositories where sensitive and crucial data are recorded to support day-to-day operations. Moreover, the knowledge behind these data is implicitly encoded by means of ES specific models. However, the need to exchange and reconcile

these data, possibly written in different languages, among the different ESs requires us to make explicit the ES specific models. Ontologies play an important role for that purpose since they are used to give full detail of the meaning of the information contained in many e-government and e-employment applications.

Various approaches have been designed to deal with the semantic integration of heterogeneous information sources by means of ontologies, either in data sources or in mediators (Wache et al., 2001). In this paper we present the approach adopted in the SEEMP¹ (Single European Employment MarketPlace) project, where a network of ontologies provides the semantics enabling the data mediation. An ontology network or a network of ontologies is defined, according to Haase et al. (2006), as a collection of ontologies (called networked ontologies) related together through different meta-relationships such as mapping, modularization, version and dependency relationships.

The network of ontology networks presented in this paper comprises two kind of components: (1) *local ontology networks*, one for each ES, that are language dependent and make explicit the knowledge implicitly encoded in each ES specific model; and (2) a *reference ontology network* developed in English that mediates among the local ontology networks and unifies the terminology and conceptualization of the domain. Thus, the SEEMP project relies on a network of ontology networks because both the reference ontology

[☆] Work funded by SEEMP (FP6-027347) and NeOn (FP6-027595) EU Projects.

^{*} Corresponding author.

E-mail addresses: bvillazon@fi.upm.es (B. Villazón-Terrazas), jramirez@fi.upm.es (J. Ramírez), mcsuarez@fi.upm.es (M.C. Suárez-Figueroa), asun@fi.upm.es (A. Gómez-Pérez).

¹ <http://www.seemp.org>.

and the local ontology are ontology networks by themselves. Furthermore, the whole e-employment ontology network is the result of putting together the reference ontology network and the local ontology networks, and defining a set of alignments or semantic mappings between each local ontology network and the reference ontology network.

In the last few years, and within the context of the NeOn project² a scenario-based methodology, called the NeOn Methodology, has been developed. This methodology aims to build ontology networks by reusing and re-engineering knowledge resources. The development of the SEEMP ontologies has required several reverse engineering processes that take advantage of the existence of non-ontological resources already agreed on either in each local ES or in the European scope in the form of standards. The fact that a consensus in the terminology defined by a non-ontological resource has been reached must not be underestimated since this consensus helps to reduce development costs drastically. The NeOn Methodology (Suárez-Figueroa, 2010) provides detailed methodological guidelines for the different processes and activities involved in the ontology network development process.

This paper shows how the NeOn Methodology has been applied successfully in the development of the SEEMP ontology networks. More concretely, the SEEMP prototype has required the development of a reference ontology network and two local ontology networks (for Telmi ES and EURES ES, respectively). In addition, in this paper we have tried to demonstrate that the approach to building ontologies by reusing and re-engineering agreed upon non-ontological resources allows building ontologies faster and with less resources. Moreover, another advantage of this approach is that the ontologies built in this way can reach an immediate consensus.

The remaining of the paper is organized as follows: Section 2 presents the goals of the SEEMP project and outlines the proposed interoperability architecture. Section 3 summarizes the NeOn Methodology and emphasizes those aspects most relevant for the development of the SEEMP ontology networks. Section 4 shows how the NeOn guidelines have been applied in building the SEEMP ontologies. Section 5 presents our conclusions and the final section focuses on new lines of research derived from this work.

2. Related work

In this section we present the most outstanding research efforts for applying ontologies to the human resources domain. Gualtieri and Ruffolo (2005) and Terziev et al. (2005) present ontologies that represent organizational knowledge of a business. The former propose an ontology-based framework organized as a two-level family of ontologies: the first-level ontologies represent organizational background, whereas the second-level ontologies formally represent human resources, business processes, technical resources and knowledge objects. The latter, on the other hand, present a modular ontology, PROTON, that was built by reusing the KIMO ontology³ for modelling people, organizations, locations, numbers, dates and addresses.

There are also interesting contributions in the area of the competency management. Thus, for example, Trichet and LeclFre (2003) introduces CommOn (Competency Management through Ontologies), a generic framework dedicated to the development of Competency Based Systems. Their framework is based on the following concepts: competency, resources, context, and objective. Four types of resources are covered in their work: theoretical knowledge, procedural knowledge, skills and behavioral aptitudes. Biesalski and Abecker (2005) demonstrate how the use of competency catalogues (as lightweight ontologies) helps to

integrate process in human resources and present a german competency catalog containing information about competency and training. To show this they reused a catalogue stored in a simple flat database.

The works of Bizer et al. (2005) and Mochol and Paslaru (2006) are specially remarkable in the way they reuse and integrate widespread standards and classifications when creating an ontology for e-employment in a national scope (Germany). Two examples of these standards and classifications are: SOC, Occupation Code (Berufskennziffer – BKZ),⁴ Classification of Industry Sector (WZ2003),⁵ etc. Their ontology comprises the following subontologies: Education, JobPositionSeeker, Industry, JobPositionPosting, Organization, Skills and Person. However, apart from mentioning the standards employed in each of these subontologies, they do not give further details about the composition of these subontologies.

Another work related to e-employment that deals with the reusing of standards and classifications is Dorn, Naz, and Pichlmair (2007), which shows the development of an ontology modelling job descriptions, competences and learning objects for two different projects: a meta-search engine for searching for jobs in job portals and an university competence management system. In the building of this ontology Standard Occupational System (SOC)⁶ and HR-XML recommendation were employed.

Another good example of e-employment ontology is García-Sánchez, Martínez-Béjar, Contreras, Fernández-Breis, and Castellanos-Nieves (2006) where the ontology supports a search engine that provides intelligent matches between job offers and candidates curricula in a job portal bounded to a rural area. Nevertheless, the development of this ontology does not rely on any widespread standard or classification.

So far, any previous e-employment ontology has been built as a network of ontology networks, or has been designed to support interoperability of job offers and CVs in an European scope. Therefore, to support such type of interoperability we built a reference ontology, which required a greater effort than that employed for building an ontology intended for a local scope. Specifically, this effort was significantly greater when selecting and adopting international standards and classifications. Additionally, in order to support a suitable mediation among local ontologies, our reference ontology was created to provide a richer vocabulary than previous ontologies bounded solely to a regional or national scope.

Concerning methodological issues, none of the papers mentioned above except for Mochol and Paslaru (2006) documents the use of any methodology for reusing ontological or non-ontological resources. In this regard, it should be noted that the reusing of non-ontological resources was a key aspect in the development of our reference ontology, because, as we will comment in Section 5.1.4, all the standards and classifications that we adopted are considered non-ontological resources.

3. A semantic interoperability platform for e-employment

The main use case scenario consists of a job seeker that submits his/her search criteria through a Web site of a local ES. These search criteria describe the characteristics of the job offer (JO) in which the job seeker is interested (type of occupation, contract type, location of the job, compensation conditions, etc.). Normally, after this submission, the job seeker obtains some JOs from the local database of the ES. However, if the job seeker wishes to know about other JOs, which may be stored in foreign ESs, he would have to submit his/her search criteria in the Web site of other ESs, probably in a language other than his/her own. For this scenario, SEEMP

⁴ http://www.arbeitsamt.de/hst/markt/news/BKZ_alpha.txt.

⁵ <http://www.destatis.de/allg/d/klassif/wz2003.htm>.

⁶ <http://www.bls.gov/soc/>.

² <http://www.neon-project.org>.

³ <http://www.ontotext.com/kim>.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات