



016

# Semantic Web Approach for Determining Industry Qualifications Demand on Real-time Bases

S. AbdElall, C. Reise, G. Seliger

Technische Universität Berlin, Institute of Machine Tools and Factory Management,  
Pascalstr. 8-9, 10587 Berlin, Germany  
abdelall@mf.tu-berlin.de

**Conference Topic:** University - Business Cooperation

**Keywords:** Qualifications, curriculum, job announcements, semantic web, ontology

Prior applying for a job, candidates have to choose courses and curriculum that will qualify them for their intended job position. In times of dynamised markets, qualification demands change more frequently. Identifying the industry qualifications demand on real-time bases becomes therefore an important issue. Job announcements are written carefully to reflect exactly the current qualifications demand whenever a job vacancy appears. Qualifications described in job announcements vary often in their verbal descriptions (syntactics) even though the specific requirements (semantics) may be the same. For a meaningful analysis it is useful to decrease the amount of categories by bringing synonyms together under one qualification description. An automated analysis of job announcements has the potential to be more resource effective and more quickly than a human analysis. Modern information technology offers the chance to identify same semantic by using artificial intelligence. It is based on a model describing the classification of qualification needs. The information technological model – a so-called ontology – aims to be a formal and explicit description of a shared concept about technological qualification. It brings different perspectives on things together by defining its relations and memberships to a class. Therewith machines are enabled to reason. They can transform existing, but implicit, knowledge into explicit one, using so-called first order logic. Such logics using ontologies – the so-called semantic web – enable software applications to interpret heterogeneous information.

Semantic Web knowledge bases facilitate precise and unambiguous answers in web queries. The volume and diversity of information can be used more efficiently, and knowledge can be better distributed due to the creation of a vast global knowledge base. New information can be gained through reasoning and used in knowledge intensive applications, such as analyses of job announcements regarding their qualification demands. In this paper, more than one thousand job announcements have been analyzed to determine the real-time job market qualifications demand for the manufacturing engineering. For a precise analysis, custom software has been programmed, this software is cumulatively learning by analyzing each job announcements, the ontology and its application on a big database with many entities representing qualification statements is presented. The ontology was modeled with the open source software protégé, the database is created using a Microsoft Access databases.

The education system can be viewed as a production system. The student entered the system as an input, shaped by several teaching activities, at the end of study period student graduated as an output of



the system. The graduated student as an output of the education system should satisfy the demand of the customer. The customer in this case is the industry that is intended to employ the graduate. The educational institution as a supplier of graduate must be aware of the customer qualifications demand, therefore producing a qualified graduate according to these demands. This interaction between educational institutions and industries can be viewed as a chain of suppliers and customers<sup>1</sup>.

Engineering curriculum is mostly divided into three parts: compulsory courses, elective courses, and senior project. Each counted for 45%, 30% and 25% of the total European Credit Transfer and Accumulation System (ECTS) respectively<sup>2</sup>. The compulsory courses are at the initial stages of the engineering study should follow the push strategy. Latter at the senior level stage, the student must be aware of the industry-oriented qualifications demand. Hence, choose the courses that will qualify them for their intended job position, this follows the pull strategy. Further, senior project is a good opportunity for students to be more specialized in specific area of work and to enhance the communication and teamwork skills.

In any industry whenever there is a job vacancy or a need for specific skills, they translate these needs into a form of job announcement. Job announcement contains valuable information of the assigned responsibilities, and qualifications needed for specific job position. The main part of the job announcement is the qualifications demand; if the applicants satisfy these demands, they will have a high chance of getting the job. Job announcements can be considered as the voice of the industries, which reflect their current qualifications demand. Industries are continuously updating these data according to their real-time demands. The analysis of job announcements will provide valuable information about the current qualifications demand. Training/teaching individual based on the latest job market demand will help to better-fit individuals to the industry demand.

Semantic web technology can help in creating such intelligent system, hence reducing the gap between the job market and the educational institutions by preparing work-ready graduates. This system will be able to collect and analyse the job market qualifications demand in real-time, and proposing these demands in term of qualifications to the educational institutions for preparing the courses and curriculum. Humans understand the semantics of the published texts in the job announcements in term of qualifications needed, and responsibilities assigned for the stated job position. The Semantic Web is an extension of the existing WWW. It intends to bring structure to the meaningful content of Web pages. Ontologies represent the structure of the knowledge base in a defined model<sup>3</sup>. Entities of knowledge are stored based on the ontology structure in a so-called semantic web knowledge base. The ontology model is based on a vocabulary empirically developed out by analyzing around 1100 job announcements for job titled manufacturing engineer. The data have been collected from the period 01.02.2011 to 30.04.2011. The sources of these data were several job search engine like Monster ([www.monster.com](http://www.monster.com)), Jobsearch ([www.jobsearch.co.uk](http://www.jobsearch.co.uk)), and Bayt ([www.bayt.com](http://www.bayt.com)). A customized software application has been programmed for analyzing the job announcements and determining the job market qualifications demand. The qualifications and its defined vocabulary were formalized as ontology and enriched with a knowledge base, with various relations between qualification statements. ■

<sup>1</sup> Al-Turki, U.M., et al., Stakeholders integration in higher education: supply chain approach. *European Journal of Engineering Education*, 2008. 33(2): p. 211-219.

<sup>2</sup> GPE. Global Production Engineering - The master program of the TU-Berlin. 2012 [cited 2012 12.03]; Available from: [www.gpe.tu-berlin.de](http://www.gpe.tu-berlin.de).

<sup>3</sup> Staab, S. Wissensmanagement mit Ontologien und Metadaten. *Informatik Spektrum*, 2002.