

Chapter 94

Modeling Collaborative Design Competence with Ontologies

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INTRODUCTION

Collaborative design in dispersed groups of engineers creates various kinds of challenges to technology, organization and social environment. Selected examples are knowledge sharing, coordination support or secure tool integration (Jacucci, Pawlak, & Sandkuhl, 2005). Work presented in this chapter is located in the area of formation of teams for collaborative design. The challenge addressed is how to describe and represent the competences needed for a planned collaborative design project in a way that those individuals best suited for the collaboration can be identified. The proposed approach is to apply ontology engineering to modeling competences of individuals, including different competence areas

like cultural competences, professional competences or occupational competences.

The next section will present some related work in competence modeling and provide background for our work. The second section describes selected results from an empirical investigation in the field of information use, which confirms the importance of competence when selecting partners for collaboration activities. The fourth section will introduce the structure of competence models with focus on specific elements for collaborative design. The representation of competence models with ontologies and the results of modeling of a software design team are described in the next section. The two last sections present an outlook on future work and a summary of the results.

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BACKGROUND

This chapter is a condensed and enhanced version of the paper published in *International Journal of e-Collaboration* (Tarasov & Lundqvist, 2007). The presented approach is based on earlier work in the field of competence modeling, both of enterprise competences (Hench & Sandkuhl, 2002) and of individual competences (Tarasov, Sandkuhl, & Hench, 2006). Furthermore, earlier work has addressed formation of networks for collaborative engineering (Blomqvist, Levashova, Öhgren, Sandkuhl, & Smirnov, 2005), flexible supply chains (Sandkuhl, Smirnov, & Shilov) or business community creation (Kashevnik, Sandkuhl, Shilov, Smirnov, & Tarasov, 2008), but with a focus on identifying suitable enterprises for a given task description.

Analyzing and structuring competences has been addressed in many papers. Genevi, ve, Blaize Horner, & Izak (1997) examined competences of business managers and structured them into two groups: IT knowledge and IT experience. The former represents acquired knowledge and the latter reflects skills obtained through work. Another work (Giardino & Pearce, 1993) describes core competences needed for information development. They comprise general competences including design and analysis abilities, technical expertise in the IT area, and business skills like knowledge of the market. Structuring competences as well as indicators for analysis of individual and enterprise competences are also addressed in (Jussupova-Mariethoz & Probst, 2007). The identified individual competences are knowledge gained through education, skills mastered with experience, and behavioral characteristics. Competences are also grouped according to level and importance.

The identified competences can be analyzed to drive competence development and business improvement (Giardino & Pearce, 1993). If competences are formalized in the form of an ontology, it can be used as part of a competence retrieval system (Jussupova-Mariethoz & Probst,

2007). It allows for analysis, planning and control of business performance of an enterprise. Another example of using an ontology-based competence model is given in (Paquette, 2007). The author describes an ontology-driven e-learning system that supports evaluation of competencies by determining competency gaps. The evaluation result is used to plan activities to achieve learning goals.

Despite much work has been done in competence modeling, competences for collaborative design were not addressed explicitly and described in a detailed manner. The approach proposed in this chapter analyses and formalizes specifically skills and abilities required for collaborative design. Moreover, our approach proposes to use ontology matching to support team composition for a collaborative design task. This kind of tasks is important for companies producing complex products and needing to find competence unavailable at home. The existing work describes many solutions to automatic competence retrieval and competence analysis based on ontologies but design team creation is not considered to a needed extent.

IMPORTANCE OF COMPETENCE: FINDINGS FROM AN EMPIRICAL INVESTIGATION

During March–June 2005, an empirical investigation was carried out in Sweden aimed at studying how information is used in Swedish authorities and small- and medium sized enterprises. The investigation comprised 27 interviews with individuals from three different organizations, The Swedish Board of Agriculture, Kongsberg Automotive, and Proton Engineering, the last two being suppliers within the automotive industry. The individuals constituted a sample of all levels staff in the investigated organizations, i.e. from top-level management via middle management down to production- and administrative personnel. It was performed as a series of semi-structured

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