A User-Aware Multi-Agent System for Team Building

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INTRODUCTION

In this chapter we present a system for the management of team building and team update activities in the current human resource management scenario. The proposed system presents three important characteristics that appear particularly relevant in this scenario. Firstly, it exploits a suitable standard to uniformly represent and handle expert skills. Secondly, it is highly distributed and, therefore, is well suited for the typical organization of the current job market where consulting firms are intermediating most job positions. Finally, it considers not only experts' technical skills but also their social and organizational capabilities, as well as the affinity degree possibly shown by them when they worked together in the past.

BACKGROUND

In the last years job market and organization have undergone deep changes. In fact, centralized job organization, where a company directly recruits its experts and assigns them to its activities, has been substituted by a distributed organization, where a company outsources most of its activities to external consulting firms. These last are often very large and complex; moreover, they frequently share the same clients or, even, the same projects and, consequently, they are enforced to cooperate. In the current human resource management scenario, most of available experts are recruited by these firms that send them to their final clients to run specific project tasks. It often happens that experts belonging to different consulting firms work together in the same project of interest to a final client (Meister, 1997).

In this highly distributed and flexible scenario, team building activities play a crucial role (Becerra & Fernandez, 2006). Interestingly enough, these activities are often known as task allocation activities (Dash, Vytelingum, Rogers, David & Jennings, 2007; Manisterski, David, Kraus & Jennings, 2006; Rahwan, Ramchurn, Dang, Giovannucci & Jennings, 2007). However, in the context of human resource management, team building problem presents some specific features (West, 2003) that make it more difficult and delicate to be handled w.r.t. the more general task allocation problem. Specifically, there are at least three main challenges to face.

The first challenge regards the highly distributed context; in fact, if experts of different consulting firms are enrolled to work together, then centralized team building approaches do not appear adequate.

The second challenge concerns the need of a standard for representing expert skills and capabilities (Hefke & Stojanovic, 2004; Harzallah, Leclere & Trichet, 2002; Biesalski, 2003); in fact, if consulting firms and/or their final clients use different ways to represent the skills of available experts and/or the skills desired for a project, then the comparison of experts and the matching between expert skills and project requirements may become difficult and unclear (Colucci, Di Noia, Di Sciascio, Donini & Ragone, 2007; Hefke & Stojanovic, 2004); as a consequence, there is a high

risk that constructed teams are not adequate for the projects assigned to them and, consequently, that final clients will be unsatisfied.

The third challenge regards the type of expert skills that must be considered during a team construction. In fact, technical skills, even if extremely important, cannot be the only criterion for choosing team members (Coutts & Gruman, 2005; Mehandjiev & Odgers, 1999). Indeed, other skills, such as social and organizational ones, appear equally important (Drach-Zahavy & Somech, 2002). As a confirmation of this claim, it is currently well known that a team wholly composed by technically talented experts is often characterized by a negative form of competition because its members tend to assert themselves each other by nature (LaFasto & Larson, 2001).

MAIN THRUST OF THE CHAPTER

System Overview

This chapter proposes a multi-agent system that exploits the Europass Curriculum Vitae (hereafter, Europass CV) standard to perform team building and team update activities. Europass CV is one of the standards defined by Europass (Europass, 2007); Europass is an initiative of the European Commission for achieving transparency of competencies and qualifications of an individual. Europass CV includes categories for describing past work experiences as well as technical skills and educational attainments; moreover, it records various additional competencies held by an individual, especially his social and organizational skills. The sections and the entries of this standard have been defined in such a way as to guarantee a company or an educational agency to obtain effective and suitable data about a candidate.

For each pair of experts, our system registers also the affinity degree showed by them in the projects where they worked together in the past. A project is represented as a collection of tasks; each task is described by a profile indicating the technical, social and organizational skills it requires to an expert if he wants to be eligible to execute it.

Each time a new team must be built for handling a project, our system generates a set of potentially adequate teams. Candidate teams are built on the basis of project tasks' requirements, as well as on the basis of technical, social and organizational skills of available experts. Once candidate teams have been built, our system selects, among them, that showing the highest value of internal cohesiveness. Our system is also capable of supporting team update activity; the algorithm underlying this task performs those updates that tend to optimize team performance and cohesiveness.

System Architecture and Behaviour

The architecture of our system is shown in Figure 1. It refers to a scenario in which *p* projects, each consisting of a certain number of tasks, must be handled by *n* experts (possibly enrolled from different consulting firms). Each project is uniquely assigned to a *project leader* who is in charge of insuring the fulfillment of its goals.

As shown in Figure 1, our system requires the presence of two databases, namely:

- *The Expert Profile Database* (hereafter, *EPD*); it stores both expert profiles and a support data structure called *Affinity Matrix* (hereafter, *AM*). The profile of an expert registers his personal data, the set of technical skills acquired by him in the past, as well as the set of his social and organizational skills. It is structured and organized according to the directives of the Europass CV standard. *AM* is a $n \times n$ matrix; its generic element *AM[i,l]* consists of a pair $<NP_{il}, S_{il}>$, where: *(i)* NP_{il} represents the overall number of projects on which the experts Exp_i and Exp_l worked together in the past; *(ii)* S_{il} stores the weighted sum of the scores obtained by Exp_i and Exp_l in the past; in other words, $S_{il} = \sum_{k=1}^{NP_{il}} k \cdot sc_{il}^{k}$ where sc_{il}^{k} is a score, belonging to the real interval [0,1], denoting how much Exp_i and Exp_l positively interacted in the fulfillment of the k^{th} project. The presence of *k* in this formula allows our system to give more importance to the scores obtained by Exp_i and Exp_l for their recent collaborations w.r.t. the scores assigned to them for their earliest collaborations.
- *The Task Profile Database* (hereafter, *TPD*); it stores the profiles of the tasks associated with the projects into consideration. The profile of a task registers the set of technical, social and organizational skills necessary to perform it.