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Research Statement

In this document I present research I performed in the course of my PhD thesis (Schall 2009) covering areas from human interactions in service-oriented environments to link-based interaction mining techniques. A high level summary is presented followed by results and publications in these areas.

Recently, Web-based collaboration platforms have started to evolve into Web services-based architectures. In such platforms, collaborations include both humans and software services. The challenge of composing these new type of services — user-driven contributions as services and software services — is that interactions are highly dynamic and context-dependent. However, a fundamental issue is that existing collaboration platforms do not support humans in specifying their capabilities as services. User-defined services can be used as interfaces to interact with people. Furthermore, humans need different ways to denote their availability and desire to participate in collaborations. The problem is that current systems lack the notion of *human capabilities* in SOA. The challenge is to support the user in designing and providing services. Such services are called HPS and can be discovered like any software-based services. However, humans must be able to offer HPSs and mange their interactions in pervasive environments. Moreover, in open and dynamic collaboration environment, typically a very large number of people collaborate and interact by using different collaboration tools and platforms. It is important to determine *expertise* and *skill* level of users. Somebody seeking help or advice on how to solve a specific problem needs to be able to find the right expert.

However, the expertise and importance of users changes depending on performed tasks, interactions with other users, as users gain know-how by collaborating with other experts, and based on the information users receive from other people. An expert recommender algorithm must consider the expert's *interest* in a certain area. For example, a scientist may have done research in a certain field; however, the scientist might change his/her principle research domain over time and therefore no longer be the right expert to contact. Thus, the interest and activity level of a person in a specific field must be considered. We believe that ranking models should not only rely on profiles or skill information that need to be maintained and manually updated by users. It is unlikely that a single skill- or expertise-ontology is sufficient to capture the concepts and requirements of various collaboration domains. Tagging mechanisms can be used to classify information and to derive the context of interactions. Tags provide a) input to derive skills and user-interests; and b) the context of activities and interactions. The challenge is to devise a ranking model that is able to capture these dynamic, context-dependent properties.

Topics

- Activity and Interaction Modeling: Publications in the area of activity-centric collaboration and related interaction models appeared in *Human Interactions in Dynamic Environments through Mobile Web Services* (Schall et al. 2007) and *VieCAR - Enabling Self-adaptive Collaboration Services* (Schall et al. 2008). The concept of activities and actions using SOA has led to the definition of Human-Provided Services. Initial use cases of HPS were published in a book chapter *Context-aware Mobile Computing* (Schall, Dorn, and Dustdar 2007a). Furthermore, we gave a brief introduction of HPS and the relation to activity-centric collaboration in (Schall, Gombotz, and Dustdar 2006).

- Human-Provided Services: The most important paper discussing the HPS framework as well as HPS interaction models were published at

  1. International Conference on Web Services (*ICWS 2007*) (Schall, Gombotz, Dorn, and Dustdar 2007): focusing on the notion of activities and the mapping of such activities to interactions with HPS. In the paper we focused on mobile collaboration scenarios and context-aware discovery of HPSs. The work was performed based on results of *Web Services on Embedded Devices* (Schall, Aiello, and Dustdar 2006) and *Wireless Internet Applications* (Schall, Dorn, and Dustdar 2007b).
  2. IEEE Conference on Enterprise Computing, E-Commerce and E-Services (*EEE 2008*) (Schall, Truong, and Dustdar 2008a): we presented the HPS framework and a detailed description of HPS related XML collections.
  3. IEEE Internet Computing (special issue on Web-scale workflows) (Schall, Truong, and Dustdar 2008b): presenting the HPS framework as well as selected use cases showing how HPSs can be utilized in Web-scale collaborations.

  Furthermore, a novel approach to designing Human-Provided Services was presented in (Schall et al. 2008). Our approach focuses on a tagging model for activities and services to recommend resources in the design process. We presented a recommendation algorithm that is based on collaborative tagging of resources in SOA.

- Importance Ranking and Recommendations: We presented a ranking approach for activities, context and services at the Conference on Software Engineering and Advanced Applications (*SEAA 2008*) (Schall et al. 2008). Furthermore, the publication contained a description of VieCAR (*Vienna Collaborative Activity and Resource Management Framework*), which is an OSGi-based middleware; see (Schall et al. 2008, Section 2). In (Schall and Dustdar 2009), we introduced DSARank (Dynamic Skill- and Activity-aware PageRank) for estimating the relative importance of users based on the concept of eigenvector centrality in collaboration networks.

- Tagging and Message Annotation: An initial tagging model that associates task-information as annotations with, for example, email messages, was presented in *Pattern-based Collaboration in Ad-Hoc Teams Through Message Annotation* (Schall, Gombotz, and Dustdar 2007). The work provided the basic ideas for the interaction-based recommendation algorithms to support the design of HPSs.

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