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Technical Challenges in Mixed Service Systems

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Abstract - A coming together of the technological networks that connect computers on the internet and the social networks that link humans for millennia has been observed in the past few decades. Even as this has led to the changes in the styles of communication, the media has also remained governed by long standing principles of human social interaction. Web-based collaborations have become vital in today's business environments. They have paved the way for new type of collaborative system. As collaborative Web-based platforms develop into service oriented architectures (SOA), they promote mixed user enriched services. Due to the availability of various SOA frameworks, Web services emerged as the de facto technology to realize flexible compositions of services. Knowledge-intensive environments clearly demand for provisioning of human expertise along with sharing of computing resources or business data through software-based services. To address the challenges, an adaptive approach allowing humans to provide their expertise through services using SOA standards, such as Web Services Description Language (WSDL) and Simple Object Access Protocol (SOAP) is introduced. The seamless integration of humans in the SOA loop triggers numerous social implications, such as evolving expertise and drifting interests of human service providers.

Index Terms— Human Provided Services, Service Avatar, Service Oriented Architecture.

I. INTRODUCTION

Online collaborative systems allow people from various domains to interact and collaborate. These systems can be considered as communication channels as they provide communication tools and services that can be integrated on the web. Web-based collaborative systems and processes play a very important role in today's business environments. They help in building interactions between people and services across globally distributed companies. A collaborative atmosphere consists of humans and software based services which are bound together to create dynamic complex interactions. The interactions between people and services are role-based. This increases the complexity of composing the collaborative systems and the distribution of these systems requires adaptive context aware interaction models. To establish a context based interaction, a system or a process requires knowledge of context aware infrastructures.

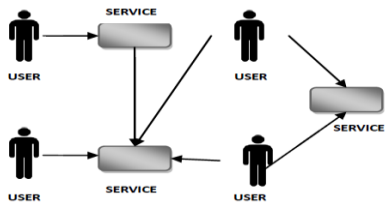

Figure 1. Users and Software Service Interaction

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The existing platforms do not allow users to specify interaction platforms and if a web based system has to evolve into service-oriented architecture, then it should be able to promote composite and user-enriched services. Open service-oriented environments require a flexible yet reusable collaboration model because compositions comprise interactions between people and a number of software services [1]. Figure 1 shows how software services and users interact.

A mixed service-oriented system composed of both human-provided and Software-Based Services was introduced to support such complex interaction scenarios. This paper aims at addressing the following technical challenges found in mixed systems. Figure 2 shows the depiction of the same.

1. *Service Avatar*. This concept is used to represent human capabilities as services on the Web.
2. *Personal Provisioning*. Personalized services can provide significant user benefits since they adapt their behavior to better support the user.
3. *Feedback-based Adaptation*. Feedback in all sciences is usually considered as a kind of a loop from an output of a certain action to its input.

A. *Mixed Service-Oriented Systems*

The system consists of Human-Provided Services (HPS) which allows people to publish their capabilities and skills as services. The users are able to define, create and deploy services for different collaborations. The collaborations can be ad-hoc and process-centric collaborations. *Ad hoc collaboration* follows a bottom-up approach where many aspects depend on the actual players (that is, humans) involved in the process. *Process-centric collaboration* defines process models and here the business analyst or process architect must fully understand the processes before modelling and enacting them.

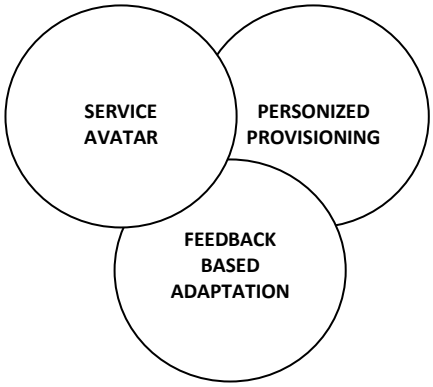

Figure 2. Challenges of a Mixed System

The HPS framework is used by the applications to integrate human capabilities into service-oriented infrastructures. By using the framework, people can manage their interactions and provide services in dynamic collaborations.

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This helps in promoting reusability and flexibility of interaction flows between the different collaborations. Web services and SOA are considered as the de-facto technology to implement compositions of humans and services. Drifting interests of people, evolving skills and varying collaborations incentives requires enhanced technical infrastructure in terms of flexibility and adaptability. This has led to the need to acquire approaches for the automated management of actor skills, reputation, and trust. Discovering the right actor in mixed service-oriented systems is challenging due to the temporary nature of collaborations [2]. The expertise and importance of user's keep changing 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.

The features supported by the HPS framework must be: [3]

1) *Ability to define services:* Services and their corresponding interfaces must be easy to define, or anyone must be able to simply use a reference or copy an existing interface and reuse or modify it. The profile information and service interface must be defined to support the usage of services.
2) *Specification of interactions*: The communication scenarios between users in a multi user system will be defined by the interaction protocols. Users must be able to specify their interaction protocols. These customized protocols allow interactions to be managed in a given context.
3) *User-centric service publishing/provisioning:* User-centric service allows users to stimulate the service composition process so that, services can be created to satisfy the requirements of the users, as compositions of available services. It allows end users to compose applications with the ability to easily publish and interact with services. Users can also deploy and register personal services.
4) *Discovery and interactions with users/processes*: Processes and humans must be able to discover HPS. HPS simplifies the interactions with user-provided services by abstracting from service location and deployment. Requesters discover humans and services and interact with the selected human and services through the HPS middleware.

II. SERVICE AVATAR

An avatar is the graphical representation of the user or character. In a SOA environment, an avatar represents a human's services as well as actively acts on behalf of the human it represents. An avatar is an interactive, social representation which can be of different dimension. It can be a photo or a drawing or can also be based on a real person's appearance. Avatars can be a mix of real and the imagined that represent an internet user which allow people to interact with a computer system and/or with other people. Without a social environment or one that mimics a social interaction, the avatar cannot exist; socialability is the air an avatar needs to breathe. An avatar helps a human to interact socially. It is usually controlled by the user. Pre- defined configuration policies and rules help in regulating the behavior of services. It plays an important role in unburdening the human from frequent but simple decisions by automatically categorizing or rejecting user requests.

In wider sense, an avatar helps a user to be an interactive character helping him to choose or change the services required by him. The control on an avatar depends on the degree of customization used while creating an avatar which helps the user to modify how an avatar can be used. A service avatar is a human in transition featuring an interactive self portrait to be used for social interaction

III. PERSONAL PROVISIONING

Personalized services can provide significant user benefits since they adjust their behavior to better support the user. To decide the characteristics and behavior of a user, a personalized service will require a variety of user related data. This data can be collected by making use of a provisioning system which provides an option to select a relevant service for the user. In an omnipresent environment, the data which helps in defining the service behavior may be unavailable due to two possible reasons. One is that the data does not exist. The other is that the data exists but cannot be accessed. Social aspects require personalized service provisioning by establishing peer-to-peer relations between clients and service providers on demand [4].

Personalized services can provide significant user benefits since they adapt their behavior to better support the user. These services use a variety of data related to the user to decide their behavior. Thus personalized service needs a provisioning system that can collect the data that impacts service behavior and allows selection of the most appropriate service [3].

Provisioning focuses on the deployment of Web services according to users' preferences. A Web service is an accessible application that other applications and humans can discover and trigger. Context is the information that characterizes the interactions between humans, applications, and the surrounding environment. Web services are subject to personalization if there is a need of accommodating users' preferences during service performance and outcome delivery.

IV. FEEDBACK BASED ADAPTATION

The concept of feedback is used in many fields of science: education, psychology, biology, economics, and information systems, each examining it from its own perspective. Kinds of feedback systems have been used in mechanical devices since their appearance. Feedback in all sciences is usually considered as a kind of a loop from an output of a certain action to its input. This view on feedback is based on the control system's feedback concept and helps to understand its nature in that context.

In computer systems, feedback could be considered either as a loop from the computer to the user or from the user to the computer. It is information about what happened as the result or effect of the user's action and is provided to a user to compare his or her performance with the expected one. One of the main feedback classifications that have its origins in studies of control systems is the categorization of feedback into negative and positive. The feedback is called positive if the resulting action goes in the same direction as the condition that triggers it.

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The positive feedback tends to increase output and speed up the process. It is used in certain situations where rapid change is desirable. The positive feedback is more responsive than the negative one. When the resulting action opposes the condition that triggers it, then the feedback is called negative. The negative feedback is considered as more stable, because the system becomes more immune to changes of the input [5].

The feedback can be presented in textual, graphical, animated, audio, or video form or in a combination of these ones. The most commonly used information presentation form for feedback is the textual one.

V. CONCLUSION

With the human user in the loop numerous concepts, including personalization, expertise involvement, drifting interests and social dynamics become of paramount importance. From a sole technical view, dealing with quality of service measurements only seems feasible; the situation in Mixed Systems fundamentally changes. When we integrate the human in the loop of service oriented applications, one has to deal with influences that shape the interaction behavior of people on the Web. In today's large-scale systems, a thorough technical grounding to support and automate discovery, interactions, rating, and ranking is required, since no one is able to keep track of the dynamics manually.

In the future, more fine-grained monitoring and adaptation strategies can be provided. Future research aims at modeling complex human behavior. By harnessing delegation patterns that involve various participants, a complex social network perspective can be established in which connections are not only maintained between one client and an avatar, but also among avatars. The study of network effects in mixed service-oriented systems can also be done.

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