Toward a User Preferences Agent Based Web Service Composition

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**Abstract**  
The basic idea of Service Oriented Architecture (SOA) is to compose an application as a set of services that are language and platform independent, communicate with each other. Therefore, the software’s nowadays are designed and built through composing web services to support enterprise applications integration. In this paper, an agent was introduced to compose web services based on user preferences to fulfill a certain process, where the user preferences are essential for determining which web service are to be selected. In other word, the agent designed to maintain the following function: an intelligent web services selection and planning based on user preferences(such as price or availability), along with web services execution, tracking and adaptation.

**Keywords:** software Agent, Web services, Service composition, User preferences.

1. **INTRODUCTION**

Service-Oriented Architecture (SOA) is an approach to construct distributed systems that bring application functionality as services to end-user applications [1]. The basic idea of SOA is to compose an application as a set of services to support enterprise applications integration[2] which they are language and platform independent, communicate with each other using standardized messages like XML. Web services is a technology that realize the SOA.

A web service is a software system identified by a URL, whose public interfaces and bindings are determined and described using XML. Its definition can be discovered by other software systems [1]. As individual web services are limited in their capability, which created the need for composing existing services to create new functionality in the form of composite service. However, the process of creating composite service is achieved by combining existing elementary or complex services, possibly offered by different providers with different feature with each web service. Thus, In carrying out this composition task, the process of selecting and composing the web services must be determined using user preferences along with monitoring the execution of the selected web service to monitor if any web service changed their behavior or become unavailable [3].

Some proposals are being made to enable dynamic composition of web services and execution monitoring frameworks [4]. Few of these proposals address user preferences to considered during the selection of web services[4].the user preferences must be addressed to satisfy client process requirements, such as price, availability, so it is necessary to represent user preferences in the selected and composed web services. Moreover,
Evaluation of composition process: when the composer selects a web service, it is quite common that many web services have the same functionalities. So it is possible that the composer generates more than one composite service fulfilling the requirements. In that case, the composed web services are evaluated by their overall utilities using the information provided from the non-functional attributes. It is imperative to design an agent to compose web services (selection and execution) based on user preferences. In this paper, we designed a user preferences agent to select to monitor the execution of web services in case of failure of web services among the selected once, or or changes in behavior of selected web services.

The rest of the paper organized as follows: a description of web service composition process is presented in section 2. Related work is described in section 3, the proposed user preferences agent based web service composition is presented in section 4, Finally, the conclusion is drawn in section 5.

2. WEB SERVICE COMPOSITION

Web service composition is the process of combining Web services in order to offer value-added services. Composite services in turn are defined as an aggregation of elementary and composite services as illustrated in Fig. (1). The Web services composition process should satisfy both functional, non-functional requirements and guarantee the correctness of the result. Web service composition is currently an active area of research, with many languages being proposed by academic and industrial research groups due to its complexity. However, the flexibility of composition comes at the penalty of increased system engineering complexity.

The process of composing web services includes many phases as described in [5,6], which refers to the service composition life-cycle. The phases include composition definition, scheduling, construction and execution. The idea behind phased service composition life cycle is to start with an abstract definition and gradually make it concrete to generate executable service processes from these abstract specifications as presented in [6]. Definition phase starts with specifying composite service, which specifies the involved Web services that constitutes the composite service and the constraints under which they operate. Scheduling phase of the approach, where the composer system specifies the order and when to execute involved services of composite service. During this phase the system may generate alternative composition schedules and present them to the application developer for selection. Based on abovementioned the proposed agent in this paper follow this process along with selection of web services based on user preferences and agent also monitor the executing of the selected Web services.

Fig. (1). Web service composition and Execution engine.
3. RELATED WORK

An agent web service composition was proposed in [7], which is a system for Web service composition with key user preferences. The system was designed composing web based on user preferences, providing the GologPref algorithm that integrates user preference-based reasoning into Golog [8], as they claim the effectiveness and the optimality of GologPref with respect to the user’s preferences.

In [9] an description of a way to augment OWL-S process models by user preferences in planning for Web Service Composition, which was achieved through mapping a given set of process models and user preferences into a planning language for representing hierarchical Task Networks (HTNs). their web service composition process is based on a best-first search over the possible HTN-style task decompositions, by heuristically scoring those decompositions based on ontological reasoning over the input preferences (user preferences).

An approach for web service composition using user preferences was introduced in [10], the suggested approach is based on combination of configuration and query rewriting to find services that implement the functionalities expressed in the user query, the configuration phase in their approach is used to capture dependencies between services, and to generate a set of composed Web services using a ranking algorithm to rank results according to user preferences.

A hybrid Fuzzy-guided Genetic Algorithm approach was introduced in [11] for QoS-based web service composition, through determining a set of candidate web services to be bound to abstract services contained in a composition to meet a set of fuzzy constraints (user preferences) and to optimize a fitness criterion on QoS attributes. In the GA optimization, the fitness function is a fuzzy system that is constructed based on user preferences.

In [12] a hybrid method was proposed using Colored Petri Net (CPN) that takes advantage of search meta-heuristics techniques to consider functional conditions expressed as input and output attributes, and transactional properties expressed as a tolerance level. the method was introduces they uses of Colored Petri Net as formalism to represent composite web service and perform a Best-First search, where transactional and QoS properties are both integrated in the selection process, where the selection of web services is based on QoS properties from candidate service sets formed in the TCSW-CPN.

An approach for composing web services based on multi-agent software with one master agent to control the execution of composite service in [13], but this approach do not an exception handling during the execution. Presented. Although, An extended control flow model for the workflow of Web service composition using BPEL [14], along with verification technique for concurrent properties, such as deadlock-free.

4. THE PROPOSED WSC AGNET

The proposed approach to compose web services in this paper rely on agent based system to automate the composition of web services based on user preferences to fulfill a certain process, where the user preferences are essential for determining which web service are selected. In other word, the agent designed to maintain the following function: an intelligent web services selection and planning based on user preferences (such as price or availability) as illustrated in figure 2.
4.1 User Process and Preferences

The web process is a collection of related, structured activities or tasks that serve a particular goal for a particular customer or customers. Although, the customer may wish to force certain preferences on the whole process or certain task such as price, execution time, reputation of the provider of web service.

4.2 Agent based Web Service Composition

The WSC agent proposed in this paper is the mediator between user and public registries and web service providers. WSC agent contain a module called Web service discovery and selection as illustrated in figure 2. The WSC agent is responsible for the discovery of the candidate web service from Universal Description Discovery and Integration (UDDI) domain registries and returns their Web Service Description Language (WSDL) and URL and also to be stored in agent. the agent Web service discovery and selection module also is provided with an intelligent selection and matching technique to select web services based on user preferences, whether the user preference are on each individual web service or the whole composition process. The WSC agent creates number of composition plans and only one plan will be selected for execution according to user preferences. The chosen composition plan also stored in the agent repository module for later use. WSC agent also contain a module called Web service execution and monitoring, which is used to controls the execution of the composition plan and monitors the execution of web services and dynamically adapts to any change (e.g. service unavailable). The WSC agent takes the WSDL of selected Web services and generates executable BPEL code. The WSCE agent orchestrates the selected Web services to execute composite service. At run time, the WSC agent monitors the execution of composed web services. If everything goes well, after successful complete executions, the WSCE agent reports the actual recorded preferences of selected web service to agent repository of this composition for later use. Although, due to the dynamicity of internet and some of web service may fail to deliver result or become unavailable, if the one of the composed web services failed to provide service, the agent look-up for new candidate web service based on the same user preferences or at least closed to.

5. CONCLUSION

In this paper, an agent was introduced to automate the process of composing web services based on user preferences to fulfill a certain process, where the user preferences are essential for determining which web service
are selected. In other word, the agent designed to maintain the following function: an intelligent web services selection and planning based on user preferences (such as price or availability), along with web services execution and tracking and adaptation. As future work, we intend design semantic web service composition agent along with experimental results.

6. ACKNOWLEDGMENT
I would like to thank everyone who contributed to the completion of this work.

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