QoS Aware Semantic Web Service Composition Approach Considering Pre/Postconditions

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Web services present a topical research area with lot of attention. One part of this research aims to propose solutions to automatic composition of several web services into workflows bringing a utility which cannot be provided by single service. The desired goal of such composition is described in the user query. The automatic web service composition showed to be a challenging task [5]. The research of service composition in last years tends to focus on issues related to QoS [1, 3, 4], pre-/post-conditions [2, 6], user preferences (e.g. soft constraints), service selection considering complex dependencies between services [7]. Our work deals with the effectiveness and scalability of service composition aware of QoS, and pre-/post-conditions.

Our approach is based on a lot of preprocessing done before we are responding to user queries. During it we create data structures which are used to quickly answer the query. The most important is that we evaluate which services can be chained, i.e. which services produce data and have a post-condition required by the other services. This can be done without knowledge of any query which will be processed. The next important issue is that we precalculate different characteristics of the post-conditions to make fast evaluation whether the service produces condition satisfying the goal condition. The problem still remaining is to i) select the services producing the required outputs, and state (services appearing as final in the workflow), and ii) evaluate which services can be used, since they have provided inputs and how they interconnect (design of the data-/control-flow). The latter is significantly affected also by the selection of the service combination with the best aggregated QoS.

To find the services directly producing the required goal (final services of the workflow) a two step process is performed. First, we find services producing the required outputs. This is done in constant time. Second, we filter these services based on post-conditions. Here we use the precalculated characteristics of web services' post-

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conditions. We compare them with the characteristics of the condition defined in the user query. The precalculated characteristics are stored in data structures supporting fast evaluation if the post-condition of some service implies the condition defined in the user query.

The design of the data-/control-flow is based on two processes. The first selects services which can be used because they have provided inputs. The second selects services which cannot be used because they do not have provided all inputs. The second process is not necessary to find a composition. It is used only to faster the *select usable services* process, which is necessary. The improvement in terms of lower composition time caused by application of *select unusable services* is in more than one order of magnitude. Our experiments showed that the combination of these processes saves a lot of computation time when looking for a suitable composite service.

After we have found the services directly producing the required goal and designed the data-/control-flow of the composite service, we get a prescription based on which we execute services to produce the user defined goal. The data structures used during the service composition are designed to be easily updateable in the case that new service becomes available or some service is removed. This is important to support fast reaction to the dynamic changes of the web services environment.

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