

# Report from the Composition Group

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**Abstract.** This report summarizes the activities of the working group in charge of discussing issues related to Service Composition. The group worked for two consecutive afternoons.

## 1 Introduction

The Composition Group had the task of discussing the various aspects related to the composition of services. Composition is one the important aspects in service oriented computing: the general idea is that in building a new service, one can rely upon existing services which provide part of the needed operations. Several issues are related to this topic, from the research on automating the composition process, to the techniques for managing a composition, to the relationship with software (and service) reuse. These and other topics were touched in the two afternoon sessions of the group, with the goal of identifying the open research issues related to composition.

### 1.1 Participants

The participants in the activities of the Composition Group were (in alphabetical order): Boualem Benatallah, Vincenzo D'Andrea, Flavio De Paoli, Andreas Hess, Jens Hündling, Bernd Krämer, Peter Massuthe, Heinz W Schmidt, Bernhard Steffen, Mike Papazoglou, Charles Petrie. Most of them attended both session of the group activities.

### 1.2 Objectives

The objective of the task carried out by this group was to identify the main issues related to services composition, identify the dimensions that could be used to characterize the components of a composition solution and use these dimensions to study existing approaches, identify gaps in current state of the art and outline future research directions in this area.

### **1.3 Methodology**

The discussion in the group were first directed toward the definitions of relevant concepts, to establish a common understanding and vocabulary between participants. Then the group focused on the identification of the relevant dimensions that can be used in describing service composition. Each afternoon session was roughly divided into a first part of brainstorming followed by a recap of the issues discussed. A smaller group then prepared the material summarizing the results of the group work.

## **2 Topics discussed**

In the first session, the group discussed the problem of services composition, identified few dimensions that can be used to characterize composition solutions, and discussed few research issues. Main dimensions that were identified are: dynamic vs static composition, composition models and languages, composability levels (composition based only functional interfaces, composition based on additional descriptions such QoS and business protocols), purpose (user-driven composition, process-centric composition, meta-composition such as composition of management services, architectural styles and patterns), domain-specific vs generic composition techniques (e.g., reference models, generic composition languages). Some of the research issues that were discussed include QoS-aware composition, techniques that could be used in composition process such as compatibility and replace-ability techniques, and levels of automation of the composition process.

In the second session, the group continued the discussion on the dimensions that characterize service composition. The main addition was the description of the "composition purpose" dimension, specifying the range of domain-specific versus generic composition. To this end, composition as part of business process development was contrasted to end-user composition, that is created directly by the service user. A relevant example of end-user composition is data aggregation. The need to generalise compositional patterns and architectural styles, prompted the group to identify the need for meta-composition, that is composition of management services.

A relevant part of the second session was devoted to a presentation of the current state of the art in Semantic Web Services. This approach certainly addresses some relevant issues, but still leaves open problems. The most promising ideas assume the existence of annotated services, but creating the annotation is quite expensive and there is a relevant issue in annotating the currently existing services. In addition, the mapping between ontologies and services is not clearly defined apart from very narrow domains. Nevertheless, the composition group found interesting ideas in this approach and encourages the proper scientific communities to interact closely.

## **3 Conclusions and recommendations**

The last task of the composition group was to identify relevant research issues related to service composition. The first task, explored by a large number of researchers in

the field, is the automation of the composition process. While a fully automated service composition seems currently out of reach, semi-automated models could be explored.

A second topic is to define models and tools for QoS-aware composition. QoS (Quality of Service) is a shorthand for the non functional aspects of a service, such as privacy, security, exceptions handling, performance, and so on. The current approaches to service composition focus on the service operations, while there is little attention toward the possibility of composing services with, for instance, different security models.

Compositionality of services was also identified as a relevant topic. This concept is related to the notion that the whole, that is the composer of services, has a meaning which is function of the meanings of the individual parts. This view is different from considering the issue of service compatibility in a composition. Services can be made compatible by means of adapters and integrators, while compositionality issues requires to deal with semantical definition of services. From a general point of view, the group pointed out the need to progress on the definition of formal tools for composition, e.g. defining analysis operators for replaceability, compatibility, conformance, and so on.

Part of the discussion was devoted to adapters, described as special forms of service mediators. These special kind of service composers, having only one service as part of the composition, are needed to make services compatible. Their role is especially relevant when a service oriented approach is used in an organization characterised by the presence of legacy systems.

Finally, the composition group identified a relevant research area in diagnosis and monitoring of service composition, providing explanation-driven management tools.