

A Review of Dynamic Web Service Composition Techniques

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Abstract. The requester's service request sometimes includes multiple related functionalities to be satisfied by the Web service. In many cases the Web service has a limited functionality which is not sufficient to meet the requester's complex functional needs. The discovery mechanism for such complex service request involving multiple tasks (operations) may fail due to unavailability of suitable Web services advertised in the registry. In such a scenario, a need arises to compose the available atomic or composite Web services to satisfy the requester's complex request. Dynamic Web service composition generates and executes the composition plan based on the requester's runtime functional and nonfunctional requirements. This paper provides the review of Web service composition architectures and techniques used to generate new (value added) services.

Keywords: Web Services, Service Registry, Dynamic Composition, Architecture.

1 Introduction

A Web service is defined as an interface which implements the business logic through a set of operations that are accessible through standard Internet protocols. The conceptual Web services architecture [1] is defined based upon the interactions between *three* roles: *service provider*, *service registry* and *service requester*. The requester search for suitable Web services in the registry which satisfy his functional and nonfunctional requirements. The requester's service request sometimes includes multiple related functionalities to be satisfied by the Web service. In many cases the Web service has a limited functionality which is not sufficient to meet the requester's complex functional needs. The UDDI based Web service architecture does not realize complex Web service combinations, hence it provides limited support for service composition. There is a need to identify and compose the available Web services if the complex service request can not be satisfied by a single Web service. To achieve complex business goals in

real world applications, the execution of multiple Web services should be orchestrated through service composition. The Web service composition can be defined as the creation of new Web service by combining the available services (service operations) that realizes the complex service request. The service composition strategies are broadly classified as *Static* and *Dynamic* composition based on the time when the Web services are composed [2]. Static composition takes place during design time when the architecture and the design of the system is planned. Dynamic composition takes place at run time when the requested service is not provided by the single provider. The effective dynamic Web service composition is a major challenge towards the success of Web services. The following *seven* different issues have a large impact on dynamic Web service composition. They are: Describing Web services and complex service request for effective composition, Generation of composition plan for the complex service request, Modeling (specification) of composition plan (orchestration models), Selection of Web services for the composition, Coordination and Conversation modeling, Execution of composition and Transaction management.

In this paper, the authors provides detailed review of dynamic composition architectures and techniques. Section 2 describes Web service composition architectures and strategies. In section 3 describes various dynamic Web Service Composition plan generation Methods. Section 4 compares the different methods used for dynamic Composition Based on Web Service Signatures. Section 5 draws conclusions and future challenges in dynamic Web service composition.

2 Web Service Composition Strategies and Architectures

Service composition facilitates application reuse where new Web services are created using available Web services which are heterogeneous in nature and spread across organizations. The service composition strategies are classified as *Static Composition*, *Semi-dynamic Composition* and *Dynamic Composition* based on the time of composition plan creation and service binding times [3]. Static composition is also called as design time composition where the application designer manually discovers, binds and assembles the Web services during composite Web services application development. Dynamic Web service composition is a complex and very challenging task in Web services as the composition plan is generated at runtime based on the requester’s complex service request [4]. In literature, various architectures have been proposed to facilitate dynamic Web service composition. They are: *Peer-to-Peer (P2P) architectures*, *Agent architectures* and *Hybrid (Multi-role) architectures*.

2.1 P2P Architecture

The Web service composition methods defined on P2P overlay networks [5] works as follows: when a peer wants to share a service, it registers the service to the registration system. Towards service composition, it looks up and gets its successor service from the registration system and then the successor service in turn finds its successor service. This will be repeated until the composition is