Adaptive Service Agreement and Process Management

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Abstract

The ASAPM project aims at developing new techniques, mechanisms and software solutions for enablement of flexible, dynamic and robust management of service-oriented application provision processes to ensure collective functionality, end-to-end QoS and stateful coordination of complex services.

1. Introduction

We are currently experiencing a major paradigm shift in the way that business applications are designed, architected, delivered and consumed for the better support of interoperability and dynamicity in meeting the changing business needs. Service-Oriented Computing (SOC) is the new emerging paradigm for distributed computing and e-business processing. The visionary promise of SOC is a world of cooperating services where application components are assembled with little effort into a network of services that are loosely coupled to create dynamic business processes and agile applications spanning organisations and computing platforms. However, before this paradigm becomes reality, there are a number of challenging issues that need to be addressed including among others: service modelling and design methodologies; service architectures; service development, deployment and evolution; service composition and management; and their supporting technologies and infrastructure.

Agent technology offers abilities of autonomous operations, learning, adaptation, interactions, cooperation, and mobility that can be used in automating routine tasks and business processes, adaptive decision and collaboration support, and coordinated service and resource sharing within and across organisations. Therefore together with other technologies such as Web/Grid services, semantic web, process technologies, and component software, agent technology is well positioned to address some key problems in SOC and can contribute to wide adoption of the service-oriented computing paradigm.

This project targets three different application areas of telecommunication, smart information environments and multimedia services jointly with the Australian government and industry partners. The ultimate goal of the project is to develop a generalized service management platform that provides a set of management services to any service-oriented applications.

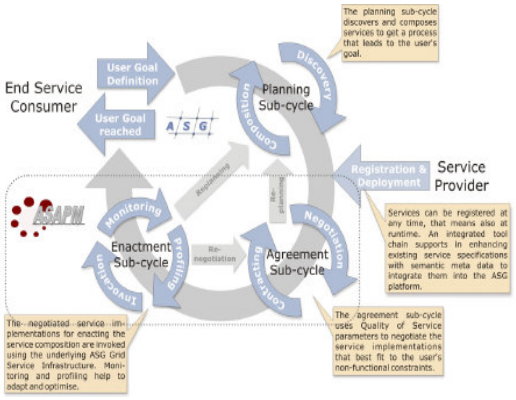

Fig. 1 Service management life circles in ASAPM

2. ASAPM Architecture

The ASAPM project focuses on developing new agent-based techniques and software prototypes for the adaptive service agreement and process management to ensure collective functionality and end-to-end QoS of complex services. The adaptive service agreement management includes:

- Automated service level agreement (SLA) negotiation
- SLA lifecycle management
- SLA monitoring and service profiling
- Dynamic SLA re-negotiation

The adaptive service process management includes:

- Service composition planning and enactment
- QoS process monitoring and exception handling
- Mediation composition for re-planning

Figure 2 depicts the overall internal architecture of ASAPM and shows the required components and their relationships to fulfill the adaptive aspects. The ASAPM

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system consists of four components that cover service negotiation, SLA and DSP management, workflow management and the mediation for service process adaptation.

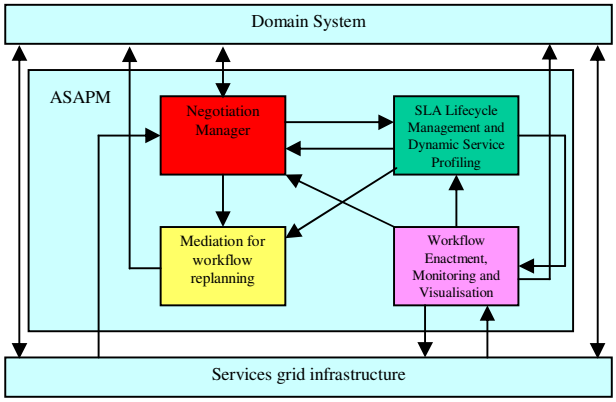

Fig.2. Overall ASAPM architecture

The Domain System is responsible for service composition according to end user's requirements. The Negotiation Manager coordinates and negotiates service attributes with potential service providers to ensure overall QoS and service performances, and re-negotiates with providers in order to adapt to changes, SLA violations and service failures. ASAPM provides the service level agreement (SLA) and dynamic service profiling (DSP) management component that automatically manages SLA documents and profiles historical data that can be used for negotiation and monitoring. The workflow manager is the component that manages the workflow execution. It includes the tasks of service enactment and also provides a user interface for workflow visualization at building and execution time. The component Mediation for Re-planning is responsible for collecting and analyzing information and data of the workflow, aiming at providing alternative service compositions satisfying the user request when a suspended service occurs.

3. ASAPM Implementation

The ASAPM System has been developing at our research center. Based the JADE multi-agent platform [2], It can be viewed as a multi-agent system in which agents are organized to perform the specified management tasks. In addition to this, we have developed a WS2JADE framework [5] for integrating Web services and the JADE agent platform. We have also extended WS2JADE (WSDM2JADE) so that we can use JADE agents to access the management functionality provided by service providers using the WSDM specifications [3]. This feature is being used to implement the monitoring of web services using JADE agents. The implementation is based upon the Apache MUSE project [4]. Our current implementation supports both 'push' and 'pull' methods for receiving notification on QoS violation or service failure.

Most negotiation systems are implemented as pure Multi-agent systems. However, to address the issue of interoperability among multiple systems, we believe that it is essential that negotiation can be provided as web service functionality. Service providers should have the flexibility to expose their negotiation capabilities either as web services or as an agent-based system. Our prototype can handle either situation by using the WS2JADE framework which allows JADE agents to invoke web services through the use of proxy agents.

We have applied our ASAPM system to three different application domains (telecommunications, smart information environments and multimedia). Currently the ASAPM system has been extending to demonstrate its applicability to any application domain.

4. Summary

We have briefly reported on the "proof of concept" ASAPM project and its development progress. The initial prototype of the project has shown its success in the specified applications. Further work will be focused on the generalization of project implementation that will provide management services to any service-oriented application domains.

Acknowledgment

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