Diploma/Master Thesis
(Diplom/Masterarbeit)

A Pluggable Process Enrichment Framework for Automatic Runtime Adaptation

German Title: Ein erweiterbares Rahmenwerk zur Anreicherung von Prozessen und deren automatischer Anpassung zur Laufzeit
Beginning: immediately

Background

Workflow Management Systems (WfMS) provide the necessary software artifacts to model, execute, and monitor workflows [6]. Due to the low complexity exposed for the development and execution of workflows, these are used in multiple domains, such as e-Science and Collective Adaptive Systems, towards modeling, provisioning, and executing sets of complex tasks which require the usage of distributed resources [1,2]. Such tasks often require the fulfillment of preliminary flexible and adaptable functionalities towards satisfying functional and non-functional aspects of the process, which can be described by enriching the process model. Their corresponding functionalities and behavior might not be known during design time, and are therefore discovered during runtime, e.g. enabling a conditional execution of activities based on external context information or performing preliminary configuration tasks.

The WS-BPEL standard defines a well-known and established workflow modeling language in both research and industry. It enables the specification of interactions within business processes with Web services, by means of defining their orchestration [2], [3]. The WS-BPEL provides the necessary mechanisms for extending the language constructs at different levels, e.g. set of activities or their corresponding set of attributes, providing the possibility to specify and realize custom functionalities and behaviors, respectively. The Apache Orchestration Director Engine (ODE) enables the execution of business processes specified in WS-BPEL [4], and supports the language extensibility mechanisms specified in the WS-BPEL standard through a pluggable framework. However, these extensibility mechanism only support the definition of custom activities (extensionActivity) and data assignment operations (extensionAssignOperation), and therefore cover only two possible extensibility points.

In this thesis we aim to provide the means to support custom process adaptability capabilities for all modeling constructs by enriching the different constructs with custom properties and configuration data, and by providing the support for plugging in its behavior’s realization at the workflow engine.

Tasks

- Based on literature research on different domains, extract the main requirements and derive the generic concepts for the approach
- Analyze and classify the enrichment possibilities/requirements/constraints at the different levels of the WS-BPEL language
Architecture, specification, and design of a pluggable process enrichment framework based on an extended version of Apache ODE (provided).

Prototypical implementation of the approach

Validation and Evaluation of the implemented approach based on a set of case studies from the previously identified domains.

Required previous knowledge and experiences

- Java programming skills and expertise
- Workflows [7]
- Apache ODE [5]
- ...or the declared intention to deeply dive into these topics in advance

The lectures of Service and Service Composition, Business Process Management, and the literature attached, such as [1], [2], [3], and [4] are recommended for preparation. The student has to manage his schedule including this work packages and milestones for himself.

The preferred language of the work is English.

Literature


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