Chapter 9
Workflow Management Systems in Distributed Environments

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ABSTRACT

With the advent of Service Oriented Architectures, more applications are built in a distributed manner based on loose coupled services. In this context, Workflow Management Systems play an important role as they are the means to both define the processes that realize the application goals as well as implement the orchestration of the different services. The purpose of the chapter is to give an overview of various solutions regarding workflow semantics and languages, as well as their enactment within the scope of distributed systems. To this end, major focus is given to solutions that are aimed at Grid environments. Scheduling algorithms and advance reservation techniques are also discussed as these are among the hottest research topics in Workflow Management Systems.

INTRODUCTION

The recent technological advances in the field of computing and networking have led to the rapid growth of the internet. People around the world started using it as a tool for not only information exchange, but also as a way to perform various tasks, from online shopping to working remotely. Enterprises were forced to keep up with the internet

boom in order to increase profits both by cutting costs and fulfilling the drastically increasing demands of the customers. Organizational efficiency and responsiveness are critical factors in determining the profitability of an organization, especially in the today's global business environment, where resources and people tend to be geographically dispersed. The same can be said for the eScience community, where profit takes on a different form. For these reasons a process oriented view is used to formalize the business processes that take place

within an organization, be it in the business or the science domain. A Business process is defined as (Coalition, Terminology, & Glossary, 1999) "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer". In essence a business process or workflow defines who needs to do what and in what order in order to achieve a specific goal. With the emergence of distributed environments such as grid and cloud infrastructures, which provide many benefits such as reliability, cost-effectiveness and scalability, workflow management systems have received great attention. Workflow management constitutes to the formalization of a business process and its automatic enactment. This provides many advantages since components that are responsible for executing a specific task can be autonomously developed without the need to incorporate any business logic within them. This task is left to the workflow management system. This also means that components can be reused in different workflows, while workflow can be easily changed in order to provide new functionalities. In this chapter we aim to define the core characteristics of workflow management systems and review some of the solutions proposed within the context of distributed environments.

BACKGROUND

The term 'workflow' is used with various meanings depending on the domain in which the term is used. The Workflow Management Coalition's definition is based on document oriented business processes:

Workflow is the automation of a business process, in whole or part, during which documents, information or tasks are passed from one participant to another for action, according to a set of procedural rules (Coalition, et al., 1999).

In the Grid community, the term workflow is typically used in the context of electronic services that may, or may not, be distributed. For example

Workflow is a pattern of business process interaction, not necessarily corresponding to a fixed set of business processes. All such interactions may be between services residing within a single data centre or across a range of different platforms and implementations anywhere (Treadwell, 2005).

In the eScience community, workflow is often used to refer to the use of workflow techniques to support the scientific process, i.e. for performing the activities that take place as part of scientific endeavour in a structured, repeatable and verifiable way. For example, in bioinformatics the scientific process can involve the use of 'in silico experiments', where local and remote resources to test a hypothesis, derive a summary or search for patterns (R. Stevens et al., 2003).

In the Business Process Management and Web Services domain, the term 'workflow' tends to mean programming and automation of processes that involve software exposed as services. This is applied in a variety of areas, e.g. enterprise application integration, supply chains, and business process automation.

WORKFLOW MANAGEMENT SYSTEMS

Overview

Traditionally, information systems have been implemented without the explicit consideration of a business process. Discreet components within a system need to be operated manually and their results propagated to the next component within the process chain. This has also led to the incorporation of process logic within application

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