

Chapter XIII

Metering and Accounting for Service–Oriented Computing

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ABSTRACT

Distributed systems of today have evolved from tightly coupled architectures such as CORBA and DCOM to loosely coupled service-oriented architectures such as Web services. The success of such architectures depends upon availability of supporting functions such as security, systems management, service level agreements, and development environments with associated tooling. An important management component of such an infrastructure is the metering and accounting for service usage, which is essential for successful deployments in commercial environments. This chapter explores the problem space and presents an architecture that addresses this need. We start by defining taxonomy of services from the perspective of usage metering, charging, and business models. We discuss how service usage can be measured, aggregated, and communicated in a uniform way. Finally, we report on a prototype design and implementation.

INTRODUCTION

Services that can be programmatically accessed over the network have become the dominant

component technology for distributed applications. They use standardized interfaces, through which their clients can remotely access their functionality or resources. Research around soft-

ware services has resulted into a service oriented computing (SOC) paradigm that proposes to utilize self-describing, platform-agnostic computational elements as fundamental components for developing distributed systems (Papazoglou & Georgakopoulos, 2003).

Web services (see <http://www.w3.org/TR/ws-arch/>) and *grid services* (Foster, Kesselman, Nick, & Tuecke, 2002) communities have defined the core of service-oriented computing. Web services is a particular realization of service-oriented architecture (SOA) with three key elements (Vogels, 2003) that include a well defined interface using WSDL (see <http://www.w3.org/TR/wsdl20-primer/>), a standardized messaging protocol such as SOAP (see <http://www.w3.org/TR/soap12-part0/>), and a service address that a requester can use to access the service. A grid service is a Web service that conforms to a set of conventions for such purposes as service lifetime management, inspection and notification of service state changes, and also handling of faults. Grid services address the need for management of distributed and long lived state that is required in distributed applications. To unify server based state management concepts in grid services with Web services concepts, the open grid services infrastructure specification (Tuecke et al., 2003) recently underwent refactoring and evolution. The resulting specification—WS-resource framework (WSRF, 2006) establishes a distinction between the concept of a “service” and the stateful entities acted upon by the service.

As more and more services are being deployed for commercial purposes, metering and accounting of *service usage* becomes an essential component of the services infrastructure. Even in non-commercial settings or for flat-rate services, metering and accounting are needed for enforcing policies such as usage quotas, and for purposes such as provisioning or analyzing usage

patterns. In commercial environments, service providers need to charge their users based upon some measure of their usage. Lack of support for such complementary and service provider-specific components has been a key inhibitor to the success of Web services (Langdon, 2003). Compared to metering of usage of resources such as CPU, disk space, bandwidth etc., the metering, accounting, and pricing considerations can be quite different in the services world for various reasons. First, the *software* function of a service often is as important as the resources that it encapsulates, and may even dominate the pricing. Secondly, complex services may be created by *composing* simpler ones—this composition must be reflected in their accounting and pricing. Also, unlike traditional scenario where a user’s job directly consumes physical resources, we can now have remote users sending requests to services, indirectly consuming the service provider’s resources. This limits the user’s ability to observe server-side resource usage, making such metrics less acceptable for charging purposes. It is apparent that enabling service provider support for management components such as metering and accounting is non-trivial.

This chapter presents an architecture that deals with various aspects of metering and accounting in a service-oriented architecture. We anchor our discussion by defining some background concepts and terminology in the “Basic Concepts and Terminology” section. The “Metering and Accounting for Services” section presents in detail the proposed metering and accounting architecture. The “System Design and Implementation” section describes our prototype implementation and the “Discussion” section informally evaluates the proposed architecture. We discuss some prior art in this area in “Related Work” section and finally, we conclude the chapter and present our thoughts on future work.

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