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Smart SOA Platforms in Cloud Computing Architectures

Ernesto Exposito

Codé Diop

iSTE

WILEY

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Dedicado a mis padres, Francisca y Ernesto Expósito

Ma nguikoymaysama ay wadjour Mame Awa Syak Serigne Diop

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Preface

The complexity involved in the development of the initial distributed applications was considerable in the context of the original Transmission Control Protocol/Internet Protocol (TCP/IP) network model. This complexity has been increasing rapidly with the evolution and diversity of transport and network services. For this reason, developers working directly over the transport layer application programming interface (API) need a high level of expertise on all the services offered by the large set of transport protocols as well as on how these various services can be combined with the underlying services offered at the IP network level.

For instance, a developer of a web application intended to operate on a mobile terminal should include, within the application logic, the selection of an adequate transport protocol to be used under different network context situations. In other words, the developer should consider not only the static situations where the web application can operate connected via WiFi or cellular networks, but should also implement the adequate logic to cope with the handover when moving from one network to another, or even when the terminal gets disconnected.

Today, developers of distributed applications want to concentrate on the application logic in order to be more productive and to reduce development delays and implementation bugs. To achieve this, they need to make an abstraction of all the details of the communication system. This means that they do not need to cope with the direct selection and configuration of the transport and network services or how to deal with the details on the transmission of data between the distributed components of the application.

Audience

This book can be used by network experts, but it is actually intended for another kind of audience: i.e. anybody interested in learning about the solutions that make it possible to make an abstraction of the transport and network layer services when developing distributed systems. We will consider this audience to be interested in information technology (IT) solutions applied to distributed applications at intra-enterprise and inter-enterprise levels.

In particular, this book will introduce various evolutions of the middleware communication layer that has been designed as an adaptation layer intended to hide the complexity of the distribution of applications components. We will introduce the evolution of the middleware layer and, in particular, we will concentrate on the main paradigm that has deeply impacted the design of this kind of system, the service-oriented architecture (SOA) paradigm. Even if this is not a new or revolutionary concept, after several years working in this area we have realized that the complexity involved in the SOA paradigm is so high that it is usually badly understood. SOA is often reduced to the basic concept of Web services (WS), losing the huge advantages of the paradigm that are urgently required to build agile and flexible distributed systems. This is particularly important in the area of cloud computing architectures, where delivering infrastructures, platforms or software following a service orientation is a fundamental principle.

Approach

Our goal is to demonstrate, based on a practical use case, how cloud computing IT platforms and SOA concepts can be efficiently applied when developing current and next generation enterprise applications. In order to avoid a sequential theoretical presentation of definitions and concepts, we have decided to propose a well-probed practical approach named project-based learning. This approach is based on the rationalization of concepts and the acquisition of competences based on the analysis, design and construction of a real-world project.

We have selected a case study inspired by the very well-known eBay online marketplace. This consumer-to-consumer distributed system use case will allow us to introduce all the components necessary for building a smart SOA platform. An initial implementation of this platform will be achieved on the basis of the fundamental pillar of the SOA: the enterprise service bus

(ESB), which is aimed at guaranteeing integrability, interoperability and extensibility non-functional requirements. We will consider this initial phase as the development of the fundamental SOA concepts that will be integrated in a first release of the proposed platform solution named Smart SOA Platform as a Service 1.0 (SSOAPaaS 1.0). Based on additional non-functional requirements, mainly related to a better decoupling or reduction of direct dependency between the distributed components as well as the needs for proactivity properties, a new version of the platform will be developed under the name of SSOAPaaS 2.0. The SSOAPaaS 2.0 enriches the previous platform by including a second fundamental pillar commonly called event-based systems for event-driven architectures (EDA). In a final development, additional non-functional requirements, in terms of manageability and scalability aspects, will be considered within the SSOAPaaS 3.0 solution. The extension of the SSOAPaaS 3.0 solution with self-management properties will make the proposed platform smart to achieve the goal of this book: designing and developing a smart platform for SOA-based systems.

A specialized IT infrastructure needs to be provided to easily install and deploy the required components for the different versions of SSOAPaaS. A solution based on virtual and cloud technologies facilitating the design and implementation of an efficient, portable and extensible infrastructure will be developed. This platform, named Smart PaaS (SPaaS), provides the required infrastructure management functionalities in order to support the three releases of the Smart SOA Platforms.

Book structure

This book is organized into six chapters, an Introduction, and Conclusion and Perspectives:

In the Introduction, we provide a global introduction including the main goals of this book and the applied project-based learning methodology.

Chapter 1 presents the case study that introduces the main requirements guiding the proposed three generations of SOA platforms.

Chapter 2 is intended to introduce the basic concepts of SOA, EDA, cloud computing and autonomic computing. It will present the basic concepts of communication middleware, the solutions for enterprise application integration and SOA, and will introduce the WS and ESB technologies. The description of an important evolution in the world of enterprise integration represented by the message-oriented and EDA paradigms will then follow. Likewise, the basic concepts illustrating how these paradigms can enhance integration solutions by providing decoupling and proactivity functionalities between distributed components will be discussed. Moreover, an introduction to virtualization and cloud computing architectures will be presented to show how non-functional requirements such as manageability and scalability can be addressed by using advanced virtualization and cloud computing strategies. Complexity of manual management of SOA platforms will be illustrated to introduce the autonomic computing framework that will be followed to implement our smart platform solutions.

Chapter 3 presents a first cookbook composed of a set of recipes guiding the development of the SPaaS solution aimed at developing the smart IT infrastructure needed for installing and deploying the required components for the different versions of SSOAPaaS platforms.

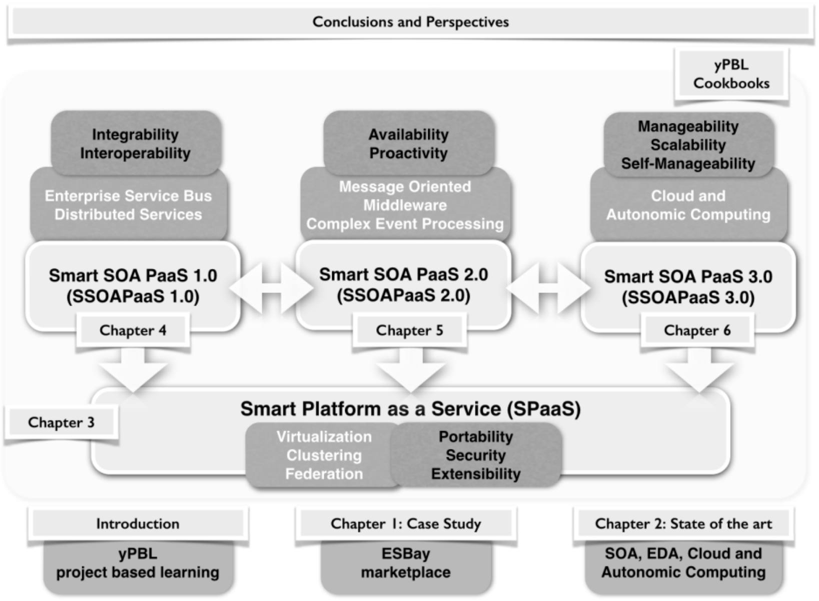
Chapter 4 develops a cookbook that shows how SOA paradigm and technologies satisfy interoperability, extensibility and integrability non-functional requirements by means of the SSOAPaaS 1.0 platform.

Chapter 5 presents a cookbook that is intended to illustrate the concept of message-oriented middleware (MOM) and the use of messaging systems (i.e. Java messaging service (JMS)) to provide asynchronous communication channels (i.e. point-to-point or publish/subscribe). Moreover, the concept of complex event processing (CEP) will also be demonstrated. This chapter shows how the message-oriented and event-driven paradigms and technologies have been able to satisfy availability and proactivity non-functional requirements due to the SSOAPaaS 2.0 platform.

Chapter 6 presents a final cookbook focused on the modern generation of SOA platforms within a global and interconnected extended enterprise world. A set of recipes showing how non-functional requirements such as manageability and scalability can be implemented within the SSOAPaaS 3.0 platform will be presented.

Finally, the Conclusion and Perspectives summarize the evolution of communication middleware and the role played by SOA platform generations in satisfying integration, interoperability and performance needs for large networked systems. Current and future challenges and perspectives involved in the design and development of future smart and autonomic SOA platforms in cloud computing architectures will be described. Moreover, the guidelines for smart self-configuration, self-provisioning and self-optimization strategies guiding the next generation of platform as a service solution will be presented.

Figure 1.1 presents the overall book structure and the various topics to be discussed.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yPBL Cookbooks
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Availability Proactivity
Manageability Scalability Self-Manageability
Enterprise Service Bus Distributed Services
Message Oriented Middleware Complex Event Processing
Cloud and Autonomic Computing
Smart SOA PaaS 1.0 (SSOAPaaS 1.0)
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Chapter 3
Smart Platform as a Service (SPaaS)
Virtualization Clustering Federation
Portability Security Extensibility
Introduction
Chapter 1: Case Study
Chapter 2: State of the art
yPBL project based learning
ESBay marketplace
SOA, EDA, Cloud and Autonomic Computing

Figure P.1. *Book structure*

In order to demonstrate how SOA concepts can be efficiently applied when developing the modern generation of enterprise applications, we have proposed a project-based learning methodology, based on a case study and allowing the introduction of the foundations of distributed systems design and development. We will cover SOA and EDA and how the cloud and autonomic computing paradigms play a fundamental role in modern distributed architectures.