Chapter 10
Specification of Non-Functional Requirements and their Trade-Offs in Service Contracts in the NGOSS Framework

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ABSTRACT
The community of Operation Support Systems (OSS) for telecom applications defined a set of fundamental principles, processes, and architectures for developing the Next Generation OSS through the TeleManagement Forum (TMF). At the heart of NGOSS lies the notion of a “Contract” which embodies the specification of services offered by an OSS component for quality management and product evaluation. However, TMF does not provide any method (or process) for specification of the non-functional part in the NGOSS contract specification. This chapter develops a systematic approach for specifying non-functional requirements of telecom OSS applications for contracts in the NGOSS framework for quality management and evaluation. Specifically, two categories of non-functional specification techniques are explored: qualitative and quantitative. Furthermore, two quantitative non-functional requirements specification methods are introduced: crisp and elastic to expand the capability of the current NGOSS contract specification method since only qualitative non-functional specification is currently available from TMF. In addition, a technique is developed for specification of trade-offs between non-functional requirements.

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INTRODUCTION

Background

Service Oriented Architecture (SOA) (Margolis, 2007; Leymann & Karastoyanova, 2008; Erl, 2005) is gaining momentum in information technology applications. It is a loosely-coupled architecture designed to meet business needs of an organization and allow systems group functionality around business processes. In response to challenging goals of improving quality, reducing cost, increasing agility, improving inter-operability, and managing IT and Telco resources effectively, the community of Operation Support Systems (OSS) for telecom applications, has defined a set of fundamental principles, processes, and architectures for developing the Next Generation OSS – NGOSS (TeleManagement Forum, 2004a, 2004b, 2005) based on SOA through the TeleManagement Forum TMF.

Related Work

Unlike Functional Requirements (FR) whose significance has been widely recognized, Non-Functional Requirements (NFRs) are poorly understood (Paech & Kerkow, 2004). Research of non-functional requirements has focused on their analysis instead of specification (Cysneiros & Leite, 2004; Mylopoulos et. al, 1992). In fact, neglecting non-functional requirements has been counted as one of the top risks of requirement engineering. The problem of incorrect specification of non-functional requirements often leads to disputes in business contracts, wrong design and implementation, wrong trade-off decisions, poor customer satisfaction, and loss in competition.

Specification of non-functional requirements for SOA has attracted attentions of researchers recently. It is necessary to specify non-functional requirements in addition to functional requirements in SOA since they play an important role in development and selection of services. It still has many open and challenging issues which need to be investigated (Tsai et. al, 2007). Several modeling methods have been developed to specify non-functional requirements. UML profiles have been used to model non-functional requirements in SOA (Ortiz & Hernández, 2006; Wada, Suzuki, & Oba, 2006; Wada, Suzuki, & Oba, 2007). A goal-oriented modeling method is used to represent non-functional requirements in SOA (Xiang et. al, 2007). However, non-functional requirements are specified to be crisp and they can be either satisfied or not, or they are specified to be qualitative in these non-functional requirements modeling methods. They are difficult to be used for trade-off analysis in service selection when multiple non-functional requirements cannot be satisfied at the same time and a trade-off among them is needed.

Service Level Agreements (SLAs), which are widely used in telecom industry and increasingly become popular in e-commerce and SOAs, stipulate service level requirements from external customers due to contractual or other reasons. In order to develop an OSS which satisfies service level requirements in a SLA, NGOSS introduce a notion of a “Contract”, which serves as an internal contract between intermediate phases in a development process and embodies the specification of services offered by an OSS component for quality management and product evaluation in a specific phase (TeleManagement Forum, 2005). However, TMF does not provide any method (or process) for specification of the non-functional part in the NGOSS service contract specification except the exemplary list of fields. In addition, TMF does not provide any trade-off specification mechanisms for resolving conflicts between non-functional requirements in the service contract, which exist in many Telco applications.

Objective

In this book chapter, we present a systematic approach for specifying non-functional requirements