Chapter 9

Specification of Context for Management of Service-Oriented Systems with WS-Policy4MASC

Vladimir Tosic
NICTA, Australia & The University of Western Ontario, Canada & The University of New South Wales, Australia

Rasangi Pumudu Karunaratne
The University of New South Wales, Australia

Qinghua Lu
NICTA, Australia & The University of New South Wales, Australia

ABSTRACT

Specification of monitored context properties and their influence on operation of service-oriented systems and on management activities is a prerequisite for context-sensitive operation. We researched context specification for a management system performing various management activities and potentially used by mobile service-oriented systems. Due to the similarities between processing and use of context properties and processing and use of quality of service (QoS) metrics, we decided to model context properties analogously to QoS metrics. We built our solutions for specification of context properties and related management activities into two languages: the Web Service Offerings Language (WSOL) and WS-Policy4MASC, the latter of which is the focus of this book chapter. WS-Policy4MASC is a powerful extension of the industrial standard Web Services Policy Framework (WS-Policy) with constructs for specification of information necessary for run-time policy-driven management. The presented constructs related to context increase usefulness of WS-Policy4MASC for management of mobile service-oriented systems.

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INTRODUCTION

IT system management is the process of monitoring and control to ensure regular operation, maximize quality of service (QoS), discover and fix problems, accommodate change, account consumed resources, bill consumers, enforce security, and minimize operational costs. It is necessary to achieve dependable IT systems. Monitoring determines the state of a system, e.g., by measuring or calculating various QoS metrics, determining presence of faults, evaluating satisfaction of requirements and guarantees, and calculating monetary amounts to be paid. Here, QoS is a group of measures of how well (e.g., how quickly, how reliably) a system performs its operations. A QoS metric is a particular measure of QoS. Some examples of QoS metrics are response time, throughput, and availability. On the other hand, control puts the system into the desired state, by performing run-time adaptation (e.g., re-configuration) of a system to ensure its regular operation, in spite of external changes or internal run-time problems (e.g., faults, performance degradations). For example, control of a service-oriented system includes its re-configuration, re-negotiation of contracts between the composed services and between the system and other parties, and re-composition of services. Formal and precise specification of management information is necessary for successful management activities.

One frequent-approach to IT system management is based on policies. A policy formally specifies a collection of high-level, implementation-independent, operation and management goals and/or rules in a human-readable form. Policies are enacted during runtime by middleware that measures or calculates monitored information and executes control actions. A service level agreement (SLA) is another format for specification of this information. It is a special type of contract (a binding and enforceable formal agreement between two or more parties) that specifies QoS (and often price/penalty) information. It can be used as an alternative or a complement to policies. A class of service (a.k.a. service offering) is a predefined SLA that can be used by multiple consumers (i.e., it is not custom-made). While information specified in policies and SLAs is similar in content, SLAs require two or more parties (while policies can be specified for one party only) and, traditionally, architecture of management middleware is different.

Another issue relevant for our research is that the use of mobile service-oriented systems is rapidly increasing. In such systems, services and/or consumers execute in mobile devices, e.g., laptops, personal digital assistants (PDAs), or mobile/cell phones. While at first the term “mobile Web service” was used to denote systems where only consumers were mobile and provider services stationary, the number of mobile provider services is growing. Mobile service-oriented systems support ad hoc integration of diverse software running in mobile devices with other software running on the Internet, primarily through the use of Web service industrial standards. Example application areas are mobile business, fleet management (e.g., truck tracking), and disaster relief.

Management of mobile service-oriented systems has to deal with issues that are not very prominent in management of non-mobile systems. These specific management issues include:

i. context-sensitive operation and management;
ii. relatively frequent disturbances and changes of communication-level QoS;
iii. possibility of relatively frequent disconnection during execution; and
iv. limited resources (e.g., scarce run-time memory, relatively low processing power, limited battery lifetime, and slow wireless links).

In this book chapter, we explore the management issues related to context-sensitivity (i.e., the influence of context on operation and management) of service-oriented systems. There are very
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