

Chapter 6.6

On the Management Performance of Networked Environments Using Web Services Technologies

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ABSTRACT

The management of telecommunication and data networks has been based on standards defined in historical contexts quite different than the current times. As a consequence, traditional management technologies are not able to address important challenges posed by the modern infrastructures. Web Services technologies enable the proper communication of processes deployed on quite hostile environments such as the Internet. The use of Web

Services for management allows the integration of low-level activities (e.g., retrieving monitoring information from gateways) with high-level business processes (e.g., creating a new product and its marketing strategy.) Despite clear advantages, Web Services-based management does not come for free; since Web Services are based on XML documents, its performance, compared with traditional management technologies, may represent an important drawback. This chapter covers the aspects of using Web Services for management focusing on the different interactions between managers and devices and the performance associated with it.

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INTRODUCTION

For more than ten years the Simple Network Management Protocol (SNMP) (Case, 1990) has been used to manage networks and services. Standardized by the Internet Engineering Task Force (IETF), SNMP is not only a protocol itself but a whole management framework widely recognized and accepted by both academia and industry. Despite its evolution through the definition of SNMPv2 (Presuhn et al., 2002) and SNMPv3 (Harrington et al., 2002), the SNMP framework still has restrictions that prevent its integration with other critical disciplines, such as e-Business, e-Learning, and e-Government. For example, since SNMP traffic is normally blocked by Internet firewalls, is it not possible for different companies to exchange management information via SNMP. Also, SNMP data is encoded following rules quite different than those based on XML (eXtensible Markup Language), normally used by e-Business solutions. Thus, although SNMP could technically be used in other fields, the framework restrictions make SNMP feasible almost exclusively for network management.

Recently, the Web Services (WS) technology has emerged as an interesting and promising management alternative that could overcome some of the SNMP problems. However, since Web Services are younger than SNMP, investigations are being carried out in order to understand the difficulties and the impact in adopting Web Services for management. First investigations in this field were more focused on the network bandwidth consumption (Neisse et al., 2004) because Web Services, which are based on XML, intuitively would consume more bandwidth than SNMP, which is a binary protocol with messages supposedly smaller. Next, response time and other performance aspects such as memory consumption and processing have been investigated as well (Dreves et al., 2004) (Pavlou et al., 2004), again because in comparison to SNMP, Web Services potentially would require more memory

and processing power to store and parser XML structures.

Technically, Web Services could completely replace SNMP, but that is not actually feasible because network operators would not instantaneously upgrade or replace the already deployed SNMP-enabled devices and services just because a new management framework, based on Web Services, is available. However, solely using SNMP would not allow the integration of network management-related tasks with other tasks required by those disciplines cited before. Therefore, an intermediate approach is required in order to integrate “legacy” devices and services into Web Services-based systems. That can be successfully accomplished by the use of Web Services gateways.

Gateways have been around in the network management field almost since the beginning of SNMP. CMIP (Common Management Information Protocol) to SNMP (Saydam et al., 1998) and CORBA (Common Object Request Broker Architecture) to SNMP (Aschemann et al., 1999) are examples of gateways investigated in the past whose objective was to integrate SNMP with other technologies, in this case, CMIP (OSI, 1991) defined in the ISO/OSI management framework, and CORBA (Orfali et al., 1998). The interesting point regarding gateways for Web Services integration is that they can be designed and built using different approaches, and each design approach impacts not only on the gateway building process itself, but also on the performance of the underlying managed network and associated management system.

In this chapter we present and discuss the different approaches for Web Services for management integration, namely protocol-level, object-level, and service-level gateways. We show how SNMP-enabled devices can be effectively integrated into Web Services-based systems in a feasible fashion. The discussion about the approaches for Web Services to SNMP gateways is also presented. The gateways approaches are evaluated considering a

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