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Large Scale Management of Distributed Systems

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Dublin, Ireland, October 2006, Proceedings

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Preface

This volume presents the proceedings of the *17th IFIP/IEEE International Workshop on Distributed Systems: Operations and Management (DSOM 2006)*, which was held in Dublin, Ireland during October 23rd to 25th, 2006. In line with its reputation as one of the pre-eminent fora for the discussion and debate of advances of distributed systems management, the 2006 iteration of DSOM brought together an international audience of researchers and practitioners from both industry and academia.

DSOM 2006 was the 17th in a series of annual workshops, and it followed the footsteps of highly successful previous meetings, the most recent of which were held in Barcelona, Spain (DSOM 2005), Davis, USA (DSOM 2004), Heidelberg, Germany (DSOM 2003), Montreal, Canada (DSOM 2002) and Nancy, France (DSOM 2001). The goal of the DSOM workshops is to bring together researchers in the areas of networks, systems and services management, from both industry and academia, to discuss recent advances and foster future growth in these fields. In contrast to the larger management symposia, such as Integrated Management (IM) and Network Operations and Management (NOMS), the DSOM workshops are organised as single-track programmes in order to stimulate interaction among participants.

Following the excellent experiences from the previous year, DSOM was for the second time co-located with several related events, namely the 9th IFIP/IEEE International Conference on Management of Multimedia and Mobile Networks and Services (MMNS 2006), the 6th IEEE International Workshop on IP Operations and Management (IPOM 2006), the 2nd IEEE/IFIP International Workshop on Autonomic Grid Networking and Management (AGNM 2006) and the 1st IEEE International Workshop on Modelling Autonomic Communications Environments (MACE 2006). All these events together formed the 2nd International Week on Management of Networks and Services (Manweek 2006).

The major theme of the DSOM 2006 workshop was the management of large scale systems. Such systems are becoming a reality, including: large sensor networks, server farms, distributed content provider networks, and IP and telecommunications networks. Scalability issues and their impact on the management plane are common among all such infrastructure, and the existing management approaches are largely inadequate for emerging large scale and complex systems. The ambitious goal of DSOM 2006 was to facilitate the sharing of a first research vision on scalable network management paradigms for large scale service and network infrastructures. Rethinking network and service management from a scalability perspective and redefining which management paradigms and approaches are adequate, were the main challenges of DSOM 2006. With many papers presented at the workshop addressing some of these challenges, there was also room for papers addressing general and hot-topics related to the management of distributed systems.

In response to the DSOM 2006 call for papers a total of 85 full paper submissions were received from 25 countries, out of which 77 were reviewed. The remaining 8 papers were incomplete or withdrawn. Some submissions came from groups affiliated

with the DSOM TPC co-chairs. These papers passed through a separate review process; several anonymous accounts were created on JEMS and the remaining TPC co-chairs delegated the reviews to the wider TPC, who anonymously filled in the review.

Within the comprehensive review process carried out by the technical programme committee and additional subject area experts, 75% of the submitted papers received 4 reviews and 35% of the submitted papers received 3 reviews. All submissions were ranked based on review scores as well as the wider technical programme committee's view on their contribution and relevance to the conference. After lengthy online discussions, it was decided to accept 21 of the submissions as full papers (an acceptance rate of 25.6%). Due to their relevance and quality, we recommended 5 of the submissions as short papers, of which 4 were presented at the workshop.

The papers presented here, we believe, represent novel and interesting contributions to addressing these challenges and meeting the goal of DSOM 2006 covering the following topic areas: ontologies and networks management; security and policy based management; business and service management; complexity of service management; performance of management protocols; supporting approaches for network management and management of next generation networks and services. We believe that this collection of papers provide a valuable insight into the current state of the art in techniques for scalable management for large scale service and network infrastructures.

There are many people whose hard work and commitment were essential to the success of DSOM 2006. Foremost are the researchers who submitted papers to the conference. The overall quality of submissions this year was very high and we regret that many high quality papers had to be rejected. We would like to express out gratitude to the DSOM 2006 technical programme committee, for their advice and support through all the stages of the conference preparation. We thank all paper reviewers, in particular those outside the technical programme committee, for their uniformly thorough, fair and helpful reviews. We also thank the JEMS team, which provided the infrastructure for the paper evaluation process.

We thank our sponsors, the International Federation for Information Processing (IFIP) Working Group 6.6 on Management of Networks and Distributed Systems with technical co-sponsorship by the IEEE Communications Society, Technical Committee on Network Operations and Management (CNOM). Most of the more time-consuming practical and logistical organisation tasks for the conference were handled by the members of the Manweek 2006 Organisation Committee, and this made our jobs significantly easier, and for that we are very grateful.

Finally, we wish to acknowledge the financial support of both Science Foundation Ireland and the Manweek 2006 corporate sponsors, whose contributions were hugely instrumental in helping us run what we hope was a stimulating, rewarding and, most importantly, an enjoyable conference for all its participants.

October 2006

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Efficient Information Retrieval in Network Management Using Web Services

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Abstract. Web Services is an XML-based technology that has attracted significant attention for building distributed Internet services. There have also been significant efforts trying to extend it to become a unifying management technology. An all-encompassing management technology needs to support efficient information retrieval, scalable event management, transaction support for configuration management and also security. Previous technologies, such as CMIP, SNMP and CORBA have addressed these aspects poorly, partially or at a high cost. This paper proposes an approach to address efficient information retrieval in terms of both bulk and selective data transfer. In order to achieve this, services modelling management information need to be organized in a hierarchy through service association. In order to achieve service association, information metadata are defined in secondary endpoints compared to the ones where services are deployed and accessed. We have defined a language for expressing arbitrarily complex information retrieval expressions and implemented a parser at the object level that evaluates these expressions, navigates arbitrary service associations and returns the results. We demonstrate the use and usefulness of the approach in an example usage scenario.

1 Introduction

Since the introduction of the Simple Network Management Protocol (SNMP) in the early 1990's and the versions of it that followed, its wide deployment for sophisticated network management still raises a lot of concerns. In the 2002 IAB Network Management Workshop [1] it became evident that SNMP can not be used for sophisticated management since its inneficiencies limit its potential usage to relatively simple monitoring. Therefore, alternative technologies are required to meet management goals such as efficiency in information retrieval, transaction support, security and also reduced development & operational costs. Distributed object technologies and, in particular, the Common Object Request Broker Architecture (CORBA) was considered as a unifying management technology and, although it has come a long way since then, it still has serious inefficiencies. In Corba federation and bulk retrieval are not supported, filtering capabilities lack expressiveness, scalability

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is an issue in addition to the large agent footprint. More recently, the introduction of Web Services, coupled with the advent of maturing eXtensible Markup Language (XML) technology standards, is seen as a promising approach for faster product development, tighter system integration and robust device management [2].

Web Services (WS) is an XML technology that encompasses W3C standards such as the Simple Object Access Protocol (SOAP) [3], the Web Services Definition Language (WSDL) [4] and the Universal Discovery Description and Integration protocol (UDDI) [5]. Since all these have their CORBA equivalents [7], WS can be used for distributed network management in a similar fashion to CORBA. But can they address this goal efficiently? Researchers in [6] and [7] compared the performance of WS, CORBA and SNMP. The conclusion was that when the amount of information to be retrieved increases, so does the efficiency of WS in comparison to SNMP. Smaller amounts of data though results in higher traffic for WS. The performance of WS, in terms of coding and latency, is poor in comparison to CORBA and SNMP.

Though the measurements in [6] and [7] show that WS could only be used in management scenarios where large amounts of data need to be exchanged, this is not necessarily true. WS performance at this stage can yield ambiguous results. As discussed in [8] and [9] approaches to resolve issues such as parsing, tranport problems, compression and data serialization etc, are still immature. Moreover the support WS provide to create sophisticated requests needs also to be investigated. Emulating the behavior of SNMP's operations such as GetNext and GetBulk is not a good practice when using WS. Such practices deprive any WS-based framework from the ability to use alternative sophisticated approaches to perform operations such as complex information retrieval. Performance and capabilities are thus inhibited.

In this paper we introduce a sophisticated approach to achieve true bulk or selective information retrieval, a capability that only CMIS/P offers among all management technologies, albeit at the cost of complexity and adherence to OSI upper layers that are not used widely anymore. In comparison, SNMP has limited support for bulk retrieval, mainly due to its mapping to UDP, and has no selective retrieval capabilities. Finally, CORBA lacks explicit support for such functionality.

Since one of our goals is to provide solutions for real management information retrieval scenarios, we have used SNMP MIBs modeled as web services to which retrieval scenarios are applied. In order to facilitate information retrieval it was important to come up with a way to organize data and services in a hierarchy that allows navigation of the information being held. To do this, we came up with a scheme to associate services and define arbitrary relationships between them. This hierarchical organization allows us to employ schemes of selective or bulk retrieval. This is done by deploying a parser at the object level on the agent side that accepts requests in the form of queries from a manager expressed in a language we designed. The agent uses the parser to interpret these queries and respond to the manager with the data collected from a list of management web services the agent has access to.

The remainder of this paper is structured as follows. In section II, we provide an analysis of our system model. In section III we present details on how service association is performed and how arbitrary service relationships can be defined. Section IV discusses details about the information retrieval grammar and the parser we developed. In section V we present a usage scenario that demonstrates the use and usefulness of our approach. Finally, in section VI we present our conclusions.

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