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Preface

Dear Participants,

Confronted with the ever-increasing complexity of technical processes and the growing demands on their efficiency, security and flexibility, the scientific world needs to establish new methods of engineering design and new methods of systems operation. The factors likely to affect the design of the smart systems of the future will doubtless include the following:

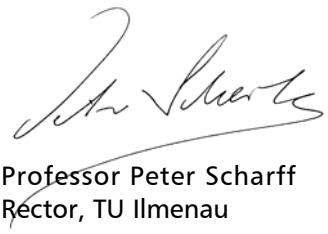
- As computational costs decrease, it will be possible to apply more complex algorithms, even in real time. These algorithms will take into account system nonlinearities or provide online optimisation of the system's performance.
- New fields of application will be addressed. Interest is now being expressed, beyond that in "classical" technical systems and processes, in environmental systems or medical and bioengineering applications.
- The boundaries between software and hardware design are being eroded. New design methods will include co-design of software and hardware and even of sensor and actuator components.
- Automation will not only replace human operators but will assist, support and supervise humans so that their work is safe and even more effective.
- Networked systems or swarms will be crucial, requiring improvement of the communication within them and study of how their behaviour can be made globally consistent.
- The issues of security and safety, not only during the operation of systems but also in the course of their design, will continue to increase in importance.

The title "Computer Science meets Automation", borne by the 52nd International Scientific Colloquium (IWK) at the Technische Universität Ilmenau, Germany, expresses the desire of scientists and engineers to rise to these challenges, cooperating closely on innovative methods in the two disciplines of computer science and automation.

The IWK has a long tradition going back as far as 1953. In the years before 1989, a major function of the colloquium was to bring together scientists from both sides of the Iron Curtain. Naturally, bonds were also deepened between the countries from the East. Today, the objective of the colloquium is still to bring researchers together. They come from the eastern and western member states of the European Union, and, indeed, from all over the world. All who wish to share their ideas on the points where "Computer Science meets Automation" are addressed by this colloquium at the Technische Universität Ilmenau.

All the University's Faculties have joined forces to ensure that nothing is left out. Control engineering, information science, cybernetics, communication technology and systems engineering – for all of these and their applications (ranging from biological systems to heavy engineering), the issues are being covered.

Together with all the organizers I should like to thank you for your contributions to the conference, ensuring, as they do, a most interesting colloquium programme of an interdisciplinary nature.
I am looking forward to an inspiring colloquium. It promises to be a fine platform for you to present your research, to address new concepts and to meet colleagues in Ilmenau.



Professor Peter Scharff
Rector, TU Ilmenau

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Head of Organisation

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2 Advances in Control Theory and Control Engineering

Zhihui.Lu / Yiping.Zhong / Yu.Wu / Jie.Wu

WSReMS:A Novel WSDM-based System Resource Management Scheme

Abstract

Based on the OASIS-Web Services Distributed Management Standards- WSDM, we propose a novel system resource management scheme- WSReMS. Furthermore, we discuss MUSE-CIMOM based system management scheme implementation- WSReMS-Platform, including Manager Layer, WSDM-Gateway Layer, and Agent Layer, and then analyze the experiment results. At last, from our research experiences and related survey, we analyze the prospective research direction and challenges in this field.

Key words: Web Services, WSDM,System Management, Resourse Management

1.Introduction and Background

IT system has been playing a more and more important role in the commercial world nowadays as well as in the daily life. Not only has the daily management of the company relied on the IT support, but also the process of critical business requirements have relied on the IT infrastructures and new IT technologies to assure the whole business continuity.

The total IT environment is becoming more and more complicated. Therefore, the difficulty of IT System management is also increasing. Because the system operators do not get all the information of the system operation, they do not know the bottleneck of current system and they do not know how many more resources should be added to fit for the new business requirements. They are often in the situation that they have put more resources but with little gains in productivity. And the IT environment is becoming more and more complex. All of this translates into additional costs and result in low ROI (return on investment). Enterprise Architecture believes that SOA(Service-Oriented Architecture) can help businesses respond more quickly and cost-effectively to the changing market conditions and the complexity of the IT environment. This style of architecture promotes reuse at the macro (service) level rather than micro levels (e.g. objects). It can also simplify interconnection to and

usage of existing IT (legacy) assets. Currently, Web Services is a series of feasible technology packages to implement SOA.

The OASIS Web Services Distributed Management TC is defining a set of Web Services Distributed Management (WSDM) specifications: The WSDM specifications define how to use Web services to expose manageable resources (MUWS, Management Using Web Services [1]), and in addition, define how to expose manageable Web service implementations (MOWS, Management Of Web Services[2]). In a word, the main idea of WSDM is to define a Web Service architecture to manage distributed resources. WSDM further exposes the Web Service Endpoint of the virtualized resource, as the manageability interfaces. And the manageability interfaces support common operations: (a) Control: start, stop, etc; (b) Monitoring: status & performance.

2.WSReMS: A Novel WSDM-based System Resource Management Scheme Design

Based on WSDM, we propose a novel system resource management scheme-WSReMS. Furthermore, we have developed and implemented a prototype system: WSReMS-Platform, WSReMS makes the physical IT resources virtualized by applying the international standards-WSDM. These resources are to be applied in our target scenarios to verify the effectiveness and the behavior of the WSReMS.

With our WSReMS-Platform, the system configuration manager can configure the properties of the managed IT resources. The operator can monitor the performance of the IT resources. The operator can subscribe to some management events. If an event happens, the operator shall get the notification. Then the operator can also execute some operations to react to the notification and to deal with the situation.

The WSReMS-Platform consists of three layers. They are the Manager Layer, the Gateway Layer and the Agent Layer as the following figure 1.

Manager Layer is a manageability consumer. It manipulates the manageable resource by invoking the management interface exposed by the Gateway component.

Gateway Layer takes the responsibility of mapping the physical resources that are manipulated by agent component to the WSDM resource. It should also provide WSDM-required management interface and the custom management interface which are mapped to the corresponding agent management interface. In a word, Gateway component takes charge of the property-mapping and management interface-

mapping job between the physical resources and corresponding WSDM resources.

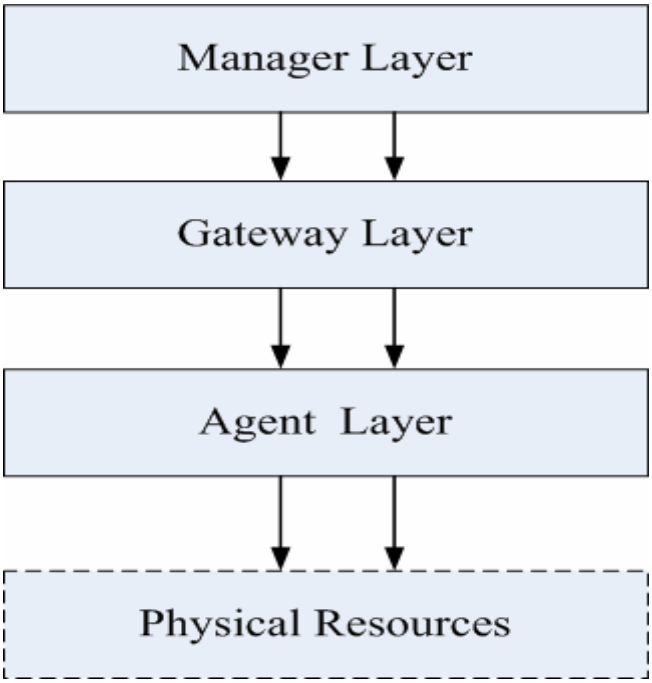

Figure1 General Description of WSReMS 3-Layer Architecture

Agent Layer uses its own management interface (such as JMX MBean, CIM interface, SNMP interface .etc.) to manipulate physical resources. Developers of software can use whatever technology they prefer to implement the manipulation on the 'Real Resource'.

WSReMS Object Modeling Design

Object Modeling Design contains the Class design and the relationship of the classes of the Object in the WSReMS, including the attributes and operations.

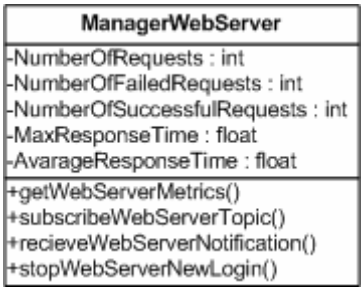

Figure2 Class Diagram of Manger Web Server

The Manager Web Server Class (Figure 2- Class Diagram of Manger Web Server) is the modeling of the service that is monitored in the Manager Component. The Manager Web Server Class has some operations that can be executed to react to some certain situation.

The instance image (Figure3 Instance Image of the Classes of Manager Layer) gives the general idea of the relationship of the classes we have designed above.

The relationship between the MangerService and the ManagerDatabaseServer (ManagerDBSvr), ManagerWebServer (ManagerWebSvr), ManagerLoadBalancer (ManagerLB) is aggregation.

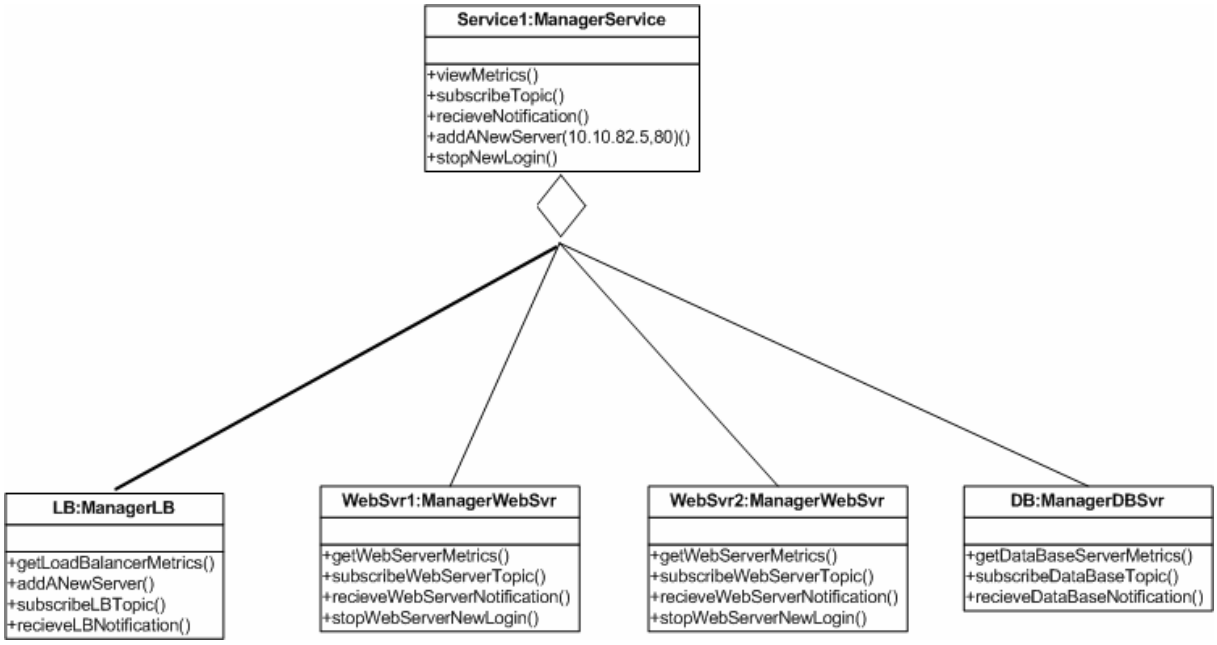

Figure3 Instance Image of the Classes of Manager Layer

3. MUSE and CIMOM Based Scheme Implementation and Experiment Analysis

In WSReMS -Platformv1.0, we have implemented the service monitoring and switching of Web server and DB server using CIMOM and MUSE Project development library [6].

In this system, there are three parts: Manager Layer, WSDM-Gateway Layer, and Agent Layer-the local resource service point. The WSDM-Gateway side is in charge of service status information collecting and publishing, while Manager Layer is in charge of retrieving status data from every resource service point, and managing and switching service.

WSReMS-Platform is developed using CIMOM-Common Information Model Object Manager[9]. It is the implementation of the core part of WBEM (DMTF - Web-Based Enterprise Management) protocols [7]. WSDM-Gateway Layer is developed based on the open source software 'MUSE 2.0', as its implementation of WSDM standards. MUSE [6] – is a Java-based implementation of the WS-Resource Framework (WSRF) 1.2, WS-Base Notification (WSN)1.3, and WS-Distributed Management (WSDM) 1.1 specifications.

In agent layer, we use JMX standard to encapsulate all the resource (hardware or

software) with java objects and expose them in a distributed environment at the resource service point side.

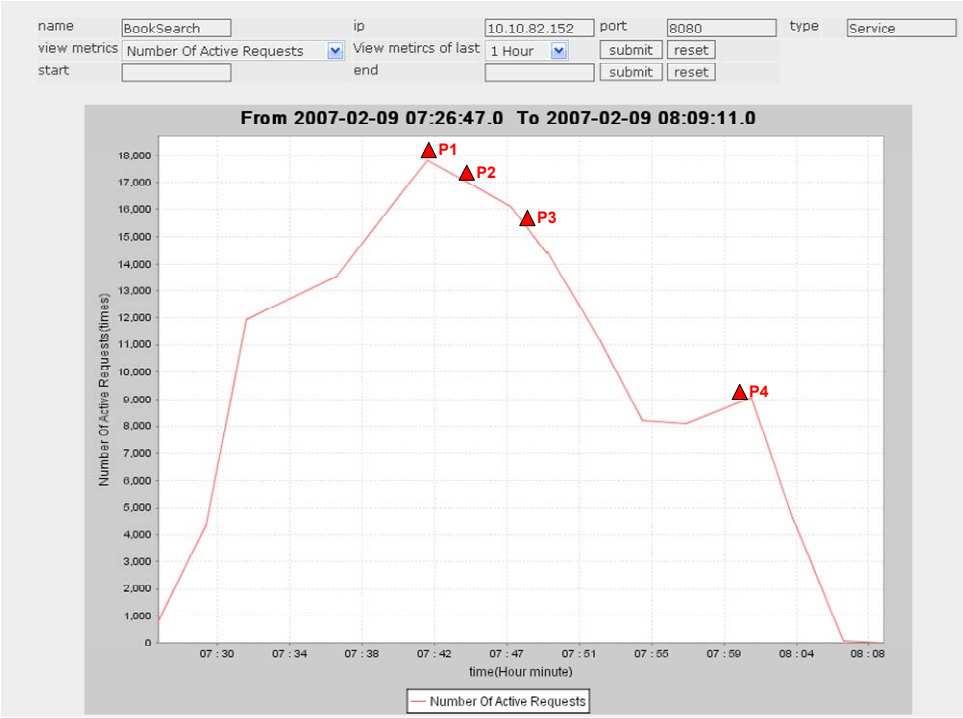

Figure4 Experiment Result Description

In our current WSReMS -Platform, we realize a case of a single service management. When overload scenario of the single service happens, the operator will get the notification. And then the new web server can be added to support more requests. Figure4 give a description of experement result. Manager first retrieves the numberOfCurrentRequests of the service and then it retrieves the numberOfCurrentRequests of the web1. Because of the time delay, P1 and P2 could be of different positions. And normally during our tests P2 is later than P1.

At P3, when web3 is added to the cluster, the numberOfCurrentRequests of the service drops down.

At P4, the increase of the value is not included in our test. The test ends at 08:00.

4.Conclusion and Futrue Works

In our current WSReMS -Platform, we just realize a management case of a single service. Actually, we don't use the complex composite service. In general, composing multiple Web services, rather than accessing a single service, is essential and provides more benefits to users. Composition primarily addresses the situation of a user's request that cannot be satisfied by any available service, whereas a composite service obtained by combining available services might be used [10].When the

complex Web Services composition is used in WSReMS -Platform, we should consider the following problem must be solved:

(1) The structure of the composite services, which is described by BPEL, is complex. If WSReMS -Platform would like to manage the composite service, the structure of the WSReMS -Platform, especially the Manager Layer might need to be re-designed. And the target service might need to re-build.

(2) We might need to consider the metrics of the composite service. What kind of metrics is useful should be evaluated carefully. The refinement of the metrics of the current system might be necessary.

WSDM-based System Resource Management Scheme is a new distributed system management scheme. The new scheme further being realized in global Internet will necessarily make this technology closer to business field and obtain more industry space. Before realizing WSDM-based System Resource Management service on a worldwide scale, researchers must overcome many key technologies and carry on many experiments in test bed with carefully controlled trials, continuously validating its scalability and evaluating its actual performance.

With the rapid development of Web Services, and WSDM technology, we believe this novel system monitoring and management solution will necessarily obtain powerful and persistent life force and industrialization development space.

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