

Web Services for Converged IP Networks

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Abstract—Rapid growth of computer network leading to converging necessitates management of servers by a server. Simple Network Management Protocol (SNMP) based management cannot be used for the converged network management due to its limitations and relatively simple monitoring. Therefore alternative technologies are required to meet various goals such as scalability, security, reduced development and operational cost, etc. Web service along with object oriented approach such as eXtensible Markup Language (XML) and Java seems to be promising approach for tighter system integration and robust device management.

Based on the above, a prototype of Web Based Server of Server (WBSOS) has been designed. It implements two servers, DHCP and NETCONF and the database is stored in a centralized location in an RDBMS. NETCONF is being implemented using Web Services Description Language (WSDL) that imports the definitions of XML types and elements from the base NETCONF schema.

Various issues regarding performance of web services developed using Java API for XML Web Services (JAX-WS) with reference to WBSOS will be discussed and accordingly various system configurations will be proposed in this paper.

Keywords—SNMP, NETCONF, WSDL, XML, JAX-WS

I. INTRODUCTION

With technology growth, SNMP is proving to be inefficient in terms of information retrieval, automation management and accessibility to new services and applications. SNMP has been used for mostly in monitoring for fault and performance management, but very less used for configuration management [2].

Based on the above, NETCONF was proposed in 2006 which uses XML to send and receive management information between manager and agent [4]. NETCONF not only defines the basic operations but also puts forward several high level configuration management operations. It uses RPC paradigm to send and receive request and responses as described in the XML schema file. It adopts the connection- oriented Simple Object Access Protocol (SOAP) to ensure the security of the transmission [5]. Research has proved that NETCONF will cater the needs of the various management issues of the converged network. To cater the need of growing management system, a WBSOS has been proposed.

To develop WBSOS, two servers DHCP and NETCONF have been implemented. DHCP server has been implemented using the Java library for DHCP (JDHCP). NETCONF has been build on the architecture of web services which used Web Services Description Language (WSDL) and Xml Schema Definitions (XSD) files. This paper takes a detailed look at performance and scalability issues around Web services in the real world, as well as strategies that architects and developers can adopt to mitigate any risks in the applications.

II. WEB BASED SERVER OF SERVERS

Fig. 1 shows a prototype of WBSOS. The WBSOS implements two servers namely DHCP server and NETCONF server. The parameters of both the servers can be configured using a single browser based application called as a “**Network Management Tool**” (NMT). The DHCP server mainly configures the basic network parameters for a system that brings it in the network such as: allowed IP address range, not-allowed IP address range and lease time. The network device acts as DHCP client and gets its IP address from the DHCP server. The DHCP server saves the information of all the network devices in the centralized data repository of MySQL.

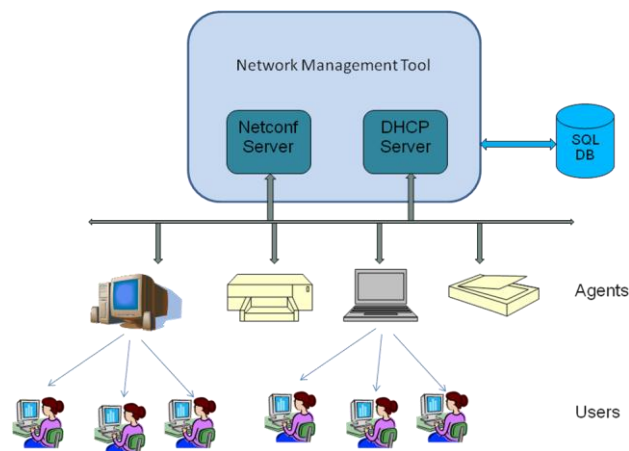


Figure 1. Prototype of WBSOS

The NMT has been set in “auto” mode which helps NETCONF to gather information stored in the centralized data store and thus detect number of devices and its basic configuration. The other configuration information such as its

NETCONF capabilities can be viewed by clicking on the properties button in the GUI of Network Management tool. The basic operations such as <get>, <get-config>, <edit-config>, <copy-config>, <close-session>, <kill-session>, <lock> and <unlock> sessions has been implemented in this prototype.

III. WEB SERVICE

The World Wide Web Consortium (W3C) defines a "Web service" as "a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards[4]. Web service architecture involves many layered and interrelated technologies. Fig. 2 below shows some of these technology families. WSDL, XSD and SOAP are some of the important technologies used in the creation of a web service.

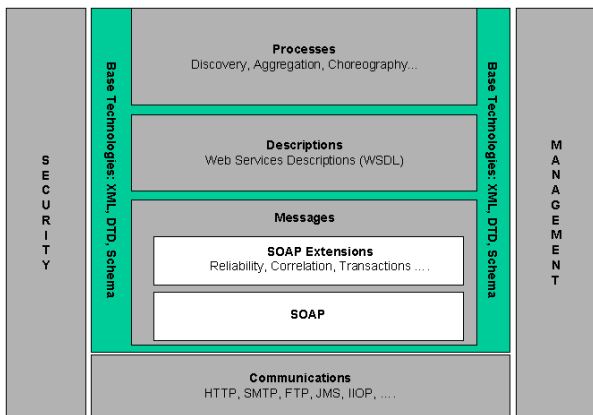


Figure 2. Web Services Architecture Stack

A. Management of a web service

Management of a web service is governed by various factors such as its design, its architecture, its application platform and available hardware and software infrastructure. Web service performance can be analyzed from different points of view viz. Response time, Transactions/sec, Concurrent users and Throughput (request/sec).

While designing web service for WBSOS, architecture was primarily taken into consideration. The web service was created based on the architecture of JAX –WS (Figure 3)

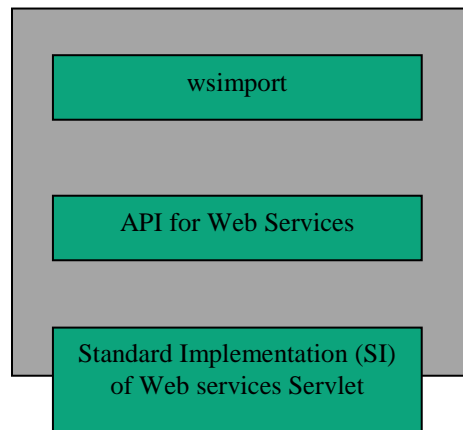


Figure 3. Architecture of JAX-WS

JAX-WS [5] is a technology used for building the web services and clients that communicate using XML. It consists of APIs, standard implementation servlets and set of tools such as “wsimport” for generating artifacts such as beans, stubs and XML for the client code. A remote procedure call is represented by an XML- based protocol such as SOAP. SOAP specification defines the envelope structure, encoding rules, and conventions for representing RPC and responses. JAX-WS API hides the complexity from the developer regarding SOAP messages.

With JAX-WS, clients and web services have a big advantage: the platform independence of the Java programming language and performs faster and better. In addition, JAX-WS is not restrictive. This flexibility is possible because JAX-WS uses technologies defined by the World Wide Web Consortium (W3C): HTTP, SOAP, and the Web Service Description Language (WSDL). WSDL specifies an XML format for describing a service as a set of endpoints operating on messages. JAX-WS uses Java EE 5. Java enterprise platform offers better scalability than .NET platform. Also JAX-WS performs faster than in .NET environment.

B. Various configuration of WBSOS

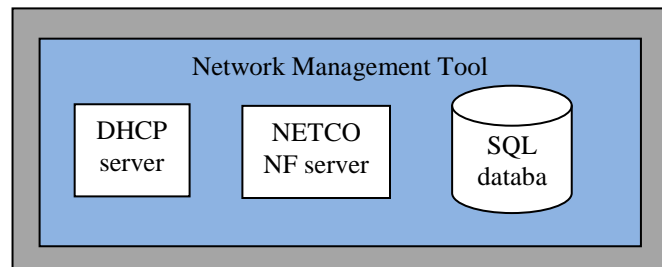


Figure 4. WBSOS on a single system

For small network consisting of some 100s of client nodes, the DHCP server, the Netconf server, Network management

tool and the SQL database can be on a single system with minimum server configuration. The WBSOS has been tested for small network in which all the components were installed on a single system with windows XP professional. But as the network grows in number and when various internet nodes are to be managed, the above diagram will need to be modified as below as shown in figure 5.

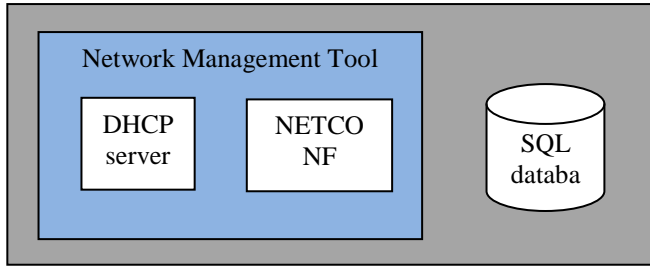


Figure 5. WBSOS on two systems

Here DHCP server, the NETCONF server and the Network Management Tools are installed on single system while the SQL server in on different system. For balancing the request and response on the network all the components can be installed on separate systems also (Figure 6). In WBSOS, the Network Management Tool (NMT) is embedded in the NETCONF server. Hence the NETCONF server and NMT will be on the same system. As the WBSOS is based on web services architecture, the system is highly scalable. We have to develop only what is required and for how much.

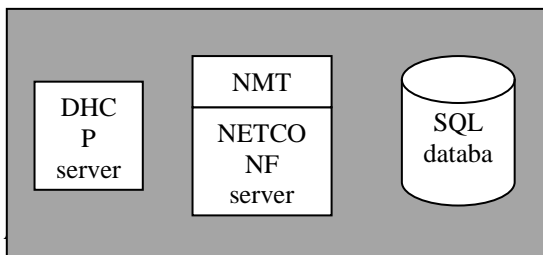


Figure 5. WBSOS on three different systems

IV. CONCLUSION

Developers responsible for building scalable Web services have challenges, expectations, and available technologies that are evolving. The web service has the main advantage that the same service can be used on different platforms. Hence

scalability does not pose a major factor in developing a network management system using web services.

In WBSOS, the system can be designed depending upon the requirement of the network to be managed. The new Object Oriented Technology (OOT) helps to lower the burden on network administrator.

References

- [1] J. Schonwalder, A. Pras, and J. P. Martin-Flatin, "On the Future of Internet Management Technologies", IEEE Communication Magazine, vol 41 pp 90-97, 2003.
- [2] R. Enns, "NETCONF Configuration Protocol", RFC 4741 , December 2006.
- [3] Goddard, T., "Using NETCONF over the Simple Object Access Protocol (SOAP)", RFC 4743, December 2006
- [4] Web service: <http://www.w3.org/TR/ws-arch>
- [5] <http://axis.apache.org/axis2/java/core/docs/jaxws-guide.html>
- [6] Mi-Jung Choi, Hyoun-Mi Choi, and James W. Hong, Hong-Taek Ju, "XML-Based Configuration Management for IP Network Devices", IEEE Communication Magazine, July 2004.
- [7] J. P. Martin-Flatin, "Web-Based Management of IP Networks and Systems", Ph. D. Thesis, Swiss Federal Institute of Technology, Lausanne (EPFL), October 2000.
- [8] Mi-Jung Choi, James W. Hong, and Hong-Taek Ju, "XML-Based Network Management for IP Networks", ETRI Journal, Volume 25, Number 6, December 2003
- [9] Yanan Chang, Debao Xiao, "Design and Implementation of NETCONF-Based Network Management System", Member, IEEE, 2008, Second International Conference on Future Generation Communication and Networking
- [10] Netbeans 6.8 IDE help
- [11] "Web Service Description Language (WSDL) 1.1", <http://www.w3.org/TR/wsdl>
- [12] "netconf.xsd" <http://www.w3.org/2001/XMLSchema>
- [13] Sun-Mi Yoo, Dept. of Computer Science and Engineering, POSTECH, Hong-Taek Ju, and James W. Hong, "Web Services Based Configuration Management for IP Network Devices", Dept. of Computer Engineering, Keimyung University, IFIP International Federation for Information Processing - 2005
- [14] Jae-Oh Lee, WarePlus, "Enabling Network Management Using Java Technologies" , Inc./Korea Telecom , January 2000 issue of IEEE Communications