Chapter 21
Some Aspects of QoS for High Performance of Service-Oriented Computing in Load Balancing Cluster-Based Web Server

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ABSTRACT

Quality estimation for viability of data processing and delivering through the paradigm of service oriented computing and load balancing cluster based web server for high performance of services against extensive load of consumers is an important concern in the domain of grid and distributed computing, big data analysis and internet of things. As such, this chapter proposes a quality estimation framework considering a prototype architecture for multi service multi-functional web services deploying in load balancing cluster based Apache Tomcat web server and developing a clinical database for processing disease related queries through the architecture. The high quality of service is monitored by generating extensive load of users over the system through Mercury LoadRunner load testing tool. In this chapter, the authors will discuss the methodology to study the quality of service, recorded quality metrics against different load of users and the statistical analysis along with results to establish the feasibility, applicability and adaptability of proposed quality estimation framework.

INTRODUCTION

Service Oriented Architecture (SOA) introduces the flexibility of services over internet. It enhances the applicability of distributed and grid computing, interoperability of Internet of Things (IoT) through Service Oriented Computing (SOC) over network based protocol. SOC based system primarily includes

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binding, publishing and consuming activity of service over network. Among different techniques of SOC based system, Web Services (WSs) are popularly used for its flexibility in power of binding, publishing and discovering over network. WSs support interoperable node to node interaction and use the infrastructure of SOA for delivering the service over network (Booth, 2004). Due to the exponential growth of WSs over internet, the framework of SOA provides the excellent platform for service developing and delivering in the era of Web 2.0 (O'Reilly, 2007). The SOC based system consists of multiple numbers of homogeneous or heterogeneous WSs that work together for the functional objective. How to assess the overall quality of such SOC based system against load of users becomes a crucial problem in research community, software practitioners and among research organizations.

With the increase in consumers of WSs over internet, the load in the server side increases gradually. As such, quality estimation of service has become critical. At peak time of usage, it is highly essential to handle and respond each incoming request properly, so that the consumers do not face the invalid response of such a system. In such cases, cluster based load balancing web server deployment can enhance the ability to process incoming request properly against massive load of consumers.

From the articles of research community presented elsewhere, evidences are acquired that inclusion of cluster based web server for deployment of growing business oriented process in today's era can retain large extend of users, and can handle the challenges of bulks of request processing in server side (Cardellini et al., 2001; Zhu et al., 2001; Andreolini et al., 2002; Andreolini et al., 2004; Hong et al., 2006; Urgaonkar et al., 2007; Vercauteren et al., 2007).

In general WSs are viewed as black box, where the knowledge of internal architecture is omitted. So quality evaluation primarily depends upon the views of users (Zheng et al., 2014). The quality metrics usually vary over exposure period of service time against different stresses of users. As such we emphasize here on quality estimation of multi service multi-functional Simple Object Access Protocol (SOAP) based WSs using load balancing cluster based web server through the analysis of performance and reliability records against high load of users at a peak time of usage.

The Background

SOA is an evolutionary framework for distributed computing over internet that exposes software agents, functional process, and modular business oriented process as service over network based protocol. It is most popular standard model for SOC based system that utilizes WSs, tightly or loosely coupled software agents for service delivery. It provides programmable interface to consumers for consuming self describing modular oriented application in their system (Matthew et al., 2005). It provides a conceptual method to deploy the distributed architecture of WSs. In SOA, the client is not aware of internal programming data structure and the platform that it is running on. The client simply uses the service for their computational logic over network.

The system, running service in the server side is usually termed as SOC based system. The SOC based system contains WSs for the operational purpose. It may contain atomic or composite WSs for implementation of business logic (BL).

WSs contain three foundation layers for service delivery, namely:

1. SOAP,
2. Web Service Description Language (WSDL), and
3. Universal Description Discovery and Integration (UDDI).