Web Services-Based Data Management: Evaluating the Performance of UDDI Registries

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Abstract

With the advancement of web services technologies, on-line businesses have the ability to offer their capabilities to larger, lesser known communities of potential collaborators. Universal Description, Discovery, and Integration (UDDI) specification and supporting technologies support open frameworks for businesses to store, advertise and retrieve pertinent services. Many researchers investigate approaches that ubiquitously create higher-level processes by composing services discovered in and retrieved from UDDI registries. However, there are few studies that consider the impact of registry performance on future service automation. This work focuses on evaluating the performance of UDDI registries considering variability and concurrent load of publish and inquiry requests.

Keywords *:* UDDI, Performance Evaluation, Software Engineering

1. Introduction

Web service [5] technologies allow businesses to expose specific capabilities or services, usually through a networked connection. These technologies enable other companies or software programs to use the services. UDDI technologies [4] are distributed, on-line databases that specifically allow the management of meta-information describing these services. The meta-information is generally represented in the Web Service Description Language (WSDL) [6]. Service-oriented computing or *orchestration* [3] is the concept of developing new business processes through the discovery and connectivity of multiple web services using UDDI registries.

Considering the anticipated growth of service-oriented computing, concurrent processing on UDDI registries supporting the management of web services may have a significant impact on overall system performance. Although there are researchers that investigate technologies that directly support the composition of web services [1][2], there are few studies known by the authors that investigate how the performance of UDDI technologies might affect the large-scale acceptance of service-oriented computing. This work addresses two research questions as follows.

- *Given standard operation, what is the baseline performance of current state-of-the-art UDDI frameworks?*
- *What is the performance of current UDDI frameworks for common operations considering increasing concurrency of processes?*

The paper proceeds in the following section with an experimental approach to evaluate UDDI technologies. The subsequent sections contain the experiments performed and a discussion of the results with implications to large scale uses of UDDI.

2. Experimental Assumptions

In evaluating the performance of the UDDI technologies, the jUDDI registry was chosen from several applications that were surveyed. Considering the fact that all registries are developed from the same specification, we assume that the underlying data modeling is relatively similar. jUDDI is a Java-based implementation of UDDI that was created to integrate effectively with the Tomcat web server. jUDDI represents the best application for performance evaluation based on our experimental operational environment.

One may argue that evaluating one UDDI application does not capture the benefit of multiple distributed registries. In this work, we assume that one or many UDDI applications would be established for a particular domain of interest. Therefore, although the registries are distributed, a specific group of users would only connect to a limited set of registries that address a very specific group of services. Given this assumption, distributed UDDI registries for a specific type of service should over time scale relatively similar to just one UDDI registry.

3. Experimentation and Results

Although there are several functions described in the UDDI specification, our studies focus on the publication and inquiry capabilities. There were two experiments implemented with respect to these capabilities. The experiments were performed on a 1.5 gigahertz, Pentium 4, Dell workstation with 1 gigabyte of RAM. The jUDDI

registry and the Tomcat 4.1 web server were used in the experiments. The jUDDI registry was applied to the mySQL database. The general approach in the experiments was to first evaluate the registry under normal conditions then to evaluate the degradation of the performance as other functions were executed on the same registry concurrently.

In the first experiment, the publication and inquiry functions were measured under normal operations without additional traffic. The inquiry (read) function was executed 10 times sequentially and the average service time was recorded. Likewise, the average service time over 10 runs was recorded for the publication function. The inquiry function executed at an average of 40 ms over 10 invocations. The publication function has an average service time of 251ms over 10 invocations. These baseline measures for publication and inquiry are displayed in Figure 1 and 2. It was anticipated that the publication function would require more time based on the underlying database commit that must take place.

In the second experiment, the inquiry and publication functions were evaluated with other concurrent publication and inquiry traffic. There were 3 cases of concurrent traffic, 1 inquiry/second, 1 publication/second, and 1 inquiry/second *and* 1 publication/second. Based on the 3 cases, the inquiry measures were 67.1ms, 254 ms, and 804 ms respectively. The publication measures were 689ms, 2.3 secs, and 3.1 secs. The results of the experiments are also shown in Figure 1 and Figure 2.

4. Discussion and Related Work

Based on the experiments performed in this study, we determined that large numbers of concurrent inquiry requests do not have a significant impact on the performance of the UDDI registries. However, additional concurrent publications increased the service time by 5 times and by 10 times for the inquiry and publication functions, respectively. This was a considerable increase in service time considering that the traffic was only 1 additional publication per second. When the traffic was increased to 2 additional publications per second, the registry immediately experienced locking and in some cases deadlock.

As known by the authors, this is first study that considers the impact that UDDI registries can have on large-scale service-oriented computing. Miles [3] also measured the responsiveness of another UDDI registry (Java Web Service Development Kit) over 10 runs. The measures taken on that registry for inquiries performed about 20 ms faster than the jUDDI registry. The closeness of those values helps to validate our findings. Our work extends Miles' work with the consideration of background processes. Given these results, we conclude that the underlying data structures for UDDI registries should be evaluated. In addition, there should be mechanisms to help enhance the performance of UDDI functions by governing the requests to the registries. In future work, we plan to extend our studies to address both issues.

5. Acknowledgements

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6. References

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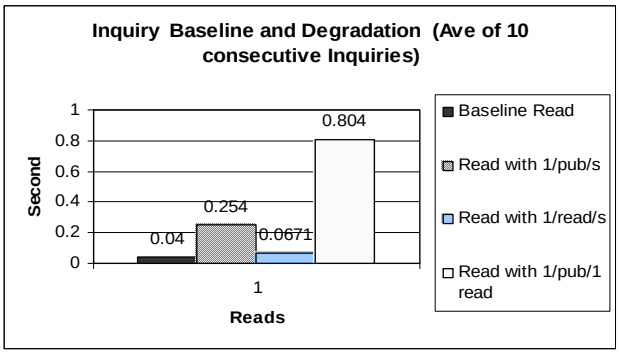

Figure 1. Performance of UDDI Inquiries

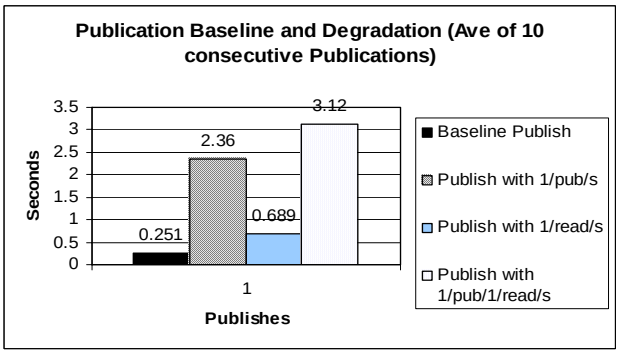

Figure 2. Performance of UDDI Publications