Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 147 (2014) 237 – 243

Procedia
Social and Behavioral Sciences

ICININFO

Service Level Agreements for the Digital Library

Masitah Ahmad*, Jemal H. Abawajy

Parallel and Distributed Computing Lab, Scholl of Information Technology, Deakin University, 3216, Victoria Australia

Abstract

Digital libraries offer a massive set of digital services to geographically distributed library patrons. The digital services are commonly sourced from third-party service providers for charge. As externally sourced digital services are becoming prevalence, issues regarding their quality assessment are gaining critical importance. Unfortunately, sourcing digital services from external providers has brought with it stringent quality of service (QoS) demand from the library service users. Currently, there is no way for ensuring QoS between the digital service providers and the library management. In this paper, we propose service level agreements (SLAs) to capture the QoS requirements of the digital service users and the commitments, as well as adherence of the digital service providers.

Selection and peer-review under responsibility of the 3rd International Conference on Integrated Information.
Keyword: SLAs; Quality of Service; Digital Library; Third-party Sourced Services

1. Introduction

Digital libraries have become more prevalent in the library and information science fields. They provide access to digital services in a coherent and economical manner to geographically distributed library patrons. The digital services include desktops, online database, electronic publishing (e-publishing), electronic journal (e-journal), electronic books (e-books), web-portal etc. An advantage of the digital libraries over the conventional libraries is that the former has the potential to store much more information with extremely little or no physical space. Increased accessibility as well as availability to none traditional constituencies of a library for reasons such as geographic location or organizational affiliation is another important advantage of the digital libraries over the

* Corresponding author. Tel.: +61043098244; fax: +613 5227 1722.
E-mail address: mahma@deakin.edu.au

Selection and peer-review under responsibility of the 3rd International Conference on Integrated Information.
doi:10.1016/j.sbspro.2014.07.166

traditional libraries. Moreover, digital library users can access some of the digital services from anywhere at any time thus saving their time (Kaur & Singh, 2012).

Digital library has changed the business model from buy-and-use to rent-and-use business model. The advantage of this change is that the libraries will be able to tailor their services to the needs of their current and future users. This in turn, will enable the libraries to be strongly linked to their communities and rapidly adjust to the changing world around them.

As libraries are dedicating increasingly large components of their budget to electronic resources (Plum, et. al, 2010), issues regarding digital services quality evaluation have recently become an area of considerable interest. Several tools such as SERVQUAL to assess service quality within library domains have been developed and widely used. It has been shown that a considerable mismatch exists between the SERVQUAL dimensions and digital service features (Parasuraman et al., 2005). To address such disparity, Vinagre et. al. (2011) developed a tool called dlQUAL that allow the assessment of service quality. Survey-based instruments mainly focus on digital service users as such the data they collect are user impressions or opinions and it's prone to errors (Plum, et. al, 2010). Several approaches such as COUNTER (Counting Online Usage of Networked Electronic Resources) [www.projectcounter.org] and SUSHI (Standardized Usage Statistics Harvesting Initiative) [www.niso.org/workrooms/sushi] that provide statistics of digital service usage also exist. However, the usage data collected are not systematically linked to the desired level of service performance, nor are the results comparable to other institutions (Plum, et. al, 2010).

Despite the great plethora of studies on service quality assessment for library and information science, only a limited number of academic literatures addressed digital service quality evaluations (Vinagre et. al., 2011). The common threat among the existing tools and approaches is that they are all designed to evaluate the performance of the services after they have been deployed. However, digital services provided by digital libraries often include services that exist outside the physical and administrative bounds of the library. These digital services are often contracted from third-party digital service providers for charge. Therefore, we believe that quality of service assessment for digital services requires including the element of third-party service provider. To the best of our knowledge, we are the first to address the integration of Service Level Agreements (SLAs) in the evaluation of library systems.

SLAs have become a valuable tool to help manage service expectations and monitor quality of service (QoS) attributes of services. In digital library, the specification and management of QoS is necessary to enhance user experiences. QoS represents the parameters that can be used to characterise and assess the functional and non-functional aspects of digital services. Some of these parameters are objective in nature and can be automatically measured, whereas others are subjective in nature and can only be measured through user evaluations (e.g., focus groups). Harris & Rockliff (2003) discussing the scope and contents as well as the role of service agreements in Australian health libraries. Comuzzi et. al (2009) focused on establishing and monitoring SLAs for complex service based systems. The authors use business, software and infrastructures services as a SLA hierarchies spanning through multiple domain and layers of a service economy. The authors applying the framework to industrial use cases. However, the proposed SLAs framework specifically on the service provider side only. Therefore, the approach is not suitable for digital library QoS measuring where QoS in the library is also expressed by parameters that focus on the interactive relationship between the libraries with the people whom it is supposed to serve (Hernon & Altman, 2010).

Alhamad et. Al (2010) proposed an approach for SLA framework in cloud computing. The authors use non-functional requirements of services such as availability, scalability and response time to define the SLA parameters for each type of cloud service (Infrastructure as a Service, Platform as a Service, Software as a Service and Storage as a Service). However, the above work is not in direct with the context of SLAs in Digital Library. Moreover, the services in this framework are focusing only toward cloud computing environments. Apart from the nominal work of Harris & Rockliff (2003), creating and implementing service level agreements in libraries does not exist in the published literature. Thus, an approach that guarantees the expected quality of digital services prior to their deployment as well as after they deploy is necessary. In the digital library settings, service level agreements (SLAs) are enormously beneficial if libraries are to achieve their stated mission of serving their patrons. However, there are no academic articles that address SLAs as a tool to create a level of digital service quality in Library. Therefore, the study of such a method is suitable and relevant to be considering because it is increasing in the Digital environments.

In this paper, we propose a three-pronged approach for the assessment of digital services quality within a library domain. At the service provider and library interface level, service level agreements (SLAs) are used to establish the required level of digital service quality. At the user-library interface level, the library management collects user experiences and perception through various existing instrumentation. Digital service usage data is collected and used in conjunction with the data that had been collected at the user-library interface. This is to enhance user experiences as well as gauge changes to the level of QoS required. The first two level assessments are also used to validate SLAs. The proposed approach is generic and can be applied to all types of libraries that have standalone digital services or provide integrated traditional and digital library services. We believe that the proposed approach provides valuable performance information to digital libraries' decision-makers, and it can assess digital service quality offered by digital libraries to their stakeholders.

The rest of the paper is organized as follows. A high level conceptual framework is presented in Section 2. Various components of the framework are also described. In Section 3, the proposed SLAs framework for third-party sourced services is explained. Finally, the conclusion and future directions are presented in Section 4.

2. Conceptual Framework

The digital library provides $\mathbb{S} = \{S_1, S_2, \dots, S_n\}$ different services (e.g., desktops, e-journals, storage and electronic books) to $\mathbb{U} = \{U_1, U_2, \dots, U_z\}$ libraries service user (LSU). The digital services can be dedicated (e.g., hardware such as desktops) or shared (e.g. databases). Also, each service will have a set of attributes such as service availability that can be quantifiable measures. The library service provider (LSP) contracts the $\mathbb{S}$ services from $\mathbb{P} = \{P_1, P_2, \dots, P_m\}$ digital service providers (DSP) for charge. LSP also provides value-added services such as searching and presentation of information of interest to the LSU. In addition, the LSU is responsible for the planning and provisioning of the digital services within the Library. They ensure that content selections, purchasing licensing and access arrangements are in place and understood by the user community. In addition, the LSP will develop a set of KPI to fulfill its clients' need.

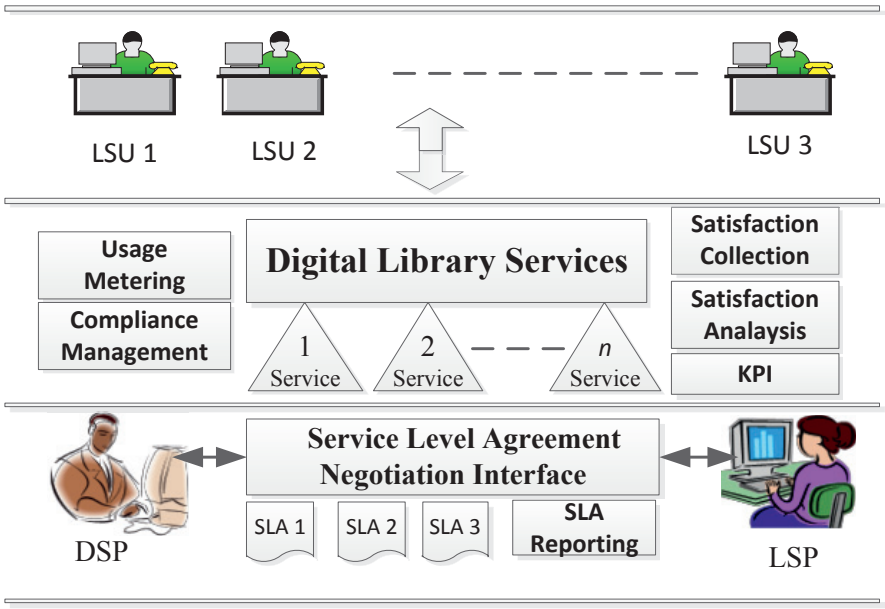

Fig. 1: Conceptual framework

Service Level Agreements (SLAs) are core to the relationship between the digital library service delivery functions and the end-users of the digital services. They capture the mutual understanding and commitment of the

DSP and LSP regarding the service quality requirements and expectations. DSP and LSP will use SLAs Negotiation Interface to negotiate and establish mutually acceptable agreement on the delivery of the service. SLAs 1, SLAs 2 and SLAs 3 contain the terms of the service level agreements as understood by both the DSP and LSP. It covers items such as the responsibilities of each party (including acceptable performance parameters with applicable metrics), a statement on the expected duration of the agreement, a description of the applications and services covered by the agreement, procedures for monitoring the service levels, a schedule for remediation of outages and associated penalties, and problem-resolution procedures. Measuring and reporting SLAs compliance are the core components of any SLA-based system. SLA reporting is vital for both LSP and DSP as it is one of the stages in SLAs process that indicates the level of compliance. KPIs and SLA metrics are used to measure and assess the digital services performance under SLAs reporting. The report serves as the basis of intervention, validation, justification and direction for agreed SLAs. Hence, SLM reporting is vital for both customer and service provider.

2. SLA-based digital library quality evaluation

Service Service Level Agreements (SLAs) have become a valuable tool to help manage service expectations and monitor quality of service (QoS) attributes of services in various domains. QoS may contain many metrics that define the deliverables acceptance criteria or serve as standalone measurements of a single aspect of the delivered service. The aims of SLAs are to implement a framework that adapts to changing business priorities and service levels, define clear objectives to shape the service offered by the provider. Effective SLAs not only ensure the delivery of negotiated service quality, but also serves as an efficient service planning and prediction or adjustment processes. Therefore, properly establishing SLAs is crucial to its successful outcome or otherwise.

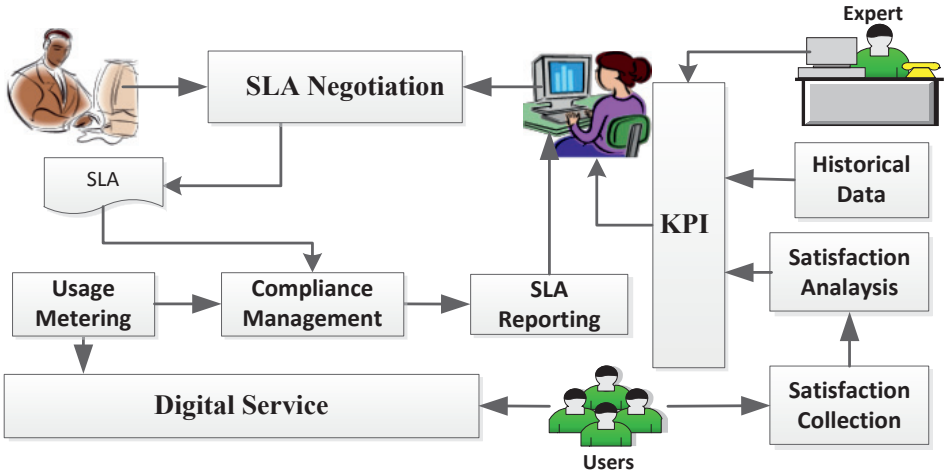

Fig. 2: SLA-based digital service quality evaluation framework

In digital library, the specification and management of QoS is necessary to enhance user experiences. QoS represents the parameters that can be used to characterise and assess the functional and non-functional aspects of digital services. Some of these parameters are objective in nature and can be automatically measured, whereas others are subjective in nature and can only be measured through user evaluations (e.g., focus groups). The proposed SLA-based approach is designed to move away from subjective measures based on opinions. Harris & Rockliff (2003) discussing the scope and contents as well as the role of service agreements in Australian health libraries. Comuzzi et. al (2009) focused on establishing and monitoring SLAs for complex service based systems. The authors use business, software and infrastructures services as a SLAs hierarchies spanning through multiple domain and layers of a service economy. The authors applying the framework to industrial use cases. However, the proposed SLAs framework specifically on the service provider side only. Therefore, the approach is not suitable for digital library QoS measuring where QoS in the library is also expressed by parameters that focus on the

interactive relationship between the libraries with the people whom it is supposed to serve (Hernon & Altman, 2010).

Fig. 2 shows the digital services quality evaluation framework. The purpose of the framework is to achieve expected level of digital service quality, through a periodic cycle of negotiation, agreeing, monitoring and reporting upon delivered digital service. The library benefits from a clearer picture of the library users expectations, the ability to balance and adjust their resources to meet those expectations, as well as explicitly detail the costs associated with any given level of service. To achieve these aims, the library management develops a set of KPIs that dictate what is important to the library clients and the librarians using historical performance data and expert knowledge. The main idea here is to convert both subjective and objective data collected by the librarians using the conventional methods into KPI's. These KPIs define the expectation of the level of service, which the library patrons can expect to receive and specified in terms of an achievable service level. KPIs are specific measurable characteristics of the digital services such as throughput, availability, response time, or quality of support. KPI for the service must accurately reflect the expectations and perceptions of both the service user and service provider. It should also be directly linked to a value, which can be consistently monitored.

The next step is to develop SLA in collaboration with the service provider. A consensus between the digital service provider and library service provider on the services delivery is critical for a service agreement to be successful (Harris & Rockliff, 2003). Basically, SLAs are intended to ensure that the service provider understands the expected service quality level they are supposed to deliver, the customer knows what to expect, and both can see what is actually being delivered. Therefore, the library service providers will need to communicate the quality requirements, how it is monitored and measured with the service providers quite succinctly. To this end, the library management will select and start negotiation with service providers based on its KPI's with the aim to reach a service level agreement (SLAs) that ensures high quality and timely delivery of digital services to support the library business. SLAs must capture the mutual understanding and commitment of the digital service provider and the library management regarding the service quality requirements and expectations. Commitments are responsibilities that digital service providers must meet to fulfil service level agreements for agreed amount of remunerations from the library. In order to avoid misunderstandings, SLAs guarantee terms need to be explicitly related to reasonable, attainable performance levels and measurable metrics. Also, SLAs should formally state the exact settings under which the digital services should be delivered. SLAs should ensure that the level of digital service delivery is objectively measured based on KPIs and should also be in compliance with relevant best practice and standards. The SLA should include a provision in which the service provider agrees to assure the library for any breaches of its agreement. Furthermore, SLAs should be clear and simple to ensure that it is possible to determine compliance.

With the SLAs in place, the library patrons are given access to the services. The library management will collect and analyse information related to its client satisfaction level with the service provided through the conventional mechanisms such as surveys. Even though some of the information collected is subjective, they can serve as a check on the validity of the SLAs. On the other hand, the digital service provider will monitor the quality of the service delivered and generate reports. The service provider will also make SLA report available to help the library management to authenticate and oversee the quality of services delivered through scheduled and on-exception reports. The library management can use the internally collected library client's level of satisfaction with the perceived level of service provided and the reports from the service provider to check how that the commitment as specified in the SLAs is faring, whether service levels have been maintained and whether you are owed any rebates for service outages or to renegotiate the terms of the SLAs if need be. We believe that making the SLAs two-sided and by measuring the end users satisfaction on mutually dependent metrics is a good way to concentrate on the intended outcomes.

4. Case Study

We now illustrate the proposed approach using a networked desktop system provided to the library from a third-party service provider. The motivation for using this example is that people increasingly depend on the local library's public access computers, Internet access, and reference support to search for jobs, take classes, complete homework assignments, obtain medical information, and receive government information and services

(Fleischmann, 2010). The various QoS properties such as availability, accessibility, performance, reliability, and security should be addressed in the creation of SLAs.

The library management identify IT services and service requirements and define, build and negotiate Service Level Agreements (SLAs)

- KPI1: Percentage increase in customer perception and satisfaction of SLAs achievements, via service reviews and customer satisfaction survey responses
- KPI2: The system (i.e., hardware, software, and network) must be functioning and available 99% of the time during business hours.
- KPI3: Customer support for service maintenance requests must not exceed 12hours at most.

KPI1 is for the sole purpose of use by the library. KPI2 dictates system availability guarantees over a period of time. KPI3 includes the typical help desk problem reporting and problem resolution guarantees based on severity level. Severity level and response and resolution times are assigned according to their impact on customers. The acceptable response time and resolution time are negotiated between the IT Service Provider and the Customer.

For the second and third KPIs, the library management will negotiate and develop an SLAs with the service provider. The developed SLAs will specify that if the system fails to meet the negotiated 99% uptime, the library is entitled to reduce its bill by an agreed-on percentage. For instance, if the system is unavailable for an hour, the library is entitled to a 10% rebate of its monthly service fees; in the case of a service outage for two hours, the library is entitled to a 20% rebate of its monthly service fees" and so on. The SLAs also describes the procedures for reporting any problems with the service to the service provider; notifying library management about all scheduled maintenance as well as generating SLAs reports and on-exception reports. It will also include scope for renegotiation and meeting response and resolution times associated with service related incidents. For example, for KPI3, average speed of answer (e.g., 15 seconds), target service level of 95^ calls answered in 15 seconds, and average talk time of less than 3.5 minutes per call can be stated.

The library management will collect satisfaction data through its own instrumentation to measure the level of KPI1 achievement. This is essential for the library to see if the digital service provided capacity is below or above that needed to meet the clients' needs and adjust the service accordingly. This will require renegotiation of the SLAs.

4. Conclusion and Future Directions

The assessment of digital services is a key element in the delivery of digital library services to meet the needs of the library users. In this paper, we have argued that SLAs are principally valuable for correlating library patron experience metrics with the underlying infrastructure components that support the associated business service. We proposed a three-pronged approach for the assessment of digital services quality within a library domain. At the service provider and library interface level, service level agreements (SLAs) are used to establish the required level of digital service quality. At the user-library interface level, the library management collects user experiences and perception through various existing instrument. At the user-service interface level, the digital service usage data is collected and used in conjunction with the data collected. Due to that, the user-library interface is to enhance user experiences as well as gauge changes to the level of QoS required. The first two level assessments are also used to validate SLA. The proposed approach is generic and can be applied to all types of libraries that have standalone digital services or provide integrated traditional and digital library services.

Acknowledgements

The research leading to these results has received funding from the parallel and distributed computing laboratory at Deakin University and the Ministry of Higher Education of Malaysia (MOHE) through its sponsorship on PhD program.

References

Alhamad, M., Dillon, T. & Chang, E. (2010). SLA-Based Trust Model for Cloud Computing. Network-Based Information Systems (NBiS), 13th International Conference on , vol., no., 321-324.

Cecilia Garibay, Humberto Gutierrez & Arturo Figueroa. (2010). Evaluation of a Digital Library by Means of Quality Function Deployment (QFD) and the Kano Model. The Journal of Academic Librarianship 36 (2), 125- 132.

computing." In J.C. Bertot, P.T. Jaeger, & C. McClure (Eds.), Public Libraries and the Internet: Roles, Perspectives, and Implications, (91-102). Santa Barbara, CA: Libraries Unlimited.

Comuzzi, M., Kotsokalis, C., Spanoudakis, G. & Yahyapour, R. (2009). Establishing and monitoring SLAs in complex service based systems, in: Proceedings of the. IEEE International Conference on Web Services, IEEE Computer Society, 783–790.

Fleischmann, K. R. (2010). The public library in the life of the Internet: How the core values of librarianship can shape human-centered

Harris, L. & Rockliff, Sue. (2003). Implementing Library Service Agreements: The Experience of Australian Health Libraries.10th Asia Pacific Special Health and Law Librarians Conference. Adelaide. Retrived from http://conferences.alia.org.au/shllc2003/papers/004.pdf.

Hernon, P. & Altman, E.(2010). Assessing Service Quality: Satisfying the expectations of library customers. American Library Association, Chicago, IL.

Jun Woo Kim & Sang Chan Park. (2010). Outsourcing strategy in two-stage call centers. Computers & Operations Research. 37 , 790-805.

Kaur, K. & Diljit, S.(2012). Modelling Web-based library service quality. Library information Science Research, 34 (3),184-196.

Nor Irvoni Mohd. Ishar and Mohd. Saidfudin Masodi. (2012). Students' Perception towards Quality Library Service Using Rasch Measurement Model. Innovation Management and Technology Research (ICIMTR), International Conference on, vol., no.,668-672.

Parasuraman, A.,Valarie A. Z. & Arvind M. (2005). E-S-QUAL: A Multiple-Item Scale for Assessing Electronic Service Quality. Journal of Service Research, 7(3), 213–3.

Plum, T., Franklin, B., Kyrillidou, M., Roebuck, Gary. & Davis, M. (2010) "Measuring the impact of networked electronic resources: Developing an assessment infrastructure for libraries, state, and other types of consortia", Performance Measurement and Metrics, 11(2),184 -198.

Shang Gao, John Krogstie & Keng Siau. (2011). Developing an instrument to measure the adoption of mobile services. Mobile information systems, 7 (1), 45-.

Vinagre, M. H., Leonor G. P. & Paula O.(2011). Revisiting digital libraries quality: a multiple-item scale approach. Performance Measurement and Metrics, 12(3),214–236.