

IMPROVING THE DOCUMENTATION OF USER'S REQUIREMENTS FOR
E-SERVICE SYSTEMS USING SERVICE RESPONSIBILITY TABLE

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This dissertation is dedicated to my late father and my mother for her endless support and encouragement.

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ABSTRACT

Popularity of the internet has caused an increase in the demand and usage of e-service systems. E-Service is defined as acts or performances that are delivered through electronic devices and networks to help people complete tasks, solve problems, or conduct transactions. The nature of e-service poses challenges in analyzing and developing the e-service systems. In recent years, UML as a tool used for analyzing systems has been criticized by several researchers and practitioners for its complexity and lack of comprehension. This has caused difficulties in using UML to analyse e-service system. As a result of this, Service Responsibility Tables (SRT) has been proposed to be used for analyzing e-service systems. Service responsibility tables is a light weight analysis tool was developed based on the concept of service value chain framework, which focuses on the activities and responsibilities of both service providers and customers based on the broad observation that service tends to be co-produced by service producers and service consumers. This research investigates the usability of SRTs as an informal language and light weight analysis tool for analyzing e-service systems, using Graduate Studies Management System (GSMS) as a case study and presents the evaluation of the tool by the users. Furthermore, the research proposed a heuristics approach for transforming the SRTs into activity diagrams and sequence diagram. From the evaluations, we found that the proposed heuristic approach could increase the involvement of users in requirements determination process and hence improve the documentation of users' requirements for e-service systems.

ABSTRAK

Populariti internet telah menyebabkan peningkatan dalam permintaan dan penggunaan sistem e-perkhidmatan. E-Perkhidmatan ditakrifkan sebagai tindakan atau persembahan yang dihantar melalui alat-alat elektronik dan rangkaian untuk membantu orang tugas-tugas yang lengkap, menyelesaikan masalah, atau transaksi yang laku. Sifat e-perkhidmatan menimbulkan cabaran dalam menganalisis dan membangunkan sistem e-perkhidmatan. Dalam tahun-tahun kebelakangan ini, UML sebagai alat yang digunakan untuk menganalisis sistem telah dikritik oleh beberapa penyelidik dan pengamal untuk kerumitan dan kekurangan kefahaman itu. Ini telah menyebabkan kesukaran dalam menggunakan UML untuk menganalisis sistem e-perkhidmatan. Hasil daripada ini, Jadual Tanggungjawab Perkhidmatan (SRT) telah dicadangkan untuk digunakan untuk menganalisis sistem e-perkhidmatan. Jadual tanggungjawab Perkhidmatan adalah berat analisis alat cahaya dibangunkan berdasarkan konsep perkhidmatan nilai rangka rantai, yang memberi tumpuan kepada aktiviti-aktiviti dan tanggungjawab kedua-dua pembekal perkhidmatan dan pelanggan berdasarkan pemerhatian yang luas yang perkhidmatan cenderung untuk bersama-dihasilkan oleh pengeluar perkhidmatan dan pengguna perkhidmatan. Kajian ini menyiasat kebolegunaan SRTs sebagai bahasa rasmi dan ringan alat analisis untuk menganalisis sistem e-perkhidmatan, dengan menggunakan Sistem Pengurusan Pengajian Siswazah (GSMS) sebagai kajian kes dan membentangkan penilaian alat oleh pengguna. Tambahan pula, kajian ini mencadangkan pendekatan heuristik untuk mengubah SRTs ke rajah aktiviti dan rajah jujukan. Dari penilaian, kami mendapati bahawa pendekatan heuristik yang dicadangkan itu boleh meningkatkan penglibatan pengguna dalam proses penentuan keperluan dan dengan itu meningkatkan dokumentasi keperluan pengguna bagi sistem e-perkhidmatan.

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LIST OF ABBREVIATIONS

UML	-	Unified Modeling Language
SRT	-	Service Responsibility Tables
IRD	-	Information Requirements Determination
WWS	-	Work System Snapshot
WSA	-	Work System Approach

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CHAPTER 1

INTRODUCTION

This Chapter contains introduction and background information of the study. The chapter also briefly explained e-service systems and highlights the problems in e-service requirements elicitation and documentation. The objectives and scope of the study is also discussed in the Chapter.

1.1 Background of the Study

In recent years people's lives have changed due to the introduction of the internet and other information and communication technologies. This has changed the way people live and do business across the globe by embracing e-service systems in conducting our business transactions. The increasing benefits of e-service systems has caused increasing demand in their development by businesses and organizations (Swamynathan et al., 2006). As usage and demand for e-service systems keeps increasing, developing the systems becomes challenging as a result of difficulties in identifying and documenting users requirements. This has made it necessary for systems analyst and designers to analyze and understand user's requirements and carefully reflect those requirements in the system construction (Fraser, 1991).

There have been several instances of software development failures in Information Systems field, which have attracted the attention of Information System researchers (Siau and Tan, 2005). It has been observed that one of the leading cause of system failures are failures from requirements determination (Browne and Ramesh, 2002). It is therefore crucial to identify and document users' requirements for the system being built during the analysis stage of the system.

System analysis and design is a process that involves series of activities conducted in order to investigate an organization or business environment with a view to identifying users' requirements for a system, hardware requirements, financial implications, personnel requirement and risk if there is any, followed by modeling, design and finally the implementation. Since the introduction of object oriented system analysis and design, Unified modeling language (UML) emerged as the de factor standard for object oriented modeling (Dobing and Parsons, 2008).

UML is defined as “graphical modeling language for modeling system requirements, describing design artifacts and specifying implementation details” (Tan et al., 2011). UML is “a language with rigorous syntax and grammar” that is very difficult to learn especially by novice developers. UML is more complicated because it is designed to be more comprehensive to be able to cover various requirements, as a result it usually difficult to develop UML diagrams. A study by Agarwal and Sinha (2003) discovered that non I.T professional found difficulties in using UML therefore could not be able to verify the documented requirements by analyst.

One of the most important aspects in systems development process is requirement engineering. Without a well documented requirements specification developers will not know what to develop and the users can not even emerging what type of system they will have, as such no one can validate if the developed system can meet the requirements of the user (Tan et al., 2011).

Requirement engineering can be defined as the process of elicitation and specification of requirements followed by documentation and validation of the requirements against the need of the user (Saiedian and Dale, 2000). Requirements engineering can only be successful when there is maximum participation of the user. Several studies have also emphasized on the participation of users, and good communication between users and analyst during requirements elicitation and documentation, but lack of understanding of the tool (Unified Modeling Language) used in representing requirements has been a major factor limiting users participation, because of the theoretical and structural complexities of UML which leads to cognitive complexity in humans (Siau et al., 2005).

1.2 Problem Statement

Information requirements determination is difficult process in systems analysis and design that requires the involvement users for successful implementation (Browne and Ramesh, 2002). Despite the general emphasis and agreement on user involvement in systems analysis and design, the level and quality of user involvement is yet in adequate due the difficulties in requirements identification and lack of comprehension Unified Modeling Language (Tan and Alter, 2008).

The introduction of object oriented system analysis and design led to the phenomenon of object oriented modeling there by introducing Unified Modeling Language (UML) as the standard tool for systems analysis and design. It is used in eliciting and documenting requirements followed by modeling of the intending system. UML is very comprehensive with various diagrams and notations that are difficult to understand by business professionals; as such it becomes difficult for users with no technical background to understand the requirements (models).

Communication between users and analyst has been emphasized by several researchers but the complexity of Unified Modeling Language (UML) affects communication between analyst and users (Business professionals). Furthermore the representation of business processes in diagrams and notations of UML makes it difficult for users to understand, as such could not verify the accuracy of the requirements. Therefore OOAD and the standard tool used in OOAD (UML) are considered as a method and tool for IT professionals because they emphasizes on IT views and artifacts that IT professionals need to produce software rather than identifying and improving the business processes (Alter, 2012).

Interaction and collaboration between business and IT professionals should be organized around concept that the business professionals can understand, to enable them participate and communicate effectively with the IT professionals in requirements determination process (Tan, Alter et al, 2011, Alter, 2012). These problems motivated series of researches with a view to provide a method and a tool that could be utilized by both the IT professionals and the business professionals. In view of the work system approach was introduced to help business professionals analyse work systems. Another result of these researches was the introduction of an informal lightweight analysis tool Service Responsibility Tables (SRTs) to supplement the formal modeling tool Unified Modeling Language (UML) in analyzing e-service systems.

The problems caused by using OOAD method and UML as a tool to represent user requirements can be summarized as follows:

- i. There are difficulties in identifying users' requirements due to the nature of e-service systems (Rowley, 2006).
- ii. Difficulties in representing and documenting user requirements with UML diagrams (Glinz, 2000, Dobing and Parsons, 2006).

- iii. Non IT professional have difficulties in understand requirement models developed with UML therefore cannot verify the documented requirements (Dawson and Swatman, 1999, Glinz, 2000).

1.3 Research Question

Based on the problems presented above, the research questions have been derived as follows:

“What are the factors that affect elicitation and documentation of users’ requirements for e-service systems”?

1. What are the difficulties in elicitation and documentation of users’ requirements for e-service systems?
2. What are the problems of using UML in elicitation and documentation of users’ requirements for e-service systems?
3. How can Service Responsibility Tables (SRTs) as a tool improve the elicitation and documentation of user’s requirements for e-service systems?

1.4 Aim and objectives of Research

The aim of the research is to recommend Service Responsibility Table (SRT) as a tool for eliciting and documenting users’ requirements for e-service systems and to propose a framework of applying SRT. To achieve the aim of the study, three objectives were identified as follows;

- i. To study the problems affecting elicitation and documentation of users' requirements for an e-service system using UML as a tool.
- ii. To recommend using Service Responsibility Table (SRT) as a tool to improve the eliciting and documenting users' requirements for e-service systems and evaluate the usability of (SRT) in analyzing e-service systems.
- iii. To propose method of transforming Service Responsibility Table (SRT) to activity and sequence diagram.

1.5 Research Scope

As a case study research, Graduate Studies Management System (GSMS) of School of Post Graduate Students (SPS) in UTM is used for the research. A requirement analysis of Graduate Studies Management System was carried out using interviews to identify requirements of the system and use Service Responsibility Tables (SRTs) to document the system requirements. Questionnaire was also used to collect responses on the usability of SRT from the stakeholders.

1.6 Significance of Research

Significance of the study is to improve in the documentation of user's requirement in e-service systems, in Universiti Teknologi Malaysia (UTM) and other stakeholders using e-service systems.

REFERENCES

- AGARWAL, R. & SINHA, A. P. 2003. Object-oriented modeling with UML: a study of developers' perceptions. *Commun. ACM*, 46, 248-256.
- ALTER, S. 2003. 18 Reasons why IT-Reliant Work Systems should replace “The IT Artifact” As The Core Subject Matter Of The IS Field. *Communications of the Association for Information Systems (Volume 12, 2003)*, 365, 365.
- ALTER, S. 2007. Service Responsibility Tables: A new Tool for Analysing and Designing Systems. *13th American Conference on Information Systems*, 1-10.
- ALTER, S. 2008. Service system fundamentals: Work system, value chain, and life cycle. *IBM Systems Journal*, 47, 71-85.
- ALTER, S. 2010. Viewing systems as services: a fresh approach in the IS field. *Communications of the association for information systems*, 26.
- ARLOW, J., EMMERICH, W. & QUINN, J. 1999. Literate modelling—capturing business knowledge with the uml. *The Unified Modeling Language.«UML»'98: Beyond the Notation*, 514-514.
- B. DOBING, J. P. 2006. How UML is used. *Communications of the ACM*, 49, 109-113.
- BABBIE, E. R. 2012. The Practice of Social Research. *Book*.
- BATRA, D. 2008. Unified Modeling Language (UML) Topics.
- BOYER, K. K., HALLOWELL, R. & ROTH, A. V. 2002. E-services: operating strategy—a case study and a method for analyzing operational benefits. *Journal of Operations Management*, 20, 175-188.
- BROWNE, G. J. & RAMESH, V. 2002. Improving information requirements determination: a cognitive perspective. *Information & Management*, 39, 625-645.

- DAVIS, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.
- DAVIS, G. B. 1982. Strategies for information requirements determination. *IBM Systems Journal*, 21, 4-30.
- DAWSON, L. & SWATMAN, P. The use of object-oriented models in requirements engineering: a field study. Proceedings of the 20th international conference on Information Systems, 1999. Association for Information Systems, 260-273.
- DE VAUS, D. 2002. Surveys in social research.
- DEMING, W. E. 1990. *Sample design in business research*, Wiley-Interscience.
- DOBING, B. & PARSONS, J. 2006. How UML is used. *Commun. ACM*, 49, 109-113.
- DOBING, B. & PARSONS, J. 2008. Dimensions of UML diagram use: a survey of practitioners. *Journal of Database Management*, 19, 1-18.
- EISENHARDT, K. M. 1989. Building Theories from Case Study Research. *Academy of Management Review*, 14, 532-550.
- ERICKSON, J. 2008. A decade and more of UML: An overview of UML semantic and structural issues and UML field use. *Journal of Database Management*, 19.
- FRASER, M. D. K., K.; VAISHNAVI, V.K. 1991. Informal and formal requirements specification languages: bridging the gap. *IEEE Transactions on Software Engineering*, 17, 454.
- FROSCH-WILKE, D. Using UML in software requirements analysis—Experiences from practical student project work. 2003.
- GEORGE, D. & MALLERY, P. 2003. *SPSS for Windows Step by Step: A Simple Guide and Reference* Boston: Pearson Education, Inc.
- GLINZ, M. 2000. Problems and Deficiencies of UML as a Requirements Specification Language. *Proceedings of the 10th International Workshop on Software Specification and Design*. IEEE Computer Society.
- JAVALGI, R. G., MARTIN, C. L. & TODD, P. R. 2004. The export of e-services in the age of technology transformation: challenges and implications for international service providers. *Journal of Services Marketing*, 18, 560-573.

- KALIANNAN, M. & AWANG, H. 2008. ICT to Enhance Administrative Performance: A Case Study from Malaysia. *International Journal of Business and Management*, 3, 78-84.
- KIM, J., HAHN, J. & HAHN, H. 2000. How do we understand a system with (so) many diagrams? Cognitive integration processes in diagrammatic reasoning. *Information Systems Research*, 11, 284-303.
- MERRIAM, S. B. 1998. Qualitative Research and Case Study Application in Education. . *San Francisco: Jossey-Bass*.
- POHL, K. 1996. *Process-Centered Requirements Engineering*, John Wiley & Sons, Inc.
- ROWLEY, J. 2006. An analysis of the e-service literature: towards a research agenda. *Internet Research*, 16, 339-359.
- RUST, R. T. & KANNAN, P. K. 2003. E-service: a new paradigm for business in the electronic environment. *Commun. ACM*, 46, 36-42.
- SAIEDIAN, H. & DALE, R. 2000. Requirements engineering: making the connection between the software developer and customer. *Information and Software Technology*, 42, 419-428.
- SANTOS, J. 2003. E-service quality: a model of virtual service quality dimensions. *Managing service quality*, 13, 233-246.
- SIAU, K., ERICKSON, J. & LEE, L. 2005. Theoretical vs. practical complexity: The case of UML. *Journal of Database Management (JDM)*, 16, 40-57.
- SIAU, K. & LEE, L. 2004. Are use case and class diagrams complementary in requirements analysis? An experimental study on use case and class diagrams in UML. *Requirements engineering*, 9, 229-237.
- SIAU, K. & LOO, P.-P. 2006. Identifying difficulties in learning UML. *Information Systems Management*, 23, 43-51.
- SIAU, K. & TAN, X. 2005. Improving the quality of conceptual modeling using cognitive mapping techniques. *Data & Knowledge Engineering*, 55, 343-365.
- SWAMYNATHAN, S., KANNAN, A. & GEETHA, T. V. 2006. Composite event monitoring in XML repositories using generic rule framework for providing reactive e-services. *Decision Support Systems*, 42, 79-88.

- TAN, X. & ALTER, S. 2008. Linking Lightweight and Heavyweight Systems Analysis by Converting Service Responsibility Tables into UML Diagrams. *Special Interest Group on Systems Analysis and Design*, 1-10.
- TAN, X., ALTER, S. & SIAU, K. 2008. Integrating Lightweight Systems Analysis into the United Process by Using Service Responsibility Tables. *American Conference on Information Systems*, 64.
- TAN, X., ALTER, S. & SIAU, K. 2011. Using service responsibility tables to supplement UML in analyzing e-service systems. *Decision Support Systems*, 51, 350-360.
- TILLEY, S. & HUANG, S. A qualitative assessment of the efficacy of UML diagrams as a form of graphical documentation in aiding program understanding. Proceedings of the 21st annual international conference on Documentation, 2003. ACM, 184-191.
- TRUEX, D., LAKEW, N., ALTER, S. & SARKAR, S. 2012. Extending a systems analysis method for business professionals. *Practical Aspects of Design Science*. Springer.
- WARD, J. L. & PEPPARD, J. 2002. *Strategic planning for information systems*, Wiley.
- YANG, Z. & JUN, M. 2002. Consumer perception of e-service quality: from internet purchaser and non-purchaser perspectives. *Journal of Business strategies*, 19.
- YIN, R. K. 2003. *Case Study Research: Design and Methods*, SAGE Publications.