SERVICE ORIENTED ARCHITECTURE (SOA)
IMPLEMENTATION FRAMEWORK FOR HETEROGENEOUS
INFORMATION SYSTEMS INTEGRATION

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SERVICE ORIENTED ARCHITECTURE (SOA) IMPLEMENTATION FRAMEWORK FOR HETEROGENEOUS INFORMATION SYSTEMS INTEGRATION

A Thesis submitted to the UUM College of Arts and Sciences in fulfilment of the requirements for the degree of Master of Science

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Abstrak

Kepelbagaian sistem maklumat (IS) menyukarkan untuk menyatukan data secara automatik dalam persekitaran IS yang berlainan. Keadaan ini telah menyebabkan kos operasi and penyelenggaraan meningkat dan juga pembaziran ruang simpanan data, yang berpunca daripada data yang bertindan. Semenjak kemunculan aliran terkini pembangunan IS, iaitu Senibina Berasaskan Perkhidmatan (SOA), ramai pengkaji telah mencadangkan pelbagai model konseptual dan rangka kerja SOA. Objektif utama usaha ini adalah untuk menjadi panduan untuk mengaplikasi SOA dengan jayanya. Di Malaysia, banyak institut pengajian tinggi telah mengambil satu inisiatif untuk melaksanakan sistem berasaskan SOA untuk meningkatkan kualiti persembahan IS. Walau bagaimanapun, kebanyakan rangka kerja SOA yang sedia ada masih kekurangan dari segi reka bentuk yang bagus untuk menyokong penyatuan kepelbagaian IS. Dalam mengisi kekurangan ini, kajian ini dijalankan untuk mencari ruang bagi menambahbaik rangka kerja pelaksanaan SOA yang sedia ada dalam integrasi kepelbagaian IS. Satu kombinasi kepelbagaian rangka kerja yang sedia ada dan persetujuan dari para pakar telah menghasilkan satu rangka kerja baru SOA. Kaedah kajian kes di sebuah universiti awam Malaysia telah diaplikasikan untuk menguji dan mengesahkan rangka kerja tersebut dengan menjalankan ekperimen prototaip dengan memfokuskan kepada beberapa sistem maklumat pelajar. Penilaian dari para pengguna menunjukkan rangka kerja yang diusulkan itu telah memenuhi beberapa kriteria SOA seperti berasaskan perkhidmatan, kemaskini data dalam masa yang nyata serta kebolehan capaian dan dibuktikan dengan jayanya melalui ekperimen prototaip. Dengan penemuan dan hasil dari kajian ini, satu penambahbaik kerja penyelesaian SOA telah dipenuhi dengan memfokuskan di dalam integrasi kepelbagaian IS. Ini adalah satu sumbangan baru kepada badan pengetahuan dalam bidang SOA dalam aspek penyatuan kepelbagaian IS di universiti awam Malaysia.

Abstract

Heterogeneous information systems (IS) creates difficulties to automatically integrate data in different IS environment. These situations have increased operating and maintenance costs as well as wasteful data storage, which is caused by data redundancy. Since the emerging of Service Oriented Architecture (SOA), the latest trend in IS development, many researchers have proposed various SOA conceptual models and frameworks. The main objective behind these efforts was to provide a guideline for a successful SOA adoption. In Malaysia, higher learning institutions have taken some initiatives to implement SOA-based systems to improve the quality of IS performance. However, most of the existing SOA frameworks available are still lacking of good design to support an integration of heterogeneous IS. In order to fill this gap, this study was conducted to seek for an opportunity to enhance the existing SOA implementation frameworks of heterogeneous IS integration. A consolidation of the existing related frameworks and consensus from experts yield a new SOA framework. A case study approach in a Malaysia public university was applied to test and validate the framework by conducted prototyping experiments with the focus on several student information systems. The evaluation from the users shows that the proposed framework has met SOA criteria like service based, data update in real time and accessibility. This finding has been proven with successful prototype experiments. With the findings and results of this study, an enhancement of SOA implementation framework was fulfilled by focusing on integrating heterogeneous IS. This is a new contribution SOA domain in the context of heterogeneous IS integration in Malaysia public universities.

Keywords: Service Oriented Architecture, Heterogeneous integration, Information systems.
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# Table of Contents

Permission to Use ......................................................................................................................... i
Abstrak........................................................................................................................................... ii
Abstract.......................................................................................................................................... iii
Acknowledgement........................................................................................................................... iv
Table of Contents............................................................................................................................ v
List of Tables.................................................................................................................................... ix
List of Figures................................................................................................................................... x
List of Appendices.......................................................................................................................... xii
List of Abbreviations....................................................................................................................... xiii

## CHAPTER ONE INTRODUCTION.................................................................................. 1

1.1 Problem Background............................................................................................................... 2
1.2 Problem Statement................................................................................................................... 3
1.3 Research Questions.................................................................................................................. 4
1.4 Research Objectives............................................................................................................... 5
1.5 Research Scope....................................................................................................................... 5
1.6 Research Framework............................................................................................................... 6
1.7 Significance of the Study........................................................................................................ 8
1.8 Research Contribution............................................................................................................ 8
1.9 Organization of the Report..................................................................................................... 8
1.10 Summary............................................................................................................................... 9

## CHAPTER TWO LITERATURE REVIEW.................................................................... 10

2.1 Heterogeneous Information Systems...................................................................................... 10
   2.1.1 Issues of Heterogeneous IS in HL.................................................................................... 11
2.1.2 Case Study in a Malaysia HLI ................................................................. 12
2.2 Heterogeneous IS Integration Approaches .................................................. 14
  2.2.1 Traditional Approach .............................................................................. 15
  2.2.2 Modern Approaches .............................................................................. 17
    2.2.2.1 Loosely vs Tightly Coupled ............................................................. 17
  2.2.3 Service Oriented Architecture (SOA) .................................................... 20
    2.2.3.1 SOA Characteristics ....................................................................... 22
  2.3 Existing SOA Models ............................................................................... 25
    2.3.1 SOA Models for Integration of Heterogeneous IS ............................... 28
    2.3.2 SOA Models for IS Integration in HLI ................................................ 31
    2.3.3 SOA in Malaysia’s HLI ...................................................................... 33
  2.4 Factors of Succeeding SOA for Malaysia HLI ........................................... 35
    2.4.1 SOA Frameworks and Models .............................................................. 35
    2.4.2 Technologies Support ......................................................................... 36
  2.5 SOA Validation Techniques ...................................................................... 38
    2.5.1 Prototypes Experiments ..................................................................... 39
      2.5.1.1 SOA Development Methods .......................................................... 40
  2.6 Summary .................................................................................................... 42

CHAPTER THREE METHODOLOGY ................................................................. 43

3.1 Research Design ........................................................................................... 43
3.2 Phase 1: Problem Definition ....................................................................... 44
3.3 Phase 2: Suggestion ...................................................................................... 45
3.4 Phase 3: Framework Construction .............................................................. 46
3.5 Phase 4: Evaluation and Validation ............................................................ 47
  3.5.1 Case Study ............................................................................................. 47
CHAPTER FOUR ANALYSIS AND DESIGNING FRAMEWORK.........51

4.1 Introduction.................................................................51

4.2 Fact-findings Analysis.......................................................51

4.2.1 The Case of Universiti Utara Malaysia.................................51

4.2.1.1 Information Systems Profile..........................................52

4.2.1.2 The Existing SIS Architecture.......................................53

4.2.2 The Consolidation of SOA Models.................................57

4.3 Data Analysis for Interviewing........................................58

4.3.1 Interview with SIS Stakeholders.......................................59

4.3.2 Interview with SOA Experts...........................................60

4.4 SOA to use into SIS.......................................................64

4.5 The Designing...............................................................65

4.5.1 Architecture for SoSIS..................................................66

4.5.2 Framework Construction..............................................67

4.6 Summary.................................................................73

CHAPTER FIVE RESULTS AND DISCUSSION............................75

5.1 Expert Review..............................................................75

5.1.2 The Revised Implementation Framework..........................76

5.2 Users Evaluation............................................................78

5.2.1 Prototype 1: Academic and Student Information System (ASIS)...........79

5.2.2 Prototype 2: Learning Zone System (LZS)..........................81

5.2.3 Prototype 3: Library System........................................84
List of Tables

Table 1.1 Research Framework ................................................................. 7
Table 2.2 SOA Characteristics................................................................. 25
Table 2.3 Characteristics of the popular technologies used in SOA implementation .37
Table 3.1 Summary of the Theoretical Relationship .................................. 50
Table 4.1 The Important Elements for SOA Implementation..................... 57
Table 4.2 The Current Heterogeneous SIS in UUM................................. 59
Table 5.1 Result of Experts Review ....................................................... 76
Table 5.2 The Average Users’ Evaluation Result................................. 86
List of Figures

Figure 1.1. The heterogeneous SIS ................................................................. 6

Figure 2.1. The Scenario of the IS Communication in UUM .................. 13

Figure 2.2. Data Warehouse Integration Approach .................................. 18

Figure 2.3. Classification of Data Integration Approach Characteristic (Adopted from Hribernik et al. (2009)) ................................................................. 19

Figure 2.4. SOA Theory (Adopted from Michlmayr et al., 2007) .............. 22

Figure 2.5. SOA Practice (Adopted from Michlmayr et al.,2007) .............. 23

Figure 2.6. SOA Reference Model that proposed by Selamat and Kharusi (2009) ..... 26

Figure 2.7. CAPSICUM Model, proposed by Roach et al. (2008) .......... 27

Figure 2.8. Framework by Huang et al. (2010) .......................................... 29

Figure 2.9. Framework by Yan-heng et al. (2010) ................................. 30

Figure 2.10. SOA Framework by Li (2013) .................................................. 31

Figure 2.11. SOA framework proposed by Alkhanak and Mokhtar (2009) .... 34

Figure 2.12. Simulation model (Adopted from Robinson, 2008) ............. 41

Figure 3.1. The research methodology (source: own work) ..................... 44

Figure 3.2. The Phases of SOAM (Adopted from Offermann and Bub (2009)) 49

Figure 4.1. SIS Architecture of UUM Systems .......................................... 53

Figure 4.2. LZS Architecture ................................................................. 56

Figure 4.3. Conceptual Model for SOA Requirements (Source: Own Work) .. 58

Figure 4.4. Service Concept ................................................................. 62
Figure 4.5. Top-Down Approach.................................................................63
Figure 4.6. Joint service of SOA approach (adopted from Anne Thomas Manes, VP & Research Director of Burton Group, 10 Jan 2008) ...........................................65
Figure 4.7. IS Architecture in Designing Phase........................................66
Figure 4.8. The Proposed SoSIS Architecture...........................................67
Figure 4.9. Deployment Diagram of SoSIS Integration...............................68
Figure 4.10. Initial Framework of SoSIS..................................................70
Figure 5.1. The Proposed SOA Implementation Framework ......................77
Figure 5.2. Flow chart of ASIS Main Functions.......................................80
Figure 5.3. The Student List’ Page ..........................................................80
Figure 5.4. Online Form for Entering New Student Data..........................81
Figure 5.5. Flow chart of LZS Main Functions.........................................82
Figure 5.6. The Real Time Integration with ASIS.....................................83
Figure 5.7. Student Profile from Lecturer View of LZS.............................83
Figure 5.8. Flow chart of LZS Main Functions.........................................84
Figure 5.9. List of Library Members’ Page ..............................................85
Figure 5.10. Checking Status Student Directly to ASIS for Borrowing Books Permission.................................................................85
List of Appendices

Appendix A  Permission Letter for Experts Review ... Error! Bookmark not defined.

Appendix B  Questions for SOA Experts ................. Error! Bookmark not defined.

Appendix C  Users Evaluation Form ................................................................. 112

Appendix D  Declaration .................................................................................. 113
## List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADX</td>
<td>Advance Data Exchange</td>
</tr>
<tr>
<td>ASIS</td>
<td>Academic and Student Information System</td>
</tr>
<tr>
<td>CORBA</td>
<td>Common Object Request Broker</td>
</tr>
<tr>
<td>DCOM</td>
<td>Distributed Component Object Model</td>
</tr>
<tr>
<td>EA</td>
<td>Enterprise Architecture</td>
</tr>
<tr>
<td>ebXML</td>
<td>Electronic Business using eXtensible Markup Language</td>
</tr>
<tr>
<td>ERP</td>
<td>Enterprise Resource Planning</td>
</tr>
<tr>
<td>ESB</td>
<td>Enterprise Service Bus</td>
</tr>
<tr>
<td>GAIS</td>
<td>Graduate Academic Information System</td>
</tr>
<tr>
<td>HLI</td>
<td>Higher Learning Institution(s)</td>
</tr>
<tr>
<td>IS</td>
<td>Information System(s)</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>JSP</td>
<td>Java Script Programming</td>
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<tr>
<td>LMS</td>
<td>Learning Management System</td>
</tr>
<tr>
<td>LZS</td>
<td>Learning Zone System</td>
</tr>
<tr>
<td>PHP</td>
<td>Hypertext Pre-processor</td>
</tr>
<tr>
<td>QoS</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>RPC</td>
<td>Remote Procedure Call</td>
</tr>
<tr>
<td>RUP</td>
<td>Rational Unified Process</td>
</tr>
<tr>
<td>SOA</td>
<td>Service Oriented Architecture</td>
</tr>
<tr>
<td>SOAP</td>
<td>Simple Object Access Protocol</td>
</tr>
<tr>
<td>SIS</td>
<td>Student Information System</td>
</tr>
<tr>
<td>UDDI</td>
<td>Universal Description Discovery and Integration</td>
</tr>
<tr>
<td>SoSIS</td>
<td>Services oriented Student Information Systems</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
</tr>
<tr>
<td>WSDL</td>
<td>Web Services Description Language</td>
</tr>
<tr>
<td>WS</td>
<td>Web Service</td>
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<tr>
<td>XML</td>
<td>eXtended Markup Language</td>
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CHAPTER ONE
INTRODUCTION

Service-oriented architecture (SOA) approach was emerging as a popular design concept of an information system (IS) development in recent years. SOA is an architectural style that is based on service concept (Erl, 2009). Many people have begun to talk about SOA and its advantages in contributing to agile IS development and efficient management on a number of articles have been published a year after year (Mohammed Al-Khannaq, 2009; Perniu, 2010; Yihui, 2011; Börner & Goeken, 2012). However, since SOA is still new for most organizations, many stakeholders of the organizations are concerned on appropriate way to implement SOA approach for their organizations’ IS (Balk, 2008; Li, Chen, Zhu, & Chung, 2010; Ma & Liu, 2013). To overcome this shortcoming, the related researchers such as Roach, Low and D’Ambra (2008), Alghafri et al. (2009), Jabr and Al-omari (2010), and Razavian and Lago (2010) had published their conceptual models and frameworks as a guide to help peoples understand SOA adoption and implementation. Nevertheless, there are still lack of a good framework design for SOA implementation (Moody, 2005; Pansa, Walter, Abeck, & Scheibenberger, 2010; Aydin & Yalcinkaya, 2011). This issue also was suggested to be solved by Pansa, Walter, Abeck, and Scheibenberger (2010) and Trkman, Kova, and Kardeljeva (2011) that claimed a framework of SOA implementation should be presented in details and clearly.

Previous studies (Lupu, Bologa, Sabau, & Muntean, 2008; Pasatcha & Sunat, 2008; MohammedAl-Khannaq, 2009) found that in education domain, many higher learning institutions (HLI) has seen an increased numbers of stakeholders, who are interested in exploring and implementing SOA into their organizations’ IS to leverage SOA
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