An Investigation of System Integrations and XML Applications within a NZ Government Agency

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Information Systems

at

Massey University, New Zealand

by

Steven Li

2009
ABSTRACT

With the evolution of Information Technology, especially the Internet, system integration is becoming a common way to expand IT systems within and beyond an enterprise network. Although system integration is becoming more and more common within large organizations, however, the literature review had found IS research in this area had not been sufficient, especially for the development of integration solutions within large organizations. It has made research like this one conducted within a large NZ government agency necessary. Four system integration projects were selected and studied using case study research methodology. The case study was designed and conducted using guidelines mainly from the well-known R. K. Yin’s (2002) “Case Study Research” book.

The research was set to seek answers for a series of research questions, which were related to requirements of system integration and challenges for solution development. Special attention had been given to XML applications, as system integration and XML were found to be coupled in many system integrations and frameworks during the literature review. Data were first gathered from all four projects one by one, and then the bulk of analysis was done on the summarized data. Various analysis methods including chain-of-evidence, root-cause-analysis and pattern-matching were adopted. The principles of interpretive research proposed by Klein and Myers (1999) and triangulation were observed.

In conclusions, a set of models have been derived from the research, namely a model for clarifying integration requirements; a model for integration solution architecture; a model for integration development life cycle and a model of critical success factor for integration projects. A development framework for small to medium size integration projects has also been proposed based on the models. The research also found XML application indeed would play an important role for system integration; the critical success factors for XML application included suitable development tools, development skills and methodologies.
ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to my supervisors, Dr. Alexei Tretiakov and Dr. Dick Whiddett, for the invaluable guidance and generous help given throughout this research project. This research would never have been possible without their guidance and support.

I am deeply grateful to my employer, a New Zealand government agency, for supporting me during my entire study in Massey University. I am especially grateful to the people from the IT team of the agency for allowing and assisting me to conduct this research project. Special thanks also go to people who have provided comment and feedback for the draft report. Without the generous help from all these people, this research would not have been possible to complete.

I am as ever, especially indebted to my family for their love and support throughout my study. They are the ultimate source for my energy and study effort. I wish to express my wholehearted appreciation and gratitude to them all.
# Table of Contents

Chapter 1 Introduction .......................................................................................................................... 1
  1.1 Research Background ................................................................................................................ 1
  1.2 Research Objectives .................................................................................................................. 1
  1.3 Significance ................................................................................................................................... 1

Chapter 2 Literature Review ................................................................................................................ 5
  2.1 Introduction .................................................................................................................................. 5
  2.2 System Integration ......................................................................................................................... 6
  2.3 Enterprise Application Integration .............................................................................................. 27
  2.4 Development of System Integration ........................................................................................... 46
  2.5 Perspectives of XML Application ............................................................................................... 65
  2.7 Review Conclusions ................................................................................................................... 88

Chapter 3 Research Proposal and Method ........................................................................................ 91
  3.1 Research Questions ..................................................................................................................... 91
  3.2 Research Methodology ................................................................................................................ 94
  3.3 Case Study Protocol .................................................................................................................. 102

Chapter 4 Case Summary .................................................................................................................. 119
  4.1 Case 1: GIS Integration ............................................................................................................. 119
  4.2 Case 2: DM Integration ............................................................................................................. 124
  4.3 Case 3: Office & Person Data Sharing ...................................................................................... 128
  4.4 Case 4: Corporate Directory ................................................................................................... 132

Chapter 5 Case Study Findings and Analysis .................................................................................. 137
  5.1 Summary and Discussion of all Cases ....................................................................................... 137
  5.2 Analysis of the Findings ............................................................................................................ 163
  5.3 Findings for the Research Questions ......................................................................................... 181

Chapter 6 Conclusions and Discussions ........................................................................................... 193
  6.1 Conclusions ............................................................................................................................... 193
  6.2 Research Contributions ............................................................................................................. 204
  6.3 Research Limitations .................................................................................................................. 206
  6.4 Future Research ......................................................................................................................... 207

Reference ............................................................................................................................................. 209

Appendix A: Case 1 Data Collection & Preliminary Analysis ....................................................... 213
Appendix B: Case 2 Data Collection & Preliminary Analysis ....................................................... 247
Appendix C: Case 3 Data Collection & Preliminary Analysis ....................................................... 277
Appendix D: Case 4 Data Collection & Preliminary Analysis ....................................................... 301
Appendix E: Review of IS Research Method ................................................................................... 321
List of Figures

Figure 2. 1 Diagram by E. Rahm, P.A. Bernstein: A survey of approaches to automatic schema matching, 2001 ................................................................. 11
Figure 2. 2 Diagram by Jinyoul Lee, Keng Siau, and Soongoo Hong (2003) ................................................................. 29
Figure 2. 4 Figures by Marinos Themistocleous, Zahir Irani, Robert M. O’Keefe and Ray Paul (2001) 34
Figure 2. 5 Figure by Vishnu S. Pendyala, Simon S.Y. Shim, Jerry Z. Gao (2003) ................................................................. 39

Figure 6. 1 Integration Requirement Model .................................................................................................................. 194
Figure 6. 2 Integration Solution Design Model ........................................................................................................ 195
Figure 6. 3 Integration Development Model ........................................................................................................ 197
Figure 6. 4 Critical Success Factor (CSF) Model ........................................................................................................ 198
Figure 6. 5 Model Based Enterprise Integration Development (MB – EAID) Framework ........................................ 202

Figure A. 1 DOCgis Main Screen .................................................................................................................................. 216
Figure A. 2 DOCgis Map Screen .................................................................................................................................. 217
Figure A. 3 DOCgis Spatial Query .................................................................................................................................. 217
Figure A. 4 DOCgis Query Result Sample ........................................................................................................ 217
Figure A. 5 DOCgis Centred National Enterprise GIS Architecture .......................................................................................... 219
Figure A. 6 GIS Viewer Main Screen .................................................................................................................................. 222
Figure A. 7 GIS Viewer Spatial Query on User Defined Area .......................................................................................... 223
Figure A. 8 GIS Viewer Spatial Query on Existing Defined Area .......................................................................................... 223
Figure A. 9 GIS Viewer Spatial Query Report Result Sample .......................................................................................... 224
Figure A. 10 GIS Viewer Map Sample .................................................................................................................................. 224
Figure A. 11 Permissions/GIS Integration Screen Sample 1 .......................................................................................... 225
Figure A. 12 Permissions/GIS Integration Screen Sample 2 .......................................................................................... 225
Figure A. 13 GIS Viewer System Architecture ........................................................................................................ 226

Figure B. 1 Document Creation Screen 1 .................................................................................................................. 250
Figure B. 2 Document Creation Screen 2 .................................................................................................................. 250
Figure B. 3 Document Creation Screen 3 .................................................................................................................. 251
Figure B. 4 Document Integration Screen ........................................................................................................ 252
Figure B. 5 DM Integration Architecture 1 ........................................................................................................ 253
Figure B. 6 DM Integration Architecture 2 ........................................................................................................ 254
Figure B. 7 DM Integration Revised Architecture 1 ........................................................................................................ 256
Figure B. 8 DM Integration Revised Architecture 2 ........................................................................................................ 257
Figure B. 9 DM Integration Second Revised Architecture 2 .......................................................................................... 259
Figure B. 10 DM Integration Land Register Sample Screen .......................................................................................... 259

Figure C. 1 PerOrg Prototype Screen 1 .................................................................................................................. 280
Figure C. 2 PerOrg System Architecture ........................................................................................................ 281
Figure C. 3 PerOrg with Common Data Proposal ........................................................................................................ 282
Figure C. 4 Office & Person Common Database ERD ........................................................................................................ 284

Figure D. 1 Corporate Directory Data Flow Diagram ........................................................................................................ 304

Figure E. 1 Figure by M. R. de Villiers (2005) ........................................................................................................ 327
## List of Tables

Table 2.1 Summary table from “Business-to-business e-commerce frameworks” by Shim, S.S.Y., Pendyala, V.S.; Sundaram, M., Gao, J.Z. (2000) ................................................................. 26
Table 2.2 Table 1 by Nina Reiersgaard, Hilde Salvesen, Stig Nordheim, Tero Päivärinta (2005) ........ 53
Table 2.3 Table 2 by Nina Reiersgaard, Hilde Salvesen, Stig Nordheim, Tero Päivärinta (2005) ........ 53
Table 2.4 Table 3 by Nina Reiersgaard, Hilde Salvesen, Stig Nordheim, Tero Päivärinta (2005) ........ 54
Table 2.5 Table 1 by Richard Berntsson-Svensson, Aybüke Aurum (2006) ...................................... 58
Table 2.6 Table 2 by Richard Berntsson-Svensson, Aybüke Aurum (2006) ...................................... 59
Table 2.7 Table by Wing Lam (2005) ............................................................................................ 60
Table 2.8 Table by Zaitun A. B. and Mashkuri Yaacob (2000) .......................................................... 62
Table 2.9 Quality Assurance Measures ......................................................................................... 115

Table E.1 Table by Robert L. Glass, V. Ramesh, Iris Vessey (2004) ............................................... 324
Table E.2 Table by Yin (2002) ....................................................................................................... 331