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What is it that the application of modelling and simulation can contribute towards understanding and managing service quality data for internet service providers (ISP) in Australia?

Karthik Vilapakkam Nagarajan

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Vilapakkam Nagarajan, Karthik, What is it that the application of modelling and simulation can contribute towards understanding and managing service quality data for internet service providers (ISP) in Australia?, MInfoTech-Res thesis, School of Information Systems and Technology, University of Wollongong, 2008. <http://ro.uow.edu.au/theses/121>

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What is it that the application of Modelling and Simulation can contribute towards understanding and managing Service Quality data for Internet Service Providers (ISP) in Australia?

A thesis submitted in fulfilment of the requirements for the award of the degree

Master of Information and Communication Technology- Research

from

UNIVERSITY OF WOLLONGONG

by

KARTHIK VILAPAKKAM NAGARAJAN

B.E (ECE) UOM, M.Es With Distinction (Comp and Telecommn Engg) UOW

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SCHOOL OF INFORMATION SYSTEMS AND TECHNOLOGY

2008

Certification

I, Karthik Vilapakkam Nagarajan declare that this thesis, submitted in fulfillment of the requirements for the award of Master of Information and Communication Technology (Research), in the School of Information Systems and Technology, University of Wollongong, is Wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualification in any other university or academic institution.

Karthik Vilapakkam Nagarajan

30th August 2007

Acknowledgements

I would like to express my sincere thanks and gratitude to my supervisors Mr. Peter James Vial and Ms Gene Awyzio for their generous support, guidance and encouragement throughout the research study program. I thank my supervisors for having patience in answering all my questions during research meetings and email enquiries. My supervisors good research advice and uplifting moral support helped me a lot during my difficult times. During our research meetings we had a lot of fruitful discussions and this helped me a lot in formulating innovative ideas. I thank Gene Awyzio for helping me in funding support to present my research paper at MIT University, Boston in 2002. I thank Peter Vial for opening up my eyes on network management and discrete event simulation modelling and analysis during my postgraduate coursework degree thesis done under his supervision in 2001. Many thanks to Dr Fazel Naghdy who provided several tips on effective technical writing during the writing my M.E thesis at the University of Wollongong in 2002.

My supervisors provided several suggestions not only on the style of writing but also on the technical content and for that I am deeply grateful. My special thanks to Dr Tamrat Woldu Tewoldeberhan, Research Fellow, DELFT University of Technology, Netherlands and now in ORACLE corporation, USA for his expert advice on simulation validation techniques and Mr Paul Beckett, RMIT University, Melbourne for his research tips. I thank Professor John Fulcher, School of IT and Computer Science, University of Wollongong for his constructive feedback on modelling methodologies during research seminars and also Mr Johit Das, Standards Australia for helping me to gain insight in to ISP industry issues.

Special thanks to Prof Peter Hyland for his support and motivation while writing this thesis. I am indebted to my sister Srivalli Vilapakkam for her outstanding help and guidance in thesis writing and for sharing her profound knowledge which has helped me achieve my research goals. I thank my late grandmother Kamalammal for the good values she taught me and always having confidence in me. I thank my mum and dad for their continuous moral support, love and understanding. Finally, I would like to thank the School of Information Technology and Computer Science, University of Wollongong, for providing the best facilities and a pleasant environment during my research study.

Karthik V.N.

(Aug 2007)

Abstract

This thesis assesses the appropriateness and effectiveness of discrete event simulation technique to understand and manage service elements in the ISP (Internet Service Provider) context. The baseline for this research involved the secondary data published by ABS (Australian Bureau of Statistics) and TIO (Telecommunications Industry Ombudsman) involving ISP numbers, Internet issues/complaints data. As many relatively new services are being offered, ISPs are finding it difficult to cope with varying customer expectations and their future technology expectancy. Access to infrastructure, avoiding anti-competitive behaviour from large players and service differentiation has become more important than ever for their survival. A number of challenges such as lack of provision of good quality service, lack of ability to cope with increasing (or varying) customer demands and expectations and lack of flexibility in providing services need to be overcome. The service environment in networking has focused heavily on the technical side and very little attention has been given to functional variables such as complaints handling, aligning technical and functional service quality processes and effective service recovery during service failures. Relying fully on the technical side obscures the nature of service. This research identified the fact that end users' perspective of quality of services need to consider not only the inherent quality of the network, but also the service quality provided by the ISP. Users perceive poor service quality provided by their ISP if they do not get help desk support required from using the ISP services. This can turn a complaint about a problem into a complaint about the company. The research question is answered by this thesis "*What is it that the use of discrete event simulation technique can contribute to the*

understanding and managing service quality data for different ISP service operations?”

The research methodology chosen was discrete event simulation methodology. The discrete event technique involves building up models based on the dynamic behavior of a network system as the time progresses. The appropriateness and effectiveness of this technique was tested by modelling technical service elements (modelling policy based networks using differentiated service schemes, alarm based network management system for effective service level agreement monitoring) and key functional elements that determine ISP non-technical service performance (ISP complaints handling, ISP call centre performance variables). The scenarios led to the development of an integrative simulation framework that addresses both user level service quality issues and network system oriented service quality issues. In the past user level service quality issues have been provided with negligible importance. The framework developed can help ISPs to model service attributes and use the results from such simulation studies to make competitive marketing decisions. The issues raised before and after simulation can be compared for effective service design. To achieve service excellence ISPs have to understand the interrelationship between various service quality dimensions such as tangibles, reliability, responsiveness, assurance and empathy and how these dimensions affect customer perception of ISP service quality. In conclusion the research found that discrete event simulation can be used to understand and manage service quality data by internet service providers involving different ISP service operations [1]-[22][23]-[46]

Table of Contents

Acknowledgements.....	i
Abstract.....	iv
Table of Contents.....	vi
List of Figures.....	x
List of Tables.....	xii
List of Acronyms and Abbreviations.....	xiii

Chapter 1 Introduction..... 1

1.1 Research Aims.....	1
1.2 Research Outcomes and Benefits.....	1
1.3 Research Background.....	4
1.4 Statement of the Problem.....	4
1.5 Research Objectives.....	11
1.6 Main Research Question.....	12
1.7 Research Methodology.....	15
1.8 Significance of this study.....	17
1.9 Limitations of the study.....	21
1.10 Use of Previously Published Research Papers.....	21
1.11 Publications arising from the research	22
1.12 Structure of the thesis.....	23
1.13 Conclusion.....	24

Chapter 2 Literature Review..... 25

2.1 Background.....	25
2.2 Customer satisfaction and service quality.....	27
2.3 Customer Satisfaction in Network Management.....	30
2.4 Importance of Customer Satisfaction and retention in Telecommunications Market.....	37
2.5 Reasons for customers switching providers: Relationship between Satisfaction and Loyalty.....	38
2.6 Impact of mergers and acquisitions on small ISP Industry: Functional service quality issues that affect small ISP business performance during mergers and takeovers.....	40
2.7 Simulation modelling and analysis in network management.....	42
2.8 Simulation role in understanding various problems related to customer satisfaction for network services.....	42
2.9 Service management in telecommunication networks.....	48
2.10 ISP Industry Problems.....	51
2.11 Why use Simulation Solutions in Telecommunications Context?.....	52
2.12 Importance of Service level agreements (SLA) and Policy Based Network Management (PBNM) in service based networks and their implication on the simulation scenario.....	54

2.13 Conclusion.....	55
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Chapter 3 Research Methodology..... 58

3.1 Abstract.....	58
3.2 Introduction.....	58
3.3 Research Strategy.....	59
3.4 Research methodology and associated steps.....	61
3.4.1 Research objectives mapping to related research questions and network scenarios.....	62
3.5 Literature review on discrete event simulation methodology: how it works and why it matters in networking context.....	62
3.5.1 Definition of Simulation and Its Importance.....	65
3.5.2 Types of Simulation Models.....	66
3.5.3 Computer Aided Simulation Modelling.....	66
3.5.4 Problems encountered in Simulation Modelling Process.....	67
3.5.5 Simulation Prototyping.....	67
3.5.6 Simulation Model Building and Working Process.....	68
3.5.7 Difference between a Prototype Model and Operational Model.....	69
3.5.8 Simulation Software Selection Criteria and Features.....	70
3.5.9 Introduction to Model Verification and Validation.....	73
3.5.9.1 Role of Model Verification and Validation in Model Development Process.....	73
3.5.9.2 Conceptual Model Validation.....	76
3.5.9.3 Computerized Model Validation.....	76
3.6 Important issues that need to be considered in modelling process.....	77
3.7 Impact of Simulation Study Failures.....	78
3.8 Credibility Issues in Simulation of Telecommunication Networks.....	82
3.9 Justification of simulation software and language used for this project and a detail review in to software.....	86
3.10 Introduction to SIMAN Modelling Language.....	96
3.11 Conclusion.....	102

Chapter 4 Model Development..... 104

4.1 Technical service quality modelling scenario using Discrete Event Simulation Technology.....	105
4.1.1 Background to Scenario 1.....	105
4.1.2 Scenario1 Model Development.....	106
4.1.3 Model Objective.....	107
4.1.4 Main Model Working Process.....	107
4.1.5 Sub-Model Working Process.....	107
4.1.6 Achieving improved network resource allocation using Network Admission Control.....	110
4.1.7 Background to Scenario 2.....	112
4.1.8 Problem studied in the Scenario 2.....	112
4.1.9 Importance of Alarms in Network Management.....	113

4.1.10 Neglecting simulations studies leads to service failures.....	114
4.1.11 Model Development: Service Level Management Process Module.....	116
4.1.12 Alarm Module.....	117
4.1.13 SLA Process Module.....	118
4.1.14 Network User Inspection Process Module.....	121
4.1.15 User SLA Process Plan Module.....	123
4.2 Conclusion.....	123

Chapter 5 SIMCTS Framework to Understand and Manage Service Quality Data.....127

5.1 Introduction to SIMCTS Framework.....	128
5.2 Objectives of SIMCTS Framework.....	128
5.3 SIMCTS used to measure discrepancy between customer perception and expectations for service.....	129
5.4 SIMCTS and its functional elements.....	132
5.5 Benefits of SIMCTS framework.....	134
5.6 Generic steps involved in SIMCTS Simulation case modelling	134
5.7 Application of SIMCTS framework in modelling ISP business operations: SIMCTS simulation models, analysis and validation.....	135
5.7.1 Importance of using SIMCTS Simulation framework to understand and model service quality dimensions in relation to ISP Complaints.....	136
5.7.2 Appropriateness and effectiveness of using SIMCTS Simulation framework to understand and manage service quality issues in ISP call centre scenario.....	139
5.7.3 Network Scenario 3.....	146
5.7.3.1 Importance User Level Service Quality Issues in Network Management.....	148
5.7.3.2 Service Quality Issues facing small ISPs: [Customer Complaints Handling Scenario].....	149
5.7.3.3 Simulation Model of ISP Complaint Management process.....	149
5.7.4 Network Scenario 4.....	155
5.7.5 Network Scenario 5.....	171
5.8 Conclusion.....	190

Chapter 6 Analysis and Discussion of Research Results..... 192

6.1 Scenario 1 (Chapter 4): Discussion and Verification of Simulation Results Using Queueing Theory Principles.....	192
6.1.1 Arrival rate with different seed values impact on network path queue time.....	196
6.2 Scenario 2 (Chapter 4) Verification and Validation of Simulation Model.....	198
6.2.1 Animation used to ensure model verification and validation.....	199
6.2.2 Terminating simulation analysis in the User SLA Process Plan Model.....	199

6.3	Modelling the generation and Handling of Complaint Process and Complaint transfer to various sections in Service department (Chapter 5).....	207
6.3.1	Validation using Confidence interval and Sensitivity analysis for this Scenario.....	209
6.4	A Call Centre Balking model to model SIMCTS Service Quality Attributes (Chapter 5).....	212
6.5	ISP Call Centre Service System: Simulation Strategies and Methodologies in Customer Satisfaction (Chapter 5).....	216
6.6	Conclusion.....	225

Chapter 7 Conclusion and Future Work..... 228

References

List of Figures

Figure 1.1:	Research domains involved in this study.....	5
Figure 1.2:	A Graph showing the trend in Very small ISP numbers in Australia: Sep'00-Mar'05.....	8
Figure 1.3:	A graph showing the trend in Small ISP numbers in Australia from Sep'00--Mar'00.....	8
Figure 1.4:	A graph showing the trend in Medium ISP numbers in Australia from Sep'00--Mar'05.....	8
Figure 1.5:	A graph showing the trend in Large ISP numbers in Australia from Sep'00--Mar'05.....	9
Figure 1.6:	A graph showing the trend in Very Large ISP numbers in Australia from Sep'00--Mar'05.....	9
Figure 1.7:	A graph showing the trend in Total ISP numbers in Australia from Sep'00--Mar'05.....	9
Figure 1.8:	Key building blocks of ISP service quality area.....	18
Figure 2.1:	Relationships between interpersonal satisfaction, interaction between inter-organizational satisfaction, perceived value and behavioural intentions.....	28
Figure 2.2:	Block diagram of important steps involved in customer satisfaction process.....	31
Figure 2.3:	Service quality issues during mergers in small ISP Industry: the Good, the Bad and the Bottom line.....	41
Figure 2.4:	Modelling steps involved in customer satisfaction for network Services.....	43
Figure 2.5:	Simulation used to offer solution to customer needs.....	45
Figure 3.1:	Research methodology and Research methods.....	61
Figure 3.2:	Block diagram of validation process in simulation modelling, analysis.....	74
Figure 3.3:	Modelling steps to be followed when creating models using ARENA.....	88
Figure 4.1:	Simulation Model of Service Level Policy Network.....	109
Figure 4.2:	Functional Block Diagram of Alarm Simulation Module.....	120
Figure 4.3:	Functional Block Diagram of SLA module.....	122
Figure 5.1:	The functional elements of SIMCTS Framework.....	132
Figure 5.2:	Closing the loop using SIMCTS Framework.....	133
Figure 5.3:	Disconfirmation model of Complaint satisfaction.....	138
Figure 5.4:	Various phases involved in service quality simulation.....	142
Figure 5.5a:	Simulation software selection criteria.....	145
Figure 5.5b:	“ASSIGN” Module in ARENA used to assign variables, attributes based on different complaint types.....	151
Figure 5.6:	Simulation model of ISP Complaint handling process: Model1 and Model 2 (Running mode).....	153
Figure 5.7:	Service quality information building blocks.....	157
Figure 5.8:	Various Service Quality Information types for Internet Service Providers.....	159
Figure 5.9:	Service waiting time across all service industries, Daily Telegraph, June 23, 2004.....	161
Figure 5.10:	Proposed changes and recommendations.....	162
Figure 5.11:	Call observation sheet.....	164
Figure 5.12:	VBA application in the model.....	170
Figure 5.13:	Customer balking and renegeing VBA alarm model.....	170
Figure 5.14:	Technical operators call schedule and call inter-arrival rates.....	182

Figure 5.15: Various steps involved in SIMCTS framework.....	184
Figure 5.16: ISP service system flow logic.....	185
Figure 5.17: Simulation model of ISP call centre scenario.....	189
Figure 6.1: Graphs Showing the Impact of Arrival Rates with Different Seed Values on Network Path Queue Time.....	196
Figure 6.2: Confidence Interval Plot for User SLA Process Plan.....	201
Figure 6.3: Peak queues observed in Network SLA Model (Peaks observed between simulation run 25000-60000 Seconds).....	206
Figure 6.4: A graph showing the difference between the actual time and estimated (expected) waiting time for response to customer complaints as a function of satisfaction.....	208
Figure 6.5: A sensitivity plot analysing simulation output across 40 replication.....	210
Figure 6.6: Simulation validation by “STEP” and “DSTATS” feature in ARENA and SIMAN editor.....	211
Figure 6.7: Model Parameters for Customer Balking and Reneging Model.....	212
Figure 6.8: Impact of service delay time on customer balking, reneging and serviced customers.....	212
Figure 6.9: Model Parameters for Customer Balking and Reneging Model.....	213
Figure 6.10: Consolidation of service reviews using the balked customers statistics and email enquiries reviews using service delay factor variation and specifying service manager process delays.....	215
Figure 6.11: Technical support services proposed schedule changes and related Utilizations.....	218
Figure 6.12: Impact of trunk lines on number of abandoned calls with current operator Levels.....	220
Figure 6.13: Optimizing the ISP schedules to set service standards.....	221
Figure 6.14: Alternative schedule scenarios and their % service levels.....	223
Figure 7.1: SIMCTS Building blocks elements to be tested as part of future work.....	232

List of Tables

Table 1.1:	ISP types in Australia.....	5
Table 1.2:	Mapping of research questions to their related chapters.....	15
Table 3.1:	Characteristics of the data used in our simulation scenarios.....	59
Table 3.2:	Research Model – Question, Results and Validation.....	60
Table 3.3:	Research Strategy involving questions, results and validation.....	60
Table 3.4:	Key questions about SIMCTS answered in the network scenarios modelled.....	64
Table 3.5:	Simulation software features.....	71
Table 3.6:	The factors that distinguish between simulator and simulator language.....	71
Table 3.7:	Modelling stages in simulation.....	75
Table 3.8:	Evaluating the server building block available in ARENA.....	90
Table 3.9:	Simulation Software Comparison on the basis of software features.....	94
Table 3.10:	Comparison of ARENA simulation software and Object-oriented programming simulation packages.....	95
Table 3.11:	Different states that entities undergo during simulation process.....	100
Table 5.1:	Steps involved in the SIMCTS simulation scenario modelling.....	134
Table 5.2:	Current scenarios and problems facing small and medium size ISPs.....	148
Table 6.1:	Simulation output of network services model.....	197
Table 6.2:	Count value for different service levels.....	198
Table 6.3:	Queue length and server utilization.....	202
Table 6.4:	Arrival Rate: EXPO(50) Alarm threshold: More than 15 users, Simulation Time:100000 seconds.....	204
Table 6.5:	Process Time: 20 Alarm threshold: More than 5 users, Simulation Time: 100000 seconds.....	204
Table 6.6:	Arrival rate: EXPO(50) Alarm threshold: More than 15 users, Simulation Time:100000 seconds.....	204

List of Acronyms and Abbreviations

ISP: Internet Service Provider

USM: User Based Security Model

LCD: Local Configuration Store

SNMPv3: Simple Network Management Protocol version 3

MIB: Management Information Base

RTFM: Real Time Traffic Flow Meter

RFC: Request For Comments

HMAC: Hash Message Authentication Code

MD5: Message Digest 5

SHA: Secure Hash Function

TCP/IP: Transmission Control Protocol / Internet Protocol

CMIP: Common Management Information Protocol

LAN: Local Area Network

MAC: Medium Access Control

UPS: Uninterruptible Power Supply

WAN: Wide Area Network

RMON: Remote Monitoring

UDP: User Datagram Protocol

PDU: Protocol Data Unit

OID: Object Identifier

SMI: Structure of Management Information

IETF: Internet Engineering Task Force

LDAP: Lightweight Directory Access Protocol

DMTF: Desktop Management Task Force

DEN: Directory Enabled Networking

PING: Packet Internet Groper

ASN.1: Abstract Syntax Notation One

SQL: Structured Query Language

SIMAN: Simulation and Analysis Language

PBNM: Policy Based Network Management

TSP: Telecommunications Service Provider

ABS: Australian Bureau of Statistics

TIO: Telecommunication Industry Ombudsman

SLA: Service Level Agreement

POP: Point of Presence

AHP: Analytic Hierarchy Process

POTS: Plain Old Telephone Service

ISDN: Integrated Service Digital Network

OAM: Operations, Administrative and Maintenance

OSS: Operation Support System

OTC: Operating Telecommunications Company

LAN: Local Area Network

WAN: Wide Area Network

ACD: Automatic Call Distribution

CASM: Computer Aided Simulation Modelling

CAD: Computer Aided Design

ODBC: Open Database Connectivity

RED: Random Early Detection Queue

VBA: Visual Basic Application

OSPF: Open Shortest Path First

RIP: Routing Information Protocol

BGP: Border Gateway protocol