2008

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?

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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

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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 in to 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]

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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