

**POLICY VALIDATION AND TRANSLATION IN  
POLICY-BASED NETWORKS FOR END-TO-END  
QUALITY OF SERVICE OVER THE INTERNET**

**Kamran Rajput**



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in Fulfillment of the Requirements for the Masters by Research Degree**

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## **Certificate of Authorship and Originality**

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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KAMRAN RAJPUT

Date: 01/12/2006

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*Dedicated to  
My Mother and Father*

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## List of Publications

The following publications resulted from the work carried out in this thesis:

1. P. Nanda, A. J. Simmonds, and K. Rajput (2003), "**Policy Based Network Architecture in Support for Guaranteed QoS**", *Information Technology Prospects and Challenges in the 21st Century (ITPC)*, Kathmandu, Nepal, vol. 2, May 23-25, 2003.
2. K. Rajput and A. J. Simmonds (2004), "**A Standards Based Framework for Policy Validation in Policy-Based Networks for end-to-end QoS**", *Australian Telecommunication Networks and Applications Conference (ATNAC 2004)*, Sydney, Australia, Dec 8-10, 2004.

# **Guaranteed end-to-end Quality of Service over the Internet: Policy Validation and Translation**

**Kamran Rajput**

**Faculty of IT, University of Technology Sydney**

Policy-Based Networks (PBNs) provide greater control and simple and automatic network administration, and make networks more secure, intelligent and centrally managed. These benefits are achieved by specifying High-Level Business Policies rather than configuring individual network devices. All these benefits of PBNs help achieve end-to-end Quality of Service (QoS) over the internet, thus making Policy-Based Networking an important and significant area of research.

High-Level Business Policies follow a validation step before their conversion to device-level policies. The focus of this thesis is on policy validation and translation in PBNs. It explores the appropriate techniques or methods for validating rule based High-Level policies, a policy specification approach defined by the IETF as well as considering alternatives. Existing solutions for Policy-Based Network Management (PBNM) use their own proprietary language or logic for specifying policies. Since these methods use different semantics and logics for evaluating policies, these solutions are not able to interpret policies specified by other systems and hence policy negotiation and merging cannot take place. Moreover, each solution uses its own method for policy analysis to implement constraints and detect conflicts among defined policies. These methods of policy validation are largely dependent on the methods of specifying policies, which is why a policy defined in one system cannot be validated by another system. One aim of this research is to find a way for different PBNs to interact.

This research project investigates policy validation and compatibility issues among different systems due to proprietary methods of policy specification. This thesis demonstrates how these issues can be resolved using XML-based policy languages and rule engines. It demonstrates the validity of the concepts and presented ideas through results obtained with test-case implementations.

This dissertation concludes that High-Level Policies can be expressed in XML-based policy languages, and that constraints, policy validation and conflict detection can be implemented effectively using XML schema and rule engines. Moreover, interoperability among different domains for policy negotiation and merging, is achievable by agreeing on a minimum set of requirements as described in this thesis.