ISSUES IN IMPLEMENTING IPV6 IN THE X-KERNEL SIMULATOR

RAJA SINGAM THILLAINATHAN

A Thesis presented to the Faculty of Computer Science and Information Technology of University of Malaya in fulfillment of the requirements of the Degree of MASTER OF INFORMATION TECHNOLOGY.

UNIVERSITY OF MALAYA

2002

Declaration

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institute of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text and a list of references is given.

Abstract

The new Internet Protocol Version 6(IPv6) or Internet Protocol Next Generation (IPNG) is bound to replace the existing Internet Protocol Version 4(IPv4). This new protocol is to address and resolve the limitations of the existing Internet Protocols. At the moment the new protocol is still in its infancy stage, and it is being implemented by both the research society and the private sector.

The x-kernel being a research project done by University of Arizona is freely available on the Internet. This x-kernel is a networking software almost similar to the Berkeley version (BSD) and it is bundled together with a simulation software called x-sim. This x-kernel simulator enables the user to test various protocols available in the software itself or newly developed ones. The x-kernel package comes with an existing set of protocol modules for the TCP/IP protocol stack and other network implementation. The TCP/IP protocol stack uses the IPv4 for its IP layer.

The main intention of this dissertation is to look at the issues in implementing IPv6 in the x-kernel simulator. The issues needed in implementing IPv6 are basically derived from the existing IPv4 implementation. The issues here can be used for the real implementation later, as these issues fills the purpose of a test-bed for the IPv6 based network simulation. The simulation issues that was looked upon was a minimal IPv6 based network simulation consisting of two hosts connected via an Ethernet internetwork with no routing, fragmentation and other options enabled in the IP layer.

Contents

Subject | **Page**

List of Figures

List of Tables

Glossary

ANSI C: American National Standard Institute

API: Application Programmer Interface

ARP: Address Resolution Protocol

BGP-4: Border Gateway Protocol version 4

BSD: Berkeley Socket Distribution

C/C++: C/C plus plus Programming Language

CIDR: Classless Interdomain Routing

ETH: Ethernet Protocol

ETHD: Ethernet Driver

GNU: Gnu's Not Unix

ICMPV6: Internet Control Message Protocol version 6

IDRP: Inter-Domain Routing Protocol

IEEE: Institute of Electrical Engineers

IETF: Internet Engineering Task Force

IGMP: Internet Group Management Protocol

IP: Internet Protocol

IPNG: Internet Protocol Next Generation

IPV4: Internet Protocol version 4

IPv6: Internet Protocol version 6

LANCE: Lance Ethernet Adapter

OSI: Open Systems Interconnection

OSPF: Open Shortest Path First

RFC2460: Request For Comment no. 2460

RIP: Routing Information Protocol

RPC: Remote Procedure Call

RTCP: Real Time Control Protocol

SIM: Simulation layer for internetwork

System V: Operating System 5

TCP: Transfer Control Protocol

TCP/IP: Transfer Control Protocol/Internet Protocol stack

UDP: User Datagram Protocol

UNIX: Unix operating system

UPI: Uniform Protocol Interface

UX: Usenix Server

VNET: Virtual Network layer

VMTP: Virtual Message Transport Protocol

Preface

This is a final year dissertation project that marks the end of my education at University of Malaya. The main goal of this project is to derive a review paper on the issues of IPv6 implementation in the x-kernel simulator. The protocol layer that is focused upon is the IP layer of TCP/IP protocol stack. The issues discussed are surrounding the IP layer of the protocol stack with its protocol semantics that is needed to implement and replace IPv4 with IPv6. Here the implementation is considered in terms of host-to-host connection, not involving any routing or fragmentation. The configuration issues of the x-kernel simulator the x-sim, is also discussed.

This dissertation project was performed between March 2001 and November 2001. My supervisor was Puan Miss Laiha Mat Kiah, (mlaiha@hotmail.com) lecturer and advisor at the faculty of Computer Science and Information Technology University of Malaya.

I would like to thank my supervisor and friends at the University for their technical and moral support during this project.

Acknowledgements

I would like to express my utmost gratitude and appreciation to my supervisor was Puan Miss Laiha Mat Kiah for sharing her invaluable knowledge and experience throughout this dissertation.

My thanks also extend to those involved in the analysis and discussion during the project. Lastly but not least, thanks to all those who help directly or indirectly, fellow classmates and friends in making this graduation project an interesting and valuable experience. Not forgetting to all the individuals who offer all the free guidance and knowledge from the World Wide Web, thank you