An Enhanced Anycast Routing Protocol using Nearest PIM-SM Tree Distribution with Load-Balancing Scheme

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by

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ABSTRACT

The Internet Protocol Version 6 (IPv6) has introduced several major improvements and services over the current Internet Protocol Version 4 (IPv4). IPv6 solves the address space depletion problem in IPv4, provides a hierarchical addressing system, better system management, improved security and better Quality of Service (QoS). Anycast, one of the new services introduced under the IPv6 specification promises improvements to the current internetworking environment, such as better service location, generalization of services and policy based routing.

The primary issue with anycast routing is the tradeoff between performance and reliability. An anycast routing protocol that can provide shorter end-to-end delay does not always have lower packet loss, and vice versa. This thesis focuses on achieving short end-to-end delay and low packet loss using anycast routing with a load-balancing scheme. The JaNetSim network simulator is used as the simulation environment for the anycast routing. An enhancement to the anycast routing protocol, called the nearest PIM-SM extension for anycast routing is proposed and evaluated. Several load-balancing schemes such as shortest-path, round robin and fuzzy shortest-path are implemented and evaluated as well. Simulation results show that the proposed nearest PIM-SM extension for anycast routing improves the performance by achieving short end-to-end delay and low packet loss.

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ABBREVIATIONS

ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
ATM LSR	Asynchronous Transfer Mode Label Switching Router
BGP	Border Gateway Protocol
BSR	BootStrap Router
B-TE	Broadband Terminal Equipment
CBT	Core Based Tree
CIDR	Classless Inter-Domain Routing
C-RP	Candidate-Rendezvous Point
DES-CBC	Data Encryption Standard-Cipher Block Chaining
DNS	Domain Name System
DNSSEC	Domain Name System Security
DHCP	Dynamic Host Configuration Protocol
DR	Designated Router
DVMRP	Distance Vector Multicast Routing Protocol
EIGRP	Enhanced Interior Gateway Routing Protocol
ESP	Encapulating Security Payload
EUI-64	64-bit Extended Unique Identifier
FLC	Fuzzy Logic Controller
FP	Format Prefix
GIA	Global Internet Protocol-Anycast
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force

IGMPv2	Internet Group Management Protocol Version 2
IGMPv3	Internet Group Management Protocol Version 3
IKE	Internet Key Exchange
IP	Internet Protocol
IPsec	Internet Protocol Security
IPv6	Internet Protocol Version 6
IPv4	Internet Protocol Version 4
IPX	Internetwork Packet Exchange
ISP	Internet Service Provider
ICMPv4	Internet Control Message Protocol Version 4
ICMPv6	Internet Control Message Protocol Version 6
LAN	Local Area Network
MAC	Media Access Control
MLD	Multicast Listener Discovery
MLDv2	Multicast Listener Discovery Version 2
MOSPF	Multicast Open Shortest Path First
MTU	Maximum Transmission Unit
NAT	Network Address Translator
NLA	Next-level Aggregators
ND	Neighbor Discovery
NSAP	Network Service Access Point
NTP	Network Time Protocol
OSPF	Open Shortest Path First
PDU	Protocol Data Unit

PIM	Protocol Independent Multicast
PIM-SM	Protocol Independent Multicast – Sparse Mode
PIM-DM	Protocol Independent Multicast – Dense Mode
RP	Rendezvous Point
RPF	Reverse-path Forwarding
SPT	Shortest Path Tree
QoS	Quality of Service
RIPng	Routing Information Protocol next generation
RSVP	Resource ReSerVation Protocol
SLA	Site-level Aggregators
TCP	Transmission Control Protocol
TLA	Top-level Aggregators
TLV	Type-length-value
TOS	Type of Service
UDP	User Datagram Protocol
VBR	Variable Bit Rate
WAN	Wide Area Network