University of St Andrews

CS4099

ILNP Routing for IoT

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Abstract

Declaration

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1 Introduction

Despite the imminent exhaustion of IPv4 addresses [1], IPv6 is still being adopted slowly [2]. Brittle solutions such as NAT are being used to temporarily expand the IP address space , and to avoid the transition costs involved in upgrading to IPv6. Whilst IPv6 does expand the address space greatly and introduces functionality such as multicast, the internet protocol itself suffers from many issues.

1.1 Issues with IP

IP addresses are used both to identify a system and to determine its topological location. [3] lists several of the downsides to this overloading of IP addresses, and why the protocol was still used despite these concerns.

The separation of concerns that should be achieved by a layered model is not possible, since the IP address is used at both the network layer and transport layer.

The issues with IP are not just semantic. Due to the overloading of the IP address and the rapid increase in internet connected devices [4], the scalability of the system is being challenged. Implementations of multipath routing with the intention of balancing load is improving network performance for the operators that use them, but with IP it places greater stress on the default-free zone (DFZ) routing information base (RIB). Multihoming is also being used increasingly to improve reliability, but with IP this requires routing entries to store multiple addresses for one host. An IAB workshop [5] detailed how the DFZ RIB databases are growing in size exponentially due to the increasing number of devices and an inability to aggregate address prefixes. With IPv6 allowing for an even larger address space, this problem will only get worse.

Due to the growing number of Internet of Things (IoT) devices, mobility is also a necessary feature for a networking protocol. Mobile IP currently requires another entity (a home agent) to track and proxy packets to the mobile host as it changes networks.

1.2 ILNP

Both multihoming and mobility are far simpler to implement and maintain if the identity and topological locator of a host are separated, and this is how

the Identifier-Locator Network Protocol functions.2

1.3 Goal

2 Context Survey

1. ILNP research
2. Ad Hoc sensor networks
3. Energy effecient routing protocols

3 Requirements Specification

1. Describe requirements of resulting python library

4 Design

1. Component structure (socket interface, router/dsrservice/forwardingtable, raw sockets)
2. Runtime behaviour (packet parsing, routing, and forwarding)
3. Use figures to visualise project structure and workflow

5 Experiment

1. Discuss aim of experiment (to measure effeciency of the used routing protocol with ILNP, and compare to IP).
2. Explain case study, with reference to source (i.e. agricultural sensor setup)
3. Use visuals to show locators to real life position and sensor radi
4. Discuss experiment configuration (how machines were chosen, results collected, battery life simulated, etc)
5. discuss choice of metrics, justifcation and how to compare results.

6 Results and Discussion

1. Show heat map of results
2. Explain features of heat map
3. Describe the behaviour if IP was used instead through analysis
4. Discuss weaknesses with experiment

7 Conclusions

1. was the goal met, and if so how well?
2. future work with ILNP, possible suggestions of better alternatives to the routing protocol used.

8 Appendix

1. Instructions on installing, and executing and using the python module, and how to configure the experiments.

References

[1] RIPE NCC. Number of Remaining IPv4 Addresses. `https://labs.ripe.net/statistics/number-of-remaining-ipv4-addresses-daily`.

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[3] Brian E. Carpenter. Ip addresses considered harmful. *SIGCOMM Comput. Commun. Rev.*, 44(2):65–69, apr 2014.

[4] Statista. Number of connected devices worldwide in 2014 and 2020, by device (in millions). `https://www.statista.com/statistics/512650/worldwide-connected-devices-amount/`.

[5] Ed D. Meyer, Ed. L. Zhang, and Ed K. Fall. Report from the IAB Workshop on Routing and Addressing. RFC 4984, RFC Editor, September 2007.