Comparing IPv6 ND-based routing protocol and OLSR in Nested NEMO field experiments

Hajime Tazaki
Graduate School of Media and Governance, Keio University
tazaki@sfc.wide.ad.jp

Abstract

This paper provides a comparison of two routing protocols proposed for Network Mobility (NEMO) in order to solve the nested NEMO problem. The protocols are: Tree Discovery protocol (TDP) with Network In Node Advertisement (NINA) and Optimized Link State routing Protocol (OLSR). These protocols were run in several Mobile Routers in a nested structure. To analyze the efficiency of the protocols, we observed the protocol behavior with our software implementation via field experiments, and measure the control overhead of each protocol. We observe that the overhead of control packets using TDP/NINA is less than using OLSR in our test network.

Introduction

MANET for NEMO, or MANEMO, is a concept defined in [1]. One of the goal of MANEMO is to provide network mobility function using multi-hop communication, which is main property of Mobile Ad-hoc Network (MANET). As a concept of MANEMO, we can deploy NEMO functionality into a multi-hop network with high mobility, global connectivity, and session continuity during the movement.

In order to advance the deployment of wireless multi-hop networks, it is important to show the evaluation with real field experiments. Since the concept of MANEMO was introduced, there has not been much investigation with real field experiments. This work focuses this aspect with our own testbed, which is targeted for the post-disaster recovery network. This paper provides the comparison and the analysis two routing protocols which are used as MANEMO scenario.

Overview of the experiments

We did some experiments with real equipment and software. Figure 1 shows logical testbed topology that we set up. We use 5 MRs with the NetBSD operating system that includes SHISA for the NEMO function. We use our zebra-mndpd software, which is an extension of the Zebra routing software, as a TDP/NINA measurement, and use the olsr.org OLSR daemon as a OLSR measurement. The red arrow in this figure means the movement path of MR4.

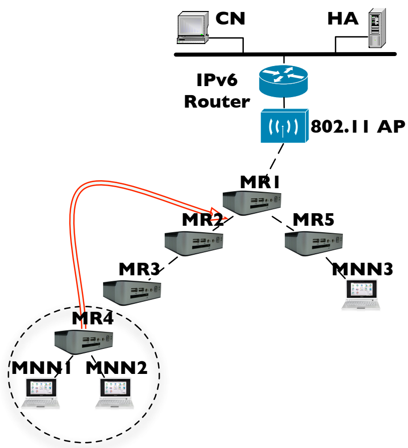

Figure 1. Overview of the testbed for protocol comparison

Evaluation

To compare the overhead of control packet of 2 routing protocols, we collected the packet capture file with tcpdump command in every MR. Basically this overhead is the trade-off issue with the interval of each control packet transmission. We use the interval timer as follows: Hello(OLSR): 1 second, TC(OLSR): 2 seconds, HNA(OLSR): 2 seconds, RA(TDP/NINA): 2 seconds.

Figure 2 shows the result of TDP/NINA packet overhead during the experiment.

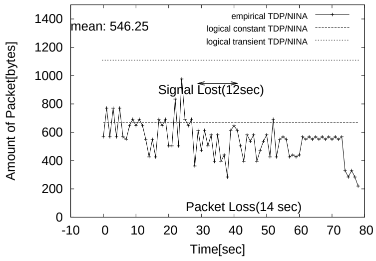

Figure 2. Overhead of TDP/NINA

In this figure, the amount of TDP/NINA packets measured once per 1 second. The duration in packet loss, 14 seconds, equals to the total handover time in this movement, and it took 12 seconds to get new signal after switching MR. From this result, we estimated that the convergence time of routing information after movement is 2 seconds. During this experiment, the mean value of bytes per seconds of TDP/NINA packets is about 546. It is mostly same as logical estimation.

Figure 3 shows the result of OLSR packet overhead during the experiment.

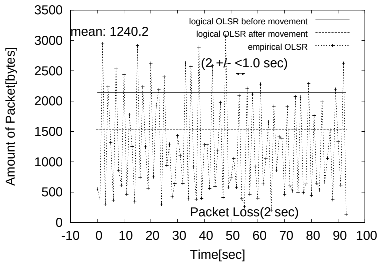

Figure 3. Overhead of OLSR

Since the number of MPRs is decreased after movement, the amount of control packet is also decreased. During the movement, the convergence time of routing information is 2 seconds, which is mostly same as the experiment of TDP/NINA. And we can see smaller mean value in empirical data than logical estimation. This is because the implementation of the software has some optimization in packet transmission.

Figure 4 shows the logical control packet consumption when the number of node which use these routing protocols is increased. From this estimation, we can confirm that the number of MPRs in OLSR affect the overhead of the control packet. On the other side, TDP/NINA consume less control packet compare with OLSR even though the number of relay MR (same as MPRs in OLSR) is high.

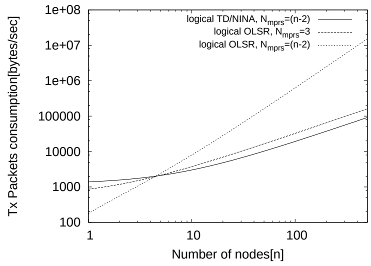

Figure 4. Logical overhead

If the operator try to extend wireless signal range with MR, the number of hops (this is equals to the number of MPRs) would be increased. In that case, TDP/NINA provide good performance in the scalability of the number of MRs.

Conclusion and Future work

We have constructed an experimental testbed to compare the efficiency of the routing protocol in nested NEMO configuration. The comparison was done by observation of the overhead of each routing protocol, and was confirmed with logical estimation from the protocol specification. Consequently we found that TDP/NINA is more efficient than OLSR when the wireless multi-hop network would be used for the extension of the wireless signal range.

For the further enhancement, TDP should be capable with ad-hoc mode interface of 802.11. However, since TDP re-use standard Neighbor Discovery protocol (NDP) [2] to process the packet, we face the problem about multi-hop with NDP which is described in *global6* proposal [3], and the prefix and address assignment does not work too. It would be improvement to provide the method using ad-hoc mode interface in TDP.

References

[1] R. Wakikawa, P. Thubert, T. Boot, J. Bound, B. McCarthy. draft-wakikawa-manemo-problem-statement-01 - Problem Statement and Requirements for MANEMO, July 2007.

[2] T. Narten, E. Nordmark, W. Simpson, and H. Soliman. Neighbor Discovery for IP version 6 (IPv6). RFC 4861 (Draft Standard), September 2007.

[3] R. Wakikawa, J T. Malinen, C. E. Perkins, A. Nilsson, A. J. Tuominen. draft-wakikawa-manet-globalv6-05 - Global connectivity for IPv6 Mobile Ad Hoc Networks, March 2006.