Simple Forwarding over Trajectory (SiFT) Implementation in ns-3

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ABSTRACT

This extended abstract is part of our full paper, explaining implementation and simulation comparison of the SiFT protocol in ns-3.

Categories and Subject Descriptors

I.6 [**Simulation and Modeling**]: General, Model Development, Model Validation and Analysis; C.2.2 [**Computer-Communication Networks**]: Applications— *SiFT routing protocol*

General Terms

Implementation, Simulation, Analysis, Verification

Keywords

SiFT implementation model, MANET, ns-3 simulator, AODV, DSDV, DSR, OLSR

1. INTRODUCTION

Mobile Ad hoc NETworks (MANETs) is a solution for rapid network development when network infrastructure is not available and nodes move in the environment. These two MANET characteristics impose other challenges such as weak or intermittent wireless links and ambiguous network topology leading to more challenges in routing protocols in such networks. On the other hand, wireless broadcast medium makes flooding as a tempting solution in these networks. However, higher cost of delivery in flooding is a main concern in this method. Therefore, proposing routing algorithms with a higher delivery rate and lower delivery cost has been a main area of research in MANET.

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In this extended abstract, we present our ns-3 [7] implementation of SiFT [1] routing protocol and summary of the performance results of this protocol. Extended results are available in ResiliNets wiki [5]. This abstract is organized as follows: In Section 2, a brief background for the SiFT protocol is explained. In Section 3, we provide the specification of SiFT implemented in ns-3. In Section 4, we present part of our experimental results and its comparison with other available protocols in ns-3, including AODV [9], DSDV [8][6], DSR [4][2] and OLSR [3]. Finally, in Section 5 we conclude our study with the future work.

2. BACKGROUND

SiFT is categorized as a Trajectory Based Forwarding (TFB) protocol suitable for ad hoc wireless networks. It is assumed that nodes know their geographical positions acquired by some mechanism such as GPS. Source nodes that have this information encode trajectory information to each packet. In contrast to source routing, these algorithms do not need to know the next node to forward the packet. Broadcasting is used to forward packets, while forwarding nodes are selected dynamically in each hop. Whenever a node receives a packet, its role changes from receiver to sender and it decides whether to forward the packet or drop it. This decision in SiFT is only based on the position of the node to the trajectory and its distance from the last forwarding node. Lack of using control information and deciding about the next forwarding node in each hop makes this protocol simple and appropriate for the environment with high mobility.

3. SIFT MODULE FOR ns-3

SiFT routing protocol in ns-3 is implemented in `ns3::sift::SiftRouting`, which is an extension of the abstract base class `ns3::Ipv4L4Protocol`. The SiFT header defined in `ns3::sift::SiftHeader`, is also an extension of the abstract class `ns3::Header`. This is a shim header between the transport and network layers that adds information about the trajectory to each packet. Information about the trajectory can be encoded with a line from the source to destination, which makes calculation very simple. The SiftGeo class implemented in `ns3::sift::SiftGeo` keeps and han-

Simulation Parameters	Value
Simulation area	1500 m × 300 m
Number of runs	10
Warmup time	3 s
Total simulation time	1,000 s
Mobility model	Random waypoint
Node speed	0 – 20 m/s
Packet size	64 bytes
Number of packets	997 packets/simulation
Link layer	wifib-11Mb/s

Table 1: Simulation parameters

dles geographical location of each nodes. Since SiFT uses the broadcast service of the network layer and doesn't keep any information about paths, no more classes are required. However, a buffer is defined in each node that holds recently received packets. The SiFT class diagram is illustrated in Figure 1.

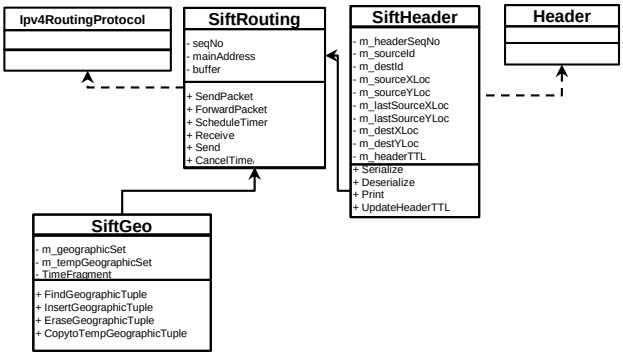

Figure 1: SiFT class diagram

4. SIMULATION SETUP AND ANALYSIS

In order to measure the performance of the SiFT protocol and compare it with other MANET protocols in ns-3, simulations are performed over an area of 1500×300m^2. Each experiment is repeated 10 times and the results are aggregated over these 10 runs. Each run has a duration of 1000s. The details of each experiment are available in our paper. Changing node density, number of data flow and node pause time are parameters to measure the behavior of the SiFT protocol in different conditions including high–low mobility and dense–sparse area. Some of the basic parameters are shown in Table 1.

As part of our experimental results the following figures show SiFT packet delivery delay and its comparison with other protocols. Figure 2 shows delay with a varying number of flows when pause time varies from 0 to 900 seconds. Delay is reduced when mobility is reduced as well. We also observe that the delay is less for the environment with fewer number of flows, which confirms the effect of collisions and timeouts. Although higher delay is observed for more flows, error rates are smaller for a greater number of flows.

The average delay for SiFT and other protocols in ns-3 is illustrated in Figure 3. As expected, the SiFT delay is much lower than other protocols. Generally delay decreases when

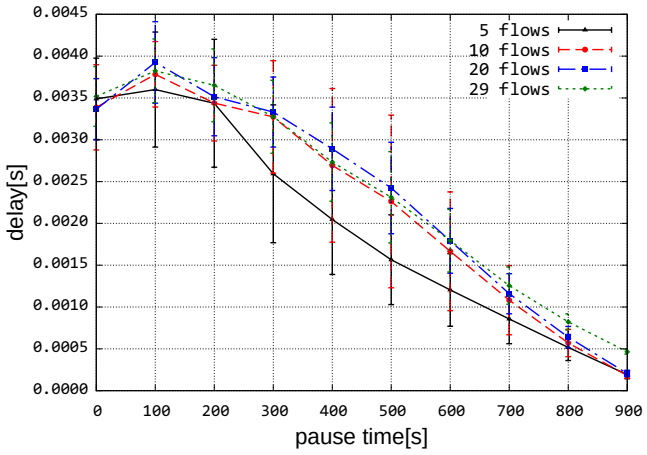

Figure 2: Delay vs. pause time

node mobility decreases. Furthermore, OLSR has lower delay than the other three protocols. Low delay in SiFT is the direct result of the lack of control messages in this protocol, while in OLSR it is caused by the consequence of more stability in routing tables.

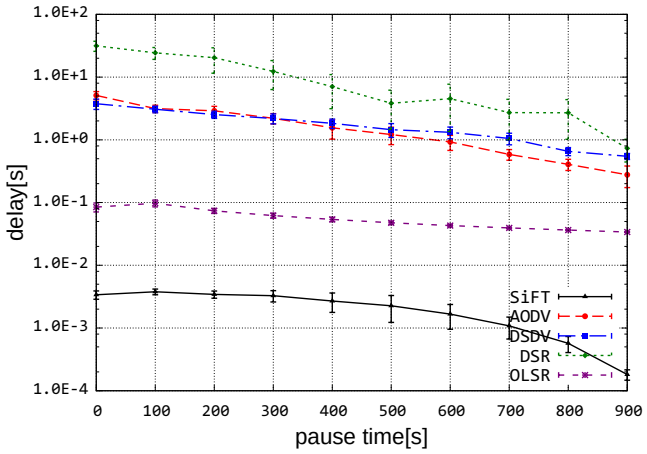

Figure 3: Delay vs. pause time

5. CONCLUSIONS

In this abstract we briefly present the architecture and implementation of SiFT in ns-3. We also show measurement for packet delivery delay. This protocol does not have high overhead, since nodes don't keep the information for the next hop; however, comparing its performance with other similar protocols is part of our future work. Moreover, we are in the process of preparing the code to be received and merged in the next ns-3 standard release.

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