A Reputation Based Intermediate Message Forwarding Scheme

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Abstract. Recent studies on the impact of selfish behavior show that the performance are severely influenced if a major portion of the nodes is selfish in terms of delivery ratio, overhead and latency. A reputation based intermediate message forwarding control scheme was proposed in this paper. Simulation results show that an appropriate reputation threshold value improves the network performance.

Keywords: reputation; behavior; simulation; control

1 Introduction

Recent studies on the impact of selfish behavior show that the performance are severely influenced if a major portion of the nodes is selfish in terms of delivery ratio, overhead and latency \cite{1}\cite{2}. In order to incentive a selfish node to cooperate in forwarding message, a number of schemes have been proposed. These schemes can be classified into \cite{2}\cite{4}: barter based \cite{3}\cite{5}\cite{6}; credit based \cite{7} and reputation based \cite{9}\cite{10}\cite{11}.

Credit-based schemes, e.g. payment schemes, aim at stimulating selfish nodes to cooperate through introducing some form of virtual currency. Nodes are paid for forwarding, and pay for the forwarding service of others. These schemes make selfish nodes unwilling to deny forwarding \cite{13}.

In this paper, we aim to design a reputation estimation scheme to combines above two together and reveal private information very little. The proposed scheme views the selfish activities (such as like dropping and non forwarding) and the uncompetitive behavior (such as dropping caused by insufficient memory or power) as the same results.

The remainder of this paper is organized as follows: Section 2 provides the reputation based intermediate message forwarding scheme. The performance evaluation is given in Section 3. Conclusion is in Section 4.
2 The Reputation Based Forwarding Scheme

We proposed a relay-ability based scheme to reflect the behavior of intermediate nodes in relaying the message which serves as a behavior record of message processing. First, the transmission and relaying of message are integrated into the protocol presented in our proposal. Equation 1 gives a comprehensive consideration in the calculation of direct reputation and indirect reputation value of the node j and i:

\[
R_{ij} = \alpha \times R_{ij}^d + (1 - \alpha) \times R_{ij}^{\text{in}}, \ 0 \leq \alpha \leq 1
\]

where \( R_{ij}^d \) is the direct reputation of the j to i. \( R_{ij}^{\text{in}} \) is the indirect reputation of the j to i. \( R_{ij} \) is the total reputation of j to i including the direct reputation and indirect reputation. The a and 1-a are weight of direct reputation and indirect reputation respectively.

\[
R_{ij}^d = N_t / N_s, \ 0 \leq R_{ij}^d \leq 1
\]

Equation 2 calculates the direct reputation. \( N_t \) is the number of message that node j relayed from node i. \( N_s \) is the number of the messages that node i sent to node j. Thus, the reputation value is between 0 and 1.

3 Simulation Results

The performance of proposed protocol is compared with related work. The simulations were performed in ONE 1.41 simulator [12].

3.1 Simulation Configuration

Table 1 summarizes the simulation configuration.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simulation time</td>
<td>10800s</td>
</tr>
<tr>
<td>Buffer size</td>
<td>5M</td>
</tr>
<tr>
<td>Wait time</td>
<td>0-120</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>2.5m/s</td>
</tr>
<tr>
<td>Event generators</td>
<td>5m/s-25m/s</td>
</tr>
<tr>
<td>Message sizes</td>
<td>500K</td>
</tr>
<tr>
<td>Number of Nodes</td>
<td>up to 360</td>
</tr>
</tbody>
</table>
3.2 Varying Mobile Speed

At beginning the delivery rate difference of proposed scheme is not obvious. A higher reputation threshold will exclude some nodes that not fully qualified but still can relay partial messages. A higher reputation threshold may benefit more from the mobility to make up for inadequate numbers of nodes, as shown in Fig.1.

![Graphs showing delivery probability, overhead ratio, and latency for varying mobile speeds.]

**Fig. 1.** The Performance of Various Speed

4 Conclusion

This paper proposed a reputation based intermediate message forwarding control scheme by monitoring the transmission and forwarding behavior of nodes.

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References