Analytical Optimal Solution of Selfish Node Detection with 2-hop Constraints in OppNets: A Pontryagin's Maximum Principle Approach

Selfish Node Detection,

Ordinary Differential Equation,

Pontryagin's maximal principle

Selfish node detection offers an effective means to mitigate the routing performance degradation caused by selfish behaviors in Opportunistic Networks (OppNets), but leads to the extra network overload and computation cost. Most existing effort in the literature focuses on exploring the detection methods based on the traffic analysis or the cooperations among nodes. In this paper, we investigate the state transition of nodes in the message dissemination without detection. Specifically, the Ordinary Differential Equation (ODE) is constructed to approximatively model the periodic detection with complete detection requirement. Then we propose the optimal detection solution with the Pontryagin's maximum principle, and mathematically deduce the right detection time during the message lifetime. The model soundness is verified statistically and the analysis accuracy is evaluated via extensive simulations. The experiments also show that our solution can achieve the tradeoff between the reward and the detection cost.

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