An analytical model of MANET single-path and multi-path load balancing routing protocol based on Markov model

LunXia *, Yonghang Yan**, DanMeng *, Zhijia Li*, Xuewen Xia*, Chen Chen*

*School of Computer Science and Information Engineering, Henan University, Kaifeng, China

** School of Computer Science and Information Engineering, Henan University, Kaifeng, China,
**corresponding author

xl786254792@gmail.com, yanyonghang@henu.edu.cn, mengdantxt@gmail.com, lizhijialzj@gmail.com, xiaxuewena@gmail.com, littletomchenchen@gmail.com

Abstract—As the research of load balancing method in wireless self-organizing networks progresses, it was found that multi-path algorithms show superiority in terms of their abilities to improve packet delivery rate, increase transmission reliability, and handle network congestion and heavy traffic in a timely manner. In this paper, a new analytical model is presented to analyze and compare the superiority of multi-path algorithm over single-path algorithm in self-organizing networks based on four aspects: energy consumption, stability, throughput, and delay. The analysis is further confirmed from the simulation results, which show that the multi-path algorithm is 37% more stable than the single-path algorithm. Under the condition of the same number of packets sent, multi-path will be more energy efficient and time saving than single-path. In addition, multi-path nodes have higher throughput than single-path nodes with the same energy value.

Keyword—Analytical model, Energy consumption, Stability, Throughput, Delay.

Lun Xia, born in 1996, graduate student of computer technology, School of computer science and information engineering, Henan University, from 2019 to 2022, the main research directions include mobile ad hoc networks, wireless sensor networks.

Yonghang Yan, born in 1981, Ph.D., is an associate professor at Henan University. His research interests include Internet Architecture, Mobile Ad hoc Networks, Cybersecurity, Internet of Things, Blockchain.

Dan Meng, born in 1995, graduate student of computer technology, School of computer science and information engineering, Henan University, from 2019 to 2022, the main research directions include mobile ad hoc networks, wireless sensor networks.

Zhijia Li, born in 1998, graduate student of computer technology, School of computer science and information engineering, Henan University, from 2020 to 2023, the main research directions include mobile ad hoc network, UAV network.

Xuewen Xia, born in 1998, graduate student of computer technology, School of computer science and information engineering, Henan University, from 2020 to 2023, the main research directions include UAV network, wireless sensor networks.

Chen Chen, born in 1997, graduate student of computer technology, School of computer science and information engineering, Henan University, from 2021 to 2024, the main research directions include mobile ad hoc network, UAV network, wireless sensor networks.