Joerg Heber
Editor-in-Chief
PLOS ONE

10 January, 2019

Dear Dr. Heber,

I am writing to re-submit the original research paper entitled, “Towards attack-tolerant networks: concurrent multipath routing and the butterfly network,” by Edward L. Platt and Daniel M. Romero, for consideration for publication in PLOS ONE. This manuscript was previously returned with revisions needed. Our communication has been with Lazaros K. Gallos.

Previous literature has shown that heavy-tailed networks, including the internet router network and the world-wide-web, are vulnerable to targeted attacks, due to having small numbers of highly-central nodes. Information security research has largely focused on cryptographic solutions. However, targeted attacks often rely on the coercion of entities in control of central nodes, rendering cryptographic solutions moot. Structural solutions are necessary: central nodes cannot be coerced if they do not exist. This manuscript presents such a solution.

In this manuscript, we present a novel algorithm for constructing concurrent routes through a butterfly network topology. Such redundant routes are desirable for eliminating critical failure points, e.g., to reduce the opportunity for targeted attacks. Our algorithm constructs 2^h h-internally disjoint paths between any distant pair of nodes. We also use numerical simulations to evaluate the benefits of imperfectly rewiring a real-world network (internet routers) to more closely resemble a butterfly network. We find that the giant component can tolerate the failure of between 2% and 8% of the most central nodes when 10% and 90% (respectively) of the edges are rewired, compared to tolerating failure of only 1% of the most central nodes with no rewiring.

We believe this manuscript is appropriate for publication in PLOS ONE because it presents novel primary results in network science, mathematics, and engineering. The interdisciplinary nature of this work makes it particularly well-suited for PLOS ONE. The problem of coercive targeted attacks in heavy-tailed networks has, so far, remained unsolved. Although potentially resource-intensive, this manuscript shows that structural solutions are, in principle, possible.

This manuscript has not been published and is not under consideration for publication elsewhere. This work was supported by the NSF under Grant No. IIS-1617820. There was no additional external funding received for this study. We declare no conflicts of interest. We suggest the following Editors: Antonio Scala, Floriana Gargiulo, Lazaros K. Gallos, Sandro Meloni, Nicola Perra, and Filippo Radicchi.

Thank you for your time and consideration. We look forward to your reply.

Sincerely,
Edward L. Platt
PhD Candidate, University of Michigan School of Information