

Reading Report #3
Paper: The Revised ARPANET Routing Metric
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The revised metrics and its implementation HN-SPF proposed by the paper improved routing in the ARPANET substantially compared to the previous alternatives (min-hop and D-SPF). However, the paper does not give good enough technical details for others to repeat or improve their work. It also leaves some open questions yet to be answered. Therefore I will first list weaknesses of the paper and then state what I would do to make up these weaknesses.

First, the paper is being vague about how they chose parameters/coefficients for the revised metric. For example, it limits the relative cost for a link can report to be no more than two additional hops in a homogeneous network. No justification was made for this number. In addition, the revised metric puts upper and lower bounds on the cost that can be reported by each link. But they did not talk about how they chose this upper and lower bound, what criteria they used and how they would justify their choices. Further, how to adjust normalization parameters based on link type remains unanswered. Is it done by hand or by program? Is it static for each link type or dynamically adaptive? Without knowing these, it is very hard to repeat their work. Moreover, we need answers to these questions in order to evaluate if the revised metrics can be scaled to more diverse networks with many link types. For complex networks, hand-tuning parameters sounds a horrible idea.

Second, the pseudo code for HN-SPF is hard to understand without being given more detailed explanations.

Third, the paper shows that HN-SPF can oscillate around its equilibrium with a bounded amplitude. But it does not talk about how we could eliminate this problem. This minor oscillation can cause more network traffic.

To address the first problem, I will elaborate the reasons for choosing those normalization parameters. Try to argue that they are optimal or sub-optimal, or give theoretical background to justify the choices, or at least give heuristics for hand-tuning those numbers to achieve better performance.

To address the second problem, I will rewrite the pseudo code for HN-SPN to make it easier for readers to understand and give more detailed explanations about it. Thus they can reproduce the work for further improvement.

To address the third problem, I will talk about how we could possibly eliminate the oscillation around the equilibrium. My thinking is that if each router is aware of as soon as it enters the oscillation region, we can avoid oscillation by using some different metrics calculation strategy or by changing the way network responses. For example, we can employ a different link cost function which only applies to the oscillation region. It can be as simple as changing the update limits (maximum & minimum changes allowed) for link cost value, or can be a complicated formula. The idea is that the routing metrics should be adaptive to the dynamic changes in networks. The assumption, though, is that routers are sensitive to the equilibrium state and oscillation region.