Draft for Networking Paper

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***Abstract*—The abstract goes here.**

I. Introduction

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II. Notes

With network developed, it is consist of more and more end-hosts, routers, switches, the topology aslo become more complex than ever before. As a result, we not only consider the utilization but also the energe consuming of the network.

Things seem to be not so obviously simple. Suppose two hosts named host A and host B, and there are three links between them, respectively, capacity with 2M, 3M and 5M. Now traffic matrix comes, with 1M from A to B. we regard the capacity as the power of the link, and the min max utilization of network links as a metric of the network performance. There are two directions for operating this demo network. One consider the min power consumption except for the utilization, it is obviously that we should close the larger power consuming links, such as the 5M and 3M links, and all the traffic go through the 2M link. In this way, the min max utilization of network is 0.5 and the power consuming is 2 units (means the power difference come from the link mainly). The other consider the power except for the utilization reversely, so we should split the 1M traffic to three parts, 0.2M accros 2M link, 0.3M accros 3M link and 0.5M accros 5M, consequently with a min max utilization of 0.1, but the power is 10 units however.

Two directions mentioned above both are extremely single-consideration. Previous researchers solve the problem more considerable, include "GreenTE" and "a%-green is engouh". The former set a threshold of min max utilization, close links as many as possible to achive the most power saving. And the latter one set a destination of the power saving, calculate optimal route for get the min max utilization. Two work have their restriction, which both need a specific traffic matrix that as base of their optimization.

But the need of precise current traffic matrix shound be carefully checked. Although some researcher contribute to this area, the real precise traffic matrix still be a challenge. Take a step back, the dynamic of traffic matrix is more diffcult even if we obtain the precise current one. Futhermore, ISP will not want to change their route policy frequently, as it will result in other route failure possiblly. So our question is that : Is there exist a route both satisfy power and utilization requirement for any traffic matrix given?

David Applegate propose a method for obtain a route wihich is "robust" to variations in demands for a specific network topology. We define d_{ab} as the demand from a to b, routing can be specified by a set of values $f_{ab}(i,j)$ which means the fraction demand from a to b routed on the link (i,j). Obviously, the d_{ab} contribute to the link (i,j) is $d_{ab}f_{ab}(i,j)$. We also defined cap_{ij} as the capacity of the link (i,j);

Formally, the max link utilization of a routing r on traffic matrix tm can be described as following:

$$U_{r,tm} = \max_{(i,j)\in links_of(tm)} \sum_{a,b} \frac{d_{ab}f_{ab}(i,j)}{cap_{ij}} \tag{1}$$

The routing which own the min max link utilization is the optimal one in the possible routing set R, it can be represented by :

$$OptU_{tm} = \min_{r\in R} U_{r,tm} \tag{2}$$

Now we define what is "robust", before this we introdunce the "distance" between the current routing r and the optimal routing in the some traffic matrix tm, as following :

$$Perf(r,\{tm\}) = \frac{\max_{(i,j)\in links_of(tm)} \sum_{a,b} d_{ab}f_{ab}(i,j)/cap_{ij}}{OptU_{tm}} \tag{3}$$

and the "robust" routing satisfied the min max distance for all possible traffic matrix which represent TM, i.e.

$$Perf(r,TM) = \max_{tm\in TM} Perf(r,\{tm\}) Perf(R,TM) = \min_{r\in R} Perf(r,T \tag{4}$$

III. Conclusion

The conclusion goes here.

References

[1] H. Kopka and P. W. Daly, *A Guide to LaTeX*, 3rd ed. Harlow, England: Addison-Wesley, 1999.