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A K self-adaptive SDN controller placement for wide area networks

Key words: Software-defined networking (SDN), Controller placement, K self-adaptive method

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Motivation

- Although local area networks like data center networks have benefited from SDN, it is still a problem to deploy SDN in wide area networks (WANs) or large-scale networks.
- The problems of SDN domain partition and controller placement should be further addressed.
- The controller placement is one of the problematic issues that have not been studied in depth. Although several studies on this topic exist, only a few have considered the effect of the latency, load balancing, reliability, and self-adaptive in this issue.

Main idea

- Inspired by the observations that people tend to partition WAN into several SDN domains, we propose a K self-adaptive spectral clustering algorithm, which can discover the stability of SDN domains and decide the optimal number of SDN domains automatically.
- To test our proposed method, a corresponding framework was established to perform the full SDN simulation.

Method

1. Introduce the concept of the WAN partition and design the rules of SDN domain partition.
2. Construct similarity matrix and obtain the optimal number of SDN domains K by analyzing the similarity matrix. Then, partition the large network into K small SDN domains.
3. Carry out various experiments based on the proposed method.

Major results

- Our method can obtain the optimal number of SDN domains K and the results are in agreement with the experimental results obtained by setting K manually.

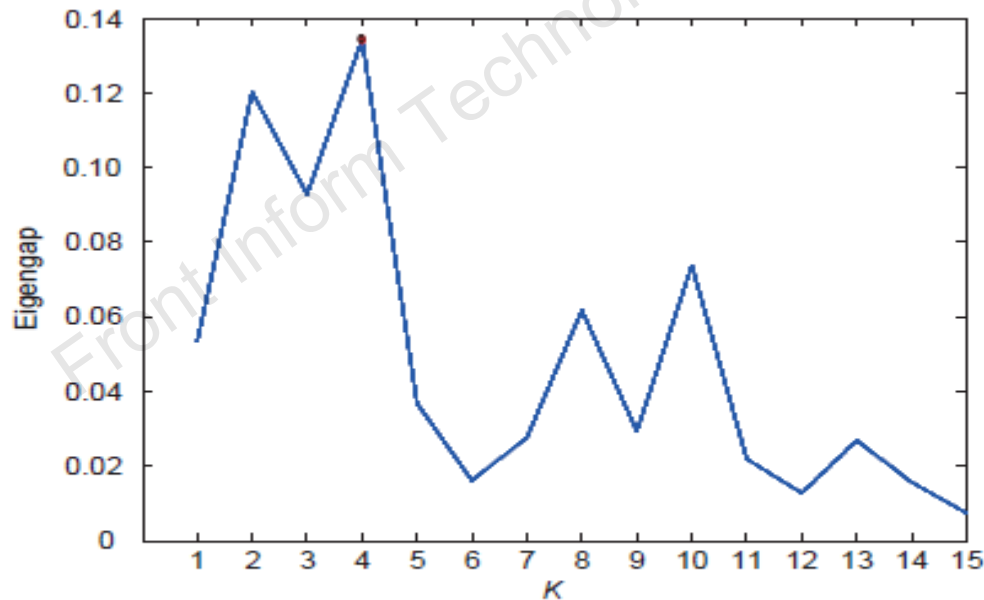


Fig. 6 Eigengap with different K 's

Major results (Cont'd)

- Compared with other methods, the experiments show the effectiveness of our method for the SDN domain partition and controller placement problems.

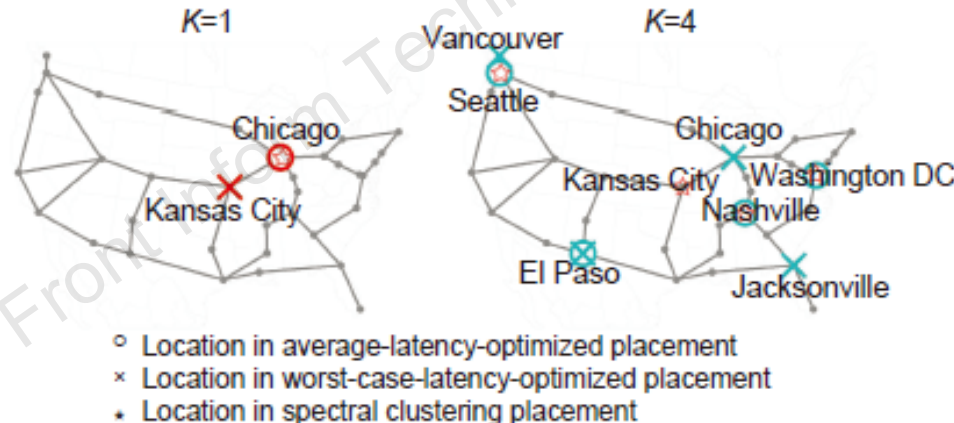


Fig. 5 Three placements for one or four controllers in the OS3E deployment

Conclusions

- Inspired by the observations in a recent survey, we present a K self-adaptive spectral clustering algorithm, to decide the optimal number of SDN domains automatically.
- We implemented our method using a spectral clustering approach, and a corresponding framework was established to perform the full SDN simulation.
- We evaluated our method with the Internet2 topology and other available WAN topologies. The results show the effectiveness of our algorithm for the SDN domain partition and controller placement.