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A forwarding graph embedding algorithm exploiting regional topology information

Key words: Network function virtualization; Virtual network function; Forwarding graph embedding

Corresponding author: Hongchao Hu
E-mail: 13633833568@139.com
ORCID: http://orcid.org/0000-0002-9770-6610

Motivation

- Network function virtualization (NFV) is a newly proposed technique designed to construct and manage network functions dynamically and efficiently.
- Allocating physical resources to virtual network function forwarding graph is a critical issue in NFV.
- We formulate the forwarding graph embedding (FGE) problem as a binary integer programming problem, which aims to increase the revenue and decrease the cost to service provider while considering limited network resources and the requirements of virtual network functions.

Main idea

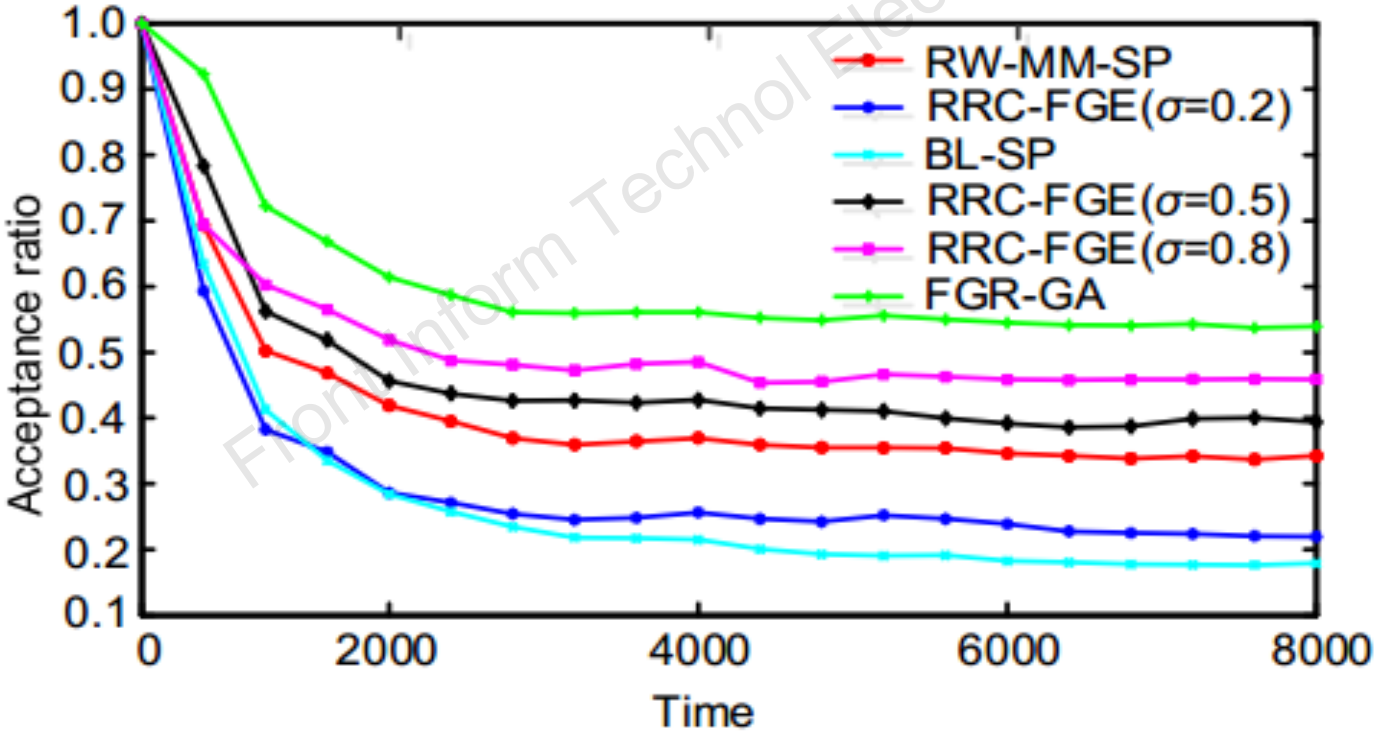
- The FGE problem is formulated as a binary integer programming (BIP) problem, which takes resource capacity of the substrate network and resource constraints of FGs into consideration.
- A regional resource clustering metric is designed to evaluate the embedding potential of substrate nodes, and an efficient topology-aware heuristic FG embedding algorithm based on that metric is proposed.
- A genetic algorithm based heuristic algorithm is also proposed to maximize the long-term economic benefits.

Method

1. The objective of the proposed BIP model is to minimize embedding cost.
2. The constraints of the BIP model are the physical resource constraint, resource requirement constraint, and flow constraint.
3. We formulate the forwarding graph embedding problem as a binary integer problem, and use a topology-aware heuristic algorithm (Algorithm 1) to find an approximate solution.

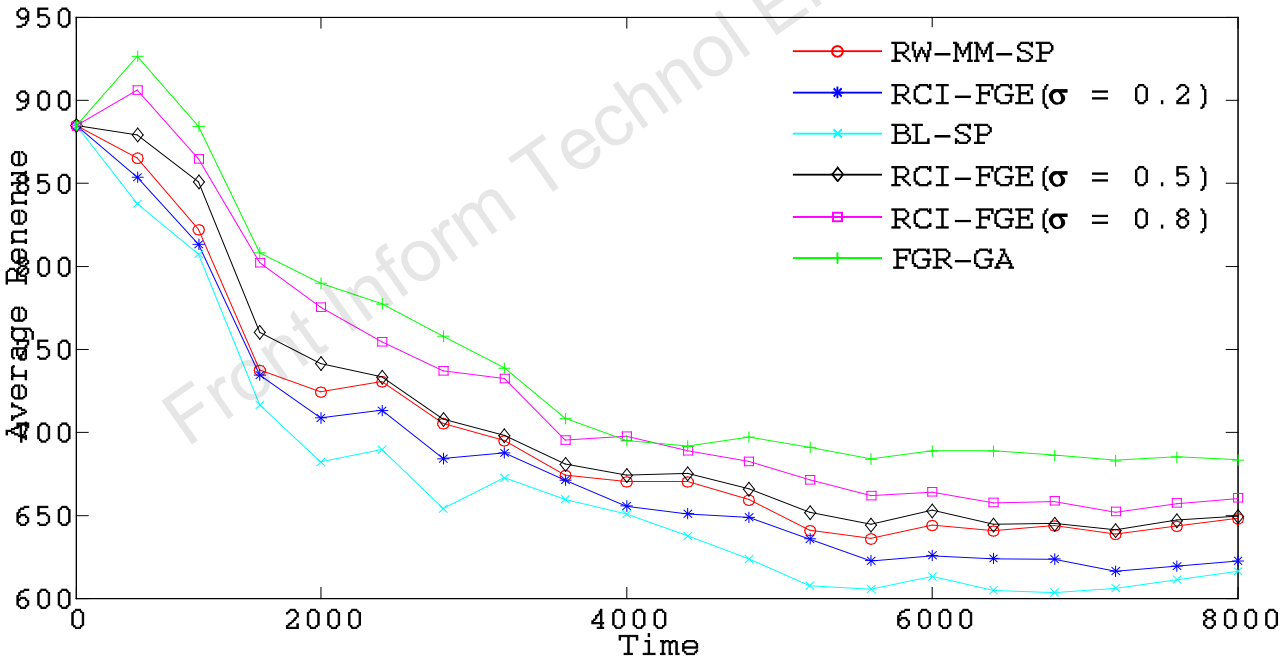
Major results

- The proposed algorithm reaches a higher request acceptance ratio than existing algorithms



Major results (Cont'd)

- The proposed algorithm reaches higher profits to the service provider.



Conclusions

- The FGE problem is a critical problem in network function virtualization.
- We formulate the FGE problem as a BIP problem and propose two heuristic embedding algorithms to solve it.
- Experiments demonstrated the efficiency of our proposed embedding algorithms in terms of the acceptance ratio and profits to the service provider.