Shui-qing Gong, Jing Chen, Qiao-yan Kang, Qing-wei Meng, Qing-chao Zhu, Si-yi Zhao, 2016. An efficient and coordinated mapping algorithm in virtualized SDN networks. *Frontiers of Information Technology & Electronic Engineering*, **17**(7):701-716. http://dx.doi.org/10.1631/FITEE.1500387

An efficient and coordinated mapping algorithm in virtualized SDN networks

Key words: Software-defined networking (SDN), Network virtualization, Controller placement, Virtual network embedding, Coordination

Contact: Shui-qing Gong
E-mail: gsq0121@126.com
ORCID: http://orcid.org/0000-0002-3657-3666

Introduction

- Due to the distinctions brought by SDN, most of the existing embedding algorithms cannot be directly applied to the SDN virtualization environment.
- The virtual SDN embedding problem is formulated into a multi-objective integer linear programming, and a heuristic algorithm called CO-vSDNE is designed to minimize the controller-to-switch delay and the mapping cost.

The virtual SDN network embedding problem

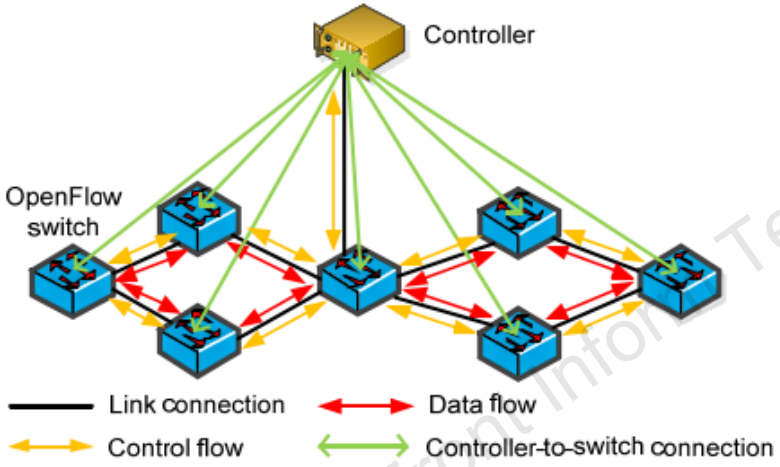

Fig. 1 Architecture of SDN network

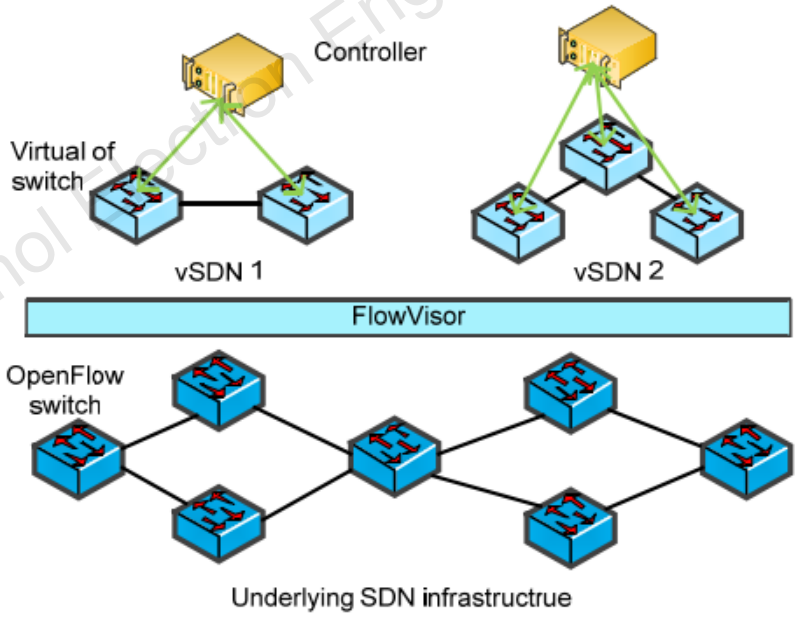

Fig. 2 Architecture of SDN virtualization

The node ranking

- **The controller location selection factor**

$$\mathrm{CLSF}(n_i) = \sum_{n_j \in N_S} (\mathrm{CPU}(n_j) + \mathrm{TCAM}(n_j)) \cdot \frac{\mathrm{bw}(n_i, n_j)}{\mathrm{delay}(n_i, n_j)}$$

- **The node mapping factor**

$$\mathrm{NR}(n_S) = \frac{H(n_S)}{\mathrm{delay}(M_N(n_C), n_S) \cdot \mathrm{hops}(M_N(f(n_V)), n_S)}$$

Measurement results

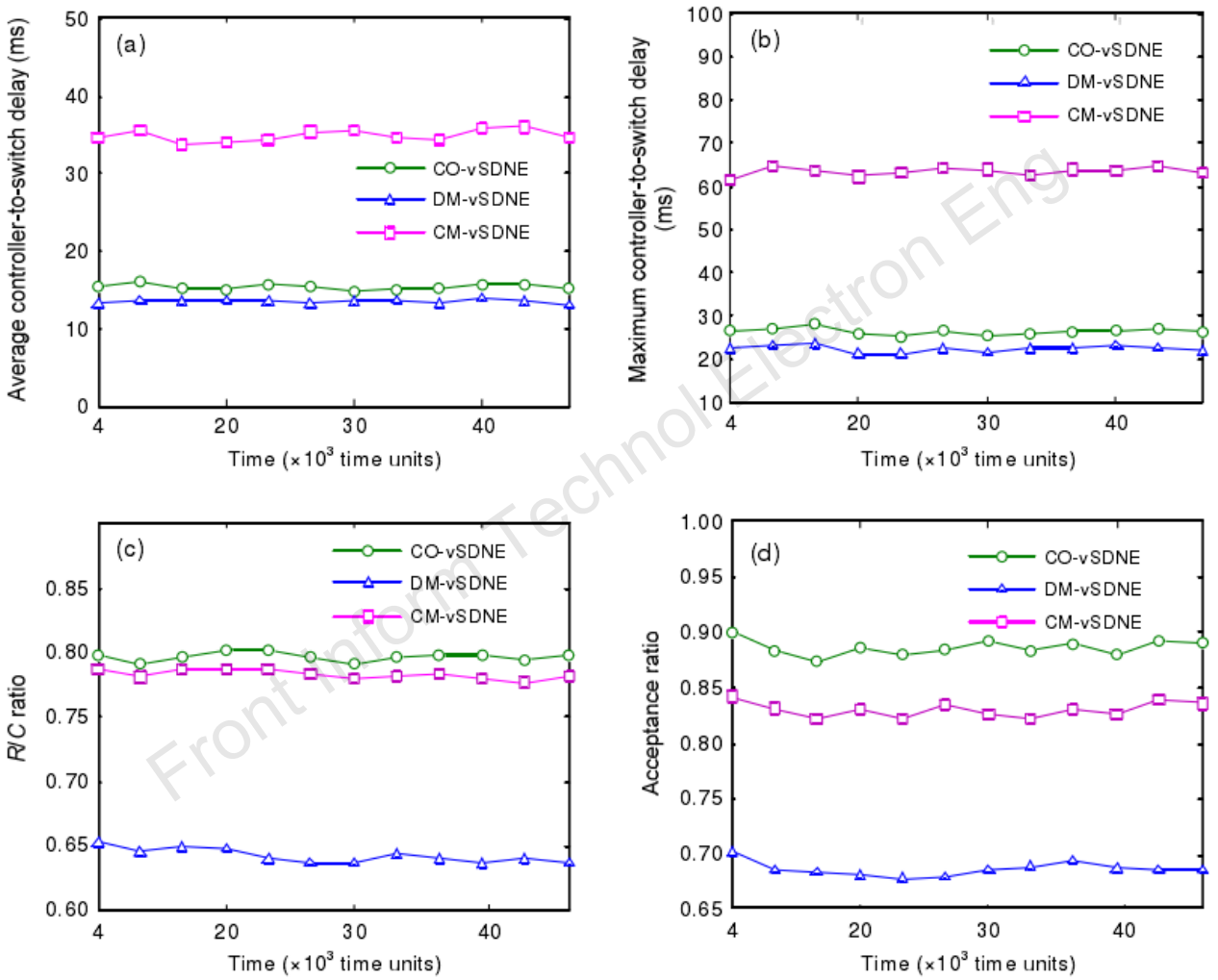

Fig. 3 Comparison between our algorithms and others on regular-sized vSDN scales in stable state: (a) long-term average controller-to-switch delay; (b) long-term maximum controller-to-switch delay; (c) long-term *R*/*C* ratio; (d) acceptance ratio

Measurement results (Cont'd)

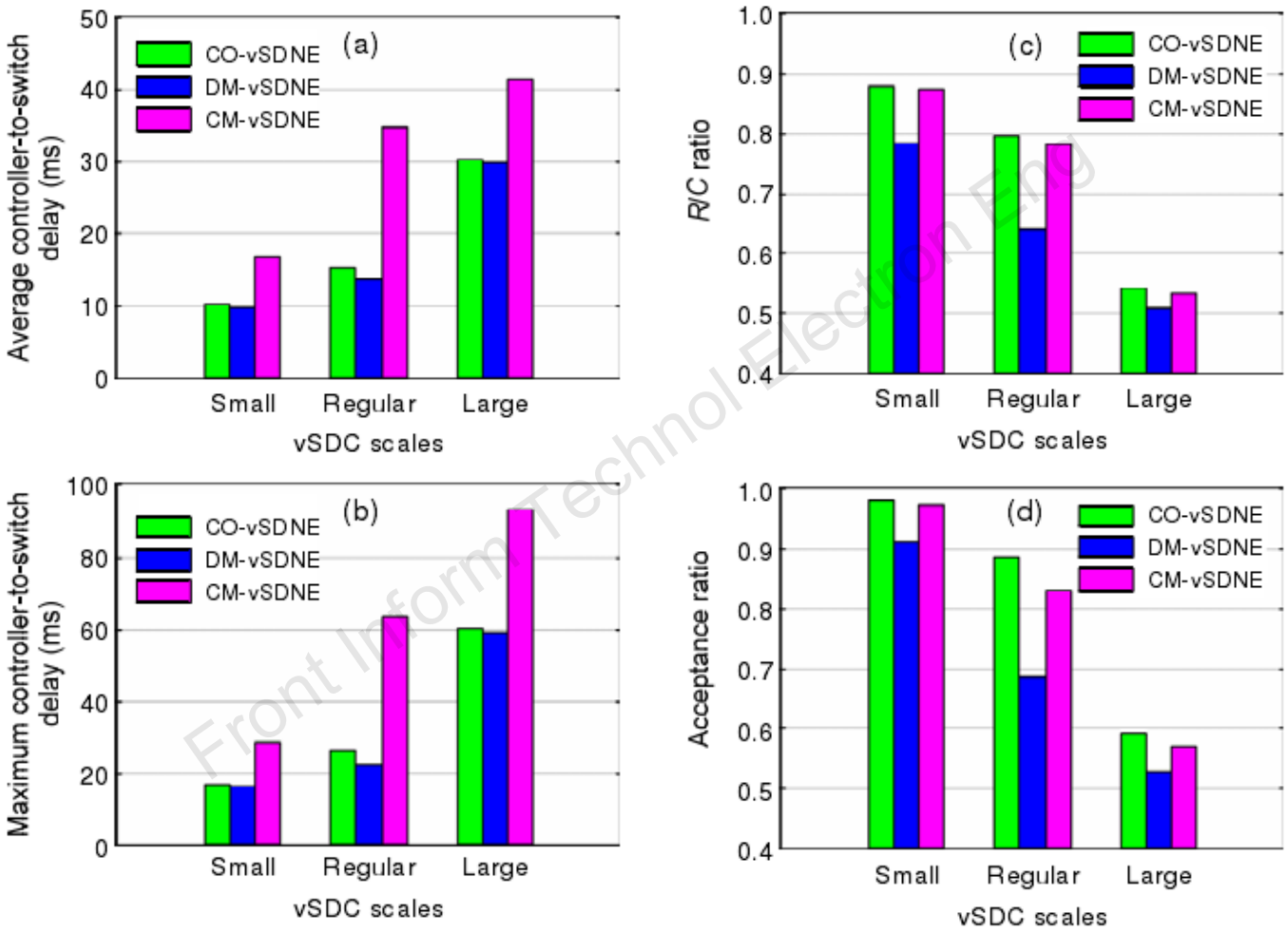

Fig. 4 Comparison between our algorithms and others on different-sized vSDN scales in stable state: (a) long-term average controller-to-switch delay; (b) long-term maximum controller-to-switch delay; (c) long-term *R*/*C* ratio; (d) acceptance ratio

Measurement results (Cont'd)

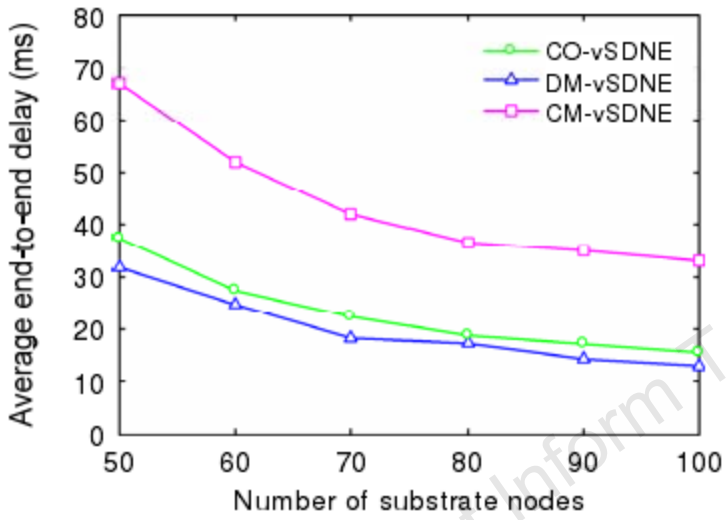

Fig. 5 Comparison of average end-to-end delay

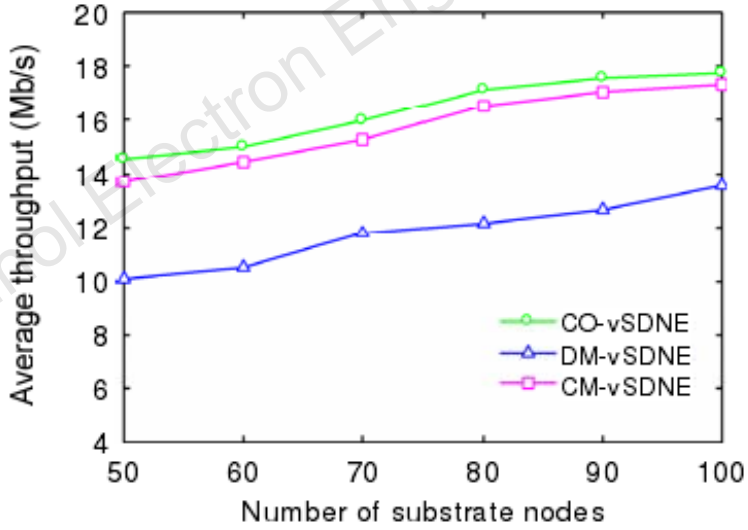

Fig. 6 Comparison of average throughput

Conclusions

We propose a novel online vSDN embedding algorithm, which performs the controller placement, the virtual node mapping, and the link mapping in a coordinated way. Simulation and emulation results show that the proposed algorithm achieves good performance in terms of the average and maximum controller-to-switch delays, the *R*/*C* ratio, the acceptance ratio, the end-to-end delay, and the throughput under different-sized vSDN scales.