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An efficient and coordinated mapping algorithm in virtualized SDN networks

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

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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

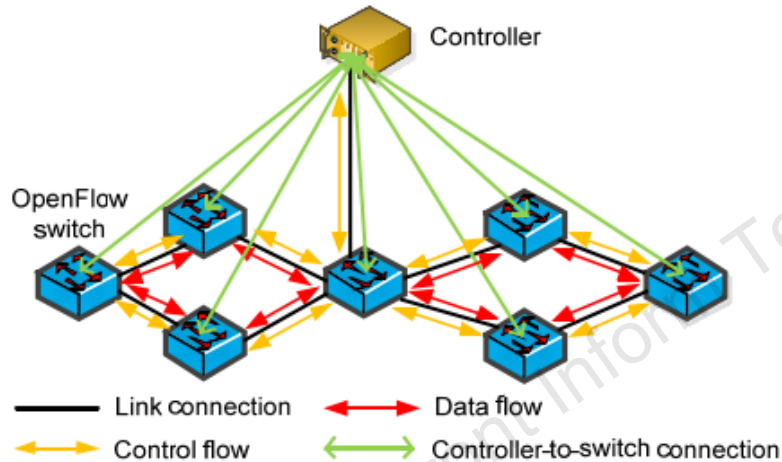


Fig. 1 Architecture of SDN network

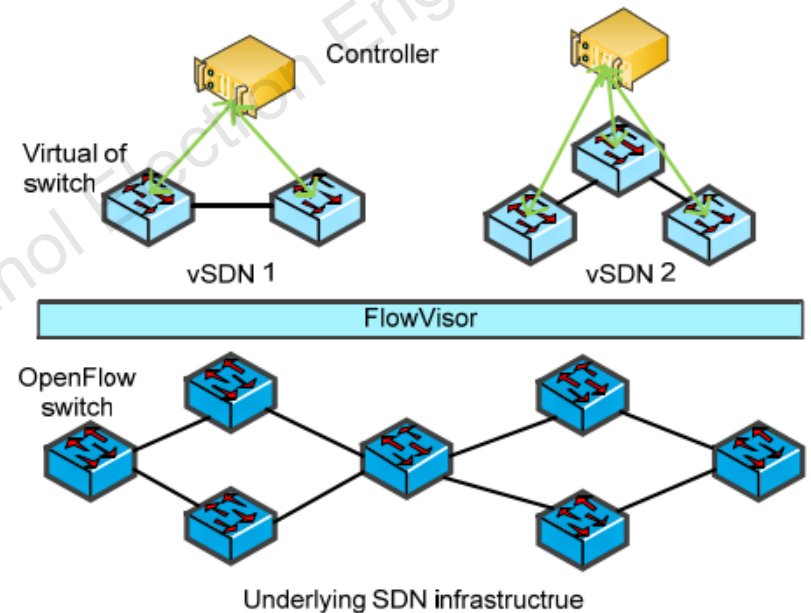


Fig. 2 Architecture of SDN virtualization

The node ranking

- The controller location selection factor

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

- The node mapping factor

$$\text{NR}(n_s) = \frac{H(n_s)}{\text{delay}(M_N(n_c), n_s) \cdot \text{hops}(M_N(f(n_v)), n_s)}$$

Measurement results

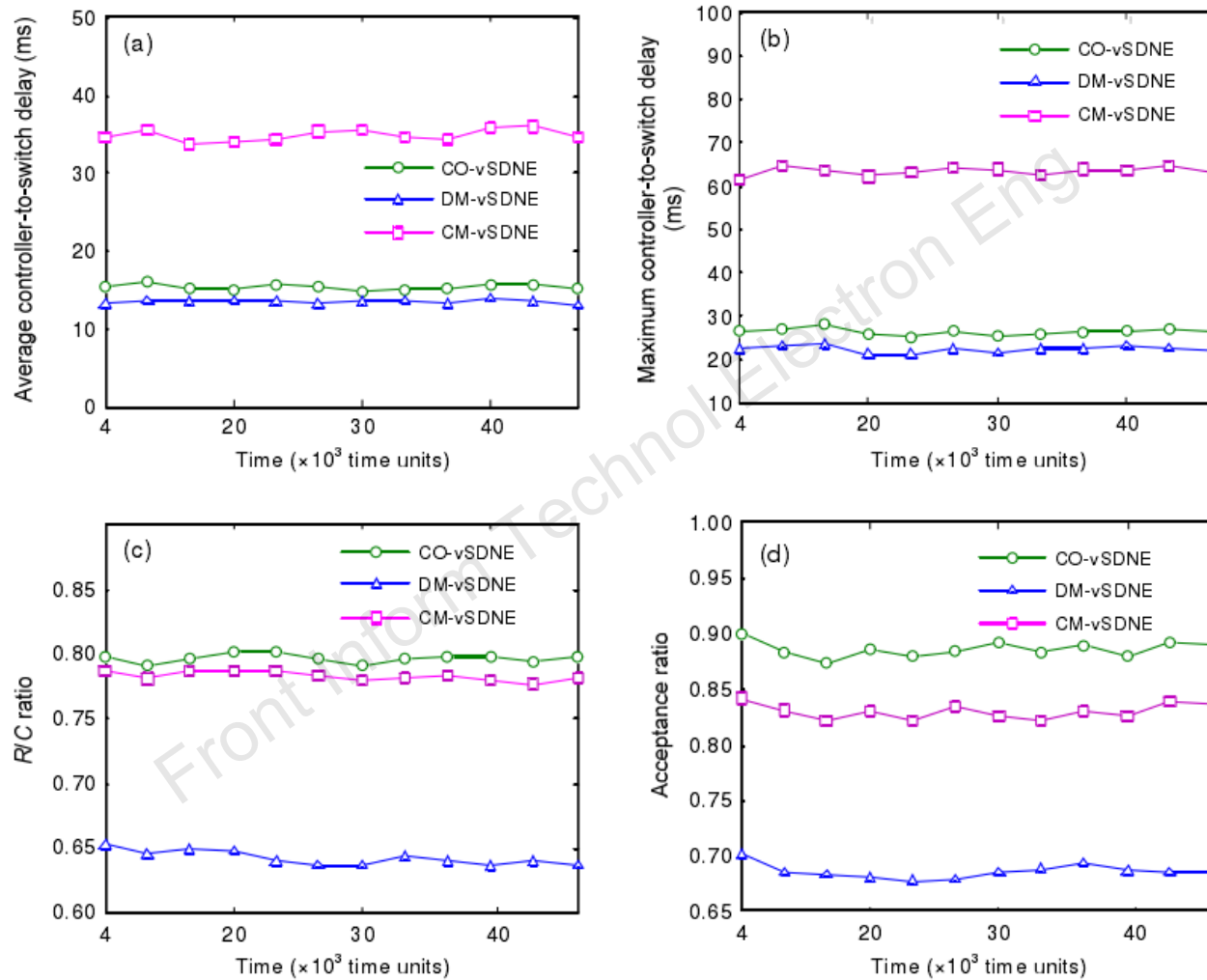


Fig. 3 Comparison between our algorithms and others on regular-sized vSDN scales in stable state: (a) long-term average controller-to-switch delay; (b) long-term maximum controller-to-switch delay; (c) long-term R/C ratio; (d) acceptance ratio

Measurement results (Cont'd)

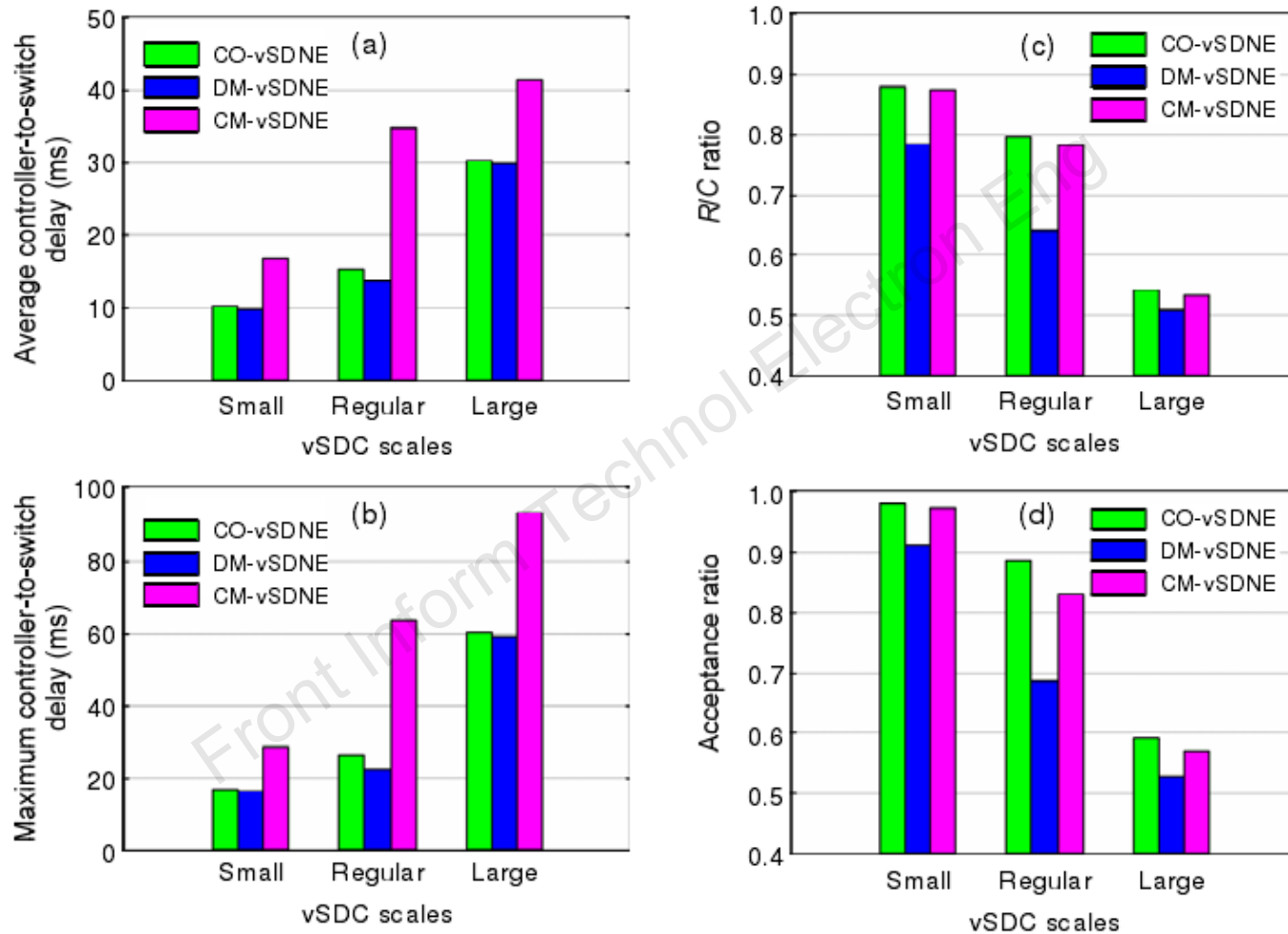


Fig. 4 Comparison between our algorithms and others on different-sized vSDN scales in stable state: (a) long-term average controller-to-switch delay; (b) long-term maximum controller-to-switch delay; (c) long-term R/C ratio; (d) acceptance ratio

Measurement results (Cont'd)

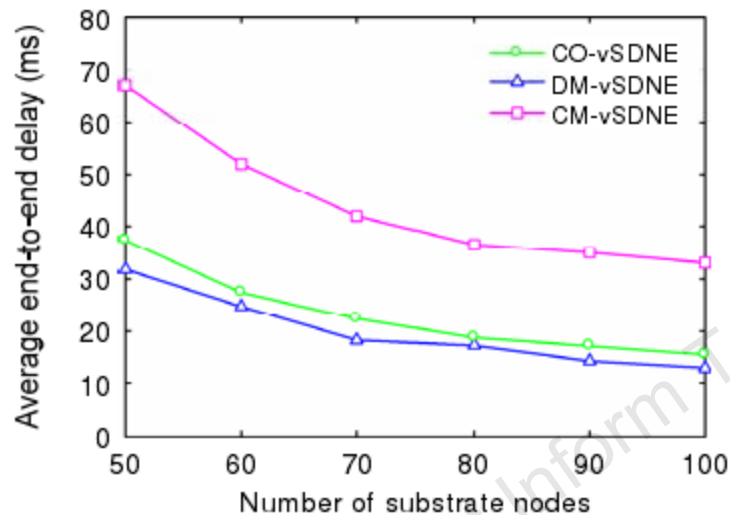


Fig. 5 Comparison of average end-to-end delay

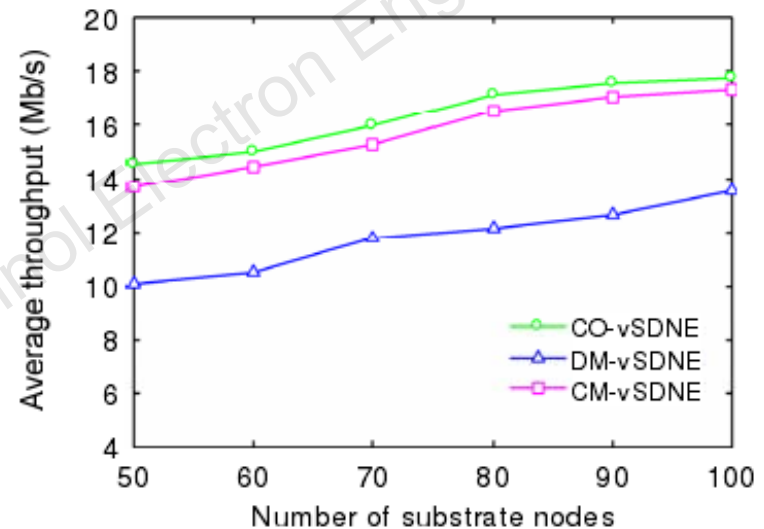


Fig. 6 Comparison of average throughput

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.