

NetSolver: Scalable Constraint-based Virtual Data Center (VDC) Allocation

Motivation

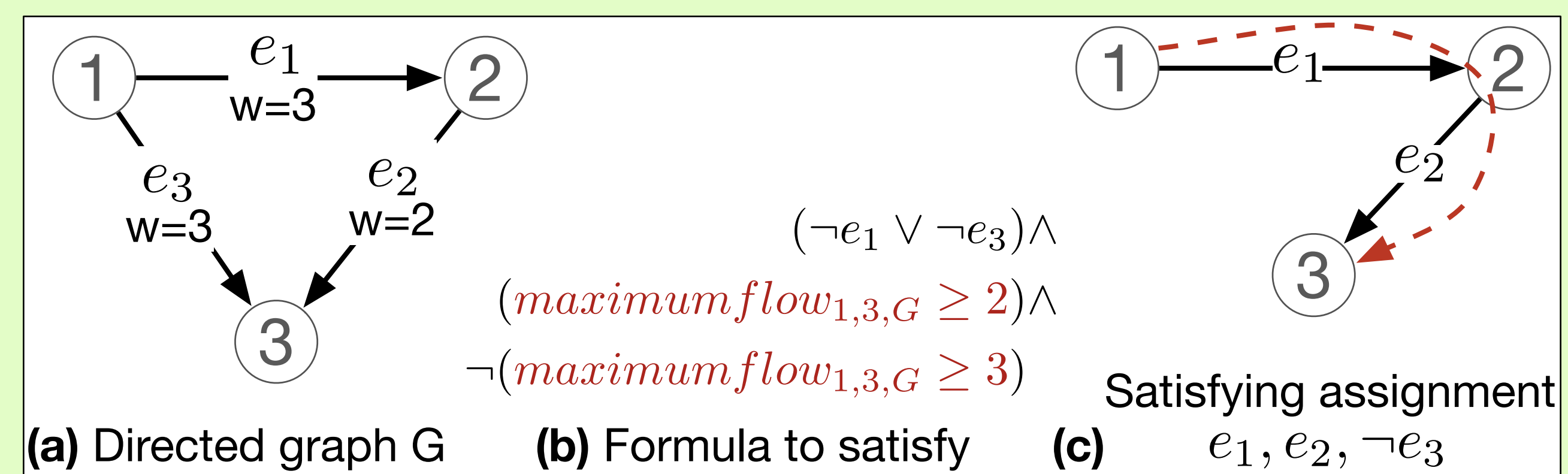
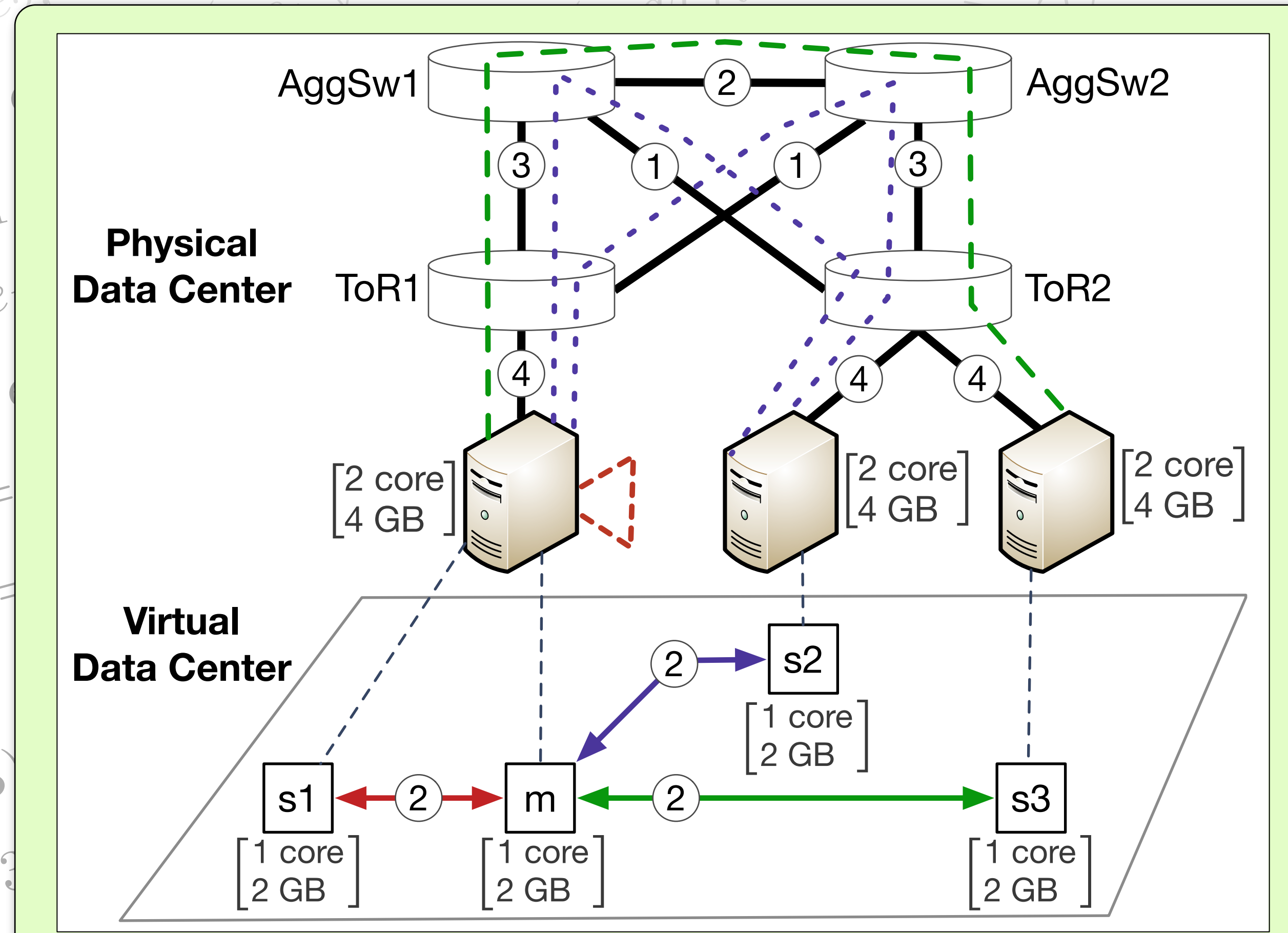
- Applications need **cloud SLAs** for predictable service
- Tenants can express their job/placement requirements as a **VDC**
- DC operators want to maximize their resource utilization

Existing approaches

- State-of-the-art: **fast but incomplete heuristic** algorithms [1]
- These **heuristics fail** to find a VDC allocation even if one exists
- Existing **constraint-based approaches** do not scale

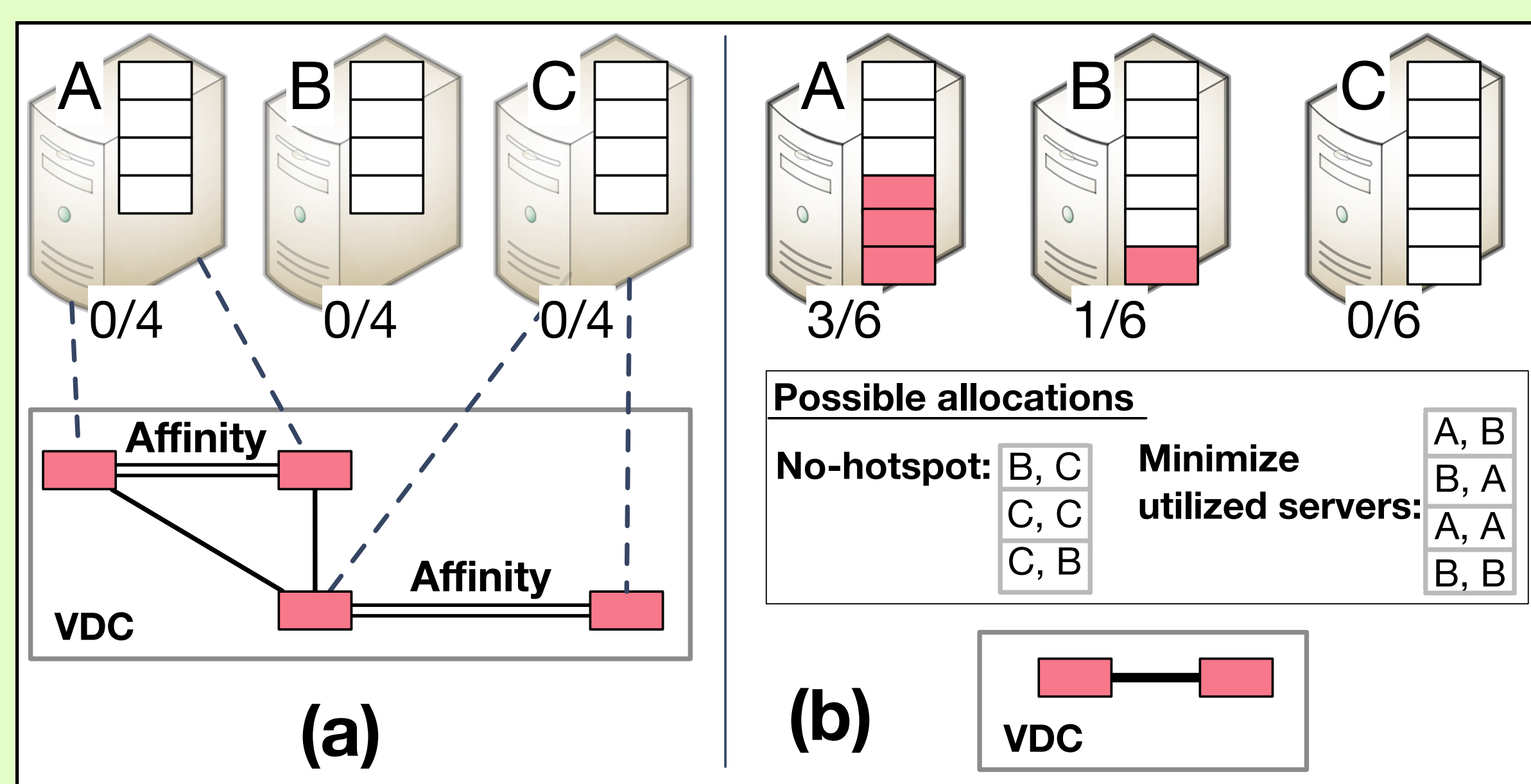
Our contribution: NetSolver

- Constraint-based** VDC placement tool that uses **MonoSAT**, an SMT solver with fast graph theories [3]
- CPU and memory are encoded as **integer constraints**
- Multi-path e2e bandwidth encoded as **max-flow constraints**
- Given a formula, MonoSAT computes a graph and a **valid flow assignment** that satisfies the formula

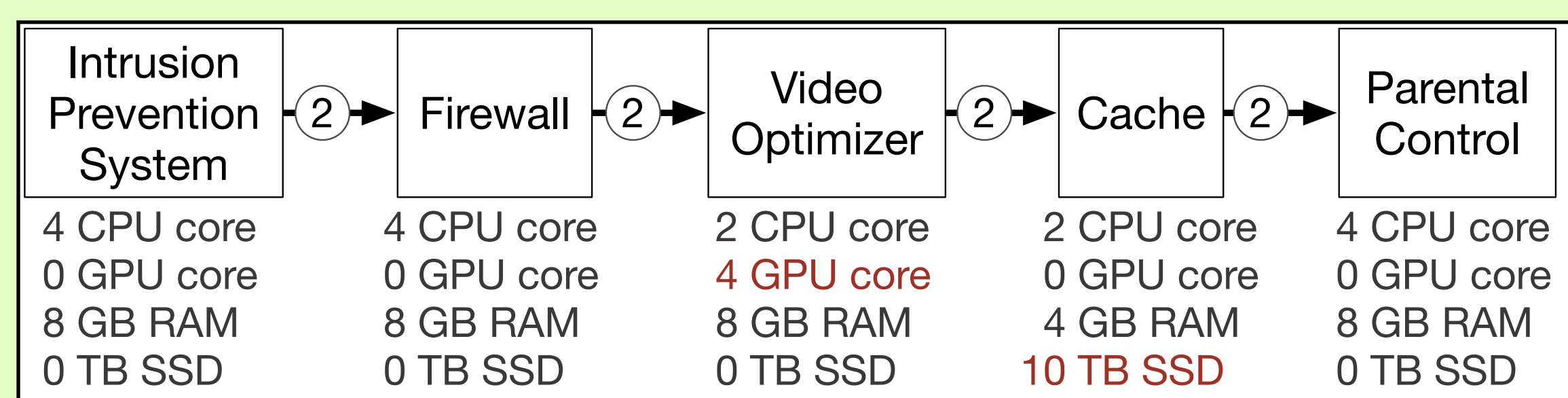


(a) Sample graph, (b) constraint, (c) solution

Extensions



VDC allocation with affinity and global constraints

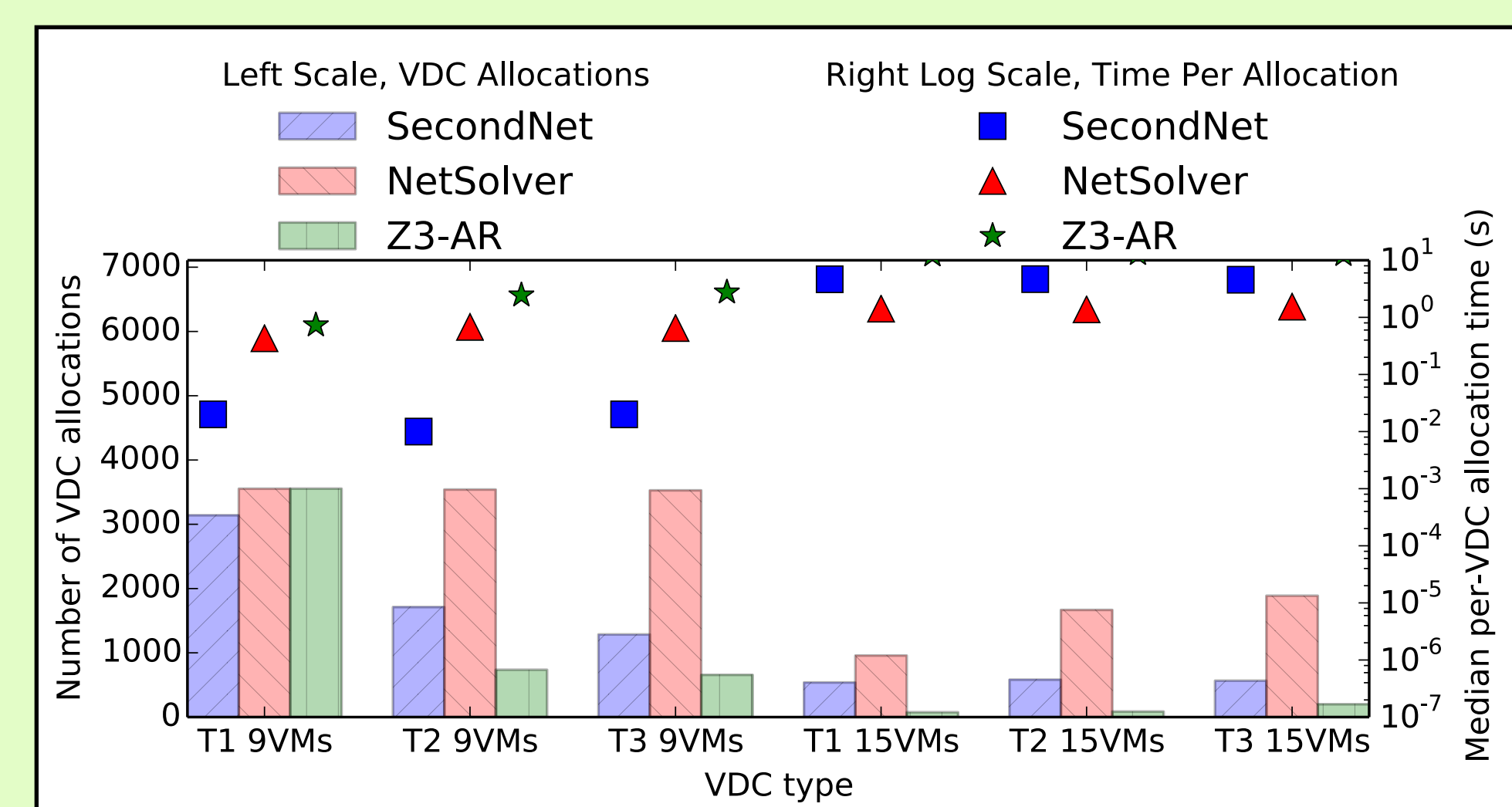


Network Function chain allocation

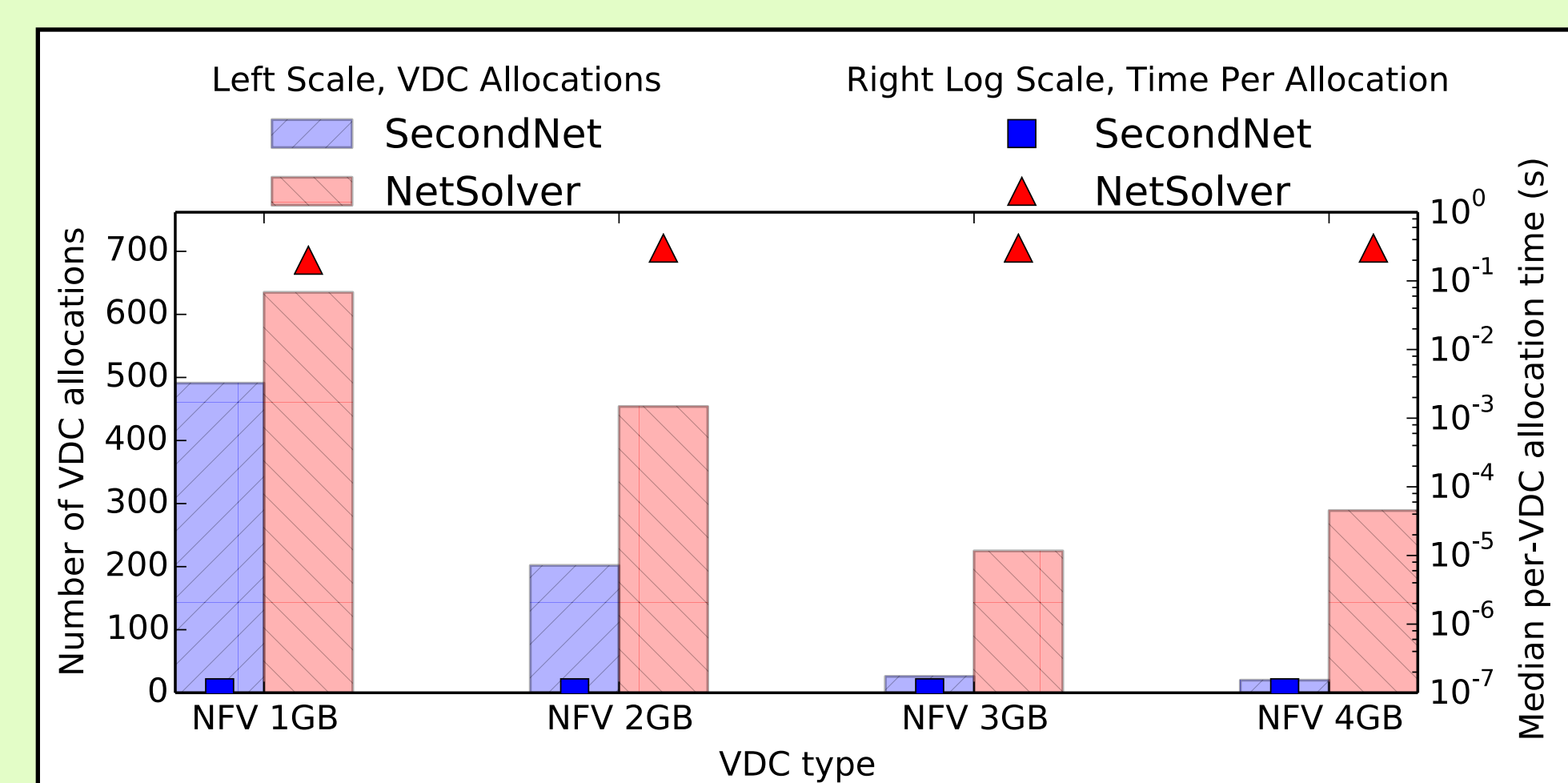
Evaluation

NetSolver achieves higher DC utilization than competing approaches

VDC allocation on data center with 2000 servers



NF chain allocation on data center with 1200 servers



- [1] Chuanxiong Guo et al. SecondNet: A Data Center Network Virtualization Architecture with Bandwidth Guarantees. In Co-NEXT, 2010.
 [2] Yifei Yuan et al. On the Feasibility of Automation for Bandwidth Allocation Problems in Data Centers. In FMCAD, 2013.
 [3] Sam Bayless, Nodir Kodirov, et al. Scalable Constraint-Based Virtual Data Center Allocation. To appear at IJCAI'17