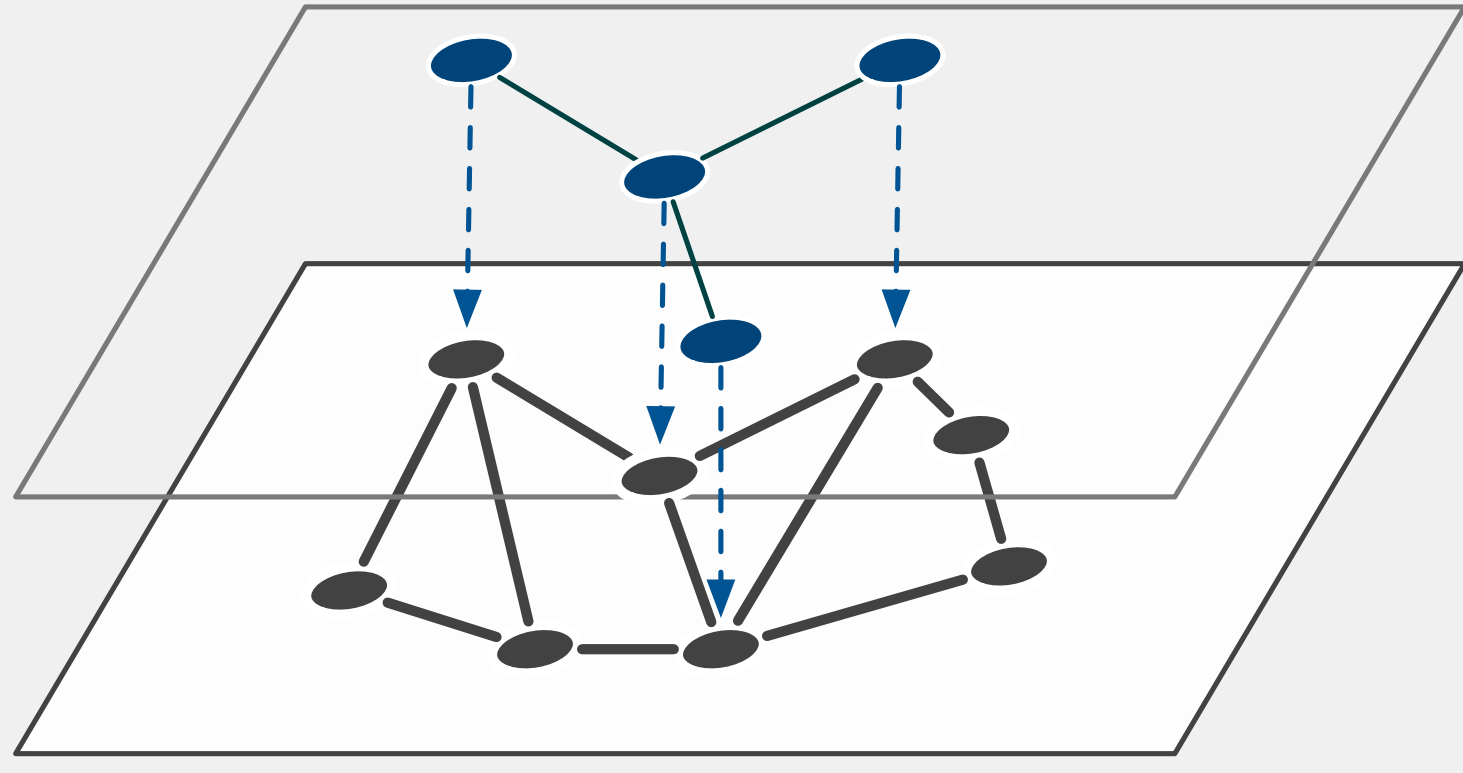


Defragmenting the Cloud

Oliver Michel, Eric Keller

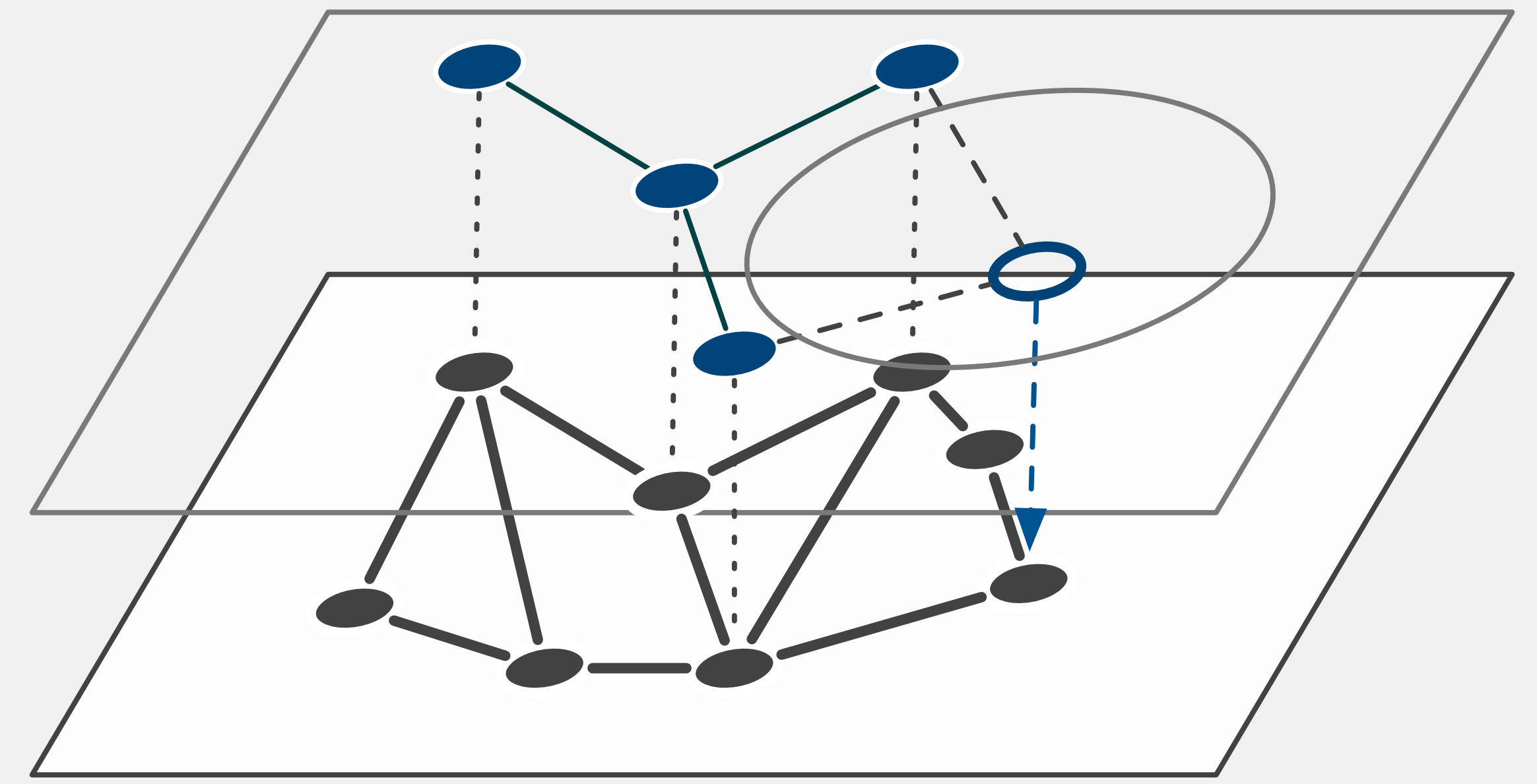
Network Virtualization

- ▶ Network virtualization is a widely used technique in datacenter networks to enable a more dynamic infrastructure



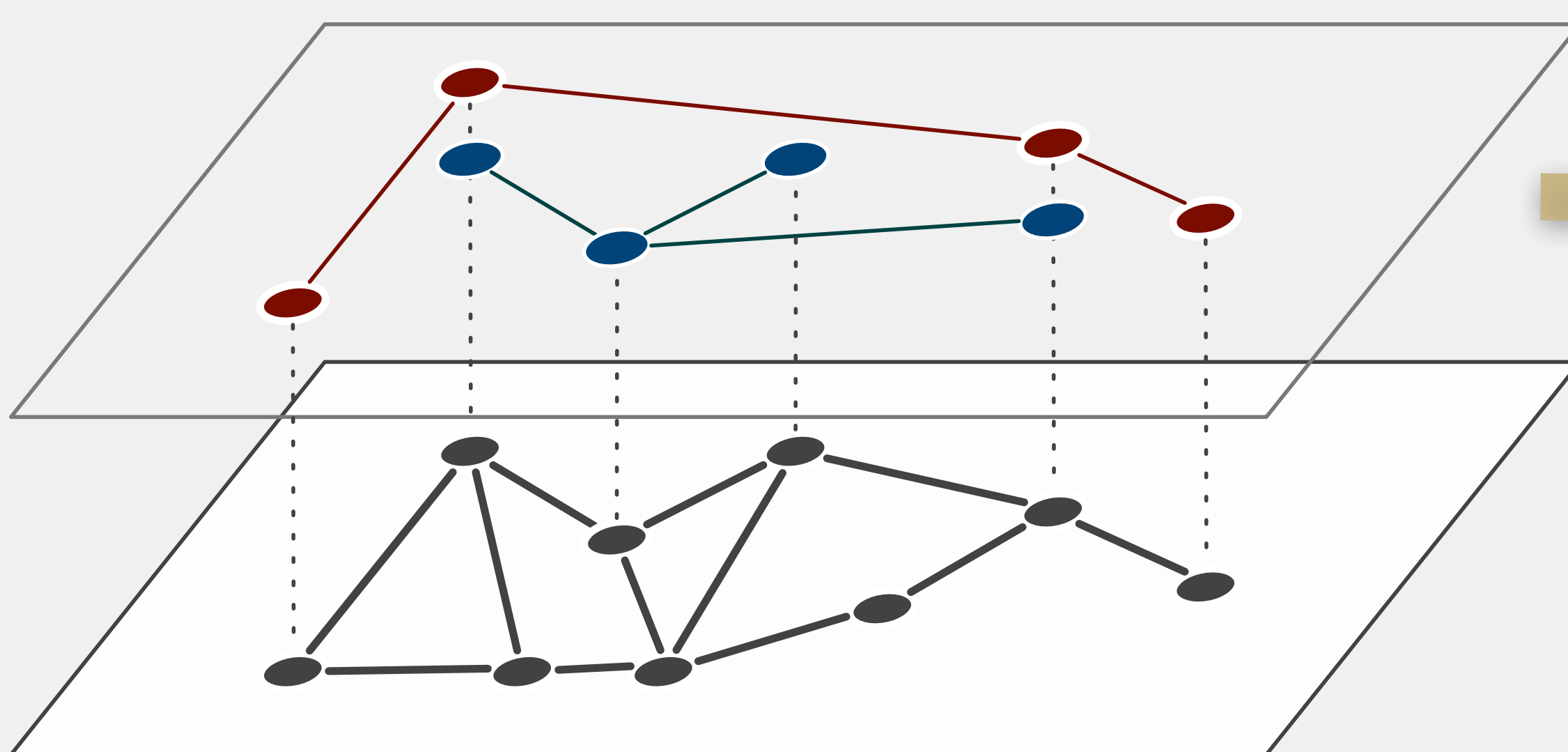
- ▶ Virtual Network Embedding (VNE) algorithms place virtual networks in physical networks given a set of constraints (e.g. capacity, connectivity)

Expanding/Contracting Virtual Networks



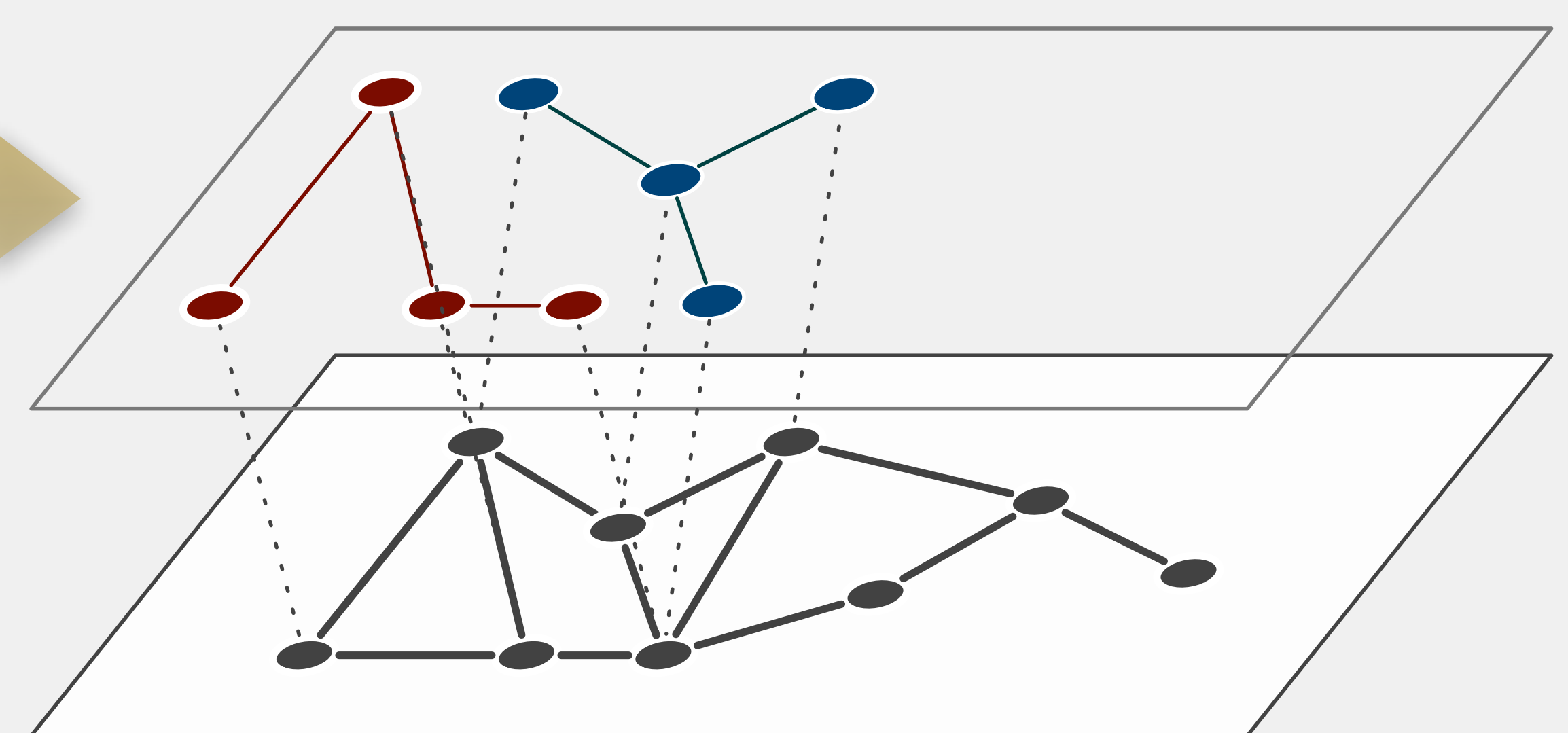
- ▶ Modified ViNE [Chowdhury09] linear programming formulation to enable expanding existing virtual networks

Resource Fragmentation



Problem

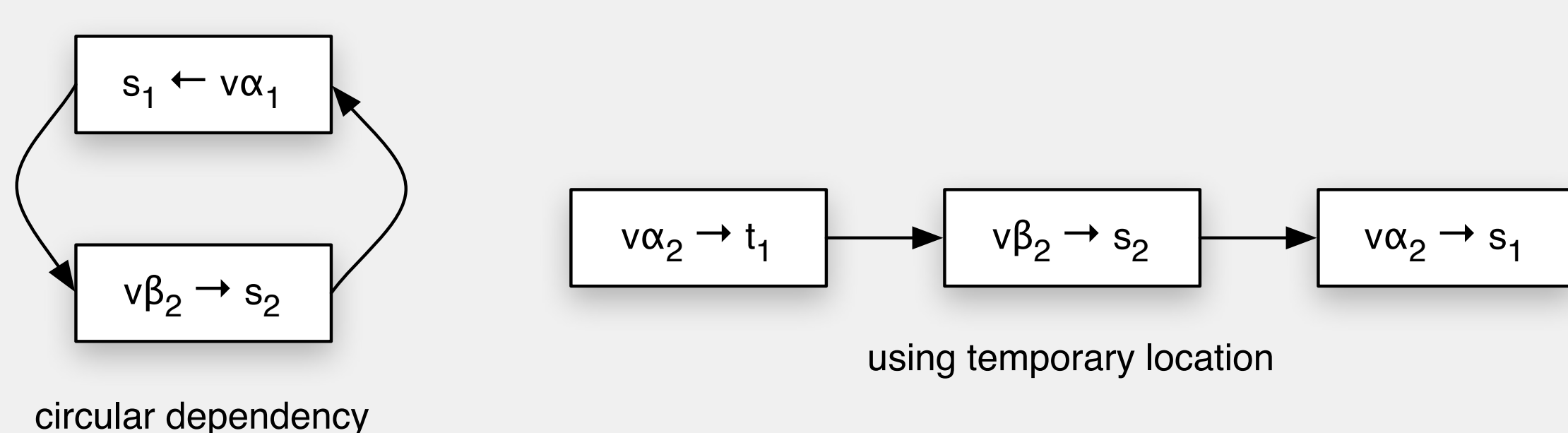
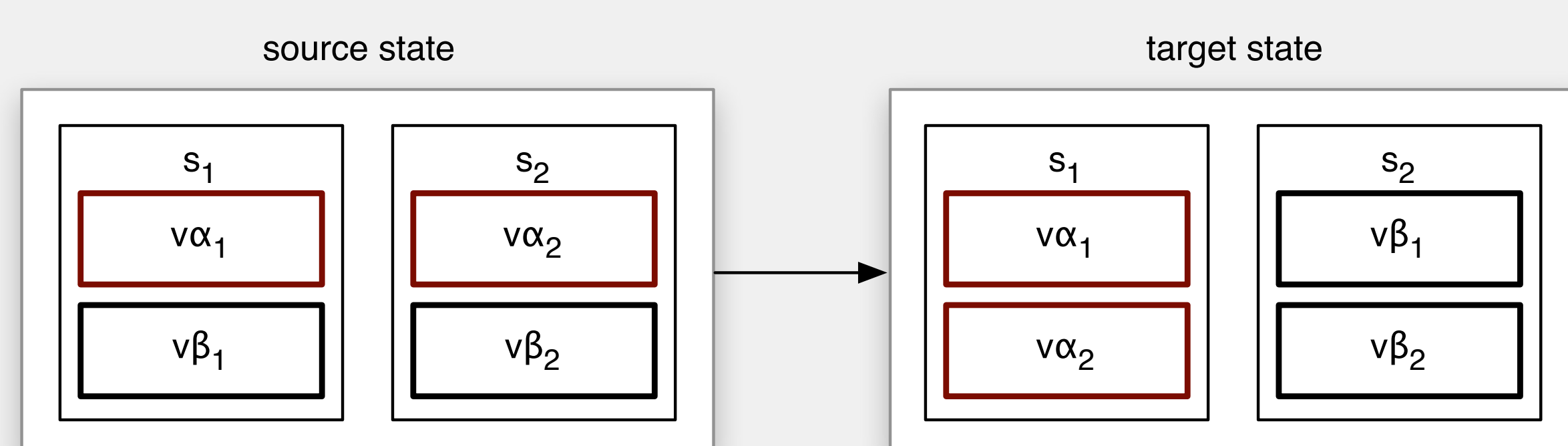
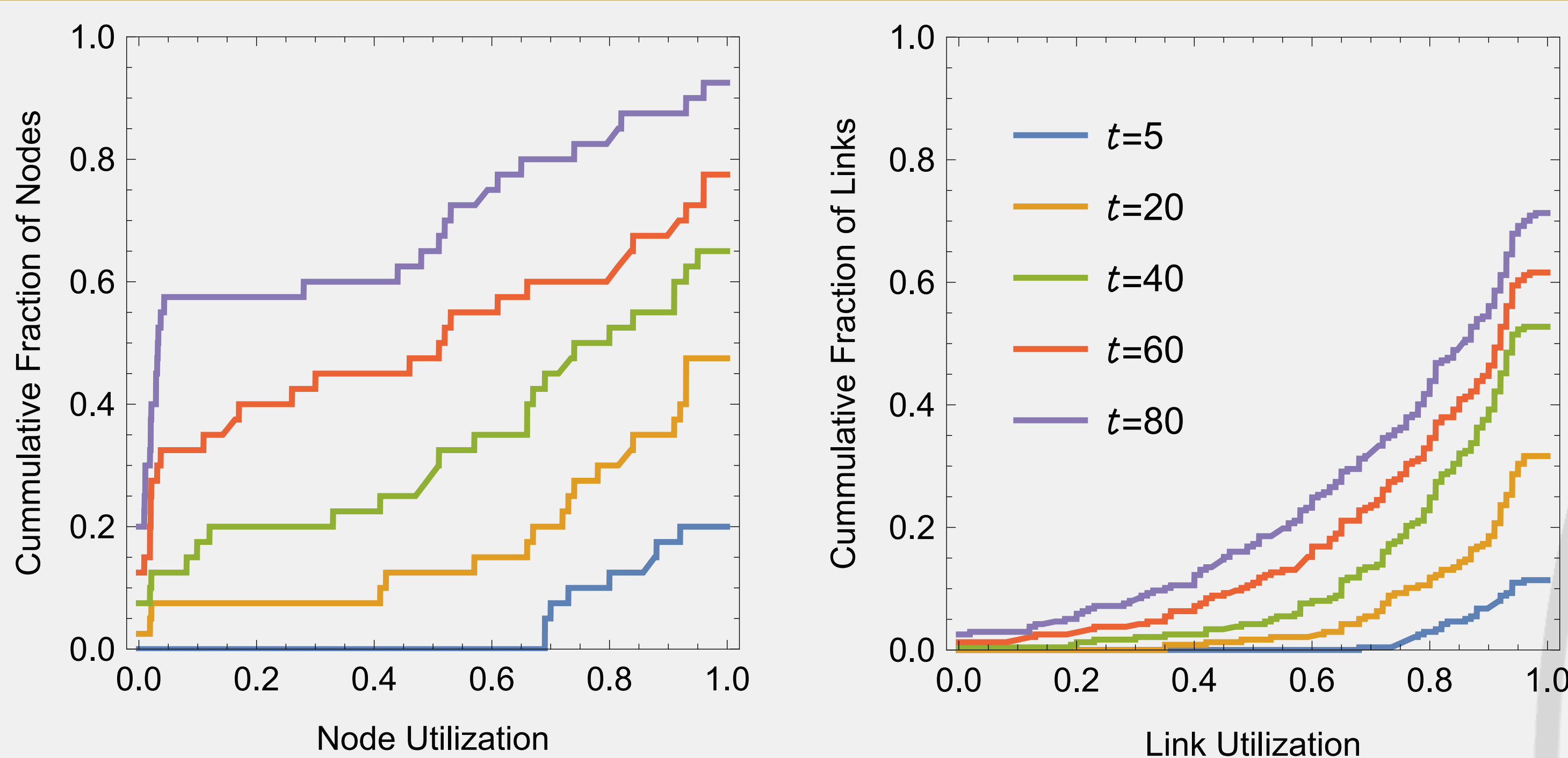
- ▶ Tenants adding, removing, expanding, contracting virtual networks can lead to fragmentation
- ▶ Analogous to file system fragmentation



Proposed Solution

- ▶ Use LIME Live Network Migration [Keller12] to migrate virtual networks to defragment the datacenter

Challenges



1. Quantifying fragmentation (metrics)
 - ▶ Decreasing VN acceptance rate
 - ▶ Resource Utilization Distribution
 - ▶ Virtual vs. physical hop count ratio (path length)
2. Determining when to trigger defrag operation
 - ▶ Periodically or upon reaching some threshold
3. Computing optimized state
 - ▶ Which metrics to account for in LP objective
 - ▶ Consider minimization of move operations
4. Compute a migration plan
 - ▶ Circular dependencies when moving resources (i.e., requiring swapping resources)