Pratyaastha: An Efficient Elastic Distributed SDN Control Plane
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Overview
Distributed SDN controller architectures have been proposed to mitigate the risks of overload and failure.

Operator Goals: i) Satisfying SLAs  ii) Minimizing controller operating costs

Current state of the art approaches are not sufficient to meet the above goals. To address this, we propose a novel approach for assigning SDN switches and partitions of SDN application state to distributed controller instances.

Motivation
Flow setup latency is critical for SDN applications like MiceTrap (traffic engineering), Multi-tenant virtualized data centers, etc.

Static Switch Assignment
A static switch-to-controller assignment strategy suffers from:
• degraded performance (insufficient CPU resources)
• inefficient hardware resource utilization (traffic load variations)

State Storage & Access
Flow setup latency is impacted by:
• State access from a distributed data store or another controller instance
• Inter-controller communication to install flow rules

Architecture
Application state
Flow arrival rate
VM configurations
Current assignment
SCaling Manager
1. Checks if controllers are overloaded
2. Runs controller-assignment algorithm
3. Migrates application states and switches

Controller assignment
ILP formulation
Variables:
• Compute requirements from flow arrival rate of switches
• Memory requirements from application state
• Application state and switch dependency
• Virtual Machine cpu and memory capacities
• Virtual Machine costs (used to launch controllers)

Objective:
• Minimize controller resource cost and inter-controller communication
• Constants $\alpha$ and $\beta$ to tune the weight of both objectives

Heuristic:
Local Search algorithm (hill climbing with simulated annealing)
First-fit decreasing assignment is set as initial state

Evaluation
42% reduction in controller operating costs
44% decrease in flow-setup latency

References
[4] Theophilus Benson et al. Network traffic characteristics of data centers in the wild