

VM Selection for Financial Exchanges in the Cloud

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1 Overview

Financial exchanges have shown interest in migrating their current infrastructure to the public cloud. The benefits are agreed upon by both the industry and academia, promising a more scalable, robust, and cost-efficient infrastructure. However, in contrast to the exchange's on-premise data centers, the public cloud does not currently offer native mechanisms for fair and performant data delivery. Exchanges need to disseminate market data to market participants (MPs) both fast and virtually simultaneously to not create unfair advantages among MPs.

Recent work, namely Jasper [1], addressed this by presenting a scalable and fair multicast for financial exchanges in the cloud. It does so via the employment of an overlay multicast tree and leveraging up-to-date advancements in clock synchronization, kernel by-passing, and hedging to simultaneously achieve considerable performance and fairness. Jasper offers a commendable alternative, outperforming a previous system CloudEx and Amazon's commercial multicast solution.

Moreover, LemonDrop [2] tackles the real issue of inconsistent VM performance within identical instance configurations in the cloud. LemonDrop was developed to select and schedule a subset of VMs optimized for a given application's latency needs, by quickly detecting under-performing VMs (*Lemons or Stragglers*). It does so by framing the selection and scheduling of VMs as a Quadratic Assignment Problem (QAP), where traffic flow between facilities, each assigned to a location, is to be minimized. LemonDrop treats services within an application as facilities and the VMs themselves as the locations.

Straggler VMs have the potential to drastically affect Jasper's overall system performance. Inspired by LemonDrop's VM selection method, the proposed work here aims to develop a simpler heuristic that can achieve reasonably good results adapted to the smaller problem set of a multicast tree. Therefore, significant improvements could be brought to Jasper's deployment and performance as a modern solution for financial exchanges in the cloud.

2 Objectives

1. Develop a VM Selection Heuristic for tree-like networks in the Cloud.

3 Experimental Setup

Cloud stack deployment, node benchmarking and heuristic development/formulation would be done via Google Cloud Platform (GCP) credits provided by Dr.Sivaraman's and his team at Systems@NYU.

1. Allocate a pool of VMs on the cloud.
2. Iteratively:
 - (a) Benchmark intra-VM latency and choose best node among the pool.
 - (b) Place/Assign node to the next available slot in the tree.
3. Conduct Jasper-runs on final tree configuration.
4. Compare to vanilla Jasper deployment.

References

- [1] M. Haseeb, J. Geng, U. Butler, X. Hao, D. Duclos-Cavalcanti, and A. Sivaraman, "Jasper: Scalable and fair multicast for financial exchanges in the cloud," 2024.
- [2] V. Sachidananda, *Scheduling and Autoscaling Methods for Low Latency Applications*. Stanford University, 2022.