

VM Selection for Financial Exchanges in the Cloud

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1 Overview

Financial exchanges consider a migration to the cloud for scalability, robustness, and cost-efficiency. Jasper [1] presents a scalable and fair multicast solution for cloud-based exchanges, addressing the lack of cloud-native mechanisms for such. To achieve this, Jasper employs an overlay multicast tree, leveraging clock synchronization, kernel-bypass techniques, and more. However, there are opportunities for enhancement by confronting the issue of inconsistent VM performance within identical instances. LemonDrop [2] tackles this problem. It selects and schedules a subset of VMs optimized for an application's latency needs by detecting under-performing VMs. Yet, we believe that LemonDrop's approach of using all-to-all latency measurements and an optimization routine for the there framed Quadratic Assignment Problem (QAP) is an overly complex solution. It may be disproportionately robust and unscalable for Jasper's use case of a multicast-tree. Finally, the proposed work aims to develop an even simpler heuristic, that achieves reasonably good results adapted to the current smaller problem set.

2 Objectives

Develop a VM selection heuristic for tree-like networks in the cloud.

1. Implement a Server-Client Manager application:
 - (a) Server: Allows user to **run**, **terminate** and **report** on processes across a cluster.
 - i. Connects to client nodes (VMs) and issues action-requests:
 - A. Action(A): Launch a process/program, store and report PID.
 - B. Action(B): Report information on ongoing process.
 - C. Action(C): Kill a previously ran process.
 - (b) Client: Waits on Server's connection and requests.
2. Employ Testbench via Server-Client Manager:
 - (a) Allocate **N** VMs, Server runs and terminates Jasper on initial configuration.
 - (b) Apply **Heuristic**:
 - (c) Server chooses **K** (parameter) VMs to form a pool and iteratively:
 - i. Runs/Obtains reports on intra-VM latency among nodes in the pool.
 - ii. Selects/Assings best node to the next available slot in the tree.
 - iii. Removes selected node from pool.
 - (d) Server produces new configuration and re-deploys the application.

3 Experimental Setup

Cloud VM instances of *c2d-highcpu-8* type would be deployed on Google Cloud's Platform. Each machine offers 8 virtual AMD Milan CPU's, 16GB of Memory and 16Gbps of Network Bandwidth. Results would be compared among a vanilla Jasper run, a heuristic-proposed and a LemonDrop proposed configuration of Jasper, as well as done so across different tree sizes.

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.