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VM Selection for Financial Exchanges in the Cloud

Daniel Duclos-Cavalcanti (Student),
Muhammad Haseeb (NYU Supervisor), Navidreza Asadi (TUM Supervisor)
Chair of Communication Networks, School of CIT
Technical University of Munich (TUM)

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, detecting under-performing VMs in a cluster and selecting a subset of VMs optimized for a given application's latency needs. Yet, we believe that LemonDrop's approach of using time-expensive all-to-all latency measurements and an optimization routine for the framed Quadratic Assignment Problem (QAP) is overly complex. The proposed work aims to develop a simpler and scalable heuristic, that achieves reasonably good results within Jasper's time constraints.

2 Objectives

Develop a VM selection heuristic for Financial Exchanges 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. Develop Testbench Framework via Server-Client Manager:

   (a) Server allocates **N** VMs, then runs and terminates Jasper on initial configuration.
   (b) Server applies **Heuristic** to produce new tree configuration.
   (c) Server re-deploys Jasper on new configuration.

3. Heuristic: Choose **K** VMs, apply selection method for **F** nodes, assign them to next layer.

   (a) **K** VMs Selection: Initially random, we intend on expanding.
   (b) **F** VMs Selection: Analyzing reports on intra-VM OWD latency among the **K** nodes.

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. Experiments would be run across two pre-selected tree structures, chosen based on a realistic cloud exchange scenario and Jasper's best fitting configurations for them.

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.