TLM

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, selecting and scheduling a subset of VMs optimized for an application's latency needs by detecting under-performing VMs. Jasper's performance can drastically be affected by under-performing VMs. Yet, we believe that LemonDrop's approach of using all-to-all latency measurements and an optimization routine for the framed QAP is an overly complex solution and may be disproportionally robust 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) Server allocates a pool of **N** VMs, runs and terminates Jasper on initial configuration.
   (b) Server applies **heuristic** to develop a new tree configuration by iteratively:

      i. Running/Obtaining reports on intra-VM latency among nodes in the pool.
      ii. Selecting/Assigning best node to the next available slot in the tree.
      iii. Removing selected node from option-pool.

   (c) Server re-deploys new configuration.

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.