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A Performance Brokerage for Heterogeneous Clouds

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Abstract. The trading of virtual machines, storage and other Cloud Computing resources on commodity exchanges has generated considerable interest from both academia and the financial services market. With multiple sellers providing appropriately equivalent virtual machines they become fungible, offering the opportunity for users to swap instances from one seller with instances from another when required, easing concerns over vendor lock-in, availability and provider failure. However, heterogeneity in the hardware from which they are provisioned is likely inevitable, given heterogeneity already found on a number of Public Clouds, where it results in performance variation across instances of the same type, and consequently variation in Cloud costs at the same price. To address this problem we propose a Cloud Service Broker (CSB) that acquires and re-sells instances on the basis of their current performance. The service reduces performance risk for users, but comes at a cost. We determine the average markup the CSB must add to the base instance price to cover the costs of operating a pool capable of satisfying a given proportion of requests. We show how increases in heterogeneity on the underlying commodity exchange lead to lower costs for the CSB, and that the largest degree of heterogeneity we consider, on the basis of real-world findings, leads to the best outcome: an average markup of just 12% on the buy price from the exchange will satisfy 95% of requests. This creates opportunities for CSB profitability to be explored on the basis of selling performance-assured instances at prices that will account for this markup.

Keywords: Infrastructure Clouds, Performance Variation, Commodity, Brokers, Exchanges

1 Introduction

The trading of low level infrastructure compute resources such as networks, storage and virtual machines as commodities has been proposed by a number of authors [1][2][3][4][5] and has also generated interest from financial exchanges such as the Chicago Mercantile Exchange (CME), responsible for the largest derivatives exchange in the world. Dynamic pricing in commodity markets allows buyers to take advantage of prices when low, whilst sellers can increase prices in response to high demand. Treating resources as commodities aids liquidity, making it easier for market participants to buy or sell at prices they are comfortable with, and higher volumes traded encourages price stability as well as providing continuous price discovery.

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