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A survey on dynamic resource provisioning over cloud for revenue maximization

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Abstract
Cloud computing promises on-demand provisioning of resource to applications and services. In cloud computing, a provider leases its computing resources in the form of virtual machines to users, and a price is charged for the period they are used. Static pricing is the dominant pricing strategy in today's market but dynamic pricing helps to improve the revenue. The main challenge is to design an optimal dynamic pricing policy, to maximize the long-term revenue. Here adaptive increment approach will be used for revenue maximization problem with dynamic pricing as well as dynamic provisioning. The aim is to understand from a Cloud Computing company's perspective, how decisions about the pricing and the optimal allocation of the given resources for the various Cloud Services can be supported.

Keywords: Dynamic Provisioning, Dynamic Pricing, Revenue Maximization, Adaptive Increment Approach

1. Introduction
Cloud computing aims at providing computing resources as public utilities like water and electricity. In a cloud computing environment, resources are typically offered in distinct types of VMs that a customer can purchase on- demand. Traditionally, cloud providers specify a fixed price for each type of VM offerings. However, it has been shown that this pricing scheme is often inefficient due to lack of incentives to rationalize demand. On one hand, when total demand is much lower than data center capacity, the data center becomes under-utilized, in which case the cloud provider wishes to encourage customers to submit more requests. On the other hand, when total demand rises over the data center capacity, it is desirable for the cloud provider to incentivize the customers to reduce their demand. A promising solution to this problem is to use market economy to reshape the demand by dynamically adjusting the price of each VM type. Specifically, when total demand is high, the mechanism raises the price to ensure resources are allocated to users who value them the most. When total demand is low, the mechanism lowers the prices and provides incentive for customers to increase their demand.

However, as multiple spot markets operate on a shared resource pool in each data center, a critical question arises regarding how to best distribute data center capacities to each individual spot market. A naive solution is to employ a static allocation strategy that pre-computes the resource allocation to each spot market. There are several drawbacks to this approach. First, the free capacity of a data center can change due to dynamic conditions such as machine failure. Second, as spot markets are designed to handle fluctuating demands, a static allocation strategy can lead to situations where certain spot markets are over-supplied while some others are under-supplied. While over-supplying resources to a market may lead to wasted resources, under-supplying resources can lead to revenue loss. In both cases, a static allocation strategy may lead to sub-optimal outcomes. Therefore, it is important to dynamically adjust supply for each spot market based on current market situation, so that resources are allocated to users who value them the most. In this project dynamic provisioning and dynamic pricing strategies will be used to overcome the drawbacks of static pricing or fixed pricing policies. The unused cloud resources will be utilized efficiently. The main goal of the project is to maximize the revenue for the cloud provider.

2. Literature Survey
Resource allocation in a cloud market through the auction of Virtual Machine (VM) instances and a cooperative primal dual approximation algorithm has been proposed [1].

It Introduced a combinatorial auctions of heterogeneous VMs, and models dynamic VM provisioning. This work studies about the resource allocation in a cloud market through the auction of Virtual Machine (VM) instances but this paper does not consider cloud auction mechanisms for more than one round. Also it models VMs as type-oblivious commodities.

A Revenue management framework from economics that deals with the problem of selling perishable resources, such as airline seats and hotel reservations, to maximize the expected revenue from a population of price sensitive customers from a population of price sensitive customers [2]. In this proposed model provider has more control over the price and eliminates the potential user collusion. Analyses of market competition and price anticipating behavior are not considered. This paper does not consider the resupply of computing resources.

A Market analyzer for forecasting the demand for each spot market is proposed for dynamic scheduling and consolidation mechanism that allocate resource to each spot market to maximize total revenue [4]. This model has an efficient algorithm for scheduling Virtual machine requests under both fixed pricing scheme and uniform pricing scheme but this paper does not address the problem of Revenue loss due to VM preemption and migration.

A new approach for dynamic autonomous resource management in computing clouds [4]. The resources are divided into individual segments and a Distributed architecture is used. Autonomous Node Agents carry out configurations in parallel using these resources. By using this distributed architecture scalability is achieved and it reduces the computational complexity of computing new configurations. This architecture significantly reduced the number of migrations. But this paper did not consider the overhead of migration more precisely.

3. Proposed System

In the proposed system dynamic resource allocation and dynamic pricing will be used. The cloud provider can efficiently utilize his resources using dynamic provisioning. The space will be allocated to the cloud user as and when needed. User can request for his desired amount of space and the cloud provider will charge for the same. Dynamic pricing will be implemented to charge for requested space by the registered user.

3.1. Problem Statement

In static pricing the space and the price is fixed to a user. If the user does not use the allocated spaces it would go waste. This in turn reduces the revenue for the cloud provider and also leads to the wastage of space. To overcome this problem dynamic pricing has been proposed. In this model the space will be allocated according to the user's usage. The service provider can accommodate large number of users in dynamic pricing. The revenue can be maximized in this case.

3.2. Objective

- The main objective of the project is to increase the revenue for the cloud provider so that a large number of users can use the space at a time.
- The project also aims at efficiently handling the space by dynamically allocating it as and when needed by the user.
- By using this method the cloud provider can accommodate a large number of users when compared to static pricing.
- This in return helps for revenue maximization to the storage provider.
- This also aims at providing the storage space at the lower cost to the end users.

3.3 Methodology

Adaptive increment approach is used to increase the cloud space for the user when needed. In this method the storage space is allocated as the user uploads his file. The system calculates the required space for a particular file and allocates the space. So it dynamically allocates space as and when required by the user. A buffer is maintained which can be used by the cloud provider if he runs out of space. Once the user exceeds his limit he will be intimated to buy extra space. The charges for the extra space will depend on the occupying rate of the previous storage. That is called as dynamic pricing. A graph will be generated to look at the rate at which the user was using the cloud resources. The dynamic pricing helps the cloud provider to increase his revenue and it also benefits the cloud user.

4. Applications and challenges

- This model will be mainly used for cloud providers who provide space and RAM.
- Dynamically space can be allocated to multiple users.
- More number of users can be accommodated at the same time which increases the revenue of the cloud provider

The challenges might be faced are:

- Relative parameter maintenance
- Maintaining the Buffer based on the graphs
- Calculating the file size at the runtime

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