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# Optimization of Resource Cost and Service Price Scheme

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**Abstract**

Cloud computing is a large distributed computing environment in which collection of resources is available to user through internet. The user can access the resources by paying the price for the infrastructure they use. At present, Cloud provider can offer two provisioning plans for computing resources namely reservation and on-demand plans. Reservation plan is cheaper than on-demand plan but best advanced reservation is difficult to achieve due to uncertainty of user's future demand and provider's price. Demand and price uncertainty is considered in Optimal Cloud Resource Provisioning (OCRP) algorithm. The OCRP algorithm can provision resources for being in multiple provisioning stages as well as long term plan. OCRB uses Stochastic programming model, Benders decomposition and Sample Average Approximation (SAA) to reduce total cost resource cost. Static pricing scheme cannot guarantee cloud profit maximization. The proposed work contains optimal pricing based on dynamic pricing scheme for that adapt to time changes. A novel price demand model designed for cloud cache and dynamic pricing scheme for queries executed in cloud cache. The pricing solution employs a novel method that calculates correlation of cache services in a time efficient manner. A cloud cache service can maximize profit by using optimal service pricing.

***Keywords:*** *Optimal pricing scheme, Resource Provisioning, OCRP algorithm, Dynamic pricing, cloud computing.*

## 1. Introduction

The leading trend for service infrastructures in the IT domain is called cloud computing, a style of computing that allows consumer to access information services. Virtualization technologies can be used to provide resources to cloud users. Cloud providers trade their services on cloud users for money. The quality of services that the users receive depends on the consumption of the resources. Cloud resources can be anything from infrastructure (CPU, memory, bandwidth, network) to platforms and applications deployed on the infrastructure. The goal of cloud economy is to optimize: (i) user fulfillment and (ii) cloud profit. The cloud enables the users to manage the data of back-end databases in a transparent manner. In cloud computing, a resource provisioning mechanism is required to supply cloud consumers a set of computing resources for processing the jobs and storing the data.

Cloud providers can offer cloud consumers two resource provisioning plans, namely short-term on-demand and long-term reservation plans. Pricing in on-demand plan is charged by pay-per-use basis. For reservation plan, pricing is charged by a onetime fee. With the reservation plan, the price to use resources is cheaper than that of the on-demand plan. But in Reservation plan, underprovisioning problem can occur when the reserved resources are not capable to fully meet the demand due to its uncertainty. On the other hand, the overprovisioning problem can occur if the reserved resources are more than the actual demand. An optimal cloud resource provisioning (OCRP) algorithm is used to minimize the total cost for provisioning resources in a certain time period.

The optimization formulation of stochastic integer programming is proposed to obtain the decision of the OCRP algorithm as such the total cost of resource provisioning in cloud computing environments is minimized. The formulation considers multiple provisioning stages with demand and price uncertainties. The solution methods based on Benders decomposition and sample-average approximation algorithms are used to solve the optimization formulation in an efficient way. The OCRP algorithm can help the adoption of cloud computing resource of the user as it can minimize the cost of computing resource significantly. A representative model for the cloud cache should take cache structures may compete during query execution. The demand depends on price of each cache structure and also other cache structure. Dynamic pricing scheme is used to maximize cloud profit.

## 2. Background

### 2.1 OCRP algorithm

Cloud consumer need to reduce the total cost of resource provisioning by minimizing the on-demand cost and oversubscribed cost of underprovisioning and overprovisioning problem. OCRP algorithm is used to reduce resource provisioning cost. OCRP includes stochastic programming, Benders decomposition, sample average approximation (SAA). Stochastic programming is to get decision of OCRP algorithm as such total resource provisioning cost is reduced. Benders decomposition and Sample Average Approximation are used to solve optimization in efficient way.

Stochastic integer programming formulation is transformed into the deterministic equivalent formulation (DEF). Benders decomposition algorithm is applied to solve the stochastic programming problem formulated which divides the optimization problem into multiple smaller problems which can be solved independently and parallelly. As a result, the time to obtain the solution of the OCRP algorithm can be minimized. The Benders decomposition algorithm can decompose integer programming problems into master problem and sub-problem. The lower and upper bounds are calculated and the algorithm stops when optimal solutions come together, i.e., the lower and upper bounds are satisfactorily close to each other. SAA approach is applied to approximate the expected cost in every considered provisioning stage.

### 2.2 Static pricing scheme

Static pricing cannot guarantee cloud profit maximization. The cloud makes profit from selling its services at a price that is higher than the actual cost. Setting the right price for a service is a non-trivial problem, because when there is competition the demand for services grows inversely but not proportionally to the price. There are two major challenges when trying to define an optimal pricing scheme for the cloud caching service. The first is to define a simplified enough model of the price demand dependency, to achieve a feasible pricing solution, but not oversimplified model that is not representative. For example, a static pricing scheme cannot be optimal if the demand for services has deterministic seasonal fluctuations. The second challenge is to define a pricing scheme that is adaptable to (i) modeling errors, (ii) time-dependent model and (iii) stochastic behavior of the application.

## 3. Proposed work

### 3.1 Optimal service pricing scheme

Optimal pricing is achieved based on dynamic pricing scheme that is adapts to time changes. A novel price-demand model designed for a cloud cache and a dynamic pricing scheme for queries executed in the cloud cache.

**Simple but not simplistic price-demand modeling:** Price-demand dependency employs second order differential equations with constant parameters. The modeling is flexible enough to represent a wide variety of demands as a function of price. The simplification of using constant parameters allows their easy estimation based on given price-demand data sets.

**Price adaptively to time changes:** Profit maximization is pursued in a finite long-term horizon. The horizon includes sequential non-overlapping intervals that allow for scheduling structure availability. Cloud redefines availability by taking offline some of the currently available structures and taking online some of the unavailable ones.

**Modeling structure correlations:** Correlation of cache structures as a dependency of the demand for each structure on the price of every available one. Pairs of structures are characterized as competitive, if they tend to exclude each other, or collaborating, if they coexist in query plans. Competitive pairs induce negative, whereas collaborating pairs induce positive correlation. Otherwise correlation is set to zero.

### 3.2 Query Execution Model

The goal of the cloud cache is to offer cheap efficient multi-user querying on the back-end data, while keeping the cloud provider profitable. The cloud cache provides the effective multiuser querying on the data but at the same time keeping the service provider gainful. In dynamic pricing scheme there are two important criteria to decide the cost of query. The first one is availability. When a user demands something from the cloud, a query is fired to the cloud .If the data is already present in the cache then the query is executed in the cache. If it is not, then the query is executed in the back-end database and the result of the query is brought back into the cache. If data is already present in the cache then less data structure is required to execute the query and hence the cost of such a query is less.

**Global**: cache structures S, price P, availability Δ
**query Execution ( )**
 **if** q can be satisfied in the cache **then**
  (result, cost)← runQueryInCache(q)
 **else**
  (result, cost) ← runQueryInBackend(q)
 **end if**
 S ←add NewStructures()
 **return** result, cost
**optimalPricing**(horizon T, intervals t[i], S)
 (Δ,p) ←determineAvailability&prices(T,t,s)
 **return** Δ,P
**main( )**
execute in parallel tasks T1 and T2:
T1:
 **for** every new i do
  slide the optimization window
  optimal Pricing(T,t[i],s)
 **end for**
T2:
 **while** new query q do
  (result,cost) queryExecution(q)
 **end while**
 **if** q executed in cache then
  charge cost to user
 **else**
  calculate total price and charge price to user
 **end if**

Fig. 1. Query execution model for cloud cache

The second important criterion is time horizon i.e. at what time the query is requested. If the query is requested on timing of high traffic then the cost of query execution is more. Since the demand and supply for a particular resource changes over time so, fixed price does not reflect the actual cost in the market.

## 4. Conclusions

Optimal cloud resource provisioning (OCRP) algorithm to used to obtain the optimum solution. This done by formulating and solving stochastic integer programming with multistage recourse and then apply benders decomposition and SAA approach for solving OCRP problem. The Benders decomposition and sample-average approximation algorithms are used to solve the optimization formulation in an efficient way.

Novel pricing demand scheme designed for a cloud cache that offers querying services and aims at the maximization of the cloud profit with predictive demand price solution on economic way of user profit. It can reduce the cost of using computing resource significantly.

The cloud caching service can maximize its profit using an optimal pricing scheme. Optimal pricing necessitates an appropriately simplified price-demand model that incorporates the correlations of structures in the cache services. The pricing scheme should be adaptable to time changes. It estimates the correlations of the cache services in a time-efficient manner.

Scenario reduction techniques will be applied to reduce the number of scenarios in optimal resource provisioning algorithm by using fast forward selection and simultaneous backward reduction process.

## References

[1] Anindya Ghose, Tridas Mukhopadhyay, Uday Rajan, Vidyanand Choudhary,”Dynamic Pricing: A Strategic Advantage For Electronic Retailers”, Proc. IEEE Int’l Conf., 2002.
[2] A.J. Conejo, E. Castillo, and R. Garcı´a-Bertrand, “Linear Programming: Complicating Variables,” Decomposition Techniques in Mathematical Programming, chapter 3, pp. 107-139, Springer, 2006.
[3] A. Filali, A.S. Hafid, and M. Gendreau, “Adaptive Resources Provisioning for Grid Applications and Services,” Proc. IEEE Int’lConf. Comm., 2008.
[4] G. Juve and E. Deelman, “Resource Provisioning Options for Large-Scale Scientific Workflows,” Proc. IEEE Fourth Int’l Conf. e-Science, 2008.
[5] H. Heitsch and W. Ro¨misch, “Scenario Reduction Algorithms in Stochastic Programming,” J. Computational Optimization and Applications, vol. 24, pp. 187-206, 2003.
[6] J. Chen, G. Soundararajan, and C. Amza, “Autonomic Provisioning of Backend Databases in Dynamic Content Web Servers,” Proc. IEEE Int’l Conf. Autonomic Computing, 2006.
[7] M. Cardosa, M.R. Korupolu, and A. Singh, “Shares and Utilities Based Power Consolidation in Virtualized Server Environments,” Proc. IFIP/IEEE 11th Int’l Conf. Symp. Integrated Network Management (IM ’09), 2009.
[8] N. Bobroff, A. Kochut, and K. Beaty, “Dynamic Placement of Virtual Machines for Managing SLA Violations,” Proc. IFIP/IEEE Int’l Symp. Integrated Network Management (IM ’07), pp. 119-128, May 2007.
[9] S. Chaisiri, B.S. Lee, and D. Niyato, “Optimal Virtual Machine Placement across Multiple Cloud Providers,” Proc. IEEE Asia- Pacific Services Computing Conf. (APSCC), 2009.
[10] Siva Chaisiri, Bu-Sung Lee, Dusit Niyato, “Optimization of Resource Provisioning Cost in Cloud Computing ,” IEEE Trans. Services Computing ,Vol.5, NO.2, April-June 2012.