# OCRP Implementation to Optimize Resource Provisioning Cost in Cloud Computing

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**Abstract- Cloud computing is a large-scale distributed computing paradigm in which a pool of computing resources is available to users via the Internet. Computing resources are represented to cloud consumers as the accessible public utility services. In cloud computing, cloud providers can offer cloud consumers two provisioning plans for computing resources, namely reservation and on-demand plans. With the reservation plan, cloud consumers reserve the resources in advance which are cheaper than that provisioned by on-demand plan. As a result, the reservation plan can reduce the total resource provisioning cost. However, the best advance reservation of resources is difficult to be achieved due to uncertainty of consumer's future demand and providers' resource prices. To address this problem, an optimal cloud resource provisioning (OCRP) algorithm is proposed by considering on-demand plan with both static and dynamic pricing to minimize the total cost for provisioning resources in a certain time period. To make an optimal decision, the demand uncertainty from cloud consumer side and price uncertainty from cloud providers are taken into account to adjust the tradeoff between on-demand and oversubscribed costs. The OCRP algorithm can provision computing resources for being used in multiple provisioning stages as well as a long-term plan, e.g., four stages in a quarter plan and twelve stages in a yearly plan. The proposed OCRP algorithm will facilitate the adoption of cloud computing of the users as it can reduce the cost of using computing resource significantly.**

**Keywords –Cloud Computing, Optimal Resource Provisioning, OCRP, Dynamic Pricing**

## I. INTRODUCTION

The term Cloud Computing refers to pool of computing resources made available to the users as per their requirement through the internet. It is mostly used to sell hosted services in the sense of application service provisioning that run client server software at a remote location. Such services are given popular acronyms like SaaS (Software as a Service), PaaS (Platform as a Service), IaaS (Infrastructure as a Service). Infrastructure-as-a-Service (IaaS) is a computational service model widely applied in the cloud computing paradigm. To deploy cloud consumers applications under IaaS, cloud users install operating-system images and their application software on the cloud infrastructure. Cloud providers typically bill IaaS services on a utility computing basis cost reflect the amount of resources allocated and consumed. A cloud provider is responsible for guaranteeing the Quality of Services (QoS) for running the VMs. A resource provisioning methodology is essential in cloud computing to provide cloud users, a set of computing resources for processing the tasks and storing the data.

Cloud providers offer two types of plans to cloud consumers in cloud computing environment. They are reservation plans and on-demand plans. In general, cost of utilizing computing resources provisioned by reservation plan is cheaper than that provisioned by on-demand plan, since cloud consumer has to pay to provider in advance. With the reservation plan, the consumer can reduce the total resource provisioning cost. However, the best advance

reservation of resources is difficult to be achieved due to uncertainty of consumer's future demand and providers' resource prices.

Underprovisioning problem can occur when the reserved resources are unable to fully meet the demand due to its uncertainty. Although this problem can be solved by provisioning more resources with on-demand plan to fit the extra demand, the high cost will be incurred due to more expensive price of resource provisioning with on-demand plan. On the other hand, the overprovisioning problem can occur if the reserved resources are more than the actual demand in which part of a resource pool will be underutilized. It is important for the cloud consumer to minimize the total cost of resource provisioning by reducing the on-demand cost and oversubscribed cost of underprovisioning and overprovisioning.

## II. RELATED WORK

An optimal cloud resource provisioning (OCRP) algorithm is proposed to minimize the total cost for provisioning resources in a certain time period. To make an optimal decision, the demand uncertainty from cloud consumer side and price uncertainty from cloud providers are taken into account to adjust the tradeoff between on-demand and oversubscribed costs. The proposed system considers following provisioning options/plans.

- Reservation Plan
- On-Demand (Static Pricing) Plan
- On-Demand (Dynamic Pricing) Plan

*Advantages–*

The proposed approach will be useful to the cloud consumers (e.g., organization and company) for the management of virtual machines in cloud computing environment. The proposed OCRP algorithm will reduce the cost of using computing resource significantly.

## III. OPTIMAL CLOUD RESOURCE PROVISIONING MODEL

*Provisioning Plans–*

A cloud provider can offer the consumer provisioning plans namely reservation plan and on-demand plans. As part of proposed system, the on-demand plans can be further considered as static pricing and dynamic pricing. The cloud broker considers the reservation plan as medium to long term planning and the on-demand plan as short term planning. The reservation plan reduces the total provisioning cost during long term. But the on-demand with static pricing plan is efficient when the resources reserved by the reservation plans are insufficient, but this will increase total provisioning cost whereas the on-demand with dynamic pricing plan provides effective provisioning by considering both demand and price uncertainty, thus reduces the total provisioning cost during short term. It can be used during the peak load.

*Provisioning Phases–*

The cloud broker considers both reservation and on demand plans for provisioning resources. Time interval when resources need to be provisioned or utilized also called provisioning phases. There are three types of phase's viz. reservation, expending and on-demand phases. In reservation phase, the cloud broker reserves the resources in advance. In the expending phase, the cloud consumer utilized the reserved resources and in on-demand phase the cloud broker provision more resources on-demand.

*Provisioning Stages–*

Provisioning stage is the time epoch when cloud broker makes a decision. Every provisioning stage may consist of one or more provisioning phases. Cloud broker makes a decision to provision resources by purchasing reservation and/or on-demand plans.

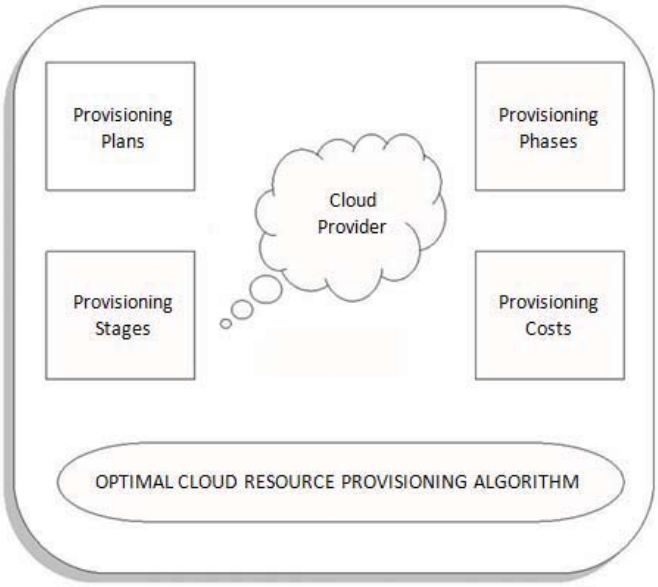


Figure 1. Optimal Cloud Resource Provisioning Model

*Provisioning Costs–*

There are three corresponding provisioning costs incurred in these phases, namely reservation costs, expending costs and on-demand costs. The prices in reservation and expending phases could be adjusted by cloud providers without informing the consumer in advance, except the price of the reservation plan in the first provisioning stage.

## IV. SYSTEM ARCHITECTURE

The cloud computing system model consists of four main components.

- Cloud Consumer
- Virtual Machine (VM) Repository
- Cloud Broker
- Cloud Providers

*Cloud Consumer–*

The cloud consumer has demand to execute jobs. Before the jobs are executed, computing resources has to be provisioned from cloud providers. To obtain such resources, the consumer firstly creates VMs integrated with software required by the jobs. In cloud consumer's site, the cloud broker is responsible on behalf of the cloud consumer for provision resources for hosting the VMs.

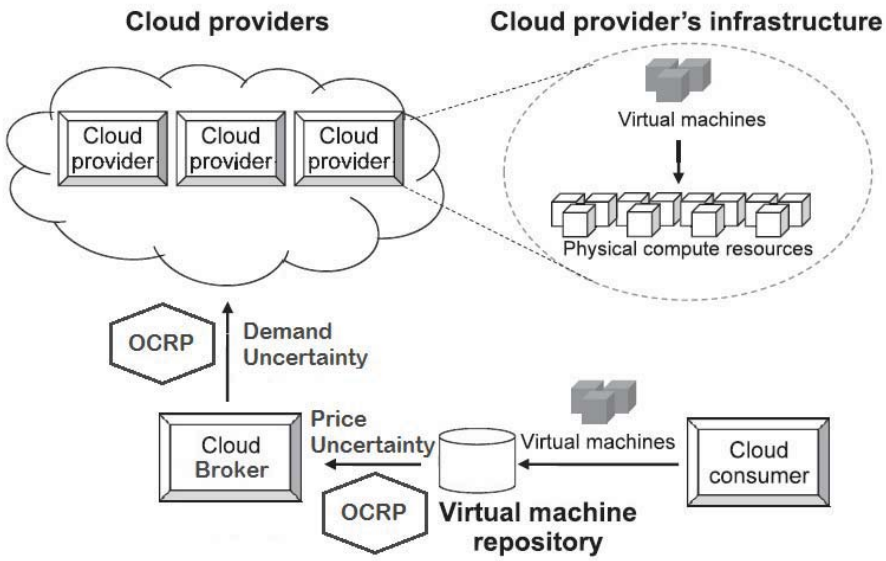


Figure 2. System Architecture

*Virtual Machine (VM) Repository–*

The optimal cloud resource provisioning algorithm is proposed for the virtual machine management. The created VMs are stored in the VM repository. Then, the VMs can be hosted on cloud providers' infrastructures whose resources can be utilized by the VMs.

*Cloud Broker–*

The broker can allocate the VM requests that stored in the VM repository to appropriate cloud provider. The broker implements the OCRP algorithm to make an optimal decision of resource provisioning. The cloud broker can reserve computing resources from cloud providers to be used in the future according to the actual demand. This demand can be determined as the number of created VMs. The additional resources can be provisioned instantly from cloud providers if the reserved resources are not enough to accommodate the actual demand.

*Cloud Provider–*

Cloud provider supplies a pool of resources to the consumer. Cloud providers can offer cloud consumers two resource provisioning plans, namely short-term on-demand and long-term reservation plans.

## V. PERFORMANCE ANALYSIS

The demand uncertainty from cloud consumer side and price uncertainty from cloud providers are considered to provide optimal resource provisioning. The results are calculated based on resources provided by cloud providers during initial load and peak load. Numerical studies are extensively performed in which the results clearly show that cloud consumer can successfully minimize total cost of resource provisioning in cloud computing environments using on-demand with dynamic pricing plan.

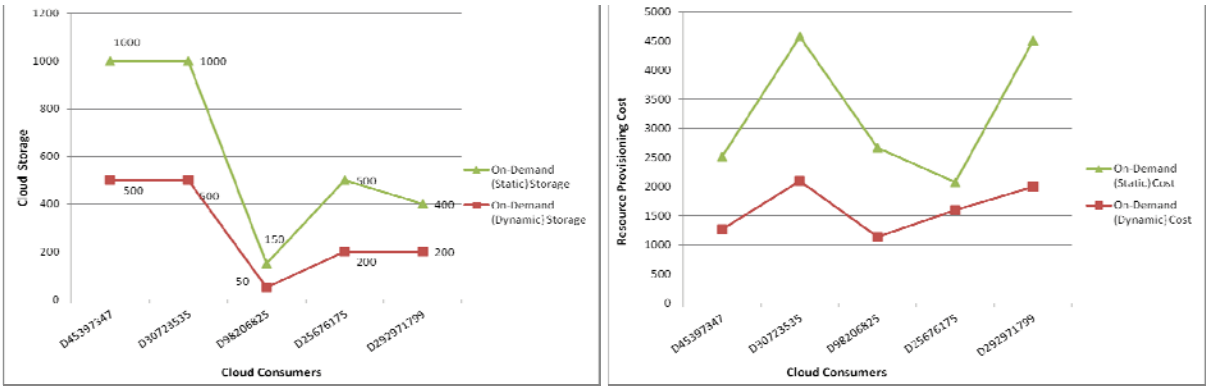


Figure 3. Demand Uncertainty

Figure 4. Price Uncertainty

## VI. CONCLUSION

In cloud computing environment the cost optimization problem draws significant of optimizing resource price and how to optimally provision cloud resources to meet service requirements. In cloud Environment on demand Cost, reservation Cost and expending cost are the major areas to be used for finding the optimal resource cost. The proposed optimal cloud resource provisioning (OCRP) algorithm is used to provision resources offered by multiple cloud providers, which reduces the on demand cost and reservation cost during the resource provisioning stage. The OCRP algorithm can be used as a resource provisioning tool for the emerging cloud computing market in which the tool can effectively save the total cost. The performance evaluation of the OCRP algorithm has been performed by numerical studies and simulations. According to the results, the algorithm can optimally correct the trade-off between reservation of resources and allocation of on demand resources by cloud consumers.

## V. FUTURE WORK

This work can be extended to incorporate the prediction of future resource demand in advance using analytical tool which further reduces the resource provision cost in cloud computing.

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