ISSN: 2278-0181

Defragmentation Based Dynamic Storage Allocation in Cloud

Krishna Prasad .R[1], *Madhu B.R.*[2]
[1]M.Tech-CSE, SET, JAIN University,
[2]Asst Prof, Dept of CSE, SET, JAIN University

Abstract - Cloud computing is an emerging computing paradigm that supply's users everything as a service. Cloud computing arise as an efficient way toallocate resources like storage, memory and processor for execution of task and services for a geographically dispersed providers from different organizations. Focus is on resource management problem is transformed to resource virtualization and allocation instead of job decomposition and scheduling. Public clouds sell capacity in the form of pre-defined virtual machine (VM) configurations to their users. This force's the users to buy the VM configuration based on the peak usage.This reduces the value proposition of moving to apublic cloud as compared to doing consolidation in a privatevirtualized datacentre. Ideally we would like the cloudtenants to buy capacity in bulk and benefit from statisticalmultiplexing among workloads. This requires dynamic allocationof bulk capacity among VMs of a user that may berunning on different servers across different datacentres.In this paper, we have used a Basic Base plus Proportional Excess model which is capable of adaptively adjusting storage space in which owner plays important role in storage allocation. We see several remarkable observations of the relationships between users and providers and owners.

IINTRODUCTION

Cloud computing is a technology which uses internet to work. Data and Applications are stored and maintained using Central remote servers in cloud. Applications can be used in Cloud computing without any installation of software or any specific hardware. The users can access the Internet and send messages anywhere in the world. Centralized storage, memory, processing and bandwidth are more efficient incomputation thatare allowed in Cloud computing. There are several cloud providers cloud services. Most Providers offer their services at fixed price and storage area, such Amazon EC2 and Windows Azure.

Prominent industry players like Amazon, Google, Network.com and Salesforce already provide Grid-based services on demand, but often use static pricing models that do not reflect the dynamics of the market supply and demand, such as pay-per-use or subscriptions for static resource configurations.

The goal of this paper is to design a defragmentation based system for the cloud instance market where multiple cloud users and providers respectively buy and sell instances to run and host cloud-based Internet applications.

The proposed Defragmentation based system assists the cloud users (i.e., both cloud users and providers) to decide how providers allocate their storage to which users in order to improve both cost and resource efficiency. In the proposed defragmentation based system users can bid for the resources in order to buy their needed resources and if required the user can upgrade using the defragmentation technique. The contribution of the paper can be summarised as

- The approach ofdefragmentation based mechanism in the cloud market where the user gets some extra storage space with the allocatedresource.
- We propose defragmentation based mechanism for single provider and multi users and can be extended to multi provider.

IIRELATED WORK

A. Resource Allocation

The importance of resource provisioning has been well discussed in various fields such aswireless networks, energy industries, and advertisements, which have proposed the allocation and pricing model of resources (e.g., wireless channels [1], [2], electricity [3], [4], and advertisements) to improve the resource utilization and efficiency. We focus on instances in clouds and consider an instance market where computing resources (e.g., bandwidth, CPU time and memory space) are traded as instances.

For the resource allocation, there exist several techniques such as game theory finding an equilibrium solution among players [5],stochastic programing considering uncertainty [6]; and bio-inspired mechanisms (e.g., genetic algorithm that seeks a Pareto solution of a multiobjective problem [7] and Ant colony that provides a heuristic solution of a complex problem[8]). We apply the auction theory to design the cloud market and formulate its resource allocation.

B. Auction based mechanism

Auction-based mechanisms have been proposed in various fields such as wireless networksand cloud computing in order to investigate how participants (or nodes) behave in a competition for resources; and different classes of auctions such as sequential second price auction [9], Vickrey auction [10], double auction [11], and combinatorial auction [12] have been considered in the design of the mechanisms.

C. Bidding strategies

Technology trends like Grid and Cloud allow resource providers to organize their resources moreefficiently and to offer them on demand. Prominent industry players like Amazon, Google, Network.com and Salesforce already provide Grid-based services on demand, but often use static pricing models that do not reflect the dynamics of the market supply and demand, such as pay-per-use or subscriptions for static resource configurations. Although there are business models that successfully promote consumption of these kinds of distributed services, incentives for using the services and simplified means of accessing them, along with legal regulation, are still insufficient.

Requirements for bidding strategies

Bidding strategies must allow the automation of the bidding process of offering and requesting computational services.

Bidding strategies must define and implement behaviours that incorporate the desired goals (maximize profit, minimize completion time), take actions (generate bid) and calculate the effects (payoff) of the actions.

Bidding strategies should adapt to market dynamics like price fluctuations, changing conditions and QoSof the provided resources. Learningmechanisms will be adopted to aggregate information pertaining to past decisions,actions and available market information in order to “fine tune” the bid generation processes.

Bidding strategies should be flexible i.e. converge to approximately optimalbids in multiple market mechanisms.

D. Windows azure architecture

Windows Azure is an Internet-scale computing and services platform hosted in Microsoft data canters. It includes a number of features with corresponding developer services which can be used individually or together.The Windows Azure SDKs for .NET, Node.js, Java, and PHP provide common tools and resources that you use to package, test and deploy your application. The Windows Azure SDK for .NET includes the Windows Azure Tools for Microsoft Visual Studio, which extends Visual Studio to enable the creation, building, packaging, running, and debugging of scalable web applications and services on Windows Azure.

The Windows Azure Management Portal provides access to Cloud Service (hosted service) deployment and management tasks as well as at-a-glance status information that lets you know the overall health of your deployments and accounts.

The Management Portal organizes the components of your Windows Azure deployments with constantly refreshed information that is easy to discover and understand. There are two portals available at this time. The New portal and the older Silverlight based portal.

ISSN: 2278-0181

Fig 1.azure architecture

III. DEFRAGMENTATION BASED MODEL

In this paper cloud environment is modelled as 3 parts: cloud providers, cloud users and the broker. Users submit the type of resource to the broker with respective bid price. The broker plays the main role. The advantage of using broker is, broker will have the complete trading information of the auction. The broker does 2 jobs. First calculate the highest bidder for the respective type of resource and second to allocate the resource to highest bidder.
And if required the defragmentation is done on the storage that is allocated.

Algorithm

Basic Base plus Proportional Excess:
Start
Input: VM settings (v); C: Capacity to allocate.
Result: Allocation Computed for VM.
Variables: i=1…n, a, b, u, v
For each i=1…n do
/*Allocate each VM its Lower Bound
a(i)=v(i)
b(i) = u(i)-v(i)
/* E is the remaining capacity
E= C – Sum(v(i)).
For each I = 1…n do

the maximum number of VMs user may need before VM creation.

a(i)=a(i) + ((b(i) * E)) / Sum(b(i))).
End

IV.COMMUNICATION AMONG ENTITIES

Cloud users register themselves with the broker. Broker provides database level match-making services for mapping user requests to suitable cloud providers. Broker acting on behalf of users consult the cloud providers about the list of cloud resource available to bid. Cloud provider initially fixes the cost to resource according to which the user has to bid. Messages from brokers to users may require a conformation, about the execution of the action.

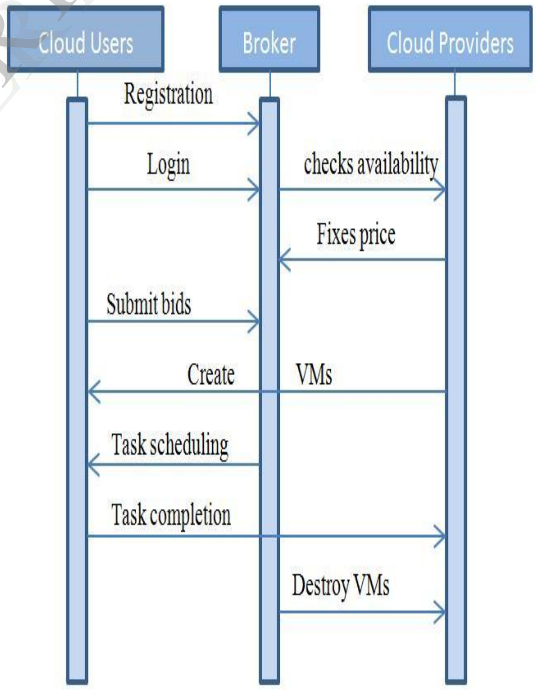

Fig2:communication data flow

V. EXPERIMENTAL SETUP FOR SINGLE PROVIDER

We use azure cloud for our single provider which provides VMs to our users. We create a broker website which acts as web hosting where the users submit their bids to the broker. We create the web role which simply acts as front end web applications. User interacts only with the web role. Broker decides to which user the VM should be allocated. Broker interacts with the provider worker role by creating the input endpoint to the worker role in the service definition file when deploying the role. Now the particular user can have full access and control over the VM, so the user can do anything he want and configure as he like. If the user requires more space he can raise a request to the owner where the owner will apply the defrag method on the leftover spaces such the user gets the required space at extra cost and SLA.

VI. RESULTS

Fig4. Storage allocated to user

The point of the diagram below is to think about

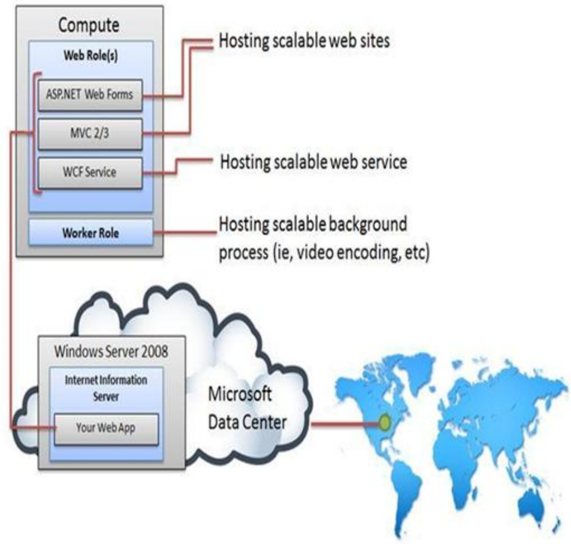

Fig3. Hosting your application

Fig5. Defragmentation done after the initial allocation is done.

VII. CONCLUSIONS AND FUTURE WORKS

In this paper we see the defrag model with the broker model important role for resource allocation with single provider. We also see the communication between the entities occurring during resource allocation. In future it would be interesting to work on multi provider and multi user to adaptively adjust resource price and storage space to see the advantages of defrag model rather on fixed price and space model for resource allocation.

ISSN: 2278-0181

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