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Regulate Capacity Sharing in a Federation of Hybrid Cloud Providers

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Abstract:

Cloud computing has a solution for solving enterprise resource allocation and configuration. A cost effective way becomes very challenging and essential among the cloud providers. The plan of a project is to maximizing their profit by selling their unused capacity in the spot market. The proposed work models the interactions among the Cloud Providers as a repeated game among selfish player. Due to uncertain of future workload fluctuations, revenue can act as a participation incentive to sharing in the repeated game. In this proposed system, also investigated the problem of allocation of service security in cloud is a major challenge. One of the key issues is to avoid any unauthorized data modification and virtual machine corruption, possibly due to server compromise. An efficient key pairing homomorphism token based encryption is introduced for verification of virtual machine allocation. The token computation function we are considering belongs to a family of universal hash function.

Index Terms:

Security Model, Optimal spot market allocations, Repeated Game-Theoretic Framework.

INTRODUCTION:

Cloud computing is an emerging paradigm that Substantiates the vision of modifying computational power, storage, and software services. In such a vision, software applications of different clients are executed over the shared cloud. All applications run in complete isolation through virtual machine (VM) instance. It launched and terminated on the cloud data centers to host applications of cloud clients on a per-needed basis. Clients of an IaaS cloud are mostly service providers from small-scale to world-wide enterprises and web service providers.

One of the major problems that face the cloud providers (CPs) is the uncertainty in their workloads. So I proposed a new model for capacity sharing in a federation of IaaS CPs. The capacity sharing strategies that maximize the long-run revenue of the federation, dubbed as socially optimal spot market allocations, and demonstrate their enforcement limitation. Using a formulation based on multistage games, a set of self-enforceable CPs capacity sharing strategies that maximize the federation's long-term revenue yet can achieve more revenue than what the individual CP can achieve outside the federation.

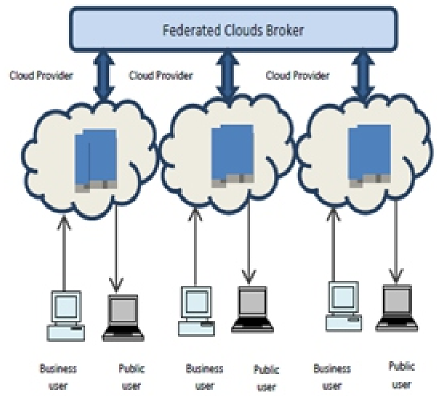

Fig: The adopted model of federated clouds.

A mechanism to dynamically allocate resources of distributed data centers among different spot markets with the objective of maximizing the total revenue. A market clearing pricing mechanism is developed where a centralized broker dynamically adjusts a single VM price for the federation. The proposed model does not assume any specific pricing scheme for the spot markets, and can employ the following resource allocation. The problem for allocating the appropriate cloud provider considering tasks with deadline constraints is presented. In general, existing approaches in the literature are concerned only with the instantaneous CP gains.

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However, most of the attention of these approaches has been focused on finding efficient pricing strategies or techniques for solving the centralized optimization problem of utility maximization in a decentralized manner. The presented work is the first to address the problem of the federated CPs long-term revenue maximization given future workloads uncertainty.

LITERATURE SURVEY:

i.Resource Sharing:

Tian Wenhong et al [24] start off by listing out the various advantages of cloud computing in our fast paced world, such as reduced costs, sharing, hiding complexity etc. But most cloud computing platforms' infrastructure is hidden to anyone who would like to research it. The strong need for platforms that support experimentation for research or learning purpose is met with the help of a Platform-as-a-Service. They go on to propose an architecture for the CRESS platform and the various modules and functions within it. The operating environment is described as having one super scheduling centre (a high performance server) and multiple other data centers (Physical clusters with virtual software). This platform is evaluated and the various applications with respect to networking, cloud storage, elastic web service and simulation as well as benefits with respect to time, cost and customization are laid out.

These authors have chosen CloudSim as their simulation tool. Doing so has encouraged understanding of how cloud computing works, and has provided a way to evaluate the effects and performance of the various scheduling and allocation algorithms present in CloudSim infrastructure. Currently, many clouds provide services such as storage and computing. Demand for scalable resources has been increasing rapidly as cloud customers are charged only for the services they use. However, a single cloud may not have sufficient resources or idle resources are not fully utilized. Therefore, with increasing demand, collaborative cloud computing (CCC) has been introduced, in which scattered resources belonging to different entities are collectively used to provide services.

The issues of resource/reputation management are addressed to guarantee successful deployment of CCC. Procedures used before for resource and reputation management were not efficient. Haiying Shen et al propose an integrated platform called Harmony.

Considering the interdependencies between resource/reputation management and for efficient and trustworthy resource sharing, Harmony combines three components-Integrated Multi-Faced Res/Rep Management, Multi-QoS-Oriented Resource selection, Price-Assisted Resource/Reputation Control. These three components enhance the reliability of globally scattered distributed resources in CCC. Verification of the different components show that Harmony performs better than existing resource/reputation management systems in terms of high scalability, balanced load distribution, loyalty awareness, QoS, effectiveness. Federated data center provides basic implementation of cloud computing. The authors have proposed an integrated platform called Harmony. Harmony combines three components that enhance the reliability of globally scattered distributed resources in CCC. For the validation of the proposed approach, a numerical simulation is conducted for critical situations. In a cloud environment, a cloud provider faces a major problem in provisioning the VMs on demand to clients; as workload spikes are erratic and unpredictable, neither over-provisioning nor guaranteeing a limited number of clients access can solve the issue of rejection of a client due to unavailability of a VM.

This paper proposes "Federated Clouds", which allows cloud providers to share their resources when they are not needed and request and obtain extra resources during high-demand periods, which allows them to successfully provide continuous service to all clients, with several proposed schemes for capacity sharing in the federation. Nancy Samaan approaches the problem of sharing unused VMs between cloud providers from a game theoretic standpoint; where each cloud provider is assumed to be a rational agent intent on maximizing its payoff. She then proceeds to show the existence of a Nash Equilibrium in the system, and thus derives schemes using "self-enforceable cloud providers" for sharing based on this environment.

Thus, by reducing the problem statement to a dynamic programming problem, she finally uses a recursive formulation to effectively reach the solution. CloudSim already provides an implementation similar to what the author proposes. A class FederatedDataCenter.java exists, which provides a Federated Data Center model for use in simulations. Other simulators can also be extended to include this functionality.

ii.Resource Provisioning:

Currently, the cost of hosting a high scale data center is incredibly high. More than half the power and cooling infrastructure cost is committed to the server hardware alone. Current solutions to this problem include virtualization-based consolidation, to combat server sprawl and to provision elastic resources, and statistical multiplexing, which allows the sum of the peak resource demands of each user exceeding the capacity of a datacenter. By leveraging differences of heterogeneous workloads (workloads of different natures, such as web browsing, streaming etc) and performance goals, a co-operative resource provisioning solution is proposed to decrease the peak resource consumption of workloads on data centers. It involves the four main heterogeneous workloads: Parallel Batch jobs, MapReduce jobs, Web Servers, and Search Engines. DynamicCloudSim already has support for heterogeneous resource allocation; however, heterogeneous workloads are currently not directly supported in cloud simulators.

Simulators have to be extended with custom logic to include algorithms such as the one described in the paper. DynamicCloudSim is the closest proponent of this. There is a huge amount of energy consumption by data centers for cooling and power distribution. One solution for this problem is Dynamic capacity provisioning. However, this method does not look at the problem of heterogeneity of workloads and physical machines. Data centers usually consist of heterogeneous machines with varying capacities and energy consumption. Qi Zhang et al first analyze workload traces from Google's production compute clusters. Due to previous drawback, Harmony is designed as a dynamic capacity provisioning (DCP) framework, which considers workload and machines and has a balance between energy savings and scheduling delay. Directly solving DCP is not possible.

Therefore, two technical solutions are provided. Finally, Google workload is evaluated with the proposed systems to conclude that it results in energy savings and also significantly improves task scheduling delay. Open source platforms such as Eucalyptus can adopt this mechanism by changing the scheduling policy to weight round-robin first fit and weight round-robin best fit. Most simulators can be extended to include support for a distributed resource manager.

iii.Distributed Computing:

With the advent of the internet and various web applications, large sets of data can be constantly collected to improve user satisfaction during application usage. For example various searches that go into a search engine are processed to improve the search results' relevance. The analysis of such large sets of data has been made possible by a processing model known as MapReduce. Since running a private Hadoop cluster is too inaccessible, the other option is running Hadoop/MapReduce on top of a public cloud. One challenge is that it is up to the user to determine the correct amount of virtual nodes for the cluster. With respect to the monetary and time costs involved in the resource allocation optimization for MapReduce, there is a tradeoff between the amount of resources provisioned (cost) and the amount of time taken to process. Cloud RESource Provisioning (CRESP), an idea by Keke Chen et al introduces two new concepts of reducing the monetary cost within limited time and reducing time costs within monetary constraints.

Once the authors set up the cost model of the algorithm they explore the resource allocation with respect to time constraints, cost constraints, and optimal tradeoff with no constraints. They demonstrate with the help of experiments and lay the foundation for future work. There are two main issues when it comes to optimization resource allocation for MapReduce programs: the monetary cost related to VM allocation and the time cost involved to get the job done. Thus the decision problem discussed above has two parts, and the Resource Time Cost Model proposed here deals with the tradeoff of these two factors: iCan cloud - which supports trade-offs between cost and performance - can be extended to include CRESP provisioning. Cloud Computing also provides Platform as a service (PaaS) which enables users to run MapReduce applications on virtual machines in the cloud. Due to the large amount of data handled by these applications, most of the recent research involves optimizing disk I/O operations in virtual machines to run these MapReduce applications. Eunji Hwang et al, however, propose a cost-effective provisioning policy of virtual machines for MapReduce applications. Cloud based on Eucalyptus software infrastructure which is used to provide IaaS. In this Master/Worker model, the Master sets up the Workers over Eucalyptus using the Nimbus Context Broker. Nimbus Context Broker is compatible with Eucalyptus cloud due to its Amazon back end.

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The introduction of parallel data processing in the Cloud has insinuated an outburst in the number of Companies offering parallel data processing capabilities in cloud infrastructures (IaaS). However, traditional parallel data processing frameworks like Hadoop have been designed for static, homogenous cluster setups and disregard the heterogeneity of the typical cloud infrastructure. Hence, a new data processing framework called Nephele in introduced as a viable alternative by Daniel Warneke. The author has designed his very own data processing framework for cloud environments called Nephele. Nephele consists of a Job Manager, Cloud Controller, VMs known as instances, and Task Managers. The Job Manager is analogous to that of Broker in CloudSim, and is responsible to schedule the tasks and allocate VMs with the help of the Cloud Controller. The Task Manager runs on VMs (also known as instances) and derives I/O from a persistent storage such as those offered by Amazon S3.

iv.Security Model:

The three issues of cloud computing security are: confidentiality, integrity and availability.

v.Availability:

Availability is the attestation that data will be available to the user in a perpetual manner irrespective of location of the user. It is ensured by: fault tolerance, network security and authentication.

vi.Integrity:

Integrity is the assurance that the data sent is same as the message received and it is not altered in between. Integrity is infringed if the transmitted message is not same as received one. It is ensured by: Firewalls and intrusion detection.

vii.Confidentiality:

Confidentiality is avoidance of unauthorized exposé of user data. It is ensured by: security protocols, authentication services and data encryption services. Since cloud computing is utility available on internet, so various issues like user privacy, data theft and leakage and unauthenticated accesses are raised. Cryptography is the science of securely transmitting and retrieving information using an insecure channel. It involves two processes: encryption and decryption. Encryption is a process in which sender converts data in form of an unintelligible string or cipher text for transmission, so that an eavesdropper could not know about the sent data. Decryption is just the reverse of encryption. The receiver transforms sender's cipher text into a meaningful text known as plaintext.

RELATED WORKS:

i.Federated Model :

Federation can help providers to absorb overloads due to spikes in demand. At the center of this model, the Cloud Exchange service plays the role of information service directory. With the aim of finding available resources from the members of federation, providers send an inquiry to the Cloud Exchange Service in case of shortage of local resources. The Cloud Exchange is responsible for generating a list of providers with corresponding service prices that can handle the current request. Therefore, the resource availability and price list is used by providers to find suitable providers where requests can be redirected to. Decision on allocating additional resources from a federated Cloud provider is performed by a component called Cloud Coordinator. The amount of idling capacity each provider shares with other members and the way providers price their resources is also decided by the Cloud Coordinator. These decisions significantly affect the profit of providers, and thus they are of paramount importance for the successful adoption of the federation paradigm by Cloud providers. Moreover, agreements between federation members are necessary in order to make the federation profitable to all its members.

ii.Economic Sharing Model :

The profit obtained from the repeated game can derive higher revenue using a simple grim trigger punishment strategy. Derive a simple update rule to find the sub game perfect Nash Equilibrium values for the spot market allocations. Reduce workload fluctuation. This pricing mechanism facilitates load balancing between federated providers, since it results in cheaper price for providers with larger amount of resources.

iii.Optimization of Resource Provisioning:

An optimal cloud resource provisioning (OCRP) algorithm is proposed by formulating a stochastic programming model.

The OCRP algorithm can compute resources for being used in multiple provisioning stages as well as a long-term plan. 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. This OVMP algorithm can yield the optimal solution for both resource provisioning and VM placement in two provisioning stages. It can reduce the cost of using computing resource significantly. Effectively save the total cost. Effectively achieves an estimated optimal solution.

The optimal cloud resource provisioning algorithm is proposed for the virtual machine management. 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 objective is to address uncertainty of resources availability. In a binary integer program to maximize revenues and utilization of resource providers was formulated. In an optimization framework for resource provisioning was developed. This framework considered multiple client QoS classes under uncertainty of workloads.

iv.Dynamic Resource Pricing:

Strategic-proofing dynamic pricing scheme is suitable for allocating resources on federated clouds. Here, pricing is used to manage rational users. A rational user are an individual user, a group, or an organization, depend on application. In federated clouds, users request more than one type of resources from different providers. Auctions are usually carried out by a third party, called the market-maker, which collects the bids, selects the winners and computes the payments.

Buyers and sellers are globally distributed, it is practical to adopt a peer-to-peer approach, where, after pricing and allocation, buyers connect to sellers to use the resources paid for. It provides better economic efficiency. Also it provides higher number of successful buyer requests and allocated seller resources. Buyer welfare is increased. Dynamic resource pricing use sampling techniques that should be reduce the sampling errors.

v.Game-Theoretic Framework:

The proposed approach is motivated by the observation that the behavior of the CPs in the above two models represents two extreme forms of a strategy adopted by players in a game of sharing unused VMs. Recognizing this fact enables us to reformulate the problem in a more general setting that alleviates the limitations of the above two models .In game theory, a stage game is typically defined by a triplet consisting of a set of players, strategies, and payoffs, where the players are assumed to be rational agents representing at maximizing their payoffs.

CONCLUSION:

An innovative economic sharing model is used to sharing capacity in a federation of IaaS cloud providers, this can be done by using interaction among cloud providers as a repeated game of virtual machine that can identify the all unused capacity in the spot market. Performance evaluation results computed the profit that increased by the federation as well as by individual cloud providers and also it demonstrated significant amount of smoothing effects on the spot market prices. It also to be achieves fully decentralized and secure virtual machine sharing between cloud providers.

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