Incorporating License Management in Cloud Simulation Environment

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Abstract— **Cloud computing is a highly scalable distributed computing platform, and an emerging technology in IT industry, in which computing resources are offered 'as a service'. These services are categorized in three services software-as-a-service (SaaS), platform-as-a-service (PaaS) and infrastructure-as-a-service (IaaS). We are free to access these services with some specific protocols. So these protocols are bind together and are put together into the form of license by service provider. To access these services we require license, a legal authorization through which a cloud service provider authorized the user to use its resources on pay-per-basis and resources are provided on demand by the service provider. But due to lack of license management in cloud computing it is a challenge to provide availability of resources to the user. This paper presents an algorithm to provide license to the user. This paper provides authenticated access to the resources through remote license server. This license management architecture can be deployed in any distributed environment.**

Index Terms— **Cloud, CloudSim, license, ISV**

I. Introduction

In recent trend of IT users access the resources over the internet in cloud environment. Cloud computing [7] is a computing environment where the services are provided to the users on demand over the internet. These services may be in the form Platform-as-a-service (PaaS), infrastructure-as-a-service (IaaS), software-as-a-service (SaaS).

Typically every service in cloud has some same properties

- Availability to the consumer on demand
- Fully controlled by the provider
- pay only for the time you used

All the services in cloud environment are made available to the user on demand and fully controlled by the provider you need just use as you want and no need to know about its internal structure and you pay only for the time you used.

Small enterprises do not make big setup of computing power, storage. They access these services over the internet on demand in cloud environment. Now the question arises how these services can be provided and who is the provider. So to access these services provider provide license to use the services. Because cloud is distributed environment hence how license can be issued. In simple client/ server technique a license is issued to a single user with an authenticated copy but in cloud environment license is provided over the internet and provider is not sure that how many users may ask for a particular resource because resources are limited if all the user asked for same resource at the same time then demand cannot be full filled at the same time.

Although there are many license management mechanism available in market but they do not support distributed environment. So there is a challenge to make available license in distributed environment from legal point of view. In distributed cloud environment we have resources and users and any user may ask for any resource we cannot expect that what is going to be in demand in coming time so we have two mechanisms to issue license.

1. License to the user:-

In this we issue license for a user and if he/she want to access any service over the cloud he/she log in and ask for resources.

2. License for processes:-

Here we are issuing license for each resource as the resource is demanded by the user.

Despite of all the technical difficulties there are some economical and legal issues. In distributed cloud environment an enterprise cannot estimate its revenue while in previous scenario service provider issues their codes yearly basis. Users buy a fixed number of licenses as their requirement with associated features and included support. So any organization can predict its revenue and it is very much stable. Unfortunately, cloud environment is in opposing a pay-per-use scenario. In a pay-per-use scenario there is no predictable revenue for the service provider and unless the ISV is also the license service provider. However, a pay-per-use model in cloud computing environment would create a new source of revenue for service provider, because SMEs, which so far could not afford to purchase licenses (for a year) can now access the licenses on a pay-per-use basis. Additionally, large no. of users are able to increase their number of licenses during peak-demand periods. Only time will tell, whether this additional revenue will be sufficient to compensate for the revenue missed due to overprovisioning.

We issue license on the basis of license to the user and make it as smooth to adopt in cloud environment. Our solution is based upon the following classes which are built and has been integrated with CloudSim.

1. Double Authenticated Access
2. Accounting and Billing
3. Easy access and job submission
4. License monitoring

II. Related Work

Several research works have focussed on incorporating license in Cloud infrastructure. In [1] a pay per use license management infrastructure has been presented. This infrastructure can be deployed in on-demand computing scenario. The architecture enables authenticated access to a remote license server. In [2] GenLM a license manager for Grid and cloud environment has been presented. This manager provides secure and robust solutions for ISVs for extending their software to Grid and cloud environment. In [3] a semantic resource allocation approach for job scheduling in cloud has been presented. This approach takes into account software licenses, enabling ISVs to distribute their products in cloud environment. In [4] concurrent licenses (which mean the owner can run a specified number of application instances at the same time) are considered as a soft constraint. In [5] elasticLM is based upon a layered architecture comprising 6 layers: Coallocation, Authentication, Administration, Management, Business, and Persistency.

III. System Design

Transition from classical license management mechanisms to license management solutions that work in distributed environments needs to be as smooth as possible. Hence solution satisfies the following requirements:

A. Double Authenticated Access

User using cloud services must have privileged to use the cloud service. i.e. user, may be in a company which is using cloud services provided by an organization(i.e. Amazon, IBM) on pay per-use- basis, must have privileges to use that service and he/she must be authorized by the company which is using cloud services. User in an organization is authorized for using cloud services or not is decided by that company not by the cloud service provider. Cloud service provider only verifies an organization not a particular person. Hence organization using cloud services must have some accounts for its user. Service provider only issue a single license for an organization and maintain account only for the organization not for the employer working in organization using cloud services and how that organization is using that license in its internal level depends on that organization.

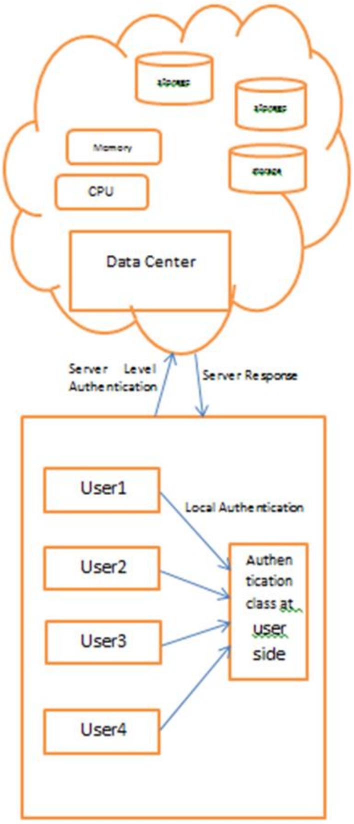

Fig.1 Double Authentication

B. Accounting and Billing

There are some side-implications with respect to accounting and billing associated. In the non-distributed scenario the bill already has been paid for in advance on yearly basis and therefore accounting plays a minor role. The pay-per-use model needs to support a flexible cost unit based accounting rather than an identity bound accounting: The reason is that usually institutions or research groups own the licenses, licenses are not owned by their individual members.

C. Easy access and job submission

The licensing mechanism has to be transparent for the user. It should not introduce significant overhead. If a user has enough privileges to submit a job then he/she should be allowed access to the cloud services easily and no more overhead should be provided to submit the job. One user who is authorized can ask for service directly.

D. License Monitor

The assumption is that such a component is essential once the license management architecture is deployed in production. It is necessary to have an efficient supervised scheduling of licenses (as is the case for other resources) and to provide the user with information on how many licenses are available on a given site before he submits his job. The monitoring component covers the ability to co-schedule licenses and resources such that jobs are not started before a required license is available.

The License Monitor consists of two parts: The License Monitor component and the integration of a license check into a datacenter. The goal is a work flow like described in Fig. 2. Once the data center is about to submit a job that needs licenses, a request is sent to the License Monitor component to check the availability of the needed licenses. If the answer of the License Monitor is positive then the cloudlet is submitted to Virtual machine for execution, otherwise it will not be executed.

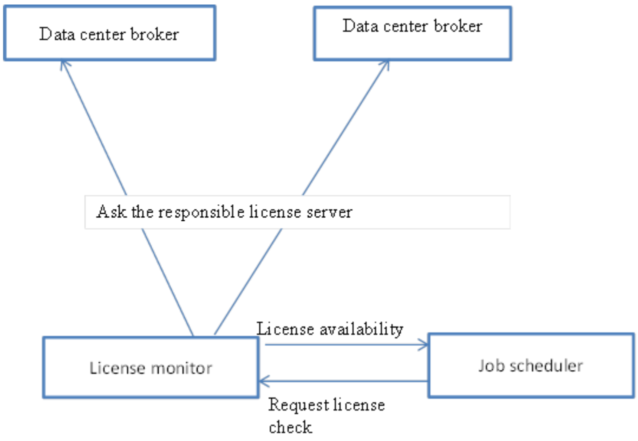

Fig.2: overview of license monitor[1]

E. *CloudSim*

The CloudSim toolkit allows simulation of a Cloud Computing environment and performance evaluation of scheduling strategies in a repeatable and controlled way. CloudSim implements core entities that simulate resource, information service, statistics, and shutdown services. These services are used to simulate a user with application, a broker for scheduling, etc. Interaction between these entities takes place through events. Events are used for service request and service delivery. Events can be internal (generated by the entity which receives it) or external (generated by some other entity). Figure 1 shows the interaction between entities in a typical Cloud simulation. The interaction between entities shown in the figure is explained below:

Figure 3 depicts the flow of communication among core CloudSim entities. At the beginning of a simulation, each Datacenter entity registers with the CIS (Cloud Information Service) Registry. CIS then provides information registry type functionalities, such as match-making services for mapping user/Brokers requests to suitable Cloud providers. Next, the DataCenter Brokers acting on behalf of users consult the CIS service to obtain the list of cloud providers who can offer infrastructure services that match application's QoS, hardware, and software requirements.

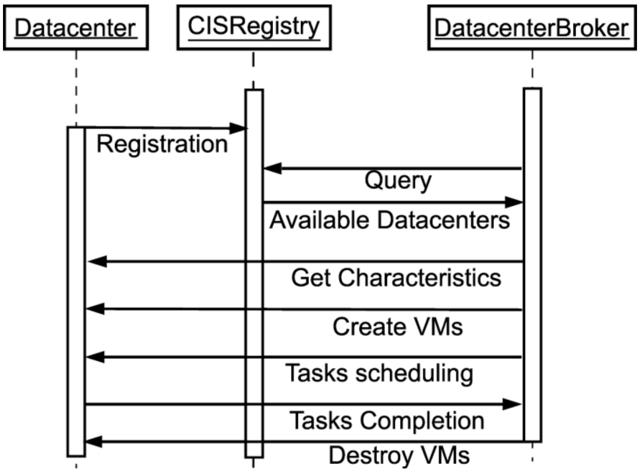

Fig.3. Simulation Data flow [6]

In the event of a match, the Datacenter broker deploys the application with the CIS suggested cloud. The communication flow described so far relates to the basic flow in a simulated experiment. Some variations in this flow are possible depending on policies. For example, messages from Brokers to Datacenters may require a confirmation from other parts of the Datacenter, about the execution of an action, or about the maximum number of VMs that a user can create.

1) *DatacenterBroker or Cloud Broker:* This class models a broker, which is responsible for mediating negotiations between SaaS and Cloud providers; and such negotiations are driven by QoS requirements. The broker acts on behalf of SaaS providers. It discovers suitable Cloud service providers by querying the Cloud Information Service (CIS) and undertakes on-line negotiations for allocation of resources/services that can meet application's QoS needs. The researchers and system developers must extend this class for evaluating and testing custom brokering policies. The difference between the broker and the Cloud Coordinator is that the former represents the customer (i.e., decisions of this components are made in order to increase user-related performance metrics), while the latter acts on behalf of the data center, i.e., it tries to maximize the overall performance of the data center, without considering needs of specific customers.

2) *Datacenter:* This class models the core infrastructure level services (hardware) that are offered by Cloud providers (Amazon, Azure, App Engine). It encapsulates a set of compute hosts that can either be homogeneous or heterogeneous with respect to their hardware configurations (memory, cores, capacity, and storage). Furthermore, every Datacenter component instantiates a generalized application provisioning component that implements a set of policies for allocating bandwidth, memory, and storage devices to hosts and VMs.

F. License management in Datacenter:

Following classes have been created for license management.

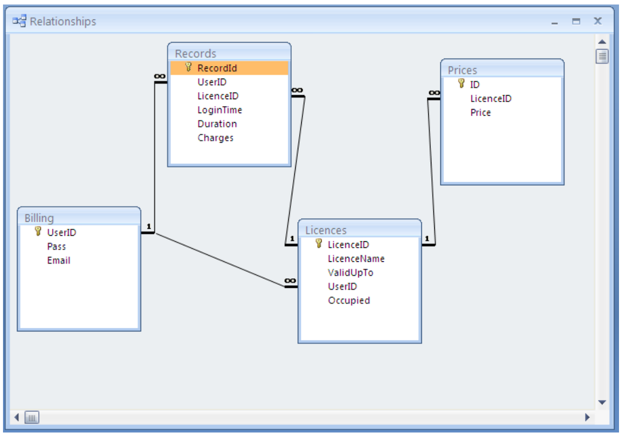

Fig.4: Class relationship diagram for license management

IV. RESULTS DISCUSSION

We simulated the above mechanism over CloudSim where 50 cloudlets were submitted. Each cloudlet has length 0f 500 MI. The cloud environment consisted of 30 hosts in one datacenter. Each host has 1 processing element and one has a CPU speed of 10 MIPS. 50 VMs were created with each VM used for execution of one cloudlet. Out of 50 cloudlets 30 were allocated resources successfully while 20 jobs failed due unavailability of required license or due to expiry of license.

V. CONCLUSION

Here is an implementation of license mechanism such that if a user want to use the services of cloud then first of all it will be checked (i.e. license will be checked) whether the user is authorized or not to use that service and user will pay the bill on pay-per-use basis.

In this mechanism when a job is submitted the authentication of job is verified via datacenter and license monitor monitors the availability of licenses. One important feature of this license mechanism is the Billing and Account part which creates the bill on pay-per-use basis. Due to Accounting and Billing part, ISV s can monitor the features their customers are most interested in and therefore keep in touch with their customer base.

Another aspect that can be considered in management of software license is the question whether it is possible to schedule licenses such that certain jobs get priority. A possible scenario is the following: A customer of some license service provider pays some more money for the licenses he needs to the license service provider. In return he gets the guarantee that his jobs always have higher priority than others but in some case it may lead to starvation for some organization. So in future work we have a challenge to implement such an algorithm in which the user pays more gets the license and no user go in starvation.

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