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An Effective Billing in Cloud Computing

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Abstract— Cloud computing is a style of computing where massively scalable IT-enabled capabilities are provided as a service over the network. It emerges as a new computing paradigm to support the maximum number of users and elastic services with the minimum resource. With the widespread adoption of cloud computing, the ability to record and account for the usage of cloud resources in an efficient way has become critical for cloud service providers. The success of a billing system depends on several factors. The paper reviews the cloud computing advances, the major characteristics and the importance of billing in cloud services. The paper emphasizes on the Iaas Billing which is considered as a complex task due to various interactions and features. Various systems exist for the cloud services billing. Cloud economics have encouraged future in the cloud computing industry that is capable of fulfilling the requirements of the current industry. A billing system has been proposed in the paper that offers the transparency of consumption, billing and frequency of usage of services.

Keywords— cloud computing, billing, SaaS, PaaS, IaaS

I. INTRODUCTION

Cloud computing is definitely not new to Information Technology. This very concept of providing computing facilities to the general public as a utility had been utilized very long ago. Cloud computing has reached popularity and developed into a major trend in IT and has been considered as the long-held dream of computing as a utility. . It represents a shift away from computing as a product, to computing as a service that is delivered to consumers over the internet from large-scale data centers or "clouds". Cloud computing is indeed considered as a revolution. Cloud computing has brought a revolutionary change in computer architecture, software and tools development, and the way we store, share and consume information. The biggest benefit is that developers no longer require the large capital outlays in hardware to deploy the innovative ideas for new Internet services service and hence cutting the human expense to operate it. Now they need not be concerned about over- provisioning or under- provisioning of the resources or services. Clouds are large pools of easily usable and accessible virtualized resources. These resources can be dynamically reconfigured to adjust to a variable scale, along with allowing optimum resource utilization. It's a pay-per-use model in which the Infrastructure Provider offers guarantees by means of customized Service Level Agreements (SLAs) which typically exploits a pool of resources.

Cloud computing has been a hotly debated topic amongst IT professionals and researchers both in the industry and in academia. Several efforts have been made in the recent past to provide the exact definition of "cloud computing" and many have not been able to provide a comprehensive one. Cloud computing is a paradigm for large-scale distributed computing that makes use of existing technologies such as virtualization, service-orientation, and grid computing. The access that this technology provides to resources and services can be scaled up or down to meet demand. Cloud computing providers typically charge customers on a pay-per-use model.

II. CHARACTERISTICS OF CLOUD COMPUTING

Cloud computing has a variety of characteristics which differentiate it from other computing paradigms. Some of them are:

- **On-demand self-service**: Computing resources include processing power, storage, virtual machines etc. These resources can be acquired and used at any time without the need for human interaction with cloud service providers.
- **Infrastructure pooling**: Cloud Computing uses a virtualized software model, enabling the sharing of physical services, storage, and networking capabilities. The cloud infrastructure seeks to make the most of the available infrastructure across a number of users.
- **Dynamic Provisioning:** It allows for the provision of services based on current demand requirements. This is done automatically using software automation, enabling the expansion and contraction of service capability as per the requirements. The maintenance of reliability and security are highly emphasized.
- **Network Access**- Deployments of services in the cloud include everything from using business applications to the latest application on the newest smartphones. The services need to be accessed across the internet from a broad range of devices such as PCs, laptops, and mobile devices, using standards-based APIs.

- **Managed Metering:** Uses metering for managing and optimizing the service and to provide reporting and billing information. In this way, consumers are billed for services according to how much they have actually used during the billing period.

III. SERVICE MODELS

Cloud computing service models are broadly classified into three categories:

1. Infrastructure as a Service (IaaS)
2. Platform as a Service (PaaS)
3. Software as a Service (SaaS)

A. Infrastructure as a Service

This is where users acquire computing resources such as processing power, memory and storage from an IaaS provider and use the resources to deploy and run their applications. Infrastructure-as-a-Service (IaaS) provides virtual servers with unique IP addresses and blocks of storage on demand. Customers can pay for exactly the amount of service they use, this service is also called utility computing. Consider an example of Amazon Elastic Compute Cloud provides users with a special virtual machine (AMI) that can be deployed and run on the EC2 infra-structure.

B. Platform as a Service

Platform as a Service (PaaS) is an application development and deployment platform delivered as a service to developers over the Web. It supports development and deployment of applications without the cost and complexity of buying and managing the underlying infrastructure, providing all of the facilities required to support the complete life cycle of building and delivering web applications and services entirely. PaaS provides users with a high level of abstraction that allows them to focus on developing their applications without concerning about the underlying infrastructure. It is a way to rent hardware, operating systems, storage and network capacity over the internet. Here applications are developed using a set of programming languages and tools that are supported by the PaaS provider. The idea behind is that someone can provide the hardware along with a certain amount of application software.

For example Microsoft Azure Services Platform: provides users with on-demand compute and storage services as well as a development platform based on Windows Azure.

C. Software as a Service

It is also referred as software on demand. Software-as-a-Service (SaaS) is the broadest market. This is where users simply make use of a user interface to access software that others have developed and offer as a service over the web. At the SaaS level, users do not have control or access to the underlying infrastructure being used to host the software. These applications can be anything from web based email, to applications like Twitter. This is the idea that someone can offer you a hosted set of software, running on a platform and infrastructure, that you don't own but pay for some element of utilization. One neither have to do any development or programming nor have to purchase anything. You just pay for what you use. For example Google Apps provides web-based office tools such as e-mail, calendar, and document management.

IV. CLOUD DEPLOYMENT MODELS

Deploying cloud computing can differ depending on requirements, and the following four deployment models have been identified, each with specific characteristics that support the needs of the services and users of the clouds in particular ways. There exist four different types of clouds on the basis of who owns and uses them:

A. ***Public cloud***

A public cloud encompasses the traditional concept of cloud computing, having the opportunity to use computing resources from anywhere in the world. In Public cloud or external cloud resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web applications/web services, from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis.

B. ***Private cloud***

Private clouds are normally data centres that are used in a private network and can therefore restrict the unwanted public to access the data that is used by the company. It is obvious that this category has a more secure background than the traditional public clouds. However, managers still have to worry about the purchase, building and maintenance of the system. The cloud infrastructure has been deployed, and is maintained and operated for a specific organization. The operation may be in-house or with a third party on the premises.

C.*Hybrid cloud*

As the name already reveals, a hybrid cloud is a mixture of both a private and public cloud. This can involve work load being processed by an enterprise data center while other activities are provided by the public cloud. The cloud infrastructure consists of a number of clouds of any type, but the clouds have the ability through their interfaces to allow data and/or applications to be moved from one cloud to another.

D.*Community cloud*

The cloud infrastructure is shared among a number of organizations with similar interests and requirements. This may help limit the capital expenditure costs for its establishment as the costs are shared among the organizations. The operation may be in-house or with a third party on the premises.

V. CLOUD BILLING

Cloud billing is the process of generating bills from the resource usage data using a set of predefined billing policies. Each cloud provider has similar, but slightly different, ways of billing. Utility billing is a universal concept that all cloud providers are using. Amazon has been the leader and trend setter in cloud billing. Providing an agile, real-time billing system is mission critical for both service providers and end users.

The purpose of having a cloud-optimized billing component is to be able to provide an interface for generating usage bills. The bill can be for real money or it can refer to a more abstract notion of exchange, depending on individual cloud computing general policies. Billing is what keeps your business ticking, yet the process for billing is often one of the last things to be considered when building out a new cloud-based service. Cloud customers are increasingly demanding instant granular billing to ensure that they only pay for the service that they use.

The billing system needs to be granular enough to drill down into each component or service and report this back to the customer as and when they need it. Traditional billing systems are not able to meet the requirements of Cloud providers. The basic idea behind a traditional billing system is the reason they are not able to cope up with the highly dynamic IaaS industry requirements. Our proposal addresses customer needs of supporting flexible pricing plans, metering and automating billing in an integrated passion for increased operational efficiency. Our customers benefit from using the billing solution for pay-as-you-use hardware infrastructures.

VI. MOTIVATION

Cloud computing is still evolving and no widely accepted definition exists for it. Cloud architecture is the design of software applications that uses internet-accessible on-demand service and the supply of management infrastructure that includes functions as computational resources provisioning, dynamic workload balancing and performance monitoring.

We describe a system which provides for pricing and billing of the cloud service. The objective of this work is to record the resource usage per cloud instance and to generate a bill based on two factors- the consumer's utilization and the load on the cloud during the period of utilization. Pricing for a cloud service can be applied based on multiple considerations. Some of the current service providers price their cloud instances mostly based on configuration and duration of use and others charge the consumers a fixed price for a lease period. The service provider specifies the pricing rules which define the pricing overhead for running the service under various load conditions. Billing calculations involve determining the overall load on the cloud over a recent interval of history and obtaining a weighted sum of the load on the entities and the corresponding pricing information.

Billing management is a core component of IaaS in cloud computing. All the information regarding the bills has to be managed and updated time to time. The frequency of billing should be maintained according to the use of services and resources for further interpretation regarding updates or addition of existing or new services. Billing arrangements can include both pre-usage payment and post-usage payment by cloud consumers.

The objectives of the proposed cloud billing system are to efficiently estimate the costs. The proposed system seeks to deliver services and other features with highest quality, reliability and consistency that meet user's requirements along with establishing and measuring performance and user satisfaction against appropriate goals with security and reliability. The objectives include the enhancement of the existing Iaas Online Billing System with the help of the user feedbacks.

In this work, a smart billing model has been proposed which provides for dynamic pricing of the cloud service. Smart billing caters to the need of a dynamic pay-per-use model in the cloud environment based on real-time pricing of the cloud service. The aim of this dynamic pay-per-use pricing model is regulation and improvement of overall utilization of the cloud infrastructure.

VII. PROPOSED SCHEME

Various systems exist for the billing and pricing of cloud services. Many studies have analyzed pre-existing billing systems of cloud computing environments. They have tried to identify the new requirements in the computing paradigm for cloud computing. The inspiration of our work originates from the challenges in estimating and comparing the cost of IaaS cloud resources, services and infrastructure.

A. Existing System

The existing system IaaS Online Billing System (IOBS) describes transparency of consumption, billing and frequency of usage of services for a cloud based pay per use system. IOBS describes various interactions and a network user interface. IOBS allows different collaborations to make billing in IaaS easy. IOBS offers a unique cloud billing service that takes the complexity out of IaaS billing and enables cloud providers to bill accurately, consistently and competitively. This framework delivers a comprehensive solution for convergent billing across cloud services, account types and billing environments, helping providers to achieve the full promise of cloud computing and provide an estimation to user through email.

IOBS provides well defined user interface for every type of user. The cloud user selects the various services managed by service management dashboard according to the requirements after registration. Budget manager manages all the discounts on current services and resources and upgrade the infrastructure as technology changes and feedback provided by billing system stakeholders. The user selects the services and generates the report consist of the total estimated cost along with services, tax, discount and other expenditures, also mailed to the respective user [11].

B. **Proposed Method**

We will be enhancing IOBS by adding consumer feedback and enhancement mechanisms. There will be regular feedbacks asked from customers and based on those feedbacks billing and services can be improved. The customer feedback will help in improving the billing and IaaS cloud services.

Next step will be implementing a risk analysis model that will be used in enhancing the services and also implement a module to learn risk metrics and add rules into the system so that alerts can be generated for risk analysis.

Three algorithms can be used collaboratively to enhance the existing system.

- Consumer feedbacks collection algorithm, this algorithm will be used to regularly collect feedback from customers. The algorithm will be sending out feedback forms and also collect feedback and feed into system to build rules for risk analysis.
- Risk metrics builder, based on the consumer feedback this algorithm will check database and use data to update risk metrics.
- Calculating potential risks in the system.

C. Methodology

(i) First of all user access the services through the user interface. After that the task of the user's authentication and authorization is performed.
(ii) Users select the currency, the services and the time duration for particular services.
(iii) Cost estimation reports are generated after including tax and commission and deducting discount.
(iv) The user can update, save and search the report from the database and provide feedback.
(v) User pays the required amount through net banking,
(vi) Consumer Feedback is collected
(vii) Feedback is fed into the system for rule formation of Risk analysis
(viii) Risk metrics builder algorithm applied to check database and update risk metrics
(ix) Calculation of potential risks in the system

The proposed methodology is needed to be implemented in a tool. The tool opted for simulation of the proposed work is Eclipse. The cloud billing proposed scheme will be implemented in java.

VIII. CONCLUSIONS

The aim of the study is to provide a full-fledged trusted, non-obstructive billing system tailored for a cloud computing environment. To accomplish this task, the ways in which existing billing systems are used in the environment are thoroughly reviewed. This paper reviews the recent advances of Cloud computing and presents our views on Cloud computing: definition, key features and enabling technologies. In this paper, the existing system IOBS has been explained and reviewed and the framework has been extended by adding advanced features through user feedback.

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