A Value Based Dynamic Resource Provisioning Model in Cloud

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ABSTRACT

Cloud computing has become an innovative computing paradigm, which aims at providing reliable, customized, Quality of Service (QoS) and guaranteed computing infrastructures for users. Efficient resource provisioning is required in cloud for effective resource utilization. For resource provisioning, cloud provides virtualized computing resources that are dynamically scalable. This property of cloud differentiates it from the traditional computing paradigm. But the initialization of a new virtual instance causes a several minutes delay in the hardware resource allocation. Furthermore, cloud provides a fault tolerant service to its clients using the virtualization. But, in order to attain higher resource utilization over this technology, a technique or a strategy is needed using which virtual machines can be deployed over physical machines by predicting its need in advance so that the delay can be avoided. To address these issues, a value based prediction model in this paper is proposed for resource provisioning in which a resource manager is used for dynamically allocating or releasing a virtual machine depending upon the resource usage rate. In order to know the recent resource usage rate, the resource manager uses sliding window to analyze the resource usage rate and to predict the system behavior in advance. By predicting the resource requirements in advance, a lot of processing time can be saved. Earlier, a server has to perform all the calculations regarding the resource usage that in turn wastes a lot of processing power thus decreasing its overall capacity to handle the incoming request. The main feature of the proposed model is that a lot of load is being shifted from the individual server to the resource manager as it performs all the calculations and therefore the server is free to handle the incoming requests to its full capacity.

Keywords: Cloud Computing, Resource Prediction, Resource Provisioning, Virtual Machine, Virtualization

1. INTRODUCTION

The invention of cloud computing is one of the major advances in the history of computing. It is the latest technology and companies are using the cloud computing in their administrative reforms to make them effective and efficient. It enables business to deliver new services, enter into new markets, get closer to customers and make employees more productive. Cloud computing has an infinite amount of resources such as CPU, memory and disk etc. It enables and

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facilitates the provisioning of various types of services and allows the users and providers to access the specified resources according to their needs. These resources are offered to the users at a competitive rate and customers pay for their actual usage without upfront costs. Due to its advantages, cloud has been increasingly adopted in many areas such as banking, e-commerce, retail industry and academic purpose. Cloud proves to be very useful for the startup companies as it gives them an opportunity to host their applications in the cloud. Thus, eliminating the overhead of procuring traditional infrastructure resources which typically take several months. It is a computing solution based on Internet where shared resources are provided like electricity distributed on the electrical grid. Machines in the cloud are configured to work together. Various applications use the collective computing power of the machines as if they are running on a single system. Allocation of resources on demand is a function of cloud computing which facilitates the use of the system’s cumulative resources and hence eliminates the need to assign specific hardware to a task. Before the advent of cloud computing, websites and server-based applications were executed on a specific system.

With cloud computing, resources are used as an aggregated virtual computer. This blended configuration provides an environment where applications execute independently without regard for any particular configuration. Cloud computing is the latest technology in which a lot of research work is going on.

Clouds are complex, large-scale and heterogeneous distributed systems (e.g., consisting of multiple data centers, each containing thousands of servers and peta bytes of storage capacity) which needs to be automated and integrated with intelligent strategies for dynamic provisioning of resources in an autonomic manner. Cloud computing providers offer their services according to several fundamental models. In industry, these services are referred as Infrastructure as a Service (IaaS) in which a computing resource such as processing power or storage is provided, Platform as a Service (PaaS) in which tools for the development of adapted applications are provided and Software as a Service (SaaS) in which the service provides functionality similar to an end-user application. These services deliver computing infrastructure including physical machines, networks, storage and system software as virtualized computing resources over Internet. Cloud management is responsible for management of all resources used by all the applications deployed in the cloud. Main cloud computing service providers are Amazon Elastic Compute Cloud (Amazon EC2), Google App engine and Salesforce respectively. In a cloud computing environment, the organization running an application does not normally own the physical hardware used for the applications. In fact, while running applications in the cloud, an organization does not usually know exactly where the computation work of the applications is being processed. Cloud computing provides an organization with considerably more flexibility and scalability to satisfy computing needs.

In early days, email services were provided to the company’s personnel. The company used to have a server hardware sitting somewhere in the company (i.e. a server with CPU, RAM, HDD). On that hardware, a server operating system (e.g. Windows NT Server 4, in those days) was installed. Then on top of Windows NT Server 4, Microsoft Exchange Server (Email server) was installed. That was all like a bundle. So if anything goes wrong with the operating system or the underlying hardware, the exchange server will halt and the company’s personnel will no longer be able to use the email services. The idea of cloud computing is that we are trying to distinguish the application, the services and the hardware from themselves and this is where the power of virtualization comes. Virtual computing puts the operating system in its own container that is running on hardware. Its benefit is, if something gets failed on a particular hardware, the instance of operating system automatically migrates to another piece of hardware on another server’s system.

Virtualization allows dynamically assigning and releasing resources to and from hosted applications at run-time. This technology hides the physical characteristics of a computing platform from the users and presents an abstract, emulated computing platform. This emulated
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