ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

A Survey on Cloud Computing Virtualization

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ABSTRACT: Cloud computing delivers IT capabilities as services-on-demand. The core of could computing is virtualization which benefits the IT industries in minimizing the resources, cloud economics, server cost, resiliency, scalability, product lifespan along with enhancements in cloud security and promoting migration of workloads across servers. There are several virtualization techniques. Among them full and para virtualizations play a vital role. The limitation of para virtualization is that the OS must be tailored specifically to run on top of the virtual machine monitor. Similarly, the limitations of full virtualization are the server performance which may sometimes be degraded and slow down the applications. This paper focuses on an overview of various work related with virtualization techniques.

KEYWORDS: cloud management, cloud computing, cloud virtualization, para and full virtualization

I. INTRODUCTION

As the number of existing cloud vendors rises exponentially, resource count and types are ever increasing leading to a need of cloud management solutions which facilitate easy cloud adoption. While providing several services, cloud management's primary role is resource provisioning. In order to meet these, application needs resources which are provided by cloud service provider. For that scalable and elastic models are being used in cloud environment. The advantages of such models are faster time-to-market, no capex and pay-per-use business model. Even though several such benefits are provided by the cloud, there are some challenges in adopting public clouds because of its dependency on infrastructure that is not completely controlled internally and rather shared with outsiders.

Cloud computing [1] led to an innovative approach in the way in which IT infrastructures, applications, and services are designed, developed, and delivered. It fosters the vision of any IT asset as a utility, which can be consumed on a pay-peruse basis. It promotes an on-demand model for IT resource provisioning where a resource can be a virtual server, a service, or an application platform. The major services provided by cloud computing are Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service(SaaS). IaaS providers deliver on-demand components for building IT infrastructure such as storage, bandwidth, and most commonly virtual servers, which can be further customized and optimized with the required software stacks for hosting applications. PaaS providers deliver development and runtime environments for applications that are hosted on the Cloud. They allow abstraction of the physical aspects of a distributed system by providing a scalable middleware for the management of application execution and dynamic resource provisioning. SaaS offers applications and services on-demand, which are accessible through the Web. SaaS applications are multi-tenant and are composed by the integration of different components available over the Internet.

The offer of different models on which computing resources can be rented creates new perspectives on the way IT infrastructures are used, because cloud offers the means for increasing IT resource availability whenever necessary, by the time these resources are required, reducing costs related to resource acquisition and maintenance. A case for exploring such a feature of clouds is in desktop grids, which are platforms that use idle cycles from desktop machines to achieve high-throughput computing [2]. Typically, applications are executed in such platforms on a best-effort basis, as no guarantees can be given about the availability of individual machines that are part of the platform. If desktop grid resources are combined with cloud resources, a better level of confidence about resource optimization.

It is noted that traditional infrastructure provisioning model is inefficient and does not meet the requirements of the internet era. In this system centric model, once the need for a business application is identified, its corresponding

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infrastructure needs will be identified and a request for infrastructure is placed with the IT infrastructure team that procures and provisions the infrastructure. The application is then developed, tested and deployed on that infrastructure. Some of the challenges with this model viz., huge investment, bad utilization of resources, slow time-to-market and faster time-to-market. The large investments need to be made in procuring the infrastructure for a business application. This increases the barrier for innovation as it is hard to experiment with a business idea without large investments. As the application usage in not constant, the infrastructure is provisioned for peak demand which results in bad utilization of resources. The slow time-to-market procuring and provisioning infrastructure usually requires significant time and reduces the agility of an organization in creating new business solutions. Similarly, Enterprises can avoid the step of initial infrastructure procurement and setup, thus allowing the business solutions to be taken to market faster.

II. VIRTUALIZATION

Virtualization is the creation of a virtual rather than actual version of something, such as an operating system, a server, a storage device or network resources. Virtual computing resources are often controlled using a hypervisor, or virtual machine (VM) monitor which sits underneath the operating system layer. The hypervisor allocates resources to individual VMs and controls their execution state.

There are two dominant virtualization techniques, the para and full virtualization is shown in Fig. 1 full virtualization and para virtualization. With full virtualization the VM is given the semblance of acting on the physical machine hardware with an isolated operating system (OS). In this sense, the guest OS is separated from the hypervisor, allowing more secure and solitary computing. Para virtualization, on the other hand, works with the hypervisor in which the guest operating system is modified to know it is being virtualized. This allows the hypervisor to more adequately schedule computingresources to the VM for increased performance. Many hypervisors have different requirements in terms of hardware and software.

Virtual machines provide many benefits, and are often used to better utilize all of the hardware resources available in powerful servers and hardware. Some of the major benefits include workload consolidation, updated applications, simultaneous OS and machine isolation. In workload consolidation benefits, the virtual machines can be moved and reorganized as units. This allows better machine utilization and less machines need to be active at a time. In updated applications benefits**,** the OS are loaded at the time the virtual machine is initialized. This means software doesn't need to be manually updated, and users can choose what operating system and software they use. This reduces the burden on the server administrator. Similarly, in simultaneous OS benefits, each virtual machine is running a separate copy of an OS. This allows a single server to have multiple different operating systems, expanding usability. In machine isolation benefits, machine resources are guaranteed for an instance of a virtual machine. This guaranteed resource allocation can provide a higher quality of service than many other time-shared compute environments. **Business benefits of virtualization extend beyond IT are** reduction in operating expenses, reduced hardware hence capital expenses reduced, disaster recovery improvements hence will have a agility and operational efficiency improvements, improved business continuity, better response by IT to requests for new services, improved SLAs on IT services, improved customer service. The results confirm that virtualization can reduce costs, improve business continuity, and further business agility.

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International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

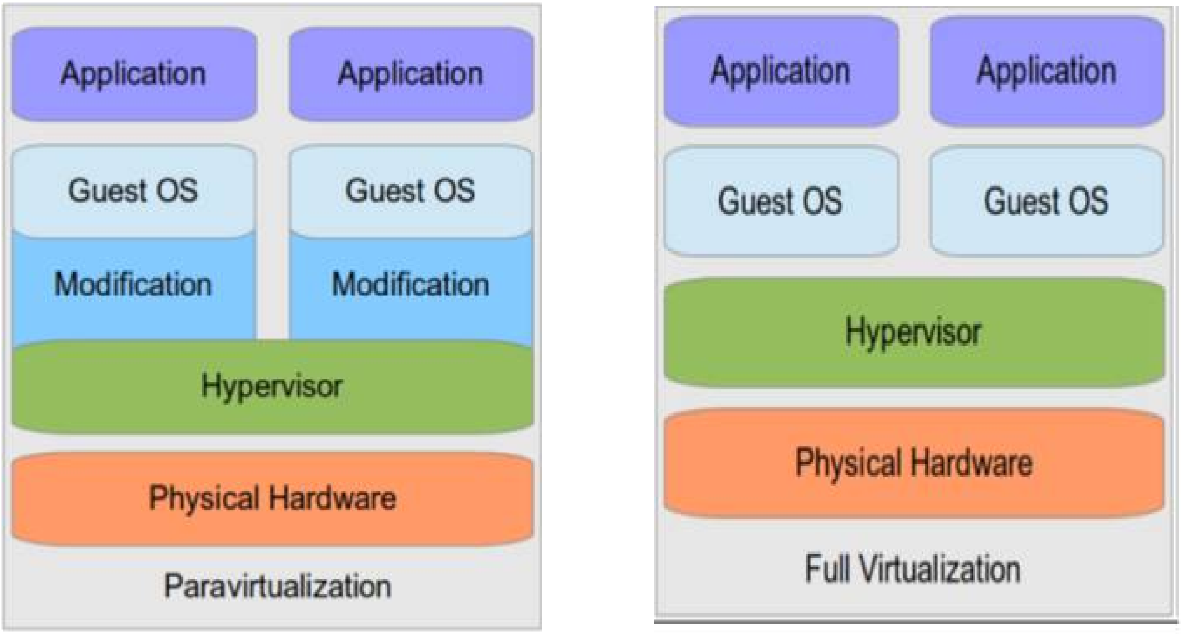

Fig.1 Para and Full virtualization

As the virtualization plays a vital role in cloud environment, optimizing it is essential.

III. RELATED WORK

Z. Xiao and Y. Xiao [4] proposed the challenges of privacy in data centres of cloud computing and the various concerns viz., storage issues, data validity, data breached, policy and process for auditing. B.Siddhisenaet. al. [5] proposed a very first server virtualization hosted on a server machine and operated by the client across a network. Secondly client hosted virtualization in which the secured and virtualized operating environment runs on local machine. Finally applications of virtualizations that provide multiple ways to run an application which is not in traditional manner. In this technique an isolated virtualized environment or partitioning technique is used to run an application.

C. Chapman et.al. [6] Proposed the optimal cloud resource provisioning algorithm which was consider as a stochastic programming model. S. Venticinque et. al. [7] proposed the process of negotiation and provisioning of resources which is built around the principles of rapid elasticity and resource pooling, where dynamic provisioning and reservation of computational resources is one of the major concerns of different virtual machine(VM) resource management solutions. In [8], A. Keller et.al have introduced the concept of Service Level Agreements (SLA). A SLA is a provider and customer contract that guarantees a minimum level of service. Typically, the SLA outlines minimum server response times for certain user interactions. Its violations are a useful performance metric due to their use in real-world applications. SLAs will differ depending provider and application.

Z. Xiao and D. Cao [9] have proposed Cloudsim which was used for performance evaluation. A policy-based approach for SLA-based negotiation was considered in, while reconsider the problem of SLA-based provisioning by adding information about the response time, evaluated on Eucalyptus was also discussed. Ling Zheng et al. [10] comparing private cloud with public cloud, listed the differences between them, put forward an architecture of private cloud computing to support smart gird, expounds structure of each layer, presented concept of private cloud computing operating system and network virtualization. The theoretical reference to build the private cloud computing was also discussed.

DusitNiyato [11] presented an optimal resource management framework for cloud computing environment. Based on virtualization technology, the workload to be processed on a virtual machine can be moved (i.e., outsourced)

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from private cloud (i.e., in-house computer system) to the service provider in public cloud. The framework introduced the virtual machine manager (VMM) in private cloud operating to minimize the cost due to the outsourcing and performance degradation. A stochastic optimization model was developed to obtain an optimal workload outsourcing policy with an objective to minimize the cost. The numerical studies revealed that the effectiveness of the optimal resource management framework to achieve an objective of private cloud. Their framework will be useful not only to optimize the performance of resource usage, but also to achieve the best benefit from economic perspective of the cloud computing regime**.**

Xiaocheng Liu et al. [12] presented light-weighted integrated virtualized environment manager (LWIVManager) based on the deep investigation on virtualization technique especially on Xen, the design and implement of a LWIVManager provides an easy use and integration way to allocate the computing resources of CPU, memory and network in the cloud. Moreover, a plugin which gathers public computing resources to scale the capacity of local private cloud in the case of request burst is integrated in their LWIVManager as well. Anita Kumari Nanda et al. [13] suggested that the "Cloud computing" – a relatively recent term, defines the paths ahead in computer science world. Being built on decades of research it utilizes all recent achievements in virtualization, distributed computing, utility computing, and networking. It implies a service oriented architecture through offering software and platforms as services, reduced information technology overhead for the enduser, great flexibility, and reduced total cost of ownership, ondemand services and many other things.

Guo et al. [14] have proposed and implemented a virtual cluster management system that allocates the resources in a way satisfying bandwidth guarantees. The allocation is determined by a heuristic that minimizes the total bandwidth utilization. The VM allocation is adapted i.e. migration is performed when some of the VMs are reallocated or power off but protocols for the migration are defined statically.

IV. AN EVOLUTIONARY APPROACH FOR CLOUD VIRTUALIZATION OPTIMIZATION

Due to a combination of potentially large values, including the number of resource characteristics, associated policies and rules, the number of available cloud providers, as well as the number of exposed offerings, the classical approach for validation and testing of the negotiation model will be more computing intensive than an approach based on a similar genetic algorithm. [15]In the evolutionary algorithm devised for building an SLA proposal, each gene represents an offer made by an identified vendor for a specific resource type, [17] while the SLA proposal is a chromosome, made up of a set of genes. Two approaches have been considered in order to generate the initial population. In the first approach, the population is generated randomly using full chromosomes, as traditionally done in evolutionary algorithms.

The second approach is a *guided approach*, where a chromosome contains only one gene from the gene pool and chromosomes are generated until all genes are covered. Standard genetic operators such as *crossover*, *elitism* or *mutation* are applied. [16]The selection for *crossover* candidates is realized through a tournament selection. The method applied for crossover is *uniform crossover*. However, when using the *guided approach*, the crossover is slightly modified in order to determine the forming of chromosomes which have the maximum number of genes. [17]This change takes place when one of the parents has a gene for a certain desired resource and the other one does not have one, thus always picking the gene over null, unlike traditional approach where there is a 50-50 chance between them.

A. Policies or rules during the construction of a CfP, together with the list of desired resources different rules and policies can be specified, for guiding the negotiation process. [19] The negotiation policies consist of a set of high level governing rules, specifying conditions/actions to be taken under specified conditions. One can use policies for filtering certain preferences for selecting best candidates under current SLA proposal. [18] Thus, the role of policies is the allow the client greater flexibility in defining its preferences. Unlike other policies presented in the CfP, these are not restricting but mainly suggestive. Along with the importance assigned to each attribute of a resource, these policies help personalize the brokering outcome. [20]The approach implemented in the prototype was to describe the rules as Jess2 rules and for each activated rule to add to a global variable the amount of fitness the rule gives. This, in turn, will be added to the overall fitness of a chromosome.

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V. CONCLUSION

Virtual machine technologies are an important and critical component of cloud computing. They reduce administration complexity by allowing multiple operating systems, isolated compute environments, and fault tolerance. Workloads can be more easily consolidated, and keeping software updated is no longer a time consuming task. As cloud infrastructure gets more sophisticated, the number of applications moving to the cloud grows. Virtual machines provide many benefits to these applications. This paper focuses on various work available in the literature. Now, more than ever, it critically important to examine and review the performance effects of virtualization in cloud computing and some of the some of the future work suggested in this direction are hybridization of optimizing the virtualization and the virtual machine hosing service provider in public cloud can optimize supply strategy to maximize the profit

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ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

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