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PERFORMANCE ANALYSIS DEPLOYING WEB APPLICATION ON AMAZON EC2 CLOUD

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Abstract: ***Cloud computing provides an ability to access shared resources and common infrastructure, over the network to perform operations that meet changing business needs. Organizations are becoming interested in leveraging cloud services as it leads to increase in flexibility and scalability of the IT services that are delivered to customers. In the meantime, Cloud computing also brings new issues and challenges in performance and scalability measurement due to its special features such as elasticity and scalability.It focus on analysing the performance and scalability of cloud based application. It also shows the applicability of the Blazemeter framework for testing performance of web or cloud based applications. It reveals that there are specific considerations to be made while performing testing operations on cloud environment. This paper reports one case study for selected web application deployed on cloud platform to demonstrates the application results for SaaS performance and scalability evaluation. The results aimed at analyzing the performance and scalability by varying the load and increasing number of users.***

Keywords: ***Cloud Computing, QoS Metrics, Performance Analysis, Scalability Analysis***

I. INTRODUCTION

Cloud Computing is defined as a service model that is used to provide on-demand access to shared pool of computing resources, such as servers, storage devices , applications and services that can be easily provisioned and de-provisioned with minimal users efforts. Initial cloud providers are Amazon EC2[1] , Google App Engine[2], Microsoft Azure[3] , SalesForce.com[4] offers many business opportunities to the interested organizations who want to use services on pay-per-use, on- demand and based on pre-defined SLAs (Service Level Agreement). Resources on cloud are pooled in order to handle multiple subscribers at the same time. Resources are allocated the basis of demand of client subscriber where they need less or more resources. It composes of a broad network access which has the capacity to access the network through different platforms , on-demand self services , and where it provide the computing services automatically. It is also accoutered with a feature of elasticity where the scaling of provisioned resources can be done rapidly in order to make the resources available at any time by the cloud subscribers. At a hardware level of cloud , number of physical devices such as processors, hard drives and other network devices are placed which are responsible for providing processing and storage needs to cloud users. Above this , combination of software layer, virtualization layer and management layer are located responsible for efficient management of cloud servers. In cloud computing [5] , there are three service models which are explained below:

Infrastructure as a Service (IaaS) : It provides the consumer with supply of processing, storage , networks and all other computing resources , and allow the consumer to run any software which can include operarting system and other applications.
Platform as a Service (PaaS) : It provides the consumer with capability to deploy onto the cloud infrastructure. The consumer does not need to worry about underlying cloud infrastructure such as servers, operating system , and other storage devices but only has control over the deployed application.
Software as a Service (SaaS) : It provides the consumers capability to use the provider's application running on a cloud infrastructure. The applications on cloud are accessible from different client devices through interfaces such as web browsers or e-mails.

II. RELATED WORK

Mohd Hairy Mohamaddiah [6], conducts a survey study about resource monitoring and allocation in cloud computing environment. Cloud providers supply various computing resources to their clients. Hence, cloud users still face the problem for resource management in receiving the needed resources on time. It describes cloud computing with its research issues and then provide approaches for resource allocation and monitoring.

Rich C. Lee[7] implies that monitoring of system resources against number of virtual machines in cloud computing environment is very challenging task for system administrators. It is difficult to evaluate the performance of various virtual machines. This paper reports how to interpret the resource utilization of various performance counters and then how to automate the performance analysis processes to ease the workload of system administrators.

Sen Zhao et al. [11] focus on scalability issues arises due to large number of users using cloud computing technology. It propose a model for evaluating the scalability of cloud system with an increase in number of users. It provides simple way to compute scalability at a given time. In order to evaluate the scalability and performance of cloud environment, effective models and metrics are needed to provide cost –effective and other systematic solutions for cloud vendors and customers.

Liviu Ciortea [12] reports Cloud9 as a on-demand testing service that can easily scale large clusters of machines which results in automation testing of softwares in very short period of time. It achieves high level of automation using symbolic engines. It runs on cloud environment like Amazon EC2 and scales use of resources over a dynamic range. Cloud9 is designed to run as a Web Service to provide the facility of automated testing in pay-as –go concept. It provides affordable and effective testing that can be easily provisioned and accessible to all.

Jerry Go [13], proposes a testing as a service infrastructure and then provide a TaaS environment with tools which was developed to meet the needs of performance and scalability evaluation. With advancement in cloud technology, testing and evaluation of applications becomes an important activity for engineers. This paper describes the results of SaaS applications based on previously designed models and metrics. It also reports a case study for SaaS application using the developed infrastructures.

Rashid Hassani [14] propose a new method to improve the performance and scalability of applications when deploy on Amazon Cloud. Improving and measuring the performance of high performance application by migrating them to cloud is becoming a major issue in the field of cloud computing. From this paper , it is concluded that there is 20 percent improvement in the response rate of HPC application when they are migrated to cloud.

Pano Gushev, Sasko Ristov [15], this paper measures the performance of multi-virtual machines when compare with single virtual machine. The main objective of this paper is to find out the best scenario which gives better performance for the same price of resources and this is done by comparing the number of attributes such as Average Response Time, Pages Per Second, Request Per Second, CPU Time. It sets a hypothesis that the multi- Virtual Machine approaches would results in better performance.

III. PERFORMANCE AND SCALABILITY IN CLOUD

In last years, there are number of published papers which discuss performance and scalability of conventional distributed and parallel systems. Many of them evaluate performance and scalability for clusters and grid computing environments. But with an increase in demand of cloud computing , many researchers pay attention to analysis the performance and scalability of cloud based applications.[16] This section gives brief introduction to performance and scalability analysis of cloud based applications. Performance and scalability of applications are evaluated to assure the quality of service. There are some resources metrics that are used for validating the performance and scalability of application in cloud. Table 1. Focus on primary metrics in performance validation and table 2. focus on Scalability evaluation and validation factors. Scalability is the capability to increase the resources to produce a ideal increase in its capacity.

Table1. Performance Evaluation and Validation Metrics

Targeted Parametres	**Metrics Description**
Resource Utilization Metrics	CPU, Memory , Disk Storage, Network-In and Network-Out, Memory Utilization, I/O operations etc.
Performance Metrics	System-user response time, reliability,scalability,availability

A. Factors Affecting Performance and Scalability Evaluation

There are number of factors which are responsible for affecting the performance of cloud environment and cloud services. Some of the factors which are taken into consideration are listed below :

1. Service Level Agreement is an agreement that is signed between users and providers , when users demands cloud services , it describe user's request , the ability of cloud providers, fees anf fines etc.
2. Storage Capacity and physical memory are also considered as an important factor in evaluating the performance of cloud computing.[17]
3. Network bandwidth, this factor can be effective on performance and can be a criterion for evaluations too. For example, if the bandwidth is too low to provide service to customers, performance will be low too [18].
4. Buffer capacity directly affects the system performance . If a server is not capable of serving a request at given time, then all the requests are buffered in a temporary memory . In case, buffer has lower capacity , then no. of requests has been rejected .which results in decrease in performance of system.
5. Response Time: It is the amount of time taken when a user sends a request to the moment that the application shows that the request has completed.
6. Fault tolerance, this factor will have great impact on performance of cloud environment.

Availability, with easy access to cloud services and the applications, performance will be increase.

Number of users; also affect the performance, if number of users increase beyond the limit. This will reduce performance of services [19]

Table 2. Cloud/SaaS Scalability Evaluation Factors

Targeted Factors	**Factors Description**
Scaling-up capability	Validating and Evaluating applications to insight how easily a cloud is capable to scale-up its capacity to manage an increase in system load with automatic utilization of resources.
Scaling-out capability	Identifying the scaling-out capabilities and all other factors in cloud when resource usage and system load are increased on user demand.
Scaling –down	Identifying the scaling down factor when the system load and resource usage decreased
Scalability Cost	Validating the costs of scalable systems resource utilization and services based on given scale in SLA.

There is distinct difference in performance evaluation and scalability analysis of conventional applications and cloud applications. In comparison to conventional software infrastructure, cloud infrastructure is capable of providing an elastic scalable computing environment which shared resources that can be easily provisioned and de-provisioned. All cloud-based applications provide a pre-defined service-level agreement for quality purposes . Utility billing is also one of the service delivery feature provided by cloud. It provides transparent approach to monitor and evaluate the correctness of the utility based on pre-defined price model. Resource allocation and utilization checked and then measured for assuring quality.

IV. EXPERIMENTAL SET-UP FOR THE CASE STUDY

Amazon EC2 provides various types of instances such as Large , Micro, Extra-Large.. In addition to this , it also supports several other instances such as CPU and memory instances. Different loads can be applied on the instances to collect the value of these parameters Dynamic load balancing can also be enabled between EC2 instancs for the given SaaS application. Morever, detailed procedure and steps used to perform the case study are explained below.

Step 1: Create Instances

In this experimental set-up, we have created creating instances. Cloud instances can be lanced in AWS cloud environment by using the EC2 service .

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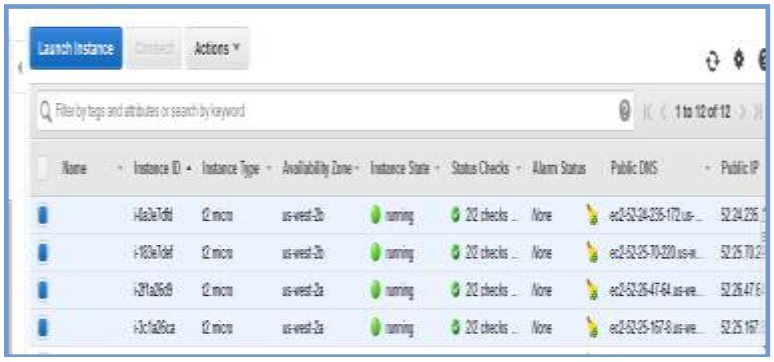

Figure 1 : Amazon EC2 Instance Creation

Step 2: Deploy Web Application on Amazon EC2

This step involves deployment of web application from netbeans to amazon cloud. Elastic Beanstalk is used to deploy and manage web applications on cloud platform.

Step 3: Create Load- Balancer

Creation of load balancer distribute the traffic of application among multiple EC2 instances. It finds out the unhealthy instances and then distribute the traffic among healthy instances.

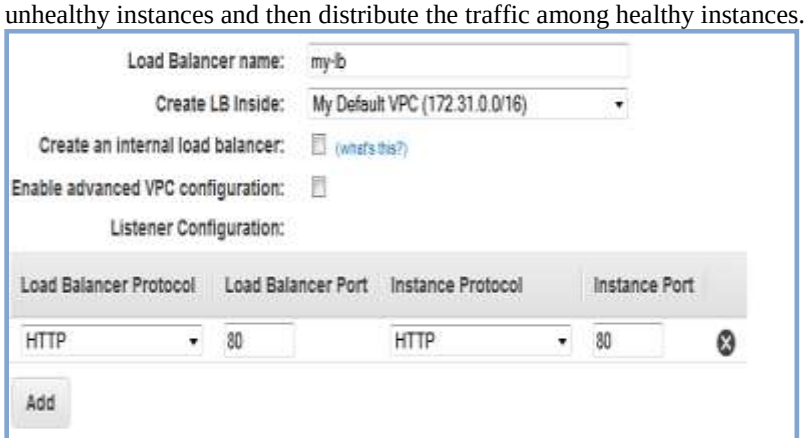

Figure 2: Load Balancing Snapshot

Step 4: Create Auto-Scaling Group

Auto scaling groups defined as.

I) First he AMI is created for the scaling group as the new initialized instances must have same configuration as other instances in the group.

II) Now the maximum and minimum size of scaling group is defined by the client. Initial group size also defined here in the show picture we have created a scaling group and set the initial group size to the

2. Added the availability zone.

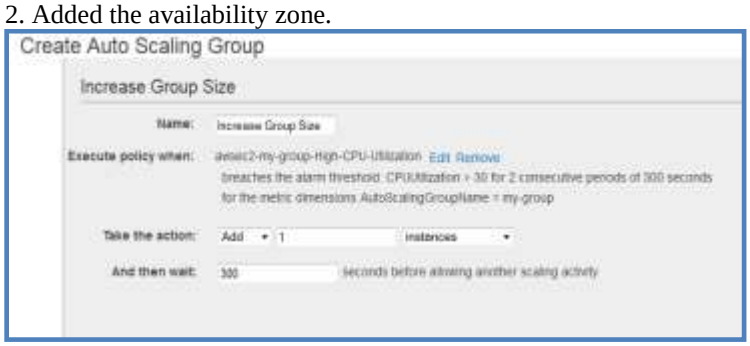

Figure 3: AutoScaling Group

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Step 5 : Resource Monitoring

There must be a tool by which admin can monitor each component on cloud . Cloudwatch is a tool provided by Amazon for resource monitoring purpose. it provides the detailed information in graph form as per user selected time frame. User can select different parameter and matrix to control the system. Blazemeter is integrated with CloudWatch for generating loads and monitoring resources in real time manner.

A. Case Study Results

The rest of this reports our case study results about system performance and scalability analysis for a selected web application. In this case study, a web application is launched onto EC2 instance in Amazon Cloud. Since the existing EC2 technology does not provides any CloudWatch API for monitoring the memory utilization and I/O of an application deployed on cloud. We added and used custom metrics for monitoring memory utilization. Custom metrics can be published in cloudwatch and then we can view the statistical graphs of our metrics. Figure(g-h) represent graphical analysis of various performance metrics.Fig.i & j shows creation of an alarm in amazon EC2 cloud

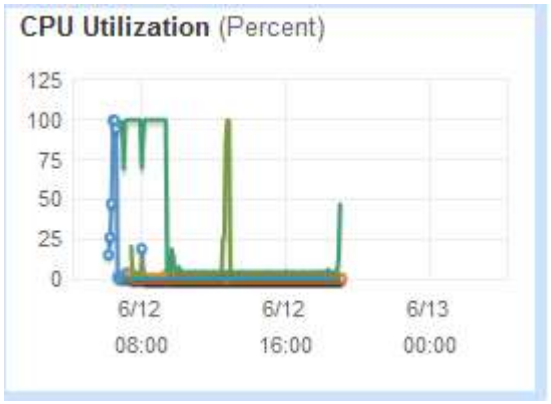

Figure a:CPUutilization

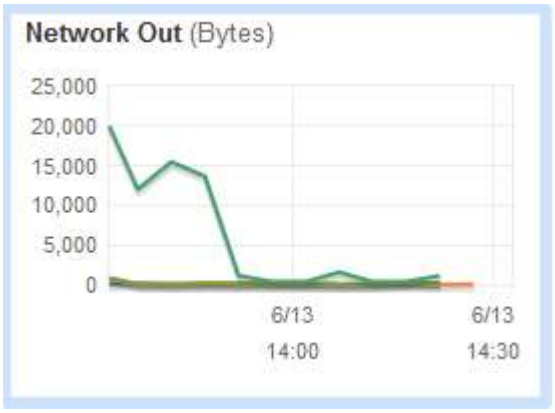

Figure c: Network In(Bytes)

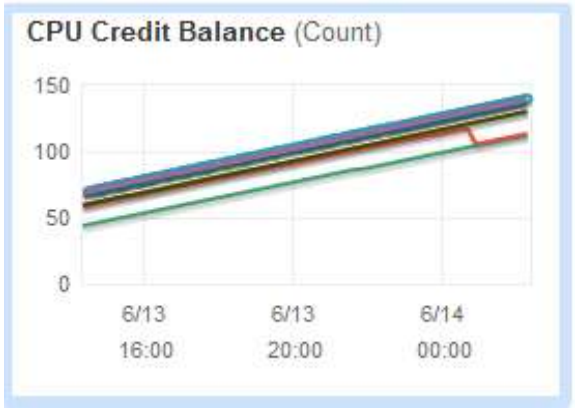

Figure b: CPU Credit Balance

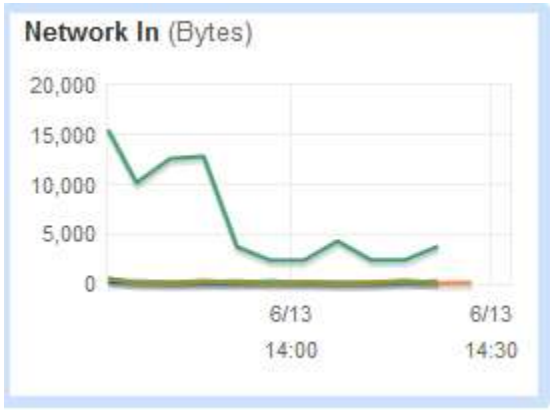

Figure d: Network Out (Bytes)

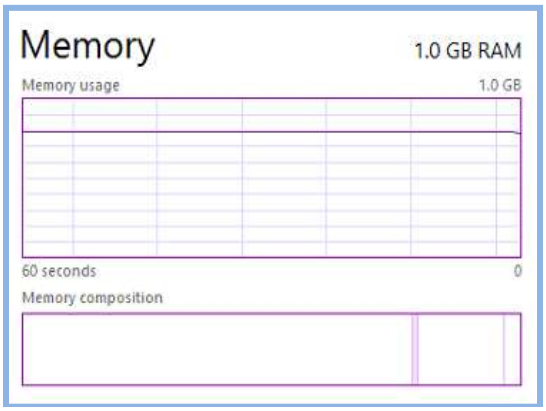

Figure e: Memory Utilization

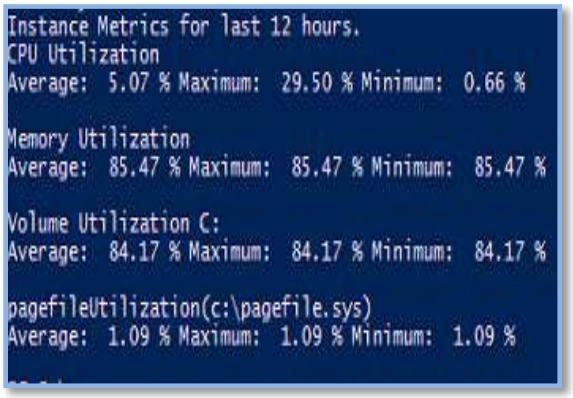

Figure f: Volume Utilization

B. Figure CloudWatch Metrics

- ElasticBean Stalk Metrics: Table shows the values of various resource metrics while deploying application on amazon cloud using Elasticbean Stalk.

Table 3: Elastic BeanStalk Metrics with Corresponding Values

Metrics Name	Values
CPU Utilization	14.9%
Average Latency	517.9
Sum Request	17.0
Max Network In	186Mb
Max Network Out	582Kb

- Scalability Measurent: As shown in table , we have configured and measured the EC2 instances with two different resource parameters. In first case, If the CPU Utilization increases more than 60% , then scale out operation is carried out, which add one more instance . In Second Case, if CPU Utilization decreases below 30%, then it causes the scale down reaction on amazon ec2 , and it reduces the ec2 instances back by 1.

Table 4: Scalability Evaluation on Amazon EC2

AutoScaling	Resource Utilization	Scalability Status	No. of Instances
CPU utilization	>60%	After Scale Out	2
CPU utilization	<30	After Scale Down	1
Network Out	>6,000,000	After Scale up	2
Network Out	<2,000,000	After Scale down	1

- Create Alarm: With Amazon CloudWatch, we can monitor various aspects of our instance and set up alarms based on criteria we choose. Here, we have configure an alarm to send an email when an instance's CPU exceeds 60 percent. With Amazon CloudWatch, we can monitor various aspects of our instance and set up alarms based on criteria we choose. Here, an alarm is configured to send an email when utilization of CPU for an instance
- exceeds 60 percent.

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Figure i : CPU Utilization Alarm

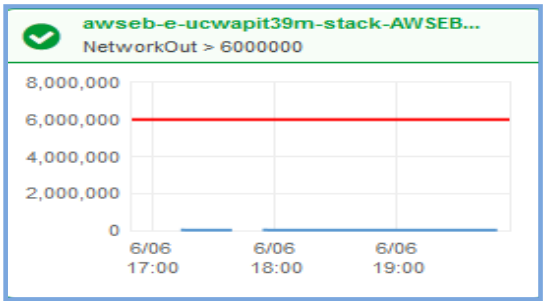

Figure j: Network Out Alarm

- Performance Analysis: CloudWatch is special feature provided by amazon for monitoring of aws resources such as Ec2, Elbs,and more CPU and disk usage etc. Cloudwatch can be integrated with blazemeter to view the performance of instances in real time. Following metrics can be examined in blazemeter.
- Comparison Results: Graphs shown below provides the comparison between performance metrics by changing the number of users. Results shown that the values of metrics increases with an increase in user load. Table 6. Shows comparison of all parameters when applying different load.


Figure 5: Comparative Analysis of Latency Parameter by varying user load


Figure 6: Comparative Analysis of Response Time with an increase in number of users

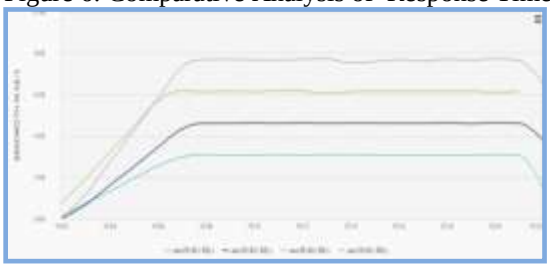
Figure 7: Comparative Analysis of Bandwidths with varying Load

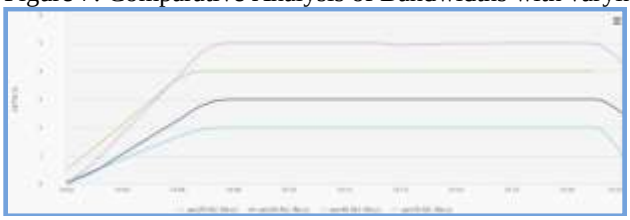

Figure 8 : Comparative analysis of No. of Hits per second with different number of users.

Table 5: Comparison of Performance Metrics by changing user load

No. Of Users	Response time(ms)	Bandwidth (bytes)	Latency (ms)	Throughput (hits/s)	Duration(hh:mm:ss)
User1	16.61	2817.58	16.54	1.79	19.44
User2	16.27	4175.72	16.64	2.65	00:19:53
User3	16.33	5576.11	16.84	3.55	00:19:53
User4	16.69	6962.18	16.94	4.42(hits)	00:19:53

V. CONCLUSION

Cloud computing brings new business opportunities to the users. There are number of research papers published in last years addressing the performance and scalability evaluation of parallel and distributed system. This paper provides an introduction to performance and scalability evaluation of cloud-based application. In addition, it also reports a case study for analysing the performance and scalability of web application deploy on cloud using Amazon EC2 cloud. The future work of this paper includes proposing a cost-effective model for evaluating the performance and scalability of cloud applications.

REFERNCES

Amazon Elastic Compute Cloud (EC2). [Online]. Available: http://www.amazon.com/ec2/.
Google App Engine. [Online]. Available: http://www.appengine.google.com
Windows Azure. [Online]. Available: http://www.microsoft.com/azure
http://www.salesforce.com/
Dimitrios Zissis, Dimitrios Lekkas,2012. Addressing cloud computing security issues. Future Generation Computer Systems.28(2012) 583-592.
Mohd Hairy Mohamaddiah, Azizol Abdullah, 2014. A Survey on Resource Allocation and Monitoring in Cloud Computing. *International Journal of Machine Learning and Computing,* vol. 4, No. 1.
Rich C. Lee. *Smart System Resource Monitoring in Cloud.* Doi=http://dx.doi.org/10.4236/ib.2012.41005.
Gan-Sen Zhao, et aI., 2010. Modeling User Growth for Cloud Scalability and Availability. *International Journal of Technology- Chinese,* Vol. 1 No. 1.
L. Ciortea, et al, 2010. Cloud9: A Software Testing Service, *ACM SIGOPS Operating Systems Review*, Vol. 43, no. 4.
Jerry Gao, K. Manjula, P. Roopa, and E. Sumalatha, 2012. A Cloud-Based TaaS Infrastructure with Tools for SaaS Validation, Performance and Scalability Evaluation. *IEEE 4th International Conference on Cloud Computing Technology and Science*
Rashid Hassani, Md Aiatullah, 2014. Improving HPC Application Performance in Public Cloud. *International Conference on Future Information Engineering. IERI Procedia* 10(2014),169-176.
Pano Gushev , Sasko Ristov, 2014. Process Management in TaaS on Cloud Computing. *IEEE International Conference on Advances in Engineering & Technology Research.*
Jerry Gao ,Xiaoying Bai w. T. Tsai., 2011. SaaS Performance and Scalability Evaluation in Clouds. *Proceedings of The 6th IEEE International Symposium on Service Oriented System Engineering.*
Simon Ostermann , Alexandru Iosup, 2010 .A Performance Analysis of EC2 Cloud Computing Services for Scientific Computing. *Institute for Computer Sciences, Social-Informatics and Telecommunications Engineering (LNICST).*
Keith R. Jackson , Krishna Muriki, 2010. Performance Analysis of High Performance Computing Applications on the Amazon Web Services Cloud. *IEEE International Conference on Cloud Computing Technology and Science.*
Niloofar Khanghahi and Reza Ravanmehr, 2013. CLOUD COMPUTING PERFORMANCE EVALUATION:ISSUES AND CHALLENGES. *International Journal on Cloud Computing: Services and Architecture (IJCCSA)* ,Vol.3, No.5. DOI = 10.5121/ijccsa.2013.3503 29.