An Introduction to Effective Cloud Management with Monitoring as a Service

Piyush Saxena, Aniket Maithani, Asish Srivastava, Tinesh Kumar Goyal

Abstract— ***In the New era of cloud computing and service based market monitoring state of a system or an application is necessary to get maximum benefit of the power of a system. Monitoring state of system means continuous checking the over-all functionality under various permutations and combinations of load considering all the factors that can harm performance of system. Monitoring can be provided as a service to clients through cloud computing. This will be beneficial for both the client and the providers as client will be aware of the over-all performance of system and which may help consumers to visualize further needs of improvement and providers may get an option for increasing revenues as well as their system knowledge.***

Cloud computing allows consumers and businesses to use application without installation and access their personal files at any computer with internet access. Speed up the calculations and processes. Provide multi tenancy features. Cloud Computing is a Computing in which services and software are provided over the Internet ("cloud") which is very cheap and affordable. Cloud computing is on demand access to virtualized IT resources that are housed outside of your own data centre, shared by other simple to use, paid for via monthly subscription which is very low in cost, and accessed over the web with many features in it.

Monitoring as a Service is a business model in which a large company rents space in their storage infrastructure to another company or individual. The key advantage to Cloud setup in the enterprise is in cost savings -- in personnel, in hardware and in physical storage space. The Cloud provider agrees to rent storage space on a cost-per-gigabyte-stored and cost-per-data-transfer basis and the company's data would be automatically transferred at the specified time over the storage provider's proprietary wide area network (WAN) or the Internet. If the company's data ever became corrupt or got lost, the network administrator could contact the cloud service provider and request a copy of the data.

Index Terms—***Cloud App Monitoring, Cloud Computing, MaaS, Virtualized IT Resources.***

I. INTRODUCTION TO CLOUD COMPUTING

Cloud computing is known as Internet based computing, with pooled resources, software and knowhow is provided to computers and other devices. Cloud Computing is a Computing in which services and software are provided over the Internet ("cloud") which is very cheap and affordable. Cloud computing is a technology that uses the internet and central remote servers to maintain data and applications.

Manuscript published on 30 April 2014.
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Cloud computing assent consumers and businesses to harness applications without installation and admittance their personal files at any computer with internet access. Example of cloud computing is Yahoo mail or Gmail etc. You don't need software or a server to harness them. The server and email management software is all on the cloud (internet) and is totally managed by the cloud service provider Yahoo, Google etc. The end user gets to harness the software alone and delight the benefits. Cloud computing is on demand access to virtualized IT resources that are housed outside of your own data centre, shared by others, simple to use, paid for via monthly subscription which is very low in cost, and accessed over the web with many features in it. (Fig 1)

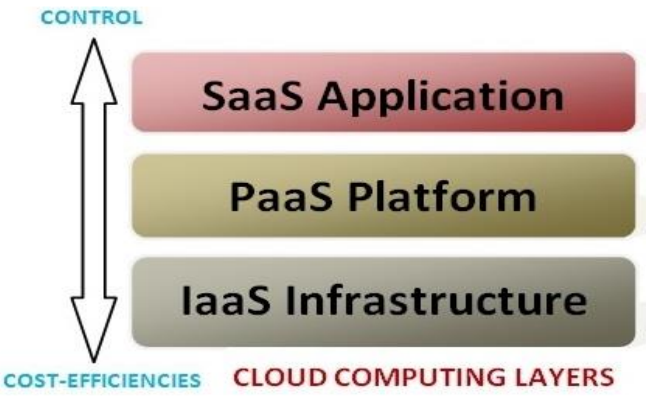

Fig 1) Types of Cloud Services

II. INTRODUCTION TO CLOUD STORAGE MODELS

There are three main cloud storage models: [1]

1. Public cloud storage services, that provides a multi-tenant storage environment that's most suitable for unstructured data.
2. Private cloud storage services provide a dedicated environment protected behind an organization's firewall. Appropriate for users who need customization and more control over their data.
3. Hybrid cloud storage is a combination of the other two models that includes at least one private cloud and one public cloud infrastructure.

III. TECHNICAL GLITCHES IN TRADITIONAL MONITORING

There are few technical glitches that need to be considered. These are as follows-[2]

1. As cloud computing requirement for service it provide vary time to time. We need such monitoring system that is capable of adjusting to such requirement

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moderations. More-over it should also provide multi-user functionality such that system is viewed by every user as a dedicated system for that user.

2. As cloud computing is distributed at a massive stretch we need monitoring systems that could give the utmost correct view of a system at any instance of time. As a computing system may be stretched continent-wise there will be communication system involved for end-to-end information exchange. Our monitoring system should be such that can provide consistent report of computing system at all the time with 100% accuracy otherwise we will never get appropriate data.
3. As we are planning to monitor systems implemented over many continents we will have tremendous amount of monitored data. We need such techniques that could separate useful data and lead to expected results. Data handling is essential for monitoring. We also need to focus on the fact that unused and unimportant data gets over-written by useful or new data. This will help in better utilization of storage space.

There are many techniques that tackle our technical problems but we need to consider short-comings of existing techniques so that we could give better solutions for achieving goals of monitoring i.e. reliability, scalability, utility, efficiency and accuracy.

By making data accessible in the cloud, it can be more easily and ubiquitously accessed, often at much lower cost, increasing its value by enabling opportunities for enhanced collaboration, integration, and analysis on a shared common platform.

The basic concept of cloud computing is using software via the Internet instead of installing it onto personal computer. From this cloud, one can find programs that he/she wants to utilize. Through web browser anyone can access programs from cloud.

IV. EXISTING CLOUD SERVICES

Business applications like SAP, Microsoft, and Oracle comprise always complicated and high-priced. They require a data centre with office space, power, cooling, networks, servers, and memory etc. And a team of experts to install, configure, and run them. And a complicated software stack. It multiplies the headaches when this takes place across hundreds or thousands of apps, it's simple to see why the major companies with the best IT departments isn't getting the applications they need. (Fig 2)

By cloud computing and IT as a Service (ITaaS) could bring the total costs down. It would reduce the need for advanced hardware on the client side. One wouldn't need to buy the fastest computer with the most memory, because the cloud system would obtain concern of those needs.[3]

IT as a service can be of 4 types:- (Fig 3)

1.) Infrastructure as a Service (IaaS)
2.) Platform as a Service (PaaS)
3.) Software as a Service (StaaS)
4.) Storage as a Service (StaaS)

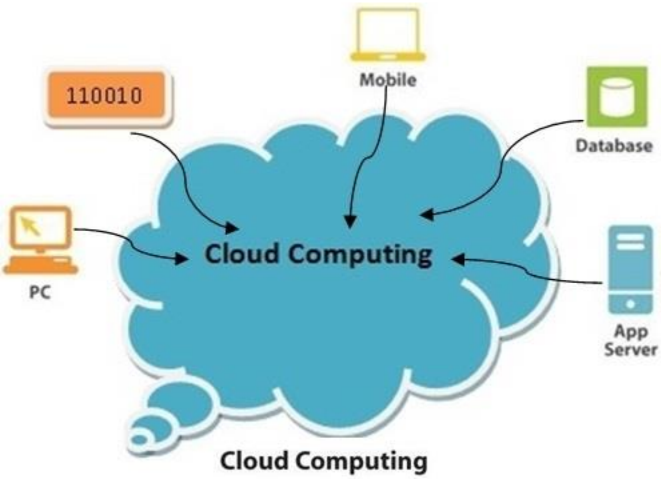

Fig 2) Cloud in Action

Description of the Services in Detail:

1) Infrastructure as a Service: IPs manages a large set of computing resources, such as sorting and handing out capacity. During virtualization, they are capable to split, allocate and dynamically resize these assets to build ad-hoc systems as demanded by clientele. They install the software stacks that run their services.

IaaS is a provision model in which an organization outsources the equipment used to maintain operations, together with storage, hardware, servers and networking elements. The service provider owns the appliance and is responsible for housing, running and maintaining it. Example: go grid etc.

2) Platform as a Service: Cloud systems can offer an additional abstraction level: instead of supplying a virtualized infrastructure, they can offer the software platform where systems run on.

The amount of the hardware resources demanded by the execution of the services is clear as crystal. This is denoted as Platform as a Service (PaaS). Example: Google Apps Engine etc.

3) Storage as a Service: [3] Commonly known as Storage as a Service (StaaS), it facilitates cloud applications to scale beyond their limited servers. StaaS allows users to store their data at remote disks and access them anytime from any situate. Cloud storage systems are expected to gather several rigorous requirements for maintaining users' data and information, with high accessibility, reliability, performance, duplication and data consistency; but because of the conflicting nature of these needs, no one system implements all of them together.

4) Software as a Service: Finally, there are services of potential interest to a wide variety of users hosted in Cloud systems. Sometimes SaaS suggested as "software on demand". It is software that is deployed to run over the internet or behind a firewall on a local area network or personal computer. SaaS has become a common model for many business applications with accounting, association, customer relationship management (CRM), enterprise resource planning (ERP), invoicing, human resource management (HRM), content management (CM) and service desk management. Example: Salesforce.com etc.

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V. CHARACTERISTICS OF CLOUD SYSTEM

Some Characteristics of the Cloud System are:

1.) Data Durability and Reliability: It stands that one can fully trust and rely on these kinds of services.

2.) Security: "Due to vagrancy of data"...There is a little amount of chance to hack and occurring some problems. In case there is any problem it can be resolved immediately.

3.) Privacy: There is no interconnection between two clients. It provides username and password which kept safe and the clients can change the password anytime. (If they doubt that their password has been breached).

4.) Reduced Redundancy storage: Reduces the redundant data stored and thus gives an excellent utilization of storage.

5.) Backup, Archiving and Disaster Recovery: Backups the complete data of data centers on many servers so as to keep up a disaster recovery logs and data for in case something happens. This is ideal for moving large quantities of data for periodic backups, or rapidly retrieving data for disaster recovery scenarios.

VI. ADVANTAGES OF CLOUD SYSTEM

Some Advantages of using Cloud Computing Systems:-

1.) Low use of power supply as the power used to transact multiple apps now is used for a single app which detracts power supply.

2.) Detract the need of high levels of cooling as only one app needs to run as compared to multiple apps.

3.) Bandwidth problem relates to networks in which there is no jamming or marching in network signal basically due to centralized server.[4]

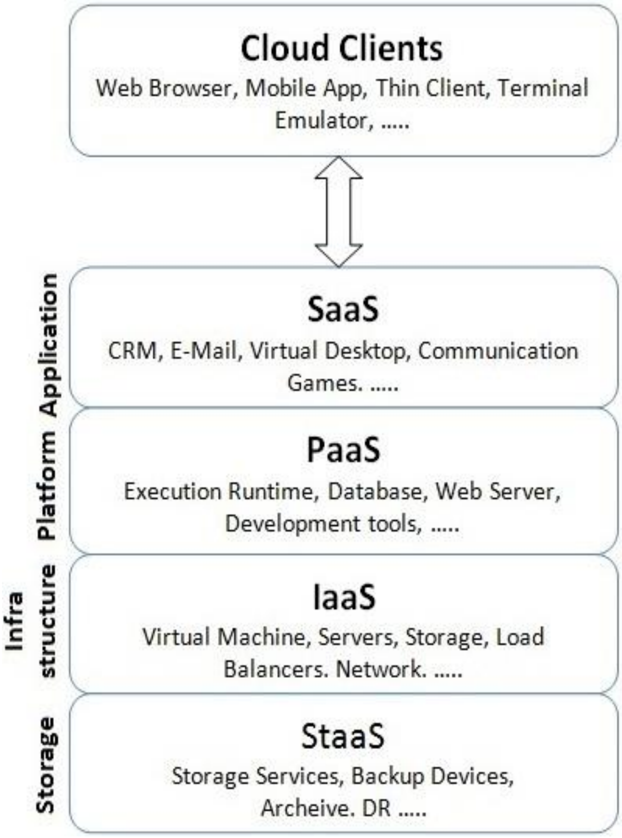

Fig 3) Cloud Stack

VII. THE NEW SERVICE – MONITORING AS A SERVICE

Monitoring as a Service or MaaS is still one of the unexplored and newly discovered sector in the cloud computing environment. Though the concept of MaaS in the cloud infrastructure is fresh still, it holds the importance in the present future. With the introduction of IaaS, PaaS services it is more likely that with the increasing dependency on these services, monitoring tool will be required to inspect the flow of information and infrastructure as a whole.

Business & Information goes hand in hand, developing potential risk for loss of information due to the collapse of infrastructure, attacks, server downtime etc.[1][5] Thus MaaS will give an alternative to handle such situations more effectively, rather than investing whole lot of money and resources in manual tools. MaaS is an effective way to bridge the divide which still exists between orthodox IT practices and Cloud infrastructure.

VIII. POTENTIAL USE AND REQUIREMENT OF MAAS

The potential use of MaaS would ensure

1. Server Uptime
2. Will make error reporting and handling easier.
3. Utilization of the resources to the fullest extent possible
4. Automated system allows greater throughput
5. Cheaper than the conventional human monitoring service
6. Easy for consumer to monitor the situation of his application on the go.

IX. WHY MAAS? (THE NEED OF MAAS)

Much notice needs to be given to the inquiry of how to supervise all the cloud services, especially in the case where the service might be combined with applications running in the data center. The idea of a monitoring tool that is delivered as a service so that one can log onto the central web based instrument panel which is hosted by the vendor of the monitoring service and see and control that all is going on with all of the applications no matter where they are located. (Fig 4)

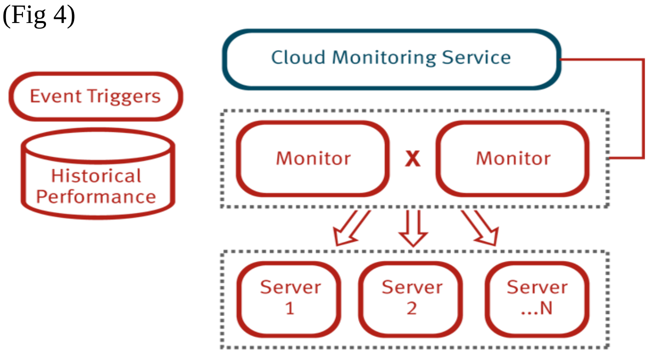

Fig 4) Architecture of Monitoring as a Service

X. OBJECTIVES OF MONITORING AS A SERVICE

As per recent trends that have shifted from the traditional IT Storage system, to cloud, ensures better performance and give the end user or even the company's better resource utilization.

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Instead of spending their money and resources on the hardware, the virtualization factor does the trick for these organizations, because as per their requirement they can increase and decrease their capacity. Monitoring system is therefore requiring alerting the cloud user about the current state of their infrastructure. Also MaaS would also deal with the predictive analysis of the resource utilization on the cloud server. [6]

Also we need to extend the concept of MaaS for heterogeneous system also, because we know that companies generally shift their services onto cloud but the crucial data still runs on their server. So since MaaS is monitoring is a service, we must also look into the aspect of combining and monitoring these two separate system, which ultimately act for one common goal, that is providing service to the user.

By 2020, most people won't do their work with software running on a general-purpose PC. Instead, they will work on Internet-based applications such as Google Docs, and in applications run from smart phones. Aspiring application developers will develop for Smartphone vendors and companies that provide Internet-based applications, because most innovative work will be done in that domain, instead of designing applications that run on a PC operating system."

Thus because of the following growth rate, and more and more application being ported to the cloud it is therefore necessary to have a insight look into the monitoring service. Because traction caused in anyone of the potential service, would ultimately affect the system of the cloud server as a whole. Though cloud does provide some levels of segregation, still it is not yet very robust and versatile. Since cloud is originally designed for optimum storage solution, MaaS would keep a counter check on their performance. Also the cross domain, monitoring issue covered in the previous section can be easily tackled by linking these two domains using MaaS. For example there should be a separate monitoring of data with respect to the service that uses it.

MaaS can alert technical staff of the problem, allowing them to begin remediation processes before outages affect business processes, end-users, or customers.

XI. MULTI-TENANCY [7]

Multi-tenancy refers to a standard in software design where a single instance of the software runs on a server, allocating numerous client-organizations (tenants). In this we show a resource-aware state monitoring consolidation technique at the monitoring topology level. The monitoring topology is the overlay network that connects monitors and coordinators. Since monitors rely on the topology to deliver monitoring data, its efficiency and multi-tenancy support is critical for Cloud monitoring services.

Cloud monitoring services host a large number of state monitoring tasks for different users. Each task runs on a set of distributed nodes to monitor system or application state information with regarding to a certain attribute (e.g., response time). The set of nodes involved with different tasks often overlap with each other. In other words, a node may host multiple tasks. In most cases, tree structures are used as monitoring topology.

Existing works on state monitoring over multiple nodes [8],[9] employ either static monitoring trees, where a pre-constructed tree is used for all monitoring tasks across all applications, or construct trees for individual monitoring tasks independently. While these two approaches work well on dedicated monitoring infrastructures, they have limitations for supporting multi-tenant MaaS in Cloud.

The resource-aware topology planning approach adopts two methods: (Fig 5)

1) Guided Local Search: It starts with an initial topology where a separate tree is created for each task, and iteratively merges (or splits) trees to optimize the monitoring topology based on two prioritized goals until no improvement can be done. The primary goal is to maximize the number of tasks supported by the topology, which emphasizes service scalability. The secondary goal is to minimize the overall data delivery cost (both per-message and relay cost), which tries to save resources for future tasks. The local search based approach is the key for addressing the complexity of the problem. Furthermore, it naturally fits Cloud monitoring services, because it can continuously improve the monitoring topology as monitoring tasks are added or removed based on the current topology without starting from scratch.

2) Adaptive Tree Construction: We employ an adaptive tree construction algorithm that iteratively invokes two procedures, the construction procedure and the adjusting procedure. In the construction procedure, a scheme that builds star-like trees is used. The star scheme gives the priority to increasing the breadth of the tree. The star scheme creates bushy trees and pays low relay cost. However, the node with large degree, suffers from high per-message overhead. Hence, when such nodes are overloaded, we invoke the adjusting procedure. Intuitively, the adjusting procedure "stretches" the tree by decreasing the breadth of the tree and increasing the height of the tree, which helps achieve good per-message load balance, with the cost of slightly increased relay cost. The topology planning technique primarily focuses on fair monitoring resource usage across distributed machines. It is an alternative approach to meet diverse monitoring needs in MaaS, and is particularly useful for data-intensive environments where monitoring resource consumption is non-trivial. Other topologies such as static ones may be more desirable for scenarios where monitoring resource consumption is not the concern and simple, fixed hierarchy is preferred.

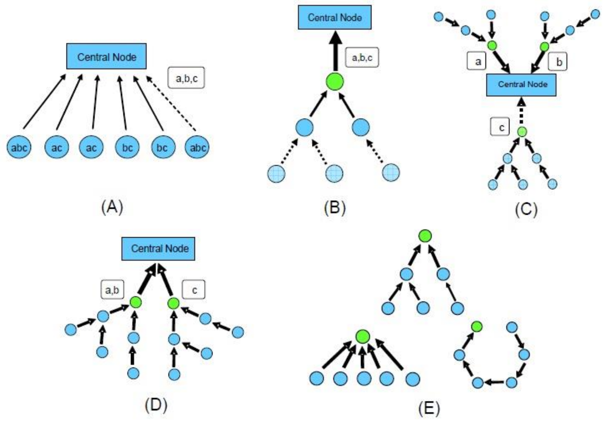

Fig 5) Cloud Monitoring Topology Planning

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XII. CHALLENGES OF MONITORING AS A SERVICE IN CLOUD SYSTEM

Top challenges of Monitoring as a Service in a cloud system are:[10]

1.) Lack of ability to recognize applications that can be faultlessly moved to the cloud

It's an important decision made by the organization about applications that should be moved to the cloud environment by making proper estimations and calculation about IT and business benefits that they can accomplish from this action. It is also an important part to do the feasibility study as to if the cloud infrastructure they are using will be able to support applications that are being transferred to the cloud.

2.) Lack of ability to make erudite decisions about adding or terminating cloud resources

Organizations need to have capability of monitoring usage of the cloud resources that would alert them about the need of additional resources and about applications for which these additional resources are needed. These monitoring capabilities include tools for monitoring CPU usage per computing resource, ratios between systems activity and user activity, and CPU usage from specific job tasks.

3.) Lack of ability to monitor efficiency of applications that use a hybrid cloud system

Organizations sometimes use a hybrid model for deploying cloud computing, which presents end-user organizations with the challenge of monitoring usage of resources that are hosted and managed both externally and internally and are being used by the same application.

4.) Improving scalability of the infrastructure that causes heterogeneous environments which are even hard to manage

Improving scalability creates a new situation that is quite compound to monitor and deal with. Thus, traditional IT management tools create the challenge of striking a balance between scalability and flexibility of computing resources and ease of management and visibility into performance of the IT services.

XIII. REQUIREMENTS OF THE SOLUTION [11]

1.) Tools for analyzing the impact of rules for handing over cloud resources on basis of end-user experience
2.) Ability to compare cloud service delivery to performance of the internal environment
3.) An independent tool for monitoring/validating performance of a heterogeneous set of applications in the cloud
4.) Ability to monitor cloud applications alongside with internal IT systems

XIV. BENEFITS, RECOMMENDATION OF ACTIONS AND IMPLEMENTED PRODUCT/SOLUTION

Benefits

- Prevention and resolution of performance issues in a timely manner.
- Ability to support changes in business demand.
- Ability to optimize spending decisions.

In order to have full visibility into the performance of cloud services, organizations should consider taking the following actions:[12][13] (Fig 6)

- Deploy independent tools for monitoring and validating the performance of cloud services.
- Deploy tools for measuring the impact of rules for assigning cloud resources based on quality of end-user experience.
- Develop the ability to compare cloud service delivery to performance of the internal environment.
- Make sure your monitoring tool supports a hybrid deployment architecture.

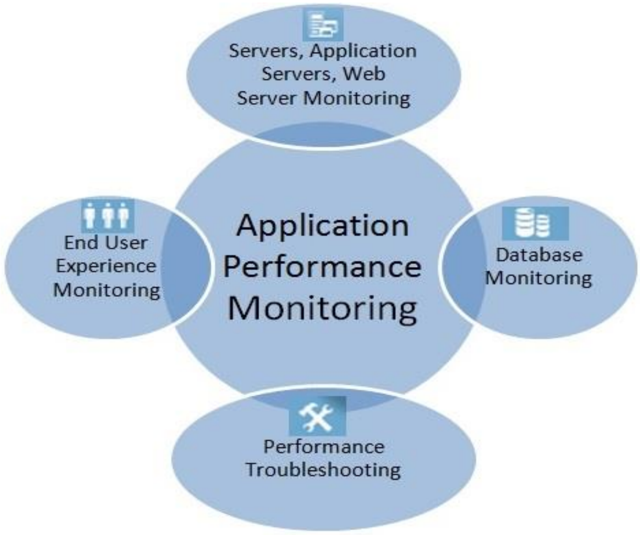

Fig 6) Monitoring as a Service

Implemented Solution

One such brilliant technique is REMO, a resource aware monitoring system. REMO manages the resource utilization among various datacenters. It keeps an eye on network and helps to keep load on all CPU moderate lading to better CPU utilization. But still it could provide 35-45% error reduction. Another technique is CRYSTALBALL, it is a monitoring system that works on datacenters of distributed system and keeps updating accuracy updates based on analysis of failures observed. It improves monitoring capabilities.

XV. CONCLUSION AND FUTURE WORK

This paper describes the model for the Monitoring as a Service and its future implication in the near future. The best part of the cloud is that it automatically scales the virtualization level as per the requirement and the available infrastructure, similarly MaaS as a whole will be able to manage the arising security concerns and other issues, and the inbuilt algorithm will take the required action in such crisis. [14] The scope for future work will include, MaaS for different heterogeneous systems, for example companies keep their data on their own servers where as application on cloud, so we need a bridge and set of protocols to manage this inconsistency on a far wide scale level. [15] Moreover, better algorithms to tackle the issues and robustness of the system will be one area which can be specifically being worked upon. There is a lot that can be done with MaaS.

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REFERENCES

1. L. Raschid, H.-F. Wen, A. Gal, and V. Zadorozhny, "Monitoring the performance of wide area applications using latency profiles," in WWW'03.
2. B. Raghavan, K. V. Vishwanath, S. Ramabhadran, K. Yocum, and A. C.Snoeren, "Cloud control with distributed rate limiting," in SIGCOMM,2007, pp. 337–348.
3. Piyush Saxena, Satyajit Padhy, Praveen Kumar 2013. Use of storage as a service for online operating system in Cloud Computing, International Conference on Telecom and Networks.
4. Bernd Harzog, "Monitoring as a Service", Virtualization practices 2012.
5. N. Jain, P. Mahajan, D. Kit, P. Yalagandula, M. Dahlin, and Y. Zhang, "Network imprecision: A new consistency metric for scalable monitoring," in OSDI, 2008, pp. 87–102.
6. Amazon, "Ec2 auto-scaling," http://aws.amazon.com/autoscaling/.
7. Shicong Meng, Ling Liu, "Enhanced Monitoring-as-a-Service for Effective Cloud Management", IEEE Transaction on Computers 2012.
8. S. Madden and et al., "Tag: A tiny aggregation service for ad-hoc sensor networks," in OSDI, 2002, pp. 131–146.
9. P. Yalagandula and M. Dahlin, "A scalable distributed information management system," in SIGCOMM04, pp. 379–390.
10. M. Dilman and D. Raz, "Efficient reactive monitoring," in INFOCOM, 2001, pp. 1012–1019.
11. R. Keralapura, G. Cormode, and J. Ramamirtham, "Communicationefficient distributed monitoring of threshold counts," in SIGMOD, 2006.
12. S. Meng, T. Wang, and L. Liu, "Monitoring continuous state violation in datacenters: Exploring the time dimension," in ICDE, 2010, pp. 968–979.
13. S. Meng, A. Iyengar, I. Rouvellou, L. Liu, K. Lee, B. Palanisamy, and Y. Tang, "Reliable state monitoring in cloud datacenters," in IEEE Cloud, 2012.
14. P. Yalagandula and M. Dahlin, "A scalable distributed information management system," in SIGCOMM04, pp. 379–390.
15. S. Meng, S. R. Kashyap, C. Venkatramani, and L. Liu, "Remo: Resourceaware application state monitoring for large-scale distributed systems," in ICDCS, 2009, pp. 248–25.

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