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S Cloud Resource Management – A Survey

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Abstract: Cloud computing is a delivery of computing as a service with shared resources, software and information over a network. The key advantage of the cloud is the flexibility and scalability. Due to its widespread nature of computing technologies all the IT organisations are drawn towards cloud. Cloud provides different service models like platform as a service, infrastructure as a service and software as a service. Cloud contains different infrastructure like storage, server and networks and applications like web apps and database. Cloud provides on demand access to shared resources and services which are hosted on datacenters at cloud providers. Effective management of these shared resources and services is a major requirement of cloud computing. Cloud management is complex and faces great challenges due to different infrastructure, different vendors and business view point of different users. Several cloud management challenges includes security, abstraction, processes, policies, dynamism, network resource management, corporate account management etc. The traditional cloud management requires installation of software, updates and patches. This software is different for a different infrastructure vendor hence increases the complexity of management. Hence to overcome this, there is a need of management framework which manages all the functions irrespective of vendors. This paper provides a survey of different management model proposed by many authors.

Keywords: cloud computing, cloud management, resource management, private cloud, public cloud, infrastructure as a service, cloud security management, collaborative cloud**.**

I. INTRODUCTION

Cloud management as defined in [1-3] means the software and technologies designed for operating and monitoring data, applications and services residing in the cloud. The cloud management tools help ensure a company's cloud computing-based resources are working optimally and properly interacting with users and other services.

Today's IT organizations are under a lot of pressure to implement self-service provisioning and build next-generation infrastructure for the cloud. However, the traditional management tools were built for siloed, static environments and simply not designed to meet the demand. As IT environments become increasingly dynamic and businesses move towards the cloud, a new approach to management is needed. [4-7] propose several architectures for cloud management. There are several cloud management [8-9] techniques, that include infrastructure management [10], cloud resource usage management [11], cloud security management [12], management as a service [13], energy management over cloud [14], cloud management for load balancing of tasks etc. Everything comes with limitations, so does cloud management. The limitations of cloud management and the challenges involved are described in [15].

As the leader in virtualization and cloud infrastructure, VMware offers purpose-built management solutions for dynamic environments that fundamentally improve how organizations manage IT and deliver services. The VMware approach enables zero-touch infrastructure, with built-in automation and policy-based control required to deploy a self-service model. These solutions fundamentally simplify how IT is managed by accelerating IT service delivery, automatically assuring compliance, increasing operational efficiency, and by reducing business risks.

II. RELATED WORKS

Dr. Kumar Saurabh et.al [1] proposes a cloud management simulation and design model which is described in an integrated approach for restructuring all the cloud functions based on the customer's values. These restructuring needs to address the excellence based on criteria's like cost, quality, delivery and service. The author provides the solution to improve the utilization of resources in cloud based on simulation and modelling on private provisioning, ticketing management and with the application of system dynamics.

The paper provides the quantitative and qualitative research on resource allocation in cloud computing shared services and infrastructure managed business process modelling with the help of dynamic cloud business process modelling mechanism the manager can understand the dynamic interrelationship in the organisation in the better way. The major aim of the paper is to include simulation and modelling framework to understand workflow design and service management and business process modelling. The benefits is provides reliable forecasts of short to midterm trends.

Dapeng Dong et.al [2] proposes a distributed service architecture which is designed to provide an automated, shared, off-site operation management service for private clouds. Operation management for a private cloud infrastructure faces many challenges like efficient resource allocation, load-balancing, and quick response to real-time workload changes. Traditional manual IT operation

management is inadequate for this highly dynamic and complex environment. The proposed service architecture incorporates concepts such as: Metric Templates for minimising the network overhead for transmission of cloud metrics; a Cloud Snapshot that provides a global view of the current status of the cloud, supporting optimal decision making; and a Calendar-based Data Storage Model to reduce the storage required for cloud metric data and increase analysis performance. The architecture generates a response to cloud events based on the statistics and the measured metrics. This response will help in management of the private cloud operations.

Xing Chen et al [3] propose an architecture based approach to managing diverse Cloud resources. Challenges due to the diversity of Cloud resources and ever-changing management requirements cloud management faces a lot challenges. For constructing a management system to satisfy a specific management requirement a solution based on existing management system will be more practicable than developing the system from scratch but the difficulty involved is great. Constructing an integrated Cloud management system based on the architecture-based runtime models of Cloud resources is more feasible, it also reduces the development workload.

The authors propose to construct the runtime model of each kind of Cloud resource automatically based on its architecture meta-model and management interfaces, and define the customized model which satisfies the specific Cloud management requirement. The operations on the customized model are mapped to the ones on Cloud resource runtime models through model transformation. Thus, all the management tasks can be carried out through executing operations on the customized model. The whole approach only needs to define a group of meta-models and mapping rules, thus greatly reduces the workload of hand coding. All the management tasks can be carried out through executing operations on the customized model.

Li Xu et.al [4] proposes a hypervisor and cloud neutral agile cloud environment management platform called ACLOME (Agile cloud environment management platform) to overcome the disadvantages of complex and error prone datacenter which are cloudified with hypervisor and cloud tools. The Aclome aims to simplify and automate the process of dynamic cloud management based on the management issue. The architecture provides two types of portals: management center and business center. The portal aims to solve resource provisioning and management issues of cloud in simple and agile way. The major goals of the architecture are 1: Ensure the availability and performance of CAPP 2: all the resources in cloud environment are managed and shared as a unified resource model 3: keeping low energy consumption. The automatic control policy development is still difficult and complex.

Narsimha Reddy CH proposed in [5] a common information model (CIM) based management model for clouds. In today's cloud there is no single standard framework to manage infrastructure and applications this is why cloud management is more complex task. To overcome this, author proposed a various independent CIM based management models. CIM provides a consistent definition and structure of data using object oriented principles. The standard language used to define elements of CIM is Managed Object Format (MOF). All the relationship between data center hypervisor, network switches, storage and applications can be managed by CIM.

John panneerselvam et.al [6] provides an investigation on the effect of cloud computing on network management. Cloud computing with its computing features is wide spread in the variety of application. Cloud management is a complex process. Cloud management is different from network management in many aspects. This paper provides the importance and functionality of network management and effect of cloud computing over network management. The functionalities are fault, configuration, accounting, performance and security. Fault management plays a vital role in a cloud based virtual network (CVN) where 2 parameters are required such as recovery point objective and recovery time objective. Configuration management CVN are done through IP address. Accounting management deals with charges and billing of services on CVN. In performance management CVN is clustered to form a cloud and performance includes cloud states and CVN monitoring. Security management involves the control of security services and distribution of security related information. Other cloud issues are privacy, back-up, interoperability and security issues.

A.M. Lonea et.al [7] provides a survey on management interface for Eucalyptus cloud. This paper provides a overview of several management interfaces for Eucalyptus cloud by addressing the taxonomy and evaluation of cloud management interface. Firstly, paper addresses the eucalyptus architecture which presents the deployment management and execution of IaaS.

The management tools are presented with two perspective first analyses the cloud portals from user roles and second with respect to types of tools used. In the first perspective different portals are encountered such as service consumer portal, service provider portal and service development portal. The second perspective describes the major components of common cloud management architecture like operational support service and business support service. Different ECC management perspectives are user interface, operational management function, web based management, client tools, and also additional third party tools are described.

Tiancheng Liu et.al [8] proposes a multi cloud management for unified cloud services across the cloud sites. Due to the development of multi infrastructure as a service, management of cloud site environment is annoying to users/administrators because cloud site is managed separately by cloud owners with the help of

different cloud sites. To overcome this, multi cloud platform is developed which is situated between the cloud user and cloud sites which provides unified clod services. It reduces the workload on server user/administrator by a service a service catlog federation, a collaboration management and application virtual server migration service. Service catlog federation automatically picks up services catlog that meet user requirement from multi cloud sites and creates a single service catlog and provides federation service catlog. A collaboration management extracts virtual server information from cloud sites and provides administrator on unified cloud management portal. An application server migration provides service that migrate an application from one cloud to another. Another work which has to be observed is cloud service mash up across multi cloud sites.

Shixing yan et.al [9] proposes an infrastructure management hybrid cloud for enterprise users. In the past years cloud computing is widespread and infrastructure as a service (IaaS) is the acceptable model. This IaaS faces a management complexity in the hybrid cloud environment which enterprise user is mostly building up. To overcome this, author proposed Monsoon which provides enterprise users an interface and portal to manage the cloud infrastructures from multiple public and private cloud service providers. To meet the requirement of enterprise user the Monsoon which has some key components like user management, access control, corporate account management and policy implementation engine.

The corporate account module provides management of multilevel accounts in a hybrid cloud which consists of multiple public cloud service providers and private cloud. Policy implementation engine provides the geography based requirements security level and subscription and deployment of users cloud infrastructure. The cloud infrastructure management includes user management, resource management, monitoring and reporting. The advance features includes corporate account policy implementation, billing and charges. The IaaS proxy provides interface for hybrid cloud and portal for management.

Vladimir Tosic et.al [10] provides a management towards reducing the cloud usage costs. Due to the information and computing technology model of cloud many organisation are drawn towards cloud which improves flexibility and total cost. It is difficult for a cloud user to determine and manage the cloud usage cost. To overcome this, the author provides NICTA research projects that determines the cloud usage cost and helps in making decision based on different business view points. Before migrating to cloud the decision has to be made to which cloud service the migration has to be done and a side by side comparison of cloud has to be provided. NICTA has developed a cost estimation tool that calculates the usage costs. This tool can also be used in runtime in making decisions. NICTA also developed a tool for flexibility and integrated monitoring of applications in cloud. It also extendsWS-Policy4MAS6 language and miniZnMASC middle ware for automatic business driven IT management and events and adaption actions for cloud management.

Michael Kertzschnar et.al [11] studied Cloud security management issues and interoperability challenges for Collaborative Clouds. Most of the cloud models employed by organizations and businesses to enable cloud services have additional risks compared to the traditional IT solutions. Based on a comprehensive requirements analysis, Cloud security management domains, integrating various Cloud security services of an organization were identified to get an overview of the cloud activities of an organization. Ubiquitous connectivity, the amorphous nature of information interchange, and the ineffectiveness of traditional static security controls which cannot deal with the dynamic nature of cloud services, all require new security thinking with regard to Cloud Computing in the context of Collaborative Clouds.

To overcome this situation, the interoperability challenges based on a Cloud security management model that support to manage various Cloud security services and the integration of Cloud security management within the security management of the whole organisation are presented. Furthermore the suggested model supports the collaboration with Cloud service users and other Clouds. This model can be used as a guideline to design and implement future Cloud security management systems.

Cong Xu et.al [12] propose a novel Management-as-a-Service (MaaS) architecture which is based on cloud computing architecture that provides more scalable network management capabilities to network managers. Ontology based semantic information model and a functional model are designed to support the cloud network management architecture by providing appropriate management information description and service deployment method. A prototype of cloud network management architecture based on the MaaS model is developed to evaluate the performance of cloud network management services and validate the functional model used in the MaaS cloud. Using cloud computing technology, the elastic management services over MaaS cloud show better scalability, which can dynamically change the management resources held by them. Ontology based management information model is also designed to enable the MaaS cloud to provide intelligent query of management information, and the functional model used in this cloud management architecture optimizes the deployment of each service over MaaS cloud, improves the management efficiency of the architecture. The proposed model proves that it provides optimal deployment of each cloud service and the elasticity of cloud management services improves both the management efficiencies and the utilization of management resources.

Marwah M Alansari et.al [13] proposes an framework for enforcing energy management policies in cloud. All the recent research focuses on dynamic management of running of virtual machines in cloud. Despite of this there

is another dimension that is related to high level policies and guide lines set by administrators for management energy consumption. Currently all this management energy consumption is done manually with the use of low level programming language. Since management energy consumption changes frequently the manual management increases cost and time. Hence we need a way to execute this automatically. This paper provides a generic architecture framework via business rule engine. The business rule engine is integrated to work with cloud manager via two components sensors and actuators. Sensors are responsible for requesting measurement metrics and actuator are responsible for management actions. The framework consists of four components they are business rule, sensor, actuator and decision making. The cloud manager interacts with sensors and actuator for measurement data by remote API. The business rule engine executes the monitoring rule to request the sensors to report for every 10 min on an average workload. This way the measurement is done. The implementation is done using open Nebula management system with the use of JAVA classes, XML and other APIs.

Antonio Corradi et.al [14] propose a Cloud monitoring and management architecture based on the data-centric publish-subscribe Data Distribution Service (DDS) standard that is able to support the scheduling of highly dynamic tasks in the Cloud while maintaining low overheads. Mobile devices are usually resource constrained due to the limitations on processing and power, so typical applications are not easy portable. Battery draining and application performance greatly impact the quality of experience, so shifting applications and services to the Cloud may improve mobile user's satisfaction. However, most of the cloud solutions that are available focus on scenarios with slowly changing provisioning, which are unable to support and dynamically react to short-term provisioning requests. The proposed Dargos support is a feasible and a very promising solution to serve task offloading requests from mobile nodes and to increase the final Cloud efficiency. Although it is specifically designed to address resource provisioning in highly dynamic scenarios, due to its flexibility Dargos can also be effectively employed to serve slowly changing service scenarios.

Tim Forell et.al [15] outlines several challenges for management solutions in Cloud environments. Effective management of these shared resources and services that are provisioned over the cloud is one of the key requirements for the delivery of cloud computing. However, there are several challenges to achieve effective cloud management - scale, multiple levels of abstraction, federation, sustainability, and dynamism. Scalability- Traditional resource monitoring and management systems are typically centralized. They do not scale to potentially millions of management objects in cloud systems. Approaches that are more distributed and have scalability properties that allow easy scale-up and scale-down of the monitoring and management systems to elastically meet cloud requirements are needed. Multiple levels of abstraction- The separation of functionality across IaaS, PaaS, and SaaS layers provides a good abstraction for cloud systems, but having separate management systems for these layers results in silo-ed operations and subsystem level solutions. This leads to inefficiency and redundancy, thus requiring better coordination and exchange of information across the layers. Federation- No Cloud provider has unlimited capacity and in case of significant customer demand may have to overflow to another provider. Federated sites enable much larger pool of resources and therefore more flexible and cheaper use of resources. But federation creates several challenges for management systems.

Monitoring and management techniques would have to be extended across multiple clouds, but still need to provide a single abstraction view to the applications and consumers. This increases the complexity of interfaces needed to enable federated management. Energy Efficiency: Given the scale and scope of cloud data centers, energy efficiency is a critical requirement to meet cost, regulations, and environmental constraints. Also, energy and power has to be managed across multiple heterogeneous processors, and policies coordinated across the hardware and software (OS) layers to balance performance and power. Dynamism: Cloud systems have high loads due to continuous arrival and departure of workloads. With virtualization, workloads can also migrate across the data center. This presents challenges for management software. The authors also come up with management architectures to address a few of these research challenges in the context of OpenCirrus, a cloud computing research testbed.

Mohemed Almorsy et.al[16] introduce a new cloud security management framework based on aligning the FISMA standard to fit with the cloud computing model, enabling cloud providers and consumers to be security certified. Though there are a lot of advantages associated with the use of cloud and the services provisioned over cloud, there is a loss of security control over the assets that are hosted on the cloud. This is mostly due to the provisioning of the assets over third-party cloud platforms. Obtaining security certificate and well established service level agreements will solve the issue to an extent but it does not cover the full complexity of the cloud computing model. The suggested framework is built on top of a number of security standards that assist in automating the process of security management. It aims to improve collaboration between the cloud providers, service providers and service consumers in managing the security of the cloud platform and the services that are hosted over the cloud.

Michael Kertzschnar et.al [17] proposed an inter cloud security management areas that describes all functional aspects. The security management areas are proposed based on the existing security management areas that can be enhanced in cloud computing. The author proposed different security management areas like identity management for confirming the lifecycle of the end users,

credential management for managing the certificates, passwords and keys, attribute management for managing property of users, privilege management for managing permissions, digital policy management to generate, convert and replace digital policies, configuration management for managing security related configuration items like defining and controlling configuration data for services, meta data management for managing security related meta data, SM information management where security relevant information of cloud services are gathered and managed. The author uses these proposed areas to build a security architecture which is a future enhancement.

Christian baun et.al [18] proposed an east way to manage cloud service using KOALA cloud manager. The cloud computing is flexible and scalable. In contrast the traditional management requires local software installation and updates with patches. This software is not compatible with many vendors. So to overcome this author proposes a KOALA cloud management service which is web based application. KOALA is built on top of application engine. This operates on private cloud with a management application running inside the same cloud and customers are free to use any port number. KOALA can operate on both public and private cloud.

Deepa Krishnan et.al [19] provides a cloud security management suite for SaaS. Cloud computing is a innovation in a IT with some of the features like multi tenancy, massive scalability, elasticity, pay as you use etc. but the major problem is security. Both the cloud user and the provider are concerned about the trust and privacy, identity and access management, auditing and accounting. Hence to overcome this, author provides a security model called security management as a service through which both cloud user and vendor can have the facility for identity and access management, trust and privacy, auditing and accounting. The major feature is this facility can be utilised as per demand which is essential for today's dynamic world. It is also helpful to customer who migrates to cloud with les technical upgrades. This cloud security management service is simple and easy to use facility where the user is only required to mention the security requirement. There are two phases in the architecture enrolment phase and service rendering phase. Other logging features can also be included.

Preeti Agrawal et.al [20] present a cloud computing where both hardware and software resources are available on the temporary basis or in the leased form. When there are more users for single cloud resources at one instance of time there is a synchronization problem for resource scheduling for multiple users. There is a difficulty managing multiple resources with multiple architectures for multiple users and also it is difficult to optimally schedule applications in such environments. The authors give a strategy on efficient management of resources in the cloud environment. Resource management means a single cloud having cluster of functional servers, so that the cloud resources can be scheduled for multiple users. The authors propose that the resources be scheduled according to non-pre-emptive priority M/G/1 queuing model for the jobs. The proposed algorithm for the resource scheduling when multiple users request for the same resource shows that user is provides with the resource in less time.

Anton Beloglazov et.al [21] propose an energy efficient resource management system for virtualized Cloud data centers that reduces operational costs and provides required Quality of Service (QoS). Energy savings are achieved by the continuous consolidation of VMs according to the utilization of resources, virtual network topologies established between VMs and thermal state of computing nodes. The results of simulation-driven evaluation of heuristics for dynamic reallocation of VMs using live migration according to current requirements for CPU performance show that the proposed technique brings substantial energy savings, while ensuring reliable QoS. The proposed infrastructure is represented by a large-scale Cloud data center comprising n heterogeneous physical nodes. Each node has a CPU, which can be multicore, with performance defined in Millions Instructions per Second (MIPS). Also, a node is characterized by the amount of RAM and network bandwidth. Users submit requests for provisioning of m heterogeneous VMs with resource requirements defined in MIPS, amount of RAM and network bandwidth. The local managers reside on each physical node as a part of a Virtual Machine Monitor (VMM). They are responsible for observing current utilization of the node's resources and its thermal state. The local managers choose VMs that have to be migrated to another node based on a few predefined conditions. The local managers send to the global managers the information about the utilization of resources and VMs chosen to migrate. The global managers continuously apply distributed version of a heuristic for semi-online multidimensional bin-packing, where bins represent physical nodes and items are VMs that have to be allocated. The decentralization removes a Single Point of Failure (SPF) and improves scalability. The results obtained show that dynamic consolidation of VMs brings substantial energy savings while providing required QoS.

Andrew J. Younge et.al [22] proposes a new framework that provides efficient green enhancements within a scalable Cloud computing architecture. Using power-aware scheduling techniques, variable resource management, live migration, and a minimal virtual machine design, overall system efficiency will be vastly improved in a data center based Cloud with minimal performance overhead. The proposed framework is a novel Green computing framework that is applied to the Cloud in order to meet the goal of reducing power consumption. This framework is meant to define efficient computing resource management and Green computing technologies can be adapted and applied to Cloud systems. There are two competing types of Green scheduling systems for Supercomputers; power-aware and thermal aware scheduling. In thermal-aware scheduling, jobs are scheduled in a manner that minimizes the overall data center temperature. The goal is not always to conserve the

energy used to the servers, but instead to reduce the energy needed to operate the data center cooling systems. In power-aware scheduling, jobs are scheduled to nodes in such a way to minimize the server's total power. The power consumption curve regarding watts of energy consumed verses the number of processing cores in use, illustrates that as the number of processing cores increases, the amount of energy used does not increase proportionally rather the power consumption decreases. The authors also propose a new greedy-based algorithm to minimize power consumption within the data center.

Rajkumar Buyya et al [23]. present the vision, challenges, and architectural elements for energy-efficient management of Cloud computing environments. The focus is on the development of dynamic resource provisioning and allocation algorithms that consider the synergy between various data center infrastructures, and holistically work to boost data center energy efficiency and performance. The authors propose (a) architectural principles for energy-efficient management of Clouds; (b) energy-efficient resource allocation policies and scheduling algorithms considering quality-of-service expectations, and devices power usage characteristics; and (c) a novel software technology for energy-efficient management of Clouds.

The problem of VM allocation can be divided in two: the first part is admission of new requests for VM provisioning and placing the VMs on hosts, whereas the second part is optimization of current allocation of VMs. To solve it the Best Fit Decreasing (BFD) algorithm is applied ,that is shown to use no more than 11/9 OPT + 1 bins (where OPT is the number of bins given by the optimal solution). In the proposed modification (MBFD) we sort all VMs in decreasing order of current utilization and allocate each VM to a host that provides the least increase of power consumption due to this allocation. This allows leveraging heterogeneity of the nodes by choosing the most power-efficient ones. Optimization of current allocation of VMs is carried out in two steps: at the first step we select VMs that need to be migrated, at the second step chosen VMs are placed on hosts using MBFD algorithm. The authors propose several heuristics for choosing VMs to migrate. The proposed work advances Cloud computing field in two ways. First, it plays a significant role in the reduction of data center energy consumption costs and thus helps to develop a strong, competitive Cloud computing industry. Second, consumers are increasingly becoming conscious about the environment. In Australia, a recent study shows that data centers represent a large and rapidly growing energy consumption sector of the economy and is a significant source of CO2 emissions.

III. CONCLUSION

In this paper an analysis is presented for different cloud resource management techniques which can be employed to different infrastructure provided by cloud provider. Many existing techniques have been employed in recent years for cloud management. In this paper an overview for different management issues and policies are presented. The main focus is on using a cloud management model which provides dynamically management of cloud. The summary of various management modules with their advantages has been presented.

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