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Dev One Cloud - Service Discovery and QoS comparison for Multi-cloud

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ABSTRACT-The usage of several cloud computing and storage services by different cloud service providers in the same network architecture is known as multi-cloud. Multi-cloud systems are used by businesses to diversify computing resources and reduce the risk of outages and data loss. With technological advancements, private clouds have evolved into public clouds and hybrid clouds. Choosing a cloud hosting service that will satisfy the specified QoS specifications of SaaS consumers is the key concßern for SaaS providers. To do this, SaaS providers must first map their users' needs to their own QoS standards, and then to the IaaS layer. MCDM strategies work to select cloud services, but different MCDM techniques produce different results. These results suggest that cloud services can be selected using MCDM strategies.

Keywords- Cloud, On-Prem, Multi Cloud, Cost Optimization, Current Market Share, Vendor Lockin

I. INTRODUCTION

The usage of several cloud computing and storage services by diverse cloud service providers in the same network architecture is referred to as multi-cloud.

This is the method for distributing cloud assets, programmes, and other resources across several cloud environments. A multi-cloud system seeks to lessen reliance on a single cloud provider or instance, with a typical multi-cloud design comprising two or more public and private clouds.

A multi-cloud system could be completely private, completely public, or a mix of both. Businesses utilize multi-cloud systems to diversify computing resources and lessen the risk of downtime and data loss. They can also help a corporation expand its computing and storage capacities. Cloud advancements have led to a move away from single-user private clouds in recent years. In recent years, cloud innovations have resulted in a shift from single-user private clouds to multi-tenant public clouds and hybrid clouds — a heterogeneous environment that combines private and public cloud technology.

II. BACKGROUND & MOTIVATION

Cloud service providers are coming up with more and more services, currently more than 200 services are offered by AWS itself. This makes it harder for developers to be skilled in all of them and often leads them to confusion in choosing which service they should choose. DevOne Cloud provides an approach to help them in determining best service for them and widen their options by service discovery.

III. LITERATURE SURVEY

[1] Oscar Gonz´alez-Rojas and Juan Tafurth "Multi-cloud Services Configuration Based on Risk Optimization", October 2019 OTM Conferences

This paper outlines a method for modelling and configuring multi-cloud services that can react to changes in user preferences as well as threats to specific services. We present a method for modelling and finding optimal configurations of large adaptive systems, such as multi-cloud services, that integrates Product Line (PL) and Machine Learning (ML) techniques.

A three-layer variability modelling based on domain, user preferences, and adaptability restrictions is presented to construct multi-cloud systems. By examining how a service was affected by incremental threats over time, ML regression methods are utilised to evaluate the risk of resulting configurations. An experimental evaluation of the proposed approach on a real-world electronic identification and trust multi-cloud service demonstrates its applicability in predicting the risk of alternative re-configurations on autonomous and decentralised services that change their availability and provision attributes on a continuous basis.

[2] Nirmal Kumawat, Nikhil Handa, Avinash Kharbanda "Cloud Computing Resources Utilization and Cost Optimization for Processing Cloud Assets", 2020 IEEE International Conference on Smart Cloud

In the realm of Cloud Content Platform, a user can store a variety of cloud assets (for example, PDF documents) and access them from any platform, including Web, Desktop, and Mobile. Different sorts of assets can be created by a creative content application and stored on a cloud content platform. To handle asset processing requests, a corresponding micro-service or cloud-worker should be present. The cost of using cloud computing to handle such requests is not optimal, and cloud computing resources are often underutilised. Additionally, due to the long processing time of a large and complicated asset, the overall response time may increase.

This paper implements a machine learning model to predict cloud computing resources to serve input asset processing requests. The method and system maximizes resource utilization, minimize cost spent and minimize processing time by such computing resources. It includes supervised learning based predictive models with historic data, namely asset processing requests, assets properties, and their corresponding cloud computing resource utilization.

[3] Seyed Majid Razavian, Hadi Khani, Nasser Yazdani, Fatemeh Ghassemi "An analysis of vendor lock-in problem in cloud storage" ICCKE 2013

This study examines the distribution of a large file over various cloud providers as a solution to the problem of vendor lock-in. It takes into account a large file with numerous starting blocks. Erasure coding is used to transfer this file in a more secure manner. Initial blocks are transformed to shares as a result of this coding, and these shares are distributed between cloud providers. As long as a subset of shares with a minimal size survives, the entire file can be recovered. Each share has the potential to become inaccessible.

Each share's inaccessibility is assumed to occur independently, and that the shares don't become accessible again. This assumption isn't true in practice. For example, all shares hosted in the same cloud provider become unreachable at the same time. As a result, their inaccessibility is interdependent. The second assumption is possible to be incorrect. When a share becomes inaccessible due to corruption, it can be repaired. However, if that portion is out of reach due to excessive costs, it may never reappear.

[4] Ronny Hans, Ulrich Lampe, Ralf Steinmetz "QoS-Aware, Cost-Efficient Selection of Cloud Data Centers" 2013 IEEE Sixth International Conference on Cloud Computing

The QoS-aware, cost-efficient selection of data centers is an important challenge that arises with the increasing delivery of multimedia services through the cloud.

The process of selecting possible data centres, as well as defining resource capacity and allocation to unique user clusters for each data centre, has limitations. Constraints such as meeting the service expectations of all user clusters and matching QoS criteria with matching guarantees are met. In the author's paper, this problem is referred to as the Cloud Data Center Selection Problem (CDCSP). According to the study, an exact optimization technique is used based on integer linear programming. According to a preliminary assessment, solving larger problem cases with practical relevance necessitates a lot of compute.

[5] Raed Karim, Chen Ding, Ali Miri "An End-to-End QoS Mapping Approach for Cloud Service Selection", 2013 IEEE Ninth World Congress on Services

The ultimate goal of cloud providers is to meet the expectations of customers and to compete with their peers who provide functionally equivalent services. We consider the SaaS's perspective to help them map the users' requirements to their QoS guarantees, then perform the mapping again to the most appropriate IaaS service available on the Internet. They are: QoS based service selection, QoS based cloud service selection and QoS mapping approaches.

Considering the web service selection systems, a QoS-context aware model is proposed to overcome the difficulty of modeling some QoS attributes. Three main steps are defined in the process: context information generation, QoS prediction and service selection based on QoS prediction. A cloud service selection approach based on user's constraints on QoS is proposed. For

modeling the QoS, the paper considers the service management index (SMI) attributes, in which the QoS attributes are classified into seven major groups.

SaaS developers compose appropriate services based on different QoS constraints of multiple users. It also considers achieving SaaS optimizing goals (less price and high performance). This is performed by modeling the problem as a constraint optimization problem (COP).

[6] Kena Alexander, Choonhwa Lee, "Enabling End-to-End Orchestration of Multi-Cloud Applications ", IEEE Access, 2017

Using the TOSCA and CAMP standards in conjunction, this paper explains and optimises a technique for defining, deploying, and sustaining distributed cloud applications. Declarative policies that can be used to coordinate the components of a deployed application across several cloud platforms have been demonstrated by expanding the current CAMP standard. The study develops, implements, and tests a method to translate TOSCA documents into CAMP plans while maintaining the separation of the model components.

A sample implementation demonstrating our approach to converting TOSCA service templates to CAMP deployment plans is included in the paper, as well as a description of the TOSCAMP platform.

[7] Zia ur Rehman, Omar K. Hussain, Farookh K. Hussain, "Iaas Cloud Selection using MCDM Methods", 2012 IEEE Ninth International Conference on e-Business Engineering

This paper uses a case study that includes five fundamental performance assessments of thirteen cloud services by a third-party monitoring service to highlight key multi-criteria decision-making methodologies for IaaS cloud service selection. It shows how to utilize various multi-criteria techniques for cloud service selection and compares the results achieved using each method to see how the choice of a particular MCDM method influences the outcome of the IaaS cloud service selection decision-making process.

This paper briefly elaborates various MCDM methods: Mix-max method, Max-min method, Compromise Programming, TOPSIS method, ELECTRE, PROMETHEE, AHP.

The ideal and anti-ideal solutions were identified by finding the highest and lowest values in each column.

The ideal and nonideal solutions were used for Min-max, Max-Min, Compromise programming and TOPSIS methods (AHP and the two outranking methods do not utilize the ideal and nonideal solutions).

[8] Naixue Xiong, J. Zhu, J. Lu, "E-health Web Application Frameworks Based on Cloud Technology", Mar. 2018 Journal of Internet Technology

The fundamental purpose of this thesis is to develop a universal E-health web application framework that involves cloud platform selection, security mechanism description, and the usage of responsive web design. The MWA cloud platform and ASP.Net, HTML5, CSS3 were chosen as the key tools in a detailed comparison due to their great compatibility and operability. To protect personal information, a basic security guideline, common login structure, and RBAC access control structure have been given. The following are some of the paper's flaws: To begin with, personal data storage, particularly password encryption in cloud databases, will pose a significant risk to privacy security. Encryption methods such as RSA and DES, among others, can be used to increase data security.

[9] Yuezhi Zhou, Di Zhang, Naixue Xiong ''Post-cloud computing paradigms: A survey and comparison,'', Dec 2017 IEEE Xplore Tsinghua Science and Technology

In this paper, we examined the obstacles connected with cloud computing, established the essential characteristics of cloud computing, and underlined its unavoidable development tendency in this study. Following that, we briefly discussed newly developing network computing concepts such as fog computing, MEC, and dew computing. We conducted a deep comparative analysis of cloud computing and post-cloud computing and analyzed the distinctions between post-cloud computing paradigms to assist readers grasp the features of these post-cloud computing paradigms. As a consequence of the increasingly visible challenges that cloud computing is experiencing, post-cloud computing will likely become a suitable study topic in the industry and academic sectors in the near future.

[10] Li Liu, Caiwu Lu, Fengjun Xiao "A Practical, Integrated Multi-Criteria Decision-Making Scheme for Choosing Cloud Services in Cloud Systems", June 2021 - IEEE Access

This paper presents a realistic integrated MCDM strategy for cloud computing based on Quality of Service criteria that identifies the best cloud service. It proposes a more complete and accurate cloud model distance measuring technique from the standpoint of cloud drop distribution, and applies it to the computation of cloud model similarity and the gray correlation coefficient. The similarity between the expert assessment cloud model and the arithmetic mean cloud model is used

to calculate the dynamic expert weights. The suggested technique determines the weights of the criteria by building a multi-objective optimization model that maximizes the relative proximity of all options.

Even with the benefits of our proposed scheme, there are a few barriers and room for similar research. We can enhance cloud carrier QoS assessment. The proposed method's calculation time may be drastically decreased via software program improvement strategies, a good way to facilitate a quicker assessment and choice of the cloud carrier.

[11] Zheng Li, He Zhang, Liam O'Brien "On evaluating commercial cloud services: A systematic review,'' Sep. 2013 Journal of Systems and Software

According to the report, we can identify two weaknesses of the present Cloud services evaluation work. To begin, less than 16% of articles precisely noted the period of evaluation experiments. Since commercial Cloud services are frequently changing, the absence of revealing experimental time will surely jeopardize reusing assessment results or tracking prior data in the future. Second, several main research did not clearly define the evaluation conditions or experimental methodologies. Some of the points that this paper missed were: The gathered data in this SLR will be formatted and saved in a database to facilitate a Cloud services evaluation technique. Using the outcome of this SLR as a strong starting point, we will do more research into Cloud service assessment, such as developing sophisticated evaluation

[12] Hesham Elmasry ''Cloud computing: A study of infrastructure as a service (IAAS)'' 2010 Journal of Engineering and Information

Finally, because the infrastructure associated with supplying compute power, storage, and networking is not purchased and maintained by the customer, an Infrastructure as a Service (IaaS) offering provides significant cost reductions. These assets are the responsibility of the IaaS provider, and users are only charged for what they use when they use it. Infrastructure as a Service (IaaS) is a flexible service that is popular among infrastructure architects. Infrastructure as a Service (IaaS) is popular among infrastructure architects because it provides an architecture-based approach to shifting datacenter workloads to the Cloud. In an IaaS system, if a programme can be virtualized, it can be uploaded and run. Infrastructure as a Service (IaaS) is popular among infrastructure architects because it provides an architecture-based approach to offloading datacenter workloads to the Cloud.

[13] Marco Anisetti, Claudio Agostino Ardagna, Ernesto Damiani, Filippo Gaudenz ''A semiautomatic and trustworthy scheme for continuous cloud service certification,'' Jan. 2020

This work presents a revolutionary intelligent computation offloading-based MEC architecture with a mix of three modes, in contrast to the limitations of standard local computing, edge computing, and cloud computing modes. The research goals and benefits of the future generation of MEC were also discussed in this publication. The suggested architecture is used to build the compute offloading and task migration approach based on task prediction. An LSTM-based computation task prediction method, task prediction based computing offloading strategy for mobile devices, and a computation task migration scheme for edge cloud scheduling are all outlined in the ideal computation offloading approach. Our technique effectively reduces overall work delay when calculating huge data quantities when compared to local computing and single edge computing offloading strategies.

[14] Stefan Frey, Claudia Lüthje, Christoph Reich "Cloud QoS Scaling by Fuzzy Logic", 2014 IEEE International Conference on Cloud Engineering (IC2E)

This study demonstrates how additional imprecise information (for example, expected daytime/week-time performance) modeled with fuzzy logic and used in a behavior**,** load and performance prediction model to improve a cloud service's up and down scaling mechanism. Based on the results of the evaluation, SLA violations could be minimized by choosing this approach. In this paper, a freeblock scheduler is shown to be possible via an external framework.The scheduler can replace rotational delay with relevant background media transfers from outside the disc, and it does so with nearly no increase in foreground service times (less than 2%). Achieving this goal required greater accuracy than could be achieved with previous external SPTF schedulers, which our scheduler achieves by exploiting the disk's command queueing features. In addition, over 3.1 MB/s of free bandwidth (15% of the disk's total media bandwidth) is delivered during background disk scans, which is 65% of what was predicted from simulations.

[15] Saakshi Narula, Arushi Jain, Prachi "Computing Security: Amazon Web Services" International Conference on Advanced Computing & Communication Technologies

Although cloud computing delivers several services and benefits, there are other issues that must be addressed in order to expand the market for such a world-class technology . The main worry in cloud computing is SECURITY in terms of data, access, and privacy protection. Cloud computing should be safe and resilient, with risks minimized. According to cloud computing research, security should be a core function rather than an add-on process. Because of its exceptional work in the field of data security, AWS has done many efforts: a) network security; and b) creating a real-time sliding window dashboard.d) Amazon Web Services (AWS) for Disaster Recovery d) Scalable security: AWS logging e) Encryption for data security g) Approach to Backup and Recovery Customers have trust in AWS because of the security services it provides. As a result, the primary goal of cloud computing should be to foster confidence by offering security services.

[16] Simon Ostermann, Alexandru Iosup, Nezih Yigitbasi "A Performance Analysis of EC2 Cloud Computing Services for Scientific Computing" Cloud Computing - First International Conference

E-scientists now have a new platform option thanks to the rise of cloud computing as a paradigm in which scientific computing is done purely on resources leased only when needed from huge data centres. The cloud computing paradigm's initial goal, however, does not match the characteristics of scientific computing workloads. The most important conclusion is that the examined cloud's performance and dependability are inadequate. As a result, while this cloud is unsuitable for large-scale scientific computing, it appeals to scientists who require resources rapidly and infrequently. They studied strategies to improve current clouds for scientific computing as a result of this discovery, and uncovered two research subjects with significant potential for improving cloud performance today.

[17] Valentina Salapura, Ruchi Mahindru "Enabling Enterprise-Class Workloads in the Cloud", 2016 IEEE International Conference on Cloud Engineering (IC2E)

This paper presents how IBM CMS cloud software delivers enterprise-level ERP workloads to the cloud by implementing infrastructure high availability, clustering, shared storage, and private networks for both virtualized and non-virtualized environments. IBM Cloud Managed Services (CMS) offers shared storage, clustering, and private networks. This functionality allows huge numbers of SAP and Oracle workloads to be used in both virtualized and non-virtualized cloud settings. These resilience capabilities enabled the adoption of a variety of enterprise applications in the IBM CMS cloud, including SAP, SAP HANA, and Oracle RAC, allowing enterprises to benefit from the cloud's flexibility, elasticity, and cheap cost.

[18] Chen Wang Hyong Kim Ricardo Morla "Users Know Better: A QoE based Adaptive Control System for VoD in the Cloud", 2015 IEEE Conference and Exhibition on Global Telecommunications (GLOBECOM)

This paper proposes an adaptive control mechanism for VoD in the Cloud based on QoE. According to extensive testing results, this method is better at managing users' QoE than existing measurement-based server selection systems. Currently, more users are obtaining QoE above a preset level, the system gives improved QoE guarantees, and it continues to function despite server/VM failures. These results back up the theory that QoE delivers a more realistic picture of system performance than commonly used measurements like RTT and server load. QoE may be used in additional aspects of system control in the future, such as content caching and resource allocation.

[19] Lixia Liu, Hong Mei, Bing Xie "Towards a multi-QoS human-centric cloud computing load balance resource allocation method", July 2016 The Journal of Supercomputing

The MQLB-RAM approach is described in the study as a way to partition resource allocation into two components. The first connects tasks submitted by specific sensor users with virtual peers, while the second connects tasks submitted by specific sensor users with virtual peers. It includes the numerous aspects of resource scheduling that should be addressed, each with its own focus; resource allocation methods provided by distinct scenarios each have their own set of criteria. Resource allocation strategies are used in the resource allocation method for multi-QoS load balancing (MQLB-RAM). In the cloud computing service, the service request is frequently deployed on a virtual peer of the same physical resource as programmes and data from the same user. The issue of allocating jobs to users in a timely manner is translated into management and allocation of virtual machines on the same host.

[20] Yi-Ju Chiang, Yen-Chieh Ouyang "An Efficient Green Control Algorithm in Cloud Computing for Cost Optimization", IEEE TRANSACTIONS ON CLOUD COMPUTING

This paper concludes that the growing crisis in power shortages has brought a concern in existing and future cloud system designs. Three power-saving approaches with distinct decision procedures and mode-switching controls are studied to reduce or eliminate needless idle power usage. Based on differences in arrival rates and incurred costs, the topic of selecting the most appropriate policy among several power management strategies in order to achieve a relatively high effectiveness has been investigated. When there is a reduced beginning cost, experimental data suggest that a system with the SI policy can achieve a higher cost effectiveness than other policies. In a circumstance with a low arrival rate, it can also dramatically enhance response time.

IV. CONCLUSION

As a result of the above study of the existing methods to solve the problem of choosing the cloud service provider, it is evident that there are major issues that must be addressed like siloed vendor tools, skill shortage, spiral costing. These issues can be solved by a multi cloud management tool. It serves as an end to end integrated platform that helps developers to choose best between multiple services and how to get started with them.

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