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Cloud Server Reliability Enhancement Via Virtual Machine Optimization

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ABSTRACT

With the increasing scale of cloud datacenters and rapid development of virtualization technologies, many cloud-based services have been deployed to meet requirements. Virtual machines (VMs) are placed on physical servers, and often provide virtual environment for cloud services. Therefore, virtual machines placement (VMP) problem has gradually attracted many attentions. It is meaningful that how to effectively and efficiently place VMs on servers to guarantee the service reliability and reduce the bandwidth consumption. In this paper, we first formulate VMP with a reliability model and a bandwidth consumption model, and analyse its complexity. This paper proposes a redundant VM placement optimization approach to enhancing the reliability of cloud services. The approach employs three algorithms. The first algorithm selects an appropriate set of VM-hosting servers from a potentially large set of candidate host servers based upon the network topology. The second algorithm determines an optimal strategy to place the primary and backup VMs on the selected host servers with k-fault-tolerance assurance. Lastly, a heuristic is used to address the task-to-VM reassignment optimization problem, which is formulated as finding a maximum weight matching in bipartite graphs. The evaluation results show that the proposed approach outperforms four other representative methods in network resource consumption in the service recovery stage

Keywords : VMP, Virtual Machines

I. INTRODUCTION

With the rapid development of cloud computing, exponentially increasing numbers of applications and services are deployed on Virtual Machines (VMs), which are all placed on physical servers [1]. As statistical analysis shown on the study with the growing trend of datacenters, the probability of host servers failures is nontrivial. Node failures may lead to the loss of VMs allocated on the server, and all deployed services will fall into invalidation consequently. Reliability, as a substantial property of Quality of Service (QoS), should be guaranteed. An efficient approach to overcome the reliability problem is to create some VM replicas as backup and place them in a distributed manner. Besides, loosely placing VMs in multiple domains in the datacenter can relatively enhance the reliability and reduce the loss caused by node failures.

In this paper, we address the traffic-aware and reliability guaranteed virtual machines

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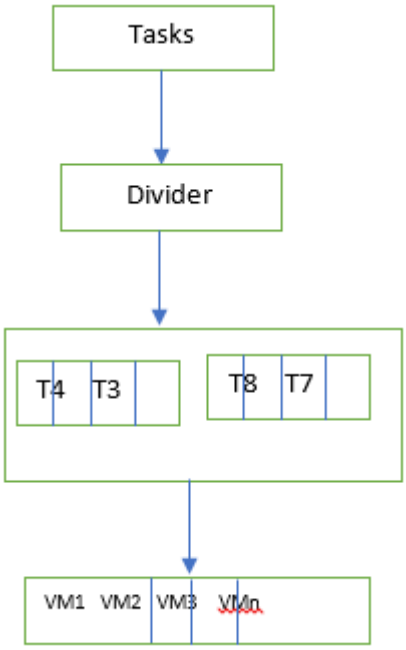
placement as an optimization problem, denoted as TRVMPO problem. VMP demands include the VMs topology, bandwidth demands, a required reliability parameter and the communication cost matrix of hosts in datacenters. We first establish a reliability model, and then formulate the whole physical bandwidth consumption of VMP as an optimization objective function. The optimal solution to the TRVMPO is a placement strategy for each VM in order to minimize the function value. And we analyse the complexity of TRVMPO problem and prove the problem as NP-hard. We propose an approximation algorithm based on the minimum k-cut of graph to solve TRVMPO, and theoretically prove the effectiveness and efficiency of the approach. The core aspect of TRVMPO algorithm involves two parts: 1) the algorithm partitions VMs in accordance with VMs integration threshold to guarantee the required reliability; 2) VM partitions are matched with target hosts. Finally, we conduct our experiments and compare the performance with other VMP algorithms. The evaluation results show the effectiveness of proposed TRVMPO algorithm and performance advancement over the other approaches.

Many fault tolerance mechanisms have been proposed. Checkpointing is a common fault tolerance mechanism for cloud services. The checkpointing mechanism periodically saves the execution state of a running task (e.g., as a VM image file), and enables the task to be resumed from the latest saved state after failure occurs. However, taking checkpoints periodically and resuming a failed service via checkpoint image(s) are time-consuming. This mechanism may incur too much performance overhead when it is deployed for some small scale tasks or dividable tasks (e.g., a data analytic task that can be divided into a set of small tasks).

Replication, e.g., one-to-one and one-to-many standby, is another common fault tolerance mechanism, which exploits redundant deployment of computing resources, e.g., VMs. When the fault tolerance capability of a specific service is provisioned via VM replication, the redundant VMs are classified into two categories: primary VMs and backup VMs. Notable approaches were developed to reduce the implementation cost by exploiting the degree of redundancy.

II. ARCHITECTURAL DESIGN



III. RELATED WORK

We propose a reliability model and a bandwidth consumption model. The former one deduces the VM integration threshold, which guarantees the reliability of VMP. The latter one combines VM bandwidth demands and network communication costs together, and formulte into an optimization objective function.

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combines VM bandwidth demands and network communication costs together, and formulate into an optimization objective function.
We compare our approach with other VMP algorithms in terms of experimental performance via simulations.

It uses the two algorithms namely cloudrank1 and cloudrank2.This paper overcomes the existing system and it consists of following pros: It avoids time-consuming plus expensive real world service invocations. It does not necessitate additional invocations of cloud services. It takes the advantage of past usage experiences from other users. Identify the risky problem of personalized QoS ranking for cloud services and proposes a QoS ranking prediction framework to tackle the problem. Achieve ranking accuracy for cloud services compared with other ranking algorithm. Publicly release this service QoS data set for upcoming research, so build this experiment reproducible.

Methodology
rapid adoption of the cloud computing model, many enterprises have begun deploying cloud-based services. Failures of virtual machines (VMs) in clouds have caused serious quality assurance issues for those services.
the need to costly over-provision on-premise computing resources to accommodate peak demand Thus, deploying services into the cloud has become a growing trend.
unrealistic for a complex computing system like a cloud computing environment in production, in which VM failure is inevitable.
Fault tolerance techniques, which try to ensure service continuity when failure occurs, complements those three techniques with a fundamentally different service reliability enhancement approach and with a more practical reliability management goal for cloud services
Many fault tolerance mechanisms have been proposed. Checkpointing is a common fault tolerance mechanism for cloud services. The checkpointing mechanism periodically saves the execution state of a running task, and enables the task to be resumed from the latest saved state after failure occurs
Replication, e.g., one-to-one and one-to-many standby, is another common fault tolerance mechanism, which exploits redundant deployment of computing resources, e.g., VMs
Reliability is an important aspect of Quality of Service (QoS). With many virtual machines (VMs) running in a cloud data center, it is difficult to ensure all the VMs always perform satisfactorily
Data centers have limited network resources and may readily become congested when a huge number of checkpoint image files are transferred.
To save more network resources, we place the primary and backup virtual machines by considering the network topology of the datacenter.
reducing the network resource consumption of the upper layer links becomes an important problem that has to be solved. The host servers must retrieve data from the storage servers, all of which are connected by the storage area network (SAN). In turn, each one of these storage resources is segmented into a number of virtual disks. In a centralized storage scheme where the SAN switches connect to the root layer switches, re-fetching the data from the storage server may consume too much upper layer resources.

V **CONCLUSION**

In this paper, we proposed a TRVMPO algorithm for optimizing bandwidth consumption with reliability guaranteed in VMP problem in cloud data centers. We formally described a reliability model and a bandwidth consumption model, and deduced the optimization objective function. Leveraging both theoretical demonstration and experimental evaluations on different settings, our proposed approach was proved effective and efficient in solving traffic-aware and reliabilityguaranteed VMP problems. Moreover, the TRVMPO algorithm can also be exploited in similar resource assignment problems with other optimization objective such as energy

consumption of physical nodes. An optimal algorithm is presented to solve the problem. The experimental evaluation results show that the proposed approach consumes less network resources than four other representative approaches.

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