ISSN : 2231-0711
N.Navatha Kumari et al | IJCSET(www.ijcset.net) | August 2015 | Vol 5, Issue 8,309-311

Implementing the ToF Transformations for Workflows in the Multiple Cloud Environments

N.Navatha Kumari[1], Dr. A.P.Siva Kumar[2]

[1]*Post-Graduate Student, Department of Computer Science and Engineering, JNTU College of Engineering (Autonomous), Anantapur-515002, AP, India*

[2] *Assistant Professor Department of Computer Science And Engineering, JNTU College of Engineering (Autonomous), Anantapur-515002, AP, India*

Abstract: **Due to the wide range use of cloud computing services (SaaS, IaaS and PaaS) in real life utility apps, the performance and monetary cost optimization techniques were leads to open a new research area in cloud computing. In general, the process workloads, cloud offering and user expectations are different from workflow to workflow. In this case, the existing ad-hoc resource optimization techniques were failed to identify the reliable optimization values. To overcome this problem, in this paper it introduced a ToF transformation technology to optimize the workflows in multiple clouds. This approach will consider each workflow as a DAG and executes in a separate thread to determine the possible optimizations with each individual configuration. Experimental result are showing that our approach is assessing the possible optimize values for each dynamic configuration.**

Keywords: Cloud Computing, Resource Optimization, DAG's, workflow

1. INTRODUCTION

Cloud computing is a tremendously bright and highly potential technology that facilitates the enterprises to reduce the operational expenditures as in the context of increasing the overall performance. Although cloud computing emerged and has been distributed and utilized in the computing productivity, the security level in cloud computing is even at the level of immaturity and demands larger research focus. Its pay-as-you-used pricing scheme has attracted many application owners to either deploy their applications in the cloud or extend their home clusters to cloud when the demand is too high. Figure1 shows the basic cloud architecture with multiple user groups, organization and individuals.

Costs of Cloud services are often very high. Hence it is necessary to optimize the cost of operations that are associated with the cloud services. In the cloud performance and cost are non-trivial tasks because of the interconnected factors.

As these systems are ad hoc in the sense and they fail to capture the optimization opportunities in various user requirements, workflows and cloud offerings. So a fixed sequence [2] of operations is used in workflow transformation operations to minimize cost along with the satisfying performance of each and every workflow but it can be effective for a few workflows and cloud offerings, and ineffective for others. An extensible workflow [1] framework is design for different and even developing requirements of user, cloud offering and workflows to overcome this limitation.

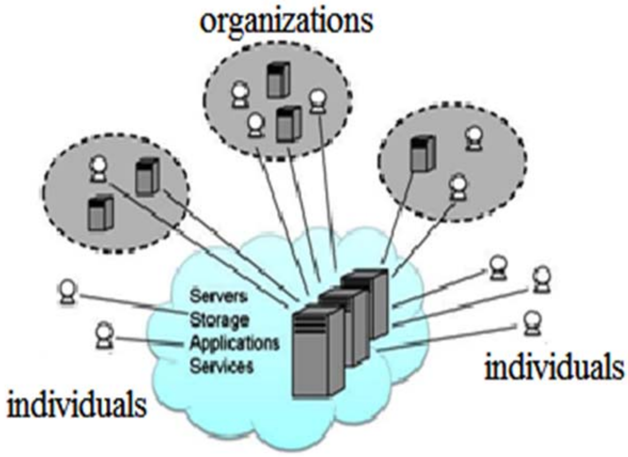

Fig1:Basic cloud architecture

As the above process work for single cloud, in this paper it introduced a ToF transformation technology to optimize the workflows in multiple clouds [4]. This approach will consider each workflow as a DAG and executes in a separate thread to determine the possible optimizations with each individual configuration. Experimental result are showing that our approach is assessing the possible optimize values for each dynamic configuration.

2. RELATED WORK

cloud computing platforms has emerged as important computing technology and its pay-as-you-used cost structure which enabled the providers to offer computing and storage service on demand and pay for the resources just as utility computing. For the system optimization the monetary cost has become one of the important metric. A workflow management [3] system should balance the cost and performance. In recent days, these performance and cost optimizations are one of the important research topics in cloud workflows.

Costs of Cloud services are often very high. Hence it is necessary to optimize the cost of operations that are associated with the cloud services. In the cloud performance and cost are non-trivial tasks because of the following interconnected factors. First, every cloud users have different requirements on process of performance and cost. In existing studies [2], [5], many of people have focused on minimization of the cost to satisfy the performance [6], [7]. Second, different clouds offer different structure of cost for workflow executions, yet from the same cloud provider; there are several types of virtual machine with different prices and computing capabilities. Third, as we observed in previous studies workflows have different computational I/O characteristics and complicated structures. All these factors used for general and effective approach for cost and performance optimizations.

Most of the above systems are ad hoc in the sense and they fail to capture the optimization opportunities in various user requirements, workflows and cloud offerings. Here they used fixed sequence [2] of operations in workflow transformation operations to minimize cost along with the satisfying performance of each and every workflow. It can be effective for a few workflows and cloud offerings, but ineffective for others. All those studies potentially lose optimization opportunities for performance and cost.

To overcome the limitations of the above approaches, an extensible workflow framework is design for different and even developing requirements of user, cloud offering and workflows.

The following are the three design principles of the frame work:

1. The framework should have an extendable ability to optimize the workflows and it should capable of adapting various workflow structures and cloud platforms.
2. The framework will have common optimization techniques for various requirements on cost and performance constraints.
3. For online decision making the frame should be light weight.

But these design principle work for the single cloud.

3. PROPOSED WORK

ToF based Cost Optimization in Cloud

By refering the above three design principles; we propose a transformation-based optimization framework (ToF) for workflows in the cloud which will work for multiple clouds [4], [8]. ToF will optimize the cost and performance of workflows in the cloud; workflow is modeled as a DAG (directed acyclic graph) [9].ToF transformations are divided into two types

1. Main schemas
2. Auxiliary schemas

Main schemes are one of the transformation operations; these are used to reduce the monetary cost for workflows. The main schemes are as follows

- Join together
- Demote

Auxiliary schemes are also operations for transforming workflows; these are used to convert workflows into DAG. The auxiliary schemes are as follows

- Divide
- Promote
- Move
- Co-scheduling.

These six transformation operations are used to optimize the cost. The main schemes are more important in workflow operations and the auxiliary schemes operations support the execution of the main scheme operations. The transformation model of workflow is responsible for performing the various transformations of workflows, while the execution time of action is specified by the planner graph (DAG).

Join together (J): This operation performs on those two vertices when same type of instances is assigned to those vertices, at the end of completion of one vertex another is assigned to start (shortly).

Demote (D): This operation performs on a particular vertex by demoting the execution to a cheaper instance which will reduce the cost at the risk of a longer execution time.

Move (V): The Move operation moves a task subsequently to the end of another task to give chance for main schemes to reduce cost.

Divide (Di): This operation divides a task into two, which is same as suspending a running task which can make room intended for more urgent task which is assigned to the similar instance type.

Promote (P): The Promote operation is a dual operation for the Demote operation. It promotes a task to a better instance for the benefit of reducing the execution time. The implementation of this operation is similar to demote operation.

Co-scheduling (C): Some types of instances can afford many tasks running at the same time. The Co-scheduling operation is to run many tasks which contain similar start and end time and similar leftover time before it meets deadlines on the same instance.

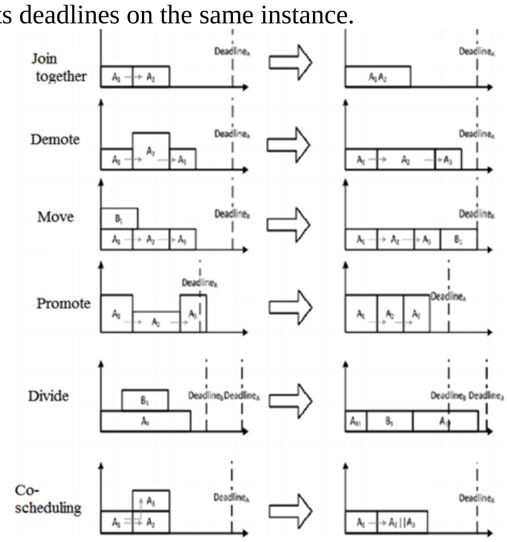

Fig2:Proposed six transformations for workflow optimization

Figure 2 show that our proposed six transformation with respective action implementations. Initially set a new workflow process for each experiment. After this the cloud will assign a new instance for the workflow execution by generating a Direct A-Cyclic Graph (DAG). These DAG will direct the execution flows for cloud instance. While executing the workflow, optimization workflow will apply the proposed 6 techniques sequentially. After optimization with these six transforms get will a report with the detailed optimized metrics.

4. Experiment and results

In order to prove, our six transformation techniques and their optimization results sake with implemented this approach with java technology application. For these experiments we used 5 workflows [10] and deployed under three individual systems, which were considered as three different clouds.

In this implemented the total application as three modules are: ToF user, ToF instance and ToF Optimizer. With help of ToF user any user can create and submit the workflows. These workflows can be received by ToF instance and ToF Optimizer to continue the process of optimization. Once user created the tasks the ToF instance will arrange execution for the submitted workflow processes. After the Optimizer initiates the execution get will the optimization results in ToF Optimizer window and the respective graph also be shown in figure 3. Figure 3 shows transformation operation cost of six operations explained above. Figure 4 shows generated cost values in our experiment for the six operations.

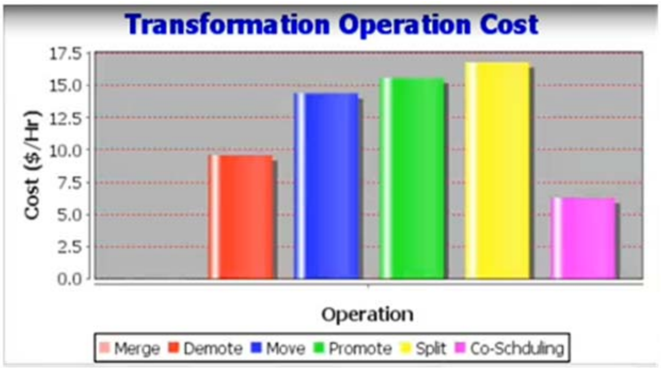

Fig3: Six transformation based optimization graph

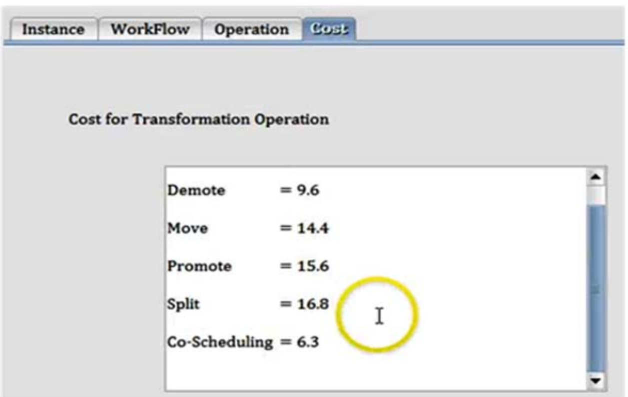

Fig4: Six transformation based optimization cost values

5.Conclusion

Performance and cost optimization for running workflow from various applications in the cloud which is the hot and important investigating topic. Due to the efficient workflow optimization requirement, in this paper proposed a new ToF transformation technology to optimize the workflows in multiple clouds. This approach will consider each workflow as a DAG and executes in a separate thread to determine the possible optimizations with each individual configuration.

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Nagireddy Navatha Kumari obtained B.tech degree in computer science engineering from Narayana Engineering College, Nellore, A.P, India.Currently pursuing M.tech in Computer Science from Jawaharlal Nehuru technological University College of Engineering, Anantapuramu, A.P, India. Her research intersts are cloud computing and data mining.

Dr A.P.SivaKumar is currently working as an Assistant Professor in Computer Science at JNTUA College of Engineering, JNT University, Anantapur, A.P, India. He received his Ph.D degree in Computer Science And Engineering from JNT University, anantapur,A.P, India. He received the bachelor's degree in 2002 and the Master's degree in 2004, both from JNTU Hyderabad, A.P, India. He has around 10 years of experience as a Lecturer/Research and Development with strong analytical background in the education sector. His research interests are Cross Lingual Information retrieval and Natural Language Processing.