

# Research Scope and Tools for Workflow Scheduling in Cloud Environment

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**Abstract:** Workflow is a prototype that executes the behavior of scientific and engineering applications for which the sequence of tasks needs to be automated based on the input parameters specified. Difficulties arise for CSPs primarily during the execution environment due to its direct impact on various QoS parameters. Existing workflow scheduling techniques has research focus with dimensions that include undetermined demands, task failure, delay cost, ambiguous deadlines, bandwidth, cache inclusion, scheduler policies, VM cycles, QoS impact, OS support, fault-tolerant and virtualization level. The comparative analysis made in this paper for workflow scheduling strategies and tools used in the cloud environment towards QoS parameters would have a greater impact on industry task automation which in turn provides the researchers to set their objectives and tools to be used in-order to bring forth new approaches and solutions. This paper can be extended considering the research scope given in the comparative analysis and the data size pertaining to each task in workflow and data migration issues which cannot be done without cost, legal policies and technical issues.

**Index Terms:** Cloud Computing; Cloud Service Providers(CSP); QoS(Quality of Service); Virtualization; Workflow Scheduling.

## I. INTRODUCTION

Cloud Computing [24] pivotal through virtualization technology plays a role in satisfying the on-demand characteristic of the cloud environment. The virtualization layer could be applied to the machine via hypervisor tools which are already available in the market. There exists various open source and licensed tools that gives support for the cloud environment. The major organizations that provide various cloud services [23] are Google, Amazon, IBM, Microsoft etc., Growing number of applications on the mobile platform has brought many challenges, and they are being undertaken to provide seamless services to the consumers. The services were offered either directly through CSP or cloud broker. Each organization develops their SLAs for each service they offer considering the marketing requirements and utilization demand. Workflow scheduling [26] requires a special attention for CSPs in-order to improve their automation process to be effective and efficient, considering all the possibilities supporting dynamic type with QoS met.

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The collection of policies to regulate the order of task to be executed by a compute engine is referred to as scheduling process. Scheduling in the cloud environment play a major role for CSP in terms of cost, policies defined, VM type, service type, QoS parameters, load-balancing, energy efficiency, data migration, replication factor, availability, execution, application type, pricing model, constraints enforced. Any CSP has to provide a strong support for managing the demand with respect to backup of audits, data flow process, lock-in issue, security mechanisms, scalability, and validation. So, the need of scheduling strategies and its issues has a continuous focus for the CSPs to move next level of enhancement. Cloud scheduler is responsible for managing the resources and allocating the VM instances based on the consumer needs. The Figure 1 illustrates the generalized process involved in cloud scheduling approaches. The complex task performed by any CSP is the resource management which has an impact over scheduling strategies applied to the execution environment.

The guidelines developed for resource management need to achieve the objectives towards optimization. CSPs have to maintain a global and consistent state information in-order to manage allocation and de-allocation of resources i.e. auto scaling should be done efficiently. The scheduling strategies implemented by researchers so far arrive at optimal or approximate solutions in the cloud environment. The cloud models [21] developed for various needs supported with number of open source tools [25] always pave a way towards the enhancement of resource management and automation in real-time environment.

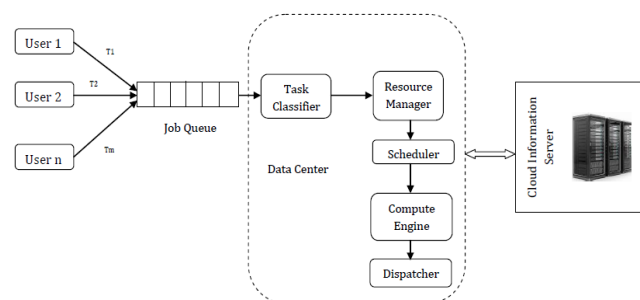


Fig. 1: Scheduling Process in Cloud Environment

## II. WORKFLOW SCHEDULING IN CLOUD

Workflow scheduling is the process of resource allocation to single or batch jobs based on the application types and QoS requirements in the cloud environment. Dynamic scheduling support should be achieved by the CSP to meet the real-time needs and also the continuous

change in the state of the VM instance strive towards strong approach to meet all the challenges. The cloud scheduling categorization [22] can be viewed as depicted in the Figure 2 and analysis compared with input and output parameters along with tools are shown in Table I below.

The workflow scheduling hierarchy proceeds with the DAG (Directed Acyclic Graph) or non-DAG input representation that decides the flow of task execution along with the dependency levels. Next, the resources required are mapped to tasks for execution for which the VM instance is needed. All these together provide the hierarchical workflow model that achieves the process automation for the specific application.

### III.CONCLUSION & FUTURE WORK

From the literature survey we unearth the following issues with respect to workflow scheduling, they include performance degradation, undefined QoS, low bandwidth, cache inclusion to focused, increased response time, resource failures, availability, cost, security, communication faults, attacks, lack of scheduler policies, and lack of updation in number of VM cycles. The research scope can be extended towards data size and data migration issues and a well-defined technique could be imposed for efficient load balanced workflow scheduling process. Further, we would like to focus on automating VM execution environment efficiently considering the parameters like VM performance variation, delays, cost, and cloud characteristics.

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