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VIRTUALIZED CLOUDS IN REAL-TIME SCHEDULING

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Abstract—The success of cloud computing makes an increasing number of real-time applications such as signal processing and weather forecasting run in the cloud. Meanwhile, scheduling for real-time tasks is playing an essential role for a cloud provider to maintain its quality of service and enhance the system's performance. In this paper, we devise a novel based scheduling mechanism in cloud computing environment to allocate real-time tasks and dynamically provision resources. The experimental results indicate that can efficiently solve the real-time task scheduling problem in virtualized clouds.

Keywords—Real-time, Virtualized Cloud

I. INTRODUCTION

Nowadays, cloud computing has become an efficient paradigm to offer computational capabilities as services on a "pay-per-use" basis. Meantime, the virtualization technology is commonly employed in clouds. This technology has brought ample opportunities for scalability, cost-efficiency, reliability, and high resource utilization. It is worthwhile noting that many applications deployed on clouds have the real-time nature in which the correctness depends not only on the computational results, but also on the time instants at which these results become available.

In order to obtain high performance for running real-time applications in clouds, scheduling plays an essential role, in which real-time tasks in these applications are mapped to machines such that deadlines and response time requirements are satisfied.

In the scheduling process based on agent technique, multiple individual agents are capable of composing a multi-agent system, in which these agents interact with each other to accomplish the goal of the system. To facilitate interactions, the ability to cooperate, coordination, and negotiate with each other is required. Coordination is the process of achieving the state in which actions of agents fit in well with each other.

Our work deviates from traditional scheduling algorithms in the literature by designing and implementing a novel scheduling mechanism based on an intelligent agent approach and then develops a corresponding dynamic scheduling algorithm for real-time tasks executed in clouds.

Contributions – The major contributions of this work are summarized as follows:

- We designed a scheduling mechanism based on an improved contract net protocol.
- We developed a scheduling algorithm in virtualized clouds for independent, real-time tasks.
- We investigated a dynamic scaling up method used for our cloud to further enhance the schedulable.

The rest of this paper is organized as follows. The related work in the literature is summarized in Section 2. Section 3 formally models the dynamic real –time scheduling problem in virtualized clouds. In Section 4, the scheduling mechanism is presented. The Modules of this paper are given in Section 5. Section 6concludes the paper with summary and future directions. References are represented in section 7.

II. RELATED WORK

Up to now, great deals of scheduling strategies have been developed in a wide range of application domains. Scheduling algorithms can be either static(i.e., off-line)or dynamic (i.e., on-line). In static scheduling algorithm, assignments of tasks and the time at which the tasks start to execute are determined a priori. They are usually developed for periodic tasks. Whereas the arrival time of aperiodic tasks is not known a priori and with timing requirements (i.e., real-time), the tasks must be scheduled by dynamic scheduling strategies.

Specially, there exist many scheduling algorithms that were designed for cloud computing environment. R.Buyya [1] suggested a resource provisioning and scheduling strategy for real-time workflow on IaaS cloud, in which the particle swarm optimization technique was employed to minimize the overall workflow execution within timing constraint. Malawski [2] presented several static and dynamic scheduling algorithms to enhance the guarantee ratio of real-time tasks while meeting QoS constraints such as budget and deadline.

I.Goiri [3] proposed an energy-efficient and multifaceted scheduling policy, modeling and managing a virtualized cloud, in which the allocation of VMs is based on multiple facets to optimize the provider's profit.

However, the aforementioned algorithms cannot efficiently address the large-scale dynamic scheduling issue. It should be noted that in clouds, both tasks and resources are dynamically varied. To be specific, most of tasks arrive in an aperiodic mode and resources changed with the variation of system workload. Thus, the scheduling algorithms that are used to allocate tasks and adjust resources are very essential to enhance the system's schedulable and utilization in dynamic cloud environment.

G. Lange [4] studied a new approach to modeling well scheduling processes in oil and gas industry using the notion of virtual enterprise with intelligent agents and contract net protocol in multi-agent systems technologies, which efficiently assists in the scheduling of resources across the well life cycle. In this study, we investigated a novel scheduling based on an improved CNP model to address the real-time task scheduling issue in virtualized clouds.

III. MODELS AND PROBLEM FORMULATION

In this section, we introduce the system model, notation, and terminologies used throughout in this paper.

SYSTEM MODEL

In this paper,the target systems is a virtualized cloud that is characterized by an infinite set$H= \{h_1, h_{2,}\}$ of physical computing hosts providing hardware infrastructure for creating virtualized resources to satisfy users requirements.

In this paper, we assume that each task cannot be preempted while executing, thus one task can only be allocated to one VM that cannot be shared by another task if these two tasks have overlap in terms of execution.

SCHEDULING OBJECTIVES

In this work, we take task guarantee ratio and priority guarantee ratio and priority guarantee ratio as two main scheduling objectives .Regarding the real-time tasks as possible before their deadlines. Moreover, if the system cannot finish all tasks due to heavy workload, our scheduling algorithm tries to finish tasks with higher priorities. Consequently, we have the objectives modeled as follows:

(1)Task Guarantee Ratio (TGR)
(2)Priority Guarantee Ratio (PGR)

IV. SCHEDULING MECHANISM DESIGN

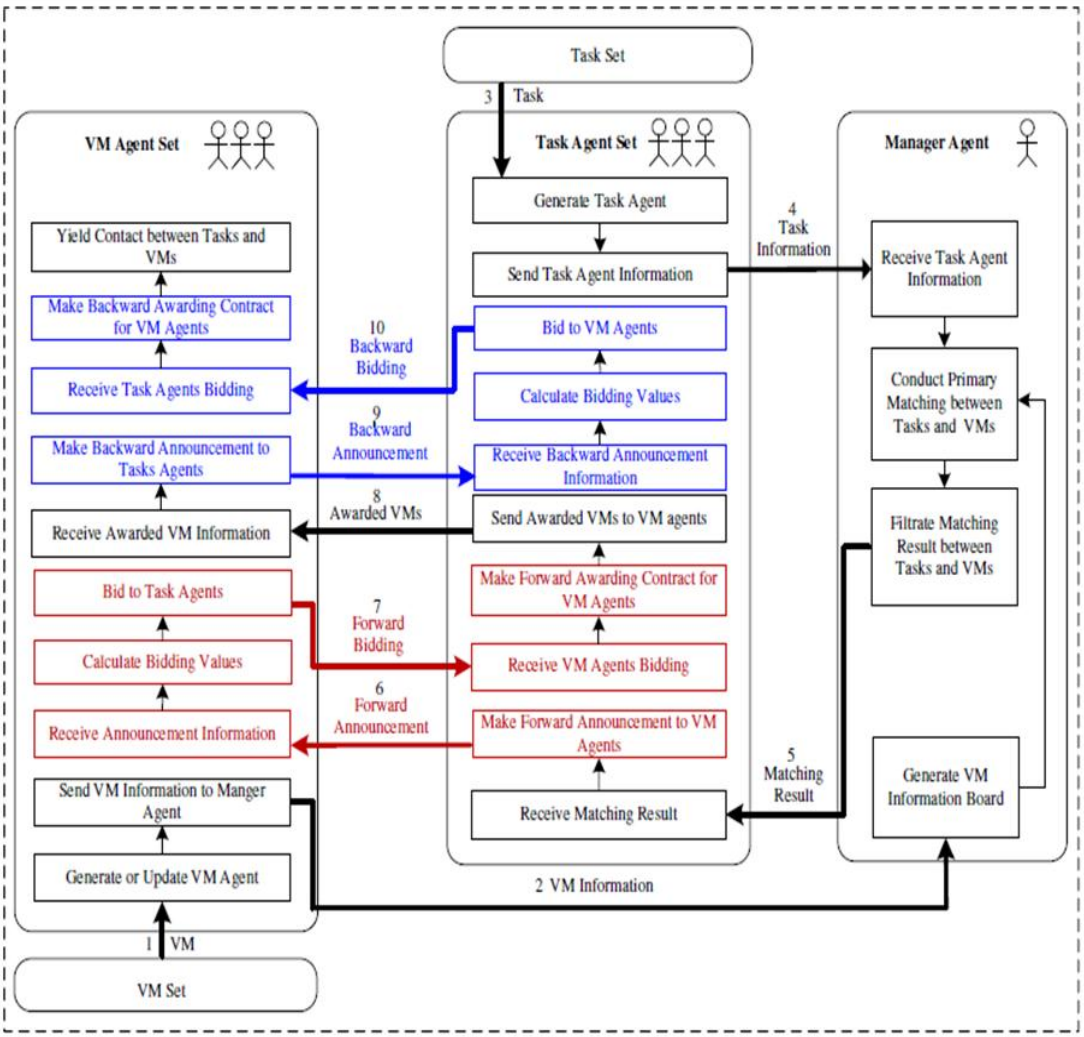
On the design of our scheduling mechanism, we attempt to employ a kind of market-like mechanism-contract net protocol (CNP) to complete task scheduling in virtualized clouds. The CNP model allows agents to coordinate and produce desirable system-wide behavior.

AGENT DESIGN

In this study, we design three kinds of agents, i.e., task agent, VM agent, and manager agent. Each of them works based on their own rules and they cooperate with each other to finish the action process of CNP.

A task agent yields with the arrival of the task and disappears with the finish of the task. A VM agent yields when the VM is established, and dies out when the VM is destroyed. However, the manager agent is always existent. The VM agents constantly update their own information and release their information to the manager agent.

- T^A-Task Agent
- V^A-VM Agent
- m^A-Manager Agent



V. MODULES

5.1 Employee Info Module

This module deals with the management of the employee information such as the personal and professional details such as name, qualification, skill, experience, login id, password, etc.,so that it can be easily added to the database with any duplication of the data.

5.2 Administration Module

This module deals with the management of the employee information such as the hiring of the eligible candidate, payments criteria, his personal information maintenance, approval of new employee, send auto generated password to the employee through the mail etc.

5.3 Project Management Module

This module deals with the management of the projects related with the employee like-projects that were past deal, current projects in his account, client, project start date and completion date, project deadline etc.

VI. CONCLUSIONS AND FUTURE WORK

In this study, we investigated the problem of scheduling for aperiodic, independent real-time tasks in virtualized clouds and proposed a novel dynamic scheduling algorithm. Again, we sufficiently considered the elasticity of clouds and proposed a scaling-up policy to dynamically add VMs so as to enhance the system schedulable.

In our future studies, we plan to address the following issue: we will implement a new scheduling mechanism in which communication and dispatching times are taken into account.

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