Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 3, Issue. 12, December 2014, pg.140 – 145

RESEARCH ARTICLE

Advance Reservation of Resources in Workflow System

Lalit
Student, Guru Nanak Dev University, Amritsar
lalit2630@gmail.com

Dr. Hardeep Singh
Professor, Guru Nanak Dev University, Amritsar
hardeep_gndu@rediffmail.com

Abstract- This is related to reserve the resource in advance in "Workflow scheduling" of cloud computing. The problem with the traditional allocation of resource is that the resource may be not available when needed and the requested application will be rejected. To overcome this problem, an advance reservation technique is used. Various techniques are used to reserve the resource in advance such as ECA rule, HAARS, Co-coordinator based, Neighborhood etc. There are two main factor of resource reservation in advance

1) ***Start time of Resource Allocation***
2) ***Resource utilization Time.***

This paper shows new approach based on time system which are used in grid system but not in workflow system. The implementation of this paper is done in Netbeans technology. This paper also shows the existing technology for the advance reservation of resources and also purposed new methodology for the advance reservation of resource.

Keywords: Workflow, Scientific Workflow, ECA, Alternate offer protocol, coordinate based reservation, control flow

I. INTRODUCTION

Advance Reservation mechanism was introduced in Grid environments to provide time Quality of Service requirements for time critical applications. Also there are applications that need resource coordination namely collocation and workflow, which benefits from this capability. There are many algorithm and method for advance reservation but not for advance reservation of resources in Workflow System.

Advance resource reservation means to reserve the resource in advance so that any machine on the network does their work without any problem. Suppose if machine complete their 95% process and remaining 5% is depend on the resource which is not available at that time then 95% work done by the machine is wasted. Due to this; effort, time and other factors

done by machine have totally wasted. To overcome this problem, an advance resource reservation is deploy in workflow system.

The concept of the ARR is that the machine send a request to central computer (Server) for reserve the resource in advance. The machine mentioned the time to reserve the resource as well as total time to spent on using the resource. After the request send by machine, the central computer (Server) check that the resource is available or not available at the time mentioned by machine. If resource is available then resource shall be temporary "Lock" and if resource is not available then machine need to resend the request with different time slots. The Advance resource reservation have some limitation that it tends to low resource utilization because most of the time resource will be "Lock" and machine can never use the resource when the resource "Lock". To overcome this problem we need to increase the quantity of resource in network but due to that cost factor will be increase but we focus on advance reservation of the resource so that we ignore this limitation.

Concept of Workflow

The concept of a workflow is applied to carry out a sequence of tasks that can be represented by individual stages. This concept is often utilized in the area of image processing. The output from a given stage is fed into subsequent stages, and becomes the input required to carry out a specific process. This process continues sequentially until the final stage is complete.

Workflow management is work like a pipeline concept i.e it divide the system into number of stages and each stage perform its own operation or function and transfer the output to next stage as a input. The Research work for WFMS is on going on Business Process and Scientific study model.

Scientific workflow is concerned with the automation of scientific processes in which tasks are structured based on their data and control dependencies. The scientific workflow systems consists of two elements in the grid workflow management system namely workflow design and workflow scheduling.

Workflow Scheduling

In workflow scheduling, different sub tasks of a bigger task are allocated resources in such a way that some pre-defined objective criteria is met. There are various problems in bioinformatics, astronomy and business enterprise ,in which a set of sub tasks is executed in a particular sequence in order to carry out a bigger task. In general, a workflow application requires series of steps to be executed in a particular fashion. These steps have parent child relationship. The parent task should be executed before its child task. The parent task is linked to child task according to set of rules .

II. RELATED WORK

In [1] Ponsy R.K. Sathia Bama et al. (2013), they have employed the Bipartite-based Heuristics Aware Advanced Reservation and Scheduling (HAARS) mechanism that select and reserve the resources from Grid/Cloud environment in an advance and near optimal manner. They use the open source software's such as PluS and Haiza for performing advance reservation in the Grid and Cloud environment. For Grid environment they use PluS software and for Cloud environment they use Haiza software.

In [3] Lovejeet Singh et al. (2013), This papers shows the workflow system with cloud computing. Cloud Computing enables the procurement of large amount of computational resources on demand by employing pay-per-use model. It delivers computational resources with the help virtualization technology. It shows new way to store data and run applications. Instead of storing data and running application on an individual desktop computer, everything is hosted on the Cloud. It allows us to access all the documents and run applications from anywhere in the world via the Internet.

In [4] M. Lakshmi Kantham et al. (2012), The author gives their concept based on cloud where each cloud contains its own coordinator and handle their working itself. In this technique they give an architecture that contains the "Cloud Exchange Unit (CEU)". Cloud Exchange Unit act as a controller to control the request to and from the cloud.

In [5] Derek J. Walvoord et al. (2012), This paper describes the concept of Workflow. The concept of a workflow is same like a pipelining concept that applied to carry out a sequence of tasks that can be represented by individual stages. The output from a given stage is fed into subsequent stages, and becomes the input required to carry out a specific process. This process continues sequentially until the final stage is complete. In this paper, Workflow framework was implemented in the Python programming language due to its object-oriented oriented.

In [7] Achilleos K. G et al. (2012), This paper shows the application domains for Scientific Workflow management system. There are various domains like Health Science, Biology, Ecology, Genetics, Botany, Physics, Economics, Music etc. are list in this paper. Nowadays scientists work in e-science environments and carry out *in* silico experiments.

In [8] Navjot Kaur et al. (2011), This is a base paper of my thesis. They mentioned all the algorithms (like cost based, budget constraints, best effort based, QoS based etc) but not explain and compare. They explain their new approach based on "Time Based Management" and Pareto Analysis (80-20 rule). They used algorithm for that. They also introduced "Urgency score" and "Importance score".

In [9] Khine Khine Htwe et al. (2011), The author of this explain the concept of Workflow system with its own specification. In this paper, A Petri nets model has been proposed for workflow of academic private cloud environment. The main focus of author is to concerned of mapping from workflow to Petri net based workflow model, which incorporates the control flow and data flow coordination, and an integrated workflow model can be obtained by integrating of services from private cloud and public cloud.

In [10] Enda Barrett et al. (2010), The author explain the Workflow Architecture, tells about the scheduling of workflow and also give the genetic algorithm. The scheduling of workflow applications involves the mapping of individual workflow tasks to computational resources, based on a range of functional and non-functional quality of service requirements. Workflow applications require extensive computational requirements, and often involve the processing of significant amounts of data. Furthermore, dependencies that exist amongst tasks require that schedules must be generated strictly in accordance with defined precedence constraints.

In [11] Li Hangbiao et al. (2010), This paper actually describe the concept of Scientific Workflow and three open-source scientific workflow engine such as Kelper, Taverna and Triana, illustrated on how to they are work , how to modify ,how to implement. This paper describe the term scientific workflow engines, usually packed with hundreds of kind of components that have different function example text processing, image processing, web services and so on. This paper shows users can also create new components by extending java classes from source code if they are familiar with java.

III. ADVANCE RESERVATION TECHNIQUES

A. ECA Rule

Users must reserve these resources in advance before use them. Present solutions need users confirm the absolute start time of reservation before the reservation which is impossible in practice at most time. But they can often estimate the relative time to start reservation after a specific event, e.g. beginning or finishing a task. As a part of Shanghai Grid, they develop an ECA rule-based workflow management system (EWMS) which can serve for arranging the relative start time of advance resource reservation as users demand.

There are three reason to use ECA(Entity Condition Activity) rule

- It is easily understood by end-users.
- It can express complicated logical relationship of web services.
- It fits in with graphic realization.

Definition : An ECA rule-based workflow model (EWM) is an seven-tuple (*E,C,*A, *R, LC, F, D*O) :

B. Alternate offer protocol

Alternate offer protocol is used in "Aneka Resource Reservation". The advance reservation capability in Aneka is enabled by two components, the Allocation Manager at the executor end and the Reservation Manager at the scheduler end.

The Allocation Manager is associated with a policy object that encodes the utility function of the node. For example, this may specify a maximum duration that can be specified for a reservation request at the node level.

The Reservation Manager determines which of the reservation request coming from users are to be accepted based on factor such as feasibility, profitability or improvement in utilization. For this reason,it is associative with a QoS Policy object that represents the reservation policy at the level of the entire system. For example, this object may specify a minimum reward for considering a reservation request.

C. Heuristics Aware Advance Reservation and Scheduling

The heuristics based resource scheduling algorithm generates the possible schedule in a periodic interval. It is based on the assignment of jobs to resources based on the user job requirements. It builds all possible combinations of jobs with available resources with the objective of minimizing makespan and flow time value. The proposed deterministic heuristic is to obtain

an optimal matching between jobs and resources by modeling the job-resource scenario as a bipartite graph. The objective of the proposed algorithm is to select a resource for each job in such a way that flow time and makespan is minimized.

The Bipartite-based Heuristics Aware Advanced Reservation and Scheduling (HAARS) mechanism that select and reserve the resources from Grid/Cloud environment in an advance and near optimal manner. The proposed mechanism made use of the open source software's such as PluS and Haizea for performing advance reservation in the Grid and Cloud environment. The proposed approach guarantees the availability of resources during the application execution, and also it achieves the user required Quality of Service (QoS) requirements.

It builds all possible combinations of jobs with available resources with the objective of minimizing makespan and flow time value.

D. Coordinator Based Advanced Reservation and Ranking

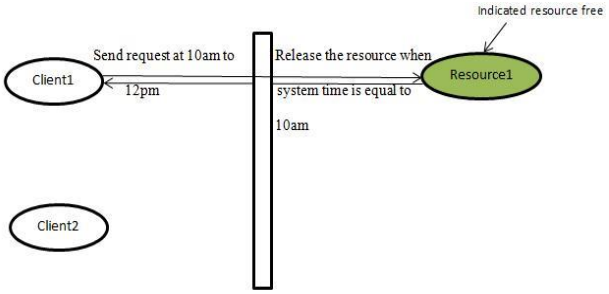
Coordinator based advance reservation approach follows the two algorithms first is for ranking the resource and second for reserve the resource. When there are multiple resources there will be a confusion that which resources should be chosen for optimal performance.

In order to provide the user's quality of service, the service level agreement between the customers and providers should be satisfied. However the resources available in a single datacenter are limited. Thus if a large demand is observed in a given time, a cloud provider is not able to deliver a uniform QoS. To avoid this scenario, they enable the application to scale it across multiple independent cloud datacenters by forming federated clouds. In such a case, from the customer's point of view it is always difficult to decide whose resources they should use. To handle this case a ranking mechanism is proposed which measures the quality and prioritize the cloud resources. In this work they propose a framework and mechanism for coordinator based advance reservation and ranking of cloud resources which allows the users to book resource in advance. Advance reservation provides guaranteed delivery of resources to the right customers at the right time. The resources available in a single data centre are limited even though data centres may contain thousands of physical machines able to host tens of thousands of virtual machines when there is a large demand is observed. A single data centre is unable to provide all the requested resources. In order to satisfy the customers need some of the SLA's may be violated. The overall architecture of the system is depicted here. The cloud exchange unit also provide ranking for resources. When there are multiple resources there will be a confusion that which resources should be chosen for optimal performance. To avoid this scenario ranking algorithm is included This models acts as an improvement over existing methods already being employed.

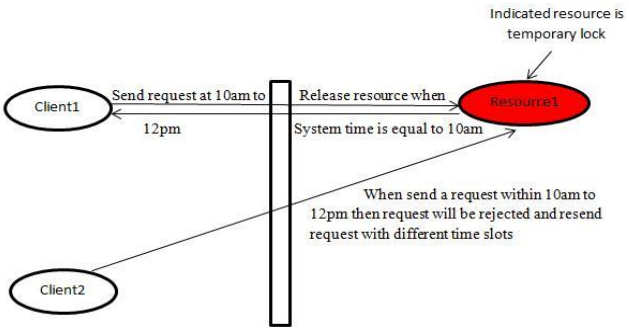
IV. NEW METHODOLOGY

The Significant part of WFS is to schedule the task or giving the resources to application in various stages. In traditional technique, the resource is allocated to application when the application request for the resource. The problem with this technique is that if requested resource is not available then the application fails.

For example if a machine doing 90% of its work and remaining 10% work is depend on resource but if that resource is not available at that moment then 90% of work done by machine is totally waist (Time and effort is totally waist). To overcome this problem we try to reserve the resource in advance so that machine can easily use their resource when they needed. But this solution have lead some disadvantage such that resource utilization is low due to reserve by machine in advance(Resource always reserve until they freeze by machine/node).



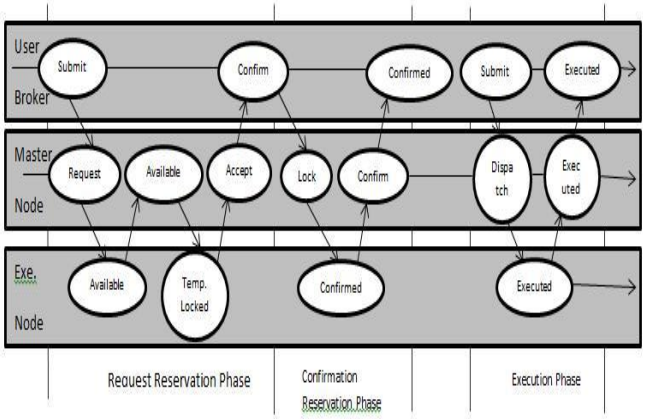
In above fig, new technology is explain graphically. If client1 request for resource 1 then client1 sent request to server then server check the request of client1 with current status of reservation table. According to reservation table, if resource1 is free then it will be 'temporary lock' for client1. When system time is equal to time specified by client1 in reservation request then resource is release for client1.



If client2 request for resource 1 then clien2 sent request to server then server check the request of client2 with current status of reservation table. According to reservation table, if resource1 is not free then request send by client will be reject and client2 need to resend the request with different time slot.

V. IMPLEMENTATION AND CONTROL FLOW

The implementation of my paper is done in "Java Beans". The implementation of my base paper [8] is done in microsoft.Net. The following figure shows the control flow of advance reservation of resources.
In request phase, user firstly send a request for reserve the resource. In confirmation reserve phase, master node check that weather the requested resource is available or not ? In execution phase, execution node give the resource to that node whose time is met with time specified in time slot.



When a proposal is finally accepted, the Reservation Manager executes a two phase commit to finalize the reservation .In the initial phase, it requests the respective Allocation Managers to "soft" lock the time slot for that particular request. A soft lock in this case is an entry for the time-slot in the Allocation Manager database which is removed if a confirmation is not received within a certain time-interval. Once all the nodes successfully acknowledge that this operation has been performed, the reservation manager then sends an ACCEPT message to the broker. If the broker then sends a CONFIRM message, the Reservation Manager asks all of the Allocation Managers to commit the reservation. On receiving their acknowledgement, a CONFIRM ACCEPTANCE message is returned to the broker. The negotiation session identifier is then used as a reference for the resource reservation by subsequent tasks.

VI. CONCLUSION AND FUTURE WORK

This paper is based on the advance reservation of resource where resources are reserve before they use. Many of the technologies are available for the Advance reserve reservation. This paper is ensure to reserve the resource before they use. Various methodologies are used by different author. Each methodology have its own functionality and purpose to use. Some of the existing methodology are given in this paper. But methodology which I have use in my paper leads some disadvantage. The resource utilization is low due to temporary lock in advance before they use. At time of temporary lock of resource, the resource will idle that mean they can't be used. But this methodology is ensuring to reserve the resource in advance without any conflict. This methodology works under only LAN circumstances. The existing technology for the advance resource reservation also have some leads to problem because every technology work its own functionality and have made for purpose. This methodology will be extent for either MAN or WAN.

REFERENCES

[1] Ponsy R.K. Sathia Bama, Thamarai Selvi Somasundaram, Kannan Govindarajan," Heuristics Aware Advance Reservation and Scheduling (HAARS) mechanism in Hybrid (Grid/Cloud) environment" 2013 IEEE.
[2] Dr S.Karthik, K.Ganga, "A Fault Tolerent Approach in Scientific Workflow Systems based on Cloud Computing", 2013, IEEE.
[3] Lovejeet Singh, Sarbjeet Singh, " A Survey of Workflow Scheduling Algorithms and Research Issues", 2013, IEEE.
[4] M. Lakshmi Kantham, "Coordinator Based Advanced Reservation and Ranking for Cloud Resources", 2012 IEEE, Conference.
[5] Derek J. Walvoord, Adam J. Rossi, Harvey Rhody, Carl Salvaggio, "Abstract Workflow Framework with a structure from motion application" , 2012 IEEE.
[6] Mingzhong Wang, Liehuang, and jinjun Chen,"Risk-aware Checkpoint Selection in Cloud-based Scientific Workflow", 2012, IEEE.
[7] Achilleos K. G., Kannas C. C., Nicolaou C. A, "Open Source Workflow Systems in Life Sciences Informatics", 2012,IEEE.
[8] Navjot Kaur, Rajbir Singh Cheema, Taranjit Singh Aulakh , "Comparison of Workflow Scheduling Algorithm in Cloud Computing", 2011 IEEE, Journal.
[9] Khine Khine Htwe, Thinn Thu Naing ,"Workflow-Based Integration of Services on a Private Cloud System", 2011, IEEE.
[10] Enda Barrett, Enda Howley, Jim Duggan, "A Learning Architecture for Scheduling Workflow Applications in the Cloud", 2010 IEEE, Journal.
[11] Li Hangbiao, LiFeng, YuWanjun, "The Research of Scientific workflow Engine", 2010 , IEEE. Conference.
[12] Dou Sun, "Orchestra designer: an open source tool for scientific workflow modeling" 2009 IEEE, journal.
[13] Atsuko Takefusa, "An Advance Reservation-based Co-Allocation Algorithm for Distributed Computers and Network Bandwidth on QoS-guaranteed Grids", 2009, NIAIST.
[14] Ankitkumar N. Patel, Yi Zhu, Qingya She and and Jason P. Jue,"Routing and Scheduling for Time- Shift Advance Reservation",2009, IEEE.
[15] Srikumar Venugopal, Xingchen Chu, and Rajkumar Buyya, "A Negotiation Mechanism for Advance Resource Reservations using the Alternate Offers Protocol", 2008 IEEE.
[16] Yi Wang, Minglu Li, Jian Cao, Ying Li, Lin Chen, Xinhua Lin, Feilong Tang, "An ECA- Rule-Based Workflow Approach for Advance Resource Reservation in ShanghaiGrid", 2006, IEEE.

