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A REVIEW ON RESOURCE RESERVATION IN GRID ENVIRONMENT

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***Abstract*— Grid is a distributed high performance computing paradigm that offers various types of resources (like computing, storage, communication) to resource-intensive user tasks. These tasks are scheduled to allocate available Grid resources efficiently to achieve high system throughput and to satisfy user requirements. Providing guaranteed QoS for Grid services using resource reservation and allocation is an important feature for today's service Grid. In this paper, we explore and explain some existing resource reservation mechanisms for resource reservation problems employed in Grid systems.**

***Index Terms*— Gird Computing, Resource Reservation, Resource Allocation, Scheduling,QoS**

I. INTRODUCTION

Grid is a hardware and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities. It is a shared environment implemented via the deployment of a persistent, standards-based service infrastructure that supports the creation of, and resource sharing within, distributed communities. Resources can be computers, storage space, instruments, software applications, and data, all connected through the Internet and a middleware software layer that provides basic services for security, monitoring, resource management, and so forth. Resources owned by various administrative organizations are shared under locally defined policies that specify what is shared, who is allowed to access what, and under what conditions [1]. The resources are typically heterogeneous, locally administered, and accessible under different local access policies. The broker operates without global control, and its decisions are entirely based on the information provided by individual resources and information services with aggregated resource information. In addition to information about what resources are available, each resource may provide static information about architecture type, memory configuration, processor speed, operating system, local scheduling system, various policy issues, etc, and dynamic information such as current load and batch queue status [2]. In most Grid scheduling systems, submitted jobs are initially placed into a queue if there are no available resources. Therefore, there is no guarantee as to when these jobs will be executed. This causes problems in parallel applications, where most of them have dependencies among each other. Advance Reservation (AR) is a process of requesting resources for use at a specific time in the future [3]. Common resources whose usage can be reserved or requested are CPUs, memory, disk space and network bandwidth. AR for a grid resource solves the above problem by allowing users to gain concurrent access to adequate resources for applications to be executed. AR also guarantees the availability of resources to users and applications at the required times. In this paper discussed various research related to resource reservation in Grid environments.

II. REVIEW OF RESOURCE RESERVATION

Lata Ghadavi, *et al.* [1] Computational grids are a new trend in distributed computing systems. In the distributed environment every node has its own operating system, own resources, own processing speed, so the responsibility of communication between different platforms have been done by middleware. For this purpose, middleware takes the jobs from users and according to the job specification resource discovery has been done by middleware as a first step then assign the job to the particular resource, which has been discovered. So the middleware is responsible for the resource discovery, resource allocation and job will be executed successively in the grid environment. To reduce the load from the middleware & provide better facility to grid for job submission, selection of best resource from all the available resources & advance reservation of resources are to be handled. In addition to processor utilization, it is important to consider the waiting time, throughput, and response times of jobs in evaluating the performance of grid scheduling strategies. To handle above mentioned issues, best resource selection & advance reservation of resources system model is designed and deployed in this paper.

Charu Sharma, *et al.* [2] proposes a resource allocation algorithm in grid environment to maximize scalability and resource utilization & to minimize the total time for task completion in effective and efficient way. This algorithm uses a mechanism to reserve the best resource for the task. Unlike traditional reserved algorithms this algorithm reserves only the best resource and hence it allows other resources to

participate in other bidding processes. This proposed algorithm can allocate the most fitting resources for tasks execution and achieve a good performance in terms of effectiveness and efficiency.

Eliza Gomes, *et al.* [3] propose a new advanced reservation approach which owners to a user the possibility to select resources in advance for a future utilization. Therefore, the main goal of this proposal is to owner a best effort feature to a user from an opportunistic configuration. In these types of environments, it is not possible to provide QoS, because, usually, there are no guarantees of resources availability and, consequently, the execution of user's applications. In addition, this research work provides a way to organize executions, what it can improve the scheduling and system operations. Experimental results, carried out through a case study, shown the efficiency and relevance of our proposal.

Seyedeh Yasaman Rashida, *et al.* [4] propose a bargaining based scheduling for resource advanced reservation using Simulated Annealing such that consumers can choose providers that best meet their requirements with low price. To achieve the goals, used a maximum conflict algorithm. The simulation results indicate that the scheduling lead to maximize number of reserved requests in their deadline and both consumers and providers obtain maximum profits

D. Ramyachitra, *et al* [5] depicts and evaluates broker selection strategies for job reservation and bidding. Especially, this paper analyzed two different types of existing algorithms simple and categorized aggregation algorithm. The first algorithm which aggregates the resource information acts as input for the categorized aggregation algorithm to assign rank for the resources. Meta broker allocates the job based on the rank. Form our assessment performed with simulation tool, we proposed advanced job reservation algorithm for resource allocation. Even though no resources are free to run the job, using this advanced resource algorithm we can reserve the resource for job allocation. In addition we proposed bidding technique when more than one users approach same resources. From the simulation results, conclude that the proposed system reduces the execution time and generates better revenue for Meta broker.

Mahamat Hassan, *et al* [6] states Resource Discovery is an important key issue in grid systems since resource reservation and task scheduling are based on it. This paper proposes a novel semantic-based scalable decentralized grid RD framework. The paper integrates ontology, Peer-to-Peer network and intelligent agents to build the framework. The framework consists of an ontology model, an agent model, and a set of algorithms for implementing the P2P architecture and searching the shared resources. how the framework satisfies grid RD features such as scalability, decentralization, dynamism and interoperability.

Christoph Barz, *et al* [7] presents ARGON, a system that integrates metro and wide area networks into Grid environments by providing advance reservations and guaranteed network services. Here, single-domain as well as multi domain network environments are considered. A major objective is to support Meta schedulers in the planning of workflows for e-science applications with demanding network requirements

Chunming Hu, *et al* [8] propose a flexible capacity reservation mechanism, called FIRST, which employs the slack time-enabled request admission control with differentiated selection strategies. We implement the prototype of FIRST in our CROWN node server, the service container of CROWN service grid middleware. The performance of the admission control algorithm for FIRST is evaluated by comprehensive simulations and implementations. Experimental results show that a better resource utilization ratio can be achieved by introducing the slack time into fixed reservation scenario, and a min-min based request selection strategy obtains a better performance compared with existing strategies.

Jianbing Xing, *et al* [9] presents, a flexible advance reservation is introduced. Its parameters can be modified according to resource status in order to fill the gaps of resource. Particular admission control algorithm for this new type of reservation is provided too. Simulation shows that it can improve performance of resource reservation in terms of both call acceptance rate and resource utilization.

Silvia Figueira*, *et al* [10] states advance reservation is an important part of grid computing. It guarantees that resources will be available at a pre-determined time to participate in the execution of a grid application. The advance reservation and scheduling of optical networks are key in guaranteeing that enough bandwidth, i.e., lightpaths, will be available for an application during a predetermined interval of time. This paper studies the behavior of two algorithms developed for scheduling multiple lightpaths requested by advance reservation. To assess the benefit of each algorithm, we compare the blocking probability introduced by each of them. The blocking probability is obtained by simulating their behavior on different topologies. This simulation is based on traces of requests generated by FONTS, our Flexible Optical Network Traffic Simulator, which provides on-demand and advance-reservation requests with different characteristics.

Jim Pruyne, *et al* [11] In particular, we build heavily on the WS-Agreement specification which provides methods for doing negotiation and creating offers and counteroffers. This is precisely the model we need for doing reservation in these complex environments. On top of WS-Agreement we define a method for describing resource reservations over arbitrary time intervals, with the ability to specify periodic fluctuation in demand, and with uncertain resource levels. Ultimately, the system is intended to support both scientific as well as enterprise resource demands.

Oleg Shcherbina1, *et al* [12] presents the applicability of a combinatorial optimization model in grid resource optimization. The advent of grid computing and demand for QoS guarantees call for a need of advance reservation mechanisms in order to coordinate resource sharing between autonomous partners. This term means the guarantee of providing specific resources at a specific time. The paper assumes that grid resource sharing can greatly benefit from the application of combinatorial optimization for improving the advance reservation mechanisms. Specifically, the temporal knapsack problem is used for modeling the advance

reservation. For improving the QoS guarantees and efficient advance reservation, a new methods based on dynamic programming and a decomposition of the temporal knapsack problem is developed.

Atsuko Takefusa1, *et al* [13] proposed an advance reservation-based co-allocation algorithm for both computing and network resources on a QoSguaranteed Grid, modeled as an integer programming (IP) problem. The goal of our algorithm is to create reservation plans satisfying user resource requirements as an on-line service. Also the algorithm takes co-allocation options for user and resource administrator issues into consideration. evaluate the proposed algorithm with extensive simulation, in terms of both functionality and practicality. The results show: The algorithm enables efficient co-allocation of both computing and network resources provided by multiple domains, and can reflect reservation options for resource administrators issues as a first step. The calculation times needed for selecting resources using an IP solver are acceptable for an on-line service.

Matheus A, *et al* [14] presents an authentication architecture utilizing a "lightweight" user-centric authentication approach. Specifically, we aim to provide mobile users with access to advance resource reservation within grid environments, and, consequently, our approach incorporates this objective. The approach, however, applies to user authentication with any grid resource or service. In attempting to overcome the limitations of mobile devices, such as limited battery power, mobile users can utilize grid environments in a transparent and secure way.

Erik Elmroth, *et al* [15] contribution presents algorithms, methods, and software for a Grid resource manager, responsible for resource brokering and scheduling in early production Grids. The broker selects computing resources based on actual job requirements and a number of criteria identifying the available resources, with the aim to minimize the total time to delivery for the individual application. The total time to delivery includes the time for program execution, batch queue waiting, input/output data transfer, and executable staging. Main features of the resource manager include advance reservations, resource selection based on computer benchmark results and network performance predictions, and a basic adaptation facility.

Arshad Ali3, *et al* [16] presented the general requirements that a Resource Management system should satisfy. The taxonomy has also been defined based on which survey of resource management systems in different existing Grid projects has been conducted to identify the key areas where these systems lack the desired functionality.

Anthony Sulistio1, *et al* [17] present new approaches to advance reservation in order to deal with the limitations of the existing data structures, such as Segment Tree and Calendar Queue in similar problems. Propose a Grid advanced reservation Queue (GarQ), which is a new data structure that improves some weaknesses of the aforementioned data structures. Demonstrate the superiority of the proposed structure by conducting a detailed performance evaluation on real workload traces.

Ming Wu, *et al* [18] investigate the effect of resource reservation on external applications as well as local jobs, and design efficient task scheduling algorithms considering the tolerance of local jobs to resource reservation. Extensive simulations and implementation experiments have been carried out to confirm our analysis results. Experimental results show that the relative slowdown metric and the failure minimization scheduling algorithms proposed in this study are practically effective and have a real potential.

Anthony Sulistio, *et al* [19] presents a Advance Reservation (AR) for global grids becomes an important research area as it allows users to gain concurrent access for their applications to be executed in parallel, and guarantees the availability of resources at specified future times. Evaluating various AR scenarios cannot feasibly be carried out on a real grid environment due to its dynamic nature. Therefore, it extends a GridSim simulation package to support AR for repeatable and controlled evaluations. This research discusses the design and implementation of AR within GridSim, together with the effects of AR from users' and resources' point of view in the experiments.

Srikumar Venugopal, *et al* [20] promote Service Level Agreements (SLAs) between grid users and providers have been proposed as mechanisms for ensuring that the users' Quality of Service (QoS) requirements are met, and that the provider is able to realise utility from its infrastructure. Presents a bilateral protocol for SLA negotiation using the Alternate Offers mechanism wherein a party is able to respond to an offer by modifying some of its terms to generate a counter offer. Apply this protocol to the negotiation between a resource broker and a provider for advance reservation of compute nodes, and implement and evaluate it on a real grid system.

RUI MIN, *et al* [21] introduces a priority and benefit function based scheduling algorithm for advance reservations. Simulations are performed to compare our algorithm with an existing approach. The results indicate that the proposed algorithm can improve the overall the performance by satisfying larger number of reservation requests.

Nadia Ranaldo, *et al* [22] presents a framework for brokering of Grid resources, virtualized through Web Services, which can be dynamically configured with respect to multiple syntactic and semantic description languages and related matching strategies. Hence, it discovers and selects resources and automatically allocates application tasks to them on the basis of both functional and Quality of Service (QoS) requirements. In particular the research presents the framework specialization, which aims to select a pool of resources whose overall performance allows for satisfying time and cost constraints for the execution of an application partitioned in concurrent tasks according to the data parallelism pattern.

III. CONCLUSION

The Grid provides ability to access, use and manage various virtual organizations heterogeneous resources across multiple domains and institutions where requests are served

from external users with local users. Due to the extremely heterogeneous and complex computing environments, availability of resources may possibly fluctuate in Grid environments. Advance reservation for grid resources allows users to gain *concurrent access* for their applications to be executed in parallel. It also guarantees the availability of resources at the specified times in the future. The goal of this survey paper is to investigate various methods for designing effective and efficient resource reservation systems for Grid environments.

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