Grid Computing: A Collaborative Approach in Distributed Environment for Achieving Parallel Performance and Better Resource Utilization

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Abstract— **From the very beginning various measures are taken or consider for better utilization of available limited resources in the computer system for operational environment, this is came in consideration because most of the time our system get free and not able to exploit the system resource/capabilities as whole cause low performance. Parallel Computing can work efficiently, where operations are handled by multi-processors independently or efficiently, without any other processing capabilities. All processing unit's works in a parallel fashioned and increases the system throughput without any resource allocation problem among different processing units. But this is limited and effective within a single machine. Today in this computing world, maintaining and establishing high speed computational work environment in a distributed scenario seems to be a challenging task because this environment made all operations by not depending on single resources but by interacting with other resources in the vast network architecture. All current resource management system can only work smoothly if they apply these resources within their clusters, local organizations or disputed among many users who needs processing power, but for vast distributed environment performing various operational activities seems to be difficult because data is physically not maintained in a centralized location, it is geographically dispersed on multiple remote computers systems. Computers in the distributed environment have to depend on multiple resources for their task completion. Effective performance with high availability of resources to each computer in this speedy distributed computational environment is the major concern. To solve this problem a new approach is coined called "Grid Computing" environment. Grid uses a Middleware to coordinate disparate resources across a network, allows users to function as a virtual whole and make computing fast. In this paper I want to focus on Grid Computing system "a virtual resource provider in a high computing environment", which is fully capable to utilize or handle the less availability of resources situation with effective load balancing techniques and enhance the proficiency of the interacting users.**

Keywords: **Distributed, Grid Computing, Load Balancing, Middleware, Proficiency, Resources, Utilize, Virtual**

I. INTRODUCTION

Grid computing is a distributed computing approach where the end user will be ubiquitously offered any of the services of a grid or a network of computer system located either in a Local Area Network or in a Wide Area Network in a spread of geographical area. Grid Computing aims is to dynamically select and allocate the computational resources such as processing power, disk storage etc according to the demands of the end users. Grid which itself show vast computational environment shows some degree of abstraction to end user in respect to allocation of resources. It is same as water and power supply grid where end users draw power or water as they need, at any time and any location without any knowledge or reference to the details such as the exact location or nature or quality of the resources being drawn. Before the grid computing came about, individual data centres had been operationalized. Before the data centres came about, each user organization maintained its own servers and its own specialized software, an expensive and redundant approach. However, individual data centres may not necessarily maintain and offers all the possible resources hardware and software. The user organizations or individual users connected to a single data centre may be able to use the resources available in that particular data centre and not the resources available in another data centre, belonging to a different organization. The concept of grid computing enables multiple data centres of the same or different organizations to be networked into a grid, so as to offer all the resources of hardware and software, in all data centres to any of the users of any of these multiple organizations, however remote they may be. Grid computing work for two distinct but related goals: providing remote access to IT assets, and aggregating processing power. The most obvious resource included in a grid is a processor, but Grids also encompass sensors, data- storage systems, applications, and other resources. Grid technology plays a significant role for the distributed working

environment where research work seems impractical or unfeasible due to the physical locations of the resources. Using a Grid, researchers in India, for example, can conduct research that relies on database across Europe, instrumentation in Japan, and computational power in the United States. Therefore, Grid computing provides an innovative, strategic approach to building and managing a lower-cost IT infrastructure that can flex to meet rapidly changing and growing computing requirements.

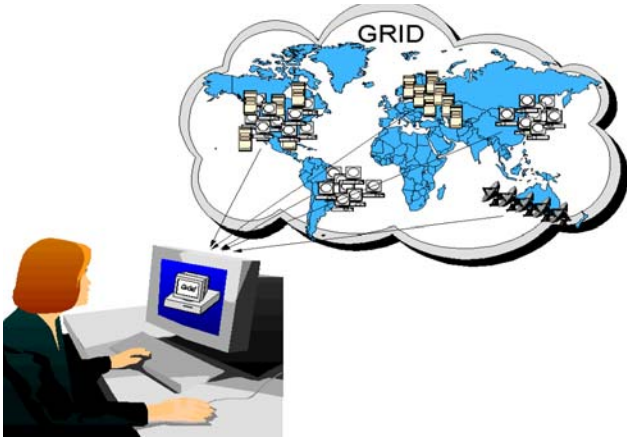

Fig 1.1 The Grid virtualizes heterogeneous, geographically disperse resources

II. Resource Utilization By Balancing Sharing And Utilization

In large distributed computing infrastructure users constantly looking or demanding resources, where required things are available widely geographically dispersed areas cause degradation in performance or not use the under utilized resources as a whole. Grid computing deployment in this situation plays an important role to improve the performance by parallel distributing the limited resources among users. Balancing of resources is one of the ways through Grid Computing map a new single system image. It is happen when scheduling of grid jobs implements or applies. It can be achieved by many ways:

- An unexpected peak can be routed to relatively idle machines in the grid. The regular access of same resources again and again in vast dispersed environment becomes difficult to manage because burden for any required resources is natural in such circumstances because every user utilizes the resource for the sake of their task completion. To eliminate such possibilities grid jobs are shifted towards or route towards idle machine to entertained end-users request.
- If the grid is already fully utilized, the lowest priority work being performed on the grid can be temporarily suspended or even cancelled and performed again later to make room for the higher priority work.

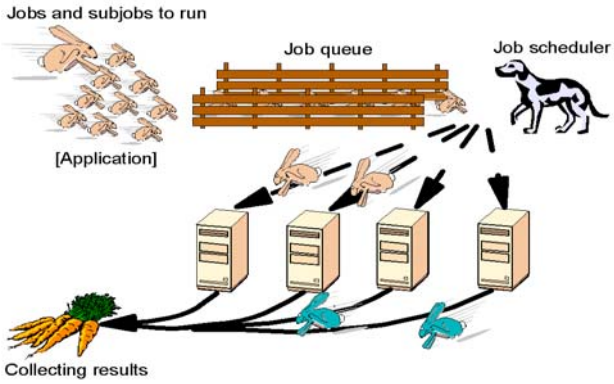

Fig 2.2: one or more jobs that are scheduled to run on grid

In a Grid system, for establishing balanced infrastructure in any organization GRAM (Globus Resource Allocation Manager) play an important role so that resources are allocated among right end-users and make availability of the resources and avoid misuse of resource by others. A GRAM job is to manage jobs request

and to execute and monitor them on remote machine. One of the main part's of GRAM is the gatekeeper. When any clients request a job submission to the gatekeeper daemon on the remote host. The gatekeeper daemon checks if the client is authorized, by mapping the client account on the system. Once authentication is over, the gatekeeper starts a job manager that initiates and monitors the job execution. GRAM interfaces to various local schedulers such as Portable Batch System (PBS), Load Sharing Facility (LSF) and LoadLeveler. Grid maintain load balancing when jobs communicate with each other, the Internet, or with storage resources, an advanced scheduler could schedule them to minimize communications traffic or minimize the distance of the communications. This can potentially reduce communication and other forms of contention in the grid.

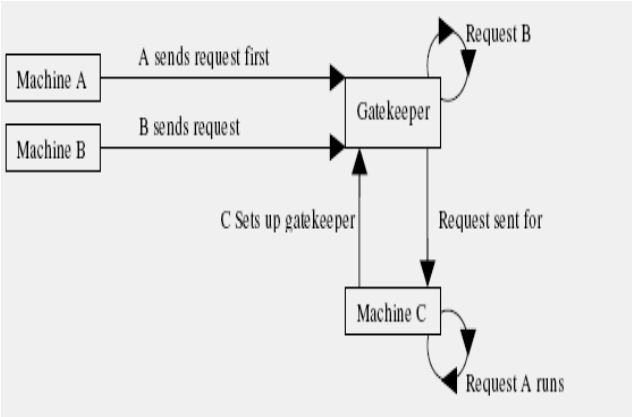

Fig 2.1 Working of gatekeeper

III. HIGH PERFORMANCE

In a Grid infrastructure maintaining high performance is complicated as well as difficult due to vast network and physically connections. The term performance means, fully exploitation of computation resources of a grid. There are three primary ways to exploit the computation resources of a grid:

- The first and simplest is to use it to run an existing application on an available machine on the grid rather than locally.
- The second is to use an application designed to split its work in such a way that the separate parts can execute in parallel on different processors.
- The third is to run an application that needs to be executed many times, on many different machines in the grid.
- Migration of tasks from one location to another to adjust workload.
- Detect available local and remote resources so that jobs are assigned to a selected resource.
- Re-arranging running computation jobs on demand.

From the System point of view, load sharing will typically increased the throughput of the Grids. It seems that a large fraction of workstations could be unused for a large fraction of time. Grid computing seeks to exploit otherwise idle workstations and PCs to create powerful distributed computing systems with global reach and supercomputer capabilities. With the migration capability, a systematic scattering of computations across processors which allows heavily loaded processors to efficiently balance their load with lightly loaded processors gives the executing Grid an opportunity to achieve a better overall throughput.

In a distributed environment, Searching and automatically categorizing vast amounts of geographically distributed information is also a difficult task in performance point of view.

IV. LOAD BALANCING

A Distributed system will have a number of interconnected resources who can work independently or in cooperation with each other. Each resource has owner workload, which represents an amount of work to be performed and every one may have a different processing capability. To minimize the time needed to perform all tasks, the workload has to be evenly distributed over all resources based on their processing speed. Load balancing concerns even distribution of workload over multiple processors to improve whole parallel computation performance. For scientific applications, computations are portioned into multiple tasks running on different processors/computers. Load imbalanced scenario occurs frequently even though the workload was

distributed even before. Therefore, dynamically and periodically adjusting workload distribution is required to make sure that all running task at different locations will finish their execution virtually at the same time, minimizing the idle time. Such load reconfiguration needs to migrate tasks from one location to another.

The essential objective of a Load Balancing consists primarily in optimizing the average response time of applications, which often means maintaining the workload proportionally equivalent on the whole resource of a system. Conceptually, load balancing algorithms can be classified into two categories:

1) Static Load Balancing
2) Dynamic Load Balancing

In Static load balancing, a task is assigned to an available resource when it is generated or admitted to the system using a fixed schema. On the contrast dynamic load balancing allocate/reallocate tasks to resources at runtime based on no priori task information, which may, determine when and whose tasks can be migrated.

V. Grid As Middleware

The grid computing middleware software will manage and execute all the activities related to identification (to find and identify the required data from data storage and servers), allocation (equal distribution of resources to end users), deallocation and consolidation of all the computing resources to the end-users transparently, as in the case of a geographical distributed resources system. Grid computing environment is a necessity,(rather than a luxury) to many end-users who cannot afford huge computational resources, both hardware and software. Therefore, any large corporate body or government organization having a large geographical spread will be essentially required to set up at least some kind of grid computing environment, so that the expensive resources of their grid can be shared and effectively utilized by all the end users. Thus, it will provide a win-win situation to both the owner organizations and end-users

VI. Grid In A Distributed Environment

Grid computing refers to cluster of computers work in a distributed environment and performed work as according to end-user request without any delay or with high performance. Distributed system refers to collection of computers called clusters. It is loosely coupled computers not able to maintain better utilization of resources because resource allocation is performed by the centralized resource manager and scheduling system cause efficiently allocation and load balancing problems occurs. To meet better utilization of resources, grid environment setup plays an important role, because grid form an integrated shape and each node that are in a grid has its own resource manager, result resources are managed individually by resource manager in each node rather than by a single resource manager in a cluster or distributed system.

VII. Conclusions

In this paper, I want to describe the role of grid computing to handle scarcity of resource in a heterogeneous distributed environment by adopting different measures and enhance the performance of the system by parallel distribution of available system resources in a controlled manner, so that heterogeneous environment will represent in a compact manner and formed a single system image.

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