Types of Grid Computing Systems and Their Features

Ved Prakash, Saleem Santan Kujur & Archana Singh

Computer Science and Engineering Department, Birla Institute of Technology, Mesra, Jharkhand 835215, India

Abstract - Grid computing has proved to be the solution for the modern day high performance computing needs of any major research activity and scientific processing of large amount of data generated in short amount of time. Grid computing systems are organized in distinct manner to cater to the different kinds of needs of the research and development community. This paper throws light upon a different kinds of grid computing systems which are utilized in different scenarios.

Keywords - Grid computing, kinds of grid computing, different grid computing, scenarios of grid computing, grid computing types, features of grid computing.

I. INTRODUCTION

A grid computing system is formed interconnecting together different kinds of heterogeneous systems composed of system composed of different hardware architectures, processors, operating systems and storage devices etc. They together form a network to function which enables resource and functionality sharing among different participants sharing surpassing the local organizational and international geographical boundaries. They have been composed and decomposed as per required by the organization with the computational requirement of teraflops range and resource sharing in real time over a intercontinental area. The computing proceeds in distributed manner where the total system may or may not be governed by a centralized server, but there exists a grid resource manager who controls coordinates and distributes the jobs in grid computing systems. The nature of resources in a grid systems is dynamic they may join the grid network or leave it as they please. This gives rise to a very unique and complex scenario for coordinated functioning of system requiring to distribute the tasks to only the current existing resources and reschedule them on the resource unavailability or failure. The grid manager has to be designed such that the job allocation and completion is optimized.

The different kinds of grid computing systems are composed as: computational grid, data grid, utility grid, collaboration grids and enterprise grids etc. The computational grid is composed to provide large amount of computational throughputs, this type of grid id often formed by the research community to solve a problem having huge computational requirements. Data grid is largely related to the on the file lifecycle management in the distributed environment. Utility grid comprises of software and sharing of a particular special resource which may computational, data or a hardware resource or device. Collaboration grid is composed by the systems and resources belonging to different organizations deciding to venture together for a project with different modules developing their part without disclosing their private functional information. Enterprise grids these are implemented under the organizations with very large ventures this facilitate the functioning among its various branches.

II. RELATED WORK

The authors of [5] give a fair amount of introductions and the grid infrastructure and technologies related the grid infrastructure is explained in the detailed way and its functioning are described. The authors proceed to build the idea of what is grid computing in the current and upcoming scenarios. The authors in [7] provide and describe various scenarios exiting in the grid computing systems. They also discuss how they affect the existing scenarios and the solutions created and prosed to handle different scenarios.

III. THE GRID COMPUTING SYSTEMS

The grid computing system one of very useful and persistent technology of the day, it provides a method to create a cost effective virtual super computing system. The grid system is very complex structure to manage, coordinate and control. The innate nature of the grid system i.e. its heterogeneous and dynamic composition makes the implementation of the functional distributed system complex. At the very base level the grid system is composed of many types of architecturally distinct hardware providing support for running different kinds of operating systems.
running situated distant geographic time zones interconnected with different kinds of networks. This forms the fabric of the grid computing system. The system is implemented using the middleware which provides a common platform for implementation and communication it is responsible for the distributed resource conjugation and security in the systems. The layer above it is implemented as the user level middleware an application existing over the user systems providing the necessary tools and services for the job submission and resource submission. The top most layer consists of the discrete applications of the such created system for whom the system was assembled.

The grid system is composed of different kinds of components[3] to support its functionality and core support systems. The components can be roughly categorized into as grid file manager, grid resource scheduler, grid information system/services, grid security components, grid interface infrastructure and the grid middleware. All these components function together form a system of grid of computers coupled together to execute the task submitted to it the functioning is illustrated in fig 2 .The tasks are submitted to the task receiver or collector of a grid system which collects and forwards the request to the grid scheduler the . The scheduler decides where to execute the submitted task i.e. on which resource so as to optimize the performance of the system. The grid information service keeps track of all the resources which are available to the scheduler at a particular moment thus the scheduler selects from the list according to some algorithm or other method and schedules the task on one or many of the resource. The problem of scheduling is NP complete thus it is never possible to optimize all parameters the algorithms utilized are modified according to the needs and network conditions to create solutions for different situations. The modification of the system also leads to variation in the services provided by the grid system thus creating different kinds of grid systems.

A. COMPUTATIONAL GRID
The Computational Grid System[2] is created to meet the high amount computational throughput required by research facility to process data produced during their research, non profit organizations, government need to process the large amount of related data together. This is a distributed system structure appearing to the user as a single entity having large computational power .The computational grid may be associated with large amount of storage which may act as a cache storage and other part may be used to store the processed data. The computation grids provide the advantage[3] in the areas as:

- Technology Improvement : Large amount of research will be able to be conducted and completed in economical costs
• Utilization of the idle capacity of the system: The computing resources attached to a computation grid efficiently utilizes idle computational capacity.
• Establishment of new problem solving technique: The computational grid provide alternate way to proceed with the huge computational requirements other than using supercomputers
• Sharing of results in huge scale: The large scale high speed grid network itself enables us to share large amount of data across the connected users and resources irrespective of the locations.

B. DATA GRID
Data Grid [5] have provided a method to share, store and maintain a resource while it is processed upon by all the participants of the grid. The data grid coupled together with the advanced computing and advance storage management technologies to constitute the high end content delivery networks. The internal P2P networks and widely distributed database management systems. The services related to high level data management, data scheduling and efficient replica management is then delivered over these established architectures. The deployment of data grid is increasing in a constant rate as after processing the data its management is the biggest challenge faced by the owner of the significant data. Many data resources [6] related to world climate changes, earth environment observations, genetic formations, highly advanced physics, astronomical observations etc require the very efficient storage and data management techniques. Adjusting the granularity of the correlated data has led to many significant observations and discoveries in many areas thus providing access to the correlated data for simultaneous analysis significantly increases the chances of observing something of importance. Furthermore replication provides a method largely reduce the access time of a particular resource contributing to decrease in load balancing and response time. Advance strategies and methods are to be employed to maintain atomicity and reliability of a particular data resource thus reliving the clients of the data maintenance concerns.

C. COLLABORATION GRID
The collaboration grids[7] promote for the inter operability among various organization collaborating together to simultaneously work on a project creating or solving their concerned parts. The data or the other resources sharing is performed in highly controlled environment such that there is no violation of access in each other domain. The sharing may be limited to ideas or the source code as per predefined thus the work is performed keeping the code of professionalism. The common consequence of this kind of grid system is that system is able to process on more than one issue simultaneously. The collaboration grids has always been viewed as the methods of great economical benefits[8] by different organizations thus moving the grids from a tool utilized by researchers to their aid, thus the business model of the grid was created. They are vastly utilized now in the study of business semantics, development of semantic web.

D. UTILITY GRID
Utility grid has emerged to be the ultimate form of grid computing having properties of all other form of the grid computing systems it has features of all above type of grid computing it aims to deliver the power of grid computing to a large base of consumers who are interested in harnessing the power of grid computing system for performing their own high performance or throughput related tasks. Here the grid power is available as a service which can be utilized are per the requirements of the consumers

E. ENTERPRISE GRIDS
Enterprise grids are established by big enterprises to coordinate the functioning among its own subsidiaries. The enterprise by its own venture establishes a high speed network of computers among its remote branches .The enterprise may establish one or more data centers to share the data among the systems. The network created is isolated, secure and has better connectivity than other networks in the enterprise.

CONCLUSION
The grid may be categorized in other ways but these are the major categories of the systems. The computing grid came into existence as need of cheaper alternative for high computation requirements but in the latter years it evolved into more useful applications. The latter categories are the result of that consequence, these days in the era of cloud computing also the grid computing system are seen as to create virtual super computers for various kinds of research and development applications. One of the major contribution is in the contribution in the biggest experiment of the world the LHC computing grid.

REFERENCES


