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Grid Computing An Overview

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Abstract*— The computing resources are continuously reducing due to increasing requirement of information processing and development of complex problems. Today, in every field computation is required and resources are needed for computation so grid computing allows to link processors, storage and many other resources of distributed computers to make efficient use of them in order to solve very large and complex problems. Grid computing helps in solving the complex problems in less time and with less cost. This paper describes evolution, advantages, disadvantages and applications of grid computing

***Index Terms*— Applications, Computing, Grid, Grid Computing.**

I. INTRODUCTION

Computing is any goal-oriented activity requiring, benefiting from, or creating computers. Thus computing includes designing and building hardware and software systems, processing, structuring, and managing various kinds of information, doing scientific research on and with computers, making computer systems behave intelligently, creating and using communications and entertainment media etc [1]. There has been a drastic change in the way we are using computing resources and services in the last few years. Many complex applications are developing or are under development which need vast amount of

computing resources. Computation is required in every field. Scientific as well as engineering problems are now becoming complex and users require more precise and accurate results in shortest time. The computational resources are decreasing continuously. The more computational power is needed in every field like earthquake simulation, climate forecasting, simulation of ocean, mathematical computation etc. Also, the problem to find adequate resources for executing the applications has been increasing constantly. Majority of resources remains idle most of the time. These idle resources can be used to overcome the problem of reduction in number of computing resources. So a computing technique is needed which can aggregate and integrate these idle resources and make them available to users for solving their problems and that computing technique is Grid Computing.

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II. EVOLUTION OF COMPUTING

Internet plays a major role in connecting people. However, Internet only connects distributed resources but does not coordinate the underutilized and unutilized geographically distributed resources for solving any complex problem. Earlier super computers were used for solving problems. They are used for performing highly calculation based operations. But they were much expensive and creating the program is not easy in the environment of supercomputers. After this, some of the other techniques came into the existence. There are many computing technique.

Some of computing techniques are:

A. Parallel Computing

Parallel Computing is a form of computation which deals with hardware and software for computation in which many calculations are carried out

simultaneously [2]. But this can be done only, where the operations are handled independently by the multiprocessors, with no need of other processing capabilities. All the processing units work parallel and increases throughput of system without any resource related problems among different processing units.

Drawbacks of Parallel Computing are:

- This is limited and effective only within a single machine.
- Also not every problem can be divided into parts and carried out simultaneously.
- Shared resources have to be used sequentially.
- Problems interdependency must also be accounted.

B. Peer to Peer Computing

A peer-to-peer computing is one in which each computer in the network can act as a client or server for the other computers in the network, allowing shared access to various resources such as files, peripherals, and sensors without the need for a central server [3].

Drawbacks of Peer to Peer Computing are:

- Peer to Peer computing has limited number of computing resources.
- Resources are homogeneous.

C. Cluster Computing

Cluster Computing is a computing in which computer clusters are created, a cluster is a type of parallel and distributed system, which consists of a collection of inter-connected stand-alone computers working together as a single integrated computing resource [4].

Drawbacks of cluster computing are:

- In computer clusters, every computer has the same hardware and operating system.
- The computers in the cluster are normally contained in a single location or complex.
- Job management system and scheduling system is centralized.

D. Grid Computing

The evolution of grid has lead to the current vision of Grid Computing, a vision of uniform and controlled access to computing resources and seamless global aggregation of resources [5]. A grid is created from some of resources which remain idle and unutilized in the network.

III. Comparison of Various Computing Techniques

Characteristics	Grid	Cluster	Peer to Peer	Parallel
System	Heterogeneous	Homogenous	Homogeneous	Homogeneous
Job management System	Distributed	Centralized	Decentralized	Centralized
Nodes	10 to millions	10 to 100k	100 to 1000	Limited Nodes
Computing	High throughput Comp-ting	High Performance Computing	File-sharing, highly parallel computing applications	Scientific computing

Table1. Comparison of various computing techniques

IV. Introduction to Grid Computing

Grid Computing is defined as a type of distributed computing which permits and ensures the sharing of aggregated resources across dispersed locations. Grid is a type of parallel and distributed system that enables the sharing, selection and aggregation of resources distributed across multiple administrative domains based on their availability, capability, performance, cost and users' quality-of-service requirements [6]. The Grid is loosely coupled, geographically distributed and heterogeneous Computers in the grid donate printers, application software, disk storage, CPU power etc. It is an infrastructure for complex computations in which remote resources are accessible for desktop, mobile phones, laptops etc through web. Grid computing provides a way

through which computer resources in organization can be utilized properly. It reduces computing cost, turnaround time of each job and increases

computing resources and also productivity. It uses a middleware layer to communicate with heterogeneous hardware and datasets. This layer is an interface between the resources and application. Its services include optimal use of resources, job execution, monitoring of progress, problem recovery and providing result back to the users.

Grid can be of following types:

- Data Grid

Data Grid provides support for management, handling, storage and discovery of large amount of data stored in various database file systems that are heterogeneous. Users need not to be concerned with where the data i-s actually located as long as they have access to data. Data grid provides access to data across multiple organizations.

- Network Grid

Network Grid provides fault tolerant and high performance communication services. Every node in the grid act as a data router between two communication points and provides data caching and other facilities to speed up the communication between such points [7].

- Computational Grid

Computational Grids are most common grids. A computational grid is a high performance computational system which consists of heterogeneous distributed resources [8].

- Utility Grid

In Utility Grid not only computation cycles and data are shared but also software and other resources are shared

V. ARCHITECTURE OF GRID COMPUTING

Its architecture consists of few layers; each layer has a specific function. There are three problems architecture for which grid computing has been successful. These are:

a) Meta computing problems [10]**:** These are **t**he problems that can be divided into large number of independent parts.

b) Mega and seamless access Problems [10]: In this, multiple data and computing resources are integrated and then used.

Loosely Coupled Nets [10]: This corresponds to functionally decomposed problems where a synchronized operation on grid is possible.

Grid Computing architecture consist of following layers:

- Application Layer
- User level middleware Layer
- Core Middleware Layer
- Fabric Layer

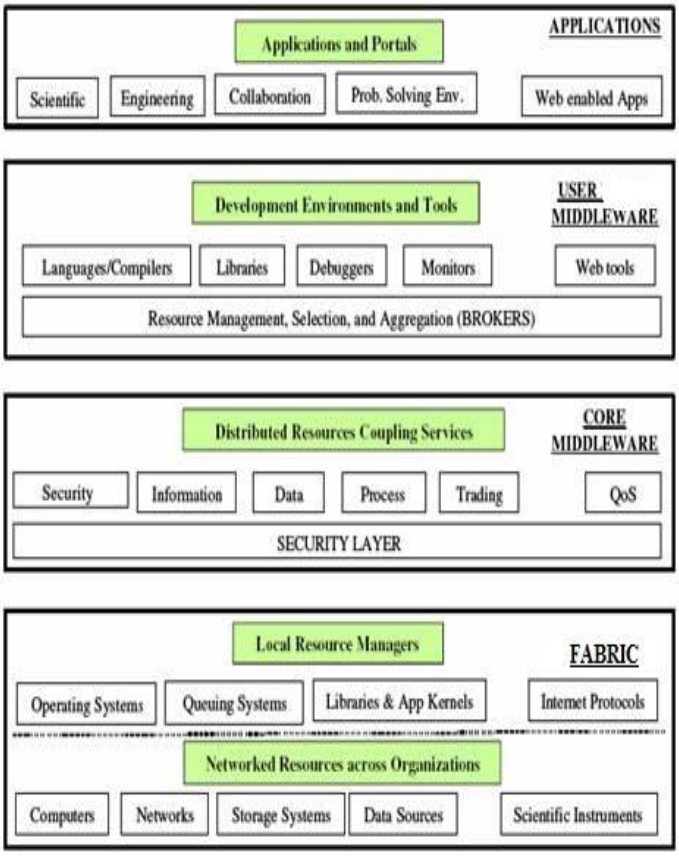

Fig.1. [13] Architecture of Grid Computing

- Application Layer

Application layer is the topmost layer of the architecture. It includes applications in science, engineering, business, Medical, Chemistry field and as well as portals in order to support the

applications. Users of the grid and interact with the application layer.

- User Level Middleware Layer

User middleware layer consist of tools like libraries, debuggers, language compilers. It consists of resource brokers that are used for resource management, Selection of resources and aggregation of resources.

- Core Middleware

This layer is responsible for management of process, resources allocation, accessing the storage, secure access of information, registry information. This layer deals with all types of security methods like authentication and authorization etc.

- Fabric Layer

Fabric Layer provides resources that are shared by the Grid like CPU time, storage, and sensors This layer helps user to find information about resources that are available for users and also manage resources.

VI. Advantages of Grid Computing

- Use Of Underutilized Resources

Applications that run on any machine might have to wait if the machine on which it runs is not free. Grid computing helps to run an existing application on a different machine. Any application could be run on any idle machine elsewhere on the grid.

- Resource are Balanced

The grid consists of large number of resources. It helps in resource balancing by scheduling jobs on underutilized systems. The lowest priority jobs will have to suffer because of highest priority jobs when the grid is fully utilized. The jobs with lowest priority might be temporarily suspended or cancelled and performed again later.

- Parallel CPU Capacity

This is most common and attractive feature of a grid. A CPU-intensive grid application can be considered as many smaller sub jobs each executing on a different machines in the grid [9].

- Virtual resources and virtual organizations for collaboration

Grid computing offers an environment for the collaboration among a wider audience. It provides standards which allows heterogeneous machines to operate together to form the image of a large virtual computing system which offers a variety of resources. Users are organized into number of virtual organizations dynamically. These organizations can share their resources collectively as a larger grid.

- Reliability

A grid is inexpensive and geographically dispersed. So if there is any failure at one location, the other parts of grid will not get affected**.**

- Less Computation Time

Grid Computing helps in solving large and complex problems in much faster and efficient way and in less time.

VII. Disadvantages of Grid Computing

- Scheduling

Scheduling is done to give access to the resources for an application. But scheduling resources in a grid is not easy. It can also present new challenges to organization that manage those resources.

- Security

Security is an important factor in planning and maintaining a grid. An organization which provides its resources to users should be confident that its involvement does not provide any threat to resources. Grid needs more advanced authorization and authentication methods.

- Lacking design enforcement

There is no proper control on how many resources can be taken by any system.

VIII. Applications of Grid Computing

Some of the applications of grid computing are:

A. Engineering and Design

The engineering activities and designs are complex and so processing requirements are complex. A grid enabled optimization and design search for

engineering (GEODISE) provides seamless access to collection of optimization and search tools [10].

B. Life Sciences

Grid Computing helps in life sciences in drug discovery and drug treatment.

C. Astronomy

Grid computing is used in astronomy also. A Grid named astrogrid is used as doorway virtual observatory to enable astronomers to explore resources from all around the world and to find, store and share data in VO space.

D. Chemistry Applications

The CICC (Chemical Informatics and cyberinfrastructure Collaboratory) uses grid computing to allow the integration of distributed chemistry tools.

E. Biomedical

A Biomedical Informatics Research network (BIRN) is an initiative in the field of biomedical to advance the search through data sharing and online collaboration.

F. Environmental Science

Grid computing also has applications in the field of environmental science. Earth System Grid (ESG) integrates the computers with large amount of data and servers located at various research labs to create environment for research on climate. Polar Grid is an another grid which is an NSF MRI funded partnership of Indiana University and Elizabeth City Sate University to acquire and deploy the computer infrastructure needed to investigate the urgent problems in glacial melting [11].

G. Business Applications

Grid Computing allows widely dispersed businesses to develop a virtual organization so that they can share data and resources among each other. This also improves the productivity.

H. Research collaboration

Research oriented organizations which participates in advanced search collaboration require analysis of large amount of data. GridPP [12] is such a collaboration of particle physicists and computer scientists from UK and CERN.

I. Economic Applications

Grid Computing is also used for economic applications. ECO Grid is used for the development of economic and market based resource management.

IX. Conclusion and Future Work

More awareness of grid computing is needed so that users, organizations and institutes can make contribution by providing their unused resources in solving large and complex problems. This paper has categorized the introduction and evolution of grid computing along with its advantages, disadvantages and applications. Grid computing proves to be an efficient computing technique in every field including science, medical, research by the means of reducing computation cost and time. Grid Computing makes it possible to solve complex and huge problems in shortest time. It is more efficient computation method in comparison to the earlier computation methods. There are many advantages of grid computing. But there are still many problems that should be resolved in order to make grid computing as one of the best technique in the field of computing. If those problems are solved, grid computing will be one of the best techniques. Resource Scheduling is one of the problems of grid computing. In Future if it can be solved then that will help grid computing to become more powerful computing technique. Grid computing can be useful in many other areas in future.

REFERENCES

[1] M.Nagaraju, B.Anitha, “Performance Analysis of Various New Technologies for computing”. 2012.

[2] Markus Schmidberger, Martin Morgan, Dirk Eddelbuettel, Hao Yu, Luke Tierney, Ulrich Mansmann, “State of the Art in Parallel Computing with R”, August 2009.

[3] Abhishek S. Naswale, Mrs. Vidya Waykule, Mandar, M. Mahadeokar, Rahul S. Gaikwad,

Abhijit R. Jain, "Collusive Piracy Prevention in P2P Network", 2013.

[4] Indu Gandotra, Pawanesh Abrol, Pooja Gupta, Rohit Uppal and Sandeep Singh, "Cloud Computing Over Cluster, Grid Computing: a Comparative Analysis", 2011.

[5] Manish Prashar, Senior member, IEEE and Craig A. Lee, Member, IEEE, "Grid Computing : Introduction and Overview".

[6] N.A. Azeez1; A.P. Abidoye; A.O. Adesina; K.K. Agbele; Iyamu Tiko, and I.M. Venter, "Peer-to-Peer Computing and Grid Computing: Towards a Better Understanding", 2011.

[7] www.redbooks.ibm.com/redbooks/pdfs/sg 246649.pdf

[8] Syed Nasir Mehmood Shah, Ahmad Kamil Bin Mahmood and Alan Oxley, "Hybrid Resource Allocation Method for Grid Computing", IEEE, 2010.

[9]www.redbooks.ibm.com/redbooks/pdfs/sg 246778.pdf

[10]Dr.K.Vivekanandan, Professor, BSMED, Bharathiar University,Coimbatore,Tamilnadu, India.D.Ramyachitra, Assistant Professor, SCSE, Bharathiar University, Coimbatore, TamilNadu, India, "Grid Applications – Past and Present - A Survey".

[11] http://polargrid.org/polargrid/about

[12] Tony Hey, Anne E. Trefethen, "The UK E-Science Core Programme and the Grid", 2002.

[13] http://bcognizance.iiita.ac.in/aug-sep05/ technova5.htm

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