COMPUTATION GRID AS A CONNECTED WORLD

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ABSTRACT

Grid computing or network computing is developed to make the available electric power in the similar way as it is available for the grid. For that we just plug in the power and whoever needs power, may use it. In grid computing if a system needs more power than available it can share the computing with other machines connected in a grid. In this way we can use the power of a super computer without a huge cost and the CPU cycles that were wasted previously can also be utilized. For performing grid computation in joined computers through the internet, the software must be installed which supports grid computation on each computer inside the VO. The software handles information queries, storage management, processing scheduling, authentication and data encryption to ensure information security.

Index Terms

Grid computing, computational grid, latest trends, state of the art grid, Grid over Internet.

1. INTRODUCTION

Grid computing is basically a distributed computing technology. Here we will have a large level of connected heterogeneous systems sharing resources as well as useful information through internet. Grid is a collection of servers and clients to solve a problem collectively to get a better output. The grid is transforming science, health, business and society. Grid uses networking, communication, computation and information to provide a platform for computation and data management. Here user can have several resources in an aggregated form as a coordinated virtual computer. It helps in executing large scale problems, time as well as resource consuming and distributed applications. Some of the features of grid computing are resource utilization, resource balancing, reliability, management.

The building blocks of grid are network, computation nodes and common infrastructure standards which lead to development of a grid. We have three types of grid that is computational grid, scavenging grid, data grid.

2. NEED FOR GRID

We cannot solve large scale problems on one system so need of grid is occurred and to get data and share resources globally we need grid. We can increase the throughput with the use of grid by distributing the independent task. We need to provide expensive resources for the remote servers which we can get from the use of grid. We can collaborate computing with the help of grid for the high level of interaction. Distributing computing, maintains high level of performance across heterogeneous systems.
3. **Architecture**

The components of grid architecture are described in form of layers. It is based on the principle of “hourglass model” at the top of the hourglass we will have high-level behaviors, at the bottom we have underlying technologies, and at the neck of the hourglass we are having resource and connectivity protocol that shows individual resource sharing.

![Grid Architecture Diagram](image)

- **Fabric layer**: The fabric layer provides the resources to which shared access is mediated by Grid protocols. Fabric components implement the local and resource-specific operations that occur on specific resources as a result of sharing operations at higher levels. Eg: computational resources, storage resources, network resources [7].

- **Connectivity layer**: This layer defines the communication and authentication protocols needed for grid network. The exchange of data between fabric layer resources is done to identify the authorized user we have cryptographically secure mechanism. Here we some important requirements like single sign on, delegation, user trust relationship etc.

- **Resource layer**: The main work of this layer is to access and control the local resources. In this we have two protocols: information protocol and management protocol. This layer takes care of secure negotiation, initiation, monitoring, control, accounting, and payment of sharing operations on individual resources [7].

- **Collective layer**: This layer shows the interaction between the collections of local resources needed in grid. Collective layer is the neck of the hourglass and is used to implement sharing behavior and also provide new requirements of the resources [7].
4. **RUNNING PROJECT**

**Migol: A Reliable Grid Service Infrastructure**

The goal of Migol project is to investigate the design and implementation of a fault-tolerant infrastructure which does not have any single point of failure, conforming to the Open Grid Service Architecture (OGSA) for supporting the migration of parallel MPI applications. OGSA builds upon open Web service technologies to expose Grid resources as Grid services. The Open Grid Services Infrastructure (OGSI) is the technical specification fulfilling the requirements described by OGSA.

An implementation of the OGSI is provided by the Globus Toolkit 3 and 4 (GT3 resp. GT4). Migol is a framework that consists of a set of Grid services and libraries that provides fault-tolerant services to Grid applications. Migol services are currently made on top of GT3. The key issues of Migol are follows-

- Efficient replication for data consistency in the Grid.
- Security: fault-tolerant credential repository
- Efficient mapping heuristics for the allocation of resources in the Grid

5. **PAST PROJECTS**

- Dynamic Load Balancing For Grid Applications
- Grid Migration: Nomadic Migration and Application Spawning
- Grid Tools
- Grid Initiatives

6. **GRID PRESENT SCENARIO OF RESEARCH**

Smart grid technology is being used worldwide; various countries are using this technique instead of traditional power grid. Countries have made their organization to support a Smart grid vision. At this initial stage some software models are required to evaluate and monitor the progress and plan for the realization of a smart grid [1]. At present some models like Smart Grid Interoperability Maturity Model, Smart Grid Maturity Model, Smart Grid Investment Model, and Smart Grid Conceptual Model are available. Smart Grid Interoperability Maturity Model is used to see the current status of automation in the areas of distribution, transmission and demand side resources [2].

The Smart Grid Investment Model is used to calculate different investments made in grid with their strategies. Smart Grid Maturity model is for planning utilities in smart grid transformation. It gives priority to the tasks and measures their progress at every stage [1]. Smart Grid Conceptual Model analyses the standards and interoperations of smart grid development. It helps to understand smart grid deployment and capability in electric utility companies [17].
7. **HOW E-SCIENCE MEET E-BUSINESS**

Grid computing is the next phase of distributed computing. It is based on pervasive internet and is used to share computing and information resource across department and make organization and boundaries secure and efficient. Grid computing development was based on the use of large scale computing and sharing datasets. Due to the E-Business requirements, adoption of emerging Web Services technologies for distributed business application integration [7]. Therefore grid computing can be applied to enterprise computing within and over the organizations and also for utility computing. Major Grid computing projects working for both e-Science and e-Business in Japan (including NaReGI and Business Grid) and several key Grid products and applications (including CyberGRIP and Resource Coordinator both developed by Fujitsu)[11].

The Global Grid Forum (GGF) has developed the Open Grid Services Architecture (OGSA) and is working throughout the industry to champion this “architectural blueprint” and the associated specifications that will enable the pervasive adoption of grid computing for e-Business and e-Science worldwide [11]. According to Cambridge Dictionaries Online, research can be defined as “detailed study of a subject, in order to discover new information”. Therefore it is expected that computing-related research would involve a study of computing such as software, hardware and communication networks, in order to discover new information/knowledge or to reach a new aspects of utilization. One more way to promote understanding of efficient utilization is to have positive attitudes in encouraging attempts to find out a systematic and scientific solution to different problem [7].

8. **LATEST GRID TRENDS**

8.1 **General trends**

Advances in computing hardware and networking technology have enabled access to computing facilities at much-reduced costs. This has made available the computing facilities and made possible in many places around the world. Exchange of information around the world became feasible due to the increase in computer network speed. As the world is tending to become a global village it is needed to advance the increasing ability of people to communicate in a real time, irrespective of their location. We also note the impact of the Internet that has enabled e-commerce. The transactions over the internet became possible because of e-commerce. Many organizations are present on the Internet by maintaining an Internet site. In government sector we use grid to provide communication for providing better service to the citizen [2].

Communication facilities to stimulate scientific activities, measuring Computing Research Excellence and Vitality of improved access to computing and, a move sometimes referred to as e-science. It is set to encourage the use of community and communication to enhance education [7]. The same trends are used in banking industry is said to as e-banking. At software development level, firstly we will simplify the development process that promotes automated programming. At application level the trends are service oriented packages and outsourcing [11].

The trend to incorporate intelligence into hardware and software is a feature that has been a realm for researchers. These trends will put higher-level demands on technology for deliveries that are acceptable. Some of these high-level demands include high-performance computing support. Now days we need fast communication and also very fast processing elements. In grid computing, computing resources are clubbed together to produce enhanced performance.
8.2 High performance computing trends

High-performance computing has been dominated by supercomputing. Supercomputers are expensive computers with very fast centralized architectures. Before they were used to handle many complex problems [7]. These are fundamental problems that generate very complex data. Supercomputers form a part in computing resources which is a part in grid computing. By the use of super computers and grid computers many challenging equations are still be investigated. In high performance computing we are using clusters also. Clusters are whole computers that are interconnected in a parallel or distributed systems settings that deliver services of a single computing resource. Some people consider cluster computing as grid computing [7].

Another trend in high-performance computing is peer-to-peer (P2P) computing. P2P computing involves linking several personal computers via the Internet with the aim of sharing computing resources such as files, but in the process accumulates much computing power [3]. An example of such computing power pooling can be associated to SETI@home project. In this project researchers hope to gain as much insight as possible into the existence of extra-terrestrial intelligence (Minoli, 2005). Another trend associated with high-performance computing is Internet computing where Web [1]. The server, storage and network resources are aggregated into a single pool of resources. Virtualization can therefore span servers for optimal utilization, networks via intelligent routers and other elements like switches, storage for improved utilization and reduced costs. Virtualization can also span applications for increased throughput, and data centers for flexible provision to meet dynamic demands.

We also point out the tendency to give data specialized attention as many applications are now complex and require the use of data in a much more specialized manner [11]. This tendency has resulted in data grids. Data grids are regarded to be part of grid computers. With data grid user can share processing power, application and data. Data, applications and shared computing resources can be found and shared. Remote access and secure provision of data resources are enabled. These data resources include flat-file data, relational data and streaming data (Grimshaw, 2004). We now highlight the focal trend in high-performance computing which is about grid computing.

This trend is regarded to be about a decade old and can be traced in focused attempts and application experimentations to pool computing resources and develop core grid protocols. Consequently toolkits such as Globus Toolkit and data grids have emerged. Grid computing may be viewed as virtualized distributed environments where dynamic runtime selection, sharing and aggregation of geographically distributed autonomous resources are enabled. Access to grid computing resources depends on availability, capability, performance, costs specific baseline requirements and processing requirements [15].

8.3 Trends in software and applications

Software and application development trends indicate that we are moving from stand-alone applications, documents, and isolated users. This move is towards universally accepted file formats, shared documents, and real-time collaboration. The database proliferation in which database forms the backbone of today’s software for accounting, project management, CAD work and e-commerce. There is Web centricity trend that involves infrastructure, database-driven Web applications, and increasing Web-dependency [7].

In cases of application service providers (ASP) limit access efficiency only to the speed of the Internet connection, regardless of how fast the local machine (PC, PDA, laptop, handheld) runs (Lamendola, 2000). Considering the information integration dimension, the tendency is for the
client database to talk to the vendor’s database. This eliminates the cost of handling paper invoices. In these application and software development trends we identify the main activities as exchange of information and data and incorporation of learning models into software. The accompanying real-time responses and quality of service demands point to the need for high-performance computing services [11].

It may also be noted that like any other technology, it will have its good points and bad points and the usage is driven by the fact that the good points outweigh its negative impact. What we note is that the Internet is being used in the Eastern African region, like in many other parts of the world. Only a decade has elapsed and the products are just coming out. A possibility of participation in grid-related research work at such a time exists in the room for opening collaboration with other researchers globally and making contributions. This will also lead to early understanding of the scope of grid computing technology for adoption of its products for the benefit of society. With these observations we now turn briefly to the technical aspects and define terms that are or have been encountered that are related to grid computing [16].

9. CHALLENGES IN GRID

Every application is not suitable or enabled for running on a grid. We cannot use some types of application in parallel with other and some application take large amount of time to achieve better throughput. The configuration affects performance, reliability and security [4]. The application development should be able to easily analyze and decomposes at a higher level of abstraction. Distributed systems have limited bandwidths among components. The system, including the programming language and compiler, should handle the details of mapping the abstract decomposition onto the computing configuration available at any given moment [2].

The application developer and the system should work together to produce a correct and efficient program through the use of execution monitoring, debugging, and tuning tools. Among the nodes of the computing configuration, this will typically be task or object parallelism [4]. A single processor of a node, used to overlap computing with data access or instructions with one another [4].

10. FUTURE ASPECTS

Grid computation is like an expensive supercomputer for doing parallel computation. Grid computation is still in the development stage, and most projects are still voluntary and experimental. But it has developed very quickly and more and more scientists are working hard to improve its efficiency and security in all aspects. If we are using all the computers in the world online then that will be the most powerful way to use grid computation.

There are millions of computers online in the world every day, some of which may just stay idle, while others are busy running programs 24 hours per day. If we will share all of the computer resources worldwide to perform some complicated computation, then we will be able to save a tremendous amount of money and time. So this is a method where we can use several resources worldwide. Coming to the security part as more computers are involved the security problems increases. How to design the largest global virtual environment for grid computation is the most important issue when trying to employ all possible computer resources on earth.
11. CONCLUSIONS

Grid computing has many useful applications in many fields. With the advancement in the Internet and the need for the people to communicate in a faster and efficient way grid computing is the more reliable and secure platform.

Industries are showing interest towards grid computing very rapidly. Both Microsoft and IBM are now providing funds to support distributed computing based on these technologies. Nine other companies worldwide have adopted grid technology as their platform.

- The key upcoming trends in IT infrastructure will be "manageability, scalability, flexibility, reliability and commoditization ", using grid computing as a utility.
- By using grid computing model we are reducing computing resources from heterogeneous systems which run by different organizations. Due to this there will be a large demand for the open source software like Linux.
- By the usage of grid computing, information will become available anywhere and everywhere and there will be better communication between organizations.
- These resources will be accessed and billed in the same way as other public utility services like water and gas are accessed.
- They will definitely become important to the point where they become an invisible part of everyday life.
- The Internet will become as useful as the telephone network, where you can simply pick up a handset and dial, leading to the advent of IP dial-tone.

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