GRID COMPUTING SCENARIO: A REVIEW

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ABSTRACT
This paper discusses some of the basic concepts about the term “grid”, “grid computing” and some other important and useful terms related with it. In this paper, the working of grids which means which component is used by the grid for its efficient operation, the analogy of the computational grids with the electrical grids, the major areas where the grids are being used at present and where the grids will be used in the coming decades, the features of grid systems ,the grid computing technology which is becoming popular these days , the operating principles of the grid systems, the advantages and disadvantages of computing grid ,challenges in front of grid-computing that need to be resolved have been discussed.

Keywords
Grid Computing, Grid Scheduling

1. INTRODUCTION TO GRID
In 1998 Foster and Kesselman defined the Grid as follows: “A computational grid is a hardware and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities.”The term ‘grid’ is generally used to describe a number of different, but related ideas including grid technologies, and grid standards. In this paper the term ‘Grid’ is used to describe the ability to pool and share Information Technology (IT) resources in a global environment in such a way which achieves seamless, secure, transparent, simple access to a vast collection of different types of hardware and software resources, (including computer nodes, software codes, data repositories, storage devices, graphics and terminal devices and instrumentation and equipment), through non-dedicated wide area networks, to deliver customized resources to specific applications. Most generally said, Grid is independent of any specific standard or technology. Any practical grid is realized through specific distributed computing technologies and standards that can support the necessary interoperability. Today, there are no universally agreed grid standards, but there are freely available, open source and grid technologies that implement emerging standards recommendations. Separate web services standards are also emerging which have many grid-like capabilities. Indeed grids are already being built by integrating and enhancing web standards technology.
The grid must be designed and created in such a way that their components —fabric, middleware, and higher-level tools — and applications handle the key design issues in a coordinated manner. For instance, Grid middleware offers services for handling heterogeneity, security, information, allocation, and so on. Higher level tools, such as resource brokers support dynamic adaptability through automatic resource discovery, trading for economy of resources, resource acquisition, scheduling, the staging of data and programs, initiating computations, and adapting to changes in the Grid status.. In addition, they also need to make sure that domain autonomy is honored but still meets user requirements such as quality of service (QoS) in coordination with other components.

2. ANALOGY BETWEEN ELECTRIC AND COMPUTATIONAL GRIDS
Computing grids are conceptually not unlike electrical grids. In an electrical grid, wall outlets allow us to link to an infrastructure of resources that generate, distribute, and bill for electricity. When you connect to the electrical grid, you don’t need to know where the power plant is or how the current gets to you. Grid computing uses middleware to coordinate disparate IT resources across a network, allowing them to function as a virtual whole. The goal of a computing grid, like that of the electrical grid, is to provide users with access to the resources they need, when they need them. An electric utility uses a grid to deal with wide variations in power demands without affecting customer service levels, grid computing provides IT resources with levels of control and adaptability that are transparent to end users, but that let IT professionals respond quickly to changing computing workloads.

3. HOW GRIDS WORK
Grids use a layer of middleware to communicate with and manipulate different types of hardware and data sets. In some fields like astronomy hardware cannot reasonably be moved and is prohibitively expensive to replicate on other sites. Thus, a Grid should have a middleware that integrates distributed and heterogeneous computational resources in a large, virtual computer that can be used to solve a single large problem at a given time. Of course, to achieve this result, the applications must be completely decoupled from the physical components, i.e. an application, instead of directly accessing a physical component of the Grid, has to request it through a middleware. Grids overcome these logistical obstacles and open the tools of research to distant faculty and students. A grid might coordinate scientific instruments in one country with a database in another and processors in a third. From a user’s perspective, these resources function as a single system—differences in platform and location become invisible.

4. AREAS WHERE GRIDS ARE BEING USED
Areas that already are taking good advantage of grid computing include bioinformatics, cheminformatics , oil & drilling, and financial applications. A grid can provide

significant processing power for users with extraordinary needs. Animation software, for instance, which is used by students in the arts, architecture, and other departments, consumes vast amounts of processor capacity. An industrial design class might use resource-intensive software to render highly detailed three-dimensional images. In both cases, a campus grid slashes the amount of time it takes students to work with these applications. All of this happens not from additional capacity but through the efficient use of existing power. Grid computing and related technologies will only be adopted by commercial users if they are confident that their data and privacy can be adequately protected and that the Grid will be at least as scalable, robust and reliable as their own in-house IT systems. Thus, new Internet technologies and standards such as IPv6 take on even greater importance. Needless to say, users of the Grid want easy, affordable, ubiquitous, broadband access to the Internet.

5. GRID SYSTEM FEATURES

- **coordinates resources that are not under a single central control**. A Grid integrates and coordinates resources and users that live within different control domains—for example, the user's desktop vs. central computing; different administrative units of the same company or different companies and addresses the issues of security, policy, payment, membership, and so forth that arise in these settings. Otherwise, we are dealing with a local management system.
- **using standard, open, general-purpose protocols and interfaces** .A Grid is built from multi-purpose protocols and interfaces that address such fundamental issues as authentication, authorization, resource discovery, and resource access. As I discuss further below, it is important that these protocols and interfaces be standard and open. Otherwise, we are dealing with an application specific system.
- **to deliver nontrivial qualities of service**. A Grid allows its constituent resources to be used in a coordinated fashion to deliver various qualities of service, relating for example to response time, throughput, availability, and security, and/or co-allocation of multiple resource types to meet complex user demands, so that the utility of the combined system is significantly greater than that of the sum of its parts.

Some of the other key features of Grid infrastructures:

• Flexibility and extensibility
• Domain autonomy
• Scalability
• Global name space
• Ease of use and transparent access
• Security
• Management and exploitation of heterogeneous resources
• Interoperability between systems
• Resource allocation and co-allocation
• Fault-tolerance
• Dynamic adaptability
• Quality of Service (QoS)
• Computational Economy

6. GRID COMPUTING

Grid Computing can be defined with the help of following definitions given by different researchers of grid computing technology-

--applying resources from many computers in a network to a single problem, usually one that requires a large number of processing cycles or access to large amounts of data. Grid computing provides structured and secure connections between peers (hosts), which allow sharing vast amount of information and computer resources. This benefit is necessary for commerce and science related projects and file sharing.

-- Grid Computing is a new paradigm that enables sharing of geographically distributed resources such as computers, databases, and scientific instruments in a secure and consistent manner without any central control for solving large-scale problems in science, engineering, and commerce. The grid enables the creating of virtual enterprises that can share geographically distributed resources, such as computers and data resources.

-- Grid computing is as the virtualization and pooling of IT resources—compute power, storage, network capacity, and so on—into a single set of shared services that can be provisioned or distributed, and then redistributed as needed.

-- Grid Computing is a successor the distributed computing and in many ways has successful redefined the era of global computing. By this we mean that Grids involve the actual networking services and connections of potential unlimited number of ubiquitous computing devices and several myriads of disparate resources. Grid Computing has a long and unending list of facilities, opportunities, and provisions to offer.

-- Grid computing is concerned with "coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations." The key concept is the ability to negotiate resource-sharing arrangements among a set of participating parties (providers and consumers) and then to use the resulting resource pool for some purpose.

Grid computing operates on these technology principles:-

- **Standardization.** IT departments have enjoyed greater interoperability and reduced their systems management overhead by standardizing on operating systems, servers, storage hardware, middleware components, and network components. Standardizing also helps reduce operational complexity in the data center by simplifying application deployment, configuration, and integration.
- **Virtualization**. Virtualizing IT resources means that applications are not tied to specific particular server, storage, or network components and can use any virtualized IT resource. Virtualization occurs through a sophisticated software layer that hides the underlying complexity of IT resources and presents a simplified, coherent interface used by applications and other IT resources.
- **Automation.** Because of the potentially large number of components—both virtual and physical—grid computing demands large-scale automation of IT operations. Each component requires configuration management, on-demand provisioning, top-down monitoring, and other management tasks. A grid management solution must ensure that infrastructure cost saving do not evaporate as a result of hiring additional staff to

manage the grid. IT administrators need a top-down view from the end-user or application level so they can effectively measure service levels and proactively resolve problems. Combining these capabilities into a single, automated, integrated solution for managing grids gives organizations a maximum return on investments.

7. GRID SCHEDULING (Resource Allocation in GRID SYSTEMS)

The most obvious resource included in a grid is a processor, but grids also encompass sensors, data-storage systems, applications, an other resources. Grid scheduling, that is, the allocation of distributed computational resources to user applications, is one of the most challenging and complex task in Grid computing. The problem of allocating resources in Grid scheduling requires the definition of a model that allows local and external schedulers to communicate in order to achieve an efficient management of the resources themselves. To this aim, some economic/market-based models have been introduced in the literature, where users, external schedulers, and local schedulers negotiate to optimize their objectives. In this paper, we propose a tender/contract-net model for Grid resource allocation, showing the interactions among the involved actors. The performance of the proposed market-based approach is experimentally compared with a round-robin allocation protocol.

8. GRID COMPUTING ADVANTAGES

- **Efficient use of idle resources:** Much more efficient use of idle resources. Jobs can be farmed out to idle servers or even idle desktops. Many of these resources sit idle especially during off business hours. Policies can be in places that allow jobs to only go to servers that are lightly loaded or have the appropriate amount of memory/cpu characteristics for the particular application.
- **Modular grid environments:** Grid environments are much more modular and don't have single points of failure. If one of the servers/desktops within the grid fail there are plenty of other resources able to pick the load. Jobs can automatically restart if a failure occurs.
- **Grid software-brains behind the grid:** Policies can be managed by the grid software. The software is really the brains behind the grid. A client will reside on each server which sends information back to the master telling it what type of availability or resources it has to complete incoming jobs.
- **Parallel job execution:** Jobs can be executed in parallel speeding performance. Grid environments are extremely well suited to run jobs that can be split into smaller chunks and run concurrently on many nodes.
- **Scalability:** This model scales very well. Need more compute resources? Just plug them in by installing grid client on additional desktops or servers. They can be removed just as easily on the fly. This modular environment really scales well.
- **Easy and Fast upgrading:** Upgrading can be done on the fly without scheduling downtime. Since there are so many resources some can be taken offline while leaving enough for work to continue. This way upgrades can be cascaded as to not affect ongoing projects.

9. GRID COMPUTING DISADVANTAGES

- **Fast interconnection needed:** You may need to have a fast interconnect between compute resources (gigabit Ethernet at a minimum).
- **Full advantage difficult to be taken**: Some applications may need to be tweaked to take full advantage of the new model.
- **License problem**: Licensing across many servers may make it prohibitive for some apps. Vendors are starting to be more flexible with environment like this.
- **Much more challenges:** Grid environments include many smaller servers across various administrative domains. Good tools for managing modifications and keeping configurations in sync with each other can be challenging in large environments
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10. GRID COMPUTING CHALLENGES

Although Grid Computing has made significant landmarks in field of high-performance computing, there are still a number of challenges that need to be addressed to provide seamless computing environment. One of the main challenges is the heterogeneity that results from the vast range of technologies, both software and hardware, encompassed by the Grid. Another challenge involves the handling of Grid resources that are spread across political and geographical boundaries and are under the administrative control of different organizations. It follows that the availability and performance of Grid resources are unpredictable as requests
from within an administrative domain may gain more priority over requests from outside. Thus, dynamic nature of Grid environment poses yet another challenge. Grid Computing has a long way to go. In general, it has yet to evolve and leave behind a long trail of accomplishments to its credit. In short, we can collect some of the expectations in the following list:

- Enabling efficient and optimal resource usage.
- Share inter-organization resources efficiently.
- Secure user authentication and authorization.
- Security of stored data and programs.
- Secure Communication.
- Centralized or semi-centralized control.
- Auditing.
- Enforcement of Quality of Service (QoS) and Service Level Agreements
- Interoperability of different grids.
- Support for transactional processes.

This is not an entire list of challenges that the grids are expected to meet. There are a number of other concerns that are present in the grid computing technology but have not been included in this paper.

11. CONCLUSION

We have discussed in this paper much of the important topics about grid computing. Grid computing now is becoming very popular in different fields such as colleges and universities, many industrial applications and many research projects. Still there are so many areas where the grid computing needs to be used and implemented, with the help of which we can increase the performance and throughput and can slow down the computing and processing time with much less of effort. So far in this paper we have discussed a lot of basic things about the grid computing and the challenges which the grid computing probably will have to face in the coming years.

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