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The Grid Computing and its Strategic Adoption in E-Commerce and Various Industries

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Abstract

Grid computing has emerged as one of the innovative technologies in the discipline of information Technology. Grid computing differs from conventional distributed computing due to its focus on large-scale resource sharing, innovative applications, and high-performance orientation. While there are tremendous benefits of Grid computing technologies; the level of adoption of the technology in E-commerce and in various industries is still in nascent stage. This paper endows with an analytical view of research and industrial initiatives which have brought this technology to various industries known as the three waves of grid computing emergence. In order to analyze the adoption of Grid technology in E-commerce and various industries, we have taken the case study of the Platform Computing Software Company. The study has mainly described the main benefits derived by the Oil and Gas, Electronics, Finance, Manufacturing, Life sciences and Government sectors. The research paper has also highlighted the trends towards the adoption of Grid technology in commercial enterprises and other industries.

Keywords: *Grid computing, Three waves of grid computing Grid technology trends.*

1. Introduction

Currently, commercial enterprises have taken keen interest in Grid computing [1]. They have begun to focus on the use of grid computing in the business, industry and commerce worlds. An enterprise Grid may provide an economy of scale access to one common High Power Computing (HPC) service for all the departments. The Grid is distinguished from conventional distributed computing by its focus on large scale resources sharing, innovative applications and in some cases, high performance orientation. [2]. The Grid is one of several mechanisms intended to exploit the highly connected network of computers, sensors and data repositories. The idea has been built around the following fact: in a distributed environment, there are applications which requires huge amount of computation resources, whereas an overwhelming majority of computers are often idle. From an optimization point of view, the ideal situation would be allowing computation intensive applications to be executed on otherwise idle resources, no matter where the latter are located. [3]

Based on the above concept, the Grid is intended to be an infrastructure that integrates computation and storage devices, software, databases, specialized instruments, displays and people from widespread locations under different management authorities. It is a move from the existing Internet to achieve a cyber world whereby the computing resources are offered to every one with inexpensive and consistent access. The Grid will provide enormous amount of shared information, where processing power and access to specialized instruments will also be provided to everyone in a secure and effective manner [4]. Nevertheless, this scenario is highly unlikely to happen in the near future due to various technical, political, management and financial reasons. However, Grid computing is feasible for a controlled environment such as within the business entity.

Grid computing within its network allows a company to utilize numerous machines to perform a task as if based on a single virtual machine. The approach could reduce the overall cost of hardware by improving utilization rates while increasing computing power without the need for new processors or computing platforms. Adoption has so far primarily been among companies that run computational intensive applications such as those used in computer graphics, media, financial analysis and forecast, geological and chemical analysis, bioinformatics and medical research.

The paper serves to provide a survey and overview of the Grid technology. Section 2 discusses the three waves of Grid technology. Section 3 discusses the adoption of Grid technology. Section 4 provides an analysis of the trend of Grid Technology adoption in various industries and Section 5 is the conclusion. It is expected that this paper will provide an insight and discussion on the state-of-the-art of Grid technology and the trends of Grid computing adoption in various commercial and industry fields.

2. Three waves of Grid Computing.

Based on literature, it is observed that there are three waves of emergence of Grid Computing .Grid computing evolved from high performance and distributed computing in the 1990s. The evolution was driven primarily by the ever-growing need for computing resources. The availability of increasingly more powerful technologies for networking, servers, middleware and applications has enabled the widespread acceptance of the internet and the World Wide Web (WWW). De to same reason E-commerce has also emerged as a major technological evolution for the business and commerce. Similar to the changes in E-commerce, the evolution of Grid computing can be viewed in following three waves,

2.1 Research Wave

The research waves started in the mid 90's with the projects like 1-WAY and the information power grid in the United States; Uniform Access to Computing Resources (UNICORE) in Europe, and NINF in Asia This wave can be considered in full development. Research in the universities and industries is currently developing grid standards and grid middleware and they are building grid test beds for running complex grid-enabled applications [5]. This is similar to the early stage of the E-commerce development whereby the technologies have mainly been conducted in the academic and research circles.

As the Grid technology gained popularity, enterprise users and technology vendors took interest. This awareness and interest motivated the technology vendors to launch a number of successful grid projects in the global research community. In these research projects, proposed features and benefits includes remote access improving resource utilization, collaboration in virtual organizations and increased productivity. Today, these features are now commonly used in many grid-like production environment and cluster of resources distributed within enterprises all across the world. The distributed resource management software include Load Sharing facility (LSF), Portable Batch System (PBS) and Sun Grid Engine, and on a more global level, Globus, Avaki, Unicore [5].

2.2 Business wave

This wave is already in progress. Grid technology is being used in many industries for their business solutions. Further development is also in progress aimed at providing grid solutions to the industry. Currently, Enterprise Grids have been successfully implemented in many industrial and commercial projects [5]. It could be expected that a wide variety of efforts will be invested to implement grid standards and interoperable technologies which will allow any company to conduct business over a worldwide and often specialized and customized grid in a user – friendly manner [5].

2.3 Consumer Wave.

This wave of Grid Computing is on the horizon. An important pre-requisite condition in order to enable development of the Consumer wave is a strong and global grid community driven by joint interest, dedication and working commitments to build the next-generation IT infrastructure for research, government, industry and consumers.[5]

3. Grid Adoption in various industries: A case Study of the Platform Computer Software Company.

The Grid differs from more traditional distributed systems in the way that the resources are utilized. A grid becomes useful when it both encompasses a large set of resources and serves a sizable community.

Keeping in view the strategic advantages of Grid computing technology, the following trends are predicted of its adoption in the business industry.

Platform computing software solutions is the largest distributed and grid computing software vendor. Platform's grid solutions have been selected by the Shanghai Supercomputer Center. This center is recently ranked as the 17th most powerful computer system in the world, and the Chinese government's influential National High Technology Research and Development Program, known as the "863 Program", which is evaluating grid applications for China's aerospace industry. [12]

3.1 Grid computing in Oil and Gas industry.

The Oil and Gas industry is dependent on rapid access to critical information for their operation in an effective and efficient manner. Time is critical to success in gaining access to new reserves and in bringing product to market. The challenge is to bring product to market without increasing total cost of operations. For instance, seismic analyses and reservoir simulations can consume days or weeks of valuable time. By distributing many of these applications to dozens or hundreds of nodes in an enterprise grid cluster, the run-times could be greatly reduced and enabling geologists and engineers to access valuable data in hours rather than days.[13]

3.2 Grid computing in Electronics Industry.

Enterprise Grid provides end-to-end solutions for the Electronics industry. The Grid provides users with the ability to accelerate the design and testing of new computational-intensive designs. For instance, System-on-Chip devices are expected to hit the ever tighter market windows of opportunity by being the first to reach the market and capable to meet the demands in volume. At the same time, the hyper-competitive Electronics sector has to reduce its margin of error as there is little margin for design error in the process. Platform Grid solutions provide agility to accelerate product development, to direct resources to the most profitable new products, and to manage IT assets more intelligently with true visibility and confidence of higher quality of results. [14]

3.3 Grid computing in Financial Industry.

Currently, financial industry is keenly inclined to adopt grid technology in their business operations. Financial services firms are under increasing pressure to grow revenue and market share amidst intense competition and the growing need for enterprise risk management. A move to a grid environment where multiple users and applications share computing resources – hardware and software licenses – in virtual pools that adjust and scale based on your firm's needs. Platform's grid computing solutions, coupled with commodity hardware architectures and high-speed interconnect technologies; can deliver supercomputer performance to the applications inexpensively, reliably and with almost immediate payback. [15]

3.4 Grid Computing in Manufacturing Industry.

In an industry where complexity and competition is increasing, product quality is critical to business success, similarly making a faster and cheaper design cycle is also essential. For example, IT managers of Aerospace and Automotive industries are forced to focus on the need of superior design, improved quality and shorter time to market with low IT utilization and over-provisioned hardware and software licenses. The platform Grid solutions maximizes the utilization of costly IT assets while improving workload throughput for more simulations, better testing, faster model development cycles and superior products.[16].

3.5 Grid computing in Government.

Platform's enterprise grid solution provides a breadth of functionality to solve the complex and grand challenges problem faced by the government industry. It has provided a capability to run more analyses, simulation and testing so as to conduct a greater volume of computations with improved resource utilization [17].

3.6 Grid computing in Life Sciences.

Platform Grid provides a best-in-class suite of integrated solution to the Life Sciences industry. Platform grid software provides functionalities to shorten the drug development cycle by streamlining and replicating processes, directing resources to the validation of successful candidates, and reducing physical lab testing. Platform grid software helps to optimize existing IT resources, anticipate and respond to regulatory issues - resulting in more accurate tests with higher Quality of Results (QoR), improved resource utilization and reduced total cost of ownership for overall increased competitive advantage. [18]

4. Grid Technology adoption Trends.

Industry	Grid Benefit	Application Area
Life Sciences	Less investment of high computer and faster discovery	Molecular modeling, computational chemistry and protein folding
Geo Sciences	Enhanced decision Support	Reservoir modeling and material sciences analysis
Financial Services	Higher quality decision making	Risk assessment liability, market strategy analysis
Government	Market-leading security and reliability for max uptime	Bio defense and drug discovery, pattern recognition and decryption
Industrial Engineering	Running simulations and modeling faster and to more precision	CAD, computational fluid dynamics, and element analysis.
Multimedia	Processing scalability and support for a wide range of applications	Digital rendering, image processing and content compression/decoding
Chemical and Materials science	Improved precision and quality of output and increased ROI on existing machines	Quantum mechanics, polymer science and crystallization and formulation design.

Table 1: Strategic Adoption of Grid Technology

The above table shows the strategic adoption of grid technology in various industries and fields for running specific kinds of applications. Based on the growing interest by the commercial enterprises in the grid technology, it has been predicted by conducting different surveys that in future, one of the five companies may deploy grid technology during the next two years. About 9% of the companies are expected to deploy a grid computing strategy in the next two years. About 5,000 organizations are currently using Sun Grid Engine software as quoted by the Sun Microsystems Inc. Amongst these organizations, 90% of the above, or about 4,500, use it for cluster grids, about 450 use it for campus grid installations and 50 for global grids [19].

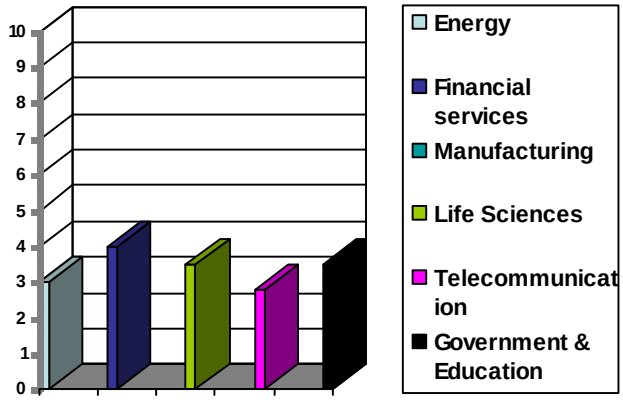

Figure 1: Percentage of Grid Technology adoption in various industries.

Currently 5000 organizations are using grid computing technology since last 10 years and this trend is growing gradually to the extant that 9% of the organizations are expected to deploy grid technology in near future.

5. Conclusion.

Based on the above discussions related to adoption of Grid Technology in various industries, it is expected that grid technology is the future IT infrastructure for the business enterprises in the competitive environment. With reference to the case study of Platform grid solution, this paper described that how enterprise grid can bring the potential benefits in respect to each different industry's business operation. It can reduce the cost of hardware by improving utilization rates while increasing compute power without the need to add new CPUs. The Grid technology has been adopted by the companies, who need to run compute intensive applications such as those used in financial analysis and medical research. Based on the benefits of the Grid technology and its growing interest in the e-commerce and commercial enterprises, the application of grid technology in business enterprise can minimized the cost of business operation by utilizing IT resources properly in an efficient and effective manner. The most important factor in the adoption of grid technology is aligning and integrating grid technology with the business strategy in a way that it rightly supports the operation of business or e-commerce according to the policies and business practices of the commercial enterprises.

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