Grid and utility computing promises a bright future

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Abstract: A bright future is promised ahead for Grid computing, a technology expected to become a popular enabling means for business applications. Today, most business applications are developed on top of systems depending on costly 'islands of computation', with each application needing its own dedicated machines and software. Grid computing breaks the barries and bridges the gaps by bringing together 'resources islands', forming virtualized computing resources. Further, it opens the door to utility computing to provide electric utility like services. This service orientation shift has resulted in new challenges and opportunities for Grid research and development.

Keywords: grid computing; utility computing; services computing; business computing; technology review.

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It is the vision of grid computing to bring together heterogeneous resources and allocates them efficiently to applications. As the focus of grid research and development is shifting from high performance computing to meeting commercial business computing requirements, we see a bright future for grid. The grid vision of resource virtualisation is being well accepted. However, it would still take several years before commercial grid computing matures as the popular enabling means for business applications. Challenges lie on both business and technical sides with issues such as grid standards maturation, software readiness, and market cultivation beyond traditional high performance computing.

1 RESEARCH TOPICS

Research and development topics in grid computing include theoretical model of the grid, grid architectures, development tools, grid applications, grid economics, and scientific, industrial and social implications. Grid computing has started to leverage web services to define standard interfaces for business services. The service collaboration and management afforded by service computing will allow disaggregated businesses to form value chains for improving productivity. The paradigm shift towards service-orientation and utility computing has resulted in new challenges and opportunities for grid research and development.

2 GRID FOR UTILITY COMPUTING

Though, some scientific and industrial applications are important enough to warrant the use of dedicated high-end computers, a much larger body of applications can benefit from the enhanced distributed computing capabilities (e.g. virtualisation, availability) powered by the managed heterogeneous resources through grid. Grid computing is becoming a critical component of science, business, and industry by providing a resource virtualisation layer. This will certainly result in a new programming model eventually reshaping the business applications development process. Benefiting fields are visible even now ranging from industrial design, to life sciences, and to financial management.

Bringing together the virtualised computing resources, grid computing would move one step further to open the door to utility computing to provide electric utility like services. Grid resource virtualisation couples naturally with utility computing, which provides IT functionality on demand. Certainly, the key to the success of utility computing is dependent on delivering the IT functionality at users' needs. As a result, quality of services becomes an increasingly important metric that matters.

3 IN THIS ISSUE

The *International Journal of Grid and Utility Computing* (IJGUC) is a high-quality double-blind refereed journal on grid and utility computing that serves as a forum for individuals in the field to publish their research as well as for interested readers. IJGUC will facilitate communication and networking between members of the grid and utility computing community in a period where considerable changes are taking place in the field, and will stimulate production of high-quality grid computing solutions and architectures.

The objectives of IJGUC are to establish an effective channel of communication between grid and utility computing researchers, engineers, and policy makers. It also aims to promote and coordinate developments in the field of grid and utility computing. The international dimension is emphasised in order to foster international collaboration in grid and utility computing to meet the need to broaden the applicability and scope of the current body of knowledge.

In this inaugural issue, we have selected five papers that span from theoretical research, grid foundations and grid applications.

Computation intensive scientific simulations are leveraging grid technologies to share computation resources over network. Peggy Lindner, Edgar Gabriel, and Michael M. Resch present a grid configuration manager for heterogeneous grid environments (GCM). Their paper presents a tool developed to hide some of the complexity of grid environments from the end-user. The central objective of the proposed tool is to ease the handling of scientific, computational jobs in heterogeneous grid environments.

In the paper titled 'A peer-to-peer approach to task scheduling in computation grid', a peer-to-peer (P2P)-based decentralised approach is presented, which off-loads the intermediate server by letting the peers in the grid to make the scheduling decision among themselves using their own scheduling policies. Both push and pull modes are used for distributing the tasks to peers with the support of load balancing and fault tolerance.

The nearest goal of ShanghaiGrid presented by Minglu Li, etc., in the paper 'ShanghaiGrid in action: the first stage projects towards digital city and city grid' is to connect all supercomputers in this metropolis together to form a sharing environment for massive storage and grid computing. The first stage projects of ShanghaiGrid comprise four sub-projects, including research and development on grid infrastructure, grid system software, peer-to-peer based virtual research platform and grid applications.

In the paper 'An adaptive meta-scheduler for data-intensive applications' by Jin Hai etc., an adaptive scheduling model is developed that considers availability of computational, storage and network resources. In data-intensive applications, such as high-energy physics, bio-informatics, it is observed that such applications usually involving numerous jobs that access and generate large datasets. Effective scheduling of such applications is a challenge, due to the need to consider both computational and data storage resources.

In the paper titled as ‘Appcast – a low stress and high stretch overlay protocol’, V. Radha, etc. present an application level multicast protocol enriching the multicasting mechanisms. With IP multicast not gaining wide acceptance, attention is turned to alternative multicast mechanisms like application level multicast. Application level multicast protocols arrange the participating hosts into an overlay topology; maintain it and distribute data packets over that topology.

In the fifth paper, a practical task-level distributed parallel programming interface (PPI) for grid computing is introduced. It provides a group of generic and abstract function prototypes with well-specified semantics. Grid PPI is an MPI-like interface plus high-level parallel tasking over grid. Following its specification, users might couple multiple computing tools distributed over grid to run complex computing problems. Grid-API prototypes support all operations that are necessary for such task-level distributed parallel computing over grid.

In the sixth paper, authors propose a general authorisation and access control architecture, RB-GACA, for grid computing. It is based on classical access control mechanism in distributed applications, Role Based Access Control (RBAC). A kind of standard policy language is used as the presentation of access control policies to provide a general and standard support for different services and resources.

4 CONCLUSIONS

Today, most business applications are developed on top of systems depending on costly ‘islands of computation,’ with each application needing its own set of dedicated machines and software. Grid computing breaks the barriers and bridges the gaps by bringing together ‘resources islands’, forming virtualised computing resources.

While grid computing, at present, is still considered a strategic IT investment, it is believed to become a critical technology for businesses. The industry momentum for grid computing continues to build. Many analyst firms as well as grid technology players expect grid computing to play an increasingly important role in the years to come when the grid pilots demonstrate viability as more and more companies see concrete benefits from adopting grid computing technologies.

Now, it is the right time to become familiar with grid technology, and to start contributing to this important field. Toward this direction, with your support, we hope IJGUC becomes a prestigious research journal to help professionals, academics, researchers and policy makers, working in the fields relevant to grid and utility computing, to disseminate information and to learn from each other’s work.