Building an Application Portal for Geoscience

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Abstract

Grid technology will be a valuable technique providing both the software and resources necessary for calculating complex algorithms used in predicting geological phenomenon. This setup is enabling huge, expensive, multi-processing servers to be replaced by many small, relatively cheaper personal computers. With the ever expansion of petroleum drilling projects, reducing time and money are becoming the basic objectives for reservoir engineers. The idea is to create an application that will allow users to access across the internet, from any web browser, a computational grid. There they can input data from their drilling site to a main server from where it can be distributed over a network of computers and then processed and simulated. The UCoMS project portal group is developing the web interface to input the drilling and simulator parameters and the middleware group is setting up the programs to handle the requests from the portal and processing of the parameter values. As part of this project we hope to achieve by using the Apache Ant with the Jakarta Tomcat container in conjunction with the GridSphere / GridPortlets framework to setup an application. We were able to setup a grid of computers at various institutions in the state of Louisiana. We hope that in the future to setup the UCoMS grid to apply to other applications requiring the need for high performance processing.

What is the Problem?

The world of petroleum drilling is immersed with many uncertainties. For many reservoir engineers, their main objective is to optimize their output by capita used. This objective is unrealistic because of much of the uncertainty involved in drilling. It is impossible for engineers to know exactly what the output would be if they drill at a particular site. This knowledge along could help in determining which particular site they should setup at. They could also figure out the costs for drilling at that site and determine whether it would be worth the time to initiate.

Fig.1. Petroleum Rig

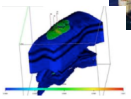


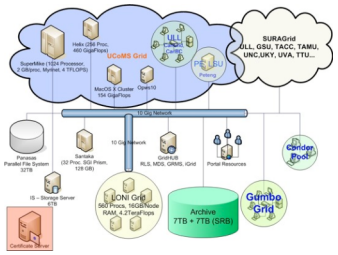
Fig. 2. Petroleum Reservoir

To solve this problem, many engineers have adopted complex algorithms to help them predict many outcomes and clear up many of these uncertainties. Now this solution itself has brought along a problems of its own. Many of these algorithms require lots of time to calculate and with the use of computers, this calculation time is still enormous and time consuming. Even when the grid is added to the calculation time is still a problem because of how large the output files are debugging output is hard process which leads to making many errors in analysis.

UCoMS Proposed Solution

The idea of the UCoMS group is to reduce this processing time by adding more computer processors to the equation. Instead of achieving this by purchasing an expensive, multi-processing supercomputer such as SuperMike, we hope to do this by networking many smaller clusters and personal computers with a centralized server.

Fig. 3. Resource Grid



The server will act as the distributor of the jobs across the grid to be processed. When the job is finished being processed, the individual components are assembled into an output file that the server returns to the user. The hope is that this can reduce calculation times and allow for a more effective and accurate output to help reduce reservoir uncertainties. To assist in utilizing this grid, we have developed a portal application for a user-friendly interface.

What is a Portal?

A portal is a web-based application that usually connects to a server on a network. The grid is usually accessed through a command-line, which is not easily navigable and many users are reluctant to use it. The portal gives users a different, user-friendly option to accessing a grid. It allows users access to all grid resources through a single-sign on via an internet browser on any particular platform. It also provides all users with a standardized interface but yet flexible to give users the ability to customize and personalize the interface to fit their needs. This in turn provides new tools in other areas of research because research who are new to command-line access can easily maneuver the interface giving them a new tool to utilize in their research. While connected, users can transmit raw data to the server and retrieve the processed data. The UCoMS portal is set up as the gateway to the GridHUB server at CCT.

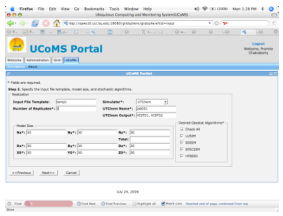


Fig. 4. User Input

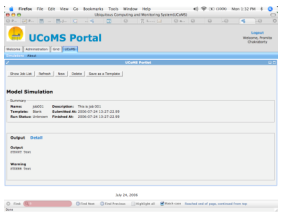


Fig. 5. Job Output

UCoMS Portal

The grid network is accessible by users via the internet through the UCoMS portal.

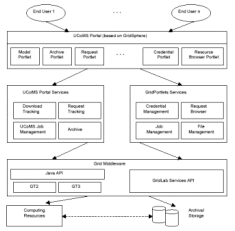


Fig. 6. UCoMS Portal Architecture

We developed a portal to provide petroleum researchers with many necessary tools to assist in developing a job to submit and for retrieval and recycling of previously processed jobs. We have gone through the job submission portlets and provided pages for the users to input the simulator parameters along with factor and well data. Following feedback from actual petroleum researchers, we have also given them the ability to check on the progress of submitted jobs. There they can see the job's status and what errors might have occurred during the simulations. We have also setup a template system, in order to allow users to recall previously used parameter values for other submitted jobs. See figures 4-5 for a glance at the web application as presented to users.

References

1.UCoMS website: http://www.UCoMS.org

2. Zhou Lei, Dayong Huang, Archit Kulshrestha, Santiago Pena, Gabrielle Allen, Xin Li, Christopher White, Richard Duff, John R. Smith, Subhash Kalla, *ResGrid: A Grid-aware Toolkit For Reservoir Uncertainty Analysis*, in proceedings of the Sixth IEEE International Symposium on Cluster Computing and the Grid (CCGrid06), May 16-19, 2006, Singapore, Pages 249-252, 2006.

3. GridSphere / GridPortlets: http://www.gridsphere.org

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