Developing A Grid Portal For Large-scale Reservoir Studies

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Outline

• Analysis of reservoir uncertainty.
  • Advantages of grid technology
  • Proposed Solution of the UCoMS Team
• What is a Portal?
  • UCoMS Portal
  • Achievements
  • Frameworks and platform
• Ongoing & Future Works
Background

• Forecast reservoir performance
• Discovery and management of energy resources
• Reservoir simulations: used to predict the performance of oil and gas reservoirs.
• Reservoir uncertainty analysis: ResGrid
Analysis of reservoir uncertainty...

Petroleum drilling consist of many uncertainties.

Main objective is to optimize output by capita used.

Unrealistic, due to these uncertainty involved in drilling making it impossible to know exactly what the output would be if they drill at a particular site.

Drilling knowledge could help in determining which particular site they should focus on.
Analysis of reservoir uncertainty.

Solution to this problem:
Engineers have adopted complex algorithms to help predict many outcomes in hopes of clearing up these uncertainties.

Problems with solution:
Many of these algorithms require lots of time to calculate, even with the use of computers. Even with the grid, the calculation time is still a problem due to the large output files, which when it comes debugging is a hard process leading to making many errors in analysis.
Proposed Solution of the UcoMS Team...

The idea is to reduce processing time by adding more and more computer processors.

Multi-processing supercomputers (e.g. SuperMike) are expensive.

A cheaper way: by networking many smaller clusters and personal computers with a centralized server.
The centralized server acts as the distributor of the jobs across the grid to be processed.

When the job has finished processing, the individual components are assembled into an output file, which the server returns to the user.
This can reduce computation time

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 web-based application that usually connects to a server on a network.

The UCoMS Portal:

The grid is usually accessed through a command-line, but the portal gives users a different, user-friendly option to accessing a grid. 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.
...What is a Portal?

Benefits:

● allows users access to all grid resources through a single-sign on via an internet browser on any particular platform
● 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
● provides new tools in other areas of research
ResGrid Portal

User Job List:

<table>
<thead>
<tr>
<th>Name</th>
<th>Template</th>
<th>Status</th>
<th>Submitted At</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCoMSv1</td>
<td>template1</td>
<td>Job completed with message success</td>
<td>2006-10-04 13:19:12.222</td>
</tr>
<tr>
<td>ucomsjob12</td>
<td>template1</td>
<td>Job completed with message success</td>
<td>2006-10-04 14:10:41.485</td>
</tr>
<tr>
<td>UCoMS_1</td>
<td>template1</td>
<td>Job completed with message success</td>
<td>2006-10-18 11:54:39.279</td>
</tr>
<tr>
<td>UCoMSV1</td>
<td>template1</td>
<td>Job completed with message success</td>
<td>2006-10-18 13:44:45.414</td>
</tr>
<tr>
<td>UCoMS_2</td>
<td>Template2</td>
<td>Job completed with message success</td>
<td>2006-10-18 14:27:15.402</td>
</tr>
</tbody>
</table>

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The UCoMS Portal ...

Via the internet, users can:

- develops jobs to submit and retrieve
  - provided pages for the users to input the simulator parameters along with factor and well data

- recycle previously processed jobs
### Step 3. Specify factors for model simulation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name*</th>
<th>Symbol*</th>
<th># of Levels*</th>
<th>Levels*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>l_range</td>
<td>6</td>
<td>0</td>
<td>[10, 20, 30]</td>
</tr>
<tr>
<td>2</td>
<td>l_range</td>
<td>6</td>
<td>0</td>
<td>[5, 10]</td>
</tr>
<tr>
<td>3</td>
<td>Intragrid effect</td>
<td>6</td>
<td>0</td>
<td>[0.2, 0.5]</td>
</tr>
<tr>
<td>4</td>
<td>L-stratified rate</td>
<td>6</td>
<td>0</td>
<td>[25, 50]</td>
</tr>
</tbody>
</table>

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### Step 4. Specify wells for model simulation.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name*</th>
<th>Type*</th>
<th>I*</th>
<th>J*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B2</td>
<td>Producer</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>A1</td>
<td>Injector</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
What petroleum researchers want:

- the ability to check on the progress of submitted jobs
- allow users to see the job’s status and what errors might have occurred during simulations
- set up a template system, in order to allow users to recall previously used parameter values for other submitted jobs

...The UCoMS Portal

Mission Accomplished!
### User Template List:

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Created At</th>
<th>Modified At</th>
<th>Edit Template</th>
</tr>
</thead>
</table>
Achievements: UCoMS Portal

We were able to design the UCoMS portal to:

- provide a user-friendly interface for complex jobs
- verify user credentials
- create, edit and retrieve templates to facilitate user input
- view job status
- provide an estimation of simulations and computation time
Frameworks and Platforms

- **Gridsphere** – portlet container that is used to display the files
- **Gridportlets** – credential/security module that gives access to resources
- **Hibernate** – database interface for the gridsphere environment
- **Apache Ant** – portlet installer and setup module
- **Jakarta Tomcat** – gridsphere container and server environment
Ongoing Works

At present we are working on adding the following features to our portal:

- allowing for the user specification of resources

- allowing for the archiving of jobs
Future Plans

We hope that in the future, our portal will:

- be able to handle notification by email and AIM

- suggest the best combination of resource selection to the user, to get an output faster.
Thank You!

Questions?