The Grid Application Portal for Glass Technology (GAP-GT).

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Abstract

The GAP-GT project is an exchange of expertise between commercial and academic organisations enabling the development of a web based application portal utilising the White Rose Grid. Although Grid Technology has so far been mainly the preserve of the scientific community it would also appear to offer significant benefit to other organisations from both the public and the private sector. As part of the move to assess the commercial interest in a grid infrastructure the White Rose Grid are embarking on a number of initiatives to assess commercial interest of which the GAP-GT project is an example.

The application portal provides Engineering Departments with a service that enables testing and publishing of a wide range of modelling applications. This feature is particularly attractive as it enables users to focus on the problem area in which they are particularly interested without the need for expertise in a particular modelling application. This provides increased value for engineering analysis expertise and immediate benefits for developers of modelling applications. The portal enables submission of compute tasks to the White Rose Grid and enhances collaborative working by making applications available to the wider academic and commercial communities.

Using the EASA web application builder and the java Commodity Grid kit (COG), the GAP-GT project has implemented such a portal and has tested the implementation by making analytical applications available to glass technologists in the glass container industry. This poster describes the design and implementation of GAP-GT and details the specific glass technology application to which it has been applied.

1. Introduction

The White Rose Grid [1] [2] is an important and developing resource for data and compute intensive jobs. Significant interest in this resource has been shown by both the scientific community and the regional corporate base; particularly by the glass industry such as British Glass and Rockware PLC. Access to these resources is currently constrained by the absence of any internet based portal. The GAP-GT project has addressed these issues by developing a portal providing easy and secure access onto the White Rose Grid. GAP-GT has provided users with a portal providing:

- Access to a suite of modelling applications through a user interface accessible through a web site.
- A tool for rapid publication applications.

The aims of the GAP-GT project are as follows

- Evaluate Grid Technology
- Model Evaluation
- Technology Transfer
- Knowledge Transfer
- Provide Demonstrators
- To Provide Access to Grid Services

2. Application Portals

For many users grid access through the Globus toolkit involves a relatively steep learning curve. To simplify this access, the WRG has undertaken the development of portals providing a single gateway to all resources from the user's desktop.

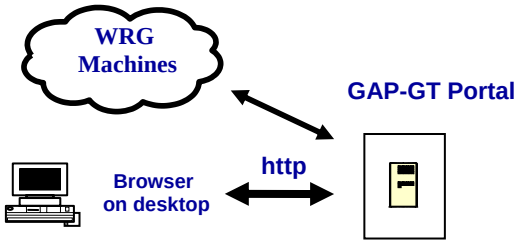


Figure 1: White Rose Grid GAP-GT Portal Architecture.

The GAP-GT project provides a web application portal enabling researchers to publish and run modelling applications. The published applications exploit compute resources provided by the White Rose Grid. The development of this portal was achieved through the use of a commercial off the shelf tool for web application development called EASA (Enterprise Accessible Software

Applications)[3]. EASA, a division of AEA Technology plc, have developed a software tool which provides users within an organisation access to a proprietary library of applications over the internet. This technology has been used in combination with a grid enabled job broker and adapted to provide an application portal for users of White Rose Grid resources. The key stages of the project include:

- Configuring the portal.
- Developing a job broker to enable submission of jobs to the White Rose Grid.
- Testing application authoring, publication and use.

3 Grid Application Portals for Glass Technology

Experimental testing of manufacturing processes can be expensive and time consuming, hence alternative methods such as computational simulation can be employed. One such method is Finite Element Analysis. A large number of manufacturing processes and quality management methods used by the glass industry can benefit from modelling and simulation techniques. The GAP-GT portal has been tested by the publication and execution of an application for modelling the thermal characteristics of coatings on moulds used in the glass container forming process.

The glass forming process is a hot, high speed, automated process with machines producing millions of bottles daily. During the process the abrasive nature of hot, molten glass causes the mould to wear. To reduce this problem moulds can be lubricated by an operator. However, it is preferable for safety and cost issues if alternative methods are found to lessen the effect of mould wear. One method is to line the inside of the mould with a harder, wear resistant material.

The main method for manufacturers of container glass is the ‘Press and Blow’ method. A ‘gob’ of glass is dropped into a mould, formed by a plunger and inverted.

In the second stage this initial mould or ‘blank’ is then blown using compressed air and the final container shape is formed.

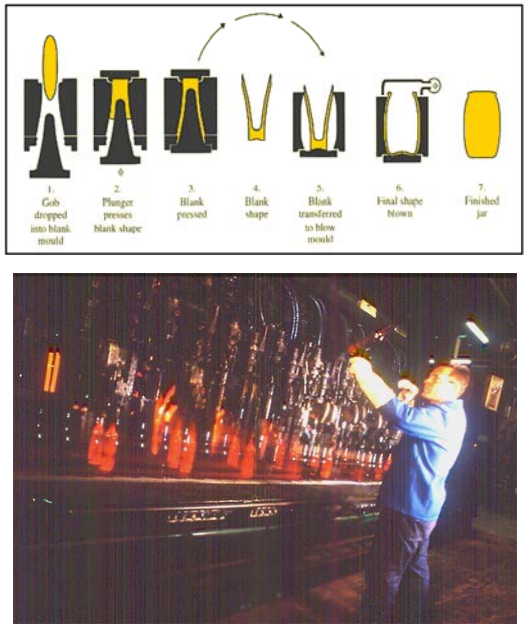


Figure 2:The Press–Blow Container Forming Process.

Companies spend considerable time and money training employees to develop expertise that may be lost during turnover. This expertise can be embedded into custom software applications that would quickly guide new users to a solution. Development of such custom applications using conventional programming technologies requires a significant amount of time on the part of both programmers and subject matter experts. The cost and time involved in creating custom applications to capture a substantial percentage of a company’s technical knowledge would be prohibitive for most organizations if they were to use conventional programming methods.

Figure 3:Finite Element Model of a Glass Mould.

4 The Portal Architecture

The GAP-GT portal [4] features four types of user these are:

- Administrators configure and manage the portal.
- Authors create and publish applications on the portal.
- Users run applications and manage results under their user accounts.
- Guest accounts are available for visitors to preview the system before deciding to register.

4.1 The EASA System

The EASA system employed by the GAP-GT portal provides users with two unique areas of functionality:
1. An application builder, which allows efficient and rapid creation of applications, including user interfaces, links to the models and automatic output data reporting.
2. A web-based environment, allowing wide access to published applications, remote use of software codes and viewing of results from a central library.

The key features provided by EASA include:

- Web Browser Access - Users access the GAP-GT via a web browser. User login is required to access full functionality and user groups can be set to distinguish users with different access levels and different application interests.
- Application Library - This central repository for EASA Applications, also known as EASAPs, consolidates storage of software tools in the organisation for users to access and run.
- Results Library – Again a central repository for an organisation's information that consolidates storage of results generated by the users. Additionally, the results library allows viewing results of other users.

4.2 The White Rose Grid Job Broker

Submission of jobs to the grid is enabled through a job broker developed and tested by Essira ltd and the University of Sheffield. When an application is published the author specifies that the process to be run is a job broker application. This application is provided with user credentials, script files used to execute jobs on different schedulers and resource files for different applications. The job broker authenticates a user to the grid and ensures that selected grid compute nodes are provided with the correct resource files for executing the job. The globus resource allocation manager is used to submit a particular job to a scheduler on different grid nodes. Grid ftp is used to transfer resource files and results files. The job broker built using the JAVA commodity grid kit [5] is based on three main classes.

- Job Broker class used to submit an application to the grid
- Job Execution class uses the globus resource allocation manager to execute a script file provided by the author on a resource scheduler provided by the White Rose Grid.
- File Transfer class used by the job broker to transfer resource files and results files to and from the grid.

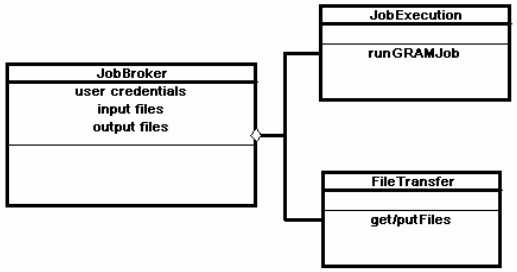


Figure 4: Simple Class Diagram for the java COG Based Job Broker.

4.3 Authouring and Publishing an Application

To make the process of building the applications as simple and fast as possible, EASA contains a tool called EASAP Builder. EASAP Builder is a graphical tool for constructing EASA applications (EASAPs) and is used to:

- Set basic properties.
- Generate graphical user interface objects.
- Create coupling to underlying software applications.
- Format output to be displayed under Results.

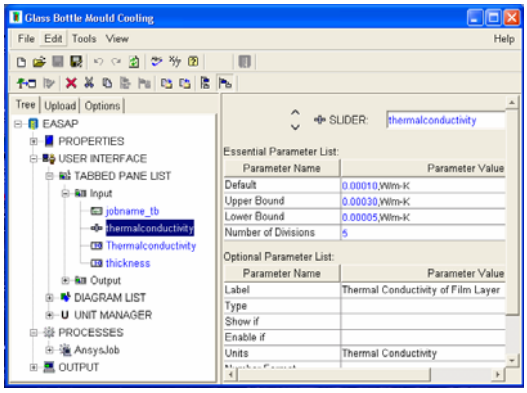


Figure 5: Application User Interface Development Tool Provided by EASA.

4.4 Coupling EASAP with Underlying Application

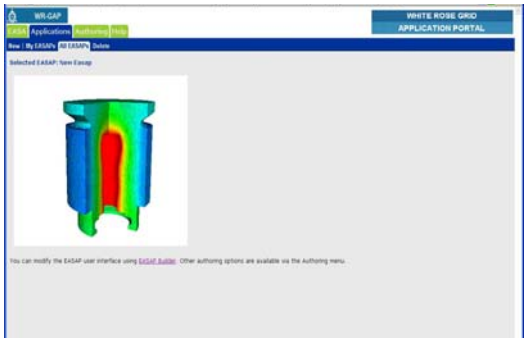
EASA is able to drive any application that can be driven by a text input file. To transfer information from the user interface to an application input file EASA contains a tool called the Template Editor. In the current version of the GAP-GT portal the application author is required to provide:

- A script describing the application that is to be executed and the resources required by that application.
- A script file used by the scheduler at the remote node.
- Other resources required to execute the application.

Within the EASA application user interface development tool, the author specifies the job broker as the application to be run by the GAP-GT portal. The job broker submits the requested user application to the grid and returns the results to the GAP-GT portal.

5 Conclusions

The Grid Application Portal for Glass Technology is a successful demonstration of how grid technology enables a user to remotely submit modelling applications for computation on the White Rose Grid. This submission of jobs takes place via the web without having to use complex modelling software. Users are able to analyse results remotely. This has major benefits for industry whereby experienced engineers can analyse the effects of varying parameters without expensive training or hardware investment. Future work includes the utilisation of the job broker within a grid sphere [6] based White Rose Grid portal and the provision of grid application portal service.



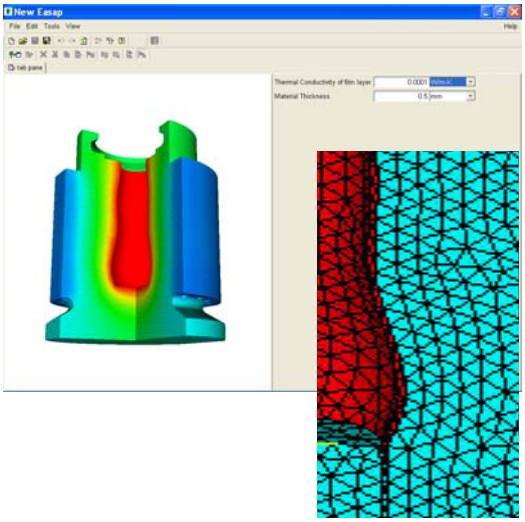


Figure 6: A Completed and Published Application User Interface Provided by the GAP-GT Portal.

6. References

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[6] http://www.gridsphere.org

7. Acknowledgements

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