Application of the gLite Workflow Management System for the ARC Infrastructure

Vladislav Kucher

IP "Sherp ILS", 10-A Geroev Oborony Str., Kyiv, Ukraine

commastergm@gmail.com

Abstract. *Research conducted in this paper relates to the coordination of ARC client and gLite WMS. In this respect, load distribution in Grid middleware - ARC and gLite have been studied, possible ways to improve both data processing speed and load balancing have been proposed, ARC modifications to interact with gLite WMS have been implemented. Bridging between ARC and gLite infrastructures is realized by the procedure of task transferring from ARC UI to gLite WMS. An algorithm to connect the job processing procedures in ARC and gLite infrastructures has been elaborated, which contains modifications of existing files as well as new relevant files and applications. Developed infrastructure modifications made it possible to use ARC WMS while tasks' allocating onto resources.*

Keywords

Grid-system, middleware, NorduGrid ARC, gLite WMS, interaction/interoperability.

1 Introduction

Nowadays, there are a great number of industry and interdisciplinary Grid-projects. One of the main disadvantages in the implementation of Grid-structures is the use of different incompatible middleware facilities provided by system services and their interaction tools that receive and process user jobs. Within recent years, works to enable interoperability of different Grid-structures and to expand the range of the participants of middleware improvement activities have been intensified. The initiators of these activities were CERN (as a main organization to solve the problems connected with the LHC experiments' conduction) and the group "Grid Interoperability Now" set up under the association Open Grid Forum. Since design of the Grid-system with a single universal middleware requires considerable time, system of existing Grid-structures has to be realized with bridge interfaces connecting the Grid-structures.

2 Related Works

In order to develop a unified middleware, four large contributors: gLite, ARC, UNICORE and dCache joined their forces under a project directed toward its development (European Middleware Initiative, EMI [1]). Project EMI provides a consolidated set of middleware. Products managed by middleware suppliers are now designed, developed and tested in collaboration intended for deployment in EGI and other distributed computing infrastructures, to enhance cooperation and integration between Grids, to enhance services' reliability and manageability and to provide a stable model of support, coordination and development of effective middleware that meets the requirements of the scientific community.

There are several ways how users can benefit from the use of resources, which middleware of various Grid-systems functions on [2]. A simple model is, for instance, parallel installation of two or more Grid middleware within a single computing cluster. It is rather simple to implement, but it does not provide an actual interaction of Grids. In addition, it increases load on system administering. User-oriented approach via different Grids means the creation of interfaces or plug-ins with user applications, so that applications can send jobs to process in several Grid-systems. Another model is to create a bridge (gateway) between different Grid-systems. Interaction on applications' support level is easier in terms of a number of programs that need to interact. However, this interaction should be implemented individually for each application. Interaction on a Grid middleware level requires quite a complex system of gateways. Though, an interaction on a Grid level is independent from applications and, therefore, should be implemented only once.

Currently, NorduGrid project is one of the most advanced, universal and efficient Grid-systems oriented toward scientific programs. The main functional difference of gLite from ARC is that the choice of resources to process a job in ARC is done by a client, while the choice of resource in gLite is delegated to a global broker, Workflow Management System. gLite strategies provide more efficient job distribution, while ARC scheduling provides a better scalability. Despite that existing software products ensure interoperability between these two middleware, users face difficulties trying to cross the border between these systems. Issues concerning the interoperability, transfer protocol and transactions related to the job submission are still relevant.

3 Improvement of the interoperability of EMI components ARC UI and gLite WMS

The bridging of ARC and gLite is realized by means of the procedure that has been developed in this work to redirect jobs from ARC UI to gLite WMS.

Task transfer algorithm is based on the following:

- Task processing procedure in ARC infrastructure
- Task processing procedure in gLite infrastructure
- Developed algorithm to connect task processing procedures
- Implemented modification of existing ARC files, created new files and applications

Jobs in ARC infrastructure are processed by means of the following procedure steps:

- Reading and parsing the job file
- Reading the configuration file
- Certificate validation
- Converting the job file into an internal form using existing parser plugins
- Selecting the submission type based on execution arguments
- Selecting the submission interface from those provided by submission plugins
- Converting the job description from internal form into plugin-specific one

In particular, jobs can be processed further on the base of ARC manager as follows:

- Certificate validation
- Job registration, aquiring job ID
- Transfer of possible job input files
- Displaying the job ID and/or storing it to a file

The procedure of job processing in gLite infrastructure is conducted by the following steps:

- Searching for WMProxy node
- Reading the job file
- Converting the job file into an internal form using existing parser plugins
- Searching for certificate
- Autodelegation or retrieving the delegation ID from arguments
- Job registration with delegation ID

- Transfer of possible job input files
- Sending Job Start command
- Displaying the job ID and/or storing it to a file.

Algorithm to connect the job processing procedures is presented in Figure 1:

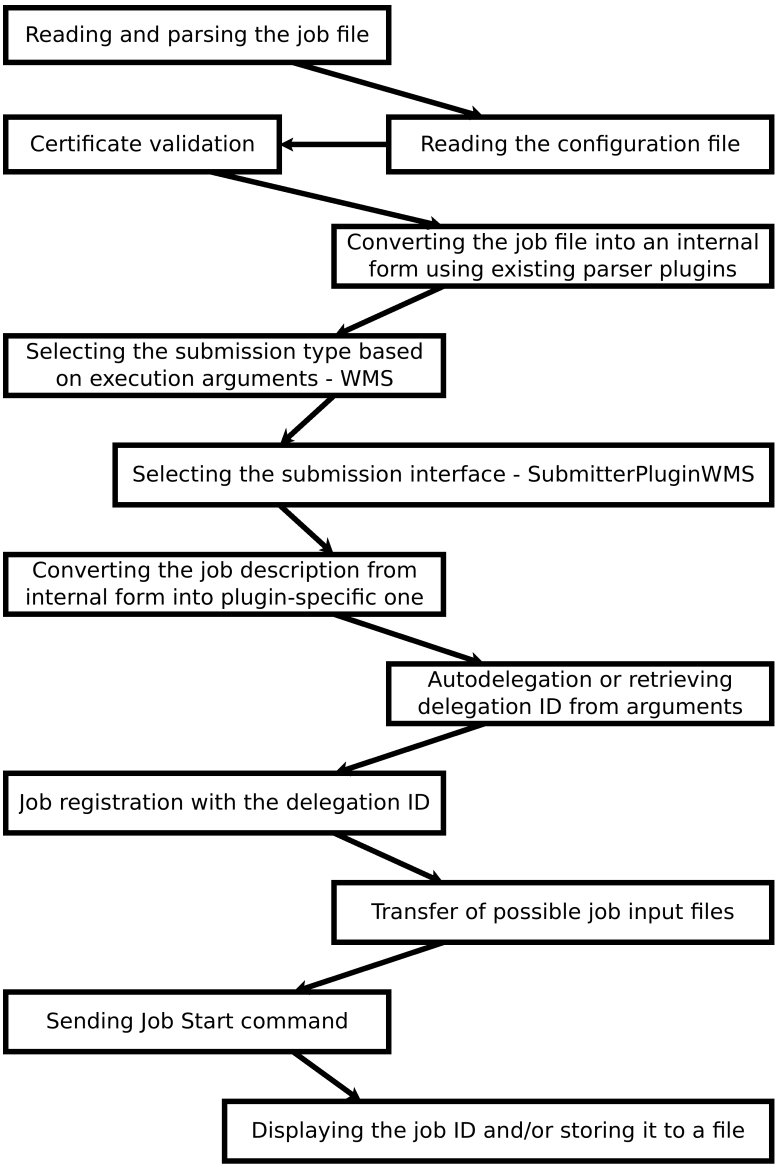

Figure 1. Algorithm Scheme

Figure 1 shows the scheme of the algorithm to connect the ARC and gLite procedures of the job processing. The algorithm to connect the job processing procedures includes modifications of the existing ARC files as well as new files and applications.

New files and used applications:

- gLite WMS API
- Makefile.am
- DescriptorsWMS.cpp
- SubmitterPluginWMS.h

- SubmitterPluginWMS.cpp

The plug-in redirecting jobs from the ARC user interface into the load balancing system WMS of gLite has been developed. This included a separate parameter to indicate that the user wants to send a job from ARC into WMS gLite. Job redirecting is done directly, without a broker. Accordingly, the following name of the interface has been introduced: "org.glite.wms".

Load balancing system is registered with the interface described above. Processing of a parameter –W (–wms) has been added. Plug-in introduced in this work, uses an application programming interface glite.wms.API, which is provided by gLite. Job redirecting is conducted without any adjustments due to the coincidence of file formats.

4 Conclusion

Application of load distribution system WMS within the ARC and gLite increases data processing speed and improves load balancing, what corresponds to the needs of data analysis problems for the LHC Computing Grid. ARC modifications enabling its interaction with WMS improve significantly the interoperability of EMI components (ARC UI and gLite WMS). Application of the proposed solution allows bridging of the ARC and gLite infrastructures.

References

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