

# ALIEN WEB PORTAL

L. Betev, P. Buncic, M. Meoni, A. Peters, V. Pinto Morais, P. Saiz, P. Tissot-Daguette

CERN, Geneva, Switzerland

## Abstract

The AliEn (Alice Environment) framework is an implementation of a Grid system developed in the Alice Collaboration. It is currently used to produce and analyze Monte-Carlo data at over 30 computing sites on four continents. The AliEn Web Portal was designed and built to serve as an entry point to AliEn and to encapsulate both a command and control interface and a complete monitoring system. The portal is built around common Open Source components with backend based on Web Services Resource Framework (WSRF). An easy and intuitive presentation layer allows the user to access information from multiple sources in a transparent and convenient way. Users can manipulate and check job provenance and access process monitoring information from a MonALISA repository. The presentation layer is separated from the content layer which is realized as several WS-Resources and Web Services serving one or more users or Virtual Organizations. The security and authentication of the portal is based on the Globus Grid Security infrastructure, WSRF::Lite and MyProxy online credentials repository. In this paper the architecture and functionality of the AliEn Web Portal is presented.

## I. OVERVIEW

AliEn [1] is a distributed computing environment developed by the ALICE [2] Offline Project offering to the ALICE user community a transparent access to worldwide distributed computing and storage resources. It is currently used for a massive production of Monte-Carlo data for detector and physics studies and also for user analysis jobs.

In this context the necessity of a central access gateway to various information sources relevant to the job control, processing and monitoring is evident. This gateway is the AliEn Web Portal.

This paper is organized in the following sections: Section II describes the layers of the Portal architecture and implementation details. The functionality of the different integrated services is presented in Section III. Section IV is dedicated to the discussion of the usability aspects of the middleware, regarding the technology and functionality aspects. The conclusions and future plans are summarized in the section V.

## II. ARCHITECTURE AND IMPLEMENTATION

The architecture of the AliEn Web Portal is shown in figure 1:

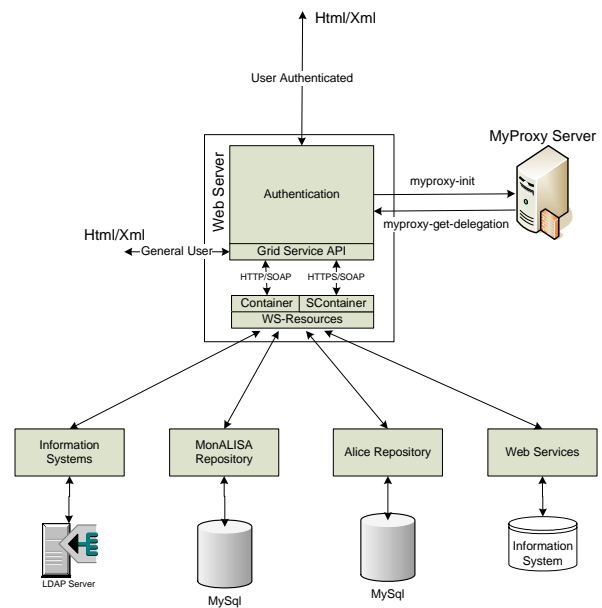


Figure 1 – Web Portal Architecture

It consists of several components that can be logically split in the following categories:

- *Data sources*

The data sources of the AliEn Portal are divided in three types: information system (IS), repositories and Web Services (WS).

The IS is implemented in a hierarchical database - LDAP (Lightweight Directory Access Protocol), which contains static information about the configuration of the Virtual Organizations (VO), for example, the server name of the databases used by the VO and the location of the MyProxy server, as well as user account information.

The repositories are data sources, hosted in MySQL DBs. These contain accounting and logging information for every job executed on the AliEn Grid.

The MonALISA (Monitoring Agents in A Large Integrated Services Architecture) [3] information is exclusively monitor oriented. A generic framework for building service "pseudo-clients" allows to create dedicated Web Service repositories with selected information from specific groups of monitored parameters. The repositories use the same LUS (LookUp Services) approach to find the active MonALISA services from a specified set of groups and subscribes to these services with a list of predicates and filters. These predicates or filters specify the information the repository wants to collect from the services: it stores all the values received in a local

MySQL database, and uses procedures written as Java threads to compress the collected data. A Tomcat based servlet engine is used to provide a flexible way to present global data and to construct on the fly graphical charts for pre-defined or customized historical values, on demand. Dedicated servlets are used to generate Wireless Access Protocol (WAP) pages containing the same information for mobile phone users. Multiple Web Repositories can easily be created to globally describe the services running in a distributed environment.

The AliEn system has also specific web services that provide monitoring information related to the operation of the Cluster Monitor and Queue Systems [4]. The Cluster Monitor is a service that runs on each remote site, being used as an interface between the site and the central services (Job Manager and Broker). The Queue Systems are the batch queues at every Computer Element (CE). AliEn has interfaces to the most popular schedulers up to date: LSF, PBS, BQS, CONDOR and SGE.

- *Grid Services APIs*

The Grid Services APIs are used to wrap-up the Web request parameters into a SOAP call and send this information to the Container or SContainer (explained in the next section).

- *WS-Resources*

The WS-Resources are grid services hosted in the Container or SContainer. The SContainer is the secure version of the Container, using the host certificate of the machine where it is running. The Container can be spread over different machines, allowing for a load balanced Web Server, where the most efficient Container replies to a request.

These containers are lightweight web servers implemented in WSRF::Lite [5]. WSRF::Lite is a Perl package that implements the WSRF [6]. The Web Service Resource Framework is a re-factoring of OGSF [7], announced by the Globus Alliance and IBM in conjunction with HP on 20<sup>th</sup> of January, 2004. It explores the latest developments in Web Services architecture, allowing for services state management through a set of interfaces. These interfaces are Web Services that act as a front end to the different stateful resources. These resources can be created, destroyed and can expire. A WS-Resource is created by a request of the Container, which returns a specific endpoint for a service and an identifier of the WS-Resource. The identification is contained in the header of the SOAP call that is sent to the Container. Thus, the Container can switch to the right WS-Resource.

WS-Resources can be implemented in different ways. The process based WS-Resources use a process that holds the state of a single resource, while for the multi-session based WS-Resources multiple resource states are managed by a single a process. In the AliEn Web Portal implementation, the state of each service is file based. The file contains the status between two subsequent calls, which allows for it to be kept even if the case of a Container/SContainer failure.

- *MyProxy Server*

The security and authentication in the AliEn Web Portal is based on the GSI (Globus Grid Security) infrastructure and the use of MyProxy [8] online credentials.

The credentials are stored in a MyProxy repository, which allows the user to retrieve the credentials whenever and wherever needed, avoiding problems and security risks associated with the management of private keys and certificate files. The process of storing a credential in the repository (*myproxy-init*) and the credential retrieval (*myproxy-get-delegation*) is shown in figure 1. These functionalities are provided by GridPort Toolkit [9], which also provides a communication API for the MyProxy server, allowing the Web Server to act on the user's behalf.

- *Web Server*

The AliEn Web Portal uses the Apache HTTP Server as Web Server to process the user requests. The security between the client web browser and the Web Server is handled by the Secure Socket Layer (SSL) protocol via HTTPS.

### III. FUNCTIONALITY

An essential part of managing a global distributed system, like the AliEn Grid, is a monitoring system that is able to track multitude of parameters directly controlled or used by AliEn, for example the computer centre facilities, tasks associated with a job execution and the network infrastructure. The use of the MonALISA framework in the AliEn Web Portal provides to the users a complete history overview of the behaviour inside the AliEn Grid. In addition to that the AliEn ALICE VO repository allows the monitoring of specific job information in real time, for example its current execution status, or static information like the job JDL. The different functionalities provided by the Web Portal can be summarized in the following categories:

- *User Interface*

The User Interface allows to retrieve generic documentation about the AliEn framework, e.g. installation manuals, PerlDocs, as well as features related to the Grid monitoring, the job status submitted to the Grid, the task queue and the transfer queue. The information can be displayed in tabular and graphical form (pie charts, histograms).

A central part of the monitoring is following the progress of a job as it passes through the different stages of execution [10]. These stages are illustrated in fig.2

The figure also shows the possible error conditions at each stage. The AliEn and MonALISA repositories track the job status and errors both on a single job level and also as sums over all jobs currently running as a function of time.

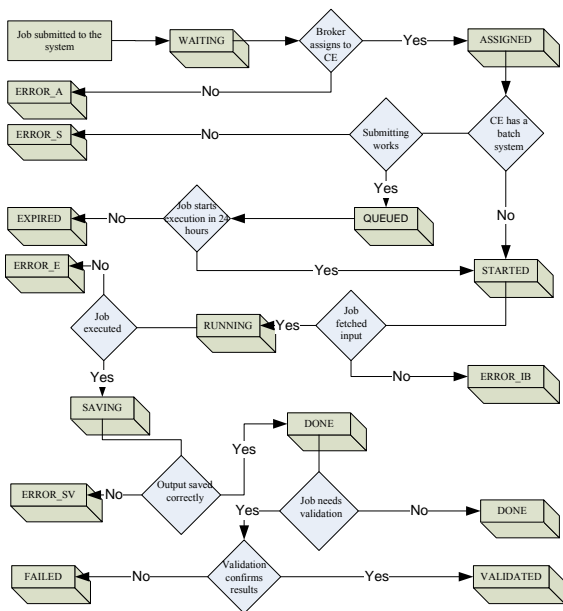


Figure 2 – Job Status

- *Grid Administrator Interface*

The highest control and monitoring level is the Grid Administrator Interface. On this level, the administrator can access the computing and storage elements and the queue systems at the sites and also monitor their parameters and log files.

- *VO Administration Interface*

In this interface, the VO administrator can monitor the messages sent by the different AliEn services, run by the VO, for example the ClusterMonitor, which runs on every site and parse the log files produced by the AliEn Logger service. These files contain information on the status of all AliEn services. On this level there is also an interface to the AliEn File Catalogue, network traffic and server load factors.

#### IV. DISCUSSION

The AliEn Web Portal is designed to serve as an entry point for the users of the AliEn Grid. Its functionalities allow the users to authenticate themselves for Grid access and also to monitor the state of their jobs. On administrative level, the state of the various AliEn services can be controlled and monitored. In addition to that, the MonALISA framework provides an ensemble of autonomous multi-threaded, agent-based subsystems which are registered as dynamic services which can perform a wide range of monitoring tasks in a distributed computing environment.

The architecture of the Portal allows for an easy installation and instantiation by different VOs, each with a custom flavor and layout. This approach follows the latest standard of statefull web services (WSRF), which guarantees the user session management capabilities. Figure 3 illustrates the method through which each VO can configure its own layout and content.

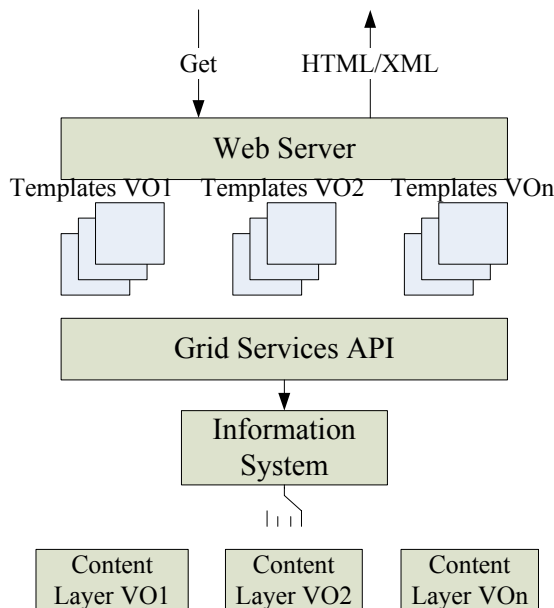


Figure 3 – Presentation and content configuration

Three kind user interactions with the portal are allowed: anonymous user, authenticated user and user authenticated over SSL. The authentication aspect determines the level of access. The anonymous user has access only to the general information provided by the Portal.

When a user starts a session, a dedicated service with the proper user context is created. This context is inserted in the state of a WS-Resource, together with information about the user's VO and the lifetime of the service. The WS-Resources' creation/destruction follows two approaches, depending on the user type. For an anonymous user, the resources are created with a lifetime of one year. This allows for quick access to the services and improves the Portal performance, since these are already instantiated at the time of the start of the Apache Server. For the authenticated user, the resources are destroyed after the expiration of the session, avoiding the waste of resources on the server. Each time a user interacts with his WS-Resource, the corresponding lifetime is extended.

The security mechanism is based on the Grid Port Toolkit, which allows for implementation of various Grid technologies. Two of them, GSI and MyProxy, are used in the Web Portal.

The AliEn Web Portal accomplishes the user authentication providing the portal with a valid proxy file. The user login sessions are tracked via a browser cookie which is assigned a random value by the Web Server when the user is successfully authenticated. The random value in the cookie corresponds to a session file, which ties the cookie in the user's browser to a specific user on the portal. The session files and user proxies are stored in a restricted repository, controlled by user and group permissions.

The MonALISA system provides a distributed service for monitoring of complex systems. MonALISA is based on Java/JINI and Web Services

technologies: each MonALISA server acts as a dynamic service system and provides the functionality to be discovered and used by any other services or clients that require such information.

The aim of ALICE's MonALISA repository is to store monitoring information of the AliEn Grid: running parameters, task completion and resource status. It has been realized as a modification of the framework to suit the ALICE Grid and production needs, retrieving data via one MonALISA server (MQ), native AliEn monitoring commands, SOAP asynchronous communication and LCG monitoring scripts, as illustrated in figure 4:

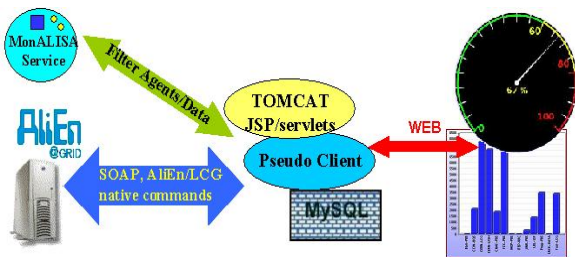


Figure 4 – MonALISA architecture in Alice

The information gathering began on March 13<sup>th</sup> 2004 and 17 millions records of data with 1 minute granularity have been stored within the repository database so far. There are 937 different monitored parameters, such as computing element load factors, storage element occupancy, job status and error information and CERN network traffic. In addition, 150 derived parameters, such as sites or system's efficiency, are computed. Monitored data can be displayed in several formats: running history, bar and stacked bar histograms, pie charts, tables, dials and active real-time geographic map.

The repository depends only on the active process tables in AliEn, and provides complete history information on every monitored variable. Incremental variables (like number of done jobs) are computed from the current AliEn process tables using cumulative algorithms. All values can also be displayed and calculated for a given time interval. The implementation also has some tools for basic data analysis and provides API to get data either from distributed or central source. Every site can be monitored independently and in relation with others; the job status are separately monitored.

## V. CONCLUSIONS

In this article, the main components of the AliEn Web Portal are described, with emphasis on the elements associated with the emerging need for a complete access and monitoring tool for distributed computing environments like the AliEn Grid.

The architecture of the Portal follows the WSRF specification, allowing the access to both generic and particular Grid services, depending of the user authentication level. Special consideration is given to the Portal installation and adaptation to the needs of the

different VOs, - it allows for layout and content customization at a VO.

The AliEn Web Portal has been successfully implemented to the requirements of the ongoing ALICE Physics Data Challenge, being able to store, plot, sort and group any kind of data either basic or derived in multitude of presentation formats and integrating the AliEn ALICE and the MonALISA repositories.

The following points list the tasks that remain to be completed in the AliEn Portal:

- Integrate an easy and intuitive layout customization on user level;
- Integration possibilities for various monitoring tools, as well as different Grid services;
- Implementation of new report and display formats.

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