ARC and gLite interoperability in ATLAS sites

Andrej Filipcic\textsuperscript{1}, Szymon Gadomski\textsuperscript{2} and Sigve Haug\textsuperscript{3}

for the ATLAS collaboration

\textsuperscript{1} Jozef Stefan Institute, Ljubljana, Slovenia
\textsuperscript{2} DPNC, University of Geneva, Switzerland
\textsuperscript{3} LHEP, University of Bern, Switzerland

E-mail: andrej.filipcic@ijs.si, szymon.gadomski@unige.ch, sigve.haug@lhep.unibe.ch

Abstract. In the Worldwide Large Hadron Collider Computing Grid several sites deploy both gLite and ARC middlewares. In this manner they are simultaneously providing resources to more than one federation of sites. In this article the interoperability between the two middleware flavors at sites that provide distributed resources to the ATLAS experiment is described. Some motivations for dual deployments, the coexistence of a gLite computing element and an ARC front-end on the same local resource management system, consistent monitoring, accounting and ticket handling are discussed.

1. Introduction
The high energy physics detector ATLAS at the Large Hadron Collider (LHC) is recording data which is distributed within the Worldwide LHC Computing Grid (WLCG) \cite{1} \cite{2}. WLCG also serves the ATLAS collaboration as the main resource for data simulation and analysis. WLCG is build on ARC, gLite, OSG software, often referred to as middlewares \cite{3} \cite{4} \cite{5}. This grid infrastructure includes more than 200 sites.

While most computing resource providers in the ATLAS collaboration deploy one of the middlewares mentioned above, some present their resources via both gLite and ARC computing elements. These dual sites are seen in Figure 1 as red points. The blue points represent sites with only ARC computing elements, not all supporting ATLAS. Sites with only gLite computing elements are not shown, but are between 150 and 200 in number. The dual sites shown in Figure 1 are CSCS-LCG2 in Switzerland, SE-SNIC-T2 in Sweden, SIGNET and ARNES in Slovenia and UKI-SCOTGRID-GLASGOW in the United Kingdom.

The sites' motivation for dual deployment varies. A site may have to serve users who work with different clients. For example, in Switzerland the CSCS-LCG2 site has to serve Swiss ATLAS users relying on the ARC client in addition to international users submitting with the gLite client. Another motivation is to increase the occupancy of a site. In ATLAS the centrally organized submissions to the different sub-grids (OSG, gLite, NorduGrid) are not always synchronous, i.e. in periods when few jobs come in via the gLite interface, many may come in via the ARC interface. A third motivation for a site to deploy several middleware flavors can be to follow and learn about more than one grid technology.

Below the deployment and operation at sites in ATLAS with both ARC and gLite middlewares are briefly described.
2. Interoperable deployment

The deployment of ARC and gLite computing elements, for ARC often called front-ends, which serve the same local resource management system, i.e. the batch system, is due to dependency conflicts wisely done on two different systems. While the ARC computing element supports several linux flavors, the gLite element is only available for Scientific Linux CERN or equivalents. The computing element nodes require a client for the local resource management system.

The same application software, in this case the ATLAS offline releases, can be shared by jobs coming from both computing elements. This is considered as recommended since the management of the many million files can cause complications. If the application software is shared, the central installation has to be coordinated.

The so-called pool accounts, i.e. the local user accounts used for submission to the batch system, can be the same for both computing elements. If a site has already implemented a scheduling policy based on those accounts, the addition of a new computing element then does not require any additional policy or implementation.

Grid monitoring of the basic services are done by Nagios tests [6]. These tests are provided by the national grid infrastructure, into which the site is federated. In countries where this provision is not yet in place, sites may require assistance from the European Grid Initiative [7]. Since the tests are probes of different services, their distribution package and configuration depend on the middleware flavor on the node which is to be monitored.

The accounting system at a dual site should publish consistently with the pledges to its federations. Dual sites in ATLAS have individual and custom made solutions for this. One solution for ARC sites deploying the ARC compatible SGAS tool [8] is to insert the SGAS records into the gLite APEL database [4]. Another direct solution is to map the accounting information from the batch system to the grid identity of the job and insert the information into APEL. For both solutions APEL publishes the information to the central Grid Operation Center (GOC) accounting database. In this way GOC receives consistent accounting data per site.

Regarding user interfaces, these may be deployed on the same system. This is an important fact as different and multiple user interfaces are inconvenient for users. The linux flavor of the system is dictated by gLite. In the case of ATLAS, also the essential and application specific
distributed data management clients can co-exist with the middleware clients.

Both ARC and gLite provide storage elements in their repositories. Currently there are no sites in the ATLAS distributed data management system, which use storage elements from the ARC repository. However, the ARC clients and also the ARC computing element support the SRM protocol and communication with the gLite LHC File Catalog. Thus, there are sites deploying ARC computing elements and gLite storage elements successfully.

In summary, the deployment of gLite and ARC computing elements on the same local resource management system goes without complications and some such dual instances are in production since years. A non-grid site or a gLite-only site can become an ARC site by adding one server, i.e. the ARC computing element. The ARC user interface, if desired, can be deployed on the same system as the gLite user interface. The only part which requires some local solution, is the accounting. A picture exemplifying a site setup is shown in Figure 2.

## 3. Interoperable Operation

The operation of an ATLAS grid site typically deals with two levels of federation. The first level is the basic federation into the Grid Operations Center Data Base (GOCDB), i.e. normally into the national grid infrastructure as a subgroup of this data base [9]. This ensures the basic monitoring of the site services, the right place for accounting information, the routing of site tickets, and the possibility to publish downtimes. All services, which a site desires to publish, regardless of the middleware flavor, are registered in the same place. The federation of a dual site is in this sense consistent.

The second level of federation for a site which supports ATLAS, is the assignment of its storage element within the distributed management topology of ATLAS. This assignment, i.e. the entering of the storage end-point address into the central topology configuration file, may affect the job flow to the site since the data model is mainly based on a *jobs to data* concept. The operational tasks at this level of federation concerns the management of the application software and the data on the storage element. This is done centrally.

## 4. Summary

In the Worldwide Large Hadron Collider Computing Grid some sites deploy both gLite and ARC middlewares. In this manner they are simultaneously providing resources to more than one ATLAS federation of sites. The dual deployment is uncomplicated. Only the publishing of ARC accounting information into the Grid Operation Center (GOC) accounting data base is not included in the standard installations. The federation of a site with both ARC and gLite
services into the GOC site data base is consistently achieved by listing the additional services together with the others.

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