

The SAM-GRID project: architecture and plan.

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Abstract

SAM is a robust distributed file-based data management and access service, fully integrated with the DZero experiment at Fermilab and in phase of evaluation at the CDF experiment. The goal of the SAM-Grid project is to fully enable distributed computing for the experiments. The architecture of the project is composed of three primary functional blocks: the job handling, data handling, and monitoring and information services. Job handling and monitoring/information services are built on top of standard grid technologies (Condor-G/Globus Toolkit), which are integrated with the data handling system, provided by SAM. The plan is devised to provide the users incrementally increasing levels of capability over the next two years.

1. Introduction

Goal of the SAM/Grid project is enabling fully distributed computing for DZero and CDF, by enhancing the distributed data handling system of the experiments (SAM), incorporating standard Grid tools and protocols, and developing new solutions for Grid computing.

The project is funded by PPDG and GridPP. Within these organizations, our group is working with both computer scientists, like the Condor Team, and physicists, like UTA and Imperial College teams. The Project is also taking advantage of the collaboration with other groups working on Grid technologies, such as EDG and DataTAG. Through these collaborations, we promote interoperability and code re-use via modularization and standardization.

2. The SAM & JIM Architecture

The architecture of the project results from three major considerations

1. Both the DZero and CDF experiments have large and widely geographically distributed collaborations;
2. SAM is a mature data handling system, distributed in nature, which we believe is well suited to play a major role in a Grid-like environment, for its proven qualities of scalability, robustness and flexibility;
3. The development teams of both Condor-G^I and the Globus Toolkit^{II}, the Grid technologies that the architecture exploits, are part of PPDG and GridPP, like the SAM Grid project. We believe we are in a favorable position to influence the development of such

querying the Information System. These scripts implement the “intelligence” of the Brokering Service in a modular fashion.

- **The Job Submission Service** is implemented via CondorG. The service offers reliable submission of jobs to remote resources via the GRAM protocol. It also provides a persistent queuing mechanism in case the machine where this service runs needs to be shut down. Also, at the time of submission, CondorG, using GRAM, transparently starts up a GASS^{VII} server to manage the transport of standard input/output and error.
- **GRAM^{VIII}** is the submission protocol used by the Job Submission Service. We use the Globus Toolkit implementation of the GRAM clients/servers.
- **The Advertisement of Resources** is managed by Grid sensors that publish static and small-size dynamic collective information in the form of ClassAds.

The Monitoring and Information System.

- **The Resource Information Service** is based on top of 2 components, MDS^{IX} and the Condor Collector. The architecture of MDS, based on LDAP, is well suited for monitoring run-time parameters, because it conveniently treats information as stale after a tunable expiration time. The Condor Collector, instead, transparently makes available to the Match Maker the characteristics of the resources advertised by the Grid sensors. An intermediate protocol translation layer, which uses XML as *lingua franca*, manages information exchange between the two services.
- **Logging and Bookkeeping services** are currently implemented using the logging facilities of SAM. We envision interfacing the Match Maker to these services to enable brokering decisions

based on the statistical analysis of the history of the grid usage/condition.

- The **Replica Catalog** is implemented as a global resource via SAM. We look with interest to the developments of standard grid-enabled distributed RC services.

3. Current Infrastructure and future Plans

We currently run a prototype grid of 6 clusters, distributed between Illinois, Texas and the UK. We plan to expand such infrastructure as part of the project collaborative effort.

The 2-yr term goals of the project can be identified as:

- the reliable execution of structured, locally distributed Monte Carlo and SAM analysis jobs with basic brokering;
- Scheduling criteria for data-intensive jobs, full Job Handling – Data Handling interaction;
- Fully Distributed Monitoring and Information Services for Structured Jobs and Data Handling.

^I The home page:

<http://www.cs.wisc.edu/condor>

^{II} The home page: <http://www.globus.org>

^{III} The home page:

<http://eu-datagrid.web.cern.ch/eu-datagrid>

^{IV} Meta-Computing at DØ, Igor Terekhov et al., ACAT 2002, Proceedings

^V Proposal for DØ Job Description Language, D. Meyer *et al.*, Internal Note 2002

^{VI} The web page from Condor:

<http://www.cs.wisc.edu/condor/dagman>

^{VII} The web page from the Globus Toolkit:

<http://www.globus.org/gass>

^{VIII} The web page from the Globus Toolkit:

<http://www.globus.org/gram>

^{IX} A Directory Service for Configuring High-Performance Distributed Computations, S. Fitzgerald *et al.*, HPDC 1997.

<ftp://ftp.globus.org/pub/globus/papers/hpdc97-mds.pdf>