

GridLab Resource Management System (GRMS) is a job scheduling and resource management framework, developed under the GridLab Project, which allows users to build and deploy job and resource management systems for Grids. Based on dynamic resource discovery and selection, mapping and advanced scheduling methodologies, combined with a feedback control architecture and support from other GridLab middleware services such as adaptive components, monitoring, data management, etc. GRMS deals with dynamic Grid environment and resource management challenges. Therefore, the main goal of GRMS is to manage securely and efficiently the whole process of remote job submission and control to various remote systems belonging to many different, geographically distributed domains.

GRMS main features include:

- Modular & pluggable architecture,
- Advanced scheduling algorithms and plugins available for:
 - multicriteria optimization of resource allocations,
 - job re-scheduling (using user-level checkpointing and job migration),
 - time-constraint scheduling,
 - job dependency and work-flow management,
- Portable (all internal modules implemented in Java)
- Compatibility and integration with common technologies, including Globus Pre-WS and new GT4/WSRF services, Mercury grid monitoring system, iGrid, and many others,
- Email alerts and SMS notifications for users and administrators,
- Enhanced support for VO-level authorization scenarios with GAS,
- Detailed job run accountability and tracking,
- Scalability and capability of handling the configuration and processing of thousands of jobs.

Other:

- GRMS is delivered with a broad range of clients such as command line tools, GridSphere portlets and J2ME mobile clients,
- Technical documentation and user guides are available,
- Support will be continued after the GridLab project is finished,
- Hundreds of downloads,
- Used and tested in many Grid projects and environments, including HPC-Europa (www.hpc-europa.org), IntelGrid (www.intelgrid.com), Progress (<http://progress.psn.c.pl/>), Clusterix (www.clusterix.pcz.pl),
- Ready to use, open source and 100% free !!!

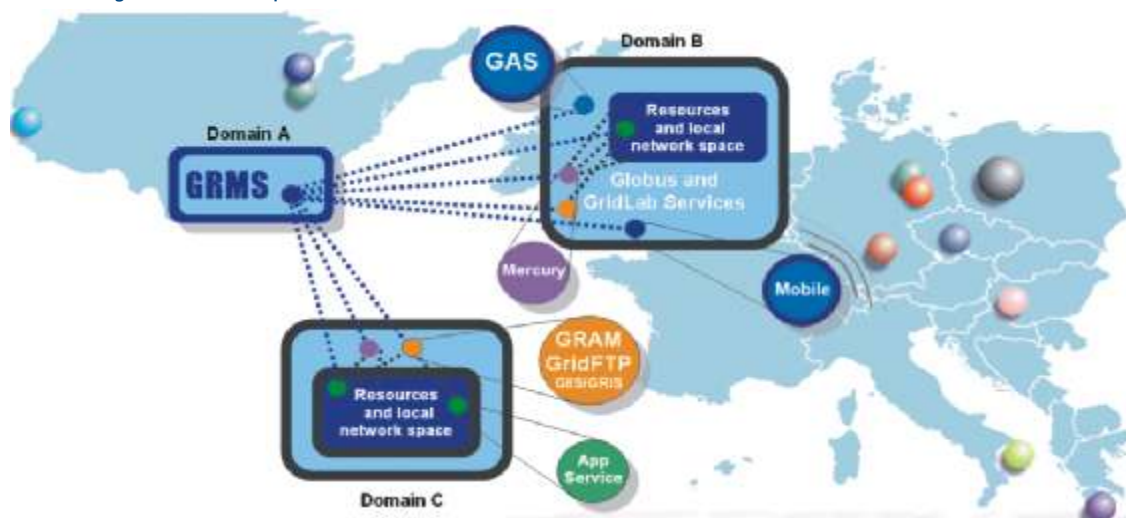


Figure 1. GRMS in collaboration with Globus and GridLab services.

GRMS was designed as an independent set of components for resource management processes which can take advantage of various low-level Core Services, in particular taken from Globus Toolkit (GRAM, GridFTP, GIIS/GRIS) and Mercury Grid Monitoring System. Moreover, in order to support more sophisticated grid scenarios, GRMS is able to use other grid middleware services, e.g. GridLab Authorization Service (GAS), Replica and File Movement Services, Mobile Service or Delphoi Services. GRMS as a key component working together with other services provide a consistent, adaptive and robust grid middleware layer which fits dynamically to many different distributed computing infrastructures and application scenarios (see Figure 1).

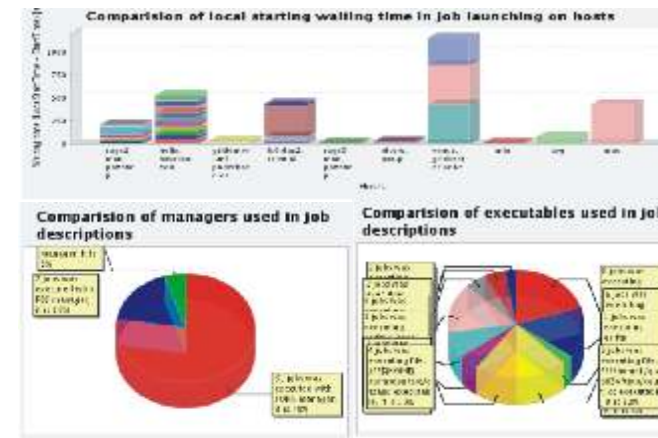
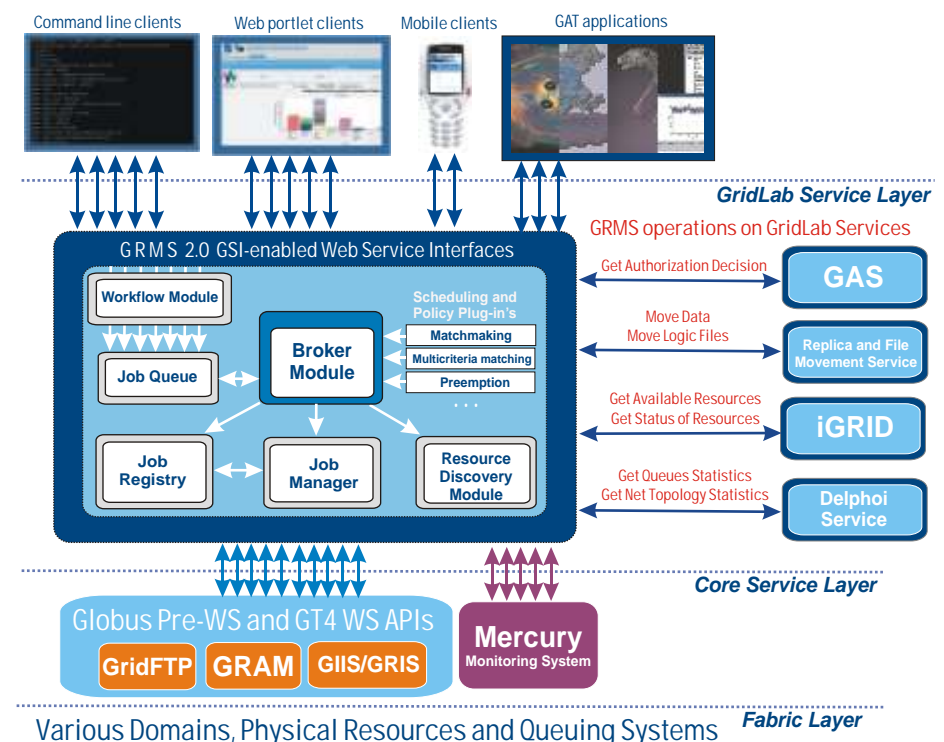


Figure 2. Statistics available in the GRMS GridSphere portlet.

Technically speaking, GRMS is a persistent service within a Tomcat/Axis container. It is written completely in Java so it can be deployed on various platforms, including Linux, Solaris, IRIX, HP-UX and Windows (other platforms will be tested and supported soon). GRMS supports Grid Security Infrastructure by providing GSI-enabled Web Service interfaces and in fact acts on behalf of end users. The communication between the GRMS service and all clients is done through a GSI-enabled HTTP-based protocol called *httpg* implementing transport-level security introduced by Globus community. With the GAS, GRMS is able to manage both, job grouping and jobs within collaborative environments according to predefined VO security rules and policies. With the Replica and File Movement services from GridLab, GRMS can create and move logical files/catalogs and deal with data intensive experiments. iGRID service can be used by GRMS as an additional information system. Delphoi service provides GRMS with useful statistics and short time predictions concerning network capabilities as well as queuing systems conditions. Finally, Mobile service can be used to send notifications via SMS/emails about events related to users' jobs and as a gateway for GRMS mobile clients.



GRMS accounting and statistics
GRMS is able to store all operations in a database. Based on this information a set of very useful statistics for both end users and administrators can be produced. All the data are also a source for further, more advanced analysis and reporting tools.

Example screenshots of some statistics and reporting tools are presented in Figure 2.



Figure 3. Internal GRMS job statuses

All users preferences and job requirements must be expressed as XML-based resource specification documents, called **GRMS Job Description**. Once such a request is sent, each job within GRMS receives a unique ID and the whole process of job scheduling and control begins (see Figure 3 and GRMS job statuses). The previous releases of GRMS were based on stable Globus Pre-WS core services deployed on resources, namely GRAM, GridFTP and GRIS/GIIS. Therefore, only these components installed and configured properly on all resources were required to start playing with GRMS and its basic functionalities. Current GRMS release 2.0 is a major milestone for GRMS. With this release, GRMS is now fully supported on the GT4/WSRF platform. Please note, that all changes to underlying GRMS components are transparent for users willing to use GRMS high-level functionality.

GRMS 2.0 new features include:

- significantly improved stability and fault tolerance,
- new workflow module to deal with complex job dependencies and time constraints,
- flexible multicriteria resource mapping and job scheduling.

For more information about GRMS visit www.gridlab.org/grms