

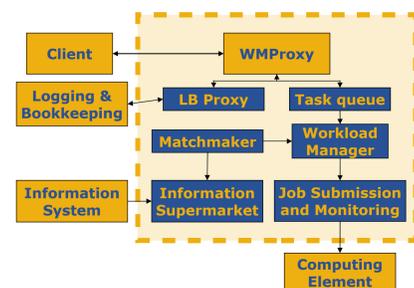
The gLite WMS and the experiments

Middleware testing is one of the most important activities of the EIS team. The purpose is to **verify** the **readiness** of the middleware with respect to the **needs of the LHC experiments**.

The LHC experiments need to generate and process huge amounts of simulated data to validate the reconstruction software, test their computing model and develop physics data analysis algorithms. For example, the current and foreseen production rates are of the order of 50 million events/month in 2007 and 100 million events/month in 2008, for ATLAS and CMS. Each experiment requires to submit and manage about **10⁵ jobs/day** at several tens of participating sites.

The **gLite** Workload Management System is an evolution of the LCG Resource Broker which provides **better performance** in terms of **scalability** and **new functionalities** (**bulk submission** being the most important).

The gLite WMS architecture



GLite

Lightweight Middleware for Grid Computing

Testing the gLite WMS

During its final development phase, the WMS was mainly tested by the EIS team. A strategy of "Experimental Services" has been followed:

- Collaboration ATLAS & CMS + JRA1 (EGEE) + SA3 (EGEE)
- Some very controlled instances of WMS (CERN, Milano & CNAF) have been used
- WMSes continuously tested, patched and re-deployed

The tests involved the **submission large numbers of jobs** to the WLCG production infrastructure, both using **simple "hello world" scripts** and **real experiment applications**. Problems encountered were reported to the developers, who provided bug fixes, in an iterative process.

Acceptance criteria were defined to assess the compliance of the WMS with the requirements from the experiments and the WLCG operations:

- Uninterrupted submission of at least 10⁴ jobs/day for period of at least five days
- No service restart required during this period
- No degradation in performance at the end of this period
- Number of *stale* jobs less than 1% of the total at the end of the test

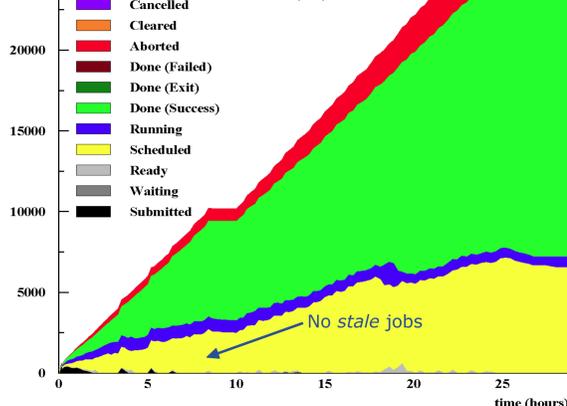
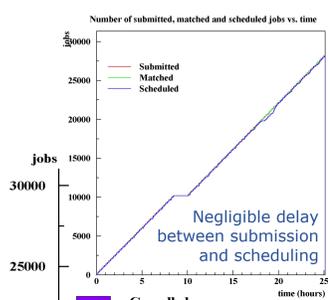
gLite WMS test results

The gLite WMS was tested both by submitting **single jobs** and **job collections** of a few hundred jobs each. The **status of the jobs** was monitored and all failures were identified and investigated. The **WMS internal status** was also monitored (system load, memory usage, etc.). A **first test** to verify the **acceptance** criteria was performed and these results were obtained:

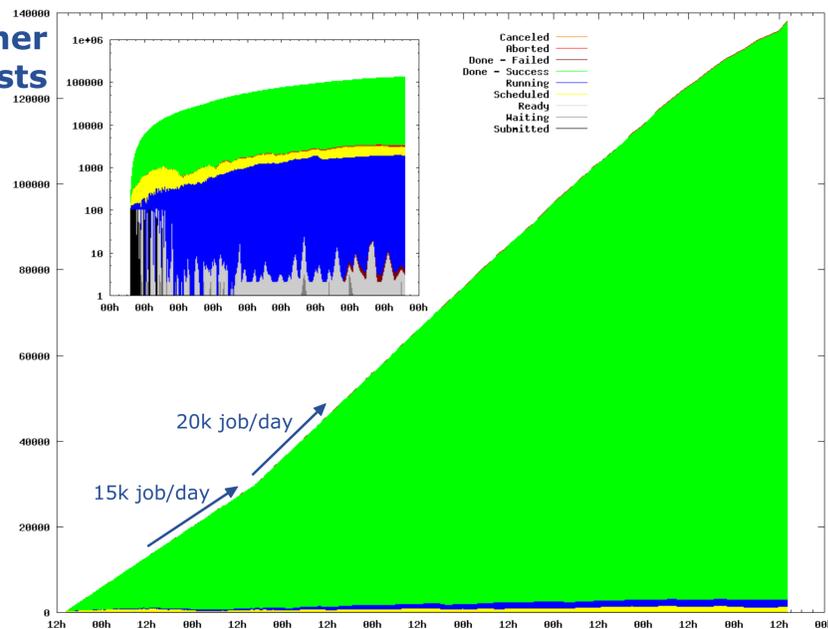
- 115'000 jobs submitted in 7 days (16'000 job/day)
- 320 (0.3%) jobs aborted due to the WMS
- Negligible delay between job submission and arrival on the CE

The acceptance criteria were fully met.

Further tests proved that the gLite WMS is able to sustain for a week an higher rate of 20'000 job/day without degradation in performances and no *stale* jobs



Further tests



The CREAM Computing Element

The **CREAM** (Computing Resource Execution And Management) Service is a simple, lightweight service for job management operations at the Computing Element (CE) level. CREAM accepts job submission requests (which are described with the same JDL language used to describe the jobs submitted to the Workload Management System) and other job management requests (e.g. job cancellation, job monitoring, etc).

CREAM can be used by the Workload Management System (WMS), via the ICE (Interface to Cream Environment) component, or by a generic client, e.g. an end-user willing to directly submit jobs to a CREAM CE. For the latter user case a C++ command line interface and Java clients are available.

Testing the CREAM CE

The purpose of the performed test was to verify the **performance** and **reliability** of a CREAM based CE deployed on a **SL4 environment**. The test consisted in submitting **jobs collections** to a CREAM CE, via an **ICE enabled gLite WMS**, at a well **specified rate** (10K jobs/day) in order to **always keep at least 5'000 jobs active in the CE**, according to the criteria defined by the EGEE project for the CE acceptance tests. The collections composed of 100 simple jobs ("sleep 1 hour") each, were submitted to a single CREAM CE node by **50 fake users** with certificates signed by a fake CA.

CREAM CE test results

The CREAM CE was tested using a dedicated UI and a dedicated ICE enabled gLite WMS. On the contrary the Logging and Bookkeeping was used also by other experimental WMS and the BDII published information about the CREAM CE along with the information about other non-CREAM CEs. The CREAM CE had 34 Worker Nodes (part of the Tier 1 LSF cluster) for a maximum of 420 job slots (max 12 jobs per WN).

A first test to verify the acceptance criteria was performed by means of a 5-day non-stop submission with the following results:

- ~60k jobs submitted (10k j/d and ~5k jobs always active in the CE)
- 119 jobs aborted (<0.2%)
- no error due to CREAM
- no performance degradation observed
- the CREAM service never restarted

