

Distributed Analysis Experiences within D-Grid



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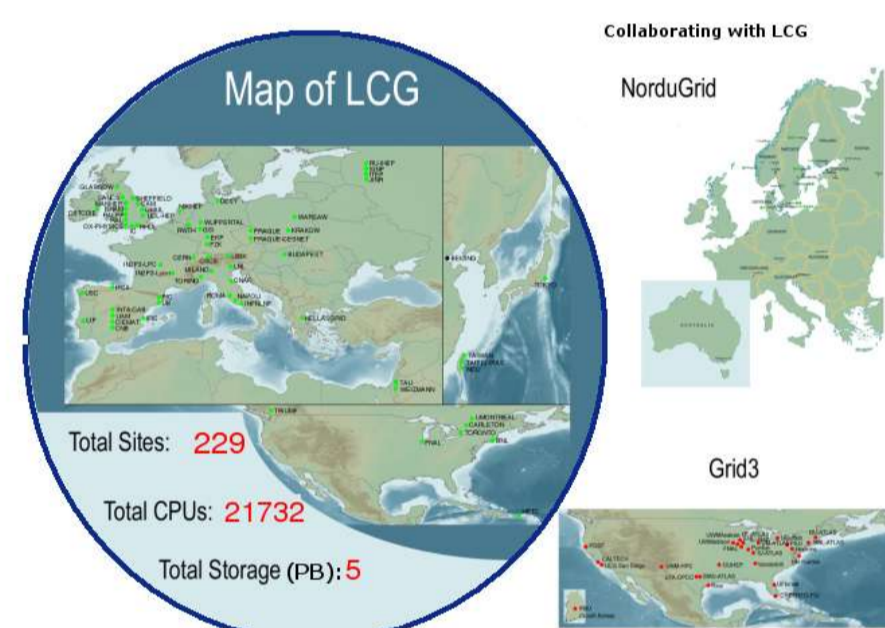
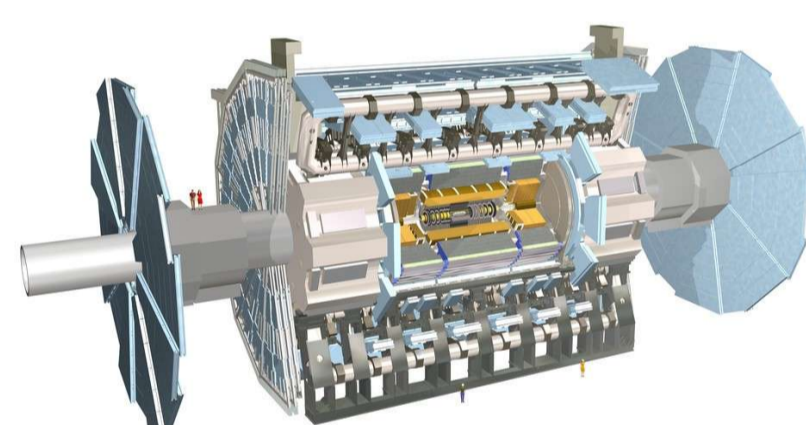
1. D-Grid Initiative

Since September 2005 five Community projects and the D-Grid Integrationsproject (DGI) started within the D-Grid consortium to build a sustainable Grid infrastructure in Germany. This infrastructure will help to establish methods of e-science in the German scientific community. The community projects will develop together with the integration project a general and sustainable Grid-infrastructure, that will be available for all German scientists.

Subproject: HEP-CG Distributed Analysis

In the context of the German D-Grid project different aspects of Grid tools have been assessed. Existing Grid middleware and tools for the distributed and interactive analysis are reviewed. A gap analysis is pursued to identify missing features and components. All this is done with a closer look into the computing environment Athena of the ATLAS experiment.

2. HEP-Grid



Some HEP experiment numbers:

ATLAS Raw Data Size	MB/evt	1.6
DØ Raw Data Size	MB/evt	0.25
ATLAS / DØ Rec Data Size	MB/evt	~0.1
Time for Reconstruction	kSI2k-sec/evt	15
ATLAS Events	evt/year	$2 \cdot 10^9$
DØ Events '02-'04 ($L=380 \text{ pb}^{-1}$)	evt	$1 \cdot 10^9$
DØ 2m-Skim Size	evt	$55.2 \cdot 10^6$
DØ 2m-Skim Size	TB	1.1
DØ 2m Presel. n-tuple	evt	$2 \cdot 10^5$
DØ Analysis on TMB	evt/s	10-30
DØ Analysis jobs	jobs	100-500
ATLAS Analysis jobs	jobs	-10000

User analysis scenarios:

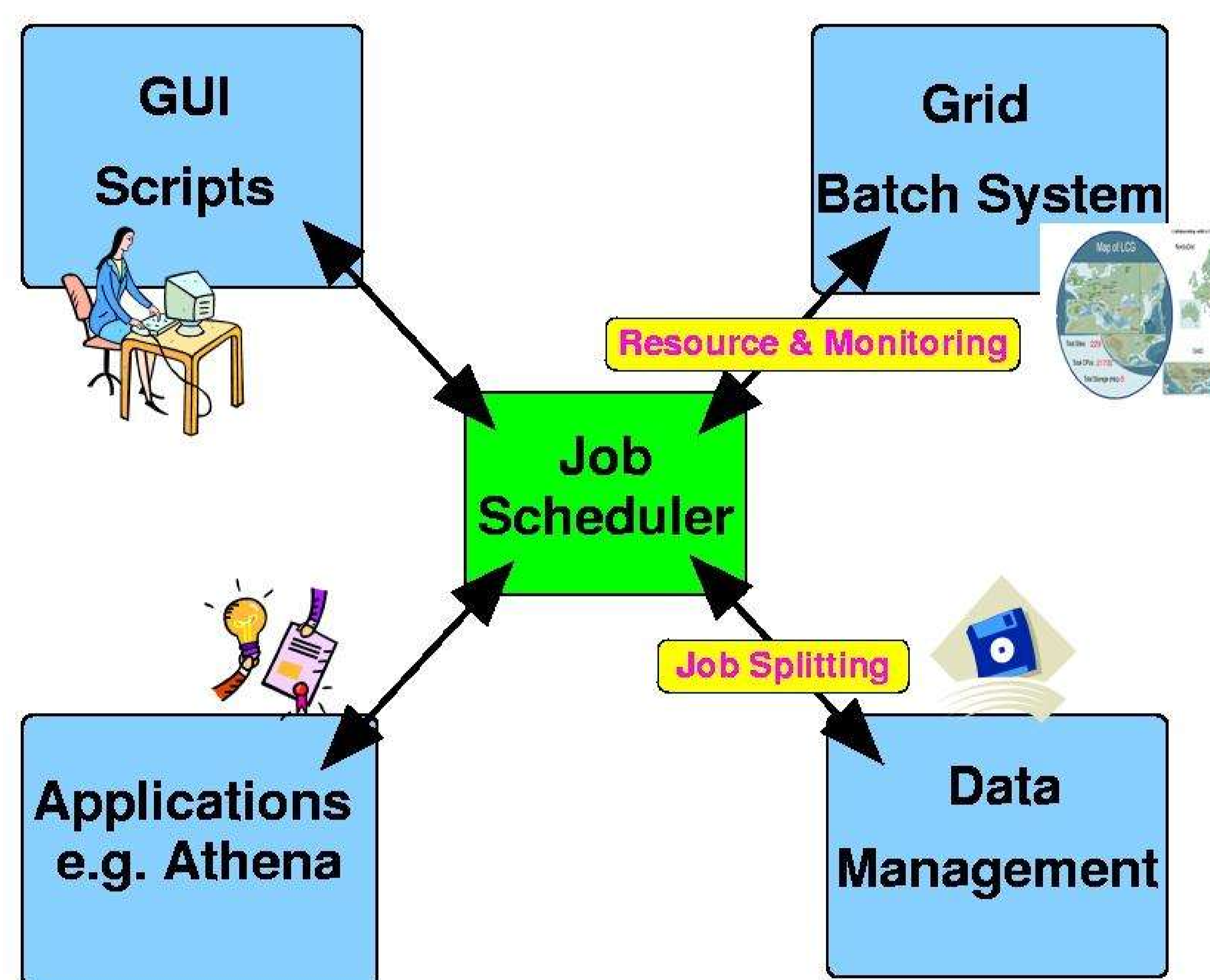
1. analysis with **fast** response time and a **high** level of user influence
2. analysis with **intermediate** response time and influence
3. analysis with **long** response times and a **low** level of user influence.

Extrapolation of numbers and user analysis scenarios to LHC experiments leads to example **components** of a robust system:

- For 1. : PROOF or DIANE
parallel processing of skimmed n-tuples and/or fast interaction in a more local environment on
- For 2. & 3: Automatic **job manager** and **scheduler** in a distributed computing environment for a small scale Monte Carlo production and first steps of skimming

3. Job Scheduler

- Interface for job configuration
- Job submission interface for Grid and Batch systems
- Integration of data management
- Resource estimation
- Job monitoring
- Job error checking
- Collecting and merging of results
- Job archive



4. Applications

- Job and scheduling manager example: **GANGA**
 - ✓ jointly developed by ATLAS and LHCb
 - ✓ User analysis scenarios 2. & 3.
- ✓ **Successfully tested** in use case 2. & 3.:
 - Small scale Monte Carlo production on LCG
 - Input/Output datasets on LCG SE
 - 10000 events, 603 jobs, only 0.3% failures
 - 2000 events, 106 jobs, 50% failures (File catalog, Database problems)
- ✓ **Improvements:**
 - 10-20 sec/jobs submission time \Rightarrow need for bulk submission
 - Job error handling, Automatic job resubmission
 - Data management, Monitoring
- PROOF performs well in interactive analysis with n-tuples on local computing cluster
- DIANE is an application for all three use cases with fast response and turn around times. Successfully used on local cluster and different LCG sites with automatic histogram merging