ARDA Prototypes

Andrew Maier

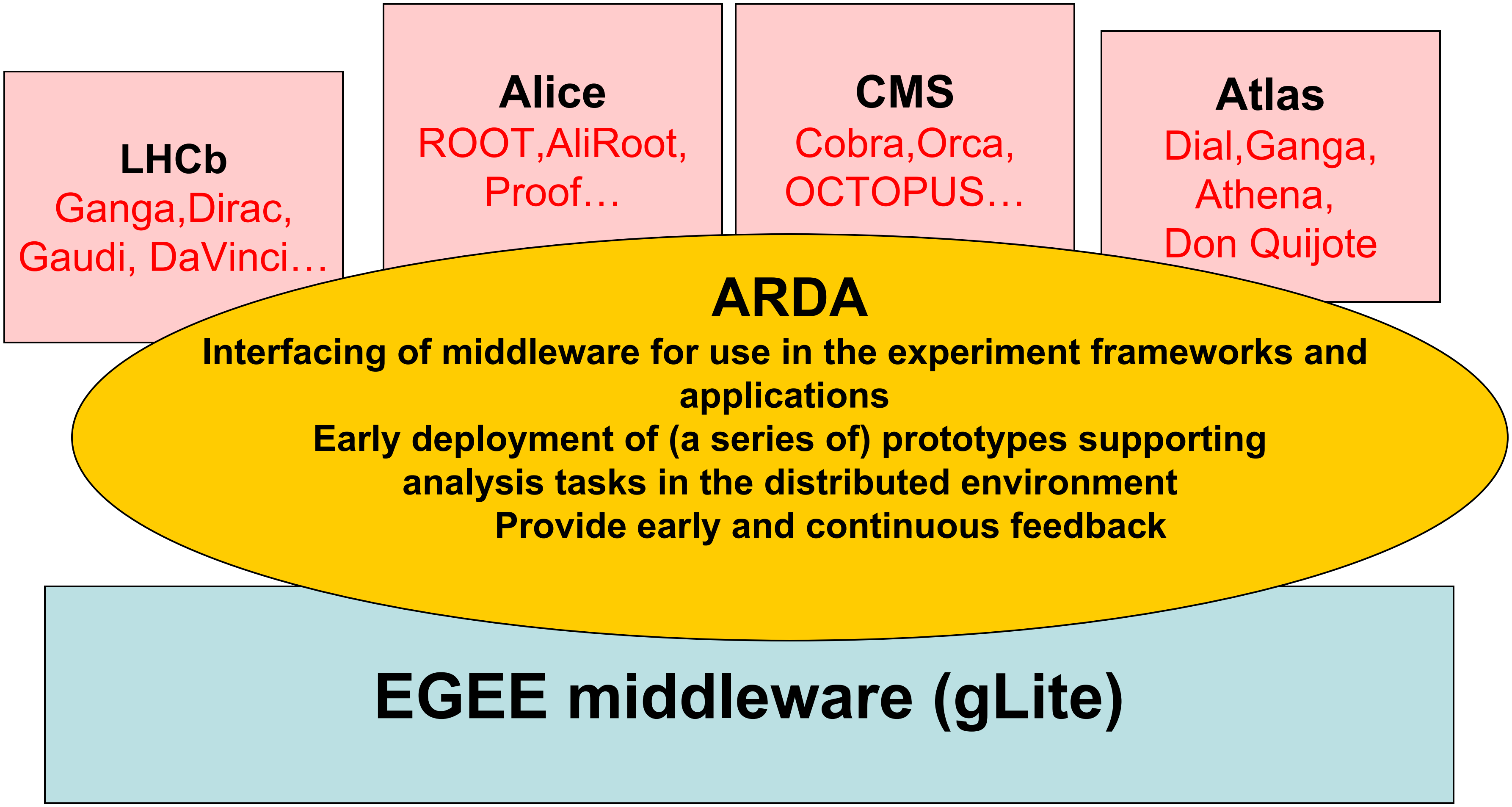
CERN

Enabling Grids for E-science in Europe

Overview

- ARDA in a nutshell
  - Experiments
  - Middleware
- Experiment prototypes (basic components, ARDA contribution, status, plans)
  - CMS, ATLAS, LHCb and ALICE
- Conclusions

ARDA and HEP experiments



LHCb
Ganga,Dirac,
Gaudi, DaVinci…

Alice
ROOT,AliRoot,
Proof…

CMS
Cobra,Orca,
OCTOPUS…

Atlas
Dial,Ganga,
Athena,
Don Quijote

ARDA

Interfacing of middleware for use in the experiment frameworks and applications

Early deployment of (a series of) prototypes supporting analysis tasks in the distributed environment

Provide early and continuous feedback

EGEE middleware (gLite)

Working model

- Development of one prototype per experiment
  - ARDA emphasis is to enable each of the experiment to do its job
  - A Common Application Layer *might* emerge in future
- Provide a forum for discussion
  - Comparison on results/experience/ideas
  - Interaction with other projects
  - …
- Organizes workshops to interact with the community

Analysis environment

Additional requirements

- Multiple users

  Robustness might be an issue
- Concurrent “read” actions

  Performance should be addressed
- Used by all physicists for their analysis

  Easy access and simplicity

LCG milestones

End-To-End Prototype activity

Date	Description
Dec 2004	E2E prototype for each experiments (4 prototypes), capable of analysis (or advanced production)
Dec 2005	E2E prototype for each experiments (4 prototypes), capable of analysis and production

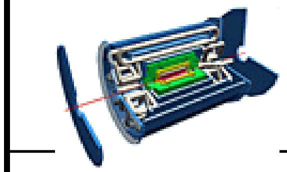
Middleware Prototype

- Available for us since May 18th
  - In the first month, many problems connected with the stability of the service and procedures
  - At that point just a few worker nodes available
  - Most important services are available:

    file catalog, authentication module, job queue, meta-data catalog, package manager, Grid access service
  - A second site (Madison) available since the end of June
  - CASTOR access to the actual data store

- Number of CPUs will increase
  - 50 as a target for CERN, hardware available
- Number of sites will increase

Prototypes overview

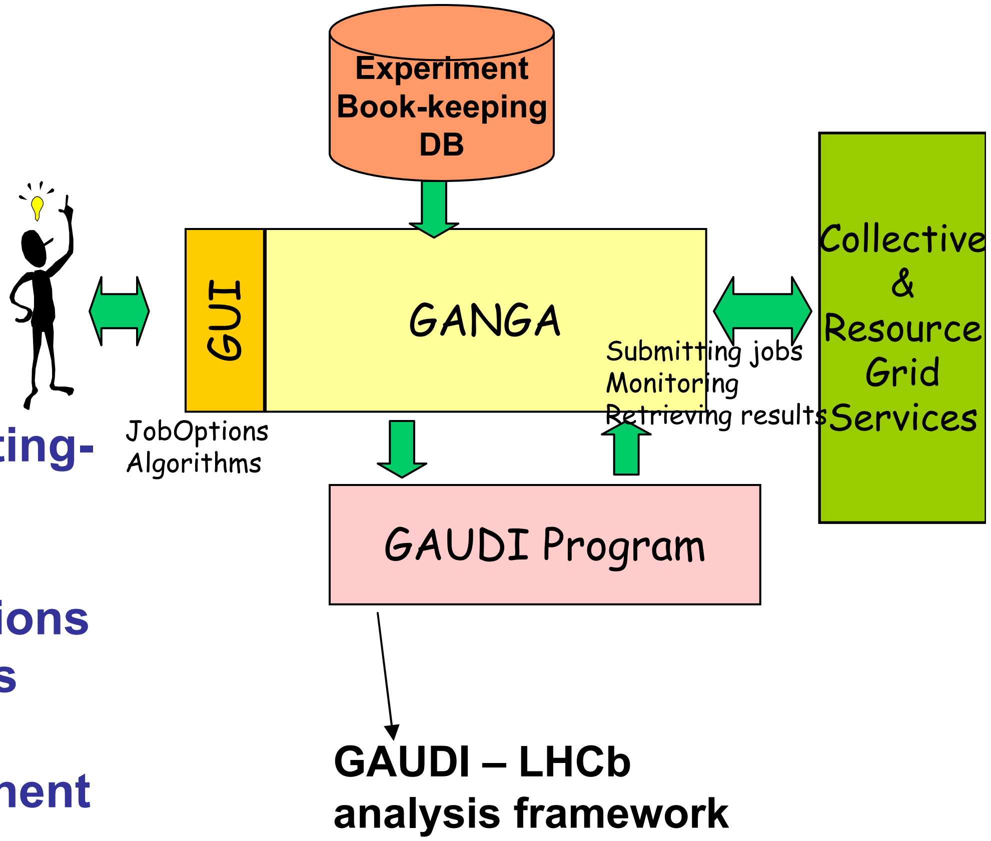
LHC Experiment	Main focus	Basic prototype component	Experiment analysis application framework	Middleware prototype
LHCb	GUI to Grid	**GANGA**	**DaVinci**	gLite
ALICE	Interactive analysis	**PROOF**	**AliROOT**	gLite
	**High level service**	**DIAL**	**Athena**	gLite
CMS	**Use of maximum native gLite functionality**	Not yet fully defined by CMS	**ORCA**	gLite

LHCb

Basic component of the prototype defined by the experiment :

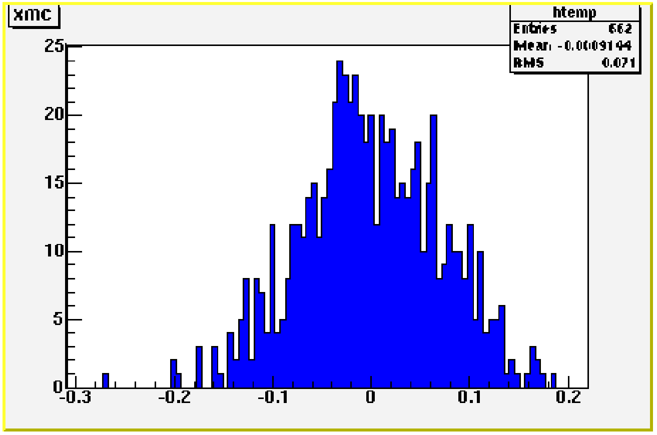
GANGA - Gaudi/Athena aNd Grid Alliance

- Framework for job creating-submitting-monitoring
- Can be used with different applications and different submission back-ends
- Was chosen as a prototype component also by the Atlas experiment


Experiment Book-keeping DB
GUI
GANGA
Collective & Resource Grid Services
Submitting jobs
Monitoring
Retrieving results
JobOptions
Algorithms
GAUDI Program
GAUDI – LHCb analysis framework

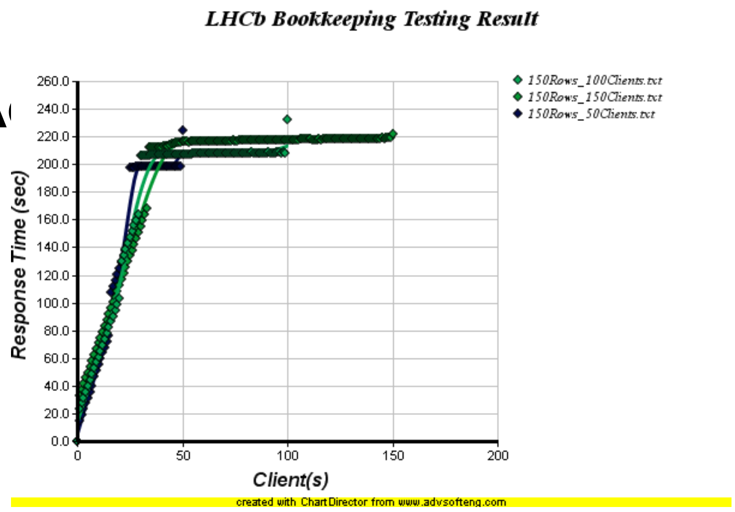
LHCb

- **ARDA contributions :**
  - **GANGA Release management and software process**
    - **CVS, Savannah,…**
  - **GANGA Participating in the development driven by the GANGA team**
  - **GANGA-gLite Integrating of GANGA with gLite**
    - **Enabling job submission through GANGA to gLite**
    - **Job splitting and merging**
    - **Retrieving results**
  - **GANGA-gLite-DaVinci Enabling real analysis jobs (DaVinci) to run on gLite using GANGA framework**
    - **Running DaVinci jobs on gLite**
    - **Installing and managing LHCb software on gLite using gLite package manager**



LHCb

- Related activities :
  - GANGA-DIRAC (LHCb production system)
    - Convergence with GANGA/components/experience
    - Submitting jobs to DIRAC using GANGA
  - GANGA-Condor
    - Enabling submission of jobs through GANGA to Condor and DA
  - LHCb Metadata catalogue performance tests
    - Collaboration with Taiwan colleagues , using their experience



LHCb

– **Current Status**

- **GANGA job submission handler for gLite has been developed**
- **DaVinci job running on gLite submitted through GANGA**
- **Submission of user jobs is working**
- **Using the gLite provided job-splitter works on the file level**
- **Command line interface (CLI) prototype for GANGA has been developed**
- **Can submit jobs using the gLite job-splitter**

LHCb

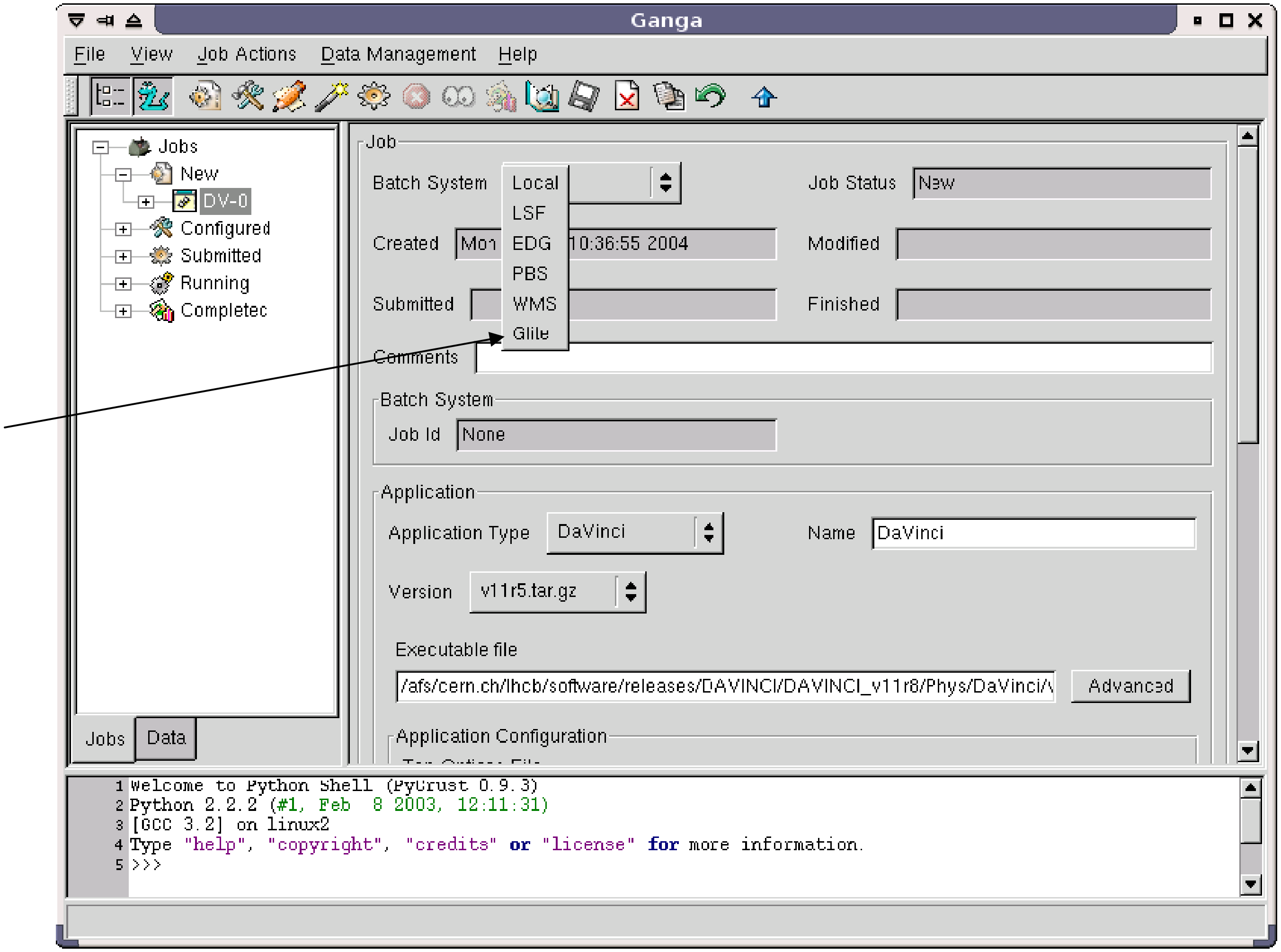
- Working CLI example
  - Submits a job to gLite
  - Uses the gLite job splitter

```
#!/usr/bin/env python

import sys
sys.path.append('/afs/cern.ch/sw/ganga/install/rh73_gcc32/cli-
   2.3.1/Ganga/python')
from Ganga.CLI import *
from Ganga.CLI.egee_handlers import Glite
j = Job(backend="Glite",exe='subjob')
j.backend.datafiles=['LF:/egee/user/a/andrew/bin/run',
   'LF:/egee/user/a/andrew/bin/davinci.csh']
j.backend.voms_user = 'andrew'
j.backend.split_file = 1
j.submit()
```

LHCb

gLite handler in GANGA



Batch System: Local

Job Status: New

Created: Mon 10:36:55 2004

Modified:

Submitted:

Finished:

Comments:

Batch System

Job Id: None

Application

Application Type: DaVinci

Name: DaVinci

Version: v11r5.tar.gz

Executable file: /afs/cern.ch/lhcb/software/releases/DAVINCI/DAVINCI_v11r8/Phys/DaVinci/\

```
Welcome to Python Shell (PyCrust 0.9.3)
Python 2.2.2 (#1, Feb  8 2003, 12:11:31)
[GCC 3.2] on linux2
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

LHCb

- Short term plans
  - Involve people from LHCb physics community (limited number) in testing for getting feed back from the user side
  - Integrating LHCb software releases with the gLite package manager

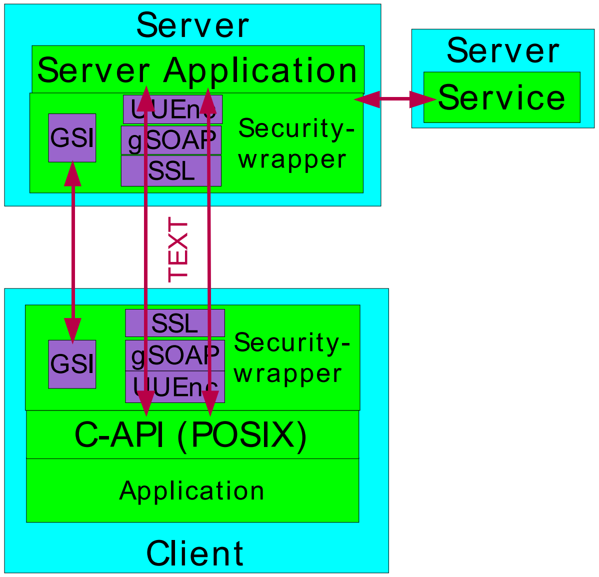
Alice

Basic components of the prototype defined by the experiment :

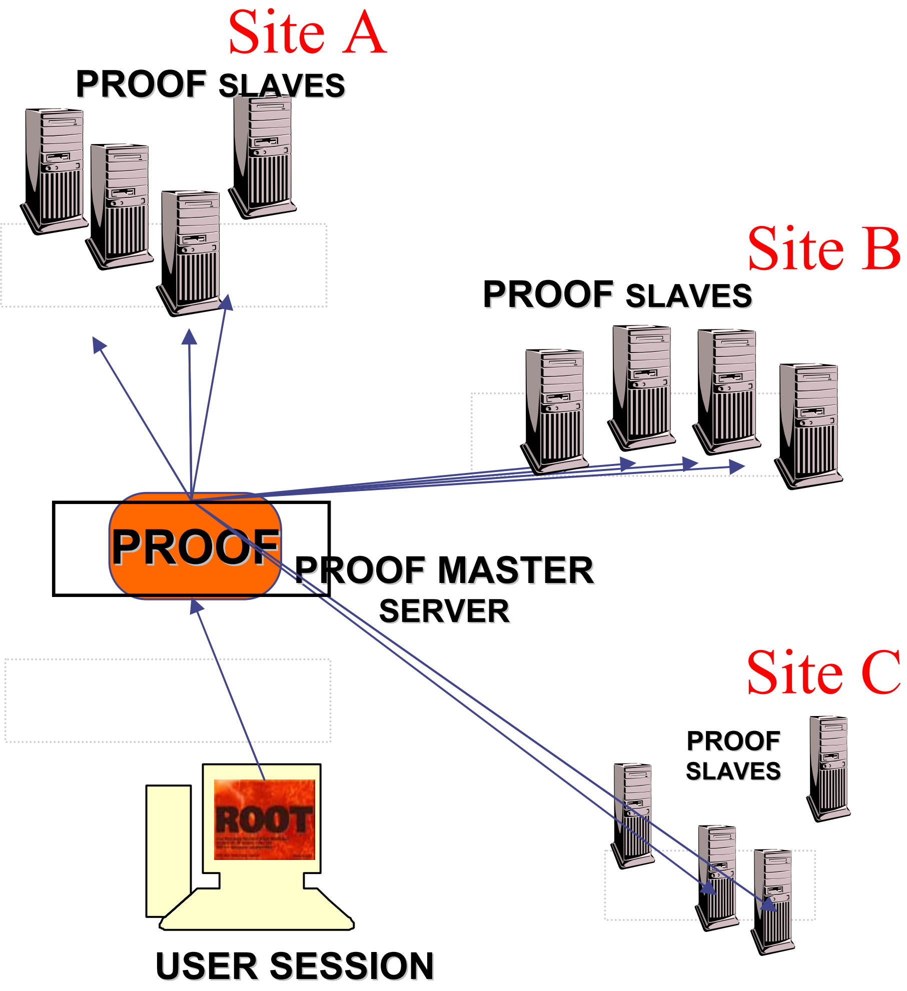
ROOT
AliROOT
PROOF

ARDA contributions :

- **Enabling of batch and interactive analysis on gLite**
- **Main focus on the interactive analysis using PROOF, emphasising robustness and error recovery**
- **gLite–related activities (all experiments can profit) :**
  - **- C++ access library for gLite**
  - **- C library for Posix like IO**

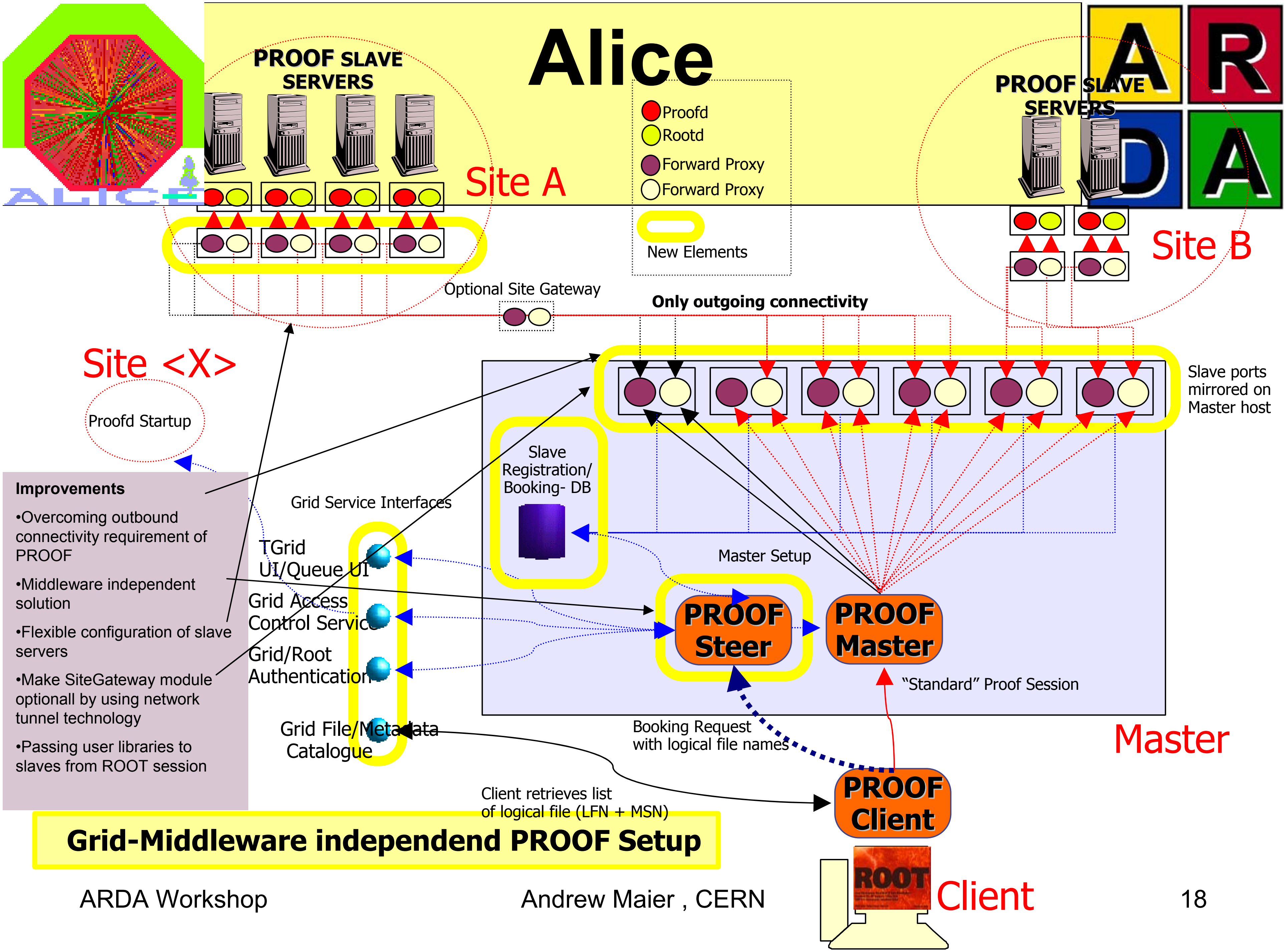


Alice



- **PROOF Analysis system based on ROOT**

- **The ALICE/ARDA will evolve the ALICE analysis system (SuperComputing 2003)**



Improvements

- •Overcoming outbound connectivity requirement of PROOF
- •Middleware independent solution
- •Flexible configuration of slave servers
- •Make SiteGateway module optionall by using network tunnel technology
- •Passing user libraries to slaves from ROOT session

Grid-Middleware independend PROOF Setup

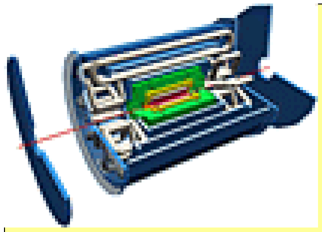
Alice

Current status

- Batch analysis jobs are running on gLite middleware
- Interactive analysis is under way
- Improving robustness and error recovery of PROOF
- Parallelizing of the startup of PROOF slaves is implemented
- C++ access library and C IO libraries are developed, will be deployed very soon

Short term plans

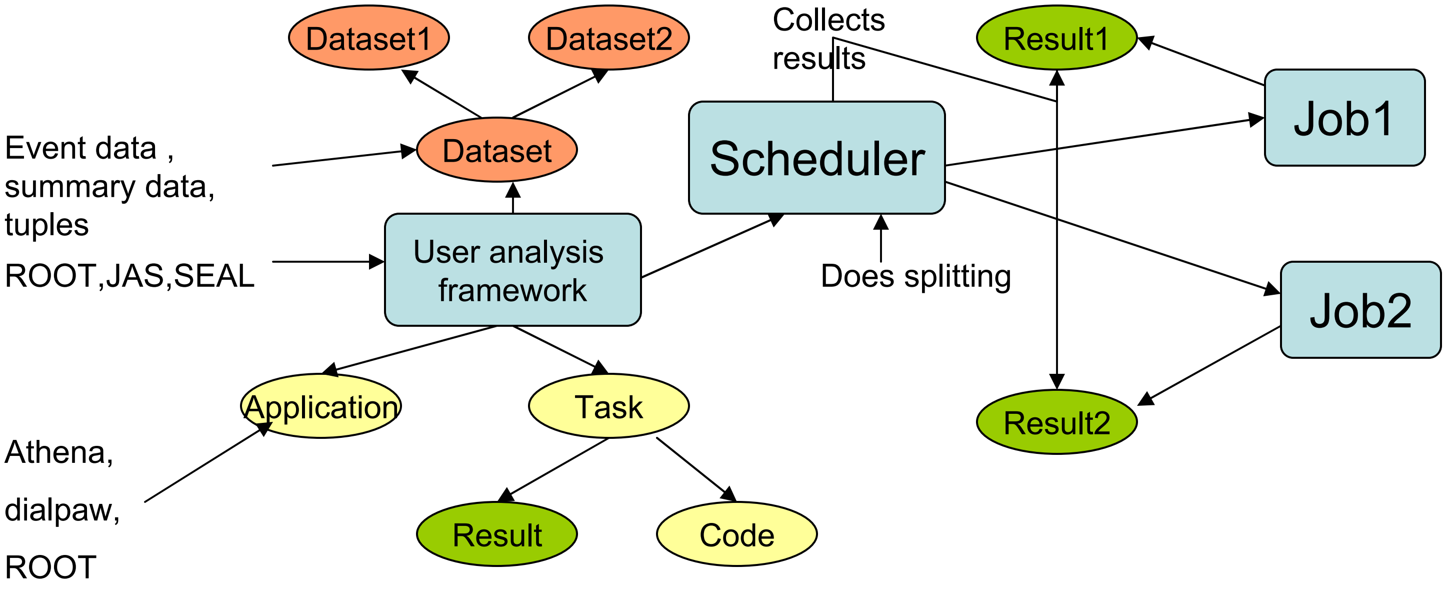
- Enable both batch and interactive analysis running on gLite by beginning of November



ATLAS

Basic component of the prototype

- **DIAL- Distributed Analysis of Large datasets**



Dataset1

Dataset2

Collects results

Result1

Event data , summary data, tuples

Dataset

Scheduler

Job1

ROOT,JAS,SEAL

User analysis framework

Does splitting

Job2

Application

Task

Result2

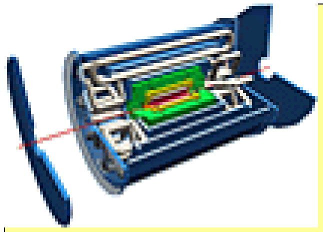
Athena,

dialpaw,

ROOT

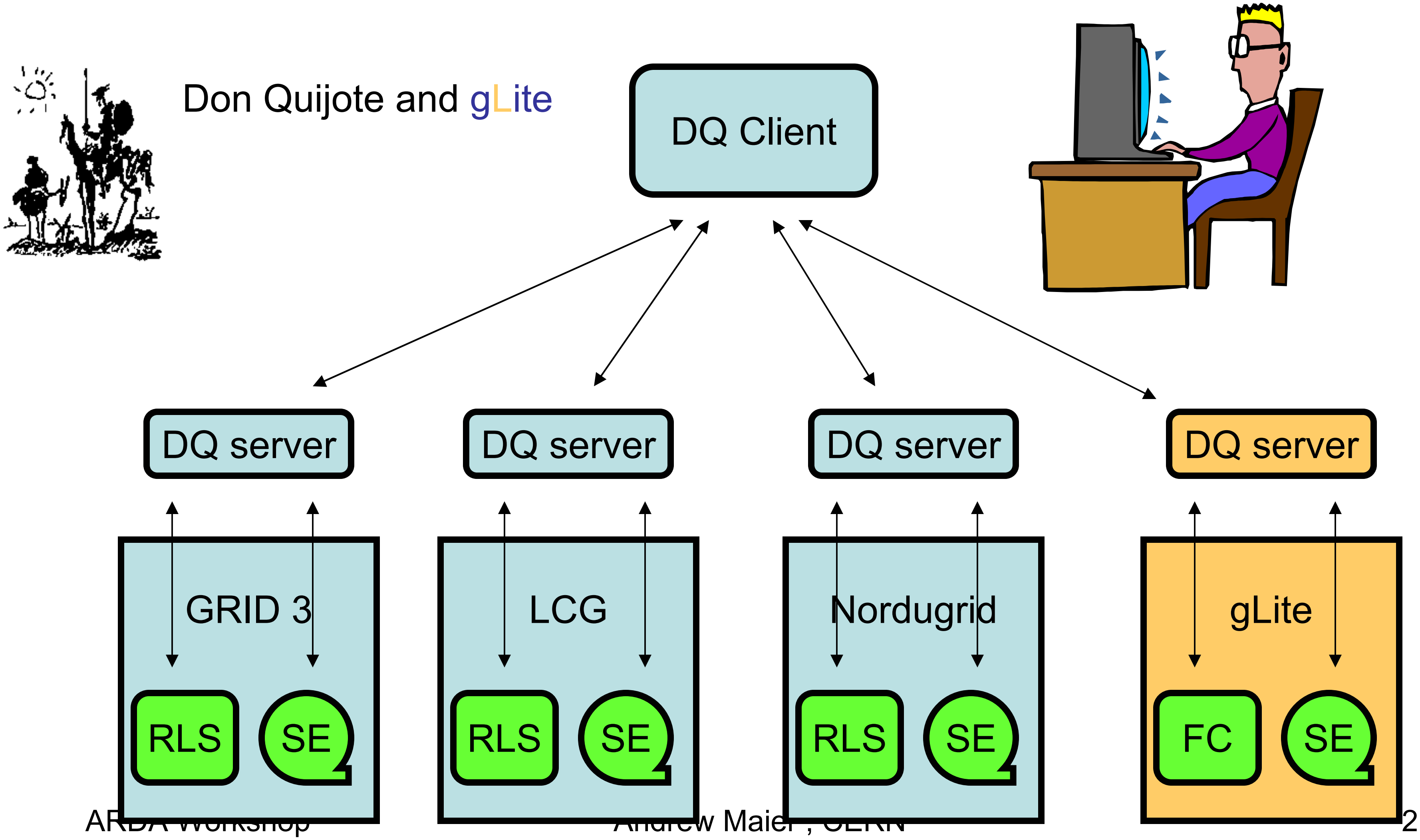
Result

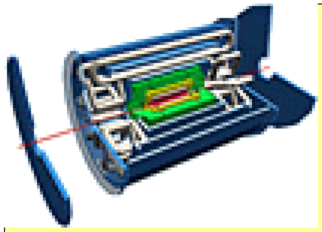
Code



ATLAS

Don Quijote and gLite





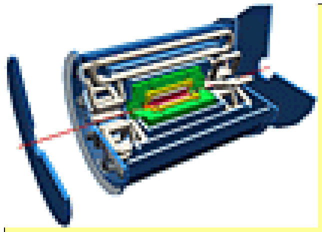
ATLAS

ARDA contribution:

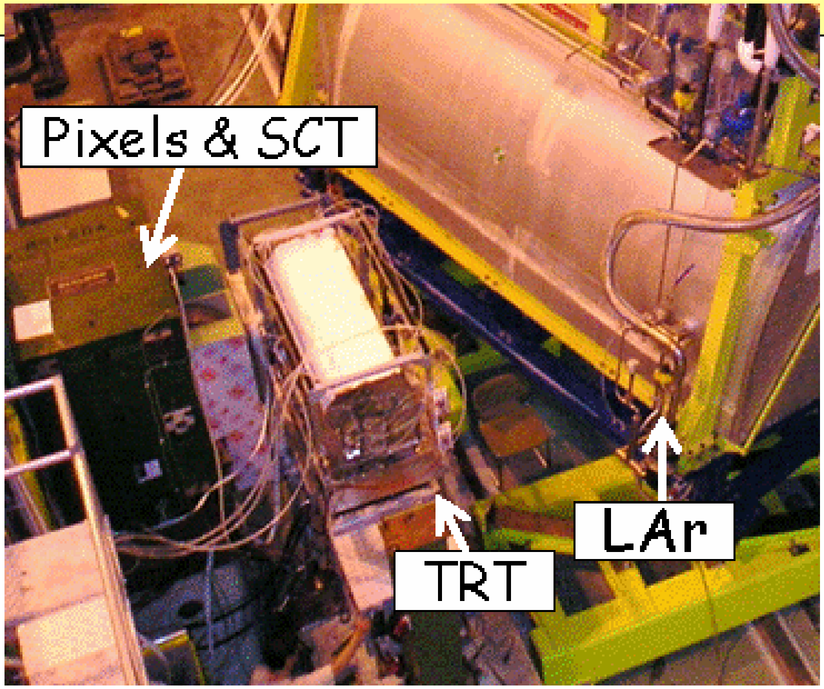
- **Integrating DIAL with gLite**
- **Enabling Atlas analysis jobs (Athena application) submitted through DIAL to run on gLite**
- **Integrate gLite with Atlas data management based on Don Quijote**

Related activities:

- **Stress testing of the AMI metadata DB**



ATLAS

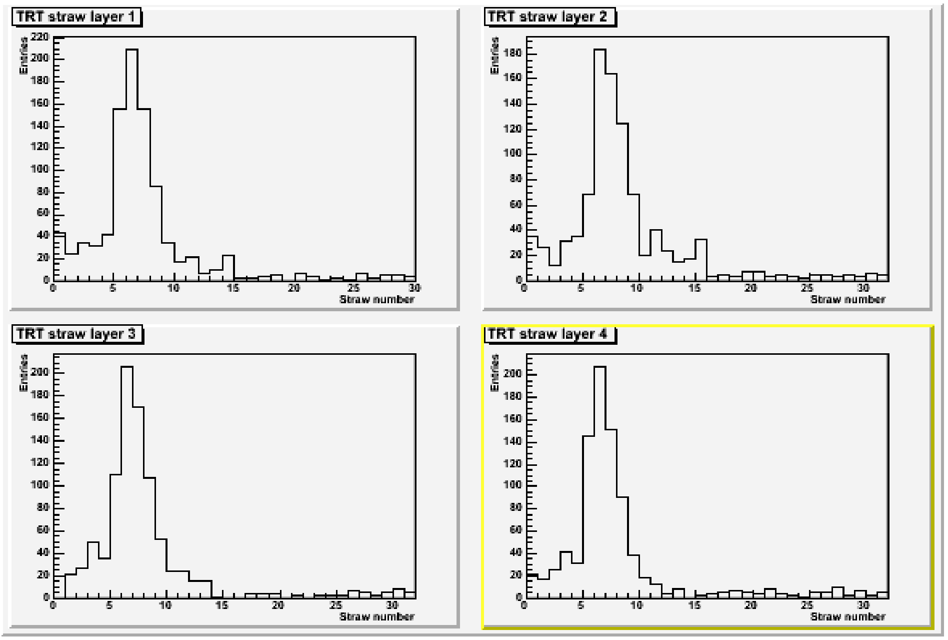


Real data processed at gLite

Standard RecExTB

Data from CASTOR

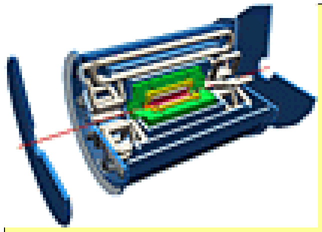
Processing on gLite workernode



Example:

ATLAS TRT data analysis PNPI
St Petersburg

Number of straw hits per layer



ATLAS

Current status :

- DIAL server has been adapted to CERN environment and installed at CERN
- First implementation of gLite scheduler for DIAL is developed
- Still depending on a shared file system for inter-job communication
- ATHENA jobs submitted through DIAL are run on gLite middleware
- Integration of gLite with Atlas file management based on Don Quijote is in progress

Future plans :

- Evolve ATLAS prototype to work directly with glite middleware:
  - Authentication and seamless data access

CMS

The CMS system within ARDA is still under discussion

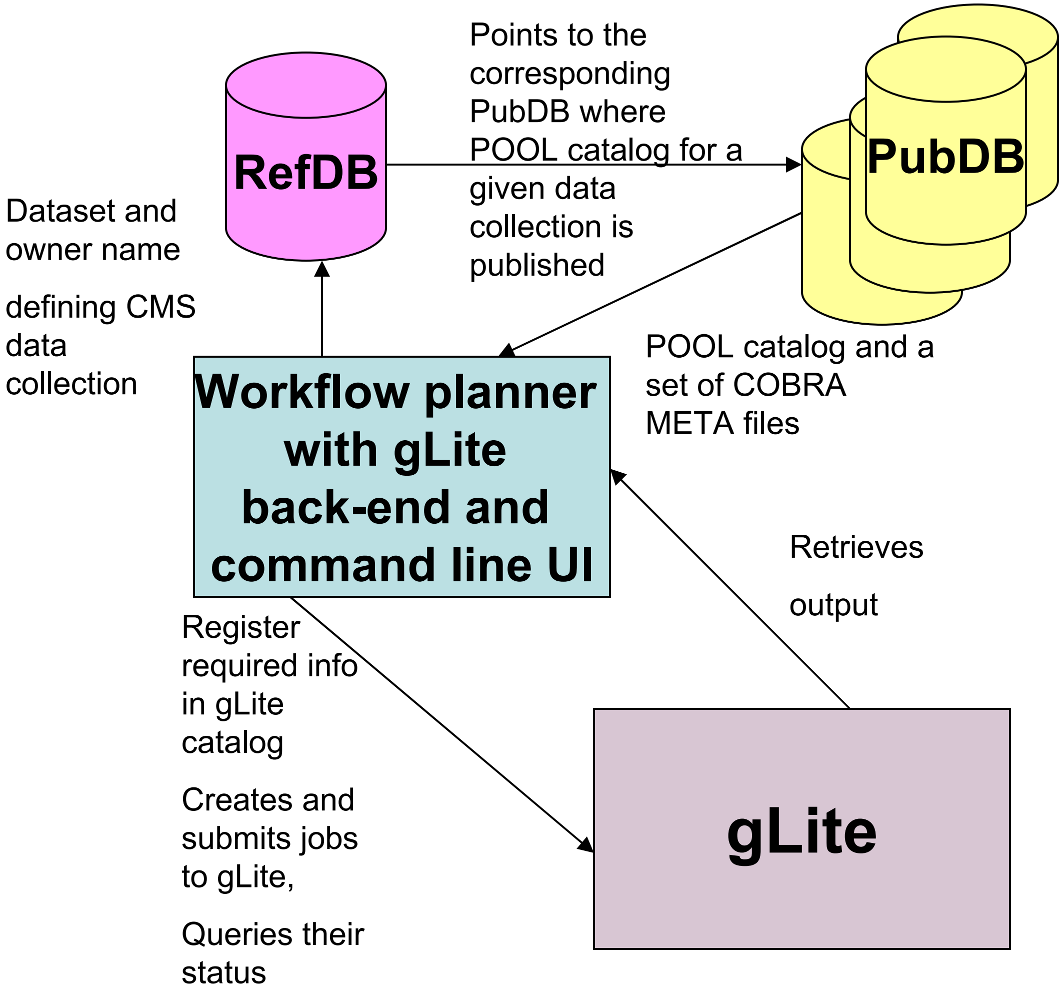
Exploratory/preparatory activity

- Running CMS analysis jobs (ORCA application) on gLite
- Populating gLite catalog with CMS data collections, residing at CERN castor
- Trying gLite package manager to install and handle CMS software
- Adopting gLite job-splitting service for CMS use-cases

CMS

While CMS decision for ARDA is pending:

- Started development of the first end-to-end prototype for enabling CMS analysis jobs on gLite
- Main strategy is to use as much of native middleware functionality as gLite can provide and only in case of very CMS specific tasks develop something on top of existing middleware



RefDB

PubDB

Points to the corresponding PubDB where POOL catalog for a given data collection is published

Dataset and owner name

defining CMS data collection

Workflow planner with gLite back-end and command line UI

POOL catalog and a set of COBRA META files

Retrieves

output

Register required info in gLite catalog

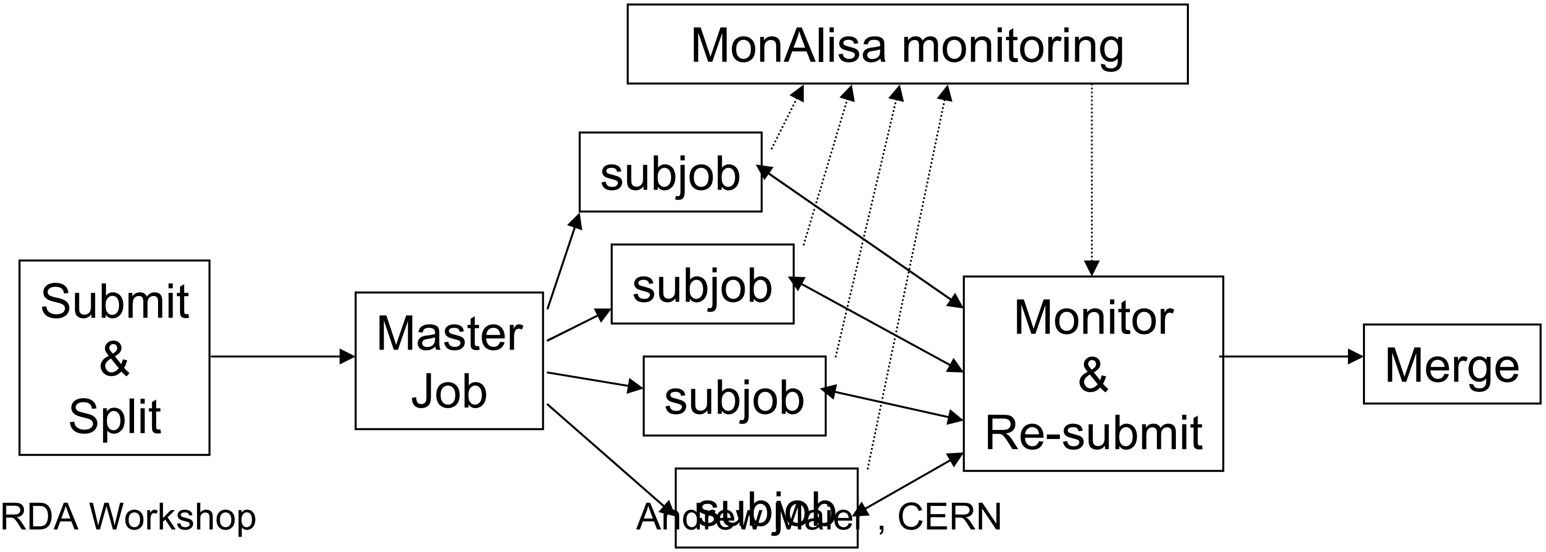
Creates and submits jobs to gLite,

Queries their status

gLite

CMS

- MonAlisa job monitoring in the CMS analysis prototype
  - Monitoring progress of splitted analysis jobs
    - Analysis task is splitted into subjobs by gLite MW
    - Each subjob reports its progress (e.g. number of analysed events) to the MonAlisa server.
  - MonAlisa output can support us to determine whether there is need to re-submit job(s).



CMS

Related activities :

- Data management task is vital for CMS
  - Participating in the development of PubDB (Publication DB) distributed data bases for publishing information about available data collection CMS-wide
  - Participating in the redesign of RefDB (Reference DB) , CMS meta data catalog and production book-keeping data base
  - Development of CMS specific tool for extracting from

    RefDB META components (POOL catalog and COBRA META files) required for running analysis on a given data collection
  - RefDB stress testing

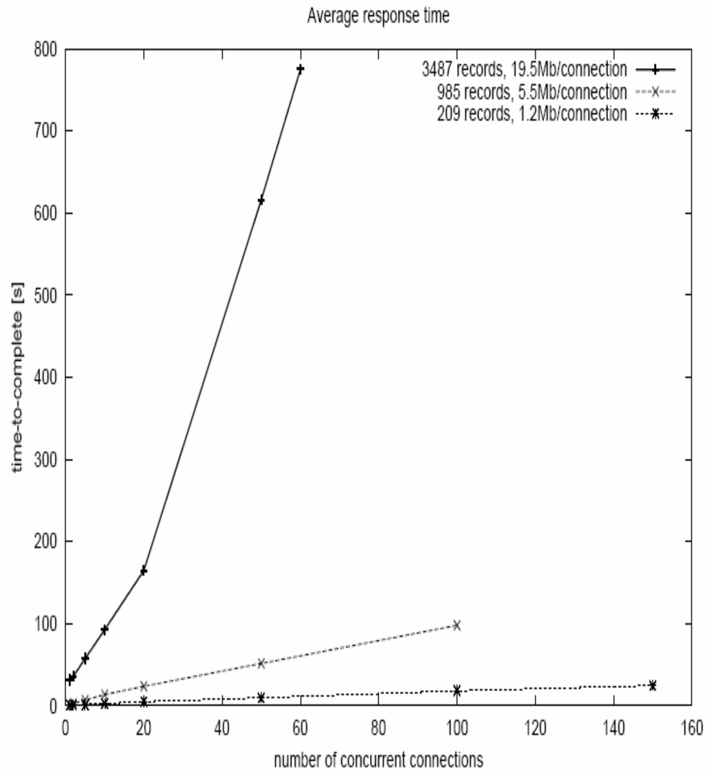


Figure 1: The average time-to-complete of a request presented as a function of the number of concurrent queries. The collections were discribed in the Table 1.

CMS

Current status:

- Prototype development is under way
- ORCA analysis jobs were successfully run on gLite test-bed

Future plans:

- Have the first version of the prototype ready for testing by limited number of CMS users by the end of October
- Depending on CMS decision either evolve this prototype according to the users feed back, or integrate it with the tool(s) which CMS would choose for ARDA prototype

Conclusions

- **ARDA is up and running**
  - Since April 1st preparing the ground for the experiments prototypes
  - Definition of the detailed work program
  - Contributions in the experiment-specific domain
  - Prototype development started and progressing well
- Next important steps
  - **(More) real users**
  - **Need of more hardware resources**
  - **Both important for December 2004 milestone**