Extending the Grid to enable access to Data Sources Engines

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GDSE Presentation Overview

- GDSE Project goals;
- GDSE Project actions;
- GDSE Architectural and Information system;
- GDSE Implemented Features;
- GDSE Future Features;
- GDSE TestBed;
- GDSE Demo Overview;

GDSE project goals

- Provide a semantically extension of the formal definition of a Grid Abstract Computing Machine (GACM), to verify the project feasibility;
  "A Formal Framework for Defining a Grid System"
  Evolving Algebra - Abstract State Machine
- Provide a suitable architectural definition of a data source engines and data sources grid access, applying the GACM extension for conceptual proofing without directly coding it;
- Provide an integration layer, with a minimal set of functions, from Grid Resource Framework Layer (GRFL),for future integration of other software computing machines, such as JVM and PVM within GRFL;
- Provide an appropriate Information Model, extending GIS capabilities for RDBMS Query Processor, RDBMS Memory Model and RDBMS OS, to globally monitoring and discovering a GDSE by its DS engines;

...GDSE project goals

- Provide an appropriate Information Model, extending GIS capabilities for RDBMS kernel DBs and RDBMS user DBs, to globally monitoring and discovering a GDSE by its DS;
- Provide a layer of distribution for allowing "Distributed Query Processes" for specialising COLLECTIVE layer of Grid QueryJob over set of GDSE (G-DistributedDSE).

GDSE project actions

- Architectural Analysis of GRID software, its workflow, its programming language, internal mechanism, and its functionality;
- Architectural Analysis of a DSE, its workflow, its programming language, internal mechanism, and its functionality;
- Conceptual mapping between DSEs and GRFL, trying to represent a DSE through the grid resource abstraction such as the GACM;
- Definition of the
  Globus XIO integration with I/O ODBC Driver transparent mechanisms;
  QueryJobManager component;
  LocalQueryJobManager component;
  Distribution QueryJob Framework over GDSE.

...GDSE project actions

- Interfacing the Grid Resource Information Index Backend with the GDSE Information Provider;
- Enhancement of the Grid Resource Specification Language (RSL) for DSE;
- Adoption of standards, such as ODBC, JDBC, SNMP, MIB, GLOBUS, EDG and VOMS.

Inductive construction of solution

The GDSE project has been divided into 5 steps, and now is ending the third one:

- 1) gridification of Data Sources Engine, without specialised Information Model.
- 2) gridification of DSE, with specialised G-DSEMIB and G-DSEODBC Information Models, both extending Glue Concepts.
- 3) gridification of GDSE with a specialised "JobODBCDriverManager" and a "set of LocalODBCDriverManagers".

...Inductive construction of solution

- 4) gridification of GDSE with a specialised Globus XIO ODBC Driver. The 5th steps will be the challenge for next 3 months:
- 5) 'strong' gridification of G-DistributedDSE with a specialised layer based on *Distributed Shared Memory framework* for Grid. Using Nexus Framework that is implemented by DUROC components of Globus.

Concerns about GDSE

Some concepts used to verify the feasibility of our solution, are reported.
We did not want to proof the solution, just by making code.
We tried to prove some invariant grid concepts.

- Concept 1: In a DSEs Grid MUST EXISTS a pool RESOURCEs (DSEs/DSs) for all USERs that hold valid credentials (mapped onto DSE credential) for DSE/DS or slices of them.
- Concept 2: In DSEs Grid MAY EXIST a pool of NODEs on which are installed USERs' PROCESSSes (granted by the declarative nature of DSE transactions but DATAs are not granted to be there).
- Concept 3: In DSEs Grid MAY EXIST a pool of NODEs holding DSE/DS that satisfy TRANSACTION REQUESTS.

...Concerns about GDSE

- Rule 1: In a DSEs Grid, MAY be possible a Mapping for TRANSACTION on more DSE/DS LOCAL to a NODE
- Rule 2: In a DSEs Grid, MUST be possible to Grant all Local DSE/DS needed for a TRANSACTION Mapped
- Rule 3: In a DSEs Grid, MUST be possible to enter Running State with specialized mecchanism for TRANSACTION if Rule 2
- Rule 4: In a DSEs Grid, MUST be possible to Grant additional DSE/DS Request based on DATA SET, TABLE SPACE etc at Run time if Rule 3
- Rule 5: In a DSEs Grid, MAY be possible a TRANSACTION Spawning for JOIN inter GDSEs

...Concerns about GDSE

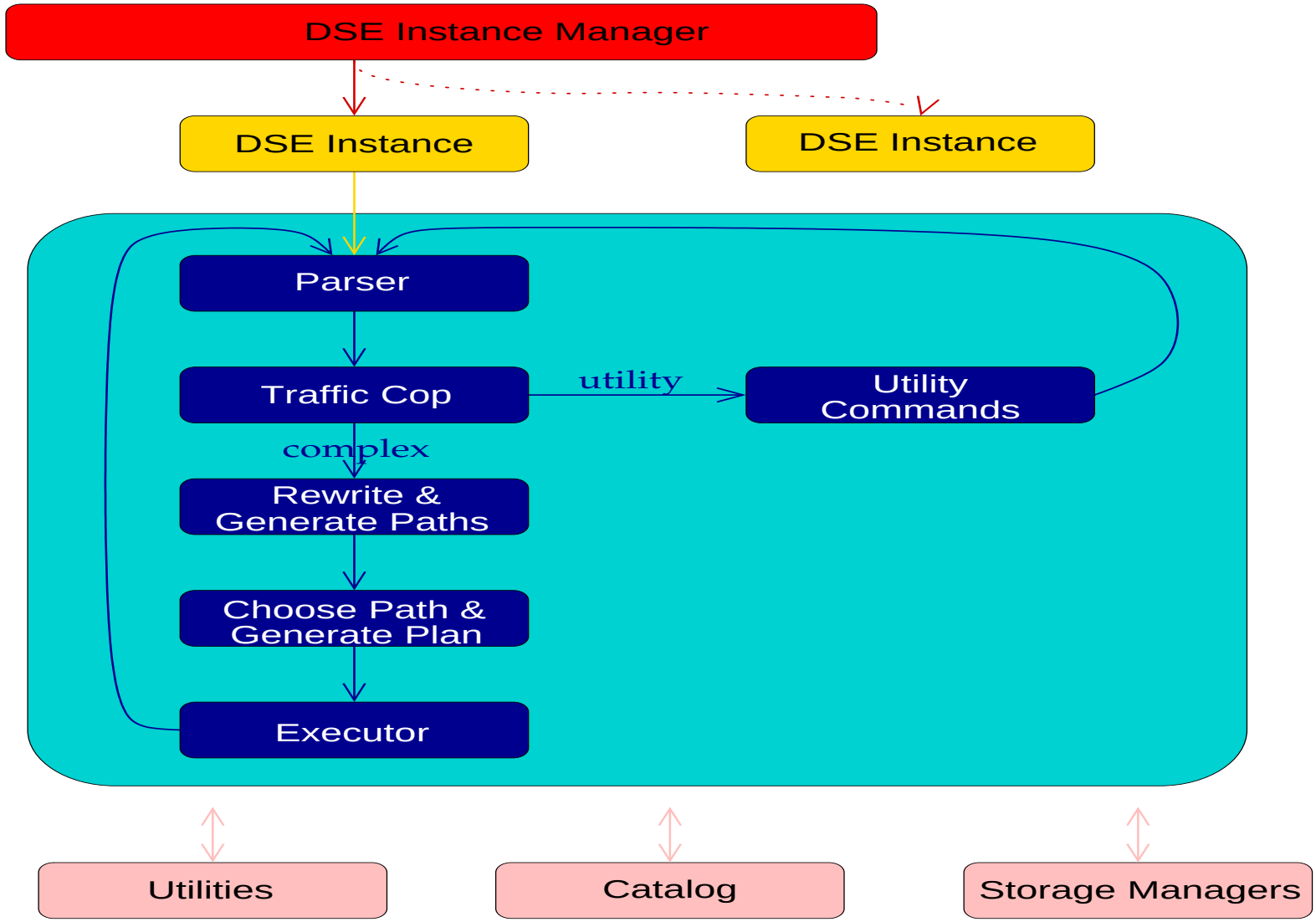
- Rule 6: In a DSEs Grid, MUST be possible to Send TRANSACTION on a remote DSE/DS if Rule 5
- Rule 7: In a DSEs Grid, MUST be possible to Receive TRANSACTION from a remote DSE/DS if Rule 5
- Rule 8: In a DSEs Grid, MUST be possible to enter Termination State for cancelling TRANSACTION
- Rule 9: In a DSEs Grid, MUST be possible to make DSE/DS Selection based on DSE/DS Features MATCHMAKING

...Concerns about GDSE

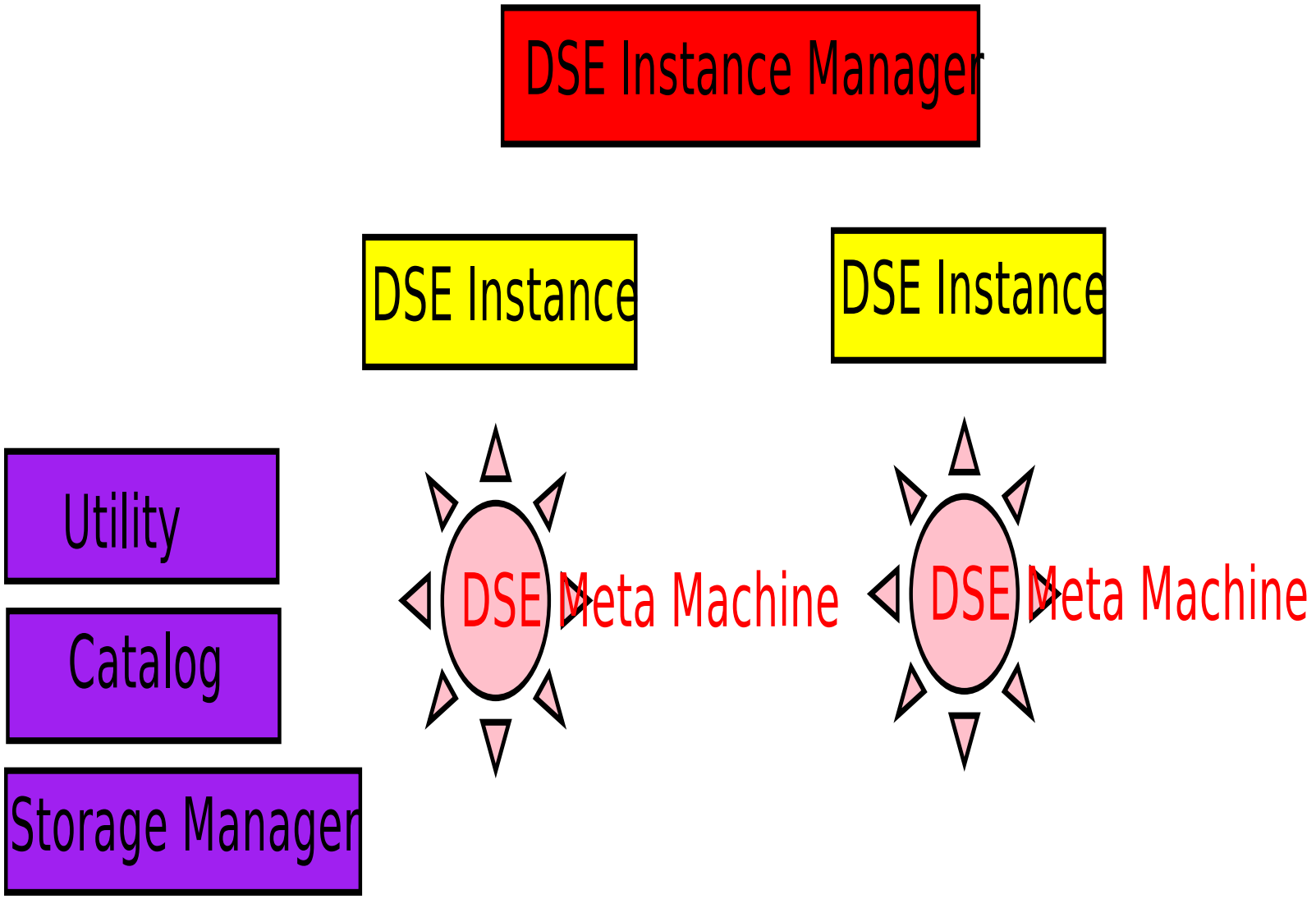
STILL:

- JOB is the CENTER of the MODEL but we have QUERY JOB
- JOB is matched on RSL PROCESS but we have QUERY JOB
- RSL PROCESS involves "EXECUTABLE" staff installed/installable on NODE within DSE/DS request, but we have TRANSACTION

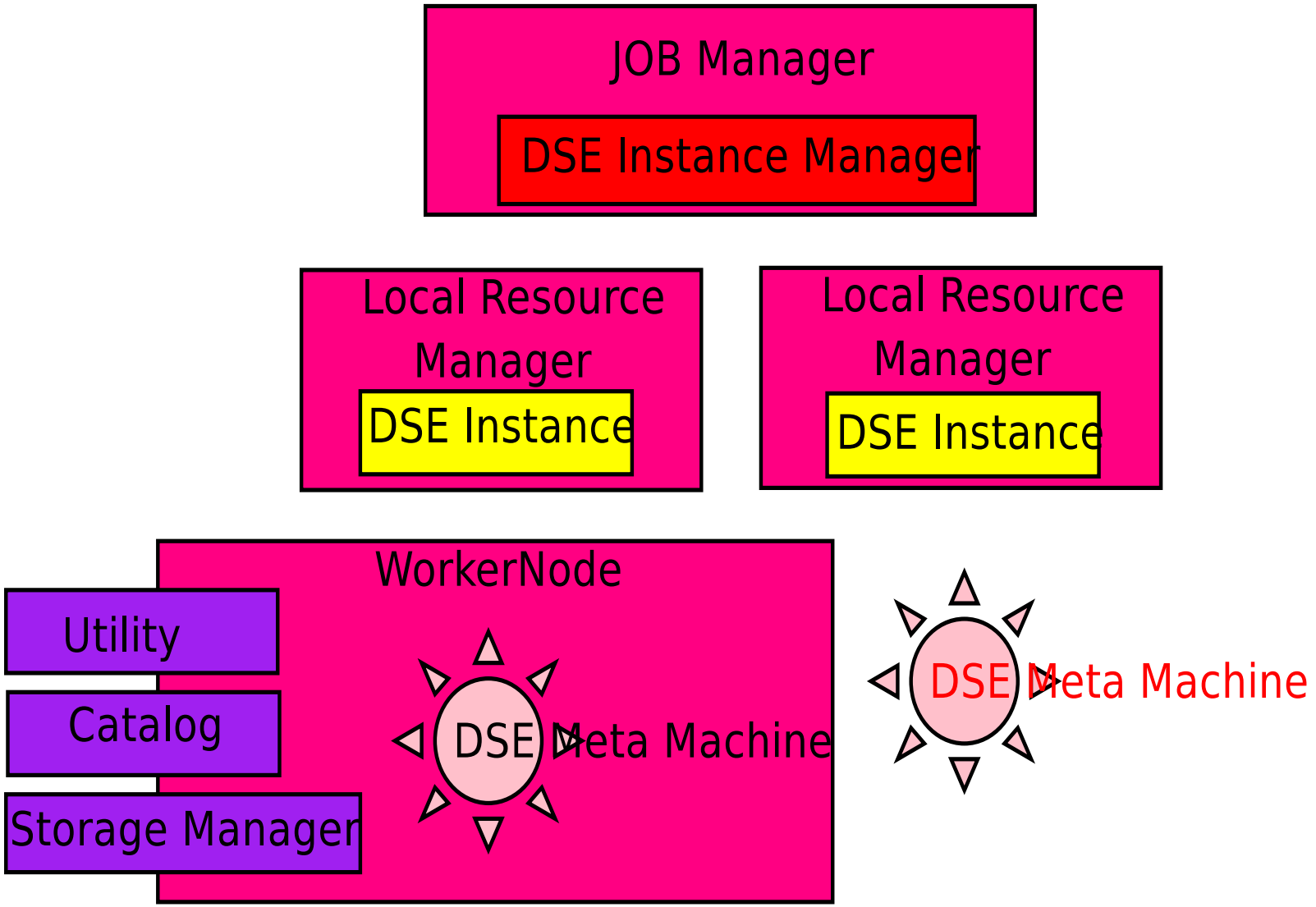
DSE Snapshot



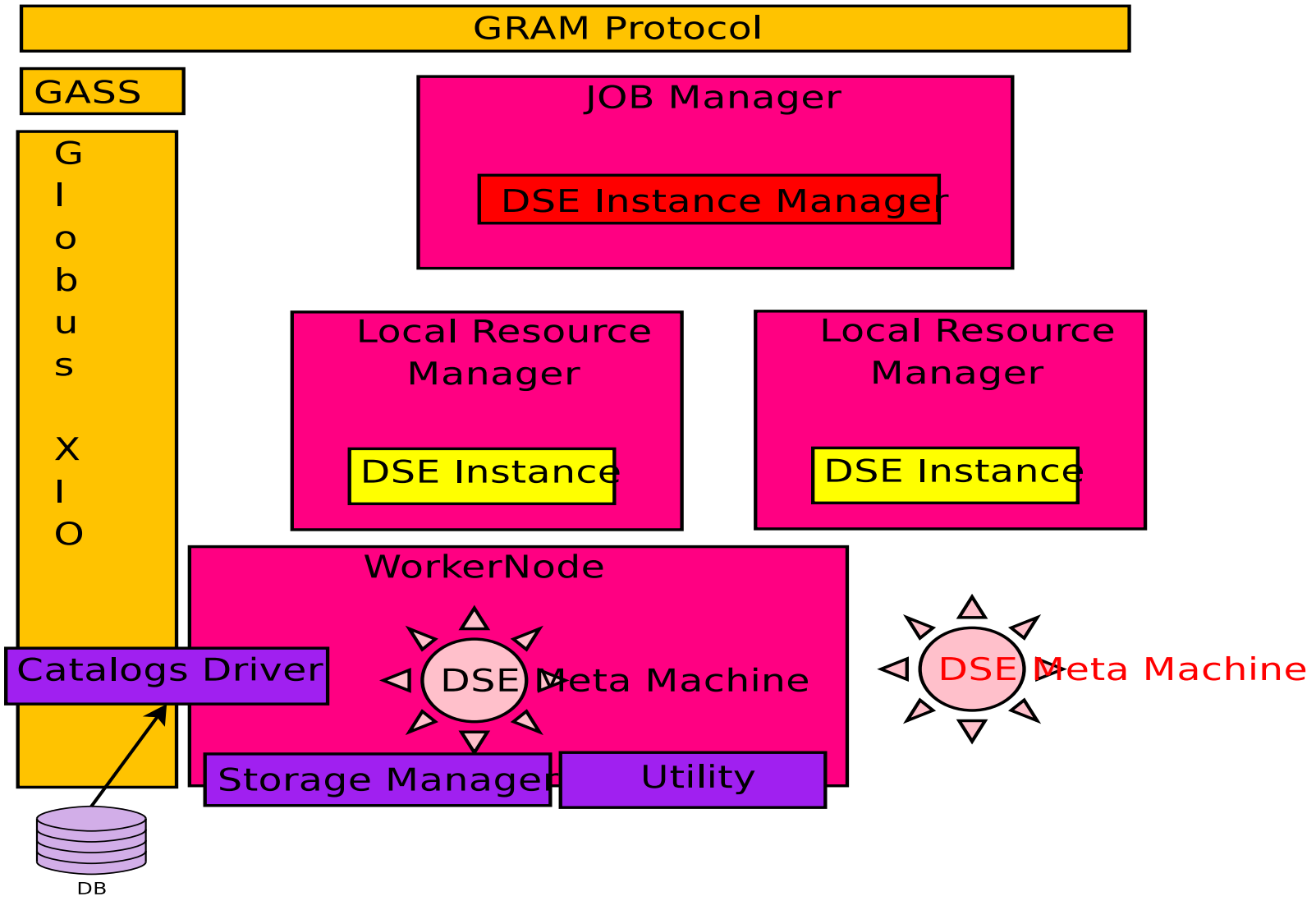
DSE Abstraction



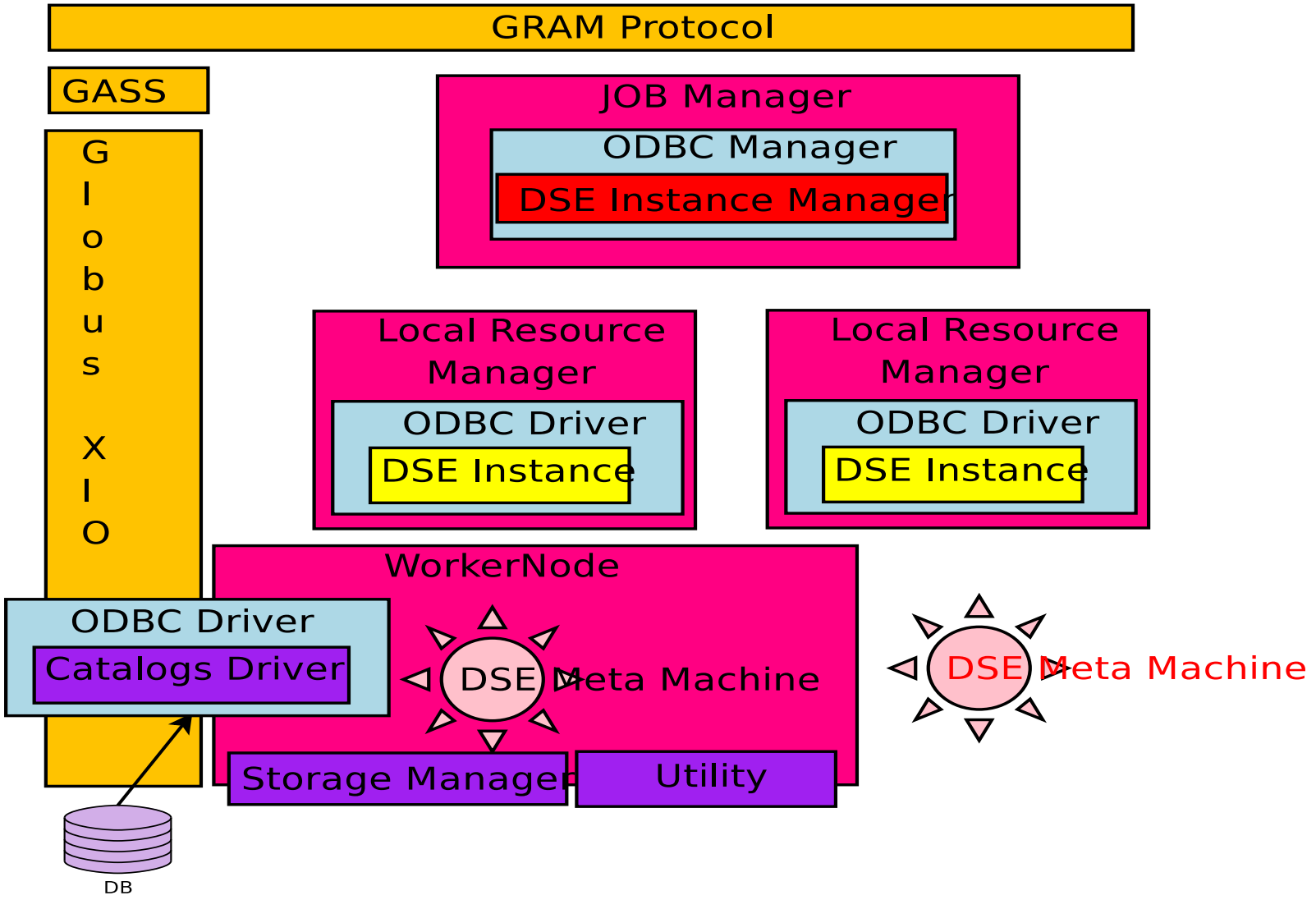
DSE Abstract Mapping



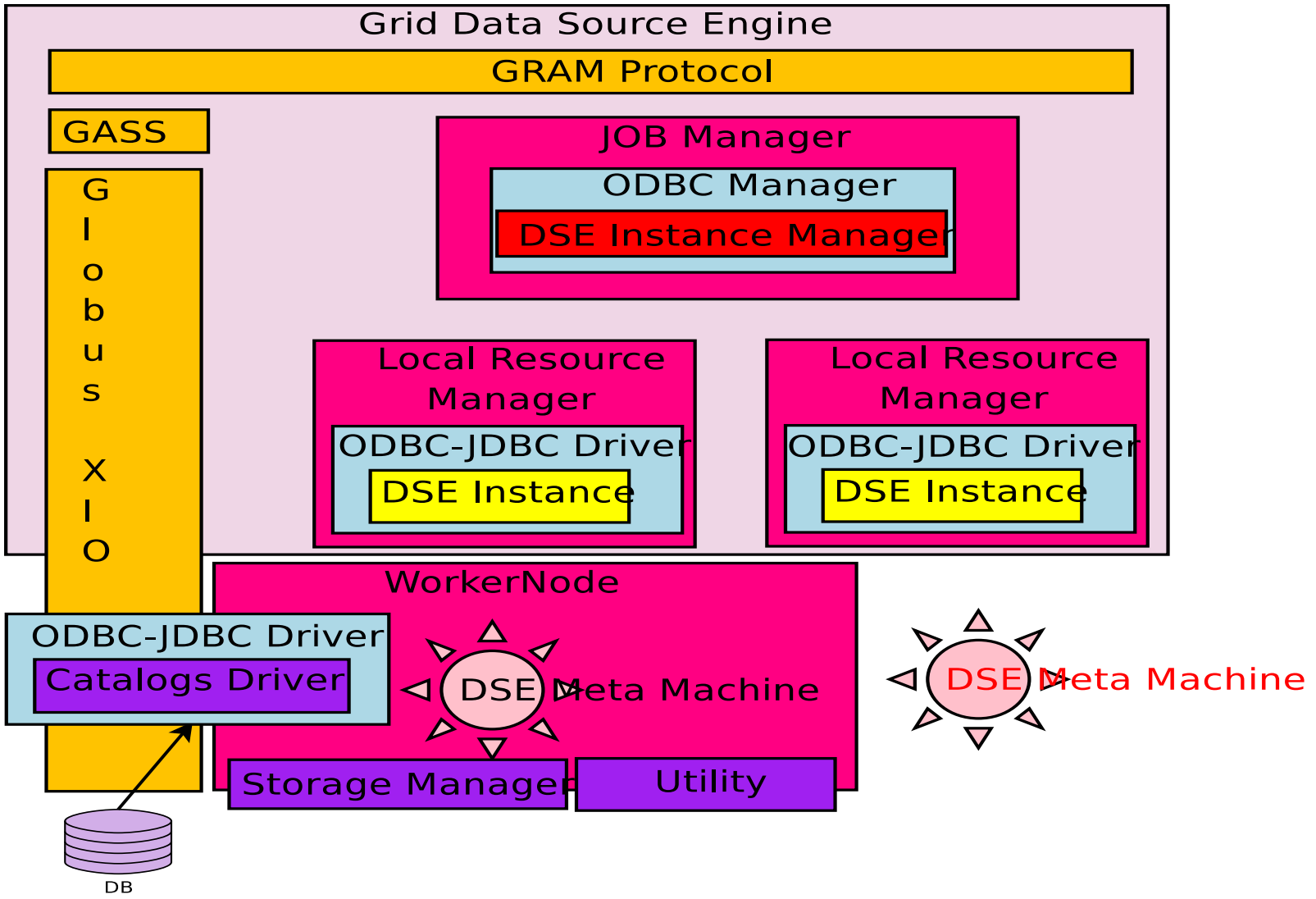
...DSE Abstract Mapping



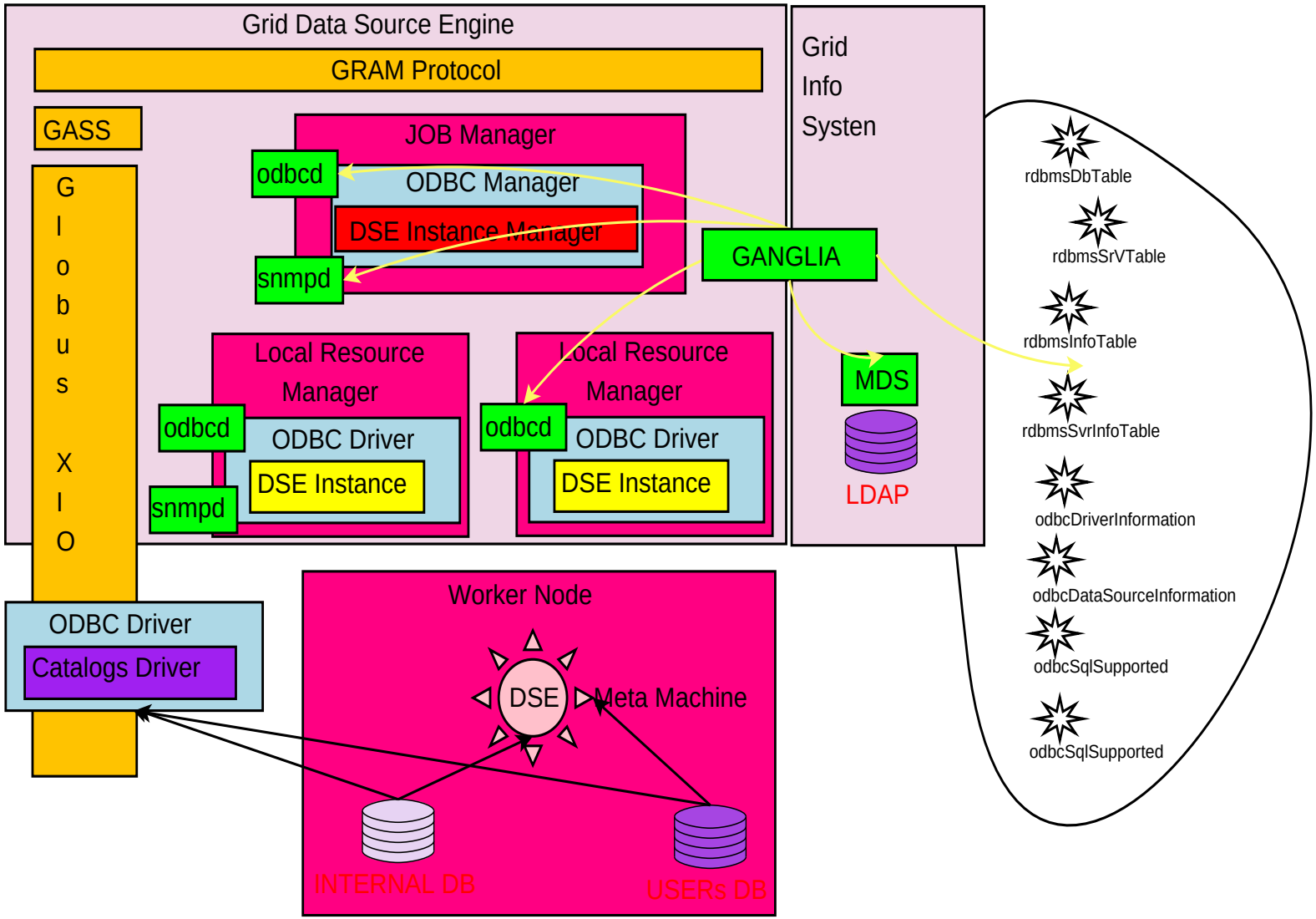
...DSE Abstract Mapping



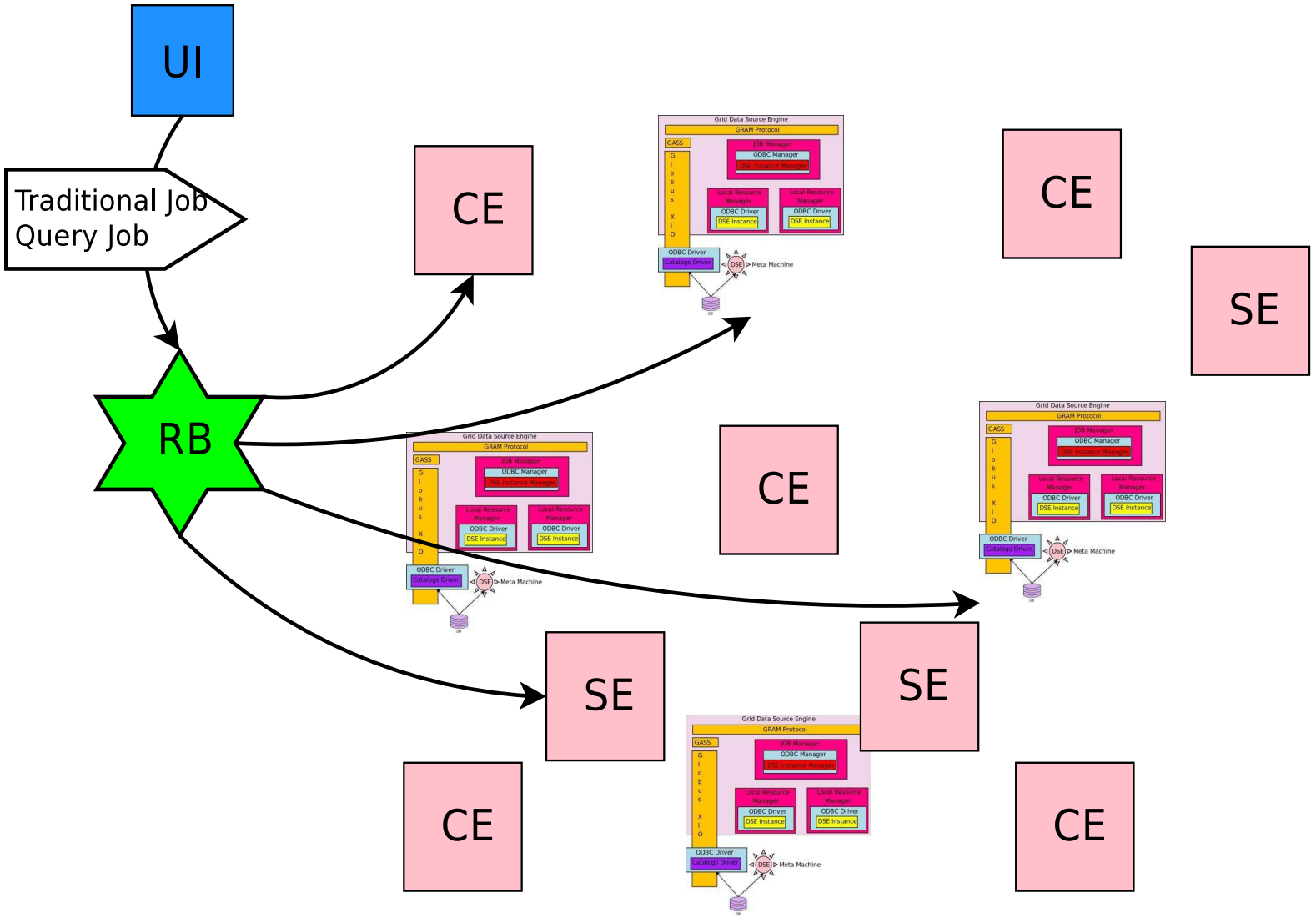
Grid DSE Definition



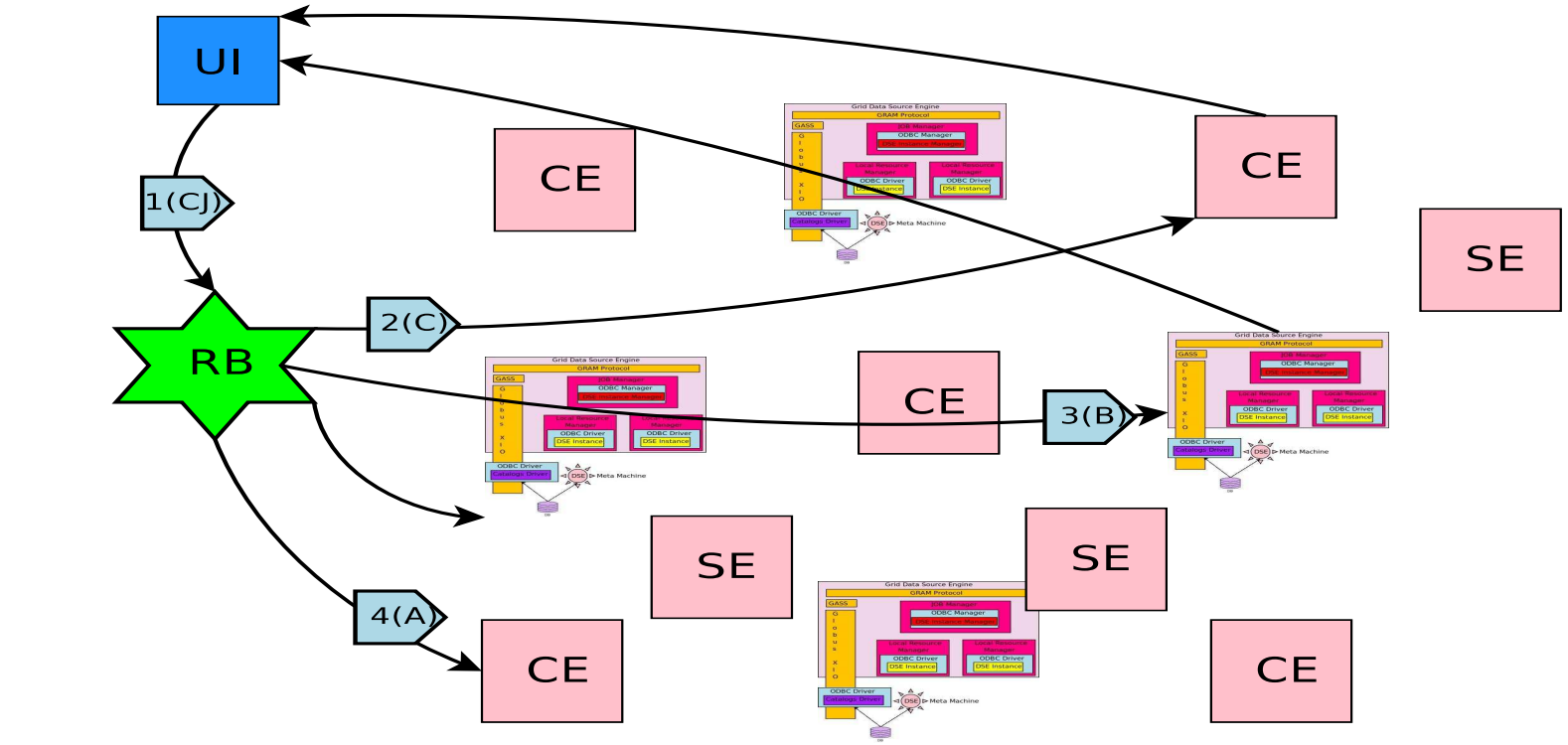
Grid DSE Information System, Concept and Metr



GDSE Possible Scenarios



GDSE Performing Misc Job

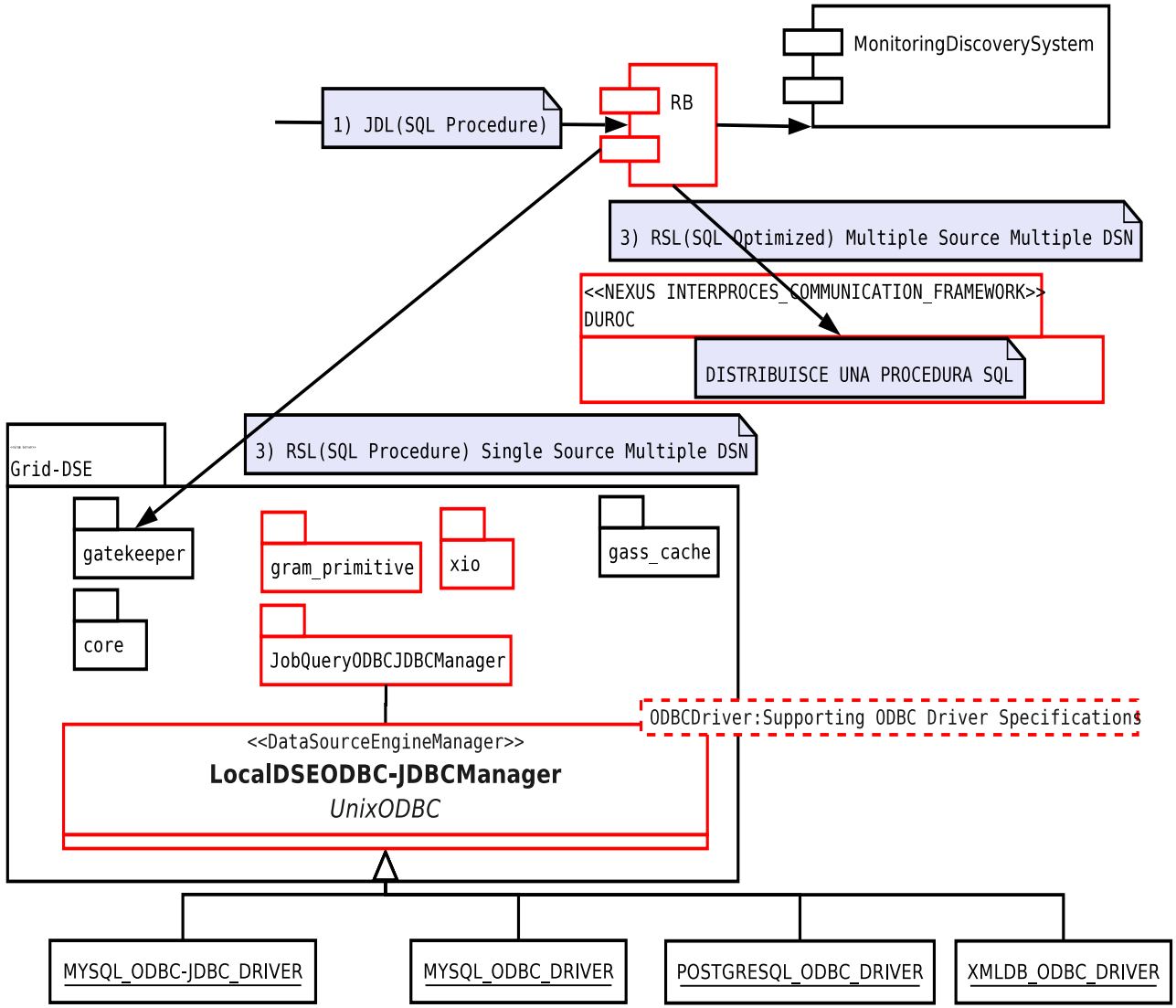


COMPLEX JOB (CJ):
Traditional Job (A)
depending on a

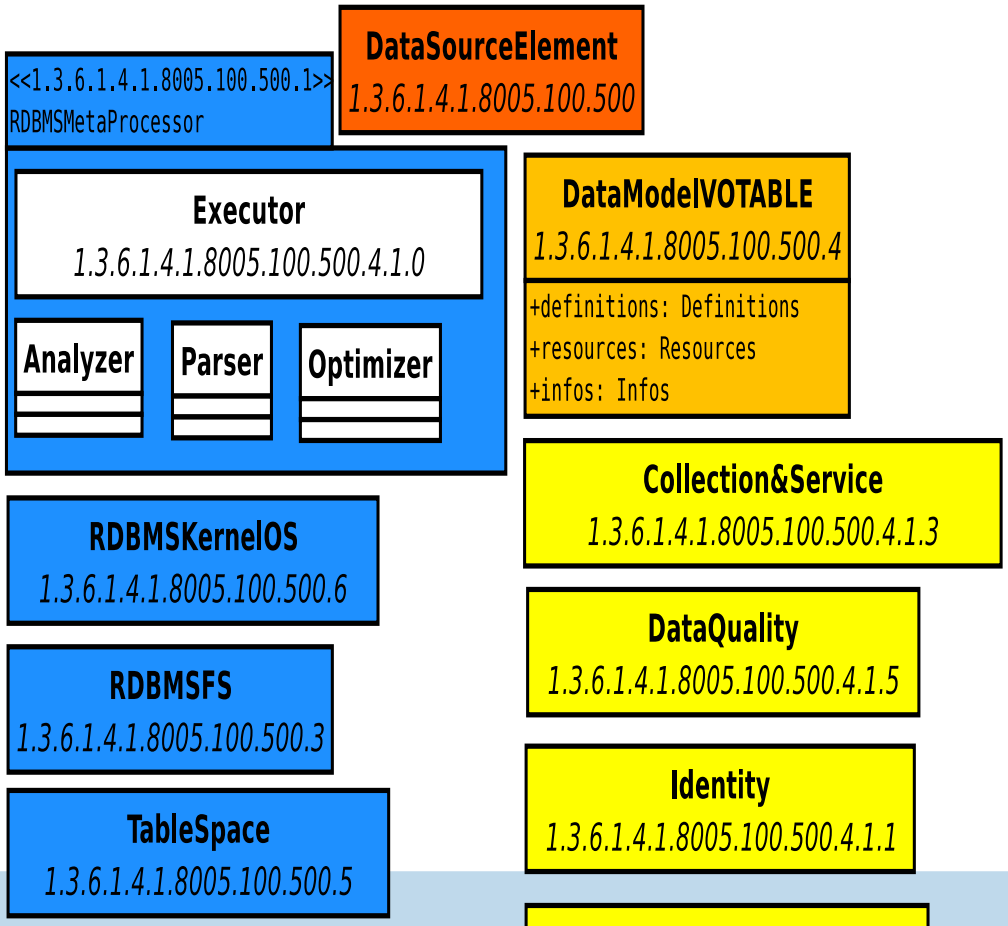
Query Job (B)
to be dealt to you form a
Scientific Function performed by a

Traditional Job (C)

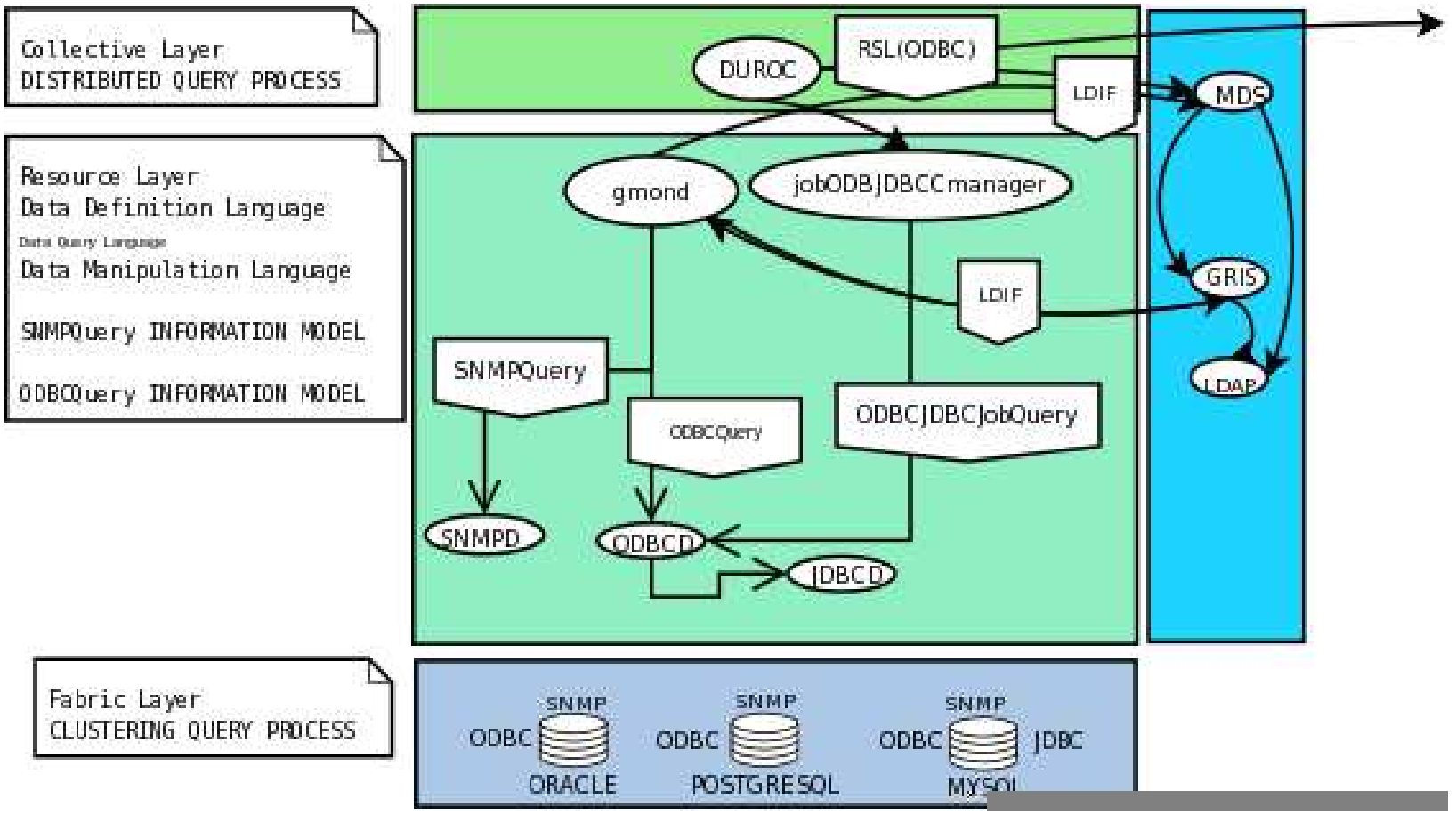
Actual GDSE's architecture snapshot



Information Document Components



Information Model Architecture View



Matchmaking Parameters example

Provided 250 MIB-RDBMS and ODBC information parameters.
Some of them are:

- 'GlueMibrdbmsSrvInfoRequestRecvs'
- 'GlueMibrdbmsSrvInfoRequestSends'
- 'GlueMibrdbmsSrvInfoHandledRequests'
- 'GlueMibrdbmsSrvInfoFinishedTransactions'

Solution

Currently, a prototype and testbed is ready for testing phase. Using GILDA certificates, users can create their own DSs using testbed at INFN-CNAF and INAF.

- We have specialised a JobManager not changing job workflow. Just the semantic of "executable concept is changed",
  - EDG job commands can be submitted just putting any kind of SQL statement belong to the following subset:
    - Data Manipulation Language,
    - Data Defintion Language,
    - Data Query Language,
    - Data Security Language

What it is now available on GDSE?

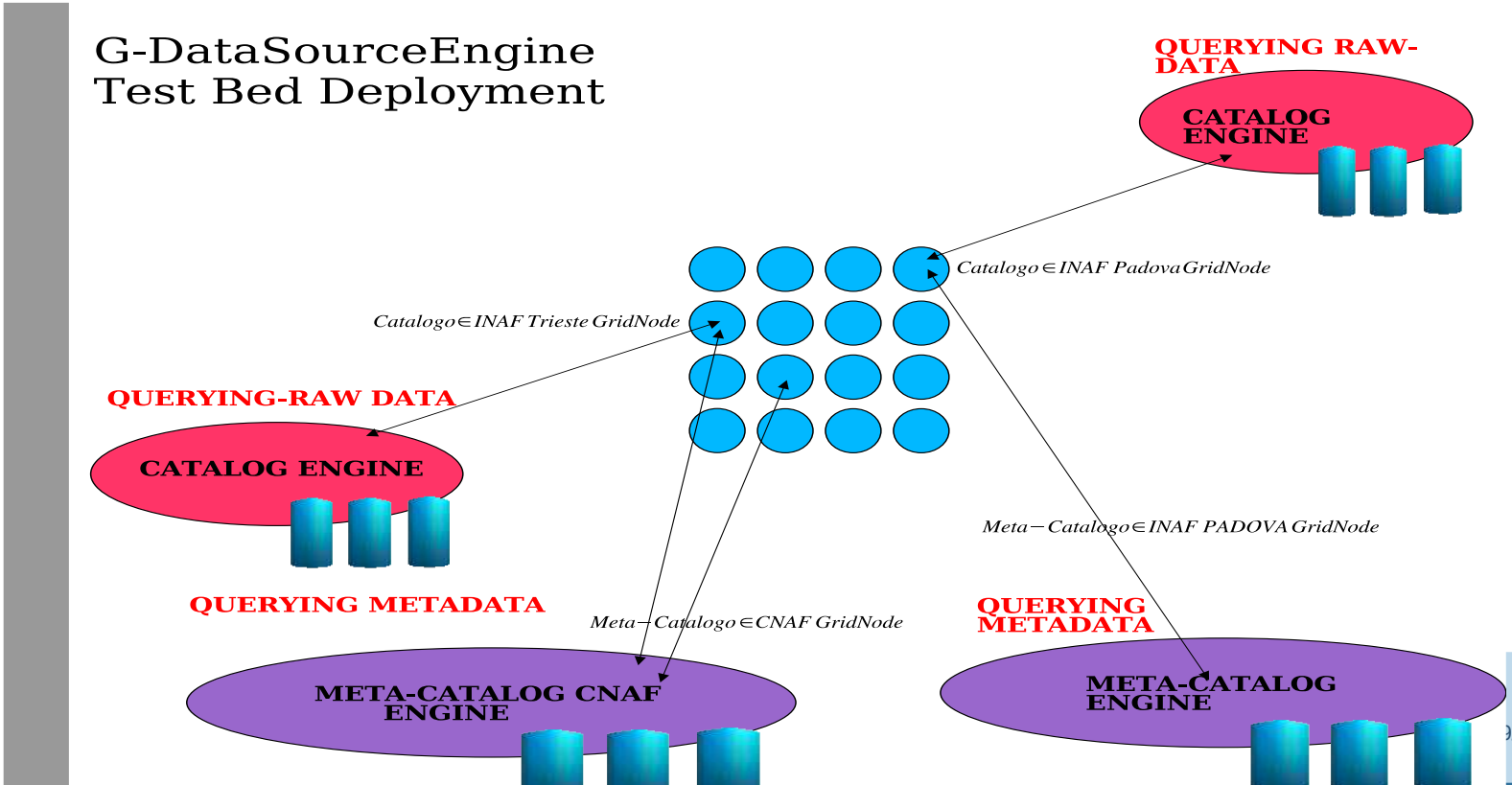
- RUNNING ENVIRONMENT: It is possible to submit and to run an sql-based "COMPLEX SINGLE GRID-SITE QUERY", using standard command like globus-job-submit and globus-job-run.
- GIS ENVIRONMENT: It is possible to make "Single QueryJob Match Macking" using RDBMS standard metrics available for documentation in rfc1697 on MDS extended schema.

What is it going to be available on G-DDSE?

- RUNNING ENVIRONMENT: A real Integrated Data Source Engine System has to be distributable. So the fourth step will make possible to submit and to run an sql-based "COMPLEX MULTIPLE TRANSPARENT GRID-SITE QUERY", using standard command like globus-job-submit and globus-job-run.
- GIS ENVIRONMENT: Will be possible to make "Multiple QueryJob Match Macking" using RDBMS standard metrics available for documentation in rfc1697 and Specialised MDS-ODBC specialised schema.

Test Bed for GDSE

Six month ago, we started the first deployement phase of GDSE, including three Grid Site, three GDSE, four RDMBS, six Information Provider.
The AstroPhysical Catalog of INAF institute has been the use case.



Future Development and Collaborations

What we want to develop in the next future?

- Extendend the XIO layer of Globus for DIRECTLY managing the ODBC/JDBC drivers;
- Adoption of DQL paradigm, provided by OGSA-DAI group, on Nexus/DUROC to implement GDDSE;
- Plan Tests in partenership with Experiments;
- .....

Who we want to collaborate with, in the next future? AMGA ???? as an INTEGRATION ENVIRONMENT ArcheoGRID????????? as a USE CASE

- G-Pbox for Data Source Policy Manipulation! Gruppo GPBox-CNAF
- VOrganizations for Partitioning Data Source Name Space and Aggregating! Gruppo VO
- OGSA-DQP and OGSA-DAI!

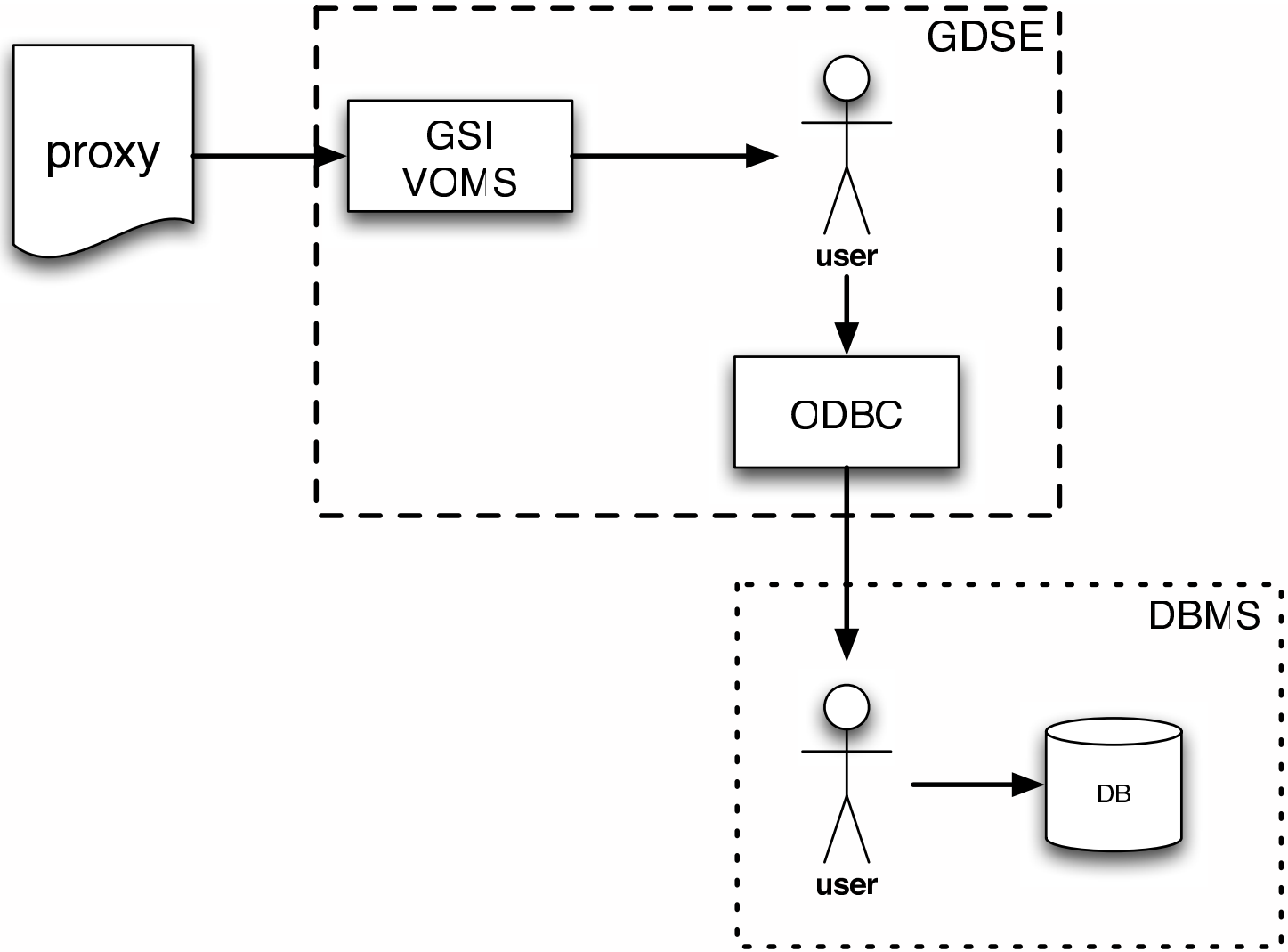
DEMO OVERVIEW

- GDSE and GSI Aspects
- GDSE Simple DB
- GDSE Simple Workflow

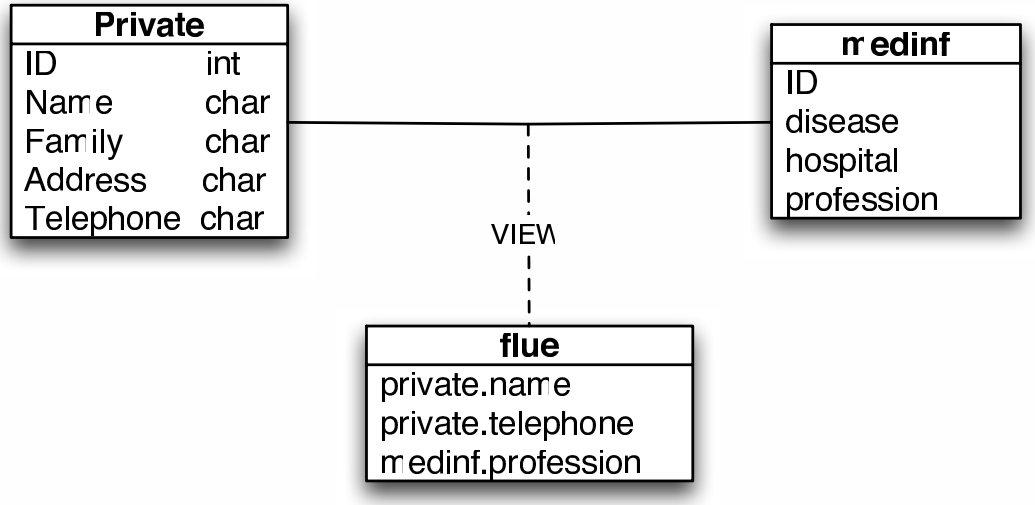
DEMO ASPECTS

- DB Administration
  - GDSE setup
  - DBs and TABLEs creation, managing, authorization, inserting, querying, transactions managing, etc.
- GDSE and GRID
  - BDII usage
  - load balancing about transactions and CPU load
- Metadata and GDSE
  - metacatalogue
  - file catalogue
  - Metadata and BDII
- Computing and GDSE
  - Correlation function on Astro DB
  - Plotting after Correlation Function
  - Parallel and Distributed query over GDSE

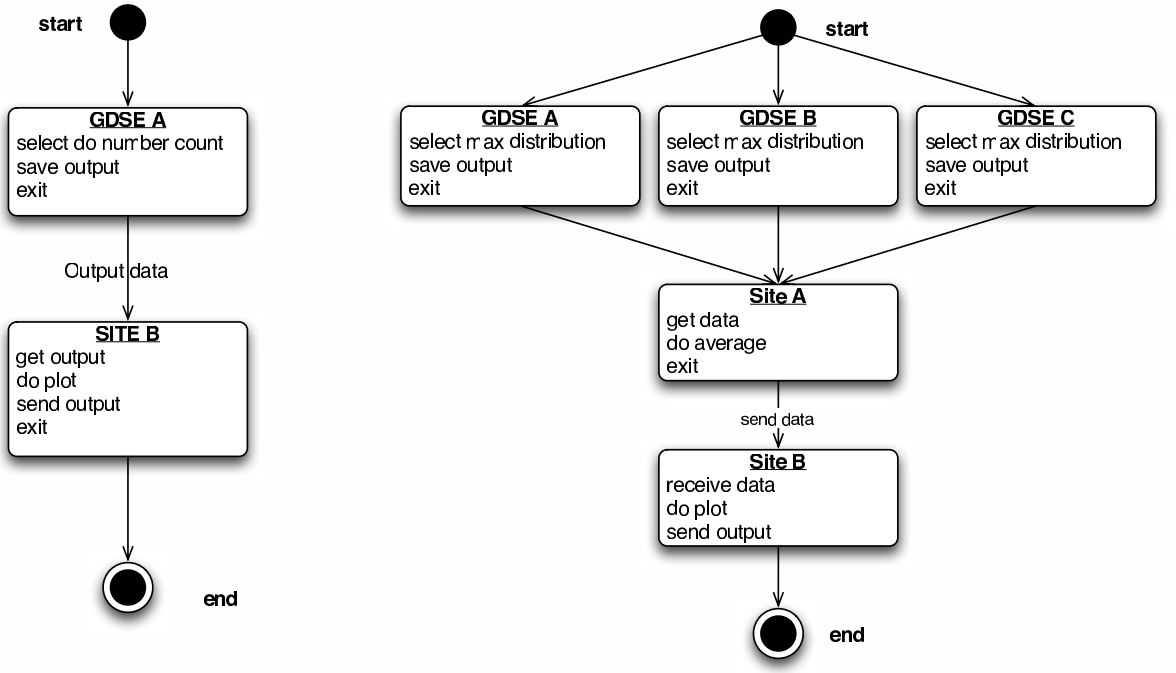
GDSE and GSI Aspects



GDSE Simple DB



GDSE Simple Workflow



Metadata: astro example

```
<!-- some FITS keywords, but in hierarchy -->
   <observation>
      <telescope>VLA</telescope>
      <observer>Syke</observer>
      <imageType>object</imageType>
      <datesAndTimes>
          <observationDate>27/10/1982</observationDate>
      </datesAndTimes>
      <positions>
          <astroObject>3C405</astroObject>
      </positions>
   </observation>
   ... continues ...
</XDF>
```

...Metadata: astro example

XMLD stores keyword structure + e.g. GUID

```
globus-job-run "SELECT guid from fileID where
observation.telescope='VLA', observation.observer='Syke',
astro.Object='3C405'....;" ODBC METADATA
```

when WMS integrated:

```
[executable= "SELECT guid from fileID where
observation.telescope='VLA', observation.observer='Syke',
astro.Object='3C405'....;"
arguments= ODBC METADATA
Requirements="GlueDSEName="AstroMetadataCatalog"....]
```