Summary of the Data Management Session

Conveners: Pasquale Pagano (CNR-ISTI) and Patricia Méndez Lorenzo (CERN)

3rd EGEE User Forum. Clermont, Thursday 14th February 2008

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Information Society and Media

Overview of the Session

- The Data Management session has been a very useful *"window"* to learn and discuss with the experts the road taken by different applications to ensure a good data access to their end-users
  - Looking for Standards towards the access of data in different collectors
    - In some cases very application oriented
  - Accessing data based in the metadata information
- The Data Management session (Wednesday 13.02) counted with 11 talks addressing the following aspects:
  - Community data models (2 talks)
  - SRM based interfaces (2 talks)
  - Authorization (1 talk)
  - Digital data access (1 talk)
  - Metadata (5 talks)
- Many interesting discussions after each presentation
- Thanks to all speakers which provided slides in advanced to ease this presentation

Presentations

Wednesday, 13 February 2008

11:00 [104] **The gCube Metadata Framework: integrated environment for managing Metadata Objects and relationships on top of Grid-enabled Storage Systems** slides
by Dr. Pasquale PAGANO (CNR-ISTI)
(Auvergne: 11:00 - 11:20)

[110] **Evaluating meta data access strategies through implementing the GOME test suite** slides
by Mr. Andre GEMUEND (FhG/SCAI)
(Auvergne: 11:20 - 11:40)

[46] **A WS-DAIR Compatible Interface for gLite-AMGA**
by Mr. Ali JAVADZADEH BOLOORI (Royal Institute of Technology (KTH))
(Auvergne: 11:40 - 12:00)

12:00 [84] **A service oriented framework to create, manage and update metadata for earth system science** slides
by Dr. Kerstin RONNEBERGER (DKRZ)
(Auvergne: 12:00 - 12:20)

Wednesday, 13 February 2008

:00 [14] **Grid Storage Interoperability Now!** slides
by Dr. Jens JENSEN (STFC-RAL)
(Auvergne: 14:00 - 14:20)

[57] **OpenSAML extension library and API to support SAML2.0 - XACML protocol for interoperable authorisation infrastructure in distributed Grid applications** slides
by Hakon Tuvin SAGEHAUG; Valerio VENTURI
(Auvergne: 14:20 - 14:40)

[64] **The Development of SRM interface for SRB** slides
by Mr. Fu-Ming TSAI (Academia Sinica Grid Computing)
(Auvergne: 14:40 - 15:00)

:00 [164] **New results on a comparative evaluation of software providing access to different relational databases interfaced to the grid** slides
by Dr. Giacinto DONVITO (INFN-Bari)
(Auvergne: 15:00 - 15:20)

Wednesday, 13 February 2008

:00 [29] **Medical Data Manager: an interface between PACS and the gLite Data Management System** slides
by Dr. Johan MONTAGNAT (CNRS)
(Auvergne: 16:00 - 16:25)

[68] **Distributed Data Management on the petascale using heterogeneous grid infrastructures with DQ2** slides
by Mr. Mario LASSNIG (CERN & University of Innsbruck, Austria)
(Auvergne: 16:25 - 16:50)

[159] **gLibrary/DRI: A grid-based platform to host multiple repositories for digital content** slides
:00 by Dr. Antonio CALANDUCCI (INFN Catania)
(Auvergne: 16:50 - 17:15)

Introduction

- In the past distributed computing was focused on Workload management
  - Support of large scale distributed computational tasks
  - Resources fairshare, stability
- Data management is currently the discussions and development hot topic
  - Many Grid applications and VOs need to manage large amount of data (~PB)
    - High Energy Physics: ~10PB/year, ~10M files/year
    - Earth observations, satellite imagery (NASA, UNO agencies)
  - Data distributed across many sites with different storage systems, access protocols
  - Developments towards standard data access (application oriented)
  - Described by multiple and heterogeneous metadata
    - From LFN (few years ago) to the metadata (present and future direction)
  - Different security requirements
    - While HEP data are worldwide read accessible, privacy is a fundamental key is some other communities
  - Reliability and scalability
    - Inaccessible storage is more damaging than inaccessible CPU

Fundamental aspects to consider

Data Management system

Data placement (Storage Systems)

- Based on physical resources matching the requirements of the data
  - Disk systems
  - Mass Storage

Data are dynamic

- Transfer of data and creation of replicas
  - Standard protocols
  - Catalogues
  - Room for community needs and decisions

Access to the data

- Homogeneous access ensure independent of the SE system
  - SRM
  - I/O: Remote access coping data locally
- Remote access, local copy
  - Space reservation and Pinning
  - Again SRM

Data organization

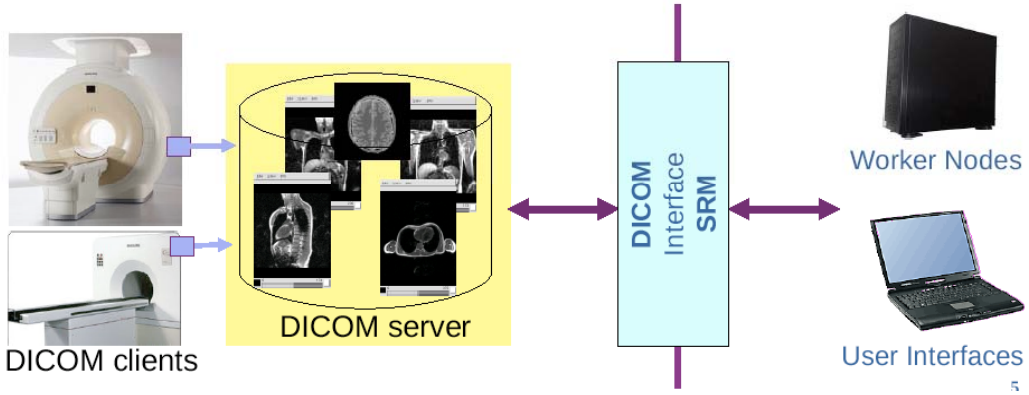
- Structures
  - Files, directories
- Metadata
  - Files cannot be opened to know what is inside
  - Structure to be created by the data management model

Type of data and type of storage

- Original data
  - Tape stored for custodial purposes
  - These are normally data that will not be much more accessed
- Handled data useful for the whole community
  - Fast access will be required: disk and tape storage
- Other kind of data
  - Data that could be removed depending on the site needs
  - Easy to be reproduced

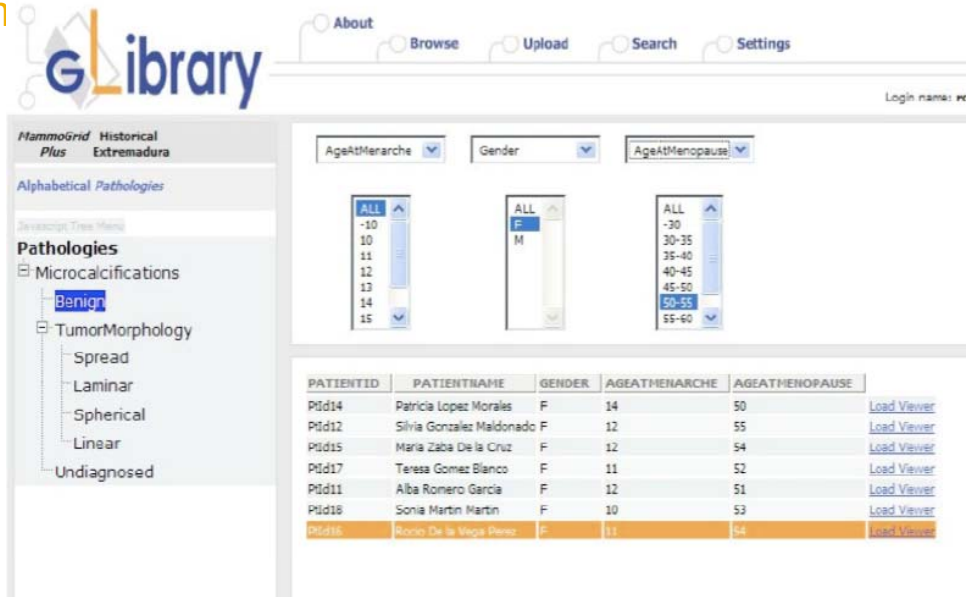
Biomedical Aspects

- The medical information
  - Medical images (digital files) and patient info (metadata)
- Requirements
  - Patient privacy, data needs to be protected (encryption) and robustness system
- Medical data management system objectives:
  - Implementation of a SRM interfaced to the DICOM servers which will allow the access and transfer of data into the Grid
- gLite3.1 elements:
  - LFC as file catalogue
  - GFAL
  - AMGA
  - SRM (v2)
  - Hydra Key Store



gLibrary/DRI

- The gLibrary/DRI (Digital Repositories Infrastructure) platform
  - Based in the **gLibrary** project (created by GILDA team at INFN. Italy) which was conceived as a file repository that takes advantage of the Grid features
  - The **gLibrary/DRI** (in collaboration with CETA-CIEMAT. Spain) infrastructure builds on this concept and extends the platform offering a general multi-repository environment designed to support complex repositories
  - Any repository providing data and annotations can vary greatly in differen repositories. However certain common points are welcome, for instance:
    - metadata for digital data
    - algorithms processing data
    - GUI to access the repository
    - Data storage federation
  - The globalization of multiple repositories of arbitrary structure in one standard with a low cost of deployment is the central scope of the DRI extension

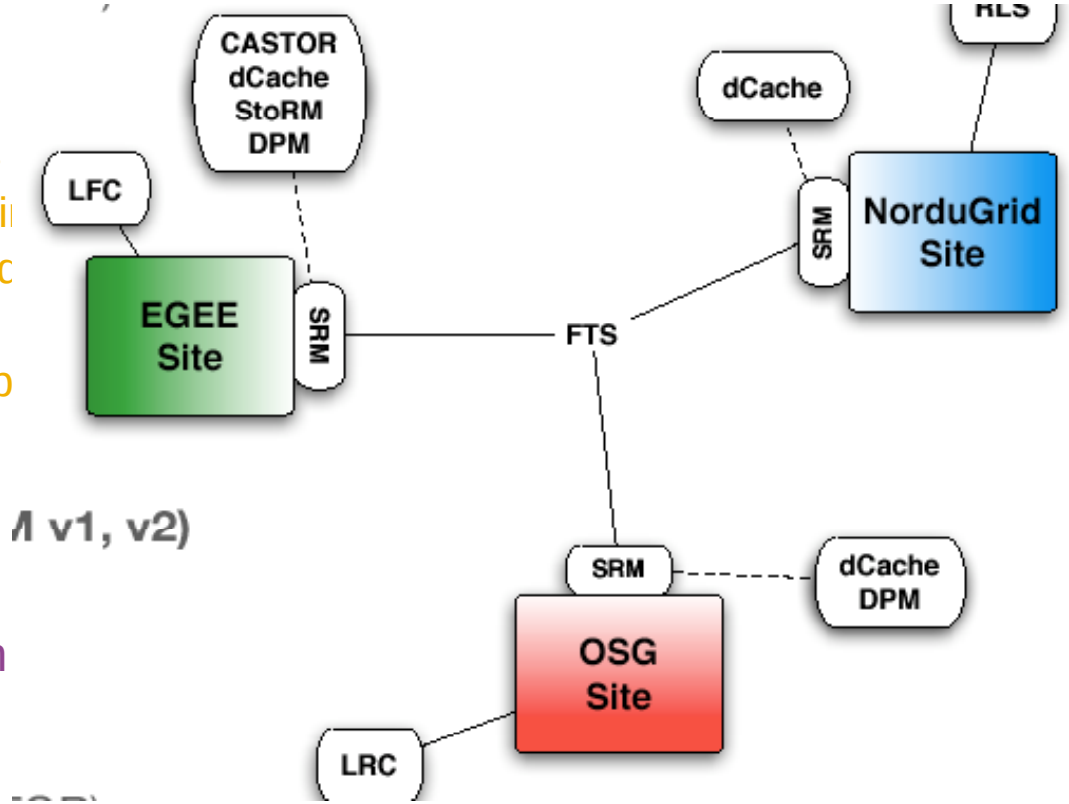


The case of HEP (I)

- Presentation of the ATLAS DDM (DQ2)
- Although applied to one LHC experiment, it has been a good example of the principal issues which the 4 LHC experiments are facing
  - Large number of users distributed all over the world
  - Enormous number of files which have to be managed in large CPU farms and that have to be accessible to all users
    - Management of raw, reconstructed and user data
    - Those user files can also be interesting for the whole community
- The DDM has to be compatible with the Computing model defined by the experiment
- It has to provide a single entry point to all distributed data
  - Also assuming different middleware platforms
- It has also to take care of the movement of data across the sites

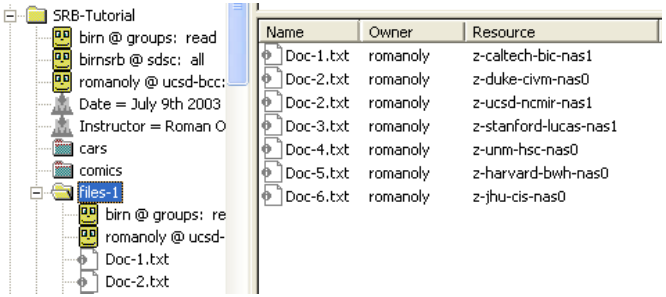
The case of HEP (II)

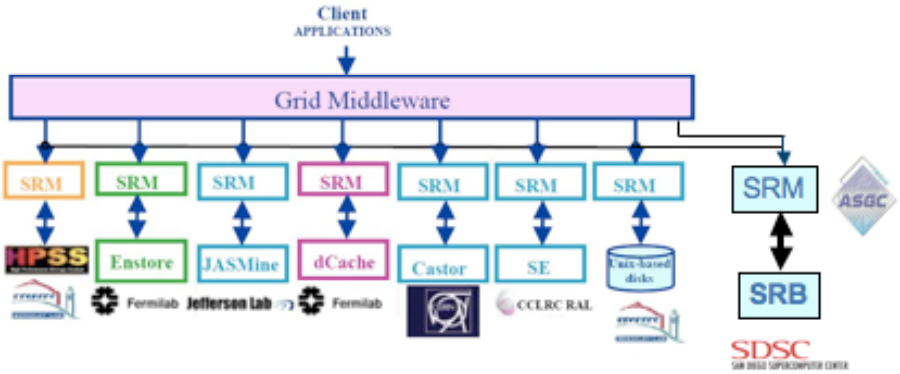
- The Data structure
  - The data are grouped in datasets which provide metadata for those grouped files
  - ATLAS provides a cloud infrastructure in terms of datasets providing a site hierarchical structure
- Transferring data via FTS
  - The movement of data is performed in pull mode usi a set of site services provic at each sites
  - Any Tx-Ty transfer possib
- Interoperability among diff. middlewares is ensured via SRM (v1,v2)
- Basic DQ2 implementation allows the listing and access to the datasets



SRM:Towards a Standard (I)

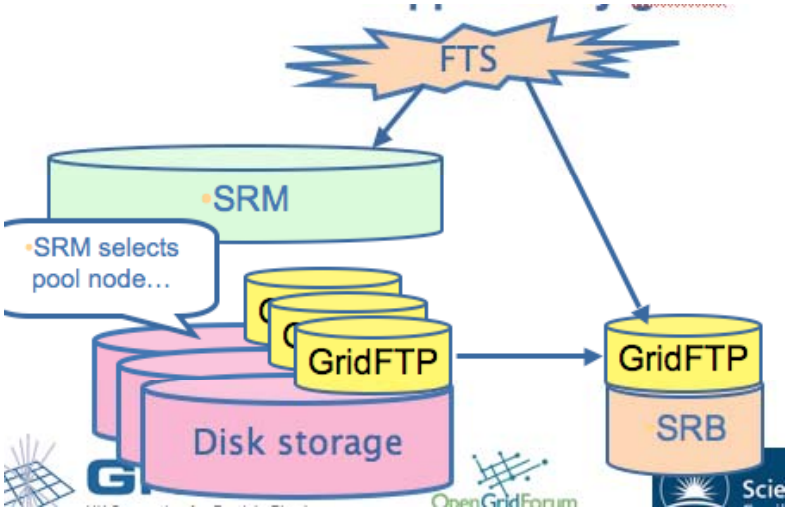
- The session had also 2 talks regarding the SRM-SRM interaction
  - SRM: Storage Resource System not handling metadata
  - SRB: Storage Resource Broker (SDSC) supports shared collections (logical name given to a set of data objects) distributed across multiple organizations and heterogeneous storage systems
- ASGC hopes to connect between SRB developed by SDSC and Grid middleware in gLite. And all gLite users can access data in SRB env through SRM interface.

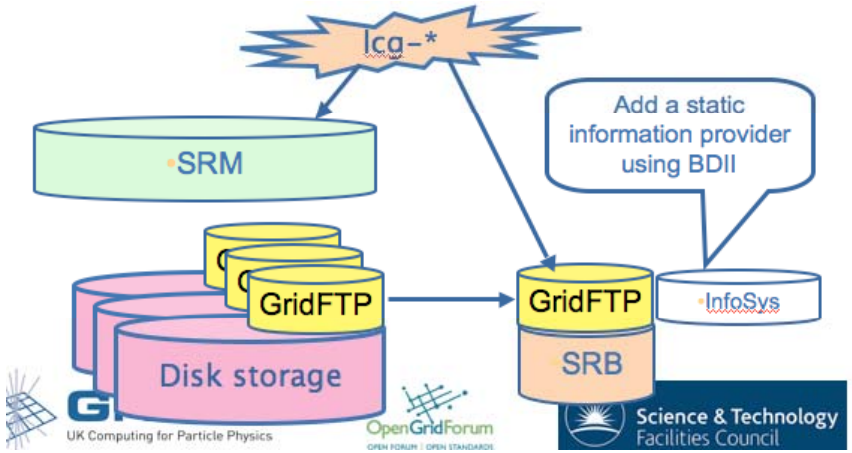




SRM:Towards a Standard (II)

- SRM-SRB interoperation
  - Availability to transfer data between SRM and SRB
  - Make SRB appearing as a SE
  - No additional development is required
  - SRB is considered as a classic SE
  - Transfers
    - ensured via FTS (which does not depend on the IS)
    - via lcg-utils requires the implementation of a infosys close to SRB





OpenSAML

- Authorization is an important component of the Grid security infrastructure
- OpenSAML extension and the API implementing SAML2.0 profile of XACML
  - Interoperability between different Authorization services
- Supports communication between the 2 major components of the generic Auth. Service:
  - Policy Enforcement Point (PEP): logical entity or place on a server that enforces policies for admission control
  - Policy Decision Point (PDP): provides role-based policy decision and distribution mechanisms allowing an administrator manage and transmit policies by roles of devices without configuring each one of network devices manually
- The implementation of the library and the API has been done as pluggable
  - Can be used by different Java Auth. Frameworks as gLite Java Auth. Framework (gJAF), G-Pbox, glexec
- The development has been done in the framework of the gJAF development and EGEE-OSG Auth interoperability initiative, and may be one of the modules in achieving interoperability in the grid

Metadata Management

- **Grid needs metadata to …**
- **Tools and frameworks are ready to be exploited and new ones are coming**
  - gCube Metadata Framework
  - Service Oriented Framework for Earth System Science (coming)
  - AMGA WS-DAIR (work still in progress)
- **Test suites and comparative evaluations**
  - AMGA
  - GRelC: Grid Relational Catalog
  - G-DSE (INAF + INFN)
  - OGSA-DAI

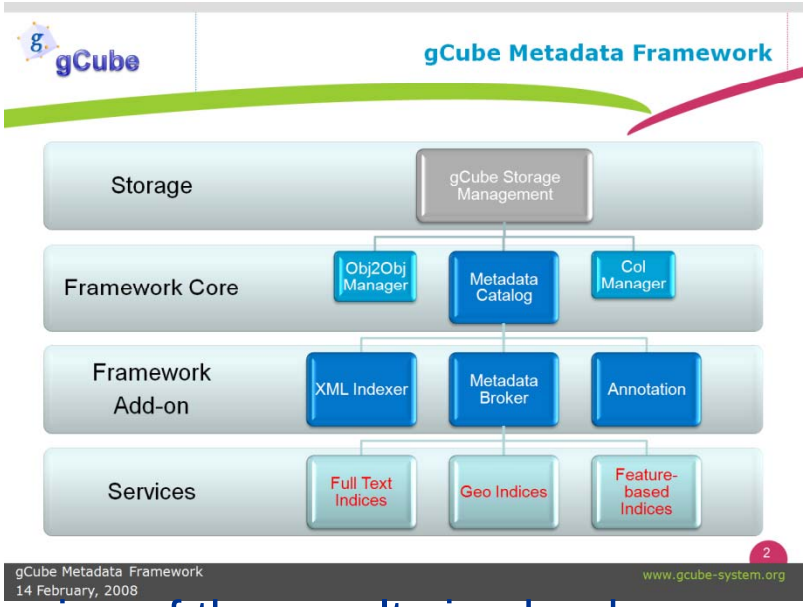
Grid needs metadata to …

- Share data
  - **Content** (unique variable description, temporal & spatial bound)
- Find data
  - **Discovery** (where to find, how to access)
- Process data in modular, independent steps
  - **Use** (format, size, etc.)
- Compare/reuse data
  - **Provenance** (origin of data, performed processing steps etc.)

Courtesy of Dr. RONNEBERGER, Kerstin

gCube Metadata Framework

Released in November 2007 (tested for 1 year in the Diligent infrastructure)

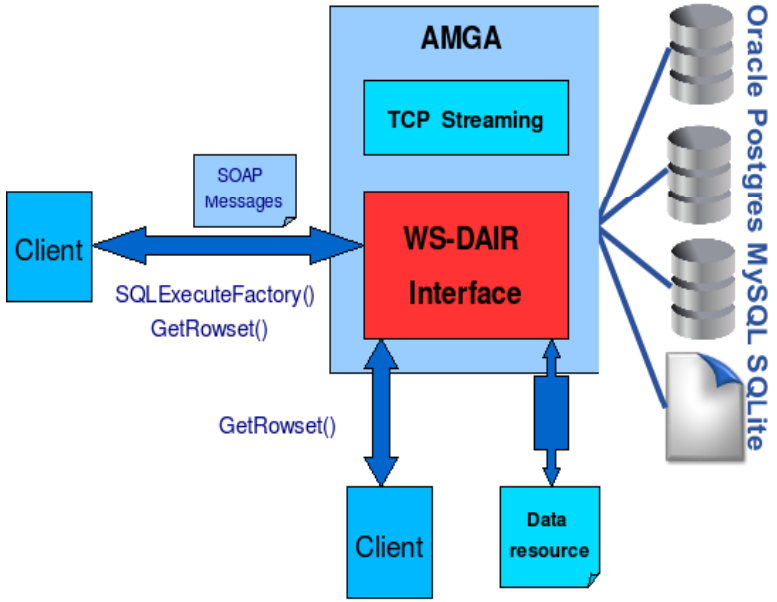


- Rely on an external storage system (gLite SE)
- Support replication and partitioning
- Support for validation
- Support indexing and discovery through xPath / xQueries expressions
- Support custom transformation and streaming of the results in chunks
- Support GSI secure conversation and VOMS authentication
- Do not adopt any pre-defined schema (do not rely on a relational DB)
- Do not support ACL

AMGA WS-DAIR

WS-DAIR

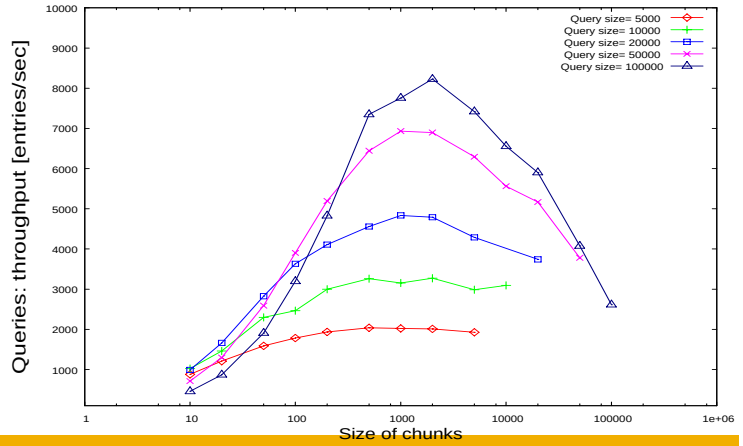
- is the extension of the standard for relational databases.
- exposes existing relational data resources capabilities
- Provides direct and indirect access patterns



AMGA WS-DAIR

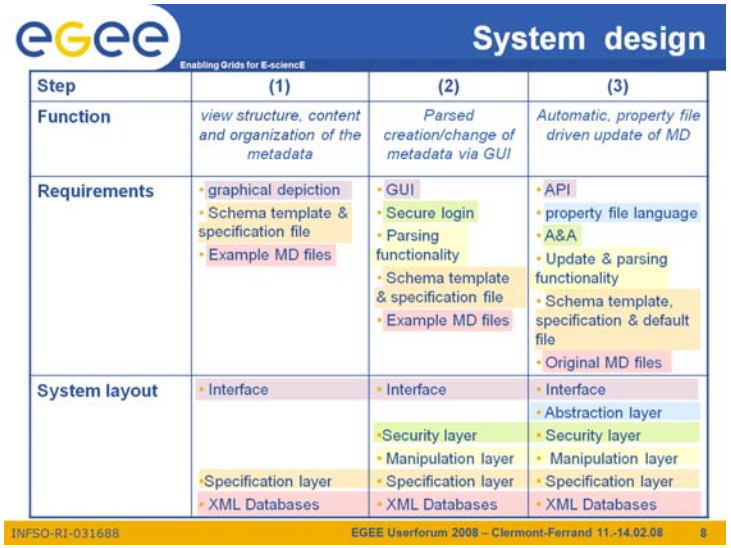
- is implemented in C++ (gSoap)
- sends result sets in chunks, using iterations
- caches result sets
- support for scrolling in result set, in any direction
- standard encoding of data (Java WebRowSet)

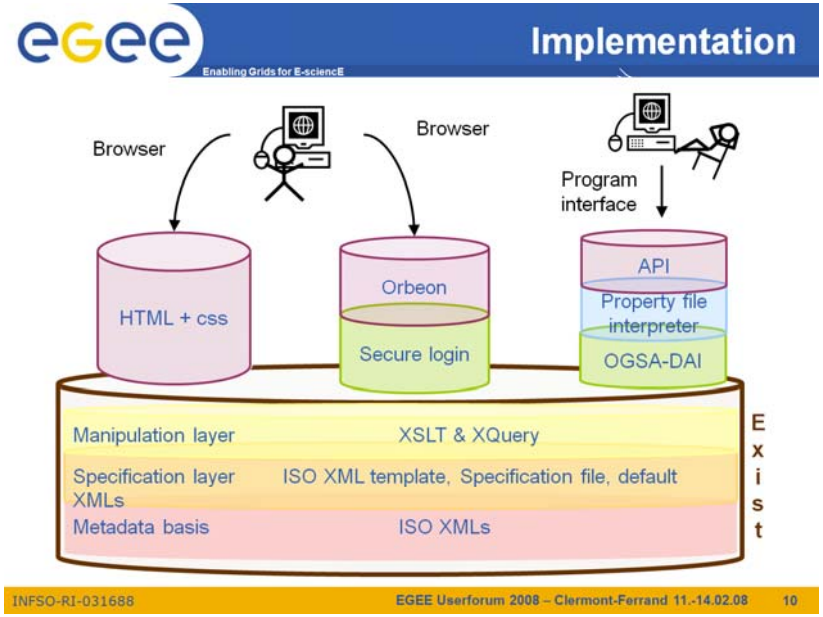
Influence Of Chunk Size



Service Oriented Framework for Earth System Science

- **ISO 19115**
  - Content, Discovery, Use, Provenance
- **Metadata workflow**
  - Create ISO MD for existing data resource
  - Automatically update ISO MD during processing
  - Interactively create default file
  - Produce property file





Test suites and comparative evaluations (I)

GOME test suite

- Compontents: AMGA, GRelC, and OGSA-DAI
- Datasets: GOME satellite and LIDAR ground station measurements (correlate by geo-coordinates and date metadata)
- Workflow:
  - Transmission and registration of data files
  - Extraction and archiving of Metadata
  - Bidirectional correlation of files through Metadata
  - Abstraction of Metadata backend
- Results:
  - Backend Compatibility
  - Data schema, types, and query language
  - Indexing (IDs) and GIS features
  - Bulk Action support
  - Hierarchical metadata
  - Reuse of Data

Test suites and comparative evaluations (II)

A joint test program of INFN, SPACI-UNILE and INAF

- Compontents: AMGA, GRelC, OGSA-DAI, and G-DSE (INAF + INFN)
- Procedure
  - Sequential Tests:
    - *Extraction of 10, 100, 1000, 10000, 100000 simple tuples*
    - *Submission of complex queries (join, multiple queries, etc)*
    - *Submission of **INSERT, UPDATE, and DELETE queries***
    - *Evaluate the differences between LAN and WAN queries*
  - Concurrent Tests:
    - *O(10) concurrent clients*
  - Only GSI authentication
    - *VOMS authentication not supported by some of them*

Test suites and comparative evaluations (III)

A joint test program of INFN, SPACI-UNILE and INAF

Security

Tools	GSI	VOMS Authentication	Transport Layer Security	Data Encryption
OGSA-DAI	Yes	No	Yes	Yes
GRELC-DAS	Yes	Yes	Yes	Yes
G-DSE	Yes	Yes	Yes	~~No~~ Yes
AMGA	Yes	Yes	Yes	Yes

http://www.bioinfogrid.eu EGEE User Forum 11-14 February 2008 - Clermont Ferrand (France)

Simple query: test results (2)

Number of Tuples	OGSA-DAI CSV CLI (s)	OGSA-DAI CSV API (s)	OGSA-DAI CLI (s)	GRELC-DAS DIME (s)	GRELC-DAS STREAM (s)	GDSE (s)	AMGA (s)
1	5,07	0,23	4,7	0,21	0,358	0,180	0,024
5	5,13	0,26	4,77	0,316	0,352	0,198	0,03
10	5,31	0,27	4,65	0,214	0,35	0,215	0,03
50	5,32	0,304	5,25	0,234	0,448	0,196	0,044
100	5,43	0,324	6,15	0,248	0,366	0,198	0,06
500	5,61	0,45	6,37	0,442	0,486	0,283	0,224
1000	6,63	0,65	7	0,652	0,592	0,343	0,416
5000	7,74	2,41	14,8	2,606	1,634	0,853	2,106
10000	9,96	4,61	24,46	4,962	2,754	1,485	4,208
50000	19,31	15,21	95,63	23,686	11,696	6,521	21,454
100000	37,42	34,21	188,86	46,486	23,(		

The new release of GDSE reduces, not only the smallest query, but also the time spent retrieving ones.
The previous table is available at:
http://indico.cern.ch/contributionDisplay.py?contribId=71&se

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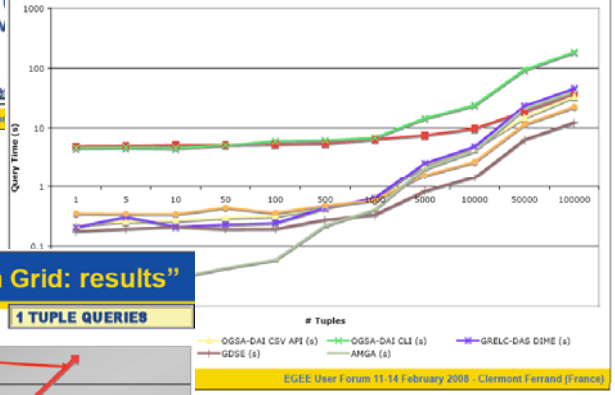
Simple query: test results (2)



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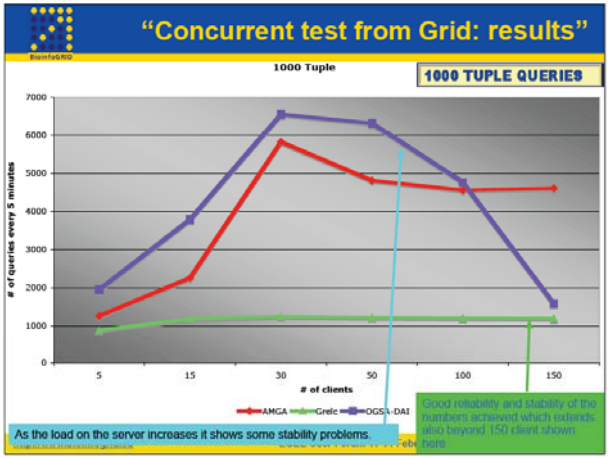
"Concurrent test from Grid: results"



"Concurrent test from Grid: results"