

# The Work Package 2 experience

## Data Management on the Grid



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# Outline

- ◆ Objectives and how they were met
- ◆ Achievements
- ◆ Lessons learned
- ◆ Future & Exploitation
- ◆ Questions

# Objectives



## DataGrid Technical Annex:

- ✓ Enable **secure access** to massive amounts of data in a universal **global name space**.
- ✓ **Move** and **replicate data** at high speed from one geographical site to another.
- ✓ **Interface to heterogeneous mass storage** management systems.
- ✗ Manage **synchronisation** of ren **Read-only write once versions**.
- ✗ **Automate data caching** and distribution according to **dynamic usage patterns**. **Network monitoring considerations**.

## Delivering Middleware

- ◆ Many existing Grid components were included in the first release (like GDMP, Globus replica catalog)
- ◆ Based on first experience and on user feedback, the EDG2 services have been designed and developed
- ◆ Pioneering role in the usage of J2EE-based web services (long time before OGSI)
- ◆ EDG2 is a complete set of data management solution – but should still be considered first generation.
- ◆ **It's in use!** Most of WP2 services are integral part of

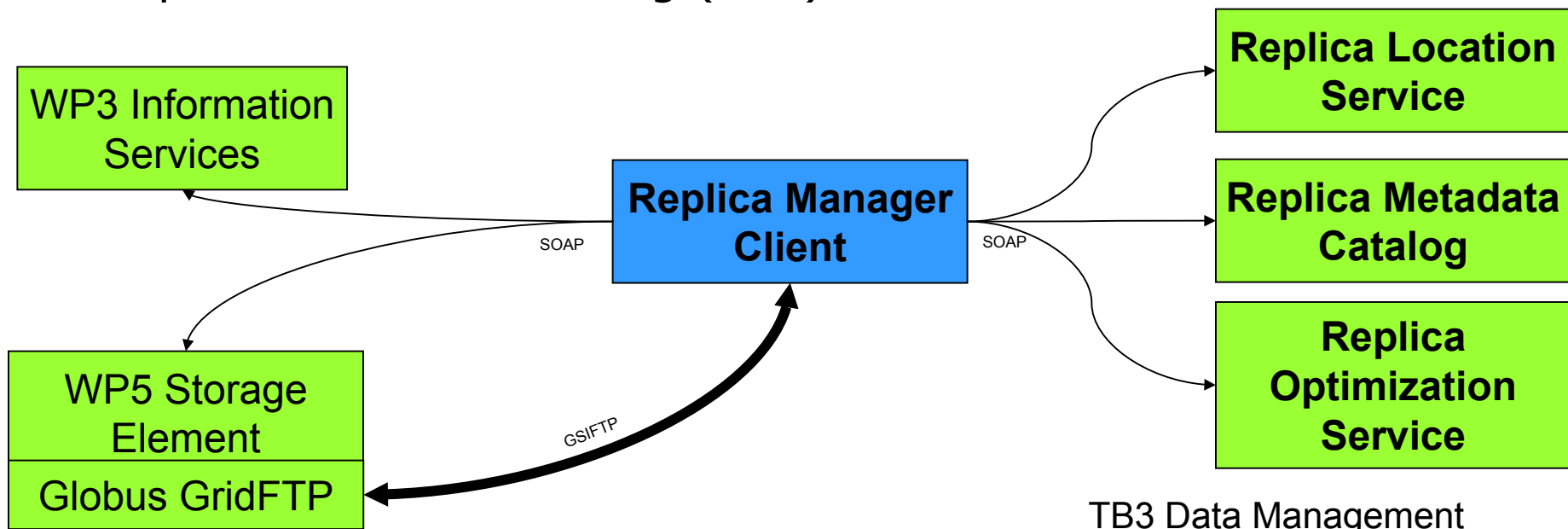
## Collaboration

- ◆ Inside EDG: participation in all project groups and close collaboration with applications
  - Close coordination with WP5 in last year
  - Direct support of applications
- ◆ Collaboration with CrossGrid on storage resource metrics
- ◆ Collaboration with the Globus Project on Replica Location Service
- ◆ Strong participation in GGF and the various groups therein
- ◆ Participation in Storage Resource Management specification
- ◆ Interaction with many more groups, like DAIS project.

# Achievements per Task

## Data Replication Task

- ◆ Replica Manager (TB1+2+3)
- ◆ Replica Catalog (TB1+2) and Replica Location Service (TB3)
- ◆ Grid Data Mirroring Package (TB1+2)
- ◆ Replica Metadata Catalog (TB3)



# Achievements TB3

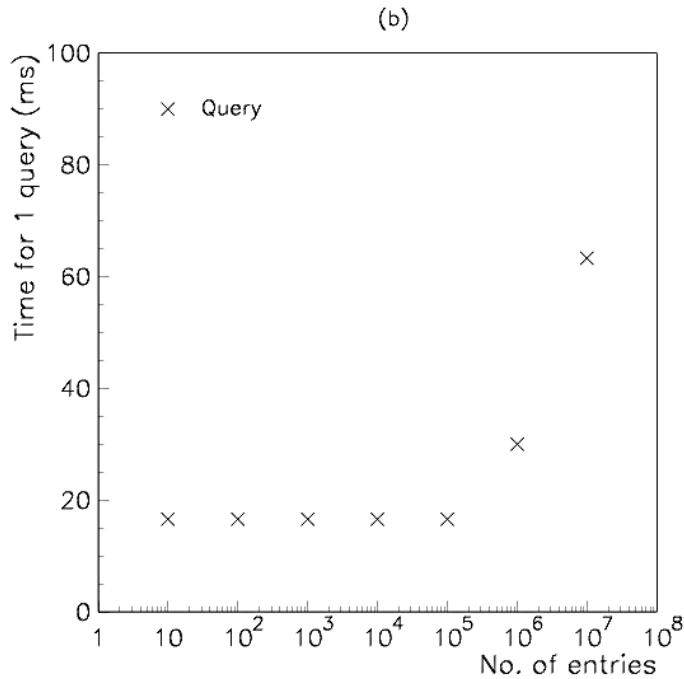
Important **scalability** improvements.

- ◆ **TB1+2 Replica Catalog** had serious limitations:
  - ~2000 entries maximum depending on file name length
  - not much concurrent usage possible.
- ◆ **TB3 Replica Location Service**
  - Limited only by underlying database ( $10^7$  still ok for MySQL)
  - Good scalability with growing size
  - Very good scalability with number of concurrent users

Important **interoperability** improvements

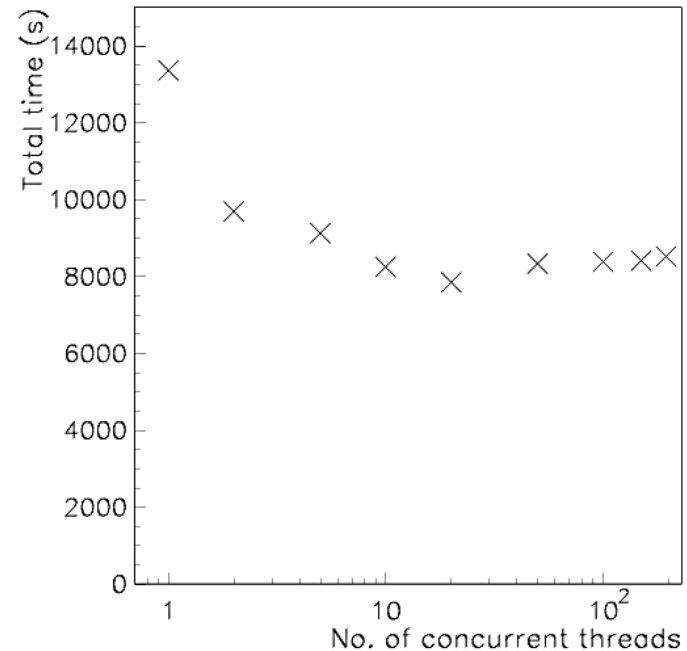
- ◆ Replica Manager is interoperable with various Storage interfaces: SE, SRM, GridFTP server (aka 'classic SE')
- ◆ Supporting both TB1+2 and TB3 information systems (MDS and R-GMA)

# Scalability Figures



Time to run a lookup  
(C++ API, MySQL)

See D2.6 for more details



Total time to add 500'000 entries  
with concurrent threads,  
one operation each (Java API)



# Achievements per Task

## Optimization Task

- ◆ Replica Optimization Service (TB3)
- ◆ Active research: OptorSim Simulation package
  - Simulation of optimal replica placement strategies
  - Includes simulation of network conditions

## Metadata Access Task

- ◆ Spitfire – Grid Access to Relational DB (Demo)
  - Served as a prototype web service application for TB3 services
- ◆ Collaboration with DAIS group.
- ◆ Replica Location Service metadata
- ◆ Replica Metadata Catalog metadata

# Achievements per Task



## Security Task

- ◆ Secure java-based web services:
  - TrustManager for authentication (TB3). In use by WP3 and WP5 as well
  - AuthorizationManager for authorization (In operation). It can apply VOMS authorization information to the service.
- ◆ Secure clients in java and C++ to web services (TB3)
- ◆ Strong participation in EDG Security Group

# Lessons Learned

## Development Cycle

- ◆ In EDG it was not possible to do a proper requirements gathering, prototyping, testing, development **fast enough** for the lifetime of the project. A faster release cycle to the end-users will be possible from now on since future projects won't start from zero.
- ◆ We focussed on **core services** in EDG. The much needed **end-to-end** capabilities can now be added more easily since the users also know better what they want and how they want it.
- ◆ **User interface and documentation** are important and difficult to get right first time

## Less is more

- ◆ Focusing on the basics: **stability and usability** paid off
- ◆ Extra features good, but should be **pluggable** because not all users want them

# Lessons Learned

## Security is key

- ◆ Can't 'add security later' – horizontal through all services
- ◆ Security mechanisms are deeply reflected in the design
- ◆ Lots of open issues: Performance, delegation, site buy-in...

## Web Services work well

- ◆ Modular web service structure
- ◆ Pluggable QoS (deployable in open source or commercial environments)
- ◆ Based on standards: well supported by industry and open source community

## Products

- ◆ The LHC Computing Grid is running WP2 services (except Replica Optimization and Spitfire) and will maintain and support them for at least this year for their community.
- ◆ EGEE can benefit from existing WP2 services as a starting point
- ◆ Spitfire has served as an example for other projects already.
- ◆ The security infrastructure will serve as one of the bases for java-based web service infrastructures over SSL for the next projects.
- ◆ The optimization work has enriched the computer science community with many valuable insights through its many publications.
- ◆ The publications, documentation and tutorials serve as a reference for future projects.

# Future & Exploitation



## People

- ◆ All members of WP2 have gained valuable experience while working on EDG. Their expertise will be very useful to their future projects.

## Processes

- ◆ The lessons learned in EDG will help improve the processes of the future projects that EDG members participate in.

## A lot of work remains to be done

- ◆ Data sets and virtual data
- ◆ Application metadata bindings into the low-level services
- ◆ End-to-end integration with user applications
- ◆ ...

# BIG THANKS



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