

GOAL AND STATUS OF THE TLSE PLATFORM

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<http://graal.ens-lyon.fr/LEGO>



REDIMPS workshop help in conjunction
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LEGO



Outline

- Overview of the GRID-TLSE Project
- Semantic description of services
- Use of scenarios to generate dynamic workflows
- Bibliography
- Status
- Conclusion



GRID-TLSE Project: Tests for Large Systems of Equations

Main purpose: Sparse linear algebra Web expert site.

- GRID-TLSE Project: ACI GRID, 01/03 – 01/06.
Academic partners: CERFACS, IRIT, LaBRI, LIP-ENSL;
- Now:
 - ANR-CICG05-11 **LEGO** Project 2006- 2009. Academic partners: LIP, IRISA, INRIA Futurs, IRIT, CERFACS, CRAL.
 - ANR-06-CIS6-010 **SOLSTICE** Project 2007-2010. Partners: INRIA, CERFACS, INPT-IRIT, CEA-CESTA, EADS CCR, EDF, CNRS-CNRM-LA.
 - CNRS / JST **REDIMPS** Project 2007-2009. Partners: JAEA and academic partners of the TLSE Project (CERFACS, IRIT, LaBri / INRIA Futurs, LIP ENS Lyon / INRIA)



Sparse Matrices Expert Site ?

- **Expert site:** Help users in choosing the right solvers and its parameters for a given problem
- **Chosen approach:** Expert scenarios which answer common user requests
- **Main goal:** Provide a friendly test environment for expert and non-expert users of sparse linear algebra software.
- **Easy access to:**
 - Software and tools;
 - A wide range of computer architectures;
 - Matrix collections;
 - Expert Scenarios.
- **Also :** Provide a testbed for sparse linear algebra software



Why do we use a Grid ?

- Sparse linear algebra software makes use of sophisticated algorithms for (pre-/post-) processing the matrix.
- Multiple parameters interfere for efficient execution of a sparse direct solver:
 - Ordering;
 - Amount of memory;
 - Architecture of computer;
 - Libraries available.
 - Determining the best combination of parameter values is a multi-parametric problem.
- *Well-suited for execution over a Grid.*



Additional Benefits of Using a Computational Grid

Provides access to:

- Large range of software and tools (academic or industrial);
- Wide range of architectures;
- Computational resources.

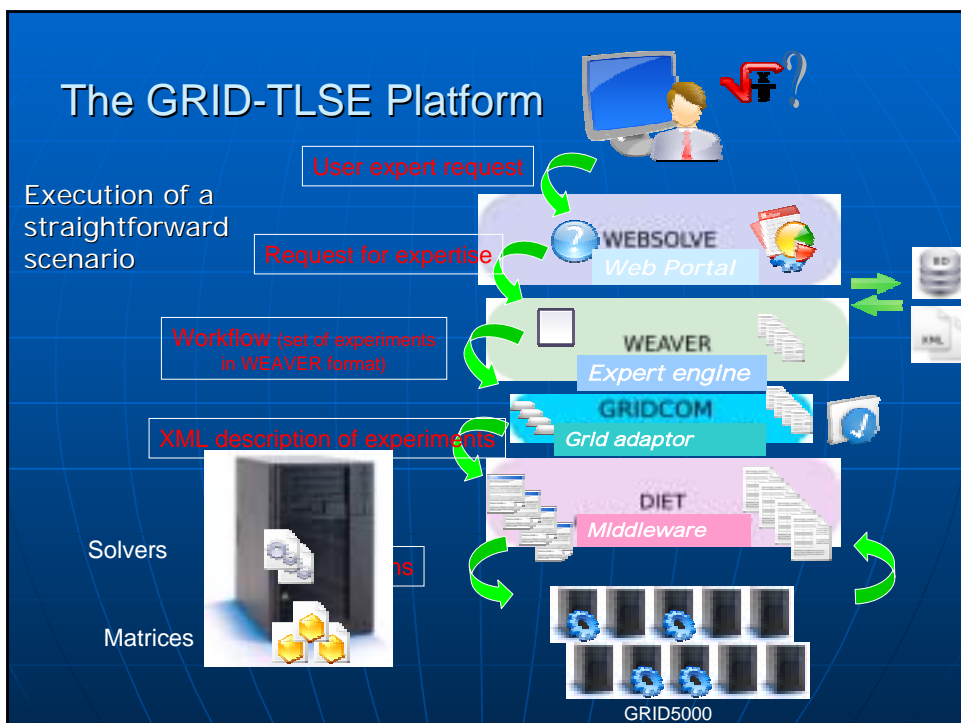


Examples of user request

- Memory required to factor a given matrix.
- Error analysis as a function of the threshold pivoting value
- Minimum time on a given computer to factor a given unsymmetric matrix
- Which ordering heuristic is the best one for solving a given problem?

Two types of users:

- Standards users that want to proceed to some tests over their matrices
- Experts that deploy tools and specify what is the expert procedure



Key ideas in describing expert procedures

- We do not want asking an expert in sparse linear algebra to deploy services over the grid at the usual level i.e. describing interfaces, GridRPC calls, . .
- We have then introduced:
 - A high level - graphical - description of the expert process that we call scenarios
 - A semantic based description of software, control parameters and matrices based on meta-data



Main Software Issues

- The same interface provides the users with access to
 - several expertise scenarios;
 - several solvers and their parameters (using middleware to access the GRID).
- Experts provide scenarios which
 - reduce the combinatorial nature;
 - produce useful synthetic comparison.
- It should be easy to
 - add new solvers which can be used by old scenarios;
 - add new scenarios which use old solvers;
 - use the characteristics of new solvers in new scenarios.



Semantic-based description

- Meta-data which describe for each package:
 - To describe a service:
 - functionalities: assembled/elemental entries, type of factorisations (LU, LDL^T , QR), multiprocessor, multiple RHS;
 - algorithmic properties: unsymmetric/symmetric solver, multifrontal, left/right looking, pivoting strategy.
 - To describe a scenario in addition to service parameters:
 - metrics: memory, numerical precision, time, ...
 - control: type of graph for post-processing, user level
- Addition of new meta-data and possible values should be easy



PRUNE : Web interface for editing abstract parameters



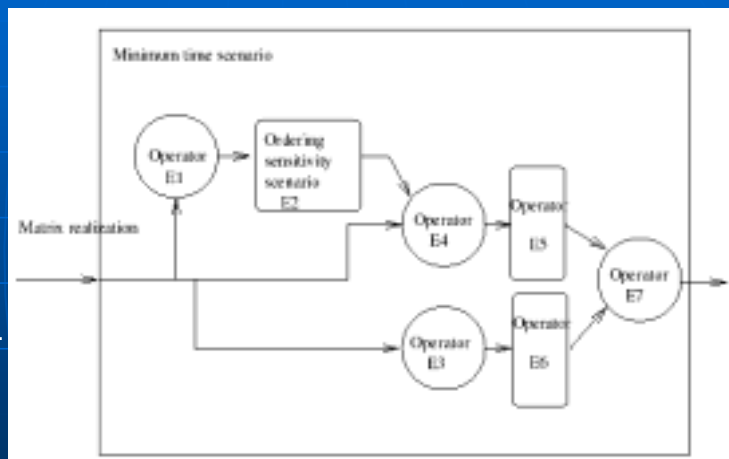
Expert Scenarios

- Scenarios described in a data-flow like way
- Structured hierarchically: a scenario may call existing ones
- Analysis / execution of a scenario may have several steps
- We have introduced:
 - Characteristics (e.g. number of flops, memory, . . .)
 - Operators: Transformation, Filtering, Generation
 - . . .



Graphical Description of Scenarios

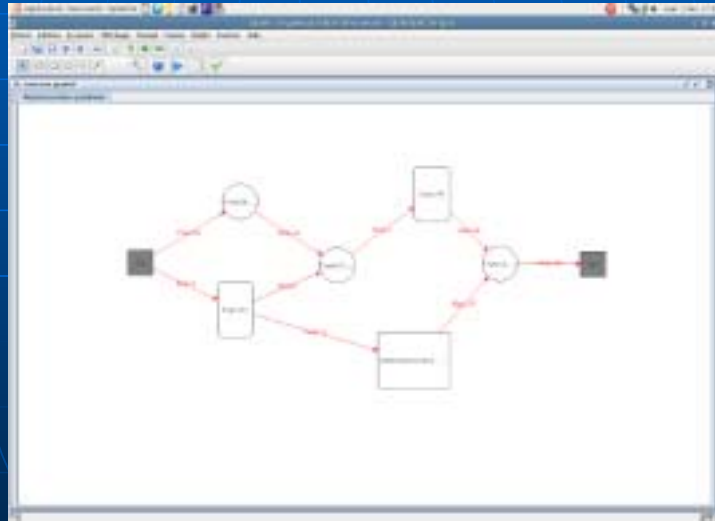
Figure:
Example of
description of
an expert
scenario
corresponding
to the
Minimum
Time Scenario.



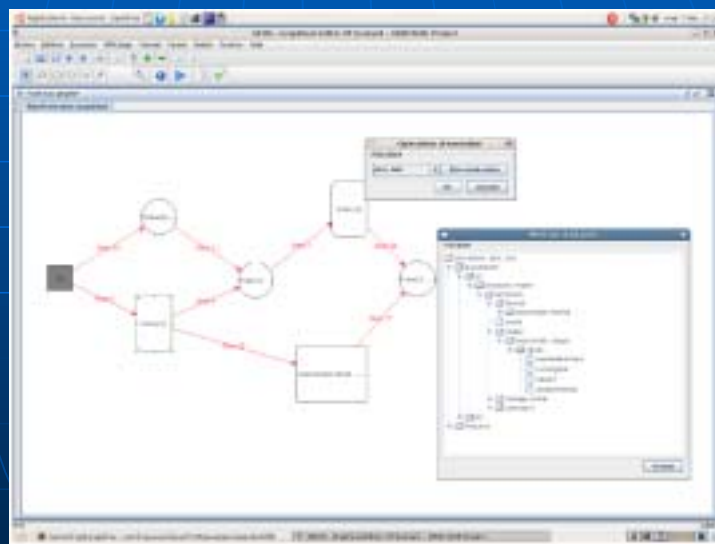
Goal: identify the combination of ordering and factorization that provides the minimal execution time.



Graphical Interface for Describing ExpertiseScenarios (GEOS)




Relationship between GEOS and PRUNE




Bibliography tool

- Advanced tools for managing bibliography (bibtex, html, ...)
- Allowing:
 - Commit of references
 - Management of bibtex and indexes
 - Checking for duplicated references
 -



The screenshot displays the user interface of the BIB tool. At the top, the title "BIB TEST FOR LARGE SYSTEMS OF EQUATIONS" is visible. Below the title, the page is titled "BROWSE BIBTEX" and shows a "List of bibtex (public)". A table lists the available bibtex files:

View	Action	Download	Name	Author	Description	No of entries
Publication	Bibtex-Zeal		carlos.bib			661

Below the table, there is a link "Back to main page". On the left side, a sidebar menu contains options such as "Menu", "File", "Profile", "Private", "Upload", "Validation", "Entry", "Macro", "Search", "Tools", and "Back to CIBO-TLSE".

BIB TEST FOR LARGE SYSTEMS OF EQUATIONS

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- A. -Dave and L.-S. -Duff Sparse Matrix Calculations on the (CRAY) 2 [1987](#) [BibTeX](#) [Detail](#)
- J. -J. -Dongarra and J. -[Du Croc] and L.-S. -Duff and S. -Hammerling A proposal for a set of (J)level 5 (J)etic (J)linear (A)gebra (S)ubprograms. [1987](#) [BibTeX](#) [Detail](#)
- L.-S. -Duff and G. -Newk On sparse solves in a stiff integrator of extrapolation type [1987](#) [BibTeX](#) [Detail](#)
- P. -R. -Amesbury and L.-S. -Duff Vectorization of a multiprocessor multifrontal code [1988](#) [BibTeX](#) [Detail](#)
- P. -R. -Amesbury and R. -A. -Tilak Solving the compressible (Q)uasi (S)tation equations with finite elements using a multifrontal method [1988](#) [BibTeX](#) [Detail](#)
- R. -Bul Use of stochastic models for the study of distributed systems [1988](#) [BibTeX](#) [Detail](#)
- R. -J. -Bayliss and L.-S. -Duff Use of (J)level 3 (BLAS) in (L) factorization on the (CRAY) 2, the (T)TA 10 (P), and the (IBM) (3090) (M) [1988](#) [BibTeX](#) [Detail](#)
- L.-S. -Duff and A. -W. -Ersson and C. -W. -Gear and J. -K. -Ried Sparsity structure and (Gaussian) elimination [1988](#) [BibTeX](#) [Detail](#)
- L.-S. -Duff Parallelism in sparse matrices [1988](#) [BibTeX](#) [Detail](#)

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> BROWSE FIELD

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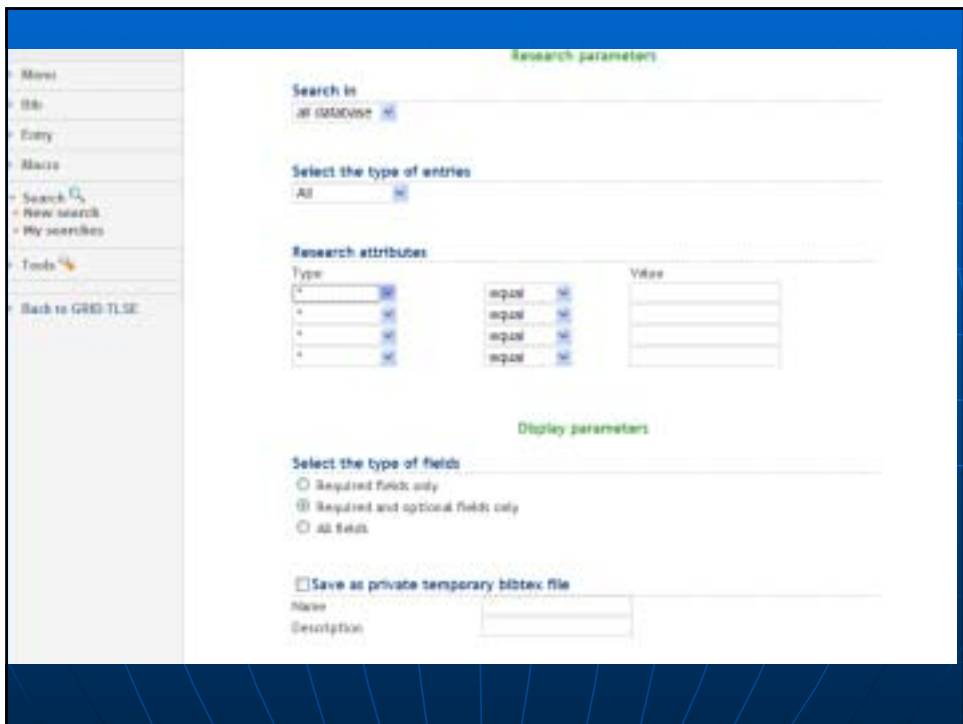
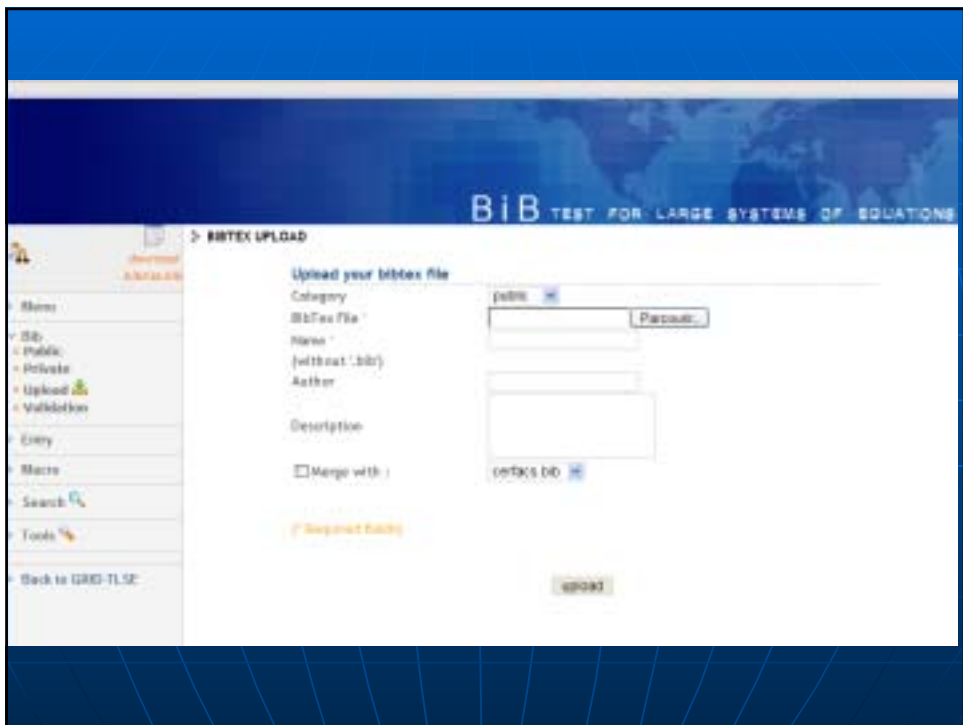
Main characteristics

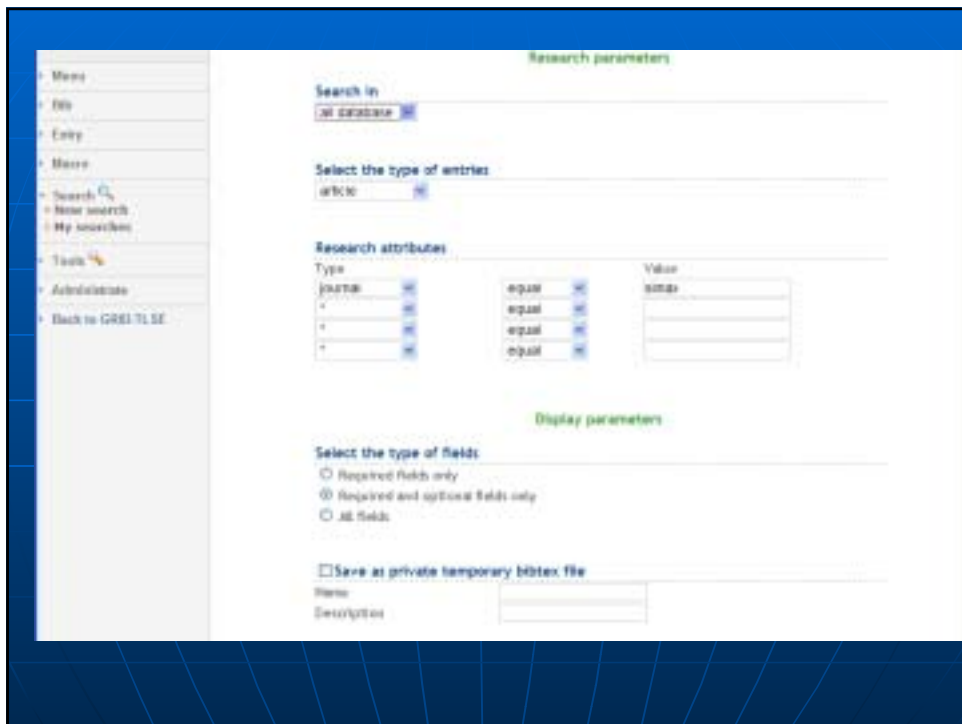
Title Key	Type
data:12/1987	article

List of fields

Type	Value
Required	
year	1987
title	Sparse Matrix Calculations on the (CRAY)-2
journal	Parallel Computing
author	A. -Dave and L.-S. -Duff
Optional	
volume	5
pages	55-64
note	textnote
Item	
level	textlevel
filesource	file://sanitec.lu/ty/beebn/box/bib/ov.bib

Back





Status of the TLSE Platform

- Final version is currently be assembled and tested
- Parts of the Web site are available:
 - Upload for matrices including validation
 - Bibliography tool



- 
- Logged as: the
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- [DSI-TLSF](#)

> MATRIX UPLOAD

Fill The Fields To Submit Your Matrix

(*) Required for public matrices

Select File

Matrix Name

* Source

Name of the person(s) who have generated the matrix

Select the groups where you want to add this matrix

Collection

Format

Type Of Values

Symmetry

Storage Mode

* Description

Technical Description Of The Problem

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> MATRIX COMMENTS

Main Characteristics


Matrix Name

Add A Comment To gr_30_30_21

Post:

Comment:

Comments (1)

 Posted By the [2007-04-12 @ 03:20:11 PM]

Warning message:
 a dimension across a
 part of page will be ignored by the solver
 -matrix is not supplied by the user out of range
 -structural deficiency

> SEARCH A MATRIX



Logged as | the

Sign out

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Expertise

Groups

Resources

Public matrices | By groups | By collections
 By application fields | By keywords | Advanced search

Query

Type of values: Symmetry: Definiteness:

Format: Storage mode:

more than but less than Rows.
 more than but less than Columns.
 more than but less than Entries.

> CREATE EXPERTISE



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Matrices

Expertise

Credits

List

Search

Statistics

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Resources

Tools

SELECTED ITEMS

Chosen Scenario:

Chosen Computer:

Chosen Matrices:

Chosen Solvers:

Chosen Metrics:

Expertise filled:

TEST FOR LARGE SYSTEMS OF EQUATIONS

ADMINISTRATION CONTROL PANEL

User management

- > Manage the users
- > Manage the groups
- > Connection statistics

Matrix management

- > Manage the matrices
- > Manage the matrix decontamination
- > Manage the matrix keywords
- > Manage the matrix application fields
- > Manage the matrix collection

Expertise management

- > Manage the expertise
- > Manage the scenarios
- > Manage the metrics
- > Manage the graphics

statistics

Resource Popularity

- MATRIX
- SOLVER
- METRIC
- COMPUTER

Resource Counts

- User: 3
- Group: 7
- Computer: 1
- Solver: 0
- Metric: 0
- Objective: 0
- Matrix: 12
- Expertise: 0
- Ranking: 0

Today Counts

- Currently Connected:
- Today Connection: 0
- New Users: 0
- New Matrices: 0

Logged as: itur
ip: not

Menu
Welcome
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085-11.52

Sparse solvers

- Solver packages installations:
 - Currently in TLSE: MUMPS, SuperLU, UMFPack;
 - Being integrated: TAUCS;
 - Future: HSL MAxx, PaStiX, SPOOLES, OBLIO, PARDISO, . . .

Conclusion

- Key points: high level description of scientific software and use of scenarios for generating dynamic workflows
- Practical consequences:
 - Adding / removing solvers does not require to update scenarios (it will be automatically discovered)
 - Introduction of new scenarios make use of deployed software
 - The approach described is intended to be generic: we explore the use of this approach in other areas



REDIMPS Project

- TLSE can be used as a prediction system for sparse solvers -> increased efficiency in solving problems in physics and engineering
- JAEA is promoting grid research (ITBL) and developing sparse solvers
- All partners (JAEA, CERFACS, IRIT, LIP, LaBRI) are / will be involved in validation and testing of the first release of TLSE
- Goal: promotion of an international expert system for sparse linear algebra