How integrate GreenComputing Concepts in **Grid-TLSE**?

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http://gridtlse.org

OUTLINE

- Overview of the project
- Platform Specifications
- GRID-TLSE and GreenComputing

Overview of the project

The GRID-TLSE project has been initially funded by the French Ministery through ACI "Globalisation des Ressources Informatiques et des Données".
It has started in 2003.

Currently, it is supported by the ANR (Agence National de la Recherche) through:

- the **COOP** project (ANR-09-COSI-001) funded by the French ANR COSINUS program.
- The **FP3C** project (ANR-JTIC 2010-2013)

Previously, the GRID-TLSE project was part of other projects:

- the **SOLSTICE** project (ANR-06-CIS6-010).
- the ANR **LEGO** project 2005-2009 (ANR-CICG05-11).
- the **ReDIMSoPS** project through the CNRS/JST (Japan) cooperation.

Financé par ANR — Action Concertée Incitative [ACI] Globalisation des Ressources Informatiques et des Données [GRID]

Goal of GRID-TLSE site

TEST FOR LARGE SYSTEMS OF EQUATIONS

TEST:

- It provides a test environment for **expert** and **non-expert** users of sparse linear algebra software
- It helps non-expert users in choosing the right solvers and its parameters for a given problem

LARGE SYSTEMS OF EQUATIONS:

- It gives facilities to share matrices

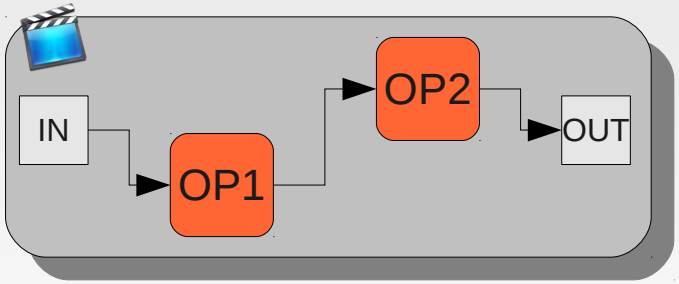
Test on sparse matrices

The GRID-TLSE web site allows an environmental testing

Examples of experiments:

- 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?

Each question corresponds to a «**scenario**»



GRID-TLSE

Why using the 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;
  - Available libraries.
- Determining the best combination of parameter values is a multi-parametric problem.

=> **W**ell-suited for execution over a Grid

GRID-TLSE

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.

Sharing test problems

The GRID-TLSE web site provides facilities to:

- Access to collections of public matrices
- Upload matrices
- Create private groups to share matrices

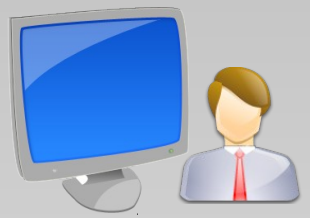
Users

Two types of users

- Non-expert users that want to proceed to some tests over their problems (**matrices**)
- Expert users that deploy tools (**solvers**) and specify **scenarios**

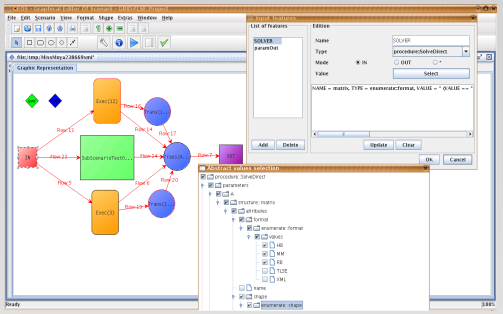
Platform Specifications

Expert Users



Expert User

Prune: Solver Descriptor



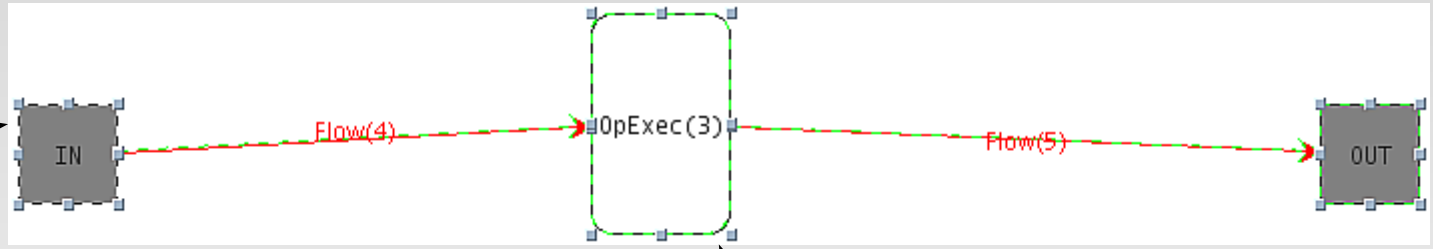
Geos: Scenario Editor

GRID-TLSE Data Base

An example of scenario

Comparison of direct solvers with their default parameters

Geos: scenario editor

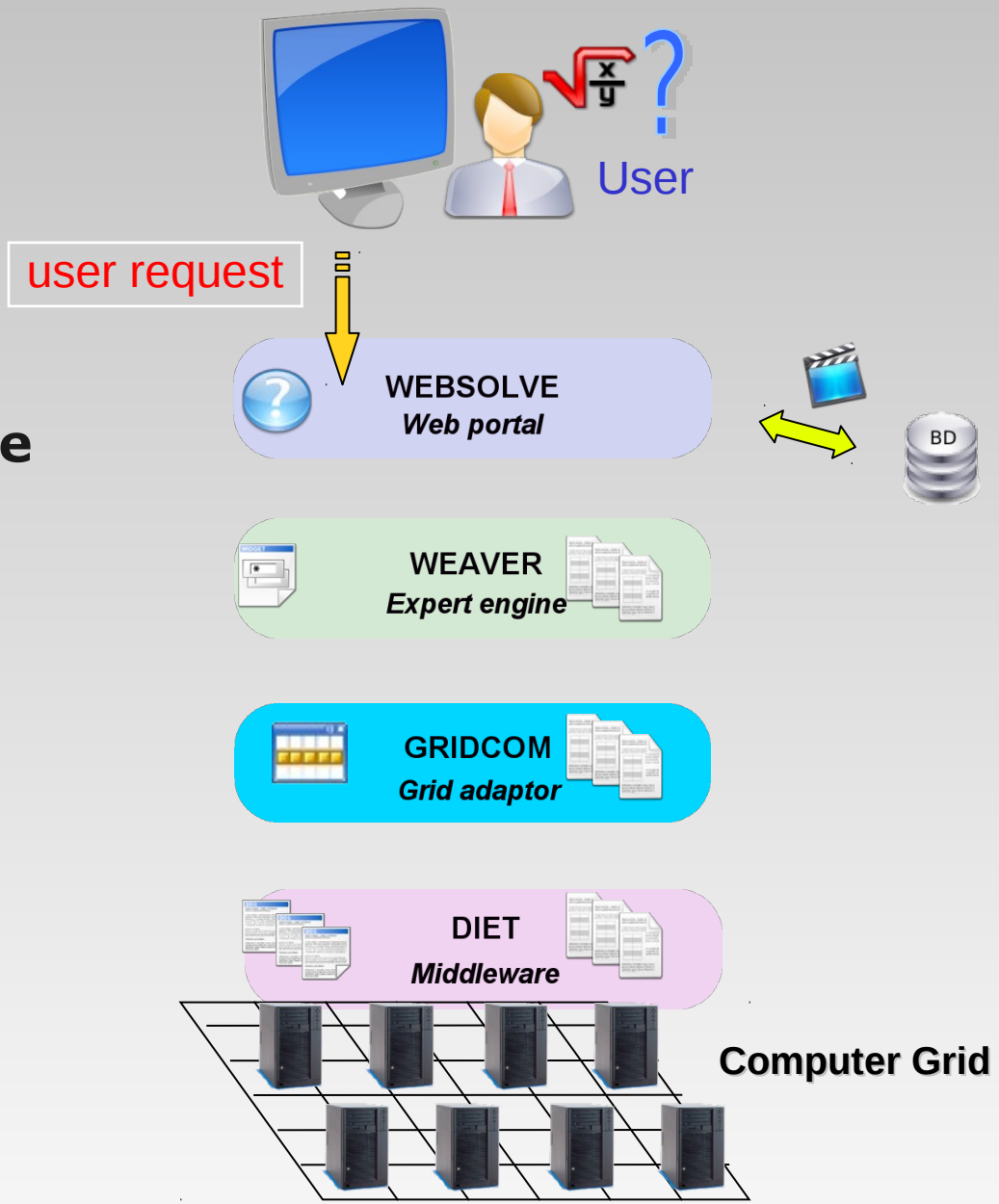


A : symmetric real

Direct solver

Non-expert Users

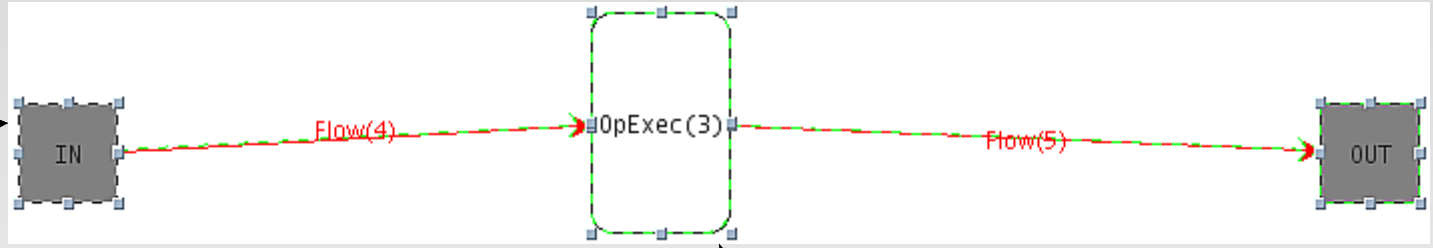
- Connects to WebSolve
- Uploads its matrices
- Chooses a scenario and Construct an **Expertise**
- Fills the expertise inputs (In our example:
  - Computers
  - Matrices)



SCENARIO: RUN_SOLVE_DIRECT

soft1
soft2
soft3

Parameters and constraint description



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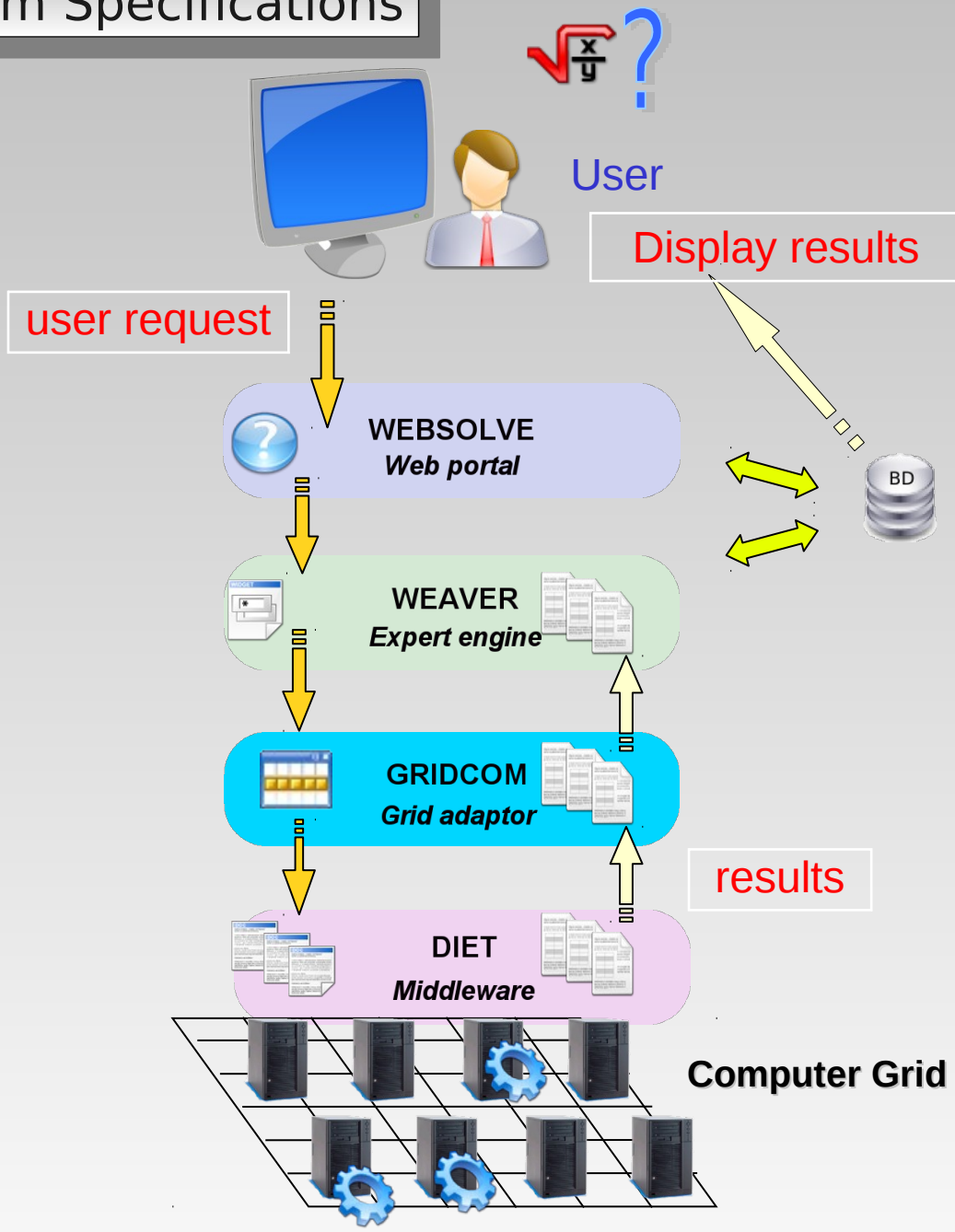
Direct solver

Non-expert Users

- Connects to WebSolve
- Uploads its matrices
- Chooses a scenario and Construct an Expertise
- Fills the expertise inputs (In our example:
  - Computers
  - Matrices)
- **Run the Expertise**



Results

Results Get the CSV file

Parameters		
name	**value**	
Experiment number	***1***	***2***
Computer	tolosa.enseeiht.fr	tolosa.enseeiht.fr
Matrix	barre11_2	barre11_2
Solver	PASTIX	PASTIX
Solver version	v1789	v2995
Control parameters		

Metrics

name	value	
Analysis_Time_CPU	0.119669	0.044028
Analysis_Time_Elapsed	0.12	0.05
Factorisation_Flops_Total_Actual	9.87143e+07	9.87143e+07
Factorisation_Time_CPU	0.238783	0.126742
Factorisation_Time_Elapsed	0.23	0.12
Factors_Memory_Total_Actual	*na*	0
Factors_NbEntries_Actual	0	369793
Flops/Second	4.13406e+08	7.7886e+08
Iter_Ref_NbSteps	8	250
Solve_Time_CPU	0.114011	2.48909
Solve_Time_Elapsed	0.11	2.49
Total_Time_CPU	0.472463	2.65986
Total_Time_Elapsed	0.46	2.66

GRID-TLSE and GreenComputing

- GRID-TLSE used as a testbench platform for Green Applications
  - the abstract parameters and scenario paradigm could be extended to other applications
  - the platform is designed
    - to described new applications (not only linear solvers)
    - to launch easily a large amount of expertises:
      each expertise runs the application with a given set of values for parameters in input
    - to access to resources (via DIET middleware)

GRID-TLSE and GreenComputing

- GRID-TLSE could take advantages of « Green information » when executing its expertises
  - if the user is not interested by a specific computer, choose a computer (or a cluster)
    - that consumes less energy
    - for which little energy is necessary to transfer data to it
    - …
  - possibility to use solvers that take account energy
  - It is a problem close to the one studied in the project COOP: adapt the scenario to the available resources

- **C**OOP ANR (2009-2012):
  - **P**artners: GRAAL (Lyon), MYRIADS (Rennes), RUNTIME (Bordeaux), IRIT (Toulouse), EDF R&D (Paris)
  - **S**tudied issues:
    - How an application can select resource with respect to its needs?
      - At launch time?
      - At run time?
    - How a resource manager can keep control on resources?
    - How to handle network topology information?

GRID-TLSE and GreenComputing

Grid-TLSE – DIET Interactions