

# Toward an International Sparse Linear Algebra Expert System by Interconnecting the ITBL Computational Grid with the Grid-TLSE Platform

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## 1 Introduction

The Japan Atomic Energy Agency (JAEA) Center for Computation Science and e-Systems (CCSE) and the TLSE partners (CERFACS, IRIT, LaBRI, and LIP-ENS) have launched an international collaboration, within the framework of the REDIMPS Project (Research and Development of International Matrix Prediction System Project). In this collaboration, an international expert system for sparse linear algebra will be constructed using an international GRID computing environment.

The TLSE Project[1,3,4] is an expert web site that aims at providing tools and software for sparse matrices. It allows the comparative analysis of a number of direct solvers (free or commercially distributed) on user-submitted problems, as well as on matrices from collections available on the site. The site provides user assistance in choosing the right solver for its problems and appropriate values for the control parameters of the selected solver. It also includes a bibliography on sparse matrices and access to collections of sparse matrices.

The computations are carried over a computational grid managed by the DIET Grid middleware[2]. DIET is developed by GRAAL INRIA Project at LIP / ÉNS Lyon, and it is a Grid RPC middleware designed to make the computers transparent from the users. On the other hand, JAEA had developed middleware of "IT based laboratory (ITBL)" **any reference there ?? even in Japanese ?**. The ITBL middleware is deployed and exploited until (Noriyuki I think it is very useful that you say how long ITBL is used), it has security network and there is a great variety of computers available in the ITBL Grid.

The time to solution of linear equation solver strongly depends on the type of problem, the selected algorithm, its implementation and the target computer architecture. Thus we believe, extending the variety of computer architecture by GRID middleware

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interoperability between DIET and ITBL has a beneficial impact to the expert system. In the present work, a prototype of interoperable system of ITBL-DIET is described.

## 2 Architecture of GRID middlewares

In this section, we give a brief overview of the two GRID middlewares, ITBL and DIET.

### 2.1 The ITBL middleware

ITBL is developed by JAEA to provide the secure and easy access to the supercomputers from the user terminal through the Internet. In figure 1 the architecture of ITBL is illustrated. In ITBL, supercomputers are isolated from the Internet by a firewall for security reasons. Therefore, computers that are set outside of ITBL are not allowed to access the supercomputers directly. This aspect is the main issue to achieve interoperability with ITBL. Users access to the computers by relaying several servers which are the gateways of ITBL network.

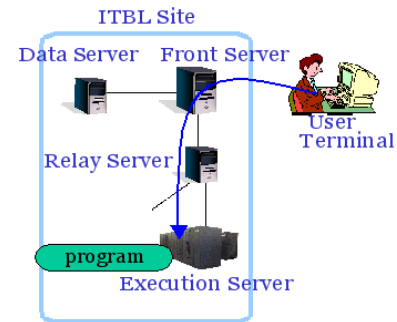


Fig. 1. Architecture of ITBL

### 2.2 The DIET middleware

The Distributed Interactive Engineering Toolbox (DIET) is developed by the GRAAL Team. The DIET project aims at developing a scalable middleware. Scheduling is distributed over a hierarchy of agents (Master and Local Agents). DIET consists of a set of elements that can be used together to build applications using the GridRPC paradigm. This middleware is able to find an appropriate server according to the information given in the client's request (e.g. problem to be solved, size of the data involved), the performance of the target platform (e.g. server load, available memory, communication performance) and the local availability of data stored during previous computations. The scheduler is distributed using several collaborating hierarchies connected either statically or dynamically (in a peer-to-peer fashion). Data management is provided to allow persistent data to stay within the system for future re-use. This feature avoids unnecessary communication when dependencies exist between different requests.

## 3 Interoperable system

In Figure 2, a conceptual architecture of interoperable system is shown. In figure 2, Master Agents (MA) and Local Agents (LA) are the components of DIET that are used for job scheduling. The DIET Server Daemon (SeD) is the user program compiled with the DIET components. In the present interoperable system, we developed a special SeD that behaves like ITBL client. This special SeD was implemented to transfer the job request from DIET to ITBL computers.

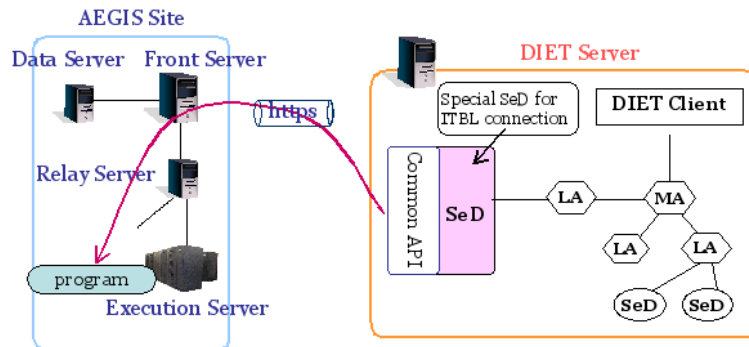


Fig. 2. Illustration of interoperable

## 4 Conclusion

The goal of the japanese-french REDIMPS Project we have introduced in this paper, is to promote the TLSE platform as a widely used international expert system for sparse linear algebra.

We have described a first step of the REDIMPS Project that consists into achieving interoperability between the DIET and the ITBL middlewares. This allows to extend the TLSE platform by incorporating the computers and the solvers available within the ITBL computational Grid. The DIET-ITBL interoperable system transfers the jobs from DIET to ITBL and allows to recover back the results.

Some parts of the TLSE platform are currently available at <http://gridtlse.org>. We are currently deploying sparse solvers within the platform.

By the time of the VECPAR conference, the TLSE platform will include several sparse solvers and will have all its features available. It will be interconnected with ITBL.

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