We would like to invite you to make a place in your schedule for a competitive challenge focused on Permutation Flowshop Scheduling – you have the chance of being one of the participants in the programming contest organized by ERCIM, ETSI and INRIA in Beijing, China on the 28th October - 2nd November 2007. The event will take place at CNIC, Beijing - http://www.etsi.org/plugtests/grid/GRID.htm. The goal of this contest is focused on solving well known benchmarks problems.

Get involved in a great challenge by deploying during the event a permutation flowshop scheduling problem, in a given time slot, on a live worldwide GRID of interconnected processors. More than 4000 processors were made available for the last year contest. The participation to the challenge as well as to all the preliminary and remote qualification tests are free of charge. The face-to-face competition will take place from the 30th October till the 1st November, 2007.

Event supported by ERCIM (http://www.ercim.org), ETSI (http://www.etsi.org), INRIA (http://www.inria.fr) and the European EchoGrid project, having as main sponsors LIAMA and HUAWEI.

Flowshop contest contact addresses: El-Ghazali Talbi (El-Ghazali.Talbi@lifl.fr), Alexandru-Adrian Tantar (Alexadru-Adrian.Tantar@inria.fr), Cc: plugtests@etsi.org.
The Permutation Flowshop Scheduling Problem

A review of various scheduling problems currently researched in the literature was proposed by Lee [LLP97] and Pinedo [Pin95]. The permutation flowshop represents a particular case of the flowshop scheduling problem, having as goal the construction of an optimal schedule for executing \( n \) jobs on \( m \) machines.

Solving a flowshop problem consists in scheduling the \( n \) jobs \((i = 1...n)\) on a set of \( m \) machines \((j = 1...m)\). A job consists of \( m \) operations, each operation having a known processing time \( p_{ij} \). For each job, the \( j^{th} \) operation is processed on the \( j \) machine (the first operation of each job is processed only by the first machine, the second operation on the second machine and so forth). Furthermore, one job can start on the \( j \) machine if its \( j-1 \) operation is already completed on the \( j-1 \) machine and if the \( j \) machine is free. No job can be simultaneously processed on two machines and no machine can simultaneously process more than one job. In addition, no job can be interrupted during processing – any given operation has to be processed completely before moving to another job.

The permutation flowshop has been chosen as test problem for the challenge, considering as objective function the overall required time for all the jobs to be processed – \( C_{\text{max}} \) (the makespan). The goal is to obtain a permutation of jobs which offers the minimum makespan value, as fast as possible, all in terms of competition between the participants.

How to participate?

From Tuesday 30\textsuperscript{th} October till Thursday 1\textsuperscript{st} November 2007 in Beijing, China, Grid Users will try to beat in real time other participants, generating the best possible solution for a proposed flowshop benchmark. A set of well known benchmark files – Taillard – may be found at the following address:

http://ina.eivd.ch/Collaborateurs/etd/problemes.dir/ordonnancement.dir/ordonnancement.html

The flowshop challenge addresses only exact methods! An exact approach method should deliver the best solution for the given test benchmark while minimizing the execution time. For the given test instances, multiple optimal solutions (permutations) may exists (having the same objective value) - only one of these permutations is required as final result. A minimal benchmark instance to be considered should start at least with 20 jobs and 20 machines (ta021 through ta030, from the Taillard’s benchmarks), a more challenging problem being given by the unresolved instances of 50 jobs and 20 machines (instances from ta051 through ta060).

The few steps that you have to follow:
- ✔ using a middleware like ProActive (http://www-sop.inria.fr/oasis/ProActive/) write a GRID program for the flowshop scheduling problem;
- ✔ register to the event and prepare beating other registered participants, in real time.

Teams willing to participate should go through the following steps:
- ✔ optional - run preliminary tests;
- ✔ pass the preliminary remote qualification phase (starting just now – July 2007);
- ✔ participate to the face-to-face challenge (30\textsuperscript{th} October - 1\textsuperscript{st} November, Beijing, China) – 3 days at the CNIC (Beijing, China) during which all competitors will:
  - execute their code on the Grid during a fixed and measured time slot to compute the best solution, as fast as possible;
  - provide their logs and source code to the jury. After the contest, all the source code produced by the competitors will be made available to all the participants as open source code.

**Important notice:** all teams will be given access to the “test room” two days before the actual start of the challenge (i.e. room 514 will be open from Sunday 28\textsuperscript{th} October 9:00am) for preparation purposes. This should give the opportunity of tuning the code in order to get it running on the Grid.
Advice - consider the challenge as a grid computing fest, not as a formal event! You may have a look on what was done during the past GRID Plugtest event in 2006 by visiting the following address:
http://www.etsi.org/WebSite/OurServices/Plugtests/2006GRID.aspx

FREE REGISTRATION TO PRELIMINARY TESTS

This is informal and optional, being offered to maximize your chance to participate in the realtime face-to-face challenge. To participate to these preliminary tests and to declare your interest – with no fee – please send an e-mail to El-Ghazali Talbi (El-Ghazali.Talbi@ifl.fr), Alexandru-Adrian Tantar (Alexandru-Adrian.Tantar@inria.fr), Cc: plugtests@etsi.org with the following information attached:

✔ the name of your team;
✔ the name and e-mail of each member of your team, willing to participate in the challenge;
✔ the name of the responsible person (team representative and contact person).

If you just want to play remotely, without attending the face-to-face event, and discuss the challenge before taking part, you can subscribe to the related discussion list: PLUGTESTS-GRID@LIST.ETSI.ORG. In order to subscribe, just send an e-mail to LISTSERV@LIST.ETSI.ORG with only the following in the body of the message:

SUB PLUGTESTS-GRID your_first_name, your_last_name

The subscription is free of charge and is open for anyone interested in this challenge and it will be used for the challenge follow-ups.

Face-to-face CHALLENGE: 28/30 October – 1 November 2007

Participants to the face-to-face challenge will be given access to a worldwide Grid of interconnected processors (more than 4000 last year). Their piece of code will be installed on a local platform, distributed on the grid, executed during a limited time slot of one hour, and the results will be evaluated by the jury.

After the face-to-face contest, the results of each team will be examined by a jury formed of Grid computing experts. The main evaluation criteria are the best found solution and the total execution time. Evaluation/analysis of the results as well as the announcement of the contest's outcomes are under the sole responsibility of the jury. In the unlikely case where several teams would be placed equal first, the jury may take other criteria into account: cpu walltime, number of grid nodes employed/activated, the efficiency of the algorithm, etc.

Although participation to the face-to-face flowshop contest is free of charge, the participants should have passed the preliminary remote qualification tests and should be registered¹:

The participants will:

✔ use the preparation days (28­29 October) to warm-up, in order to familiarize with the local platform and the Grid. This should offer the opportunity for tuning and adapting the code in order to make it run smoothly on the Grid;
✔ use the assigned time slot of one hour during the challenge (30 Oct – 1 Nov) to execute their in real time on the Grid. In the given time slot, the participants have to find the optimal solution of the proposed benchmark. The optimality of the found solution has to be proved (for example, for a Branch&Bound algorithm, all the branches are either explored either cut as a result of bounding, etc.);
✔ disclose the source code and the employed method to all the participants after the game.

The time slots schedule (participation order) will be announced at the beginning of the event. If a team is not ready at

¹http://www.etsi.org/plugtests/grid/GRID.htm
the time of its assigned time slot, that team will be re-scheduled after all other participants.

Note: it is planned to schedule the “official challenge” time slots during day time and to let participants access the Grid at night for training purposes. This of course depends on (1) the authorization to access the room at night and (2) the number of teams registered: a high number of teams may cause some challenge time slots to be scheduled at night as well, thus preventing other teams to access the Grid for training.

Although Java is the programming language commonly used by participants, it is perfectly acceptable to use non-Java code, provided all deployments and communications between machines and nodes use the ProActive library.