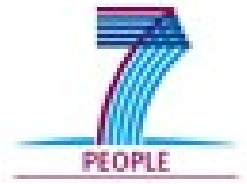

EPIKH

RESEARCH PROGRAMME

OF

<HAZEM FKAIER>

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Abstract: This document includes the functional description of the deployment of parallel and distributed algorithms solving the combinatorial optimization problems having the property of permutation using.

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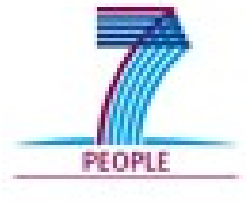

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TABLE OF CONTENTS

1. INTRODUCTION 5

1.1. PURPOSE OF THE DOCUMENT 5
1.2. DOCUMENT ORGANIZATION 5
1.3. APPLICATION AREA 5

2. RESEARCH PROGRAMME 6

3. TIME SCHEDULE AND EXPECTED OUTCOMES 7

4. REFERENCES 8

1. INTRODUCTION

1.1. PURPOSE OF THE DOCUMENT

This document deals with a large project in our laboratory UTIC, that aims at developing a framework to solve the optimization problems having the permutation property using exact and heuristic parallel algorithms. This framework can be used as an experimental platform that offers a set of tools, functions and specialized software, for both research and pedagogic aspects.

1.2. DOCUMENT ORGANIZATION

This document, is divided into four main parts, section 1, presents the structure of this document. Section two, describes the project of the deployment of parallel algorithms for the combinatorial optimization problems. Section three, presents the scheduling and the outcomes of our project. The last section contains some references used in this document.

1.3. APPLICATION AREA

This document applies to the use of a framework that offers a variety of tools, functions, algorithms and software to solve the scheduling problems having the property of permutation within the scope of the EPIKH project.

2. RESEARCH PROGRAMME

We are interested in the resolution of optimization problems with permutation property by using parallel and distributed algorithms.

A combinatorial optimization problem is to find a solution whose objective value is minimum or maximum [1]. These optimization problems contain a huge body of problems such as the salesman problem, the quadratic assignment, permutation 8ow-shop scheduling problems, vehicle routing and scheduling problems. Among these problems, permutation has been recognized as being their most common property. Essentially, a common feature of permutation problems is that if a permutation scheme is determined, its corresponding solution can be easily derived with a problem-specific procedure.

The combinatorial optimization belongs to a class of NP-hard problems [2]. Therefore, it is well known that exact methods are just suitable for some small or moderately sized NP-hard combinatorial optimization problems. For this reason, parallel computing can be a good alternative in order to resolve bigger sizes of the problem and to improve the computing time, and this is the objective of this work.

In this context, ETSI and INRIA at Sophia Antipolis France organized in 2005 the 2nd Grid PLUGTESTS Flow Shop Challenge contest [3]. The goal of this contest is focused on solving the well known benchmarks problems of Taillard [4]. Indeed, in 2007, a challenge was launched in order to solve some of the instances of combinatorial optimization problem, for instance the PFSP, and a call for competition has been announced in the web [5] in order to attract researchers and to encourage the resolution of these problems.

For this project, first, we implemented a parallel-distributed algorithm for solving the permutation flow shop problem on a cluster of computers. The experimental results are encouraging, which led us to think about deploying this algorithm on a grid of computers, in order to experiment it on data instances of large size. The use of grid computers can be useful first, to improve the running times of some instances which have a sequential run time about several days, second, to solve some instances of data not yet solved in the literature.

3. TIME SCHEDULE AND EXPECTED OUTCOMES

3.1. Time schedule

15/07-22/07:

- Learn the principles of all sorts of grid services
- Setup a grid testbed, learn how to administrate grid services
- Learn how to port an application

23/07-30/07:

- Porting our application to grid platform

01/07-07/08 :

- Making experimentations and taking measurements

07/08-14/08:

- Writing a paper about new approach and presenting the experimental results

3.2. Expected outcomes

- Enlarge and deepen my knowledge of Grid technology and applications.
- A specialized understanding of the principles of grid technologies and applications.
- Proficiency in the principles of grid technologies and applications.
- Writing a new paper presenting experiments carried out over a grid test-bed.

4. REFERENCES

[1] Nemhauser GL, Wolsey LA. Integer and combinatorial optimization. New York: Wiley; 1988.

[2] J. K. Lenstra, AHG. Rinnooy Kan and P. Bruker, “Complexity of machine scheduling problems,” Annals of Discrete Mathematics, vol. , pp. 1-343, 1977.

[3] www-sop.inria.fr/oasis/plugtest2005/2ndGridPlugtestsReport/

[4] E.Taillard, “Benchmarks for basic scheduling problems,” European Journal of Operational Research, vol. 64, pp. 278-285, 1993.

[5] www2.lifl.fr/~talbi/challenge2007/.