

Teaching Parallel Processing: Development of Curriculum and Software Tools

Jan Kwiatkowski, Marek Andruszkiewicz

Technical University of Wroclaw, Computer Science Department, Poland

E-mails: kwiatkowski@ci-1.ci.pwr.wroc.pl, andruszkiewicz@ci-1.ci.pwr.wroc.pl

Emilio Luque, Tomas Margalef

Universitat Autònoma de Barcelona, Computer Science Department, Spain

E-mail: iinf@cc.uab.es

Jose Cunha, Joao Lourenco

Universidade Nova de Lisboa, Departamento de Informatica, Portugal

Emails: jcc@fct.unl.pt, jml@fct.unl.pt

Henryk Krawczyk, Stanislaw Szejko

Technical University of Gdansk Electronics Faculty, Poland

E-mails: hkrawk@pg.gda.pl, stasz@pg.gda.pl

Abstract

This paper presents an approach to education in Parallel and Distributed Processing undertaken in the Technical University of Gdansk and Technical University of Wroclaw. The paper gives a detailed structure of the project entitled "Teaching Parallel Processing: Development of Curriculum and Software Tools" which was started in 1994 and will be finish in 1997. Two universities from Poland: Technical University of Gdansk and Technical University of Wroclaw and two universities from EC countries: University Autònoma of Barcelona from Spain and University Nova of Lisbon from Portugal participate in the presented project. The main aim of the project is to develop existing curricula of Computer Science specialisation and to establish specialisation concerned with parallel and distributed processing at Polish universities.

overall programmes of the economic and social restructuring of the countries of Central and Eastern Europe. The main goals of Tempus-Phare are: to promote the quality and support the development and renewal of higher education in the partner Phare countries and to encourage their growing interaction and as balanced a cooperation as possible with partners in the European Union, through joint activities and relevant mobility. The paper gives a detailed structure of the project entitled "Teaching Parallel Processing: Development of Curriculum and Software Tools" which was started in 1994 and will be finish in 1997. Two universities from Poland: Technical University of Gdansk and Technical University of Wroclaw and two universities from EC countries: University Autònoma of Barcelona from Spain and University Nova of Lisbon from Portugal participate in the presented project.

1. Introduction.

This paper presents an approach to education in Parallel and Distributed Processing undertaken in the Technical University of Gdansk and Technical University of Wroclaw. The project is supported by Tempus (Trans-European cooperation scheme for higher education) which was adopted by the Council of Ministers of the European Union. Tempus forms part of the

The main aim of the project is to develop existing curricula of Computer Science specialisation and to establish specialisation concerned with parallel and distributed processing at Polish universities. With this intention in mind the whole project was divided into five activities. The more important ones are: curriculum development, retraining of academic staff and creation of new laboratories. The cooperation between concerned universities will permit exchange of knowledge and news connected with this field of Computer Science. The carrying out of this project will allow Polish Universities to be on the same level as modern European ones. The students will be able to take advantage of

contact with information technology and in this way we will be able to prepare future university staff.

2. Project Objective

In the last few years we have observed the "Computer revolution" in Poland. The National Academic Computer Network, which connects the main academic centres in Poland, was established. The first commercial networks have been designed and built. Software and hardware equipment has been changed, the first supercomputers have been installed. Therefore new highly qualified specialists in Computer Science are needed, especially in the area of computer networks and parallel and distributed processing.

At both Polish universities which participate in the project computer science specialisations exist. Existing curricula includes some courses connected with parallel processing such as "Parallel programming", "New computer architectures". However, there exists a need for new specialisation concerned with different computer applications. Therefore, the participation of both Polish universities in the project will give them the possibility of using the experience of computer science researchers from EC countries during the creation of new parallel processing specialisations. To this end we need the new hardware equipment which can be used during laboratory courses. Modern software and laboratory tools are also needed. During the first year of project realisation we noticed a growing interest for parallel computing among the students and staff who took part in the project. This will increase since both Polish Universities are going to run supercomputer system this November. This will help us to prepare more experienced staff for the project.

3. Project Activities

While carrying out our project we are distinguishing five types of activity: curriculum development, retraining of academic staff, creation of education laboratories, student mobility and intensive courses. Curriculum development is the principal activity of the whole project and it is the base for other distinct activities. At the moment the system of education at Polish universities is similar to that which exists in EC countries. In the existing curricula there are both obligatory and voluntary courses. The first provides basic knowledge in a given area and the second is related to specialisation. At both Polish Universities there exists computer technology specialisation which is used in the project. The curriculum of new specialisation is made up of eight courses which are taught over five semesters. All Universities participating in the project accepted the following set of courses which allows the possibility of parallel programming on different levels such as: transputers programming, parallel programming which utilises possibilities provided by computer networks, parallel programming in multiprocessor environment and others.

- Introduction to Parallel Processing
- Parallel Algorithms
- Parallel Architectures
- Parallel Languages and Programming
- Parallel Software Design
- Distributing Processing
- System Software and Tools for Parallel Processing

Parallel Applications

For preparation of each course two universities are responsible; one from an EC country and one from Poland. These courses are currently being prepared. In terms requirements for each course preparation we would need: the content of the lecture, bibliography, transparencies for the lecture and a detailed description of exercises (classes or laboratories).

As a further starting-point we assumed that the individual course implementation, depending on, the University could be different in terms of the number of teaching hours per week (three or four hours per week for 15 weeks). This has as its end the creation of a syllabus made up of two parts: one basic and the second additional.

The second type of activity is the retraining of academic staff. This activity begins during the second year of the project realisation. During the first year the most important decisions concerned with the hardware and software requirements would be taken. The first stage of the new curricula has been completed and some hardware equipment has been installed. The preparation of the tools needed for the laboratory courses has begun. At this point, it is necessary to start the staff retraining in order to train the academic staff that will be in charge of the teaching the new subjects included in the curriculum.

Owing to the new subjects that may be included in the existing curricula and preparation of the new curricula for the parallel processing specialisation, additional laboratory equipment and some new teaching material have to be prepared. In particular the laboratory for parallel processing has to be built and instruction for laboratory courses from parallel processing has to be prepared. Based on the description of the curriculum development activity our hardware and software needs for the whole project realisation include the obtaining of laboratory equipment for each Polish university participating in the project. All of this equipment should be connected via the local area network. The new laboratories would give us the possibility to utilise parallelism at different levels such as: transputer level using OCCAM programming language, computer network level and multiprocessor programming level.

Two types of student mobilities are proposed in the project: study periods and student participation in short intensive courses which take place in Spain. This activity started during the first year of the project (short intensive courses). During these courses the ideas developed in the curriculum are applied. Staff from Spain, Portugal and Poland act as lecturers. The second type of student activity (study period) starts in the second year when the first part of the curricula would have finished. Postgraduate students only from Poland are sent to Spain and Portugal for five months study period to participate in the parallel and distributing processing courses and to develop some individual projects.

4. Project Management

The project coordinator is Dr Jan Kwiatkowski from the Computer Centre Technical University of Wroclaw and Prof. Tomas Morgalef from University Autonomia de Barcelona acts as a project contractor. These persons are responsible for the financial

and administrative parts of the project particularly during student exchange.

The way in which decisions connected with all aspects of project realisation are taken is very clear. All decisions were made during short meetings in which at least one person from each University participated. During these meetings we were discussed the way in which the final aim of our project could be achieved. Furthermore, we solved all current problems to do with the E-mail service, fax and telephone. The project will be monitored by the project staff (coordinator, contractor and contact persons) at the short meetings.

5. Conclusions

The project is really needed from several points of view. For Poland the important thing is to work in contact with the new information technologies. After completion of the project, highly educated postgraduate staff will start the work at the different Polish universities. The newly-established specialisation will educate the staff for supercomputer centres that are now being created in Poland. Insofar as the university is concerned, the level of computer science education will improve. These universities will, therefore, be more popular among students. There is now another way of developing the computer science curricula. The future belongs to high performance computer systems. The changes which Poland is undergoing mean that further changes in the education system are also needed.

As a direct result of the first year of project realisation the specialisation named "Parallel and Distributed Processing" starting from the 5-th semester was formally included in the Computer Science Curriculum of the Faculty of Electronics, Technical University of Gdansk and in the Computer Science Curriculum of the Faculty of Management and Computer Technology, Technical University of Wroclaw (as a sub-specialisation at "Software Engineering" specialisation).