High-Performance Computing and Networking

Summaries of projects and references to related projects

January 1993

Commission of the European Communities

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Information Technologies and Industries, and Telecommunications
RTD: Information Technologies

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High-Performance Computing and Networking (HPCN)

INTRODUCTION

HPCN is a crucial technology for European industrial and scientific competitiveness and for improving the quality of life. The emergence of parallel computing systems coupled with high-speed communications offers new and dramatic possibilities for the development of innovative applications, essential to meet the needs of the industrial, commercial and academic communities within Europe. HPCN thus has the potential for great and far-reaching impact on productivity, industrial competitiveness, environmental management and many other aspects of society in general.

The recently published Report of the High Perfomance Computing and Networking Advisory Committee (October 1992)[1] sets out a large and focused programme. This programme should run for at least 10 years with a mid-term review. The resources to be mobilized during this period should be made available from public and private, national and European sources, including the European Community. The programme, to be driven by user needs, will be industry-oriented and aimed at:

- establishing a European industrial and scientific lead in HPCN;
- creating domestic market conditions favourable to the development of a competitive supply industry.

Four action lines are proposed:

- application support and development;
- R&D and demonstration of key technologies;
- HPCN supporting infrastructure;
- education and training.

This directory aims to provide information on on-going R&D related to HPCN in Community R&D programmes, and as such describes the achievements which the action line "R&D and demonstration of key technologies" proposed for the new programme could build upon. Part I supplies a summary of the objectives of R&D projects which are currently underway in the domain of High Performance Computing and its Applications, and, as the case may be, progress made and results obtained in the individual projects. Part II aims at providing information on

(1) Drawn up by a committee of high-level industrial and scientific experts under the chairmanship of Professor Carlo Rubbia, Director-General of CERN.

Community R&D related to HPCN within the framework of Community R&D programmes. The list does not intend to be exhaustive, but rather assist companies and persons who are interested to know about the Community funded actions and who may have an interest in future HPCN activities.

Part I

High Performance Computing and its Applications

Summaries of Projects

2025

European Declarative System (EDS)

Keywords: relational databases, parallel architectures, Lisp, Prolog

OBJECTIVES AND APPROACH

EDS is targeted at the main business sectors of the industrial partners. These sectors need large-scale information servers supporting Relational Database (RDB) technology. EDS can be introduced into customer installations as an accelerator to give an order of magnitude improvement in the cost/performance ratio of existing applications. The support of Lisp and Prolog will give EDS the capability of extending the functionality of applications.

The project will result in the design of a large-scale distributed store parallel processing system including a RDB subsystem, Lisp and Prolog language subsystems and a Unix kernel operating system. The porting of a number of applications, representing the target market, is also included, giving a strong integration focus to the project.

By the completion of the project in 1992, it is planned to have designed and implemented a parallel processing machine system targeted towards the partners' business applications. The system will comprise:

- a distributed store multi-processor designed for up to 256 processors
- kernel software matched to the machine architecture and scale and providing basic machine control
- a Unix interface based on a bought-in system
- a parallel relational database subsystem providing an extended SQL server interface
- parallel Lisp and Prolog language subsystems.

Prototype parallel machines will be built for the industrial partners as follows: Bull, 16-node; ICL LTD, 64-node; and Siemens, 64-node.

A number of representative applications will be demonstrated on the prototypes during the final year.

PROGRESS AND RESULTS

Most of the technologies and EDS components have already been developed over the last 3 years. The final year is mainly devoted to system integration. It is expected that by the end of 1992, several fully integrated EDS prototype systems, each supporting different large commercial applications, will have been developed.

EDS is designed as a high-performance back-end information server. It can be connected to the back-ends of various mainframes from Bull, ICL and Siemens. High performance is achieved by exploiting parallelism using a "shared-nothing" computer (up to 256 processors), and by reducing data access latency using large main memory storage (up to 2 gigabytes per PE) to hold the entire database in memory at processing time.

In practice, the EDS project involves the design and implementation of a parallel hardware machine and a parallel machine executive, EMEX, to support the EDS parallel database base management system (DBMS). Moreover, a number of AI programming languages sub-systems - parallel LISP and Elipsys, parallel logic programming system - are supported in EDS. Coupling these languages with the EDS DBMS advanced information processing systems (e.g. knowledge bases) could be developed. This is demonstrated by a number of commercial applications implemented in the project.

EXPLOITATION

All the partners plan to exploit the EDS technologies, particularly those in the parallel machine and database areas. For example, ICL LTD intends to exploit the EDS parallel system to exploit existing RDMBS systems; Bull plans to use the database technology in future database products; and SNI intends to introduce new parallel hardware into its data-processing product lines.

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Start Date	Duration
04-JAN-89	*36 months*

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2288

New Architectures for Optical Processing in Industrial Applications (NAOPIA)

Keywords: optical processors, pattern recognition, vision systems

OBJECTIVES AND APPROACH

The feasibility of optical processors for object recognition in laboratory environments was successfully demonstrated in projects 534 and 1035 (COOP).

The goal of the NAOPIA project was to integrate the latest device and material developments with these new architectures in practical processors for use in industrial inspection, quality control, associative classification and signal processing. The first phase was a definition phase, where different architectures in optical processing were considered so as to fully exploit the technology developed in earlier projects in new applications.

At the end of the first year, a comparison of the possible approaches was completed with a recommendation of a practical architecture suitable for application to industrial problems in the very near future. In the second phase of the project, a demonstrator integrating this architecture in a practical industrial application is being developed. The demonstrator was completed by the end of 1991.

EXPLOITATION

Components of the system will be reused in further designs by Thomson-CSF. The demonstrator will form a basis for advanced industrial applications in user organisations in the successor project, NAOPIA II (6676).

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Start Date	Duration
01-SEP-89	*28 months*

2702

Development of a Distributed Memory MIMD System for Very High Performance Numerical Computing (GENESIS II)

Keywords: MIMD, parallel architectures, numerical architectures, supercomputers, numerical computing, high-performance computers

OBJECTIVES AND APPROACH

The GENESIS project had the ambitious aim of establishing European leadership in the field of high-performance parallel systems for numerical applications. The project was split into 3 projects, one of which was GENESIS II.

Work in GENESIS II concentrated on software environments for high-performance numerical computing on distributed memory architectures. Portable programming models and user-friendly programming environment are key issues for high performance computing and will broaden the acceptance of large parallel distributed memory systems.

In addition, the project included a small but important architectural task concerned with advanced interconnection components. In the long term, only the combination of functionalities for user requirements, user programming model, low-level system software support for communication and interconnection components will guarantee highly efficient parallel user program execution.

The main objectives of GENESIS II were to:

- develop an advanced software environment for highly parallel systems
- develop a base of commercially relevant application packages and basic libraries
- realise an implementation of a target testbed (GENESIS-P) as proposed in project 2447, GENESIS
- facilitate migration of applications from existing systems and to ensure portability of new implementations
- reflect current and emerging standards, and to participate in corresponding actions.

PROGRESS AND RESULTS

The objectives have largely been met.

Portability became a major issue of the GENESIS II project and the PARMACS (GMD/Argonne Portability Macro Library) was chosen as the central programming model of the project.

As part of the project, PARMACS were implemented on the software demonstrator based on current Meiko hardware using i860-based nodes. PARMACS are also available on the iPSC-2, iPSC/860, nCUBE-2, CRAY-YMP and SUPRENUM.

Portability was demonstrated between subsets of these machines by the GENESIS Benchmark Suite and several application programs, parallelised or ported to PARMACS during the course of this project.

A complete programming environment supports the development of PARMACS programs, including performance analysis tools, a simulator, and FLO, a tool for application software migration. Parallel numerical and communication libraries based on PARMACS improve the environment for parallel numerical applications.

A prototype of an automatic paralleliser (SUPERB) and a program generator for partial differential application solvers (// Ellpack) directly map their output onto PARMACS.

The P hardware demonstrator shows the usefulness and excellent performance of the advanced interconnection components.

A large set of software components, integrated as part of the GENESIS-P software demonstrator, is already in place, and will provide direct support for new architectures based on the advanced interconnection technology.

With respect to standardisation, an esprit special interest group was founded for open discussions, which should lead to a proposal for a standard already agreed upon by most of the European companies involved in the support of parallel computing. PARMACS is proposed as a basis for such a standard by the GENESIS project.

EXPLOITATION

Many of the results of the project are already marketed as products or will be the basis for future products. Some of the highlights are:

- The advanced interconnection technology is a processor-independent communication technology. Meiko will launch a range of parallel computers exploiting this technology in 1992. These machines will support the full software environment developed within the GENESIS project. In addition, the GENESIS software testbed itself will also serve as development platform for the GP-MIMD project.

- PALLAS and NA Software are directly committed to exploit the PARMACS programming environment and PARMACS implementations on various hardware platforms.

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- Parsytec have committed themselves to support PARMACS as their main user programming model.

- The GENESIS software environment, particularly the advanced parallelisation technology developed within GENESIS, form the starting point for the Esprit III project PPPE.

- Vienna Fortran, a proposal for instrumenting sequential Fortran programs for parallel execution, is presented as input to the High-Performance Fortran Forum.

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Start Date	**Duration**
01-DEC-89	*24 months*

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2703

High-Speed Scientific Computer (HSSC)

Keywords: scalar computers, supercomputers, scientific computing

OBJECTIVES AND APPROACH

The purpose of this one-year feasibility study was to design a high-speed scientific computer based on the following requirements:

- The fastest scalar machine available in the world at the time of delivery, with execution speed competitive with the leading vector supercomputers for all but the most vectorised applications.
- Strict adherence to market standards (such as UNIX, X-Open, OSI, RISC).
- Price/performance ratio competitive with minisupercomputers for all but the most vectorised applications.
- A product which it will be a pride to own: reliable, easy to operate and maintain, and with excellent add-on products.
- Rapid entry into the high-end scientific and technical computing market.

Design options were evaluated and a global architecture defined. The work continues in project 2716, AMUS.

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Start Date

02-NOV-89

Duration

12 months

2716

A Multiscalar Supercomputer (AMUS)

Keywords: multiscalar computers, high-performance computers

OBJECTIVES AND APPROACH

The AMUS project aims to develop the industrial prototype of a multiscalar high-performance computer. This requires the design of new architectural concepts at both the component and system levels, as well as closely related software design and development at the compiler and operating system levels. The current plan is to produce the first prototype by the end of 1993. AMUS continues the feasibility study carried out under the HSSC project (2703).

The one-year definition phase aims to study and design a multiscalar component, define a system architecture for a high-performance computer, and evaluate and select the software needed to program and exploit this multiscalar architecture.

PROGRESS AND RESULTS

The architectural concepts of the multiscalar component have been designed and validated by simulation. The system architecture has been designed, and the software requirements specified. The project is now ready to move forward to the next phase: design of multiscalar chips, integration in a multiprocessor architecture, and software (mainly compilers) design.

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Start Date	Duration
01-JAN-91	*12 months*

5184

Low-Cost Moving Symbols Recognition through Intelligent Vision Engineering (LOCOMOTIVE)

Keywords: vision systems, traffic analysis

OBJECTIVES AND APPROACH

The project intends to specify, design and develop software tools and hardware platforms to build low-cost flexible knowledge-based vision systems for real-time recognition of symbol clusters on moving objects in partially controlled environments. A large number of applications exist for such systems, but they often require the system to work with non-optimal viewpoints and perform under difficult lighting circumstances.

To be generally acceptable, these systems must be low cost and be conceived as general-purpose tools, that is, capable of being fed with an appropriate knowledge-base for each particular application and based on an open architecture making use of a standard data-bus and currently available VLSI devices.

As a real environment test of the developed system is considered a key objective, a pilot application is being considered. The prototype system will be demonstrated in the application of reading car plates on a roadway. This application is particularly demanding in terms of the variability of the lighting conditions, and in terms of the image blur due to vehicle motion.

PROGRESS AND RESULTS

During the first phase of the project (18 months), the partners have specified and designed a system based on an intelligent camera head connected to a transputer-based image processing system. The development of the various hardware modules and their integration will be completed by the end of the second year.

In parallel to these activities, methods and algorithms have been developed on standard workstations and tested with image sequences recorded in realistic conditions.

EXPLOITATION

The industrial partners have substantial experience in traffic applications and are setting up tests under real conditions to assess the developments.

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Start Date	Duration
01-JAN-91	*36 months*

5225

Advanced Real-Time Vision System and Architecture (ARVISA)

Keywords: vision systems, vision system development environments, vision system architectures, image processing, open systems, standards

OBJECTIVES AND APPROACH

ARVISA aims to develop a modular platform capable of becoming a worldwide de facto standard from 1993 onwards for real-time vision and image processing applications.

This architecture should represent a commercially viable, flexible, extendible set of solutions for anyone doing fast prototyping and target machine development, in the medium to high-end image market of the industrial, medical, military, surveillance, digital television, remote sensing, graphic arts and electronic publishing domains.

ARVISA takes its strength from:

- its modularity, which provides a minimum cost for a target machine
- its standardised fast prototyping set of software tools
- the present lack of standards, both for technical standard machines and design tools
- the use of the emerging imaging kernel standard
- the collaborative effort of the main actors in Europe in a wide set of applications where they hold an important share of the market
- the previous experience of some of the partners in designing such vision architectures.

The problems of such an open architecture will be addressed in terms of hardware, software, systems and marketing. The major deliverables will be modules, documentation, a software operating system, recommended standards and demonstrators.

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Start Date	Duration
01-JAN-91	*48 months*

5293

Neurocomputing (GALATEA)

Keywords: neural networks, parallel architectures, OCR, surface-mounted device assembly, vision systems, ASICs, silicon compilers

OBJECTIVES AND APPROACH

GALATEA builds on the PYGMALION project (number 2059), with the objective of constructing a general-purpose neural computing system for Europe. This comprehensive system will encompass:

- general-purpose neurocomputer hardware (GPNC), which efficiently supports a wide range of neural networks
- a sophisticated neural programming environment allowing the efficient use of systems comprising the GPNC, domain-specific processors and ASICs, plus conventional parallel computers and workstations
- a silicon compiler for the rapid production of ASICs
- three industrial applications, in the factory and office, that demonstrate the capabilities of the GALATEA hardware, software environment and silicon compiler, and neural networks.

These four key system components will provide Europe with an integrated hardware/software environment supporting the rapid industrialisation of neural network technology. There are excellent prospects of establishing European standards worldwide.

The software activities workpackage of GALATEA extend the PYGMALION neural network programming environment to provide a comprehensive environment for programming neural networks. The environment will also interface to a silicon compiler for the production of dedicated neural network integrated circuits.

The industrial applications cover two areas, optical character recognition and industrial vision. The main results of the optical character recognition (OCR) workpackage will be a system able to read printed documents and integrate them into any word-processing system. The results of the industrial vision workpackage are intended on the one hand to improve SMD (surface mounted device) assembly techniques for future products, and on the other hand to improve fruit video-grading systems.

The last phase of the GALATEA workprogramme is covered by project 7807 GALATEA II.

PROGRESS AND RESULTS

The project has made considerable progress on nearly all fronts.

The specification phase is now completed with clear targets for the next phase; basic decisions have been taken that follow well established standards (UNIX, VME).

The original objectives have now materialised into the aim of having a first GPNC demonstrator at month 18 in which specialised neural boards developed by two partners will be attached to workstations. The demonstrator has been specified and will serve as a vehicle to test the hardware and software concepts. The virtual machine language VML, a key component, has been specified and the compiler from the high level language N (suited for Neural applications and specified in project 2059, PYGMALION), into VML is under development.

Work on the silicon compiler has progressed though several options are still open.

In the application areas significant progress was reported, in the OCR application in particular. The basic building blocks for the application systems have been identified.

EXPLOITATION

There is good prospect for the work to be exploited in particular by the start up company MIMETICS specialised in neural applications. A software environment MIMENICE for developing neural applications is already being marketed as well as a software system for OCR integrating neural techniques.

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Start Date	Duration
01-JAN-90	*24 months*

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5390

Real-Time Gaze Control (RTGC)

Keywords: vision systems, surveillance, robotics

OBJECTIVES AND APPROACH

The RTGC project plans to develop and build an active vision system for real-time stereo gaze control that will allow objects of interest to be detected, located, fixed, and tracked in 3-D and will enable the dynamic characterisation of 3-D structures in a scene.

The system will rely both on sophisticated motion control techniques with many degrees of freedom (angular positioning, focusing, convergence accommodation, etc), multisensory fusion between proprioceptive data (angular speeds, accelerations, etc), and image data from solid-state sensors.

It is expected that active control will dramatically enhance the efficiency of 3-D vision systems by enabling objects and structures of interest to be tracked and imaged at the appropriate level of detail, and will facilitate new visual modalities by exploiting to the full motion parallax, structure from motion and change of viewpoint.

Application domains cover surveillance (detection, location, tracking, reconnaissance, security, etc) and robotics (object detection and localisation for handling, and, in particular, map-making, obstacle characterisation and manoeuvring for the outdoor operation of mobile robots).

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Start Date	**Duration**
15-JAN-91	*36 months*

5399

Compiler Generation for Parallel Machines (COMPARE)

Keywords: compilation systems, compiler generation tools, parallel systems architectures

OBJECTIVES AND APPROACH

Compilers for modern, high-performance architectures are still mainly hand-crafted, without the benefit of well-specified theory and technology. It is not yet known how to best compile to architectures such as VLIW and distributed systems or the more ambitious highly parallel architectures. Even for architectures which are relatively well understood, such as RISC and vector machines, compilers are still built by hand at high cost.

COMPARE proposes to extend the basic compilation technology for those architectures that are not yet well understood, and to extend the technology in compiler generation tools for those architectures that are better understood.

To unify the research and development among the COMPARE partners, the COSY (COmpilation SYstem) conceptual compiler model is proposed.

COMPARE aims to produce a complete compilation system based on the COSY model. Through an emphasis on compiler generation tools, this system is intended to be applicable to new processor and architecture designs as they become available, and to be adaptable to new compiler technology as it is developed.

COMPARE will produce a compiler construction system that allows the efficient production of competitive commercial compiler products. This system is intended to be incorporated in products in order to keep Europe at the leading edge in the areas of formal language and compiler research.

PROGRESS AND RESULTS

A compiler for a specimen language, ClaX, has been developed to validate the design work on the CoSy model and effect subsequent design modifications through rapid prototyping.

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Start Date	**Duration**
01-JAN-91	*48 months*

5404

General-Purpose MIMD Machines (GP MIMD)

Keywords: parallel architectures, transputers, T9000

OBJECTIVES AND APPROACH

An integrated family of parallel computers will be defined and developed based around hardware developed in two Esprit projects: the Elite and Elan message passing components from the GENESIS project and the INMOS T9000 transputer and C104 message router from the PUMA project. The architecture, systems software and T9000 hardware for this family are developed within the GPMIMD project; the GENESIS hardware is developed outside the project. By the end of 1993 there will be a fully integrated family of machines with three classes of nodes:

a) Sparc Viking nodes, running the Solaris 2.1 operating system and supporting a rich UNIX SVR4 environment.

b) 200Mflop vector nodes; the vector processor is implemented as a coprocessor to a Sparc node.

c) Highly integrated nodes, based on the T9000 transputer.

Nodes of type a) and b), the GENESIS nodes, are connected via a multistage ELITE network, the T9000 nodes via a similar C104 network.

For all node types the common software architecture will deliver:

a) FORTRAN and C compilers;

b) Standard and MIMD-extended parallel programming interfaces including PARMACS and the GPMIMD UBIK interface;

c) Process and job level debugging, performance monitoring and visulation;

d) Resource management and administration support;

e) Advanced concurrent file systems.

Special effort is devoted to support for real-time programming on T9000 nodes with the development of input/output support hardware and of demonstration applications mounted on the CHORUS real-time kernel developed in the HARMONY project.

Experience will be gained in advance from experimenting with very large configurations of parallel machines. These tasks will be carried out on existing machines with minimal risk with support from European Centres for Parallel Processing.

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Start Date	Duration
01-JAN-91	*36 months*

5433

Neural Networks for Forecasting and Diagnosis Applications (NEUFODI)

Keywords: neural networks, forecasting, medical diagnosis

OBJECTIVES AND APPROACH

The NEUFODI project aims to apply neural networks to forecasting and diagnosis problems.

At the heart of the project is the development of a unified description language (ie a unified framework). Its goal is to classify and describe different well-studied paradigms, as well as novel ones, within the domain considered. Such a language is crucial in order to get a consistent framework for applications and a deeper understanding of neural networks. A number of existing applications will be thoroughly analysed to provide input for the development of the framework. With the help of the unified language, topological and architectural heuristics will be formulated.

PROGRESS AND RESULTS

Three existing and one novel application are being considered and are progressing on schedule. The existing applications are phoneme recognition, integration of heart-scan data, and the forecasting of water demand and consumption.

One novel application is examined in particular: the problem of disturbance analysis in electrical networks. This is also intended to help in refining the prototypes of the other applications.

Three major architectural aspects of neural networks are currently investigated with promising results:

- architectures that can handle temporal sequences of input patterns
- the pre-programming of knowledge into networks
- architectures that can deal with a changing environment.

EXPLOITATION

In the short term, results from NEUFODI are intended to contribute to the industrial application of research undertaken by BIKIT, SLDE and ARIAI. In the longer term, the other partners are expected to benefit from novel applications.

5433

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Start Date	Duration
01-DEC-90	*36 months*

6057

European Declarative System II (EDS II)

Keywords: relational databases, parallel architectures, Lisp, Prolog

OBJECTIVES

Project 2025 (EDS) has developed a high-performance parallel processing technology targeted on the large-system market. The parallel machine and its Unix operating system will allow early exploitation with existing proprietary relational database transaction processing systems. The parallel ESQL (extended SQL), Lisp and ElipSys (logic) language subsystems will also allow the partners to establish a lead in application of parallel processing to large scale commercial decision support applications.

This follow-up phase concentrates on integrating the parallel machine with its EMEX operating system and the EDS relational database managment system (RDMBS), and on demonstrating and evaluating this with the PLANES commercial geographic information system. The METAL automatic translation application and the parallel Lisp language sub-system will also complete their integration and evaluation phases on the EDS platform. Demonstrating the capabilities of the EDS technology in realistic commercial applications will establish the credibility and applicability of the technology with decision-makers.

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Start Date **Duration**

01-APR-92 *12 months*

6059

European Parallel Operating System based on Chorus (EPOCH)

Keywords: operating systems, parallel architectures, ORACLE, INGRES

OBJECTIVES

The main objective of EPOCH is to produce an operating system for parallel architectures targeted at the commercial market. A parallel, fault-tolerant Unix system based on Chorus/Mix with full systems management facilities will be produced and exploited in the key area of commercial database systems, which have stringent requirements in terms of availability, fault tolerance and manageability.

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Start Date	**Duration**
01-JUL-92	*30 months*

6089

Pedestrian Monitoring In Public Places (PEDMON)

Keywords: multisensor systems, surveillance, data fusion, pedestrian monitoring, buildings management

OBJECTIVES

The aim of PEDMON is to develop the technological capability required to capture useful, reliable and robust data on the numbers and movements of freely circulating people within unrestricted areas of large buildings for planning, management and control purposes.

The technical goal is to develop a range of sensing systems capable of counting the number of people passing in both directions across a gateway threshold, up to 8 metres long, that is not necessarily bounded at either end by walls or other physical barriers. The performance target is to equal or better the 80-90% accuracy achieved by restrictive monitoring across narrow gateways or by very expensive manual counting.

The approach taken is to:

- develop appropriate low-cost, easily deployed sensors supported by effective and easily implemented sensing algorithms
- develop a suitable sensor platform capable of supporting the techniques and algorithms required
- develop multisensory data fusion approaches and algorithms to improve the robustness and accuracy of counting data
- develop suitable sensor communication techniques that address the constraints of the application environments and that conform with emerging standards for communications within buildings
- integrate sensors and algorithms with existing building monitoring and control systems
- demonstrate and evaluate prototype systems in three types of public environment: an international airport, a major railway station, and a shopping complex.

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Start Date	**Duration**
08-JUN-92	*30 months*

6166

Enhancement of Hands-Free Telecommunications (FREETEL)

Keywords: speech processing, noise robustness, telecommunications

OBJECTIVES

The objective of FREETEL is to enhance the quality of hands-free communication via a wide variety of terminals (telephones, videophones, and mobile phones). The specific characteristics of each application will be taken into account (background noise, transmission delays and interactions with the system in the case of mobile phones; longer echoes and possibly wideband signals in the case of telephones or videophones).

To achieve the necessary breakthrough in speech-processing performance, three problem areas will be attacked:

- the acoustic environment, including enhancement of the acoustic front-end
- echo cancellation
- noise reduction.

The quality target is the level of performance defined in the draft CCITT G.AEC recommendation and in GSM recommendation 3.50.

A real-time demonstrator for hands-free mobile telephones will validate the improved techniques. This will be based on an optimisation of the various elements (echo cancellation and suppression, voice activity detection, noise reduction), with an emphasis on complexity reduction. In terms of cost, the objective is to limit the hands-free function to a small fraction of the overall cost of the terminal.

6166

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IMPERIAL COLLEGE OF SCIENCE TECHNOLOGY AND MEDICINE	*UK*	*A*
ILSP	*GR*	*A*

Start Date

01-JUL-92

Duration

36 months

6173

Design by Simulation and Rendering on Parallel Architectures (DESIRE)

Keywords: parallel architectures, computational fluid dynamics, rendering software, simulation

OBJECTIVES

The objective of DESIRE is to develop and demonstrate an integrated system for the interactive design of complex industrial product components by simulation and graphic rendering on parallel architectures.

The system will be centred around rendering software aimed at simultaneously achieving the highest possible image quality and maximum rendering speed. It will enable the photo-realistic rendering of data arising in advanced CAD and CAE applications(such as the design of objects with complex shapes) as well as the visualisation of data resulting from scientific experiments or simulations. DESIRE will focus on addressing performance enhancements with parallel architectures of computational fluid dynamics codes.

In order to achieve an optimal image quality in an acceptable amount of time, the rendering software will be organised in such a way that it can run on scalable, highly parallel systems. Although considerable emphasis will be put on the portability of the software, a particular parallel machine developed independently from the project by one of the partners is intended to provide the target platform. This will be connected to graphics terminals and workstations suitable for high-quality visual output.

An essential component of the software development is the design and specification of a general standard format that unifies all aspects of visualisation, including geometry, animation, photo-realistic rendering and scientific visualisation.

The application chosen to drive the development is the interactive design and engineering of car bodies based on visual feedback through photo-realistic rendering of shape information, mechanical modelling and the visualisation of the simulation of external air-flow. The system will be evaluated at the design and construction department of a major European car manufacturer.

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Start Date **Duration**

01-JUL-92 *30 months*

6253

Supercomputer Highly Parallel System (SHIPS)

Keywords: multiscalar computers, parallel architectures, supercomputers

OBJECTIVES

The objective of SHIPS is to develop a prototype module of an advanced parallel architecture supercomputer. The prototype will be a fully symmetric multiprocessor node with a shared memory based on an innovative architecture. It will have monoprocessor user vision, a clock speed of a few nanoseconds, and be optimised to have a very high sustained/peak-performance ratio. in a later development, several nodes will form the basis of a scalable supercomputer system.

The architecture is proprietary and will support decoupled operations, hardware-assisted loop pipelining and a very large hierarchical memory. Highly optimised compilers will be developed to support these features as well as automatic parallelism (auto-tasking). The operating system (to be developed within the project) is based on a micro-kernel Unix standard.

Performance demonstrations are planned at a number of advanced European test-sites.

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Start Date	**Duration**
27-MAY-92	*36 months*

6290

High-Performance Computing for Industrial Applications (HAMLET)

Keywords: parallel applications development tools, real-time applications

OBJECTIVES

The objective of HAMLET is to provide the technology required to enable European industry to develop innovative products in the fields of pattern recognition, image generation, and other real-time/time-critical applications. The project aims to accelerate technology transfer to the industrial partners and to guide product developments in the technology suppliers towards meeting industrial requirements directly.

HAMLET is driven by industrial applications. The technology suppliers involved will assist the industrial partners in the formulation of their detailed application development system and hardware architecture requirements.

The main results of HAMLET will be:

- a number of significant application demonstrators showing the application of the hardware architecture and application development system in the construction of competitive industrial products
- an application development system integrating the early algorithm and timing simulations required with the back-end activities of debugging and monitoring the target system
- a scalable hardware architecture supporting the high levels of computational power and the high bandwidth data delivery requirements of the applications.

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Start Date	Duration
27-MAY-92	*36 months*

6373

Flexible Real-Time Environment for Traffic Control Systems (TRACS)

Keywords: data fusion, real-time systems, multisensor systems, traffic monitoring, image processing

OBJECTIVES

The TRACS project aims to develop a real-time computing system for monitoring and controlling vehicle motion in well-defined areas with high risk of collisions, such as a harbour or an airport.

The system will have three basic components:

- a set of sensory devices for data acquisition from the environment and for monitoring vehicle motion
- a parallel processing subsystem capable of handling the large amount of critical data coming from the sensors in real-time
- a real-time user console that supports sophisticated prediction models for coordinating vehicle motion and handling critical situations.

The project's main objective starting from a complete real-time development environment, is to design and implement the data processing subsystem and the general-purpose real-time user console and to support multisensor integration (including radar and video). The first prototype system will be targeted at vessel traffic control applications.

6373

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Start Date	**Duration**
01-JUN-92	*28 months*

6447

Heterogeneous Integration Architecture for Intelligent Control Systems (HINT)

Keywords: process control, heterogeneous architectures, knowledge-based systems

OBJECTIVES

The objective of the HINT project is to design and implement a software architecture and a methodology that will enable the interaction and cooperation of several heterogeneous techniques in order to solve process control problems that are not currently solvable with either conventional or isolated advanced techniques.

Special emphasis will be placed on producing a heterogeneous tool capable of dealing with problems in process industries. A software architecture will be designed and implemented to enable several modules carrying out different artificial intelligence and conventional technologies to interact meaningfully in a process control environment. Initially, modules using neural networks, fuzzy logic, model-based reasoning and expert systems will be developed, but the architecture will be open in the sense that the integration of further modules will not pose any technical problems. Additionally, a methodology will be defined to enable the designers of the different modules to ensure proper integration of their techniques with the rest of the modules via negotiation and cooperation at the designer level.

A real application will be developed to serve as test-bed for the ideas and designs suggested during the development of the project, as well as a demonstrator showing the accomplishment of the objectives.

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Start Date	**Duration**
1-SEP-92	*27 months*

6488

Study of Hidden Markov Models and Neural Networks for Robust Isolated Word Recognition (HIMARNET)

Keywords: speech recognition, noise robustness, neural networks

OBJECTIVES

The objective of the HIMARNET project is to develop and assess neural network techniques for improving the robustness of medium vocabulary (56-100 words), speaker-independent, isolated word recognisers for telephone transmission quality speech.

The main goal of the work is to learn how neural networks can be used in isolated word-recognition systems. The dominant technology for isolated word recognition is hidden Markov models (HMMs). These models provide a reasonable statistical superstructure for both the estimation of system parameters and for effective time-warping of reference speech to match incoming data. On the other hand, HMMs (as currently implemented) have significant limitations, some of which could be alleviated by the judicious use of artificial neural networks (ANNs).

ANN-based systems will be tested using databases on which HMM techniques have already been evaluated. This will allow direct comparison with these systems. Optimal ways of combining ANN and HMM techniques in a hybrid system will be determined to combine their strengths and overcome weaknesses. Direct comparisons of ANN-based, HMM-based, and hybrid ANN/HMM techniques for speech recognition will be made.

The project aims to solve two significant problems with current HMM-based systems: poor classification and discrimination of speech frames, and elimination of inaccurate independence assumptions. A method that will allow ANNs to handle a time-sequential signal will also be developed.

These developments will be integrated and tested by means of several demonstrators exploiting over-the-phone isolated word recognisers.

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Start Date	Duration
01-OCT-92	*36 months*

6516

Programming Environment for Parallel Architectures (PREPARE)

Keywords: parallel programming environments, distributed memory MIMD computers

OBJECTIVES

The objective of PREPARE is to develop a programming environment in which parallel programs can be developed or restructured in a machine-independent fashion.

PREPARE's environment will be based on three tightly integrated components:

- an *interactive module* that tells the programmer to what extent the system can parallelise the program, indicates the obstacles preventing parallelisation, and invites the user to remove such obstacles by providing directive information
- a set of *compiler directives* to specify data distribution, resulting in automatic parallel execution
- a well-defined *interface layer* to combine with the computation system in generating highly optimised code that fully exploits the intra-processor parallelism of the target machine.

6516

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Start Date	**Duration**
01-JUL-92	*36 months*

6603

An Industry Project to Progress Microkernel-based Open Operating Systems for the 1990s (OUVERTURE)

Keywords: operating systems, Microkernel technology, object-oriented technologies, Unix

OBJECTIVES

The objective of OUVERTURE is to add value to a market standard, Unix System V Release 4 (SVR4), through the addition of the Chorus distributed Microkernel technology and other object-oriented technologies. A tight focus on market requirements will be ensured through the involvement of four major European IT manufacturers, who will play a major role in defining requirements, in evaluation, and in exploiting the project's results. Close interactions with Unix System Laboratories is expected to facilitate the exchange of views with a broad community of IT manufacturers.

The aim is to target the broadest possible market, and particularly the mainstream Unix market for small to medium-sized systems. Attention will also be paid to the real-time embedded systems and high-performance parallel computing systems markets, where Microkernel technology has already proved to be of major benefit.

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Start Date	Duration
01-MAY-92	*36 months*

6643

A Portable Parallel Programming Environment (PPPE)

Keywords: parallel programming environments, parallel programming development tools, PCTE

OBJECTIVES

The aim of the PPPE project is to develop a well-integrated, production-quality toolset whose purpose is to simplify the development of large-scale scientific and engineering applications for massively parallel distributed memory architectures. The target market is scientists and engineers currently employing Meiko, Intel and IBM supercomputers for numerical simulation.

The toolset will comprise:

- systems for explicit message-passing, distributed object and workload management, and event monitoring (collectively referred to as the run-time system or environment); these components will execute on the target supercomputer systems

- a high-performance Fortran (HPF) transformation system, an HPF symbolic debugger, a post-mortem performance analyser, and a static eliminator (the cross-development tools or environment); these components will execute in the distributed environment of Sun SPARC-based and RS/6000 workstations.

The toolset will be portable, with PCTE as the portability layer for the cross-development tools and PARMACS for the run-time system. The primary base-line application programming language standard will be Fortran 77 (Fortran 90 will also be used).

The cross-development and run-time environments and the target platform will be evaluated for robustness, adequacy of purpose, scalability and performance by a representative sample of potential customers.

The successful achievement of the project's aims will result in:

- the integration of transformation and analysis tools into the PCTE; this will increase tool portability, usability, availability and acceptance

- the availability of an open, standard environment with clearly defined interfaces between the toolset components; these will be published in the public domain

- the establishment of a Fortran-based programming model for distributed memory architecture; this will greatly ease end-user acceptance and adoption of such machines and provide a clear target for machine manufacturers to support.

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Start Date	Duration
01-MAY-92	*36 months*

6676

New Architectures for Optical Processing in Industrial Applications (NAOPIA II)

Keywords: optical processors, pattern recognition, vision systems, ferroelectric LCs

OBJECTIVES

The objective of NAOPIA II is to design and construct an optical processor, combining emerging and currently available optoelectronic technologies, to perform a range of automated recognition, localisation and quality-control tasks in the context of two different industrial robotic applications.

The consortium aims to develop an optical processor made up of three building blocks: a flexible image-acquisition system comprising an illumination source and a dynamic filtering system with a video camera sensor, a compact optical correlator comprising a compact optical Fourier transformer and a high-resolution spatial light modulator, and an electronic post-processing unit for extracting and exploiting the correlator output. The design and fabrication of these building blocks will be performed in the first phase of the project, while the second phase will aim at the integration and testing of the system.

The optical processor will be used to perform non-contact recognition and localisation of mechanical parts. This will be applied to automating the unloading of containers of automobile parts (shock-absorbers and camshafts). A further application will concern online quality control in composite-structured material fabrication processes.

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Start Date	**Duration**
01-APR-92	*36 months*

6708

Application and Assessment of Parallel Programming Using Logic (APPLAUSE)

Keywords: parallel programming languages, ElipSys

OBJECTIVES

The APPLAUSE project has two main objectives. The first is to establish ElipSys an emerging European parallel programming system (based on logic developed in project 2025, EDS) in a set of commercially important applications areas. The second is to develop sophisticated, and commercially important, applications in each of the selected areas.

In the course of the work the project aims to:

- transfer an important IT technology to the selected areas and thereby enable the implementation of sophisticated applications
- establish markets for products based on technologies, in both the application and IT areas, where Europe currently enjoys a lead
- provide feedback to the efforts devoted to parallel architectures, programming languages and development environments.

The APPLAUSE consortium has selected three commercially important generic classes of application, and within each of these classes it will develop exploitable prototypes: planning and scheduling (aerospace), decision support (molecular biology and environmental monitoring), and multi-agent systems (tourism).

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Start Date	**Duration**
01-MAY-92	*36 months*

6709

Real-Time and Parallel System for the Simulation of Virtual Humans (HUMANOID)

Keywords: simulation, animation, human modelling, virtual reality

OBJECTIVES

The main objective of the HUMANOID project is to take advantage of advanced hardware (such as graphic workstations and parallel computers) and knowledge of human modelling in order to design and implement a real-time, parallel system for the simulation of "virtual humans" in typical environments. The principal goal of the system will be the simulation of all situations involving human beings, such as airports, subway stations, production lines, aircraft cockpits and audiovisual productions.

The planned system will include modules for human modelling, motion control of the human body and deformations, interaction of the virtual human with the 3-D scene, object grasping, walking, facial animation, and behavioural motion control.

This visual simulation software is intended to offer animators a full 3-D interaction with real-time feedback, including the possibility of entering the virtual world and communicating with the virtual humans. An object-oriented design and language will be used.

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Start Date	Duration
01-JUN-92	*36 months*

6715

Robot Control based on Neural Network Systems (CONNY)

Keywords: neural networks, process control, robotics, inspection systems, space applications, computer-integrated agriculture

OBJECTIVES

The objective of CONNY is to establish the suitability and advantages of neural network (NN) techniques for complex control tasks and to develop a set of corresponding NN modules. A major goal is the demonstration of the advantages and concrete applicability of NN techniques for robot control in a variety of industrial and non-industrial fields. Work will be based on the programming environment developed in project 5293, GALATEA.

The initial approach will involve an examination of several possible fields of application in order to identify critical control problems which could be more efficiently solved using NN modules than using conventional methods. CONNY will address one industrial (inspection systems) and two non-industrial (space, fruit harvesting) robot applications. Some of these critical control problems will be the basis of the development of corresponding NN control techniques and modules. These will cover critical aspects of forward control (path and grasp planning, hand-eye coordination, inverse kinematics), nominal feedback (control-oriented environment modelling) and non-nominal feedback (failure diagnosis and recovery planning and control). These key techniques will be adapted to each of the application fields mentioned above and tested by means of demonstrators.

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Start Date	Duration
30-APR-92	*36 months*

6731

A Practical Approach to Fault-Tolerant Massively Parallel Systems (FTMPS)

Keywords: fault-tolerant architectures, parallel architectures, transputers, T805, T9000

OBJECTIVES

The objective of FTMPS is to develop techniques and system software capable of managing and processing component failures in massively parallel computers comprising thousands of processors. The target market is existing 100 gigaflop and projected teraflop transputer-based machines. Topics to be covered include system architectures, system software, and modelling and testing (real-time aspects will not be considered).

The environment for the project will be a transputer-based system featuring redundant processor nodes, a fault-tolerant communications network architecture and an independent network of control processors. With a view to developing system software that can cope with the failure of a proportion of the hardware components, the project will examine:

- concurrent failure detection on a node and system basis, integrating failure-handling routines into a lightweight message-passing kernel and the control net software
- checkpointing and restart of applications by the explicit use of library routines (automatic checkpointing will be explored)
- post-failure reconfiguration using redundant processors and alternate network paths
- quantitative failure modelling.

The project will support the European standard parallel application system interface ASI (under development in GP MIMD, 5404).

6731

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Start Date	Duration
01-AUG-92	*36 months*

6753

Interactive Design Using a Network of Transputers in Fluids (IDENTIFY)

Keywords: computational fluid dynamics, simulation, visualisation, parallel architectures, STEP standard

OBJECTIVES

The objective of IDENTIFY is to develop a suite of design tools to demonstrate that the availability of parallel machines can shorten the design cycle of complex industrial components. The applications demonstrators will involve complex engineering problems such as the design of internal combustion engines and the production of optical lenses.

The design tools will be implemented using parallel architectures and will comprise:

- *pre-processing:* static mesh adaptation and regularisation
- *processing:* computational fluid dynamics code for a) compressible flows with two-phase evaporation, chemical reaction and combustion b) incompressible viscous creeping flows of liquid glass
- *post-processing:* visualisation on high-performance workstations.

The project will also contribute to the development of standards for the implementation of computational tools compatible with the neutral file format defined by project 322 (CAD*I) and by STEP.

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BMW AG	*D*	*P*

Start Date	Duration
01-SEP-92	*30 months*

6756

Computer-Aided Migration of Applications Systems (CAMAS)

Keywords: workbenches, software migration, parallel platforms, PCTE, PAM-CRASH

OBJECTIVES

The objectives of CAMAS are to assemble, extend, validate, and distribute a reference workbench for high-performance computing (HPC) which is both open and portable. The workbench will include methods and tools for developing and migrating scientific and engineering application software to general parallel and distributed (P&D) hardware platforms with HPC architectures.

The workbench will include:

- parallelisation solvers such as PARASOL to identify, implement and evaluate candidate parallelisation schemes, BLAS to parallelise and optimise vector operations, and MAP for the mapping of the Application Task Model (ATM)

- program analysis tools such as the Interprocedural Dependency Analyser (IDA), the Domain Decomposition Tool (DDT), the Static Performance Estimator (SPE) and the Symbolic Application Descriptor (SAD).

The workbench will be validated with the migration of three state-of-the-art industrial programs:

- PAM-CRASH and PAM-STAMP for the simulation of car-crashes and sheet-metal stamping respectively

- FAM for the pre- and post-processing of industrial finite element calculations.

The workbench will be demonstrated on a generic model including Fortran and C with portable and standardised communication extensions (PARMACS). A Parsytec system under Parix with Ace Fortran, C compilers and an implementation of PARMACS will serve as an example for the generic model.

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ESI GMBH	*D*	*A*

Start Date	**Duration**
01-JUL-92	*36 months*

6757

Data Fusion for an Environmental Monitoring System (EMS)

Keywords: data fusion, sensor modelling, environmental monitoring systems

OBJECTIVES

The EMS project aims to develop a general framework for data fusion in environmental monitoring systems. Fusion and interpretation will result in a state description at different levels of abstraction, catering for the varying needs of different end-user groups.

Emphasis will be placed on "high-level" fusion that is not only based on sensor data but also incorporates information stored in databases.

The research will be driven by two real-life applications: a river quality monitoring system, to be used by the drinking water supplier of the western Paris region, and a waste-dump monitoring system to be installed near Augsburg. Both these applications will define the requirements for the standard EMS tools, while the river quality monitoring system will serve as an industrial test-bed and will set the basis for the future use of the new concepts proposed.

The following results are expected:

- fusion techniques for sensor data
- monitoring techniques (situation assessment, interpretation and prediction)
- development or adaptation of sensors to obtain the basic measurement data in the most economic way
- the presentation of information at different levels of abstraction.

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Start Date	**Duration**
01-DEC-92	*36 months*

6765

Component Heuristics and Improvements for Copiers (CHIC)

Keywords: digital copiers, image processing

OBJECTIVES

CHIC will conduct a structured development and evaluation of a demonstrator for an advanced digital copier.

The requirements for the demonstrator include features such as page interpretation into components, components-based interactive processing and archiving, and high-performance component-specific image processing. This approach should produce a major quality improvement over today's US and Japanese digital copiers.

The main objectives of the project include:

- requirements specification for digital copying and advanced enhancements of the copying function
- demonstration of feasibility in a test-bed environment
- description of hardware in the VHDL hardware specification language
- operational demonstrator of the copier system and evaluation report.

6765

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Start Date	**Duration**
01-SEP-92	*36 months*

6768

Heterogeneous Distributed Real-Time Architecture (HEDRA)

Keywords: distributed control systems, flexible manufacturing systems, transputers, digital signal processors

OBJECTIVES

The objective of the HEDRA project is to design and develop a real-time distributed heterogeneous architecture for the control of machine tools and robots.

The planned control system will be a mix of Inmos transputers and Texas Instruments digital signal processors (DSPs) and, eventually, other devices. For each task or module the most optimal processor will be used. While transputers are optimised for parallel processing and communication, the DSPs are optimised for servo-control and sensor interpretation, with the newest DSPs also offering very good communication capabilities.

The parallelism within the architecture will be coarse-grained. Modules will have clearly defined interfaces and functions. Everything will be programmed in C or C++ using the same real-time distributed kernel on all processors; in this way a module can be moved to another processor type by merely reconfiguring and recompiling the sources. The kernel itself will be completely transparent, and all system calls will be independent of the actual location of the resources used.

The final demonstration will be the full control of a complex flexible manufacturing cell. A multi-axis numerically-controlled press brake with a 5-axis robot will be integrated with the machine, together with an in-process measuring system and peripheral equipment.

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Start Date

01-SEP-92

Duration

36 months

6942

Performance Evaluation of Parallel Systems (PEPS)

Keywords: parallel systems evaluation, benchmarking

OBJECTIVES

The objective of the PEPS project is to develop a methodology, techniques and tools for performance evaluation of parallel systems, and to publish performance evaluations of representative systems.

The main results are expected to include:

- *Benchmarking:* A set of internationally accepted benchmarks applicable to parallel and sequential machines. This will involve external co-operation, mainly from users of important large scale applications.
- *Monitoring:* Detailed measurement and visualisation tools adaptable to various parallel hardware architectures.
- *Modelling:* Reusable system modelling techniques, based on existing performance evaluation tools and techniques to increase their power to allow efficient solution of model of complex systems.
- *Architecture characterisation:* Techniques that provide detailed information on key systems issues and components which significantly affect performance. For example, a set of benchmarks which isolate and evaluate comparative performance of individual features of architectures.

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Start Date

01-NOV-92

Duration

36 months

7050

Highly Integrated and Compact Optical Processor for On-Board Systems (HICOPOS)

Keywords: optical processors, pattern recognition, vision systems, ferroelectric LCDs

OBJECTIVES

The objective of HICOPOS is to design, develop and implement optical parallel architectures for complex dynamic scene analysis and pattern recognition tasks. These will form the technological basis for a wide range of new low-cost, compact vision systems. The design will be based on ferroelectric liquid-crystal (FLC) technology, which allows parallel spatial processing at rates higher than the video frame rate. As the FLC optical processor is directly coupled to the silicon backplane in the planned implementation, interfaces between sensor and processor are no longer needed, resulting in a very compact system.

Although the project focuses on transport applications, the compact systems envisaged will also be capable of installation on the arms of static robots performing part selection or assembly tasks in industries ranging from automotive assembly to food packaging, or as guidance systems for mobile robots. Applications are also foreseen in medical imaging, space guidance systems, optical database searching and security (fingerprint analysis, signature verification, etc).

Road sign recognition has been chosen as the first application, because it is a good example of simple dynamic scene analysis with well-defined objectives involving planar pattern recognition only. In addition to this major application, it is intended that the final demonstrator will also be tested on tracking and robotic applications. The extension to more complex problems involving, for example, 3-D moving object detection, will also be considered from both a theoretical and experimental point of view.

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Start Date

27-MAY-92

Duration

36 months

7074

Parallel Software: Hardware Applications (PASHA)

Keywords: computational fluid dynamics, MIMD architectures, SIMD architectures, parallel computing

OBJECTIVES

The objective of PASHA is the assembly and pilot implementation of a generic hardware-software platform for computational fluid dynamics (CFD) applications.

The key features of this platform will be:

- the use of European-made parallel hardware for computer-intensive CFD applications of industrial interest, and for the graphical visualisation of CFD results
- the dissemination of CFD as an information technology instrument, by creating CFD customisation tools that make the CFD technology usable by product designers and process operators lacking CFD expertise
- the creation and use of software tools that increase the portability of CFD and other engineering applications to and between MIMD and SIMD architectures.

The approach will be to:

- port and optimise existing CFD and visualisation software to run on MIMD and SIMD parallel architectures
- develop a customisable CFD analysis tool
- evaluate the performance of SIMD and MIMD machines for a cross-section of typical CFD problems.

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Start Date	Duration
01-SEP-92	*24 months*

7091

Database Systems (PYTHAGORAS)

Keywords: parallel database servers, parallel systems evaluation

OBJECTIVES

The main objective of PYTHAGORAS is to create an integrated toolkit and methodology for predicting the performance of parallel database servers intended to support advanced information servers (AISs). It is targeted at both buyers and designers.

PYTHAGORAS will deliver a performance-measuring suite aimed at quantifying the effectiveness of AISs in several application areas, including geographic, medical, CASE, and business applications. This will be complemented by in-depth studies to improve knowledge of the key software technology required and to assess the impact of hardware technology on the software choices, such as its architecture, logical query optimisation, data placement, and language interworking.

The project will also deliver several engineering tools for designers and users of a parallel database server. A generalised DBMS simulator will provide system designers with a way of assessing the performance impact of new hardware architectures. An "adaptive performance evaluator" will provide the compiler designers with detailed application behaviour when designing query optimisers, and a SMART performance predictor will enable users to analyse application-specific performance. The DMBS test pilot will assist both database designers and users to assess the robustness and the performance of applications running on a prototype system.

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Start Date	**Duration**
01-MAY-92	*36 months*

7185

Neural Network-Based Vision and Signal System for Industrial Quality Control (NEUROQUACS)

Keywords: neural networks, image processing, vision systems, transputers, inspection systems

OBJECTIVES

The objective of NEUROQUACS is to develop and evaluate a modular, flexible transputer-based vision and sensor signal system incorporating neural networks. This system will act as a tool for developing real-time quality-control applications for industrial use. By developing this platform, low-cost applications will be facilitated.

The NEUROQUACS project will incorporate facilities to perform real-time quality control by integrating state-of-the-art components. A modular, flexible hardware platform will be developed consisting of transputer boards, digital signal processor boards, and conventional CPU boards for the host. This platform will interface to both area and line-scan cameras (colour/mono) and to other sensors to obtain a highly flexible and widely applicable quality-control platform. A decision-making unit will be implemented, consisting of a neural network and non-neural algorithms library. The main emphasis will be on neural network algorithms, together with a tool for designing complex application systems. Traditional image and signal-processing libraries for information-preserving data reduction and an applications library will be developed and enlarged during and after the conclusion of the project.

The quality-control platform will be tested and evaluated in two demonstrator applications. The first concerns the quality control of man-made products (potentiometer curves) and the second the quality control of natural products (wood surfaces). The latter demonstrator will use vision-based sensing, while the former will use signals from other sensory modes.

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Start Date	Duration
27-MAY-92	*24 months*

7207

Data Fusion for Environmental Monitoring System (AZZURRO)

Keywords: data fusion, multisensor systems, environmental monitoring, water pollution

OBJECTIVES

The objective of the AZZURRO project is to develop a data fusion system for environmental monitoring that can be mounted in an aircraft or helicopter and perform multisensor perception and situation assessment for decision making. The chosen application is the detection of water pollution.

For this objective to be met it will be necessary to develop and implement advanced data fusion techniques able to handle numerical as well as symbolic data. AZZURRO will:

- integrate different types of data: raw data formatted for processing by using filtering and validation techniques, and symbolic data likely to come from a database or human operator.
- investigate the human/machine interface modalities needed by systems which provide large quantities of information.
- develop change-detection and forecasting algorithms to analyse present and future evolution of an assessed situation.

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Start Date **Duration**

01-OCT-92 *36 months*

7253

Integrated Real-Time and Unix Systems for Transputers (HARMONY)

Keywords: transputers, real-time systems, Unix systems

OBJECTIVES

The objective of HARMONY is to produce integrated real-time and Unix systems for present and future generations of transputers based on the Chorus modular distributed operating system, and so accelerate the commercial availability of Chorus technology on the transputer processor family. The project intends to harmonise the application programming environment across the widest possible range of transputer-based hardware platforms. The developments proposed represent a complete family of modular Unix-based operating systems for parallel and real-time systems, ranging from a stand-alone distributed nucleus for embedded systems to either a Unix system V (release 4.0) or a parallel UNIX system (release 3.2).

The key goals are to:

- specify and produce a coherent operating system technology that addresses the needs of small real-time embedded systems, distributed real-time embedded systems, and mixed real-time/Unix environments.

- support Chorus technology for both the two current generations of the transputer microprocessor family in order to give access to a fully scalable and cost-effective system building environment

- satisfy the need for a more transparent integration of real-time Unix environments with a fuller implementation of Unix on standard platforms

- provide a baseline implementation of Chorus for future use within the GP-MIMD (5404) project as a precursor to a Unix implementation for a general-purpose parallel computer.

The results of the nucleus and scheduler design work will be used to better understand the advanced operating system support requirements for future generations of transputers.

7253

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Start Date

01-JUN-92

Duration

36 months

7255

General-Purpose MIMD Machines II (GP MIMD II)

Keywords: parallel architectures, transputers, T9000

OBJECTIVES AND APPROACH

This project will demonstrate the feasibility of using a European massively parallel supercomputer in two different production environments. Two CS-2 machines will be installed at CERN adn CERFACS, complete with peripherals, network access, system software, program development tools and basic scientific libraries. The computers will be used by a large number of users both for scientific code development and for installation of production codes.

The focus of the activities at CERN will be the porting of large scalar programs to the CS-2, the development of new scientific applications, requiring high performance computing and input/output, and the migration of current applications to an Oracle CS-2 system. The focus of the activities at CERFACS will be climate and meteorological modelling, taking recently developed operational models, that currently run on traditional supercomputers, and migrating them to a vector based CS-2. Experience gained during the project will lead to user driven improvements in both the operational modes and procedures as well as in the programming environments.

As part of the user support activities of system suppliers, important system software components will be developed and tested with the help of users. These include a checkpointing system, an automated task scheduling system, the provision of a hierarchical storage management system and the implementation of the OSI/DCE Distributed Computing Environment.

The partners will perform research into the technology and application of high performance computing with a very strong emphasis on the integration and operational management of high performance computers within standard operating and network environments.

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CERN	*F*	*C*
CERFACS	*F*	*P*
MEIKO	*UK*	*P*
PARSYS	*UK*	*P*
TELMAT	*F*	*P*
DKRZ	*D*	*A*
DMN	*F*	*A*
DWD	*D*	*A*
ECMWF	*UK*	*A*
UKMO	*UK*	*A*

Start Date	**Duration**
01-MAR-93	*36 months*

7504

Special Action for Parallel Architectures in Italy "Particle Tracking Neural System" (PATRANS)

Keywords: neural networks, fluid dynamics, technology transfer, Italy

OBJECTIVES AND APPROACH

The aim of PATRANS is to develop a neural-based system for application to fluid dynamics velocity measurements. The system will run on a 128-node machine and be capable of acquiring images by means of charged-coupled device (CCD) cameras. The baseline of PATRANS consists of an existing neural-based measurement system developed at Università di Roma.

The outcome of PATRANS will be a non-intrusive measurement system that can be used for both industrial and research applications. This instrument will provide concrete support for several applications where industrial competition is particularly strong, such as the aerospace and automotive sectors.

The project will include the following activities:

- optimisation of the neural algorithms for particle recognition and tracking based on existing results from national R&D, together with the adaptation of current Community R&D results where applicable
- implementation on a parallel system with optimisation of the hardware image acquisition components
- dissemination of the results and establishment of links at a transnational level for possible future cooperation.

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CAP GEMINI SESA SPA	*I*	*C*
UNIVERSITÀ DI ROMA - LA SAPIENZA	*I*	*P*

Start Date	**Duration**
15-SEP-92	*24 months*

7518

Special Action for Parallel Architectures in Italy "IT-Uptake in Land Resource Management" (ITU-LAND)

Keywords: parallel computing, land-use management, technology transfer, Italy

OBJECTIVES AND APPROACH

The ITU-LAND action aims to develop a state-of-the-art working environment for supporting land-use management activities.

Parallel computing techniques will be used to support performance requirements deriving from scenario-building activities.

The approach is based on the integration of a set of tools already on the market or in research prototypes. End-user application needs will be the main driving force.

Three different case-studies with different user organisations will be used to steer the development of the system, which is based on interactions between mathematical models and descriptive databases.

Emphasis will be given to the promotion, by means of extensive information dissemination activities, of the market for IT-based applications in the topic field by showing how effective the results of planning and managing actions can be when supported by efficient, user-oriented tools.

The approach will be to:

- implement and the prototype
- analyse users' functional requirements in order to formulate plans for detailed user studies and tests of the prototype
- disseminate information, organise workshops, and set up appropriate links with other European initiatives and actions.

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UNIVERSITÀ DI ROMA LA SAPIENZA	*I*	*P*
COMPUTER RESEARCH LABORATORY	*I*	*P*
ASSOCIAZIONE PICCOLE E MEDIE IMPRESE	*I*	*A*
AUTORITA' DI BACINO DEL TEVERE	*I*	*A*
INSIEL	*I*	*A*

Start Date	**Duration**
01-SEP-92	*24 months*

7519

Special Action for Parallel Architectures in Italy Parallelisation of Large Code (PALACE)

Keywords: parallel architectures, technology transfer, Italy

OBJECTIVES AND APPROACH

The effective usage of parallel machines in research and industry is limited by the difficulties met by the users both in designing new applications and in porting existing ones. The aim of PALACE is to start from an existing large application with an extensive user base and then produce a version which can effectively run on parallel systems.

The existing code will be ported onto a 128 modular European machine.

The Action will cover the following activities:

- technology transfer from relevant sources and training of the necessary staff to exploit and program the selected machine;
- port and test the existing code
- explanation of the techniques used and their possible generalisation to other similar codes and machines making possible a broader applicability of existing Community R&D results. Valuable feedback will be provided to the parallel processing Community at a European level.
- porting onto other selected architectures.

The experience acquired will help to build confidence of research and industry in the possibility of effectively using parallel computing machines.

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ENTE PER LE NUOVE TECNOLOGIE L'ENERGIA E L'AMBIENTE	*I*	*P*
ADVANCED COMPUTING SYSTEMS	*I*	*P*

Start Date

01-SEP-92

Duration

24 months

7530

Special Action in Germany (New Federal States) NAOPIA II (Project 6676) Extension

Keywords: optical processors, pattern recognition, vision systems, ferroelectric LCs, technology transfer, Germany

OBJECTIVES AND APPROACH

The addition of the partner Jenoptik GmbH will enable the NAOPIA II consortium to develop a Cathode-Ray-Tube (CRT) addressed spatial light modulator as data input medium devoted to optical-parallel image processing systems.

The development of a Cathode-Ray Tube - Ferroelectric Liquid Crystal Spatial Light Modulator (CRT-FLCSLM) will cover the following tasks:

- to realise a MINISCAN-CRT module;
- to examine FLCSLM parameters for omtimizing the FLC orientation and impedance matching "Photosemiconductor FLC";
- to adapt the CRT module to the FLCSLM and determine parameters;
- to integrate the CRT-FLCSLM into the existing incoherent image processing system;
- to test the complex system using concrete applications.

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Start Date

01-SEP-93

Duration

24 months

7533

Special Action in Germany (New Federal States) HEDRA (Project 6768) Extension

Keywords: distributed control systems, flexible manufacturing systems, transputers, digital signal processors, technology transfer, Germany

OBJECTIVES AND APPROACH

The addition of the partner Gesellschaft für Prozessrechnerprogrammierung (GPP) MbH, Chemnitz will enable the HEDRA consortium to support the development of software environments oriented towards parallel computing in a Transputer System or including Digital Signal Processors for complex control systems - or better heterogenous parallel real time architectures (for instance Transputer Systems) in real time control applications.

The work will be carried out through the following phases:

- description and documentation of the customer needs;
- system analyses and system design;
- code generation.

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Start Date

01-MAR-93

Duration

36 months

7534

Special Action in Germany (New Federal States) Combination of adaptive recursive data processing with Neural Network classification for diagnosis in neonates NEUFODI II (Project 5433) Extension

Keywords: neural networks, forecasting, medical diagnosis, technology transfer, Germany

OBJECTIVES AND APPROACH

The addition of the partner Friedrich-Schiller-Universität will enable the NEUFODI II consortium to realise the integration of adaptive signal processing with neural networks.

The main aim of the additional partner is to get experience in monitoring of specific medical diagnosis and applications using new concepts of dataprocessing (e.g. the cerebral status as the main application field contributing to the development of neonatology).

The main tasks of this project will be:

- to realise the integration of the optimal choice of the adaptation factors within the training algorithm of a Neural Network;
- to investigate the properties of such hybrid systems;
- to use different types of strategies within this context.

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Start Date

01-SEP-92

Duration

12 months

7807

Neurocomputing (GALATEA II)

Keywords: neural networks, parallel architectures, OCR, surface-mounted device assembly, vision systems, ASICs, silicon compilers

OBJECTIVES AND APPROACH

See project 5293 (GALATEA).

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SIAP SISTEMI SPA	*I*	*P*
INESC	*P*	*P*
PHILIPS-LEP	*F*	*P*
UNIVERSITY COLLEGE LONDON	*UK*	*P*
SIEMENS AG	*D*	*P*
SGS-THOMSON MICROELECTRONICS SRL	*I*	*P*
MIMETICS SA	*F*	*P*
CRAM	*I*	*P*
INPG	*F*	*A*

Start Date	Duration
01-JAN-93	*15 months*

Part II

References to Related Projects

This part aims at providing information on Community R&D related to HPCN within the framework of Community R&D programmes. The list does not intend to be exhaustive, but rather to assist companies and persons who are interested to know about the Community funded actions and who may have an interest in future HPCN activities.

AIM

A2003 COVIRA - Computer Vision in Radiology.

A2008 ESPIS - EEG Signal Processing and Interpretation during Sleep.

A2009 EurIPACS - European Integrated PACS in the Hospital.

A2024 MILORD - Multimedia Interaction with Large Object-oriented Radiological and Clinical Databases.

DRIVE

V2003 COMBICOM - Combined Transport Communication Systems.

V2034 FRAME - Freight Management in Europe.

ESPRIT

5165 Distributed Open Management Architecture in Networked Systems (DOMAINS).

5194 CIM Vision System (CIVIS).

5279 European Distributed System Integration Project (HARNESS).

5292 Modular Open System Architecture for Industrial Motion Control (MOSAIC).

5341 High-Performance OSI Protocols with Multimedia Support on HSLANs and B-ISDN (OSI 95).

5397 The Spirit Workstation: a High-Performance Multifunction Technical Workstation (SPIRIT-2).

5417 Benchmark of Concurrent Architectures for Use in Scientific Engineering (BECAUSE).

5497 Process Computer for Computationally Intensive Control (PROCIC).

5524 High-Performance Computing for Multidisciplinary Dynamic simulation of Mechanism (MDS).

6019 Vision Systems for a Natural Human Environment (INSIGHT II).

6084 Microprocessor Open Vision Environment (MOVE). Feasibility study of an open modular environment for industrial applications of computer vision.

6168 Computer Architecture for Production Information Systems in a Competitive Environment (CAPISCE).

6271 Benchmarking for Embedded Control and Real-Time Applications (BenchMARKING).

6360 Basic Research on Advanced Distributed Computing: From Algorithms to Systems (BROADCAST).

6361 Network of Excellence in Distributed Computing System Architecture (CABERNET).

6362 Predictably Dependable Computing Systems (PDCS2).

6586 Distributed Multimedia Operating Systems for the 1990s (PEGASUS).

6632 Novel Parallel Algorithms and New Real-Time VLSI Architectural Methodologies (NANA 2).

6634 Performance-Critical Applications of Parallel Architectures (APPARC).

6666 Future Automotive Supercomputer Technology (FAST).

6707 Parallel Formal Computing Environment (PARFORCE).

6863 Parallel Optical Processors and Memories (POPAM).

6892 Portable Workstation for Education in Europe (POWER).

7249 Highly Optimised Reusable Nucleus (HORN).

7249 Highly Optimised Reusable Nucleus (OMI/HORN).

7252 High Performance Heterogeneous Interprocessor Communication (HIC).

7269 Quantitative Modelling in Parallel Systems (QMIPS).

RACE

R1079 CAR - CAR/CAM for Automotive Industry in RACE.

R1086 TELEMED.

R2008 EuroBridge.

R2031 PAGEIN - Pilot Applications on a Gigabit European Integrated Network.

R2034 EDID - An Environment for Distributed Integrated Design.

R2036 TRAPPIST - Transfer, Processing and Interpretation of 3D NDT Data in a Standard Environment.

More detailed information on these projects can be obtained from:

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