



EDITORIAL

COOPERATION

The Scientific Community of Europe

I am happy to introduce the second issue of the common CWI-GMD-INRIA Newsletter. It is the evidence that our common will to strongly interact and coordinate our actions has led to a process which is entering into a mature phase.

Needless to stress the importance of common research actions in the building of this cooperation. The ESPRIT programme, by nature, is an excellent vehicle to carry such actions. Both in ESPRIT 2 and BRA, the three institutes are participating in common projects. A representative selection of them is briefly described in this issue. Many of them were already under way even before the decision of the three organizations to coordinate their scientific policy.

This shows that there was a deep and natural motivation among the research teams to cooperate. Thus, the desire of the institutes to strengthen their links is by no means artificial nor opportunistic. But the European Single Market brings a new challenge, namely that scientists of Europe consider themselves as members of the same scientific community. When this goal will be achieved, the European industry will have access to a major source of innovation as well as to a demanding market, exactly as the American industry in regard with the American scientific community.

We should go as fast as possible in this direction. The activities described in this issue are an important step to fulfill this objective, but a lot remains to be done. We are aware of this and we shall take new initiatives in the future. Issues to come will present them among other things.

Alain Bensoussan

European National Research Centres in the Field of Computer Science Prepare for Europe 1992 and Beyond

Computer scientists from The Netherlands, the Federal Republic of Germany and from France have decided to increase their research impact by setting up a long-term European cooperation. Three national research Institutes, the Centrum voor Wiskunde en Informatica (CWI), Amsterdam, Netherlands, the Gesellschaft für Mathematik und Datenverarbeitung mbH (GMD), Sankt Augustin, Federal Republic of Germany, and the Institut National de Recherche en Informatique et en Automatique (INRIA), Rocquencourt, France, formally agreed on a long-term research cooperation on April 13, 1989 in Sankt Augustin, Schloss Birlinghoven.

The agreement outlines a joint understanding of CWI, GMD and

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INRIA in the fields of computer science, applied mathematics and information technology. It makes precise the objectives of a cooperative strategy for strengthening research and development in these fields. This joint action programme is initiated to indicate the relevance of the planned cooperation for technology and society, but also to meet the challenges and opportunities of the Single European Act. By 1993 the European Community will become even more a reality as a political and economic entity. This development at the government level will have a major impact on research management, strategies and structures in many fields of science.

The three organizations want to actively participate in this process. They are convinced that they will improve their ability to better cope with the changing environment by combining their efforts and complementing their fields of research. It will, at the same time, enhance their contribution to the research community and to the European nations in general.

On the occasion of the second series of joint workshops held on April 13/14, 1989 (Programming, Graphic Interfaces, Concurrency) CWI, GMD and INRIA agreed to put into practice essential parts of

their joint action programme by the end of this year:

- to offer a fellowship programme for outstanding scientists from European countries;

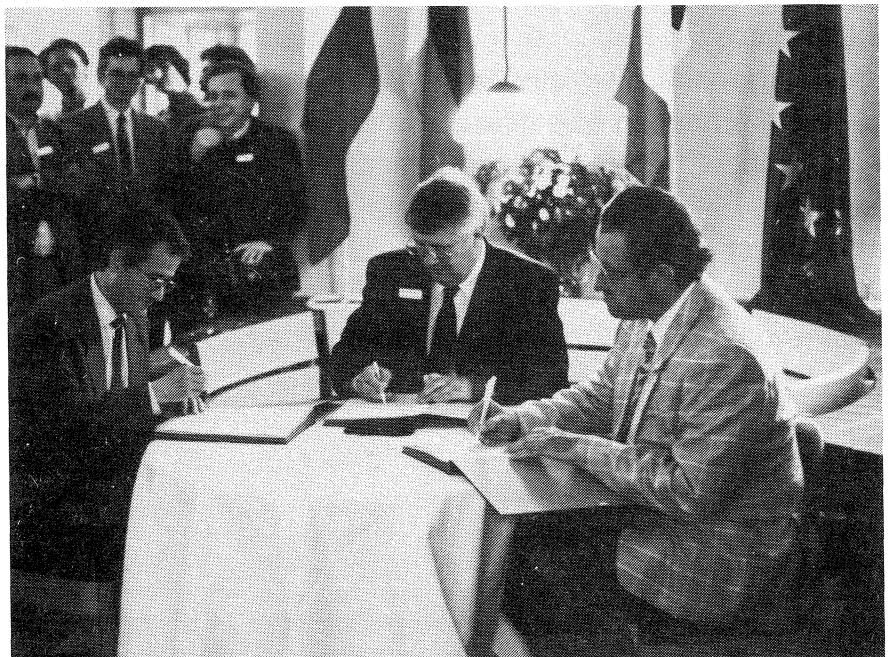
- to prepare an advanced training programme for special industrial/ academic target groups as a contribution to technology transfer from research to the industrial environment;

- to publish a joint quarterly newsletter, describing ongoing joint projects and other activities of the three partners.

The three partners also agreed on a new workshop series in December 7/8, 1989 at INRIA in Paris, focussing on security/cryptography, VLSI design and software for parallel computers.

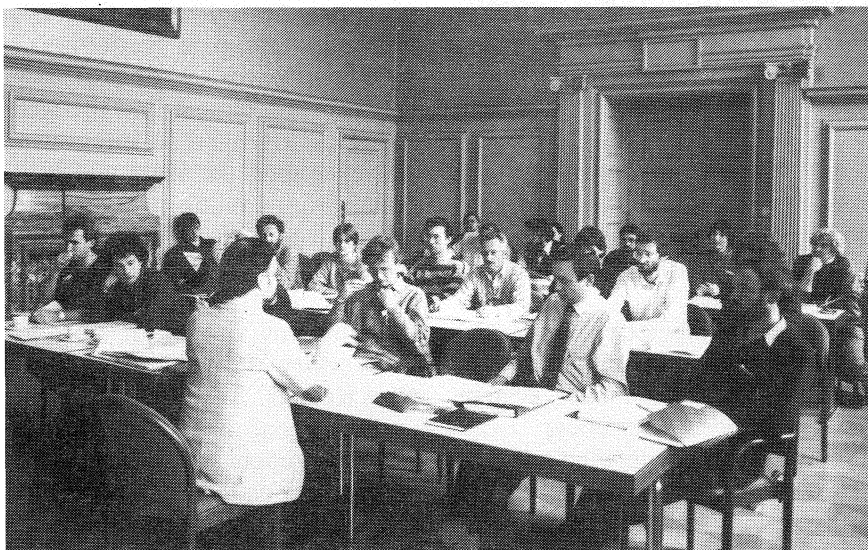
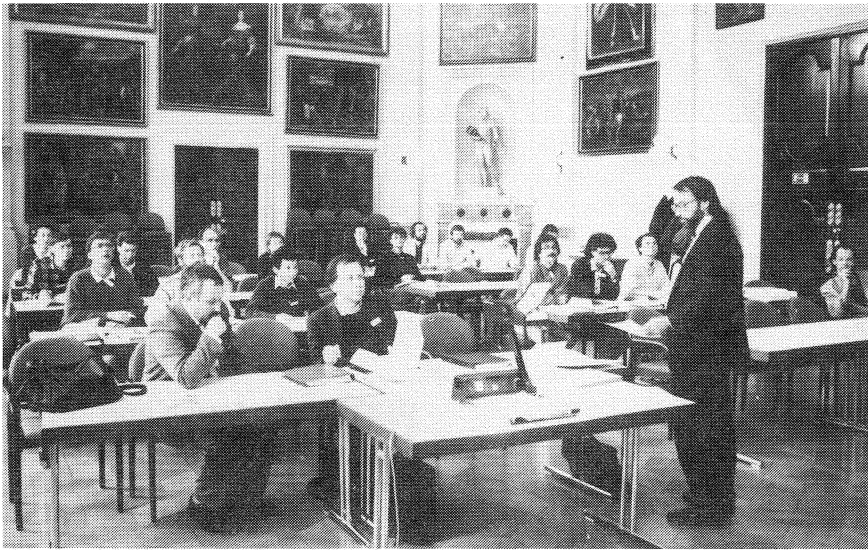
A Standing Committee and several task forces of the three partners were established to prepare and coordinate the various joint actions on an ongoing basis.

CWI, GMD and INRIA have pooled their resources to promote R & D in computer science, information technology and related mathematics to make a substantial contribution for shaping the future European research and technology market. They are open to similar research centres in other EC countries to join in and support their effort.



Signing the "Agreement on Scientific Cooperation": (from left) Prof. Alain Bensoussan (INRIA), Friedrich Winkelhage (GMD), Prof. Cor Baayen (CWI)

The members of the three working groups meet at Schloss Birlinghoven
Photos by Siegfried Münch



ESPRIT PROJECTS

ATMOSPHERE – Improving Software Tool Production

GMD - The ESPRIT II ASEE project ATMOSPHERE was officially started on March 1, 1989. ATMOSPHERE (Advanced Techniques and Models of System Production in a Heterogeneous, Extensible, and Rigorous Environment) was approved by the EC for a one year definition phase. Total budget for ATMOSPHERE's first year is approximately 6 MECU, half of which is funded by the EEC.

From April 17 to 21, 1989 representatives of the participating companies and institutions from 13 nations (among them two EFTA countries) met in Garmisch-Partenkirchen for a startup workshop. It was intended for the coordination of the project work and for getting to know the partners.

The project goal is to support system engineering by the development of appropriate, standardized methods and tools. System engineering covers all tasks necessary for the design of a complete computer system including hard- and software. System engineering is the generic term for requirements engineering (ERAE, FOREST), design engineering (SDL, COLD, HOOD), software engineering (VDM), hardware engineering (DACAPO), system allocation and system integration. System Engineering is viewed as comprising three stages: system requirements analysis; high level functionality (both technologically independent) and transformation into implementable designs. The existing methods, given in parentheses above, are considered and advanced by the partners of the ATMOSPHERE consortium, consisting of seven main partners: Siemens, Bull, SFGL, ESF, GEC-Marconi, Nixdorf and Philips. System allocation focusses on the question whether to implement a

component in hard- or in software.

Besides the more technical development ATMOSPHERE also addresses the organizational aspects of system engineering like project and product management, quality assurance, and documentation. The developed tools will be integrated into a system engineering environment on the basis of the PCTE operating system.

The GMD Research Group for Program Structures in Karlsruhe is in ATMOSPHERE subcontractor of Siemens and Philips. GMD contributes program generators for the construction of system engineering tools. First, this is G2F, an editor generator for two-dimensional graphical formulas. G2F is suitable for the construction of uniform graphical user interfaces. Secondly, these are the following newly developed compiler construction tools: the scanner generator Rex, the parser generators Lalr and Ell, the generator for abstract syntax trees Ast, and for semantic analysis the attribute grammar tool Ag. Within the project there will be a portation of the program generators to the PCTE operating system. They will be improved and validated by using them in several applications.

CWI Subcontractor

CWI - Starting March 1990, CWI will participate in ATMOSPHERE as a subcontractor of Philips with the following activities:

- Verification of SDL programs. We will use the algebraic framework ACP (Bergstra & Klop) in the verification of SDL programs; in particular a number of case studies will be performed on the basis of SDL programs supplied by industry.

- The study of modularization issues. Module Algebra (Bergstra, Heering & Klint) gives an axiomatic, algebraic calculus of modules which is based on the operators combination/union,

export, renaming and taking the visible signature. We will investigate how modularization constructs can be added to or improved in VDM, SDL and COLD, using and extending Module Algebra.

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ITHACA – Integrated Toolkit for Highly Advanced Computer Application

INRIA - The ITHACA project aims to develop an integrated application support system, based on object-oriented techniques. The system will consist of the following components:

- a strictly typed object-oriented language, with its compiler and an interface with a database system allowing object persistency;

- a set of predefined classes allowing rapid development of office or CAD applications. It contains, among others, a generic office model.

- CASE tools, such as browsers, editors, and a User Interface Management System;

- an application support environment: task manager, support for collaborative work, support for multi-media communications, and a help and information system.

To demonstrate the usefulness of this environment for rapid development of applications, three different "demonstrators" will be developed in three different areas: CAD in chemical industry, financial managing and public administration.

INRIA participates in the design and development of User Interface tools (UIMS, interface editor) and is responsible for the design of the help and advice-giving systems for end-users.

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PHOENIX – Logic and Functional Programming Paradigms

GMD - The ESPRIT Basic Research Action PHOENIX was started in April 1989 at the GMD Research Group in Karlsruhe. It will carry out a coordinated research programme into the technologies involved in integrating and extending the logic and functional programming paradigms. In this project, GMD cooperates with the Imperial College of Science and Technology (Prof. John Darlington), London, and the University of Nijmegen (Prof. Cees Koster).

Functional and logic programming languages are typical exponents of so-called declarative languages. In contrast to imperative programming languages, they have many advantages: they are mathematically founded, show a great descriptive power and are very close to specification languages, programs are easy to analyze and to manipulate, and they are well suited for execution on parallel architectures. But software technology did not yet arrive at a full exploitation of these advantages.

The PHOENIX project aims at enhancing and integrating existing technologies towards a more effective and more efficient availability of both programming paradigms to software development. The approach is a hierarchical one

which investigates three levels in parallel:

- At the language level, integrated language concepts including their formal description will be developed. They will unify different concepts of both paradigms into one language framework.

- At the transformation and refinement level, techniques for program analysis and transformation will be developed. Investigations will address transformations of programs into more efficient programs of the same language and into programs of a simpler subset of the language allowing a more efficient implementation.

- At the implementation level, implementation concepts for integrated functional/logic languages will be developed based on abstract machines. At all levels, aspects of parallelism will be considered. The hierarchical approach allows an optimal consideration of interdependencies and influences between the different levels.

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ICARUS – Incremental Construction and Analysis of Requirements Specifications

INRIA - The ESPRIT II project ICARUS is a project with a manpower of 120 m/y and is intended to last for 5 years. Four countries are involved, with 5 industrial and 3 academic partners:

- Philips Research Laboratory Brussels (PRLB), main contractor (project leader Pierre Wodon);

- Alcatel Standard Electrica (SESA), Madrid (with subcontractor TEICE, Madrid);

- Universidad Politecnica de Catalunya, Barcelona;

- Laboratoire de Marcoussis, groupe CGE, Orsay;

- RELEACE, Dublin;

- Faculté Universitaire Notre Dame de la Paix, Namur;

- INRIA-CRIN, Nancy;

- SEMA-GROUP, Montrouge.

The project is concerned with the study of formal methods and the definition of software tools for building and reusing requirement specifications.

In brief, requirement engineering (RE) is the activity of investigating the customer's needs in the context of a software development project. In order to be more precise, a distinction must be made between specification of the requirement, which describes functional and non-functional properties of the system and of its environment, and specification of the design, which describes the system alone for the benefit of the software engineers. There is no doubt that requirement engineering is a very sensitive area of software development, because it takes place early in the project's history and its errors are often discovered too late.

The study of formal methods for requirement specification distinguishes three levels of concerns:

- the specification product which is the description of the desired system in its environment ("what");

- the specification process which is the organized set of activities (choices, decisions, transformations, ...) by which the specification is produced ("how");

- the specification rationale which is the set of reasons that have led to the choice of a particular process ("why").

The aim of ICARUS is to propose an original approach to requirement specification, close to several projects, in particular the ESPRIT1 projects TOOLUSE and REPLAY intended to study the derivation of products at the design and code level.

As the three-level problem in RE has not been addressed yet, some restriction on the scope has been made in considering functional and performance (e.g. real-time) requirements.

The development of the project will take place along the following lines:

- Study of the real world practice to get deep insights in the RE process and rationales. The experience of the industrial partner will be here very important.

- Formal concepts, formal languages and a theory for modelling specification products, processes and rationales at these three levels must be defined. It should be noted that a formal method is not a way of restricting the creativity of engineers. It aims at giving them means for reasoning on their work.

- Putting RE methods into practice will be ensured by the development of a prototype of an integrated RE environment supporting such methods actively and by the performance of realistic case studies. The environment will be based on a process-driven RE assistant integrating active analyst guidance, consistency / completeness checking, specification visualization and prototype generation. The development of software tools will try to reuse versions of existing tools like PCTE, PACT, GIPE or GRASPIN. Industrialization will proceed incrementally, using the particular procedures of each participant.

Participation of INRIA in ICARUS is estimated to 17 men/year. It concerns the central task of defining a formal and linguistic framework allowing to express the three levels, including real-time constraints. INRIA is also involved in the conception and design of the environment, in the development of some specialized tools and for a lesser part in case-studies.

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REX – Reconfigurable and Extensible Parallel and Distributed Systems

GMD - Within the EC ESPRIT Research Programme, the project REX was started at the GMD Research Group for Program Structures in Karlsruhe on May 1, 1989. Ten research organizations and industrial enterprises from France, the Federal Republic of Germany, Greece and Great Britain will cooperate in REX.

The REX project will develop a methodology and support tools for the development and management of parallel and distributed systems. The emphasis of this project is on the support for reconfiguration and extension in order to exploit the parallelism available in distributed and multiprocessor hardware and the parallelism inherent to the applications. The notion of the system as a configuration of modular software and hardware components will be used as the framework research objectives.

System specification and modelling

Development of a specification methodology to express structure and behaviour of distributed and parallel systems and to guide the activities to construct and (re)configure them.

System programming

Development of adequate linguistic support for the design of software components with a high degree of parallelism, for asynchronous communication and for real-time processing.

Methods

The provision of development methods for the systematic construction of software for distributed architectures.

Analysis and evaluation

The provision of techniques and tools for the analysis and validation of system behaviour and performance.

Dynamic configuration and reconfiguration

Graphical and linguistic support for the description, construction and evolution of systems based on the (re)configuration of software components, their interrelationships and allocation to the hardware configuration.

Runtime support

Tools to support software components and systems during runtime and to enable their (re)configuration, including monitoring tools for timing analysis, load balancing, and reconfiguration.

Demonstrator applications

Realistic examples from the industrial automation and telecommunications areas are integrated, thus showing the feasibility of the REX approach and the practicability of the developed tools. They will also serve as a basis for the interchange of technology and industrial requirements among research and industrial partners.

The GMD Research Group in Karlsruhe mainly will be involved in the research for specification techniques and language concepts with special emphasis on parallelism and on communication in cooperation with partners from industry and research institutes.

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DEMON – Basic Research for the Design of Concurrent Systems

GMD - The ESPRIT basic research project DEMON started in April 1989 and planned to end in September 1991 is part of the new EC programme for basic research in information technology. The objective of the project is to explore important theoretical issues involved in the formal reasoning about concurrent systems

and to develop a formal framework supporting the design and verification of large concurrent and decentralized systems. Computer scientists from the GMD Institute for Foundations of Information Technology participate in this project. The basis for this work is the Petri net model which has the benefits of a graphical system representation and a supporting formal theory which captures the essential characteristics of concurrency and locality of state and action and is very general in that it subsumes virtually all other formal models of concurrent systems.

The focus of the project is to enhance Petri net theory by a maximum of concepts of modularity and composition required as aids for designing concurrent systems: refinement and abstraction techniques, algebras and proof rules, appropriate notions of equivalence, congruence and simulation, associated formal proving methods.

The work is organized into two strongly interrelated parts. The central part is concerned with the development of net classes showing the above characteristics of modularity. The second part involves case studies, language studies and other activities supporting the development of suitable net classes. It is the interface to the related approaches and projects.

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Type A – Machine Learning Toolbox

GMD - The ESPRIT-Project "Machine Learning Toolbox" aims at making machine learning available to a wide range of applications. Therefore, a system is developed that provides the users with several learning procedures. Moreover, the system helps the user to select and use the appropriate procedure.

Machine learning techniques have been successfully applied to a variety of problems. This requires, however, intimate knowledge of the field and a considerable effort to adapt scientific results to industrial environments. In general, it is not well known how to relate features of problem classes to those of learning procedures. Therefore, evaluating and characterizing the learning algorithm will be an important task of the Machine Learning Toolbox project. The Machine Learning Toolbox will create a wide range of learning procedures. Each of them will be evaluated using practical problems. Moreover, the procedures will be transferred to a common UNIX environment, thus enhancing availability.

Tasks of the GMD are to provide a model-based learning procedure, to evaluate and characterize it and to enhance it where it is necessary. Moreover, the GMD project group will take part in the development of a common knowledge representation for the Machine Learning Toolbox. Project duration will be from 1989 to 1993.

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CLICS – Categorical Logic in Computer Science

GMD - The ESPRIT Basic Research Action "Categorical Logic in Computer Science" aims at a unified theory of programming and specification based on methods of categorical logic. The project is motivated by the belief that category theory and the categorical approach to logic are extremely suitable for constructing mathematical explanations of the meaning of very many formal systems which are used in computer science. The strong unity of the concepts of category theory coupled with their wide applicability make the subject an invaluable tool for

the application of mathematical techniques in computer science.

Categorical logic translates possibly complicated logical structures into formally simpler, categorical ones. This has proved feasible for a remarkably large number of the basic concepts underlying traditional logic (substitution, quantification, higher-order function, power set operation). However, many of the mathematical concepts which are of fundamental concern in computer science are not so well understood.

Translation into the categorical language should play a dynamic role suggesting new formal systems and sharpening our understanding of the original concept. Categorical logic has already given some deep insights into the mathematical nature of some new paradigms of programming such as type structures (polymorphism, dependent types and inheritance), concurrency and logic of programming. This work will be continued and broadened to provide a unified mathematical and logical basis of programming specification.

All partners will be involved in the development of a meta-language for denotational semantics. GMD will moreover focus on high level specification language and on languages and proof systems for parallel processes, while INRIA will particularly work on epistemic type theory and on implementations of formal systems.

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STRETCH

INRIA - This ESPRIT II project aims at integrating database and knowledge-base technology. The goal of the project is to develop a system that can handle large amounts of data, make inferences about stored data through logic programs and express the structural semantics of data in an object-oriented fashion. The envi-

sioned approach relies on two main directions:

- Development of an extensible object server. This server will support multi-user access and update to large bases of complex objects (lists, trees, graphs,...) and execution of operations specific to these objects. These functionalities (typing system, access methods, operator) will be available in a primitive form, serving as basis for extensibility.

- Development of two languages for application programming: a rule based language and a persistent object oriented language. Each language will have an optimizer/compiler interfaced with the object server. The work performed by INRIA will consist of the design and development of main parts of the object server and the rule based language with its optimizer/ compiler. It will be a follow-up of the work already performed in the ESPRIT 1 project ISIDE.

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GRASPIN – Personal Environment for Incremental Graphical Specification and Formal Implementation of Non-Sequential Systems

GMD - As one of the first ESPRIT projects in the area of software technology, the GRASPIN project is concerned with improving current software development approaches to encourage their use on a wider industrial scale. The project is carried out by a number of industrial and research companies from Germany, Greece and Italy, GMD as the prime contractor.

The GRASPIN project, which started in September 1983 and will end in September 1989, aims at both, research and development goals.

Research activities are directed to improve current software devel-

opment approaches and, where necessary, to develop new methods. Emphasis is placed on the most critical activities in the software life cycle, namely requirements analysis and specification as well as on validation and verification. A further goal is to combine these methods in a coherent way.

Development activities aim to systematically support the methods by appropriate tools. The tools shall be integrated into a personal software engineering environment prototype.

The environment is dedicated to the incremental development of distributed software systems. It provides a methodological support for specification and development of complex and reliable systems. Concepts, methods, and tools cover many technical activities in the software life cycle, and reflect the cyclic nature of software construction with the countercurrent validation processes.

The GMD team in GRASPIN is particularly involved with specification support and generator aspects of the environment kernel. Methodological improvements are expected, e.g. from combining Petri net theory with algebraic specification and from supporting different languages for different "phases" of the software life cycle. Technical improvements are expected, e.g. from syntax directed editing techniques and from object oriented programming techniques.

The project has developed prototypes of a personal software engineering environment to support the construction and verification of distributed and non-sequential software systems. Each of these prototypes provides a flexible framework with extensive facilities for the incorporation of new methods and tools, and for the customization to a variety of languages, applications, and target systems. The prototypes are implemented on Lisp systems and PCTE-based machines.

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MULTIWORKS – Multimedia Integrated Workstation

INRIA - The aim of the ESPRIT II project MULTIWORKS is to define a low cost multimedia workstation. The project is oriented towards two main axes:

Hardware axis. Based on RISC architecture, MULTIWORKS will integrate the forthcoming VLSI technology. To minimize the costs remaining compatible with PC's costs, some multimedia functions will be integrated directly on silicon.

Software axis. The MULTIWORKS machine will be based on the UNIX system compatible with international standards. The software architecture will offer an object-oriented environment to develop some advanced management application for multimedia documents as an hypertext system. The main functionalities of the workstation will be a high resolution bitmap, a scanner, a voice treatment interface ; these functionalities will be compatible with X-Windows standard.

INRIA is involved in three major subtasks:

- Voice recognition. In the framework of MULTIWORKS, a Nancy research team will work in the project SYCO on software for automatic voice recognition: definition of the management system, and input of voice data.

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- Language for an hypermedia system. A second research group at Rocquencourt will define and implement the MULTITALK language for hypermedia systems, in which text, drawing, voice, video, graphics, etc., are integrated. This system will be connected by symbolic links allowing a non-linear access to the documents. MULTITALK will be based on the same concepts as Hypertalk of Apple

and Notecards of Xerox. It will be adapted to the environments of hypermedia document editors proposed by Bull, Olivetti and ICL, which are partners in this project.

MULTITALK will be implemented on X-Windows with the help of SYNTAX and FNC-2 ; it will support tool kits such as ANDREW (IBM - CMU) and the HP - DEC toolkit adopted in OSF.

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- Management of ideas. The conception of a document does not only consist of the edition of texts, drawings and graphics. The main work is to elaborate the ideas. The productivity of the conceptor certainly can grow by offering him a strategy of generation, organization, evaluation and control of his ideas.

The objective of this subtask is the conception and implementation of such a tool and its integration in the hypermedia system of MULTIWORKS.

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CONCUR – Theories of concurrency: unification and extension

CWI - CONCUR is an ESPRIT II Basic Research Action. It will run from 1 Sept. 1989 to 1 Sept. 1991. CWI is coordinating partner. The other partners are the University of Edinburgh, Oxford University, the University of Sussex, INRIA (Sophia Antipolis), SICS (Swedish Institute for Computer Science), and the University of Amsterdam. Formal verification of software programs, protocols and chip designs, is becoming increasingly important, but up to now has been undertaken only on a very small scale, and with a multitude of techniques and formal theories. Normal academic interchange will slowly bring unity

into the disparate world of concurrency theories, but collaboration of a more intense kind is needed to accelerate the process. Among the many formal approaches which exist for concurrent communicating systems, the important algebraic approaches are represented in this project. The principal aims of the project are to explore the relationships among these different approaches, and to develop a formalism applicable to a wide range of case studies. In addition to collaborating at the theoretical level, we will collaborate through the development, use and comparison of software reasoning tools. This latter collaboration will serve both to further unity and to enhance the theoretical collaboration. Several of the partners already have ongoing tool building activities. The action will coordinate the participants' well-established programmes of research into theories of concurrency.

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GIPE II – Generation of Interactive Programming Environments II

CWI / INRIA - GIPE II is an ESPRIT II project aiming both at advanced research in the area of interactive environments based on formal specifications and at design, implementation and experimentation of real size environments for industrial applications.

This project continues and extends the research carried out in the successful ESPRIT I project 348 (GIPE) which ends in November 1989. The main results of the ESPRIT I project are - apart from scientific publications - a prototype interactive programming environment generator called Centaur. Taking as input the complete formal description of a pro-

gramming language, Centaur provides a toolkit of generic components and compilers for constructing a specific interactive environment for that language. This environment includes an editor, an interpreter/debugger and other tools, all of which have uniform graphic man-machine interfaces.

The main result of the GIPE project is that this technology is feasible. The GIPE II project aims at making it mature by several actions.

The research on interactive environments will address subjects like the construction and analysis of large formal language definitions. Functionality and performance of the generated environments are extended by studying incremental processing and concurrency, and by adding typographical and graphical facilities to the system. In addition to this, the Centaur system will be maintained, extended and distributed.

Furthermore, two demonstrator projects will evaluate the Centaur system in industrial applications. In the first project, a programming environment for scientific computing will be generated which aims at producing highly efficient Fortran code on a variety of pipelined and parallel architectures. In the second project, a prototype environment for the LOTOS specification language will be generated.

The GIPE II consortium consists of the following partners: ADV/ORG, BULL, CWI, GIPSI, INRIA, PLANET and PTL. The University of Amsterdam will act as an associated partner of CWI.

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INTEGRATION

CWI - The ESPRIT Basic Research Action INTEGRATION aims at integrating the foundations

of functional, logic and object-oriented programming. Functional programming has its mathematical foundations in the fields of lambda calculus and term rewriting, and logic programming is rooted in predicate logic and automatic theorem proving. Integrative efforts for these two programming styles have already vigorously been pursued for several years. For object-oriented programming it is generally felt that there is a strong need for a better understanding of its mathematical nature. Also, there is ample evidence that one may profit here from the insights from functional and logic programming, which justifies the organization of the integrative effort into three chapters: integration of the functional and logic, the functional and object-oriented, and the logic and object-oriented programming styles.

Participants in INTEGRATION are: CWI (coordinator), CAIMENS, Imperial College, UNINOVA, the University of Pisa, and Philips Research Labs (Eindhoven).

Altogether, the workplan consists of nine tasks, each task being allocated to a senior and a junior researcher from one of the partners, in close co-operation with a second senior researcher from one of the other partners. The duration of the action is thirty months, during which period crossfertilization between chapters is expected to increase. A final integrative effort is envisaged for a second phase after completion of the work of this action.

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LOGICAL FRAMEWORKS

INRIA - There has been a steady increase in recent years in research towards systems that can provide assistance with reasoning about a variety of problems, particularly in the development of hard-

ware and software systems. Such systems must be usable by programmers and hardware designers who are not experts in logic and so must provide a comfortable, problem-specific environment for developing formal proofs.

A wide variety of formal systems is of interest to systems designers (operational semantics, lambda-calculi, sequent calculi, type theories, first- and higher-order logics). The task of implementing a proof development environment for a given logic is daunting, and there is considerable duplication between implementations of different logics. It is therefore desirable to develop a unifying theory of formal systems that allows one to give a concise specification of the object logic. The proof development environment can then be logic independent, accepting a specification of logic to be used. This eliminates, in large measure, the redundancy between implementations, and one can rapidly prototype systems for a variety of logics. A "logical framework" is such a unifying theory of formal systems; it provides a notation and a calculus for specifying logics.

The proposers are currently experimenting with various AUTOMATH - related type theories, with variants of Church's higher-order logic and with a general system of operational semantics as a framework in which to conduct formal proofs. One aspect of the proposed research is to understand the relationships among these systems. It appears, on present evidence, that some form of typed lambda-calculus is a basic component of such a framework. A common point of implementations is their ability to provide the user with proof-search procedures. It is expected that the experience gained in such endeavors will be among the principal results of the proposed collaboration. Most prototype software is written in ML (a functional pro-

gramming language oriented towards symbolic computation). This will enhance collaboration among the participants. Besides scientific publications, the expected result is a demonstration of feasibility and usefulness of "developing certified software in the large".

LOGICAL FRAMEWORKS is an ESPRIT Basic Research Action, and involves mostly two INRIA projects:

- the CROAP project at INRIA Sophia is working on the User of logical formalisms for the specification of the semantics of programming languages. Through this Basic Research Action, the theoretical aspects of this field are studied as well as the setting up of an elaborate interaction system to build and operate mathematical proofs (interaction, tactics, semi-automatic proofs).

- through INRIA's FORMEL project, attention is focussed on the construction calculus designed by Th. Coquand and G. Huet. This is a higher-order typed lambda-calculus, including the so-called dependent types that are practically attractive. Its metatheory is very rich, which opens good prospects for concrete applications. A prototype already exists, written in CAML (INRIA's ML dialect). It includes a mathematical vernacular, and provides the user with program extraction from proofs procedures as well as partial proof synthesis algorithms. Another research direction followed by Ph. Le Chenadec consists of investigations concerning the problem dual to proof synthesis: type inference. In these two research trends, numerous partial results, both theoretical and practical, witness the practical value of a highly formal approach to programming activity.

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SEMAGRAPH

CWI - ESPRIT BRA project SemaGraph concerns the foundations of graph rewriting. Its main objective is to develop knowledge relevant to the semantics and pragmatics of generalized graph rewriting. Our rather general notion of graph rewriting theory extends term rewriting notions to include sharing, multiple non-root rewriting and explicit control of reduction order. These can be used for optimized reduction, side effects and process communication and synchronization. Taken together, these extensions provide a potentially unifying framework for a variety of models of computation, including: functional languages, logical languages, object-oriented languages, and parallel generalizations of imperative languages. A computational model based on graph rewriting might provide the basis for a 'common virtual machine' to support European work on various symbolic and other languages.

Participants in SemaGraph are: CWI (Amsterdam), ICL (Manchester), ICST (London), the University of Nijmegen, LIENS (Paris), and UEA (Norwich) (main contractor). The project will bring together participants from various European IT programmes in a united attempt to further develop European foundational knowledge about graph rewriting. Industrial participation at observer level will aid in establishing priorities for the various investigations, and provide a channel via which relevant results can be rapidly fed to shorter term research projects.

SemaGraph started July 1, 1989, and will continue for 30 months. It will bring together and enhance knowledge in the following areas of generalized graph rewriting systems (GGRS): formal descriptions and abstract models, relating other models to GGRS, controlling reduction order and typing, static

analysis, and efficiency of normalizing lambda graph reducers.

By identifying those results which carry over from the term world to the graph world, and by a better understanding of the constraints on a rule system necessary for efficient implementation, SemaGraph will be of direct interest to larger ESPRIT II projects, particularly those concerned with general and special purpose rewriting formulations of both symbolic and numeric problems for parallel machines.

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TROPICS

CWI - TROPICS is an (industrial) ESPRIT-II project, aimed at the development of a high performance parallel system for the office. The project is structured around eight subprojects including architecture, operating system, database management, and the construction of an office application. It re-uses and builds on the experience gained in several ESPRIT-I projects (415,302,967,1588,28), and the PRISMA project funded by the Dutch computer science stimulation programme SPIN.

The TROPICS consortium consists of five main partners: Philips, Olivetti, Thomson, CAP-SESA, and Nixdorf. The project started in January 1989 and the first phase ends in June 1990. CWI will participate as a subcontractor of Philips with the following activities:

- Design of a datamodel for complex objects. In particular, we will extend the relational and NF2 models to deal with both multimedia and cartographic objects.
- Implement a prototype query processor for this model on top of the PRISMA architecture.
- Consult and aid the partners in extending the PRISMA DBMS

architecture to efficiently support the two application areas mentioned above.

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ToolUse - An Advanced Support Environment for Method-Driven Development and Evolution of Packaged Software

GMD - The project aims at providing means for active assistance in the design, implementation and evolution of software.

The underlying hypothesis for the guidance of this project is that such an assistance should be obtained by describing the development of software in a formalized manner such that this description itself can be manipulated, e.g. for describing the development of a slightly modified piece of software. The development of such a formalized description can only be based on a thorough understanding and formal definition of methods driving the process of software construction from the first description within a framework of an application oriented specification language to the stages of implementation, use, and continued evolution. The use of a formalized description must rely on the existence of an advanced support environment. This support environment in turn must comprise tools relying on the understanding, acquisition, representation and reuse of knowledge and constraints related to information processing techniques depending on given application areas and on target systems.

The project is supposed to provide a prototype environment containing an adequate user interface supporting the use of the development language, an underlying database, and a set of tools supporting the whole development process.

GMD is participating in the tasks concerned with the development of a development language, a support environment and support for program development.

In addition to contributing to the current definition of Deva, GMD has developed the following support tools so far:

- A generator for graphical user interfaces (G²F),
- a theorem prover for intuitionistic logic (TILT),
- a tool for semi-automatic complexity analysis (COMPLEXA),
- an implementation of the program development method of D. Smith (PROPER).

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RESEARCH ACTIVITIES

Semiconductor devices

CWI - Two types of simulations are of prime importance for the development of semiconductor devices: 'process modeling' of the diffusion processes describing the etching processes which give the shape to the devices, and 'device modelling' of the electric field and the electric currents inside the semiconductor material. This simulation boils down to the solution of a system of three coupled, highly non-linear and terribly scaled elliptic partial differential equations.

In view of the coming sub-micron technology it is expected that the physical models have to be extended and that the numerical problems encountered will be correspondingly harder. But even with the present physical model, the available numerical techniques are felt to be inadequate. Although in

industry several simulation programs are available, the applied methods are not yet sufficiently robust and efficient. The few efficient programs are applicable only for small sub-classes of the problems of interest. Numerical techniques for the device modeling are currently studied in CWI's Numerical Mathematics department. Research concentrates on fundamental issues: discretization methods for singularly perturbed problems and multigrid and adaptive methods for the non-linear algebraic equations resulting from the discretization.

Close contacts exist with Philips CFT Centre in Eindhoven; the research is supported by the national innovation programme IOP.

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EUROMATH

CWI - Euromath started up in 1987. It is an international project, initiated and monitored by the European Mathematical Trust under supervision of the European Mathematical Council, and sponsored by the European Commission. The aim is to stimulate the research potential of European mathematicians, by creating a research environment, the Euromath system, based on modern information technology specifically adapted to the needs of the mathematical community. CWI is one of the technical partners in the project with main responsibility for the functional design of the Euromath system.

Facilities envisaged are: electronic mail and conferencing, production and mailing of mathematical documents, mathematical databases with data on articles (published or to appear), mathematicians (addresses, specialisms, etc.), conferences, meetings, work-

shops, research facilities and their financial support, and other facilities such as a possible integration of computer algebra systems in Euromath. A number of these facilities is already available, but Euromath offers them in one integrated computer environment.

Driving force behind Euromath was (and is) the Danish mathematician F. Topsøe. At present 19 countries participate, representing a potential of 10.000 researchers in 500 centres. There are also contacts with the USA and Eastern Europe.

The Euromath project is due to be completed on December 31, 1992. During the last, operational phase the establishment of a permanent Euromath Centre for general services is envisaged.

The first phase of Euromath ended on June 30, 1989. GMD, INRIA and CWI, have expressed their great interest in the second phase of the project, in particular because Euromath II would be the first project in which all three institutions participate. The definitive decision about funding for the second phase is expected to be made in September.

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NANA - Novel Parallel Algorithms For New Real-Time VLSI Architectures

INRIA - The main theme addressed in this ESPRIT BRA project is the development of novel parallel algorithms and real-time VLSI architectures for multi-dimensional signal processing and their introduction in computer-aided synthesis environments.

The project is oriented towards the development of efficient multi-dimensional subsystems needed in application domains such as video, image processing, robotics, radar, sonar, seismic processing, telecom-

munication, factory automation, vision, advanced process control, biomedical technology, and so on.

The most important class of techniques needed in these domains are algebraic and numerical techniques for multi-dimensional problems such as linear system solving, least squares solution of overdetermined systems resulting from measurement data, eigen- or singular value computation, finite element modelling, coordinate transformations in robotics, etc.

The project will study and propose novel algorithms for these techniques. It will thoroughly investigate the implications of these algorithms on the choice of processing architectures. Synthesis strategies for making possible the future design of high-complexity applications in mega-chip technologies, will be an important research topic of the project.

The institutions involved in this project are IMEC (Leuven, Belgium), the Catholic University of Leuven (Belgium), Delft University (The Netherlands), IMAG / TIM 3 (Grenoble, France) and IRISA-INRIA (Rennes, France).

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RelaX - Reliable Distributed Applications Support on Unix

GMD - RelaX is a software layer on top of the UNIX kernel that provides system support for reliable distributed applications in form of a generalized transaction mechanism. Its functionality is available as a procedure library and relieves the programmer of dealing explicitly with concurrency control and error recovery in each distributed application. The transaction mechanism is isolated in a server and cooperates with an

extensible set of resource managers which provide different kinds of persistent, sharable data (e.g. file systems, object management systems, specialized databases). It is designed to support a broad range of applications and thus incorporates significant extensions to the conventional transaction concept used in database systems. These extensions aim to make transactions flexible and efficient to use: they comprise extended nesting by independent recovery and synchronization levels, fast recovery in virtual memory, possible separation of the completion of a transaction from its commitment to allow efficient group commitment, premature release of uncommitted data achieved by non-strictly 2-phase locking. Dependencies between transactions that result from the use of uncommitted data are recorded by the transaction mechanism and taken into account when transactions commit or abort. The flexibility introduced by these extensions makes transactions applicable as a general programming tool for reliable distributed applications.

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STONE – A Structured and Open Environment

GMD - STONE is an EUREKA project to build a software engineering environment (SEE) for education purposes. "Education" means software engineering education as well as environment engineering education. This domain requires that the environment is extremely simple and easy to learn, open for a quick integration of methods that shall be taught, and well structured in order to teach environment engineering.

At present the STONE partners have started with the detailed definition of the desired environment and its interfaces. STONE will be developed with the contribution of French and German partners. The German partners started their work in May 1989. These partners are Forschungszentrum Informatik, Karlsruhe, Fraunhofer Gesellschaft IITB, Karlsruhe, Gesellschaft für Mathematik und Datenverarbeitung mbH, Sankt Augustin and Karlsruhe, Technische Universität Berlin and Zentrum für graphische Datenverarbeitung, Darmstadt. On the French side the proposed partners are AEROSPATIALE and the Centre d'Etudes et de Recherches de Toulouse (CERT). They will start with their work items by October 1989.

The GMD contributes to STONE in two ways. First, a number of tools are developed which will support the management of software documents, their versions and their interrelationships in a multi-user environment. Secondly, the support environment of the design language DEVA, which is developed in the ToolUse project, will be integrated into the STONE environment to provide a realistic education of formal methods in practice.

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Expertise Centre Computer Algebra gets off to a good start

CWI - A starting subsidy of 1,7 million Dfl was allocated by the Dutch Ministry of Education and Science in March, 1989, to the establishment of an expertise centre for computer algebra (CA) in The Netherlands. The centre will be located at the Centrum voor

Wiskunde en Informatica (CWI) in Amsterdam. Scientific management comes under the foundation Computer Algebra Nederland (CAN), set up last December for the benefit and support of research and development in the field of computer algebra. Similar activities were already developed in other countries, e.g. France and West-Germany, because of the increasing number of researchers and users of CA. There exists also already for quite some time a European organization, SAME, which regularly organizes international conferences on CA in close cooperation with ACM-SIGSAM.

The subsidy, granted for a period of three years (1989-1991), will be used for the purchase of computers and the appointment of two staff members. Activities will concentrate on procuring researchers and users access to a central computer specially designed for CA-software, and providing them with workstations and software by means of which they can utilize this central facility through well-functioning communications (in this case SURFnet, the Dutch network of the Organization for Cooperation in Computer Support in Higher Education and Research SURF).

Moreover, the expertise centre will provide services including information about CA-systems (price and terms of delivery, documentation, required hardware, etc.), advice on the use of these systems, and if necessary expert consultation. Several CA-systems will become available through the SURF-network. At the university of Nijmegen, 'cana' - a Sun-4/280 with 32 MB main memory - is already operating within the CAN framework. Some of the installed programs are Reduce, Maple, Mathematica, Macaulay, and Lie. Activities also include the organization of meetings, workshops and courses.

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GMD Buys SUPRENUM Supercomputer

GMD - SUPRENUM, the first marketable supercomputer developed in the Federal Republic of Germany, was bought by GMD at a price of 21.5 mio deutschmarks. The purchase was financed by the Federal Government via special funding. These were the news presented by Prof. Dr. Gerhard Seegmüller, chairman of the executive board of GMD, and Prof. Dr. Ulrich Trottenberg, speaker of the SUPRENUM GmbH management.

The SUPRENUM supercomputer which is able to do five billion floating point operations per second (GFLOPS) will be used within the so-called Höchstleistungsrechenzentrum (supercomputing centre) operated by GMD, Kernforschungsanlage (KFA) in Jülich und Deutsches Elektronen-Synchrotron (DESY) in Hamburg to solve scientific problems considered so far unsolvable due to the lack of sufficient computing capacity. These are problems of high energy physics, aerodynamics and climatology on the one hand, but also problems of chip design and fundamental questions of numerical mathematics on the other. The SUPRENUM supercomputer developed for using new computing methods will again help to develop new computing methods. Since GMD continues to advance the SUPRENUM concept, the supercomputer will also be used to design its own successor model.

SUPRENUM GmbH hopes that more than half a dozen SUPRENUM systems will be installed in the German-speaking area by the end of 1990. This is a great lot if one considers that a total number of only 23 supercomputers have been installed in the Federal Republic of Germany during the last 15 years.

In 1990 SUPRENUM GmbH will intensify its activities on the European and extra-European mar-

kets. The first installation there is expected for 1991. The activities of SUPRENUM GmbH will however not be restricted to universities and publicly funded research, but will also be directed towards industry. It is hoped to sell the first SUPRENUM computer in the industrial sector in 1990/91. On medium term, SUPRENUM GmbH intends to sell every second supercomputer to industry. Thus, SUPRENUM will compete on this market with American and Japanese manufacturers.

Some weeks ago, the Commission of the European Communities approved the research project Genesis to be conducted jointly by several Member States. This project, which is to focus the development efforts of the participating Member States and institutions on a powerful supercomputer, is mainly based on the SUPRENUM concept which is thus recognized on a European basis. Therefore, the work on Genesis and that on SUPRENUM 2 will benefit from each other.

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INTERNATIONAL RELATIONS

Agreement with Columbia University

INRIA - An agreement was signed on March 17, 1989 between INRIA and the Center for Telecommunication Research at Columbia University. The aim of this agreement is to further the development of cooperation between the two research institutions in information processing technologies and telecommunica-

tions. This agreement encompasses:

- exchange of researchers,
- exchange of scientific publications,
- joint seminars,
- exchange of software for research purposes for the next three years in the following areas: image and speech processing, parallel and distributed algorithms, VLSI systems, artificial intelligence, modelling and performance evaluation, integrated communication networks, communication protocols, numerical and symbolic software, and computational complexity.

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European deputies at Sophia Antipolis

INRIA - A delegation of thirty European deputies, led by Mr. Adam, Vice-President of the Commission for Energy, Research and Technology, visited INRIA-Sophia Antipolis on March 21st.

Mr. P. Bernhard, director of the institute, gave a presentation of the institute, its international (particularly European) cooperative efforts, as well as its main industrial contacts.

Then followed the presentation of software developed by two new companies located in Sophia-Antipolis and founded by researchers: ISTAR, created by Laurent Renouard, who recently wrote his thesis while working in the project PASTIS (INRIA-Sophia Antipolis) and by other members of PASTIS; and SOPHATEC, cofounded by Serge Miranda, professor at Nice University.

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Visit of scientific counselors West-Germany and France

CWI - In the framework of the GMD-INRIA-CWI cooperation, the scientific counselors of the Federal Republic of Germany, Mr. H. von Graevenitz, and of France, prof. M. Girod, visited CWI on March 9. They were informed about CWI's science policy in general, and the co-operation with GMD and INRIA in particular, and attended some demonstrations of ongoing research in the field of computer graphics, distributed systems and cryptography. The meeting was also attended by Mr. E. Schenk of the Netherlands organization for scientific research (NWO), CWI's main sponsor. Mr. Schenk is responsible for NWO's international relations.

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Visit of Prof. Meng from Taiwan

CWI - Prof. Hsien-Chung Meng, member of the National Science Council of Taiwan and director of its Frankfurt-based European Office, visited in the middle of March a number of research institutes in The Netherlands, among which CWI. Purpose of the visit was to explore possibilities for contacts and exchanges between Taiwan and The Netherlands.

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EVENTS

Second International Conference on Japanese Information in Science, Technology and Commerce

GMD - From October 23 to 25, 1989, GMD will organize an international conference on various aspects of Japanese Information in Science, Technology and Commerce. The conference will be held at the new Japanese-German Centre in Berlin.

The conference will be sponsored by further organizations in the Federal Republic of Germany, Great Britain, the USA and Japan. More than 50 papers on the four main subjects have been received so far, i.e. on general problems of information flow, new information about information sources, state of the art of analysis and services as well as contributions to overcoming the language barrier.

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France-Japan symposium

INRIA - Dr. Iwata from the ICOT Institute has recently visited INRIA and met with Laurent Kott at the INRIA Research Center in Rennes. They organize together the next France-Japan symposium which is going to take place November 15-16-17 on Izu Peninsula (Japan).

The chair persons of this symposium are Laurent Kott (INRIA) and Kazuhiro Fuchi (ICOT). The major areas of this meeting will be:

- parallel languages and their semantics,
- all languages and architecture,
- software science and engineering,
- all applications (including natural language processing),

- automated deduction and symbolic computation.

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Conference on Very Large Databases

CWI - The Fifteenth International Conference on Very Large Data Bases, VLDB 89, was held on August 22-25, 1989, in Amsterdam. There were 500 participants. The programme included a tutorial part with five well-known speakers: C.J. Date (The foreign key Saga), K.R. Apt (Top down versus bottom up computing in deductive databases), G.M. Nijssen (An effective design method for relational databases), S.B. Zdonik (Research directions in object-oriented databases) and M.L. Brodie and J. Mylopoulos (Integrating AI and database technologies). The key-note speech was given by Hervé Gallaire, director of the European Computer Industry Research Centre.

The following topics were covered: logic, deductive and temporal databases; dependency theory and integrity enforcement; object-oriented and extensible databases; engineering-, design-, and multimedia databases; query languages and query optimization; storage management; database machines; and distributed systems.

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Workshop on Stereology & Spatial Statistics, Stochastic Geometry and Image Analysis

CWI - An international workshop on Stereology, Stochastic Geometry and Image Analysis was held at CWI on 10-12 September,

1989. This meeting was the fifth in a series initiated at the University of Aarhus (Denmark) in 1981 and held subsequently in Bath (UK) and Berne (Switzerland). These workshops are organized as a forum for specialists (applied and theoretical) to discuss new developments in the three fields.

Special themes for this meeting were: non-uniform sampling designs in stereology and image analysis, marked point process models of images and spatial data, and mathematical morphology from alternative viewpoints (algebraic formulations, statistical models). Also several demonstrations of software for image processing and spatial data analysis were given.

A number of distinguished researchers from abroad gave a talk at the workshop, including R.E. Miles (Canberra) and J. Mecke (Jena), world authorities on stochastic geometry. Researchers active in image processing were also strongly represented, the fields including stochastic image modelling (B.D. Ripley (Glasgow), P.J. Diggle (Lancaster), C. Jennison (Bath)) and morphology (members of the Fontainebleau group, C. Ronse (Philips, Brussels)).

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Second International Workshop on Protocol Test Systems

GMD - Design and implementation of protocol test systems is the subject of a workshop to be held from October 3 to 6, 1989 in Berlin. Experts from research and practice will be able to obtain information about new methods and techniques of protocol testing in systems such as OSI, ISDN and IBCN.

Available test tools will be presented, possible future develop-

ments and applications of test tools will be discussed. The workshop is organized by the GMD Research Center for Open Communication Systems in Berlin and the European Center for Network Research of IBM in cooperation with the Committee 6 of the International Federation for Information Processing.

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Summer course on constructive methods in fractal geometry

CWI - Based on Michael Barnsley's recent book 'Fractals everywhere' (Academic Press 1988), this course -held at the end of June at CWI for 80 participants- considered in particular two aspects of fractal geometry: iterative construction of fractals, and techniques for approximating given images by fractals. The course was given on a rather elementary level and treated subjects as metric spaces, contractions, construction of fractals, chaotic dynamics on fractals, fractal dimensions, fractal interpolation and measures on fractals.

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Intelligent CAD workshop

CWI - Thirty-five participants from eleven countries attended the third Eurographics workshop on Intelligent CAD, held on April 3-7, 1989, at Hotel Opduin on the island of Texel, The Netherlands. The workshop theme was "Practical Experience and Evaluation" and covered the following topics: design process, sys-

tem architecture, languages, geometric reasoning, and user interfaces. The design process was treated theoretically in a logical and a psychological approach, and more practically using product modelling as a basis. Discussions on system architecture included database manipulation, constraint propagation and the application of a history mechanism. The session about languages treated IDDL - a programming language designed for ICAD systems - , as well as a logical and graphical language for representing CAD knowledge. For geometric reasoning, the value of constraint propagation was recognized. Concerning user interfaces for ICAD, it became clear that a lot of basic research still has to be done.

A selection from the papers presented will be published by Springer Verlag as "Intelligent CAD Systems 3 - Practical Experience and Evaluation" (editors: P.J.W. ten Hagen and P.J. Veerkamp) in the Eurographics Seminar series. Organizers of the next workshop (last week of April, 1990) are J.-P. Barthes and K. El Dahshan of the Université de Technologie de Compiègne, Dépt. de Génie Informatique, C.N.R.S. UA 817, BP 233, 60206 COMPIEGNE Cédex.

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GMD Forum "Expert Systems for Industry and Science"

GMD - From June 7 to 9, 1989, the GMD in Sankt Augustin held a forum presenting the most advanced industrial expert system developments to interested people from industry and science. The system range reached from systems for speech recognition via configuration and automatization systems to expert systems for vehicle optimization in the wind tun-

nel. The presented systems originated from VW, Siemens, Hewlett-Packard, Infodas and from the Research Institute of the German Bundespost. The choice of the system reflected an important new development trend towards technical task automatization, especially in construction and configuration. The forum has shown the development lead of technical expert systems over business or other expert systems.

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INDUSTRIAL TRANSFER

PLATO – Gate Assignment at Schiphol Airport

CWI - Some 500 aircraft land at Schiphol every day, they stay for given periods and depart again. The complex logistics at the airport have a major influence on economic viability, with aircraft location during sojourn playing a crucial role. Between 1986 and 1988, CWI helped develop a planning system for the seasonal planning of aircraft-stand allocation at Schiphol Airport. It is an interactive system, formulated mathematically as an interval scheduling problem or a resource constrained scheduling problem. For the time being it uses only a simple heuristic (priority rule). The system, named PLATO (a Dutch acronym), consists of a data module, developed by a team of Schiphol Airport, and a planning module, for which CWI bears responsibility. Presently a system for the daily planning is being developed.

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CAR – Computer Aided Routing

CWI - CAR (Computer Aided Routing) is an interactive software package which has been developed at CWI during the years 1985-1988 as a tool to support physical distribution management. CAR enables the user to construct economical vehicle routes and schedules in a simple way. During the design and development of CAR the co-operation and feedback from the Dutch road transportation company Van Gend & Loos (at the same time the first user) was indispensable. At present CAR is marketed by the Dutch logistics company Logion.

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Overload control

CWI - The team of J.H. van Schuppen and P.R. de Waal is studying overload control problems for communication systems. In case of overload at a telephone exchange, the delays cause angry reactions of customers and result in a decrease of the effective throughput of the exchange to unacceptable low levels. Therefore access control algorithms must be used which are sufficiently robust to be effective at several levels of overload. The approach to this problem is based on stochastic control theory and queueing theory.

This research is financially supported by the Stichting voor de Technische Wetenschappen (Technology Foundation), a government agency which tries to promote co-operation between academic institutes and industry. The project runs for a period of 4 years until January, 1990.

Knowledge transfer is promoted in several ways. The project has an advisory committee which

meets twice a year with researchers from the companies Philips Telecommunication and Data Systems Nederland B.V. and AT&T Network Systems International, and from the national telephone company PTT and its main laboratory, the Dr. Neher Laboratorium. The task of the committee is to assist the research team and help it with making the results useful for practice. During the project frequent contacts were maintained with the companies mentioned.

A two-month visit of Peter de Waal to the INRIA Centre Sophia Antipolis for co-operation with Ph. Nain has been beneficial to the investigation. This visit funded in the framework of the separate twinning programme between INRIA and CWI.

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LE-LISP

INRIA - Since 1987, the LE-LISP club brings together software houses and computer manufacturers involved in LE-LISP. The last meetings pointed out the evolution of the normalization and the quality and quantity of the diffusions in France and abroad. The number of licences is increasing significantly year after year. INRIA has signed more than twenty provisions of LE-LISP on the machines for which INRIA did the ports (VAX / UNIX, SUN 3 and SEQUENT).

Version 16 of LE-LISP should appear in October. The kernel of this new version will be the starting point of the Eureka project ELSY (European Lisp SYstem) which brings together CRIL, BULL, ILOG and GMD.

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SPHINX Club created

INRIA - The SPHINX software was developed by the SCORE team at INRIA Rocquencourt. The aim of this system is to help the simulation of real time protocols. It is based on an "event-driven" simulation kernel. This software will, in the near future, be industrialized and commercialized by a French company.

In parallel, INRIA has created the SPHINX club, composed of universities and research institutes, to coordinate the conditions of the licences and the developments to be done on SPHINX. President of the club is P. Rolin, who was a researcher at INRIA and is now professor at the ENSTA. The first meeting took place on June 21 at INRIA Rocquencourt.

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Collaboration with CRAY Research

INRIA - INRIA and CRAY Research signed at the beginning of 1989 a collaboration agreement concerning the development of optimization techniques for vectorized programs. These techniques will allow gains of more than 50% in the program kernels. They will be extended to the CRAY3 machines.

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INRIA-GIPSI SA collaboration

INRIA - A. Lichnewsky's project has collaborated with the Public and Industrial Group "GIPSI SM 90" and then with the company GIPSI SA for the devel-

opment of a floating point vector processor (PVF) which considerably increases the performance of the BULL DPX 1000 workstation in the floating point mode. This processor is now commercialized by GIPSI SA.

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LIFE IN THE INSTITUTES

Symposium in honour of Piet J. van der Houwen

CWI - Prof. Piet van der Houwen, head of the department of Numerical Mathematics, joined CWI 25 years ago. This fact was celebrated with a symposium on the theme 'Construction of stable numerical methods for differential and integral equations'. Speakers included H. Brunner (Memorial University of Newfoundland), Th.J. Dekker (University of Amsterdam), M.N. Spijker (University of Leiden), and J.G. Verwer and B.P. Sommeijer (both CWI). Since 1975 Van der Houwen is also professor of numerical mathematics and computer science at the University of Amsterdam.

Symposium in honour of Jaco.W. de Bakker

CWI - Prof. Jaco de Bakker, head of the department of Software Technology, joined CWI 25 years ago. This fact was celebrated with a symposium under the title '25 years of semantics'. Speakers included J.V. Tucker (University of Leeds), A. Nijholt (University of Twente), P. America (Philips Research Laboratories Eindhoven),

J.A. Bergstra (University of Amsterdam), D.S. Scott (Carnegie-Mellon University, Pittsburgh), W.P. de Roever (University of Eindhoven) and E.-R. Olderog (University of Kiel). Since 1973 De Bakker is also professor of computer science at the Free University of Amsterdam.

INRIA-Visit

INRIA - A delegation of thirty RPR deputies, lead by Mr. Jacques Chirac and Mr. Alain Devaquet, visited INRIA - Sophia Antipolis on March 31st. After a general presentation of INRIA and its research unit in Sophia-Antipolis, they visited the Robotics Laboratory, where Mr. Jean-Daniel Boissonnat, leader of the PRISME project, explained the scientific objectives and the accomplishments of his project.

PEOPLE . . .

GMD - Prof. Radu Popescu-Zeletin has been appointed head of the GMD Research Center for Open Communication Systems (FOKUS), in Berlin. In this function he is successor to Prof. Karl Zander. Prof. Dr. Radu Popescu-Zeletin was also appointed professor for open communication systems at the Technical University of Berlin.

GMD - Dr. Stefan Jähnichen, head of the GMD Research Group for Program Structures, was appointed professor by the University of Karlsruhe. Jähnichen focusses his work on teaching and research in the field of program structures and data organization.

GMD - Dr. Hans Martin Wacker, formerly head of the Hauptabteilung Zentrale Datenverarbeitung der Deutschen Forschungsanstalt für Luft- und Raumfahrt, was appointed head of the GMD Institute for Computational Infrastructures on May 2, 1989.

GMD - Dr. Eike Best, member of the GMD Institute for Foundations of Information Technology, was appointed professor for theoretical informatics by the University of Hildesheim. Best focusses his work on research and teaching in the fields of formal semantics, Petri nets and concurrency.

GMD - Ernst-Joachim Freiherr von Ledebur, advisor on international affairs of GMD, has retired for age reasons. Before joining GMD, Freiherr von Ledebur was working in the field of technical information for the Gesellschaft für Information und Dokumentation.

CWI - Prof. Jaco de Bakker, head of the department of Software technology, has been elected a member of the Royal Netherlands Academy of Arts and Sciences. De Bakker's research concentrates on the semantics of programming languages.

CWI - Ko Anthonisse, researcher in the Department of Operations Research, Statistics, and System Theory, and associated with CWI since 1961, left on April 1, 1989, for a consultancy position in industry. At CWI he mainly worked on combinatorial optimization problems and decision support systems.

CWI - Prof. Jan Karel Lenstra, head of the Department of Operations Research, Statistics, and System Theory, left CWI on July 1, 1989, to accept a professorship in Mathematics, in particular Optimization and Planning, at the Technical University of Eindhoven. He is succeeded by Onno Boxma, who was a project leader in the department. Lenstra, member of a well-known family of Dutch mathematicians, came to work at CWI in 1969.

INRIA - Bernard Lorho, professor at Orléans University and Scientific Head of the project "Languages and Translation" at INRIA has been appointed Director of the Center of INRIA Rocquencourt.

INRIA - Maurice Robin, formerly Vice Director of INRIA, has been appointed responsible of the Department of Mathematics and Information Technology at the French Ministry for Research and Technology.

INRIA - Patrick Valduriez came back from the USA where he stayed four years at MCC - Austin. From September 1st he is Scientific Head of the project SABRE.

INRIA - The selection committee for the attribution of foreign fellowships has met at INRIA on the 29th of May. 42 candidates applied, 15 were selected and obtained a fellowship to spend a research stay in a foreign laboratory. 12 will stay in North America (USA and Canada), 1 in Japan and 2 in Great Britain.

