

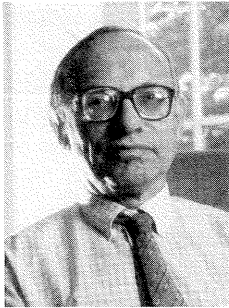
ERCIM NEWS

European Research Consortium for Informatics and Mathematics

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Prof. Peter Kirstein, from the Department of Computer Science, University College London, emphasizes the importance of a European dimension in network management.



EDITORIAL

Over the last decade, the interconnection of European research institutions has grown at an impressive rate. Examples are: the near universal availability of electronic mail, the impressive number of CEC projects with a similar set of partners, the rapidly emerging directory services, and the ability to envisage on-line research collaboration between most major research groups in Europe.

The originally purely National groupings of research groups, whose interactions were greatly helped by computer network links, were only later on supplemented by international grouping. Here a separate European dimension is vital to avoid being swamped by the transatlantic activities in research networks which, although usually ahead of ours, are not always correct for us.

This issue, with its theme of Network Management activities within ERCIM institutes, addresses issues vital to the success of the ERCIM goal to foster the European groupings in research – with broad ramifications. Several of the papers ostensibly describe just the developments of National or regional networks for research; even a perfunctory reading of the multiplicity of services, speeds and protocols these networks must embrace show that network and resource management issues dominate the technical activity behind the developments.

The major National research networks incorporate network management systems of various degrees of sophistication – usually as a result of evolution rather than a top-down design and development. From the beginning, the European RACE programme recognised the importance of network, resource and application management as major research themes. It is particularly encouraging that so many of the ERCIM organisations are collaborating in these aspects of the RACE programme. These collaborations are broad; for instance no less than six of the eight have some relations in this area with my own institution. The next generation of networks for research will be based on the Asynchronous Transfer Mode (ATM) technology which is the theme of several of the papers here. Moreover there are currently some differences between the European network management activities and those of the US; it is particularly important that there be informed network specialists in Europe who can discuss the alternate approaches internationally from a solid technical base of experience.

Three of the ERCIM laboratories will be participating with my institution in the first stage of the forthcoming Multimedia Integrated Conferencing for Europe (MICE) pilot project, and others are expected to join later. The network and resource management activities outlined here are vital to the successful outcome of that project – and that application will provide a stringent test for the applicability of the techniques being developed.

The activities of the ERCIM institutes will play an increasing role in the evolution of services to aid collaboration of European researchers; the development of standard mechanisms for network management will be a key element to success in this endeavour.

Peter Kirstein

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Next Issue:

Parallel Architectures

News from the Executive Committee

by Bob Hopgood

The Directors, at their meeting in Pisa, decided that it was time for ERCIM to be more proactive. The membership had grown to 8, the ERCIM European Economic Interest Grouping was being established so that ERCIM was a legal entity and carried weight. In consequence, the decision was taken to have an Executive Committee which would meet more regularly than the Directors could, and to which the Directors delegated some authority and a number of actions.

I have been Chairman of this body which has one member for each ERCIM partner. We have been working on quite a broad front trying to sort out items such as: making bids to the European Commission, looking at the possibility of further ERCIM membership, revamping the Workshop Programme, trying to establish an ERCIM policy and, finally, getting ERCIM better known. I will touch briefly on each of these.

European Proposals

Most of our effort was spent putting a number of proposals to the Human Capital and Mobility Programme (HCM). We sought support for extending the ERCIM Fellowship Programme, starting some internal mobility and funding our workshops. Not all of the proposals have been assessed yet but the bid to extend the ERCIM Fellowship Programme in 1993 was successful. We have been able to double the number of Fellows, and the EC-funded ones are for a period of 2 years. This is the first positive sign for ERCIM in terms of EC recognition and will impact ERCIM institutes early in 1993 when the first Fellows arrive.

We have also bid against the East-West mobility programme, and are looking at other areas where it would be appropriate to bid for EC funds to enhance the programmes that we believe in.

Membership

The two new members likely in the near future are Sweden and Spain. The Swedish partner, SICS, joined ERCIM at the meeting held at Heraklion, Crete. We are still negotiating with the possible Spanish partner. Not all countries have major government-funded research laboratories, so it is not always easy to establish who would be the best partner in each country. Spain is rather special as they have proposed a consortium called AEDIMA which represents the main universities in Spain. We have welcomed their efforts and hope to resolve the situation in 1993.

The Executive Committee is doing a survey of the remaining European countries to see if further ERCIM partners make sense. There is no point in getting partners just for the sake of it, but if obvious partners exist in other countries and they are keen to join, the Executive Committee is only too pleased to organise a visit!

Workshops

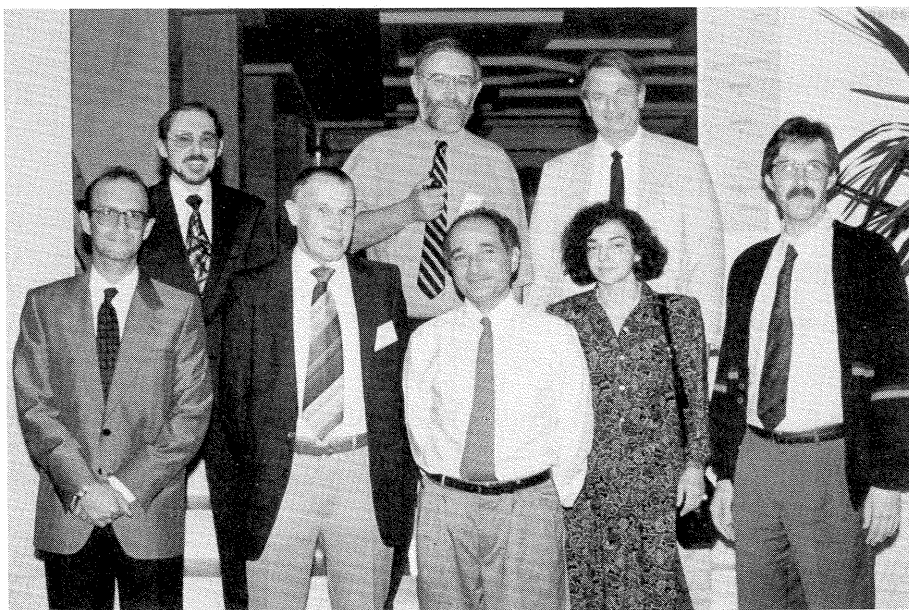
There has been a growing belief that the current bi-annual workshop programme is no longer meeting the needs of ERCIM.

While we were getting to know each other, workshops where each partner told the other what they were doing was sensible. Our belief is that researchers are now getting to the stage where they have established areas of common interest and would like to spend time having in-depth discussions, and attempt to move the state-of-the-art forward. Starting with the workshops in Norway in the Spring of 1993, we are going to move to a new format which allows much more time for discussion.

Policy

Now that ERCIM has grown to a size where it represents a significant portion of the research effort in Europe, we believe we have a responsibility to respond to European Commission Policy Papers. In consequence, we have been looking at the possibilities. Clearly the Fourth Framework Programme is of major interest, as is the High Performance Computing and Networking Initiative. There is also the relationship that Europe should have to external initiatives such as the Japanese Real World Computing initiative.

We decided to concentrate on the Fourth Framework programme first, and have produced an ERCIM Policy statement which has been published and is available from any of the ERCIM partners. We hope it will influence the final form of the programme.



Members of the ERCIM Executive Board at the meeting held in Crete at the end of November last year. (Photo: FORTH)

Publicity

Having attained legal status, we decided that we needed to increase the visibility of ERCIM. ERCIM News is a major activity in that area. We have also decided to start a number of Report series with a unique ERCIM cover. The first two series will be the Workshop Reports and Research Reports from our ERCIM Fellows. We shall also publish Policy Papers in the same distinctive cover which was prepared by the Editorial Board. In addition, we also had a stand at ESPRIT Week to broaden the awareness of ERCIM and what it can do for Europe.

Finally, the Directors are keen to get closer to the Small and Medium size Enterprises in Europe (SMEs). We are looking at the possibility of running a major Symposium once a year on a topic that we believe will be particularly relevant to both ERCIM and the SMEs when it takes place. The theme for the first Symposium to take place in the autumn of 1993 has been chosen as Affordable Parallel Computing. An Organising Committee has been established to progress this.

Integration

The Directors are keen on getting more joint activities started. Initially, we have focused on internal mobility. Several of the workshops concluded that this would be useful. In consequence, the directors have agreed to fund one person each to spend 6 months at another ERCIM partner in 1993.

Conclusion

The last few months have been quite hectic. However, we believe the effort has been worthwhile; the successful HCM bid was very welcome in this respect. Hopefully, we shall see further activities producing results which will show that ERCIM as a single entity can achieve more than the individual partners in certain areas.

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Next ERCIM Workshops in Norway

by Truls Gjestland

The next ERCIM workshops, taking place at Trondheim and Røros from 26-28 May 1993, will be organised according to the recommendations from the Executive Committee. That means an emphasis on discussions in small groups and formulation of concrete plans for future work. Poster sessions will be organised to get input and contributions from all participating ERCIM members.

A detailed description of the three workshops is given below. Please note that there is also a local organiser for each workshop at each member institution.

Storage and Retrieval of Multimedia Information

Emerging information systems will increasingly include multimedia databases and multimedia interfaces. In order to achieve successful, user-friendly, and efficient systems, it seems necessary to find new and improved solutions for storage and retrieval of multimedia objects.

Multimedia databases will become large, in the order of terabytes. New and improved hardware and software architectures have to be found. Improved performance evaluation methods are also needed, so that acceptable performance may be designed into the new information systems.

Traditional information retrieval systems do not satisfy the requirements for the retrieval of multimedia information. New design approaches that support e.g. content based retrieval have to be developed.

Dynamic user modelling is needed as well, in order to improve the relevance of retrieved multimedia information. Appropriate query-languages will have to be developed.

This workshop will comprise of presentations and discussions on the state-of-the-art, future research objectives and approaches, as well as specific applications. The workshop is expected to lead to a discussion of the structure and the contents of possible collaborative projects.

The list of topics comprises:

- storage models for multimedia information
- retrieval models for multimedia information
- performance measurements of storage and retrieval models / systems
- user modelling / dynamic user modelling
- content based retrieval
- intelligent user interfaces
- knowledge acquisition
- hardware and software architecture
- practical experiences / applications

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Modelling and Simulation of Industrial Process Systems

The European process industries have a strong position in the global markets. Nevertheless, these industries face both challenges and opportunities. The challenges include adapting to new and stricter environmental standards while the opportunities relate to taking advantage of the possibilities to obtain premium prices for small quantities of special quality products. Efficient utilisation of results emerging from mathematics and computer science is a prerequisite for the European process industries to thrive in the future.

The workshop will cover all aspects of modelling and simulation of industrial

process systems using lumped parameter models, including but not limited to the following topics:

- Automatic and interactive process modelling
- Knowledge based and object oriented process modelling
- Qualitative and hybrid modelling and simulation
- Model validation – iteration between modelling and simulation
- Model reduction techniques
- On-line adaptation of model parameters and structure
- Modelling and simulation of continuous systems with discrete events
- Modular integration of dynamic equations
- Distributed parallel and multiprocessor techniques

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Interactive Modelling, Simulation and Visualisation in Large-scale Scientific Computing

Mathematical modelling, simulation and visualisation in large-scale scientific computing are mostly “serial activities”, due to the complexity of the numerical models, lack of convenient tools, and to some extent, due to historical reasons. In many engineering applications, the pre- and postprocessing of the simulations are both time consuming and time critical, frequently adding up to several months of “non-creative” time. Obviously, this leads to a severe decrease both in research and engineering productivity.

The rapid evolution in computing equipment technology, environments for software development as well as algorithmic design, will ultimately make it possible to build “interactive platforms” for large-scale scientific computing. Up to now this concept has been limited to relatively simple models. With the promising de-

velopment of high-performance computing equipment, including parallel and distributed computing facilities, as well as specialised graphics hardware and software, the latter limitations are foreseen to be removed for more and more applications, opening a new and demanding research area for computational scientists and new possibilities in engineering studies and design. Computationally based engineering design and analysis could easily be revolutionised in the future, caused by the “interactive and simultaneous nature” of such platforms. Provided the above scenario is correct, this will result in better products in shorter times and safer systems and environment for people.

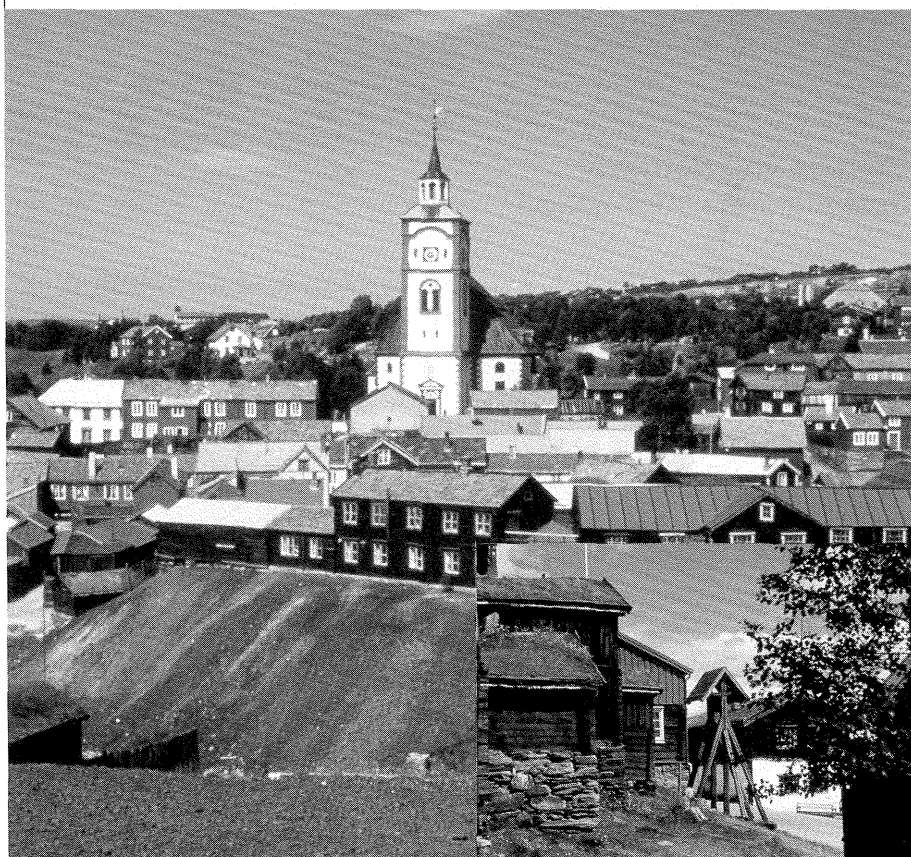
The workshop will cover the issues mentioned above. Special attention will be given to new “tools” for building such applications, suitable for both scientists and engineers dealing with mathematical models, numerical simulations and analysis of multi-dimensional problems in general. Examples of such applications are found in areas like:

- molecular dynamics simulations,
- computational fluid dynamics,
- weather predictions,
- environmental simulations
- chemical dynamics simulations,
- stress analysis,
- seismic processing and modelling,
- reservoir simulations,

and others. The main goal of the workshop is to bring together scientists and engineers to exchange experience, ideas and thoughts about existing and future technology and techniques, which are believed to be important in this context.

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The mountain village Røros, an old mining town dating back to 1640 which has earned a position on the United Nation World Heritage List, where part of the workshops will be held. (Photo: Tønset, Røros Touristboard)

ERCIM Workshops in Greece

by Constantine Stephanidis

FORTH-ICS recently hosted the latest in the series of ERCIM Workshops in Heraklion, Crete, 29-30 October 1992. Approximately 120 researchers from different ERCIM members participated, including representatives from Universities and Industry sharing common research activities and interest.

There were four separate workshops, running in parallel, on the following themes:

- Parallel Architectures for Computer Vision
- Network Management
- Methods and Tools for Software Reuse
- Numerical Methods for Linear and Non-linear problems in Wave Propagation

A one-day Executive Committee Meeting took place on the 28th October 1992 to discuss ERCIM policy in preparation for the Board of Directors Meeting. Highlights of the Board of Directors meeting include the signature of the ERCIM-EEIG contract by GMD, INESC and FORTH, the joining of ERCIM by the Swedish Institute of Computer Science (SICS), and discussions on ERCIM strategy with emphasis on the possible participation of ERCIM in the Real World Computing initiative of Japan. At the end of the plenary session on the final day, a new Institute formally signed the agreement, bringing the current number of official ERCIM members up to nine. Brief reports by the coordinators of the four workshops appear below.

Parallel Architectures for Computer Vision

The ERCIM workshop on Parallel Architectures for Computer Vision was attended by approximately 22 persons and consisted of 13 submitted papers, of which 12 were presented. The presenta-



The Swedish Institute of Computer Science, SICS, formally joined as ERCIM's ninth member when the Directors of the member institutes signed the agreement at the plenary session on the last day of the ERCIM Workshops held in Crete. Seen here signing the agreement is Siwert Sundstrom, Director of SICS. (Photo: FORTH)

tions covered a wide range of topics and there was plenty of time allowed for discussion. Specifically, techniques and methodologies were presented for the parallel implementation of low and intermediate level image analysis tasks, complexity issues were raised particularly with regard to labelling images of the real world, an approach to selecting efficient parallel implementations of intermediate level image analysis tasks was elaborated, load and data distribution strategies were considered, and new prototypes of parallel machines for computer vision were described. Clearly, due to the small number of papers, the coverage of these topics was by no means exhaustive, but sufficient to trigger interesting discussions.

Issues debated after each presentation and during open discussion sessions included: 1) the extent to which massive parallelism alone can meet the efficiency requirements of real-time vision applications, 2) the question of whether an approach based on dedicated or general purpose parallel architectures ought to be used, 3) software environments and parallelization strategies, 4) the pros and cons of message passing vs. shared memory architectures, and 5) the impact on this research and development area of an apparent growth in industrial applications of computer vision.

As expected, many important issues were raised and debated, but very few if any were resolved due to multidisciplinary nature of the field. Perhaps the greatest benefit of this exercise has been that the ERCIM research community has had a chance to meet, debate, discuss, and explore possibilities for future cooperation.

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Network Management

There were many interesting papers presented in the Workshop on Network Management. These papers covered many areas such as the description of the current and future networking infrastructure available at the various ERCIM sites, the architecture of network management systems already deployed or currently under development by the ERCIM members, as well as specific research areas related to many management functions.

The result of many discussions during the workshop was a unanimous decision to enhance cooperation between the ERCIM sites by creating certain interest

groups, and by installing multimedia applications related to collaborative work. The interest groups are related to the network management of multimedia applications, the development and use of experimental ATM platforms, the comparison of existing network management platforms, and the management of mobile systems.

The key idea behind extending collaborative work with multimedia applications is that many such applications are presently available and can be easily installed at the various sites. Furthermore, the applications chosen have low bandwidth requirements and hence can be used over the existing network connections between the ERCIM institutions. These include multimedia mail, desktop video conferencing, audio conferencing, and the use of cooperative editors. These small low-budget projects could prove to be the seed for larger similar initiatives within ERCIM.

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Methods and Tools for Software Reuse

The large number of submissions (20 presentations) and interest for the workshop (over 45 participants) demonstrated the importance and relevance of the multidisciplinary workshop.

Mostly technical issues of software reuse were covered in the workshop; managerial aspects, user motivation, etc., were not emphasised despite acknowledging their importance. The presentations covered the range from real, large applications experiences with reuse (reuse-in-the-large) to methods and tools for small examples of code reuse (reuse-in-the-small). It was noted that the individual ERCIM organisations have a strong presence in strategic EEC projects with a reuse component, but there was no instance of existing cooperation between ERCIM members in a project – a situation that may change after the stimulating and informative workshop.

In terms of tools for reuse, repositories drew most of the discussion focus, notwithstanding the interest and work on function libraries, and tools for retrieval, classification, and re-engineering. The methodological aspect of the workshop was dominated by the issues of reuse granularity (flexibility and wide coverage), reuse based on specification vs. prototyping (requiring different methods), and object-orientation (strong impact on reuse).

The participants of the workshop agreed on the prospect of evolving into a systems engineering group. As a first step, they gladly accepted the invitation from the ERCIM Database Research Group to participate in the workshop on repositories, scheduled for May 1993 in Crete.

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Numerical Methods for Linear and Nonlinear problems in Wave Propagation

In recent years, the emergence of new, important applications and the increase of the available computing power have motivated the development of effective new analytical and numerical techniques for the modelling of wave phenomena.

Twelve contributions on such new applications and the attendant mathematical and computational techniques were presented in this workshop.

The contributions included papers on the computation of guided modes in integrated optics, the numerical solution of Maxwell's equations in various geometries, the study of wave-body interactions in free-surface hydrodynamics, the modelling of long waves in coastal areas, the computation of blow-up singularities of solutions of nonlinear dispersive problems, the modelling of the ocean acoustic environment, and the diffraction of stress waves by cracks and periodic structures. A recurring theme was the efficient modelling of problems posed in unbounded regions by approximating their solutions on bounded domains under suitable boundary conditions.

The participants appreciated the diversity of the problems and the physical models presented, and also the variety and richness of the mathematical techniques, (classical and modern, analytical and numerical) needed for their solution. They also appreciated the chance to interact closely and at length with scientists with different backgrounds and to be exposed to concerns and viewpoints different from their own.

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Approximately 120 researchers participated in the ERCIM Workshops hosted by FORTH-ICS on 29-30 October 1992. (Photo: FORTH)

ERCIM Database Research Group

by Keith Jeffery

The ERCIM Database Research Group (EDRG) was set up in May 1991 following a successful ERCIM Workshop on "Database" at RAL. It received enthusiastic support from the ERCIM Directors and the (then) management committee, and has reported back to the ERCIM management periodically on its activities and plans.

It is an informal group, open to anyone in an ERCIM institute or from a university or industry working with an ERCIM institute on a collaborative project. The Group has the following activities:

- workshops, approximately twice per year, each one at an ERCIM institute and addressing a topic within "databases";
- joint projects between staff of ERCIM institutes (with or without colleagues from universities or industry);
- joint proposals for projects to be funded by the CEC (eg. ESPRIT, HCM, ...)

Workshops

Following the ERCIM workshop on "Database" at RAL in May 1991, the Group has run its own workshops:

- October 1991: CWI, Amsterdam: "Theory and languages"
- July 1992: RAL, Abingdon: "Scientific Databases" (see report on p. 34)
- September 1992: CNR, Pisa: "Constraints and transactions" (see p. 34)

and plans to run the following:

- May 1993: FORTH, Crete: Topic not finalised yet, but in the area of "Repositories, systems development methods and tools"
- October 1993: Possibly at INRIA: Topic not yet finalised

- May 1994: INESC, Lisbon: Topic to be on the area of "practical object-oriented database".

The proceedings of the workshops are being published in the official ERCIM Report series.

Projects

Joint projects are underway, initiated by discussions at workshops. One concerning the use of transition networks for systems development, supported by an advanced graphical deductive system (RAL-CNR) is described on this page. A more theoretical project between CWI and RAL is in its early stages. At the Pisa workshop, a joint project between RAL and University of Manchester was reported (so demonstrating interaction of an ERCIM institute with an associated university). Following the Pisa workshop, more such projects are expected.

Proposals

At the very last minute, and shortly after its initial formation, EDRG managed to put together a proposal for a BRA in ESPRIT III, named MAGNUM which concerns the utilisation of advanced database technology for scientific databases. Unfortunately, this proposal was not successful.

EDRG has submitted, within the overall ERCIM submission, a proposal for a network under the HCM scheme. This proposal is currently under evaluation by the CEC.

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Intelligent Support for Systems Development

by Patrizia Asirelli and
Keith Jeffery

A joint project is now under way between IEI-CNR, Pisa (Patrizia Asirelli and Domenico Aquilino) and RAL (Keith Jeffery and John Kalmus). The project was initiated after the first workshop of the ERCIM Database Research Group (EDRG) and the first joint paper was presented at the third EDRG workshop held in Pisa during September 1992.

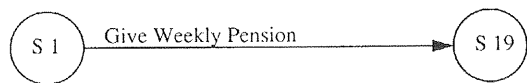
Concept

The project is founded on the notion that a system development can be formalised from fuzzy requirements to a formal specification. The system will be supported by a formalism based on transition networks where the basic units are nodes (states) and arcs. The formalism is extended to three types of arcs representing transitions (precondition, process, postcondition), constraints and transactions. The latter two kinds can parallel one or more transitions. The techniques can represent any level of abstraction from enterprise-based down to implementation level and integrate under one formalism the representation of data, processes, constraints and roles (see Figure on next page).

Support

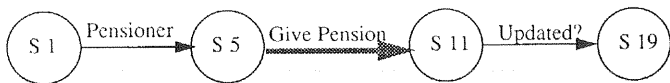
The extended transition network can be represented by a database of first-order logic formulae. This permits examination of the system design at any level and testing for completeness, validity, inconsistencies, etc. GEDBLOG provided the basis for the database and a graphical user interface; extensions to GEDBLOG permit easy handling of the network by a system designer.

Highest-level network:

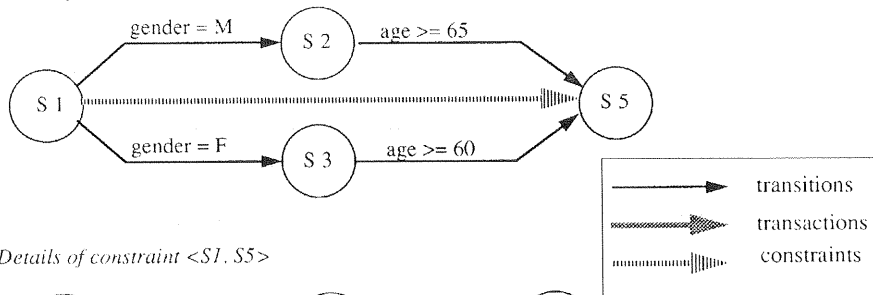


An example of extended transition networks: arc types and their use.

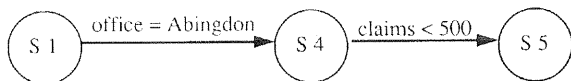
Next detailed level



Details of transition <S1, S5>



Details of constraint <S1, S5>



Progress

Following the initial agreement to cooperate we have:

- examined various extended transition network representations and converged to the three types of arc defined above;
- progressed the syntactic or semantic definitions of the arcs;
- designed the user interface - including graphic representations and interactions;
- produced some toy prototypes on paper to test the ideas.

The next step is to produce a full example using GEDBLOG as a deductive database and as a graphical user interface.

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THE EUROPEAN SCENE

ERCIM at ESPRIT Week

by Frans Snijders

From 23 to 27 November, the 1992 ESPRIT Conference was held at the Brussels Palais des Congrès. At the accompanying exhibition a total of 103 ESPRIT projects demonstrated the project results.

ERCIM was present with an information booth, manned by Engelbert Boehm-Beck from GMD, Helena du Toit from INRIA/ERCIM and Frans Snijders from CWI. A total of about 1000 persons visited the conference and exhibition. Apart from general information on ERCIM, the ERCIM view on the Fourth Framework Program, expressed in an ERCIM policy paper, attracted the visitor's attention. A copy of this document can be obtained from ERCIM (see address on p. 36 of this edition).

About 25% of the exhibiting projects had one or more ERCIM members among its



The ERCIM stand in the exhibition hall of the Palais des Congrès during the ESPRIT Conference, which took place from 23-27 November in Brussels last year. Seen here visiting the stand is Bob Hopgood, from RAL, and Arne Solvberg, from SINTEF-DELAB. (Photo: du Toit, ERCIM)

partners. No surprise if one realises that ERCIM is involved in 179 ESPRIT II and III projects.

The key issue during this ESPRIT conference was the dissemination and exploitation of research results from ESPRIT-projects. There is general agreement that Europe is doing less well than

its competitors, Japan and the US, in the transfer of knowledge and technology to applications. It is exactly here that ERCIM wants to play an important role as intermediary between academic basic research and industrial applied research.

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Human Capital and Mobility Programme

by Alain Michard

Results of the first selection round of this programme are now known, although some are not yet official. For networks, only the "recommendations" of the CODEST are known, and the management committee have still to confirm this choice.

The table indicates the number of proposals and results for mathematics and computer science. Some ERCIM institutes have also made proposals evaluated under the label "Engineering Sciences" (e.g. for robotics or telecommunications) which are not included in the data we have. As shown in the table, the acceptance rate has been low for grouped bursaries to institutes, due to the very high number of proposals under this section of the programme. Acceptance rates for individual bursaries and for Euro-Conferences are far more satisfactory.

This first round has been quite positive for ERCIM. Our grouping was selected as a host institute (grouped bursaries) for a total funding amount of 600 KECUS. Ten post-doctoral researchers have been selected and will spend 12 to 24 months in ERCIM member organisations, visiting successively two or three of them. Furthermore, several additional individual bursaries have been granted to researchers who are going to stay in one ERCIM member laboratory.

Lastly, an ERCIM proposal under the "network" division, in the domain of computer graphics, has also been selected by CODEST.

The programme is still open for individual fellowships and for Euro-Conferences.

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GENESIS Project Successfully Completed

by Clemens-August Thole

The Esprit II project GENESIS succeeded in making high performance computers easier usable by application programmers. GMD and INRIA made a major contribution to the results of the project. The commercial exploitation of the results by Meiko, PALLAS, NA Software and SIMULOG has already commenced.

"Scientific and societal progress, industrial competitiveness, the understanding and control of environmental factors necessary to human well-being will be governed by the availability of adequate computing power." (EEC Working Group on High Performance Computing headed by Prof. Carlo Rubbia from CERN) Parallel processing is the key technology when high performance computing power is concerned.

The Esprit Project GENESIS has strengthened the European position in high performance computing in two areas:

- A portable programming environment for parallel computing
- Advanced interconnection technology for interprocessor communication.

GENESIS was a European Esprit project with 18 partners from 9 European countries, which started in November 1989. Its target was the field of high performance parallel systems for numerical computing and it concentrated during the last year on portable software environments and interconnection technology. Partners of GENESIS were PALLAS (D), Meiko (UK), GMD (D), University Liverpool (UK), University Southampton (UK), Stollmann (D), CHAM (UK), Dornier (D), ECMWF (Europe), First (GR), INRIA (F), NA Software (UK), SIMULOG (F), TNO (NL), TriTech (Ire), University Jyväskylä (SF), University Polytechnica de Catalonia (E), University Vienna (A).

	Mathematical and Information Sciences	All Disciplines	
	Proposals	Accepted	Proposals
Individual bursaries	54	21	682
Bursaries to Institutes	105	19	1280
Networks	81	31	927
Large Facilities	5	2	95
Euro-Conferences	20	12	183
Totals	265	85	3167

The above table compares the number of proposals submitted with the corresponding number accepted in mathematics and computer sciences by the Human Capital and Mobility programme.

Nowadays, hundreds to thousands of computational units are used together in a parallel computer in order to solve the most demanding problems in climate science, chemistry, and fluid mechanics, for example. The interconnection network between these computational units is the necessary hardware technology. As part of the GENESIS project advanced inter-processor communication was developed which improved current communication bandwidth by a factor of 10. In addition, the system design aspect of communication latency is the key to wider applicability of parallel machines and is fundamental for further increase of the number of processing nodes.

Easy programming of parallel architecture and portability is the key software technology. Nowadays, no standard is available for programming parallel application software. As part of the project the PARMACS programming model was extended and implemented on all major parallel architectures. It is now finally possible to run one program unchanged on all these architectures, which is an essential step to overcome the typical software problem arising from different parallel architectures.

A set of tools was developed to support the programming model, the suitability of which was proven by implementing a large set of applications from different areas on top of PARMACS. Meanwhile the two major European manufacturers of parallel architectures, Meiko and Parsytec, announced to support PARMACS on their new generation of architectures.

Several companies already announced the exploitation of the project's results. Thus, the advanced interconnection network technology will be used in future developments of Meiko's computing surface heterogeneous parallel architecture. The PARMACS software environment will be marketed jointly by PALLAS (D), NA Software (UK) and SIMULOG (F). PARMACS will form also a basis for ongoing discussion on standards for programming parallel architectures.

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Fellowships at the European Research Network System Identification

by Jan van Schuppen

The European Research Network System Identification (ERNSI) has received financial support from the EC-programme Human Capital and Mobility for a project in which training and research in system identification are intertwined. Post-doctoral researchers may submit applications for fellowships to the network.

System identification concerns the construction and evaluation of mathematical models in the form of dynamical systems. Such models arise in connection with problems of control, signal processing, prediction or forecasting in areas as engineering, economics, environmental sciences and biology.

In the project the following problems will be considered:

- modelling of phenomena by dynamical systems
- the realisation problem of transforming one system representation into another
- derivation of system identification algorithms
- performance evaluation of such algorithms.

The ERNSI network comprises of eight research teams at the following institutions:

- Systems and Control Theory Network, University of Groningen (The Netherlands)

- Institut für Ökonometrie, Operations Research und Systemtheorie, Technical University Vienna (Austria)
- Laboratoire d'Automatique, Dynamique et Analyse des Systèmes, University of Louvain (Belgium)
- INRIA Sophia Antipolis (France)
- Institut de Recherche en Informatique et Systèmes Aléatoires (IRISA), University of Rennes (France)
- Department of Engineering, University of Cambridge (United Kingdom)
- Istituto per Ricerca di Dinamica dei Sistemi e di Bioingegneria (LADSEB), CNR Padova (Italy)
- Institutionen für Systemteknik, University of Linköping (Sweden).

ERNSI already runs another project on the same subject, funded through the EC-programme SCIENCE.

Post-doctoral researchers are invited to apply to the network for a fellowship. Applicants should come from member states of the European Community or from a country treated as such. Applications from the less-favoured regions of the European Community are particularly welcome. The fellowships permit a maximum stay of six months per research team, with the possibility for visits to two teams. The project will run for three years. As there are several selections annually, applications may be submitted at any moment. Submission deadline for the second selection round is March 31, 1993. The final selection, which is made by the Commission of the European Communities, will lead to an appointment on July 1, 1993, at the earliest.

Information regarding the application procedure may be obtained from the coordinator of ERNSI:

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Network Management: Activities within the ERCIM Institutes

by Costas Courcoubetis

This issue of ERCIM news contains a collection of articles describing some of the activities within ERCIM in the area of network management. Most of these articles were presented in the recent ERCIM workshop in Crete, and can be found in an extended form in the proceedings of the above workshop.

The articles which appear in this issue fall in the following basic categories according to their subject. The first group of articles is about the current and future networking infrastructure of various ERCIM sites, or about large networking initiatives at a national level conducted by ERCIM members. The article by Laura Abba and Stefano Trumpy (CNR) describes the backbone, the protocols and the services provided by GARR, the Italian Research Network. The Network Information Service of the GARR network organisation is described in the corresponding article by Laura Abba and Antonio Bonito (CNR).

The article by Bob Cooper is about SuperJANET, an advanced experimental network being currently build in the UK. This network will be based on ATM technology, and its pilot network will be operational in March 1993. The network will have a optical fiber SDH backbone operating at performance levels up to 622 Mbps. It is anticipated that its development path will lead to Gigabits/sec transmission rates.

FORTH has installed and supports a complex wide area network interconnecting LANs all over Greece and connecting them to the Internet. FORTHnet supports a large number of protocols, provides dynamic routing procedures and all the

Internet services. FORTH's policy is to follow OSI standards; there is a complete OSI subnetwork in FORTHnet based on the ISO connectionless services, which connects to the European CLNS backbone. Hence FORTHnet users can use ISO applications such as X400, X500, FTAM, VT. Stelios Sartzetakis gives a brief description of the above network.

The second group of articles deals with the architecture of the network management systems operating at various ERCIM sites. The article by Joaquim Arnaldo Martins (INESC) describes the directions of research at INESC Aveiro towards an integrated network management system. This system will provide a solution to the management of the large number of physically distributed and heterogeneous LANs at INESC.

In their article, Andreas Dittrich and Michel Tschichholz (GMD) describe the BERKOM Administration Infrastructure. This is the architecture of the network management platform providing generic management functions to BERKOM applications. This advanced platform provides both Directory Services and Management Services based on the OSI concepts. It includes a tool for the definition of managed objects and a browser of the Management Information Base.

The last group of articles deals with particular network management functions such as fault diagnosis, and quality-of-service management. The problem of providing adequate fault diagnosis capabilities is addressed in the article by Birgit Jansen (GMD). In this article the author proposes an interesting method for doing fault detection which fits to the OSI framework. This method traces a faulty network behaviour using the model of the network stored in the Management

Information Base and the related events stored in the manager's event log.

The article by Mihal Mateescu (GMD) deals with the management of the bandwidth of high-speed networks carrying integrated traffic (data, voice, video, etc.). It emphasises the fact that preemptive rather than reactive control must be used for managing congestion and hence quality-of-service in such networks. Some of the key concepts mentioned in the above article are the need for multilayer management based on the type of traffic and the time scales of the corresponding management events, and the notion of "equivalent bandwidth" needed for characterising properties of multiplexed traffic with respect to cell-loss and delay in the network.

The article by Costas Courcoubetis and George Fouskas (FORTH) deals with a related problem. It makes the key observation that managing the network and in particular doing call-acceptance management (CAM) should be based on information which is both timely and accurate, in the sense that it should be adapted to the actual information flows and not to predefined traffic models. The authors propose a method for the fast estimation of existing spare capacity in the network, and a method for the estimation of the effective bandwidth of the traffic sources. Both methods can be used for CAM, they use information which is extracted from the actual information flows, and are justified by large deviation asymptotics. ■

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The GARR Network

by Laura Abba and Stefano Trumpy

GARR is the Harmonisation Group for the Italian Ministry for the University, Scientific and Technological Research (MURST). GARR is also the name of the Italian Research Network which is currently run by the founder organisations: three public research institutions, i.e. CNR (National Council for Research), ENEA (National Council for Research on Nuclear and Alternative Energy Sources), INFN (National High Energy Physics Institute) and by three consortia providing computing resources to Italian universities, i.e. CINECA, CILEA, and Tecnopolis-CSATA. The aim of GARR is to interconnect the Italian research and academic networks and to coordinate connections to international networks.

The backbone of the network provides four TDM channels over 2 Mbps lines, carrying IP, DECnet, SNA and X.25 traffic; the last protocol carries the traffic destined for the European backbone IXI activated by the EUREKA-COSINE project.

All computers on GARR will use Internet-style domain addresses. The top-level domain is .IT (Italy) and the user Internet addresses are in the form: user@domain.it.

A Network Information Service is operative providing direct support to the managers of GARR network nodes or regional networks and to the users a Network.

The backbone consists of the original seven primary sites located in Milano (CILEA), Bologna (CINECA and CNRF-INFN), Pisa (CNUCE-CNR), Roma (ENEA and NIC-INFN) and Bari (CSATA). The University of Naples (CISED) recently joined the backbone. MURST also funded a project to connect the more than fifty universities in Italy; the major ones will be connected as extensions of the backbone, while the others will be attached with 64kbps lines to the primary sites. At present, besides Naples, the following cities plan to connect their metropolitan area networks at high speed by the end of 1992: Turin, Padua, Trieste, Palermo, Cagliari; about another thirty sites are planning to connect within a year or so at lower speed.

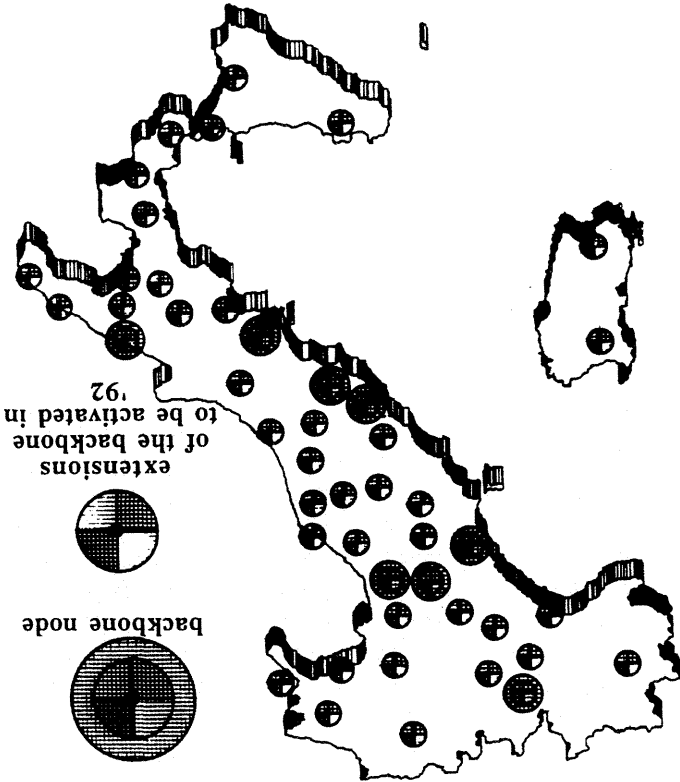
GARR will continue to maintain connections to the major research networks, including RIFE, EASinet, Internet, BIT, NET/EARN, EUnet, HEPnet, IXI-COSINE, EBONE, EMBP and other networking initiatives.

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THE GARR network interconnects the Italian research and academic networks and coordinates connections to international networks. The backbone consists of the primary sites located in Milano, Bologna, Pisa, Rome, Bari and Naples.

GARR



The GARR Network Information Service

by Laura Abba
and Antonio Blasco Bonito

Networks need income to support them and administrators to run them. Usually in a network organisation there is a Network Operations Center (NOC), to handle operations, and a Network Information Service (NIS), to handle support to the node managers and to the end user.

The NIS of GARR, the Italian research network, is located at CNUCE-CNR, Pisa, which currently provides it with all the necessary resources: hardware, software, financing, personnel, etc.

NIS works in collaboration with the GARR Committee and maintains contacts with the GARR technical groups in order to acquire documentation and information. In consideration of the needs expressed by managers of network nodes, GARR can propose new functions or activities to the NIS.

The most important task of GARR's Network Information Service is the information support for the set of Italian academic and research networks. It offers direct support to the managers of GARR network nodes or regional networks and indirect support, i.e. the circulation of information to all its users.

NIS is the reference-point for the various registration procedures (for organisa-

tions, networks, domains, persons, etc.) required to access to the GARR network and international networks.

Its main functions are:

1. Defining procedures and registration templates, taking into account the information requested by other European and American NISes, in accordance with the Guidelines established by GARR and collaborating with the managers of international networks.
2. Acquiring network information and maintaining databases and directory services in order to make such information accessible via the network.
3. Providing the Internet DNS and X.500 DSA services at the national root level, and coordinating their distributed management at the national level.
4. Publicising, duplicating or improving the accessibility (through directory and/or information discovery systems) to useful network information provided by other NISes or information-servers.
5. Cataloguing and up-dating the archive of documents produced by GARR working groups and making them available via the network, in accordance with the heads of these groups.
6. Making accessible via network both permanent and updatable information about GARR's activities, guidelines for use, statistics about the backbone and regional networks, etc.
7. Carrying out promotional activities and diffusing information about the GARR network and about NIS: periodic reports, announcements, news about workshops and seminars, etc.

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SuperJANET

by Bob Cooper

The SuperJANET initiative was launched in 1989 with the aim of creating a foundation for the development of a national broadband network to support UK higher education and research. The network would be based on optical fibre technology and would offer very high performance with a development path leading eventually to Gigabits/sec transmission rates. It was recognised that the development path that had been used during the 1980s to develop the JANET network would not be applicable; the development of SuperJANET would require close collaboration with a telecommunications carrier and with industry in general.

Several requirements and trends identified the need for a very high performance wide-area network in the 1990s, principal among them was the trend in many areas of education and research towards the increased use of images in computing and communication. Applications as diverse as distance learning, remote control of experiments, advanced data visualisation techniques, access to multimedia data bases and electronic libraries, and computer supported collaborative working call for multi-media communication. The emphasis on multi-media, including the requirement to support audio and video, indicated that high performance alone was not enough, the data network epitomised by JANET had to be replaced by a full multi-service network. Furthermore, SuperJANET would need to be more versatile than JANET with a capability of supporting a wide range of network research and development activities in addition to providing a high quality service to an expanding user community.

Discussions with the funding authorities on the #20M requested for SuperJANET continued through 1990 and 1991. In December 1991, following support from the Secretary of State at the Department of Education and Science, the Universities Funding Council approved funding for the first phase of SuperJANET.



Work on SuperJANET started to accelerate in 1991 and Dr Cooper, the Director of Networking in the Joint Network Team at RAL, was asked to take special responsibility for developing plans for the new network. The SuperJANET Project Team was set up, based at RAL, to provide support for the early planning activities.

ATM has been identified as the technology to provide the high performance multi-service switched network required for SuperJANET. The ATM Technical Advisory Group (ATAG) has been set up to provide technical support for the development of an ATM network. An underlying SDH network will provide a versatile platform for the development of the ATM network, offering the capability to support an evolving set of research, development and service requirements on a common network.

In March 1992 a Request for Proposals was issued to 19 organisations seeking proposals for the collaborative development of a national optical fibre SDH backbone network operating at performance levels up to 622 Mbps. The five proposals received demonstrated that the SuperJANET concept was valid and that there was a high probability that the first phase of the network could be deployed within the timescale and funding guidelines envisaged. An Invitation to Tender was issued in August and the selection of a supplier was expected at the end of October.

The first milestone will be the provision of a pilot network in March 1993. Cambridge University, Edinburgh University, Imperial College, Manchester University, Rutherford Laboratory and University College London have been identified as the first SuperJANET sites and will be involved in the pilot. Other sites will be selected by the end of 1992. Work has started on developing a wide range of applications that can fully exploit, at an early stage, the new facilities offered by SuperJANET. In the coming years there will be numerous opportunities for collaboration between industry and academia in advanced network research, development and service provision.

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FORTHnet: A Large Multiprotocol Network

by Stelios Sartzetakis

FORTH's Network Support Team at the Institute of Computer Science has installed and supports a complex wide area network interconnecting LANs all over Greece and linking them to Internet. All infrastructure is multi-vendor technology in both dedicated hardware and software, which is fully interoperational, providing very reliable network service to its users.

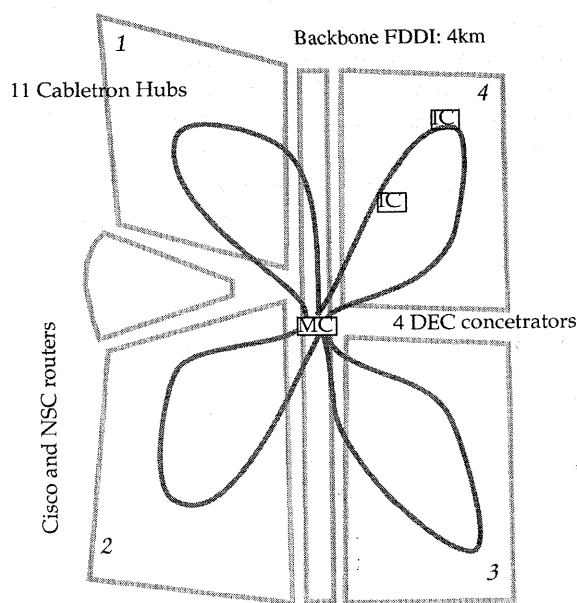
FORTHnet provides dynamic routing procedures for IP (RIP, IGRP, EGP) and all internet services, such as e-mail and file transfer to sophisticated information services. Other protocols, like DECnet, LAT and AppleTalk are also routed throughout the network, providing terminal server connections, AppleShare and other facilities.

The basic gateways to Internet are installed at ICS and UofC, located 5km apart in Heraklion, and are called

Charybde and Skylla. These are two Cisco AGS routers connected to INRIA and CNUC, using two 19200bps serial lines. They are also connected to each other via two analog 128Kbps serial lines. Both routers are connected to four 10Mbps IEEE802.3LAN segments each. Analog leased lines, sometimes of quite high speeds (14.4kbps to 2Mbps) connect other FORTH's offices all over the country. A third router is in UofC and interconnects its establishments in Rethimnon, the Institute of Molecular Biology and Biotechnology (IMBB), the University of Thrace and FORTH's administration offices. Other Greek institutes use network connections over public packet switched data networks, such as Hellaspak and AriadneNet, or dialup and leased lines in order to establish low speed TCP/IP links with FORTHnet's routers. An 100Mbps dual FDDI ring connects FORTH's buildings with UofC's network.

At Stavrakia (location of the new technology park where FORTH will reside in the near future, 10km west of ICS at Heraklion), a high speed network environment will soon be operational. It is based on FDDI rings, interconnected through routers and fast serial lines. The main LAN in Stavrakia is a star-shaped FDDI backbone. It spans four buildings, interconnecting more than fifteen ethernet, providing fast network access to all

STEP-Crete backbone



A high speed network environment will become operational at the new technology park in Heraklion where FORTH will reside in the near future..

workstations. The network will be ready for operation by January 1993.

FORTH's policy is to follow OSI standards. OSI FORTHnet which is based on the ISO connectionless services (CLNS per ISO8473) spans all UofC's and ICS's LANs, and it is connected to the European CLNS backbone network via Charybde's serial link to INRIA. It operates under the umbrella of a European CLNS project, supported by RARE. It uses serial (HDLC) and IXI links to convey CLNS traffic. It is mostly based on Cisco multiprotocol routers and uses the same equipment with the European IP backbone. Routing of CLNS packets is dynamic, based on Cisco's proprietary IGRP protocol while an upgrade to the ISO 10589 standard is planned. The ISO compliant addressing scheme is followed, and the ISO applications that have been installed and are used by the FORTHnet users include X.400 Mail Handling System, File Transfer Access and Management (FTAM), Virtual Terminal, and X.500 Directory Services.

ICS is following the developments of the IP network in Europe (RIPE, Ebone) closely. FORTHnet is connected to EARN whose policy is to migrate to OSI and TCP/IP. Hence FORTHnet has already anticipated this by migrating most of its EARN connections to TCP/IP. The central Greek EARN node responsible for serving all other Greek EARN hosts is a node of FORTHnet. Another node of FORTHnet serves as the backbone for EUnet in Greece, providing UUCP mail and USENET news services. FORTH is also connected to a central X25 switch, which is part of the Greek IXI / COSINE network, called AriadneNet. AriadneNet is used for providing low-speed IP connectivity to the major part of the Greek academic and research community.

FORTHnet is conceived as not only providing networking facilities to its end users, but as also being used as a testbed environment for FORTH's researchers and students. ICS participates in RACE ATM research projects, doing work on Quality-of-Service and Call Acceptance Management. At the same time, UofC conducts graduate research in the areas of network management and multimedia applications.

A full function network operation centre will operate at the above location, which will coordinate and troubleshoot the operation of the whole network. It will be equipped with modern workstations and the most advanced existing network management tools.

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Integrated Management of Networks at INESC

by Joaquim Arnaldo Martins

Local Area Networks (LANs) are widely used to connect computers, workstations and terminal equipment inside organisations (covering one building or a campus), to support different services and protocols. This increasing number of LANs inside organisations, sometimes with different topologies and protocols, has created the need to interconnect different geographically distributed LANs in order to obtain a global network with different access media (Ethernet, Token-Ring, FDDI, etc.), topologies, communication protocols (TCP/IP, OSI, DECNET, etc.) and services. This solution means a complex communication structure with a very difficult management. To address this problem at INESC Aveiro we have been working in several directions in the network management area, in National and European projects, as indicated in the following paragraphs.

- The specification and development of an integrated network management architecture, suitable for an heterogeneous scenario, that will hide the differences of the underlying LANs. Based on this network management architecture, the main goal will be the development of an integrated management system divided into:

- a Central Management Workstation (CMW) that will be able to take special actions over the network components, and to receive, process, retrieve and display (in a user-friendly way) information related with the network status;

- several Monitoring Devices (MDs), that will collect data from the network and will send it to the CMW. Each MD will be a device with no functions in the network operation. It will be able to observe the traffic and behaviour of the LAN to which it will be attached and will retain the necessary information. An Ethernet MD is now available.

- The development of a traffic generator for Ethernet, in order to test some of these tools or the network reactions under several types of load.

- The implementation of SNMP agents for the MD and the specification of their MIB.

- The management of network resources taking into account that the network is used to interconnect machines that belong to a distributed environment and that we must manage that global environment as a whole including the network and the several types of resources attached to it.

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STOP PRESS!

The programme of courses and seminars run by the RAL E&A Group, under the EASE Programme, can now be attended by staff from the ERCIM member institutes as if they were a member of RAL staff: this usually means that there are no fees charged! The April Edition of ERCIM News will carry further details and the 93/94 programme.

The BERKOM Administration Infrastructure

by Andreas Dittrich
and Michael Tschichholz

The BERKOM Administration Infrastructure is one particular architecture for an administration system based on OSI concepts. It offers administration support to distributed applications in an open services environment.

The BERMAN project is currently developing the BERKOM Administration Infrastructure (BAI) which is a management platform providing generic management functions to BERKOM applications. The BAI consists of two services at present, the Directory Service (DS) and the Management Support Service (MSS).

1. The Directory Service is based on the BERKOM Directory system which is

an implementation conforming to the X.500/ISO-9594 standard and which can store longer-lasting information (for example, information about services, servers, communication addresses etc.). It can be used to administer such information on behalf of the integrated services.

2. The Management Support Service (MSS) is provided by the BERKOM Management Platform. It is based on OSI systems management concepts.

OSI management is carried out by accessing and manipulating managed objects (MO). Managed objects are abstractions of data processing and data communications resources. A managed object class is defined as collection of attributes, actions and notifications and related behaviour. The value of an attribute can determine or reflect the behaviour of a managed object. Actions are operations on a managed object, the semantics of which are specified as part of the managed object class definition. Notifications are emitted by a managed object and contain information relating to an event that has occurred within the managed object.

The Management Information Base (MIB) is the conceptual repository of all managed objects located within an open system. Thus, a MIB can be seen as a deposit of information required for management purposes.

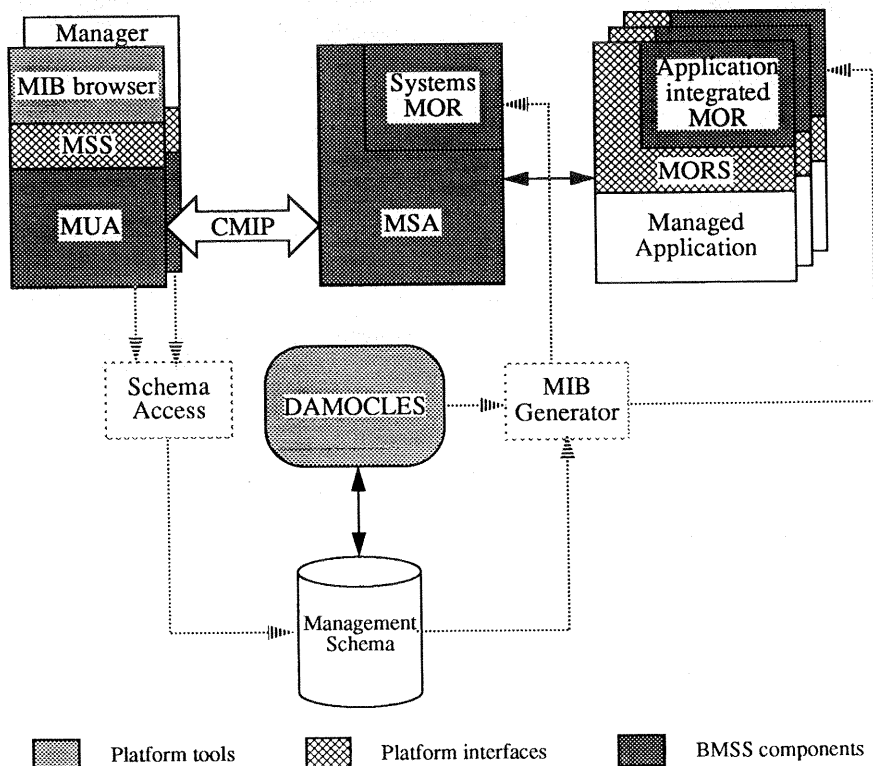
The Basic Management Support System (BMSS) constitutes the core of the BERKOM Management Platform enabling the exchange of management operations. Furthermore, the platform includes a tool for the definition of managed objects called DAMOCLES and a MIB browser which allows the inspection and manipulation of managed objects located in a particular MIB.

The BMSS encompasses:

- an implementation of the OSI systems management protocol CMIP,
- a Management User Agent (MUA) offering the Management Support Service which gives managing applications access to OSI systems management,
- an OSI management agent called the Management Support Agent (MSA) which processes CMIP requests on behalf of a managing application,
- a library of C++ classes representing generic attributes and basic managed objects, and
- a programming interface which supports the implementation of MOs and the establishment of Managed Object Repositories (MORs). This interface provides the Managed Object Repository Service (MORS)

The union of all MORs established within an end system constitutes this system's MIB. The Managed Object Repository integrated into the Management Support Agent is called Systems Managed Object Repository (SMOR). The MORs to be integrated into managed applications are named Application-integrated Managed Object Repositories (AMOR).

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Architecture of the BERKOM Management Platform

Model-based Diagnosis in Integrated Network Management

by Birgit Janssen

The increasing heterogeneity and complexity of current data communication networks strengthen the demands for integrated network management based on a common framework. Intelligent tools are required to support network administrators in the different functional areas of network management. The following work contributes to development of a general OSI-based network management tool.

Today's networks are heterogeneous in nature. Many vendors have developed their own network management strategy and nearly every device supplies its own management facilities supporting the network administrator. Since the networks are getting more and more complex the number of different tools a network administrator has to deal with increases. This requests for the development of intelligent network management tools in an integrated environment to support network administrators in ensuring highly reliable and flexible communications. One of the most interesting tasks to be solved by intelligent network management tools is to diagnose faults appearing in a network. As a level of integration the OSI Management Framework was chosen. The standards consider communications aspects, informational aspects as well as functional aspects of systems management.

The diagnosis is proposed to proceed in two steps. The first step is to determine which layer entity, according to the OSI model, causes the faulty behaviour. Since there are special logical and physical components constituting a layer and determining its behaviour, these components should be further explored in a second step.

A basic requirement to diagnose faults is the appropriate representation of the network's structure. According to OSI Management Framework it is represented by managed objects and the relationships among them. Given a faulty network behaviour, managed objects emit events, the symptoms, which are gathered in the manager's event log. A single fault may cause multiple events, e.g. a faulty transport connection causes all its user objects to fail and thus emit an event. These events can then be further processed by a diagnostic component. Incoming events are related to their emitting managed objects. Now, using the relationships defined among managed objects, an event dependency graph may be built. It is assumed that the managed object of the lowest layer that emitted an event is the causing one.

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Management of High Bandwidth Networks with Integrated Traffic

by Mihai Mateescu

One of the goals of the RACE II project LACE (Local Applied Customer Environment for Integrated Communications) is to contribute to a deeper understanding of communication management and control in high speed integrated networks. Within this framework, work is being conducted at the GMD-Institute for Open Communication Systems (FOKUS) Berlin to assess the consequences of the dramatic growth of bandwidth availability on resource management.

The increase in information carrying capacity brought along a shift in paradigm. Due to the network latency, the transmitted data are buffered in the communication channel and global state information cannot be made available in real time over the network. Distributed management relying on local information and a combination of call admission control and bit rate policing at the edges of the network have a better chance to provide effective network control.

In an integrated broadband network, different call sessions between two points in the network can be aggregated and transported over a preassigned path, whose capacity will be better used due to statistical averaging. But this can also cause congestion at the nodes and therefore connections have to be managed at the call and at the path layer.

Layering by time scales is a prerequisite for the process of abstraction of network resources and traffic entities, which in turn simplifies communication between peer instances by hiding their complexity. The state transitions at one layer are modulated by the resource allocation process at the layer of the next larger time scale and in turn control the state space at the next smaller time scale. This allows a recursive definition for the equivalent bandwidth at the layer based on the set of admission policies which can ensure a given grade-of-service.

More generally, the network will reflect a different "image" to different services and therefore more than one control mechanism is needed in order to meet the service requirements. This leads to the concept of multilayer management, based on the type of traffic, the range of the response times from the network and the time scales of the events that must be controlled, running over several micro-seconds at the cell layer to minutes at the call layer and to hours or even days for the paths configured in the network.

The requirement from the network must be parametrized in terms of the characteristics of the source. The resulting measure is termed equivalent bandwidth at the layer. The statistical behaviour of an aggregate of multiplexed connections differs significantly from the statistical behaviour of each individual connection. It

is therefore of major concern to find ways to represent the metrics of both individual and aggregate statistics.

Different models are used to accommodate various types of sources such as bursty and variable bit rate sources. The models are expected to combine reasonable accuracy with tractable computation complexity. The equivalent bandwidth computed with these models is assigned to the transmission link and is supposed to satisfy a given grade-of-service requirement for a mix of sources that share the link.

Typically, the grade-of-service is expressed in terms of cell loss probability and delay. Expressions for these parameters as a function of link capacity can be found under simplifying assumptions using queuing theory. Finding the equivalent bandwidth implies that these expressions must be inverted in order to find the minimum capacity for which the grade-of-service can be met.

Different options are being considered, ranging from analytical expressions to numerical solutions and interpolation. Using the simulation environment at GMD FOKUS these options can be verified and compared in different network settings.

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Asymptotic Techniques in Call Acceptance Management for ATM Networks

by **Costas Courcoubetis**
and **George Fouskas**

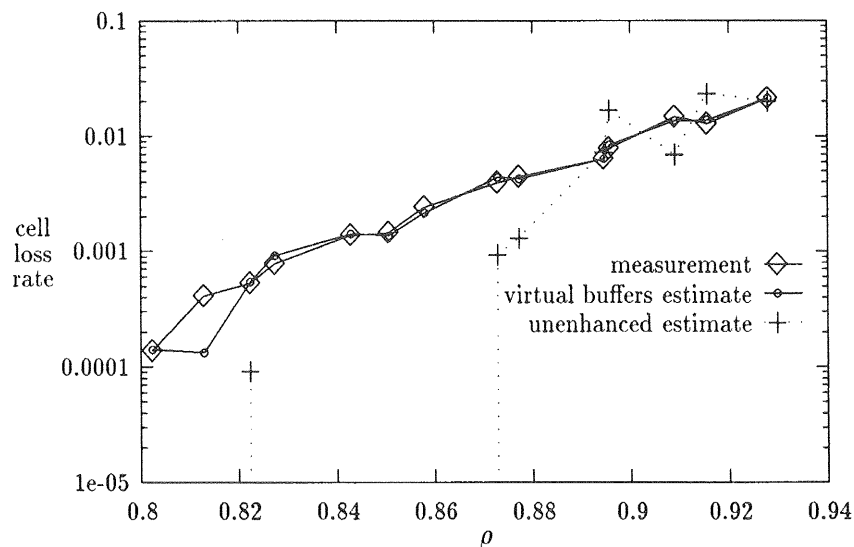
Difficulties arise in a high-speed environment because of the need for both timely and accurate information. This information should be adapted to the actual information flows and not be based on predefined traffic models. Two different approaches are described which can be used for call acceptance management (CAM). The first approach is based on a fast estimation method for the spare capacity in the network. The second approach is based on an adaptive method for the calculation of the effective bandwidths of traffic sources. Both approaches use information which is extracted from the actual traffic flows and are justified by a formal mathematical development based on large deviation asymptotics.

An ATM network provides support for a wide range of services which have differing bandwidth requirements, traffic pattern statistics and Quality of Service (QoS) constraints. Cells belonging to a number of different calls are statistically multiplexed in order to make efficient use of network resources. At the same time, the various QoS criteria must be maintained for each of the calls being served. The network is required to fulfil, with the help of the CAM function, the two conflicting goals of maximising resource usage and providing acceptable QoS. It is therefore crucial that the network has, first, a mechanism for accurately measuring QoS, and second, a CAM strategy which can efficiently provide the required QoS for the network users.

There are two main requirements for a mechanism which provides QoS information to the CAM function. The first requirement is that the information it provides must be accurate. The second requirement is that the information it provides must be timely. Due to the dynamically changing traffic mix in the network, and the high speeds at which this traffic is being carried, there are difficulties in providing the network with accurate and timely QoS measurements. Accuracy is difficult because of uncertainties in characterising traffic. Timeliness is difficult because accurate estimates often require unacceptably long sampling periods due to the "rareness" of the occurrence of the relevant events.

Our approach for providing timely and accurate QoS information does not require models describing the traffic. By doing direct measurements at the switches it estimates the current cell loss probability and the existing spare capacity of the switch so that a certain cell loss is never exceeded. To reduce the variance of the estimates (so that the information is timely and accurate), each switch estimates the cell loss that would occur with

In the plot to the left, the accuracy of the virtual buffer estimation procedure is compared to the traditional estimation procedure.



smaller buffers (virtual buffers). Then an extrapolation using some scaling property justified by large deviations allows the approximation of the actual cell loss probability. Simulations have validated the approach and the asymptotics. In the figure we show a typical simulation experiment in which we compare the accuracy of the virtual buffer estimation procedure to the traditional estimation procedure, where the estimation period used for both is equal to 2 seconds real network time.

Another popular approach for doing CAM is based on the notion of an acceptance region. The acceptance region for a given link is the set of traffic loads for which the QoS (in our case, cell-loss rate) can be guaranteed. One possible approximation for the acceptance region is

based on the concept of an effective bandwidth. The effective bandwidth of a given call is the "amount" of bandwidth that must be allocated at each link and by the call in order to obtain an acceptable level of QoS by the network. The acceptable level of QoS must be the same for all calls. The traffic load on a link is therefore the sum of the effective bandwidth of the calls passing through the link. If this sum is less than the service rate of the link, then this load is declared to be acceptable. The problem with using the effective bandwidth idea is that the effective bandwidth calculation is based on a particular model of the traffic source. Hence, since in reality such models are fairly inaccurate, any pre-calculation of the effective bandwidth and hence of the acceptance region is of questionable value. The approach we propose is a rem-

edy to the above problem since it allows the adaptive calculation of a good approximation of the effective bandwidth for a large number of types of traffic sources. It requires the estimation of the index of dispersion of the input process produced by a source. This is a well known problem in time-series analysis, and there exist powerful algorithms for estimating it.

The approaches discussed above have been jointly developed under collaboration with research groups at the University of California, Berkeley and Cambridge University.

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RESEARCH ACTIVITIES

Reusability of Large-Scale Linguistic Resources

by Nicoletta Calzolari

One of the major activities at the Institute for Computational Linguistics (ILC-CNR), directed by Antonio Zampolli, regards the definition and creation of large-scale linguistic resources, and the development of methods for their management and exploitation.

In recent years, there has been an upsurge of interest by researchers in the field in the treatment of large quantities of language data and in the theoretical problems raised by the question of exhaustiveness. Considerable attention is now being paid to the notion of reusability, both in the sense of reusing existing linguistic resources (e.g. Machine Readable Dictionaries, Text Corpora, Grammars) and extracting information from them for use in Natural Language Processing applications, and in the sense of building linguistic resources that can be used in many different theoretical and application frameworks.

This twofold concept of reusability was first expressed at the EC-sponsored Workshop on "Automating the Lexicon" organised by ILC-CNR and Pisa University, in 1986, at Grosseto. Discussion at the Workshop focussed on the possibility of converging the separate efforts of various groups towards the common goal of building large reusable lexicons; such lexicons were intended as being both polytheoretical and multifunctional (with respect to applications and users). The set of recommendations laid down at Grosseto has formed the framework for research and development since then.

The two aspects of reusability were first represented prototypically by two European projects: ACQUILEX (ESPRIT BRA) – aiming at the acquisition of lexical information from machine-readable dictionaries for NLP applications, and ET_7 (EC-Luxemburg) – studying the feasibility of building large scale reusable lexical and terminological resources. These two pioneer projects have been followed by many other public and privately funded international activities in which ILC-CNR also participates: Multilex (ESPRIT), Genelex (Eureka), the Network of European Reference Corpora (EC-Luxemburg), Bilingual Corpus-Based Lexicography (Council of Europe), ET_10 and Linguistic Research Engineering projects (EC-Luxemburg), The Survey of

Linguistic Resources and the Text Encoding Initiative (US, EC, Japan), and El-snet (ESPRIT BRA).

In addition to purely scientific considerations, the enormous intellectual and economic interest in the possibilities of such resources obviously also leads to strategic considerations such as the importance of avoiding dispersion or duplication of efforts, and the necessity for intelligent coordination to define a general programme and strategy for development, research and cooperation. As the success of advanced language applications is strongly dependent on the availability of basic technologies which incorporate both large scale language resources and related methods and tools, structures must be established that define a common methodology to which developers can refer when building a reusable source. It is clear that the harmonisation of linguistic knowledge and data and the creation of standardised, reusable resources are of utmost importance. In response to these needs, EAGLES (Expert Advisory Group of Language Engineering Standards), a new EC project coordinated in Pisa, will establish a set of coordinated expert groups in the area of prenormative linguistic research.

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A Public Transport System Based on Light Electric Cars

by Michel Parent
and Pierre-Yves Texier

Due to the increase in congestion and pollution in most cities, public transport is becoming indispensable. The system proposed in this article is based on a fleet of small electric vehicles under constant control of a central computer.

Introduction

Congestion and pollution in most cities through the entire world have increased drastically in the last ten years due to two factors :

- an increase in the demand for transportation,
- an increase in the number of cars per inhabitant.

The second factor is the consequence of the rise in the standards of living, however it also reflects the fact that the private automobile is perceived (rightly or wrongly) as the "best" way of transportation.

However, this perception is changing because of congestion problems and because of the fact that cities are starting to make it more and more difficult to use a private automobile.

Therefore, public transit is becoming more fashionable, well accepted socially, and many cities are investing heavily in a large variety of systems. However, no existing technology addresses the problem of low density traffic well : either one has to walk too far, or one has to wait too long, or it is too costly.

The system proposed here should bring a solution to this difficult problem and may even be extended to medium density traffic. It is based on a fleet of small

electric vehicles under constant control of a central computer. The vehicles can be manually driven by the users or can be used under automatic guidance on special tracks. They are available in a large number of specialised parking areas where they are maintained and recharged.

This concept is being developed in France by two large government research institutes, one in transportation technologies (INRETS), the other in computer science and automation (INRIA), and the development of prototypes will start soon in cooperation with large and small industrial companies. Several cities in France are already interested in experiments.

Background

The concept of a public transport system based on a fleet of small vehicles (electric, or even thermic) has already been experimented, several times, with poor results (Montpellier, Amsterdam, Brussels,...).

The failure of these experiments can be traced to many factors:

- insufficient number of vehicles (about 35 in two cases),
- improper localisation of the vehicles,
- no management of return trips (empty vehicles),
- vehicles not designed for heavy public usage,
- poor performances,
- poor design of the vehicle access and fare collection.

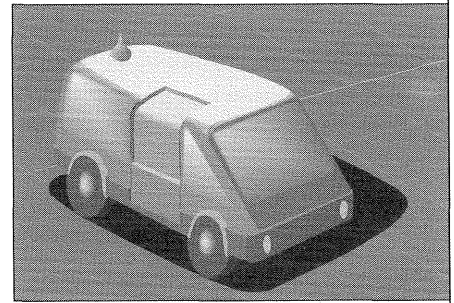
However, new technologies are now available which could easily solve these problems :

- electric vehicles are now on the market with very good performances for urban usage,
- localisation techniques are now available commercially,
- communication techniques with mobiles are now available at a low cost,
- computer techniques for managing fleets of vehicles and redirecting them according to demand can be developed,
- vehicle access and billing with the use of smart cards can easily be implemented,

- computer driving has already been experimented with and can be considered at least in parking areas and on special tracks.

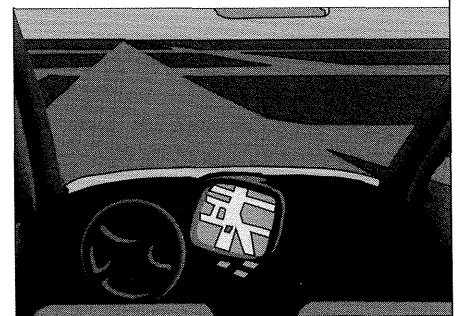
INRIA and INRETS have investigated, in cooperation with several industrial partners and public transport specialists, how these new technologies could help bring to market a novel public transport system, similar in performance to the private automobile, but without its problems in terms of cost, security, congestion, pollution and difficulty of usage.

The vehicles



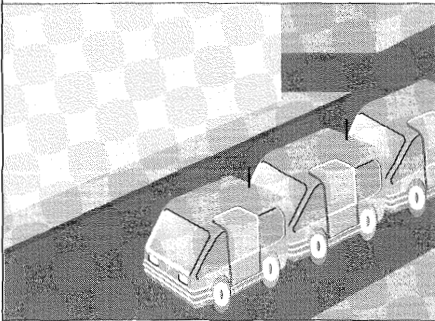
Small electric vehicles with good city performances have recently been put on the market (just in France: Microcar, Ligier, Erad,...). Car rental agencies will soon start to offer them to their customers. In parallel, many cities are exploring ways to restrict access to town centres to ZEV (zero emission vehicles).

Although there is some debate about the pollution of electric cars, it is certain that in city driving, small electric cars are much more efficient in energy usage than thermal cars. Besides, air pollution is becoming a very serious problem in many cities and it is necessary to, at least, delocalise the pollution.



The design of the vehicle calls for automatic movement in the parking areas. In the large parking areas, the users will leave the vehicles on a quay and from

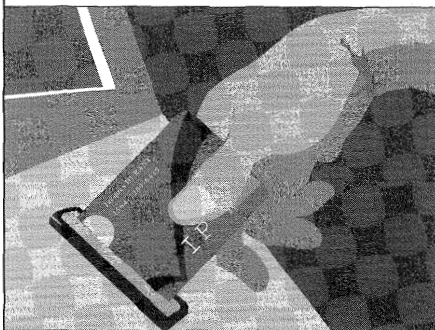
there each vehicle will move automatically on a line (eventually to some significant distance) to another quay where it will be picked up.



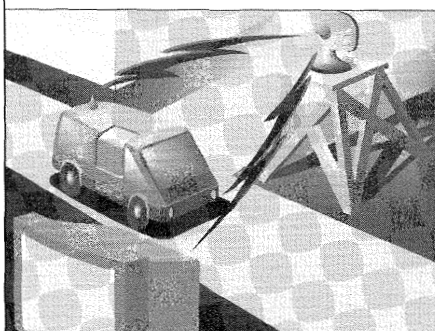
Another feature of the vehicles which is needed is the possibility to link them together to form trains. This would be particularly useful to bring back several empty vehicles with a single driver or to increase the capacity of the vehicles and to increase traffic flow.

Vehicle access and control

Users of this public transportation systems will have a contract with the system operator and will be identified by a smart card associated with some identification procedure (e.g. code number).



Since each user is clearly identified, there should be no problem of responsibility in case of accident or damage to the vehicle. Besides, the vehicle has a radio link to the central control and any incident is immediately reported.



Each vehicle is equipped with a localisation system. This system allows the central system to keep track of the entire fleet and to reserve vehicles for customers. It is also needed to issue orders to transfer empty vehicles from one location to another. The orders are carried out by human drivers or eventually under automatic control.

The customers pick up the vehicles in the designated parking areas. They can also inquire about the availability and location of vehicles and make reservations by telephone. They can also share a ride with another customer (if he is authorised and willing) who is travelling in the same direction at the appropriate time.

Conclusion

Modern technology in terms of electric vehicles, localisation, communication, electronic billing, computer controlled driving make it possible to offer a new public transportation system at an attractive cost to society. This system should attract many types of customers, in particular those now using their own cars or those which have no access to public transportation. The main features of this system are the comfort, convenience and availability offered.

Furthermore, this concept is attractive because it can be implemented in the short term with existing technologies and be improved all the way to fully automated driving as the technology progresses and it does not require large investments such as the PRTs (Personal Rapid Transit).

First experiments in France are planned for 1995 and it is believed that such a novel transportation offer can bring significant changes in the quality of life and in the designs of the cities in the not so distant future.

INRIA and INRETS are presently looking for partners to collaborate within the context of EUREKA, or any related European project.

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Traffic Generator for ATM Systems

by Bjarne Helvik

It has been internationally agreed to introduce a new digital transport and switching mechanism called ATM (Asynchronous Transfer Mode) in the Integrated Broadband Communications Network (IBCN) / the broadband ISDN.

The PARASOL consortium was initiated by major European manufacturers of telecommunication measurement equipment, with the objective to develop test and evaluation equipment for ATM. PARASOL has a number of partners in 10 European countries. The work in PARASOL is part of the RACE program (R 1083).

Norwegian Telecom is one of the partners in PARASOL, with SINTEF DELAB as a subcontractor. SINTEF DELAB is responsible for the development of an advanced traffic generator to be used in connection with validation of ATM based systems, e.g. B-ISDN. The generator is based on a traffic model previously devised at DELAB. The development is carried out in close cooperation with several other PARASOL partners.

A working prototype of the STG (Synthesised Traffic Generator) has recently been successfully demonstrated. It is capable of generating a traffic multiplex from 2048 individual sources, stemming from a number of different source types. Source types are user definable. In addition a call-level is simulated according to specified load profiles. A bulk load version, generating traffic on a number of links, is currently developed under contract with Norwegian Telecom.

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"Flight Recorder" for Automobiles

by Steinar Andresen

Within a few years, Norwegian drivers may be controlled by a small electronic container mounted on the vehicle's wheel. The device can be used to register important parameters related to the driving and the car itself. Automatic billing of road tolls, parking fees, etc, is but one possibility.

A Norwegian company, Aastvedt Industrier, is currently producing special odometers for diesel cars. In Norway these cars are taxed according to number of kilometres driven, and special tamper-proof odometers have been required. The government has now decided to tax diesel by the litre, and suddenly the odometer producer lost their market.

Research scientists at the Norwegian Institute of Technology (NTH) and SINTEF were asked to come up with new ideas for construction and applications of an improved odometer model. Professor Steinar Andresen at NTH's Department of Computer Systems and Telematics, and research scientist Bente Gaarder Andersen at SINTEF DELAB got the idea from the flight recorder used in aeroplanes, and transferred the concept for use on road travel.

Two-way Communication

Aastvedt Industrier required that the "black box" should be positioned at the same place as the odometer, i.e. in the wheel hub. This small container can collect and store information for later transmission. The information can either be transmitted to a central exchange, or to receiver units placed along the road track. The communication requirements may be supplied by the new digital cellular communications system GSM. "The black box can be adapted to serve numerous different purposes. Several European countries are currently financing research programs to develop systems for two-way communication with vehi-

cles", says professor Andresen. He recently chaired a large international conference on Vehicle Navigation and Information Systems (VNIS'92) in Oslo.

For hybrid vehicles

The black box may amongst other usages find advocates in businesses in need of fleet management. In addition to registering distance travelled and time required, the container can also measure temperature and air pressure in the tire. The latter solution may be industrialised in co-operation with car manufacturers or contractors supplying wheel hubs, the research scientists suggest. As hybrid vehicles (run by electricity and gas) are introduced on the market, the black box may be needed as a kind of advanced odometer.

Automatic speed traps?

In the future, the small container on a vehicle's wheel can be used to determine the size of some of the bills arriving in your mail. The bill for road usage from the Road Authorities, is a good example. However, speeding tickets from the police can also be the result from the information stored in the black box.

Road use pricing can be achieved automatically if a network of information beacons are distributed along the road. The toll can be varied, such that for instance driving in a city centre becomes more expensive than driving in the countryside. In Norway as well as in other European countries different systems for road pricing are being considered," says professor Andresen. "The black box may also render the police' speed traps superfluous. Sensors along the road track informs the black box about the current speed limit. Exceeding the speed limit will immediately be detected." Professor Andresen does, however, consider the concern for citizens' rights an important restriction in utilising the black box in this fashion.

The project has been financed by The Royal Norwegian Council for Scientific and Industrial Research.

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Formal Specification and Verification of Concurrent Systems

by Jos van Wamel

Verification techniques, which can be helpful in automatic proof-checking in concurrent systems, are being developed in a project at the University of Amsterdam (UvA). The techniques are based on the notions of process algebra.

Formal description techniques are increasingly more applied to the design of concurrent systems. Algebraic, axiomatic methods can be useful in the specification of distributed, concurrent algorithms, given the ambiguities in communication protocols in a natural language. On top of a specification language, tools can be defined for the simulation or automatic verification of given implementations in such formal languages.

The UvA and CWI have a long standing and close working relationship (in particular Jan Bergstra and Jan Willem Klop, respectively) in the field of process algebras, which form the mathematical foundation of a number of specification languages. This project aims to increase the expressiveness of process algebra, for example by adding features to formalise the real-time behaviour of concurrent systems and to handle data, and to formalise proof techniques so that systems of a realistic size can be verified by computer tools. Partial funding comes from the Netherlands Computer Science Research Foundation (SION).

In process algebra, two basic entities are used: processes and actions. In addition there are operators such as sequential composition, alternative composition (choice), parallel composition and a communication function which defines whether or not the simultaneous occur-

rence of two actions leads to communication. Process algebra also contains special actions or constants, the most important of which are the "deadlock" and the "silent" step. If a system can perform no action but a deadlock, it is blocked: it can not continue or terminate successfully. The silent step denotes an internal action or a hidden (non-observable) action.

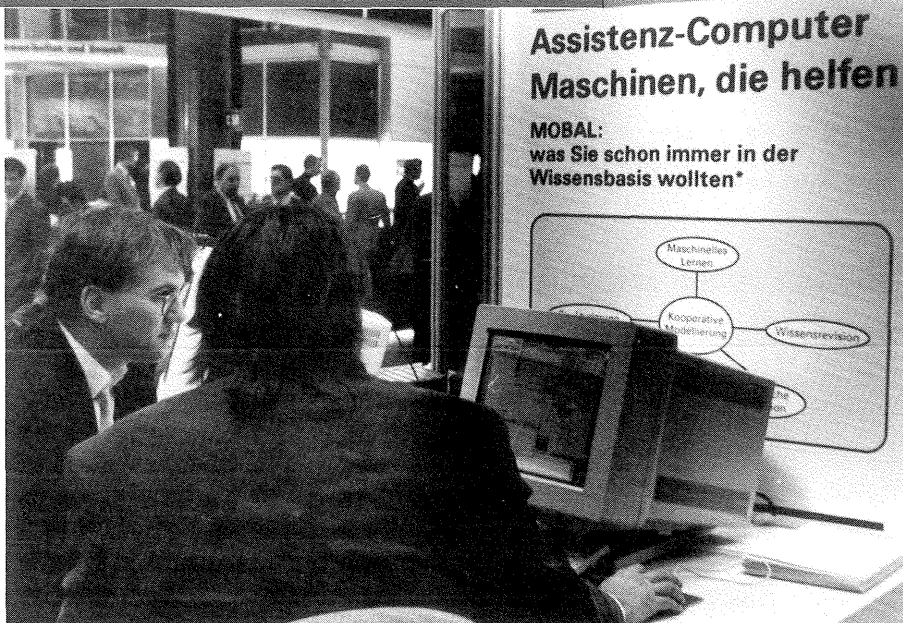
A verification of a system is the formal proof that, after abstracting from all internal actions, its external behaviour satisfies a given requirement. Algebraic verification can be performed simply by manipulating equations, using the axioms of a given algebra. Another option is verification in a model for the algebra. Models for process algebras are the well-known graphs or labelled transition systems.

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MOBAL: an Assistant for the Creation and Maintenance of Knowledge Bases

by Siegfried Münch

If a computer system is to support a user in the acquisition of knowledge, it is insufficient simply to provide him with a few formalisms for knowledge representation. This fact was instrumental in leading to the design of the MOBAL (Model Based Learning System) knowledge acquisition system. MOBAL is a subproject of the assistance computer developed at the GMD's Institute for Applied Information Technology.



The computer as a workbench for knowledge acquisition
(Photo: Münch, GMD)

The acquisition of knowledge on a new subject area is not an activity which allows complete organization or computer-based planning, but is rather a creative process involving frequent changes in the thought process and numerous iterations. The system must be flexible so as to allow the user to work in the way he requires and not the way the system dictates. The system must be able to show the user the consequences of any knowledge which is entered. Since a subject area model can only be created through working with the system, the latter must be able to accept initial data which are contradictory, incomplete or flawed. Finally, the system should assist the user in augmenting and improving the entered model e.g. by proposing new rules or terms which could supplement the existing store of knowledge.

The MOBAL system developed by scientists at GMD is a workbench providing a number of tools which can be employed either individually or collectively for the acquisition of knowledge. The core of the system is the "Coordinator and Inference Engine" which manages the knowledge base and coordinates the system functions. A subject area model is represented in MOBAL by means of facts and rules which can be modified at any time. The inference machine ensures that all entries which are dependent on the changed entries are also changed. If entries are incomplete or erroneous they

do not need to be corrected immediately. The system maintains an agenda of such "open ends" which the user can work through at a time which suits him. Even contradictory entries can be processed. The system ascertains such contradictions and provides an appropriate tool, the "knowledge revision tool", which can be used to analyze and eliminate the contradiction.

The other tools employed by MOBAL support the user by employing different techniques of machine-based learning. All learning processes here function as assistants for the user. Knowledge modelling is understood as a cooperative, balanced process between man and machine. The processes provide proposals which can assist in eliminating incompleteness, improving the structure of the knowledge base or indicating regularities. The user can act on these proposals or may opt to make similar or other entries manually.

An initial version of MOBAL has been tested in various applications. The application which is most advanced is a technical application for the allocation of access rights in the telecommunications sector (in conjunction with Alcatel Alsthon Recherche, Paris). MOBAL is part of the ESPRIT project on machine-based learning (Machine Learning Toolbox).

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Research Themes

- Applied mathematics
- Information and knowledge systems
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- Computer graphic, image processing, vision and visualisation
- Systems engineering
- Parallel and distributed systems
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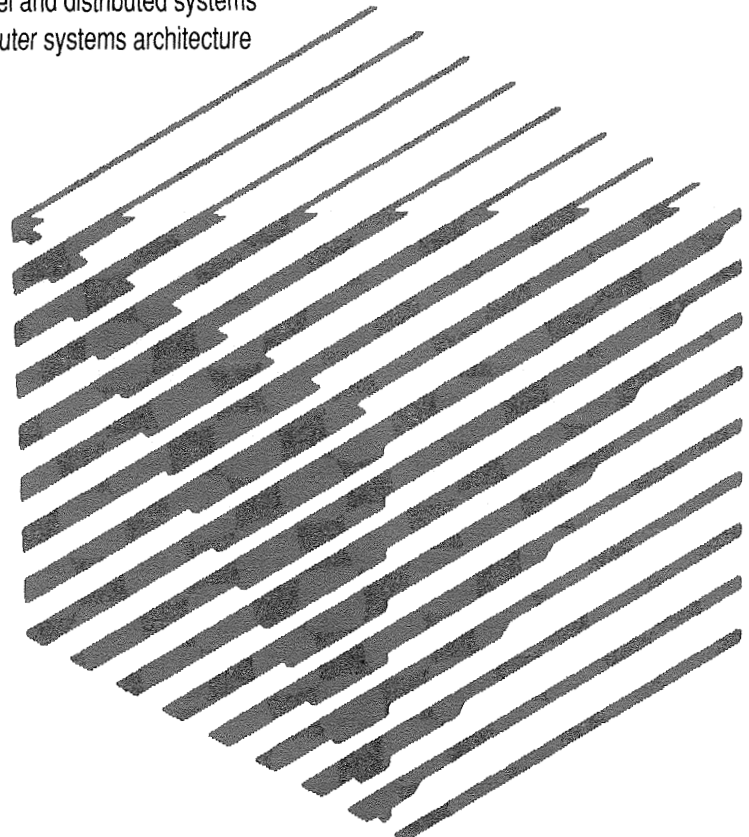


Image Analysis and Content-Based Retrieval for Semantic Image Databases

by Pasquale Savino

In recent years many application fields, such as satellite image processing, robot vision systems, medical diagnostics, and CAD/CAM systems, have evidenced the need to extend Data Base technology to manage image data. Automatic image analysis and efficient storage and content-based retrieval of images are necessary for effective management.

Research on this topic began in 1986 in the Esprit Project MULTOS and is now under way at IEI-CNR. The research focuses on the automatic recognition of simple and structured objects from graphical images and on image retrieval by expressing conditions on the image content; exact match and partial match retrieval is supported. Access structures have been defined in order to speed up the retrieval process. Recent research has focused on the possibility of providing support for user uncertainty in query formulation.

The main conceptual problem in dealing with image databases is the difficulty of defining and interpreting the content of images exactly. Images can be very rich in semantics and are subject to different interpretations according to the human perspective on the application domain. However, the real goal of image analysis in our approach is not image understanding "per se", but to support the image retrieval process.

Image analysis is restricted to images belonging to a predefined application domain. The approach supports the use of multiple domains and enables the defi-

inition of new domains and the extension of existing ones. Each domain is composed of a set of model objects either elementary or complex (e.g. for a domain of Apartment Design, elementary objects are table, chair, bed, etc., while examples of complex objects are dining room, bedroom, etc.). Elementary objects are composed of graphical elements only and are represented by using Attributed Relational Graphs (ARG). Complex objects are composed of other objects, and they are defined using rules that take into account the object's spatial relations and composition. Object components are either mandatory or optional and the importance of their presence in the image is specified.

After image acquisition, producing an image in raster form, and image restoration and segmentation, producing a vector representation of the image through simple graphical elements such as lines,

curves, etc., image analysis is completed by the following two phases:

- Recognition of elementary objects. A partial match between model and image objects is performed and the degree of matching is measured. The ARG method is used.
- Recognition of complex objects. The rules that specify the model complex objects are applied to objects recognised in the previous phase. A partial match is performed and the degree of matching is measured. Image interpretation is in terms of the objects contained in the image, their composition, position and matching degree. Multiple image interpretations are allowed.

The query language supports queries with partial conditions on the composition of the objects contained in the images to be retrieved and conditions on their relative position. A Database (DB) and an Information Retrieval (IR) approach have been

experimented with. The first supports exact-match, DB-like queries, while the second allows for partial match queries by also supporting user uncertainty about image content. A measure of the image/query similarity is provided.

In order to speed up the retrieval process, an access structure based on an extension of the signature method has been defined and experimented with. It has been used to process exact match queries and has been recently extended to partial match queries. The evaluation of the access structures used and the IR approach (measuring retrieval precision and recall) is in progress. ■

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TECHNOLOGY TRANSFER

VLSI for Interactive Raster Graphics

by Henk Nieland

The presentation and manipulation of images on graphics screens still requires a major part of a workstation's processing power. Through a new workstation architecture, designed at CWI, visual communication can be considerably improved. The architecture includes special, very powerful chips, developed in cooperation with the University of Twente. A prototype workstation is now near completion.

Many workstations have nowadays high-resolution screens and fast processors, and the generated images lead to acceptable visual communication. However, the price in terms of computing resources is very high. Moreover, real-time manipulation of illumination, shading,

texture, etc., is still completely out of reach.

Generating an image requires a series of graphical actions: image projection, computation of illumination, visibility determination and pixel generation. For interactive manipulation of the image a fast traverse of this "graphical pipeline" is necessary. Usually special hardware is incorporated for this purpose at crucial places in the architecture.

Research at CWI has shown that much more can be gained by grouping the interactions into classes and designing the graphical system's architecture accordingly. Intermediate results are stored at well-chosen levels. The lowest level only contains all completely visible parts of objects and the highest level the full 3D scene. Thus the time-consuming repeated storage of the frame-buffer is avoided.

A completely new raster-independent incremental hidden surface removal algorithm was developed, rendering an image representation on the lowest level. This enables the object to be manipulated in

space and to be partly changed. In addition, transparent objects can be treated.

On the basis of this research, special "full custom VLSI" chips for fast rasterization were constructed at the University of Twente (generation rate 12 nanoseconds per pixel). Among other things, realistic images of 3D objects can now be displayed on the screen in real-time, without the need for intermediate storage of pixels in a frame-buffer.

The chips are implemented in a prototype workstation, now near completion, in which special graphical functions are allocated to separate parallel processors. Thus a working environment comes within reach, in which one can manipulate with 3D objects as desk top publishers do with document illustrations.

This research was a Dutch Technology Foundation project in which industry is structurally involved in order to guarantee optimal transfer of research results to applications. ■

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SYNCHRON: A Project Proposal

by Albert Benveniste

It is commonly accepted to call real-time a program or system which receives external interrupts or reads sensors connected to the physical world and outputs commands to it according to timing constraints. Real-time programming is an essential industrial activity whose importance keeps increasing: factories, plants, transportation systems, military and telecommunication systems, cars, and a wide variety of everyday objects are or will be computer controlled.

This area of activity is rapidly moving from electromechanics, electronics, and analog processing toward computer systems of different sizes and complexities:

- ICs, ASICs, are now used for automata, task sequencers, microcontrollers, but also in front end signal processing;
- parallel, sometimes heterogeneous, and often particular architectures built on off-the-shelf or custom components are encountered in more advanced systems such as military, telecommunications, aircraft, and soon also in automotive industries;
- large scale complex systems (transportation, large factories and plants, large military and telecommunication systems) critically rely on huge real-time programs.

Hence there is a need for developing a coherent set of tools and software environments providing:

- a powerful formalism for specifying real-time applications, equipped with fancy user interfaces,
- tools for checking properties, performing proofs and verification in order to facilitate the certification and testing of the programs developed,
- tools allowing an automatic translation from specification into a (possibly distributed) executable program of

high efficiency both in terms of speed and memory requirements.

It is worth noticing that the reported area is essential for the competitiveness of European industry in the near and long range future: most of the European leading industries critically rely on real-time systems design and programming.

A Technical Breakthrough and an Opportunity for Europe: Synchronous Programming

The recently emerged Synchronous languages (Esterel, Lustre, Signal) provide a drastically new and elegant approach to the above mentioned issues. The synchronous approach to real-time systems design and programming consists of

1. Paying attention to the reactive aspects of the application in consideration, i.e. synchronisation, logic, and data paths. Logical rather than physical time is handled at this stage and actions as well as communications are viewed as instantaneous.
2. Proofs and program transforms can be performed, parallel or sequential execution schemes can be generated, and some evaluation can be performed using this synchrony hypothesis.
3. The synchronous hypothesis is then relaxed, and sequential programs can be generated, that can communicate both synchronously or asynchronously. And it is guaranteed that the implementation still meets the specification.

The above mentioned three languages have been developed at CMA-Sophia, LGI-Grenoble and INRIA-Rennes respectively. They are now marketed respectively by CISI-Ingénierie and ILOG, VERILOG, and TNI, four software developers and marketers.

The SYNCHRON Project: Establishing, Developing, Marketing, and Fielding the SYNCHRON Standard Format for Synchronous Programming

In order to base their approach on standards, the academic and industrial teams involved in the development of synchronous languages are currently defin-

ing the SYNCHRON format jointly, with the following objectives:

- providing a set of coherent and comprehensive standards for real-time systems specification and programming;
- providing standards that are based on a rigorous mathematical approach, and allow proofs, verifications, and program transforms to be performed;
- providing standards that allow an easy development of user interfaces fitted to specific industrial areas, as well as an easy design of code generators for specific, new, or even proprietary architectures.

Based on this currently emerging standard, the SYNCHRON project has the following objectives:

- establish the SYNCHRON format as a legal standard;
- develop and market several instances of the SYNCHRON format;
- develop and market tools tightly associated with the SYNCHRON format;
- help the insertion of the SYNCHRON format in different real-time oriented software factories;
- test on full-scale applications the SYNCHRON based approach to real-time systems specification and programming.

The following companies and academic institutions in France have decided to start launching this project jointly:

Software companies: CISI-Ingénierie (Paris), ILOG (Paris), SYSECA (Thomson group, Paris), TNI, (Brest), VERILOG (Toulouse).

Systems industries: Dassault-Aviation (Paris), Merlin-Gerin (Grenoble).

Academic institutions: CMA, Ecole des mines (Sophia-Antipolis), INRIA (Rennes and Rocquencourt), CNRS (IMAG-LGI, Grenoble).

It is clear to all the above mentioned partners that the project will gain credibility, visibility and effectiveness if other European partners join the initial consortium. We are therefore looking for interested new partners outside of France. ■

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INESC and MICROSOFT Share Know-how

by João Bilhim

The signing of an agreement for scientific and technological cooperation in Lisbon marked the beginning of a collaborative arrangement between Microsoft Corp, a major American software producer, and INESC.

The protocol was signed on 28 October on the premises of INESC ("Systems Engineering and Computers") in Lisbon with the presence of Mr Bernard Vergnes, Chairman of Microsoft Europa, and INESC Directors, José Alves Marques and João Lourenco Fernandes.

The agreement establishes the creation of a Microsoft technology "Competence Centre" in INESC for joint activities into technological research; the development, evaluation and testing of new Microsoft products and advanced training. The agreement therefore represents an important step for the signing of future contracts allowing the integration of Portuguese know-how into Microsoft products.

Special reference should inter alios, be made to the development of new products through the incorporation of Microsoft technology into products which have been developed by INESC. This was the case of system ELENA which is currently being used at Post Offices Counters throughout Portugal.

Another important facet of the above agreement refers to joint research projects with INESC's Research and Development Group which is engaged in the scientific field of machine translation and computacional syntax with the Microsoft Labs team developing software for the above applications. Other planned initiatives include the evaluation and testing of new Microsoft products to help design and develop new applications and languages and, in addition, setting up a Microsoft Competence Centre on INESC's premises with the basic objective of training top level technical programmers.

Microsoft's decision to choose INESC as a partner in its development activities is associated with its scientific and technical capacity for the development and production of equipment and systems for leading worldwide companies, gaining access to technologies which, in the area of computers and information systems, belong exclusively to the computer technology giants.

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INESC Welcomes EURESCOM

by João Bilhim

The Director of EURESCOM, Mr Kurt Katzeff, visited INESC on 28 October and had a meeting with INESC Directors Eng. Alvaro Rocha and Professors Jose Alves Marques and Mario Jorge Leitao. Representatives of the Portuguese telecommunications companies associated with EURESCOM and INESC were also present.

EURESCOM is an business sector structure coordinating the strategic development activities of the European telecommunications operators. INESC recently signed three R&D (Research and Development) contracts with TLP - one of the three Portuguese telecommunications companies for ensuring the performance of R&D contracts awarded by EURESCOM.

The objective of this working visit was to analyse the Portuguese role in EURESCOM financed telecommunications projects.

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Signing the agreement for scientific and technological cooperation between Microsoft Corp, a major American software producer, and INESC are from left to right:

Mr. Rodrigo Costa from Microsoft Portugal, Mr. Bernard Vergnes from Microsoft Europe, Prof. José Alves Marques, Director of INESC, and Prof. João Fernandes, Director of INESC.

(Photo: INESC)



Real World Computing: A Japanese Research Initiative

by Alain Michard

During their last meeting (Heraklion, October 1992) the ERCIM Board of Directors unanimously "recognised the strategic importance of the Real World Computing Programme, and decided that ERCIM should apply for membership". Why this decision, and what does it imply?

Real World Computing is a Japanese research programme, established for ten years, funded by MITI, and open to foreign participation. It is presented as a long-term research effort, and its final technological objectives are therefore not rigidly defined at the beginning of the programme. The "master-plan" mentions several complementary research domains that should be explored, the programme focusing progressively on the most promising ones to converge towards a general strategic objective. This strategic objective is to prepare the scientific and technical background needed to design massively parallel distributed systems able to process the flexible information that characterises real-world ill-defined problems. Such systems should be able to make appropriate decisions and solve problems while permitting ambiguity, incompleteness and changeability of information. Five research domains are mentioned in the master-plan:

- Theoretical foundations of human-like information processing: flexible representation, storage and recall of information, learning and self-organisation, optimization methods, etc.
- Novel functions with flexibility based on their robustness, openness and real-time: flexible recognition and understanding, flexible inference and problem-solving, flexible autonomous control. These novel functions should be integrated in two systems: a real-

world adaptive autonomous system, and an information integration dialogue system.

- Massively parallel systems: architectures, operating systems, languages, environment and system evaluation.
- Neural systems: neural models, neural hardware and software, integration with massively parallel systems.
- Optical computing and devices: optical interconnection, optical neural and digital systems, development environment. Generic technologies developed along this line should be mainly applied to image processing and spectral information processing, with learning abilities.

RWC is very attractive for research organisations, for several important reasons, some of them related to the scientific content of the programme, and others related to its management.

- The first reason is that RWC is a good example of a "strategic research" effort: it is research because it aims at solving difficult problems for which real conceptual breakthroughs are mandatory. It is strategic, because the research efforts are oriented towards the creation of generic technologies and methodologies needed to solve real-world highly-relevant problems. Understanding and managing complexity is a major intellectual challenge in our modern society. Controlling the effects of human activity on our environment, managing large economic entities, running and maintaining large flexible production systems, are some examples of activities where human-beings have to take decisions with incomplete and uncertain information, and where these decisions may have considerable effects on welfare or health of a large population. Designing IT systems which could help in mastering complexity is therefore a highly valuable challenge for researchers.
- RWC tries to merge the two classical approaches of information processing which have been developed on two parallel tracks: mathematical analysis and simulation on the one hand, and symbolic representation and processing on the other hand, will have to be integrated to try to solve the kind of real-world problems mentioned above.

- Another attractive feature is the balance maintained between the researcher's creativity and freedom, and the general consistency of the programme. The programme is launched without a precise work-plan. Research laboratories can propose specific objectives and can freely choose the methods and tools they will use to reach them. Quality of the results and relevance with the general strategic objectives should be the criteria used for assessing each research action.
- A flexible process is defined for progressive focusing of the programme on its final objectives. During the first five years of the programme, several competing approaches will be supported for each domain. After five years, evaluation of the results will lead to the selection of the more focused research themes to be concentrated on in the second half of the programme.
- Ten years is probably a good timescale for a strategic programme. Several ambitious projects in Europe have suffered from premature ending, at the moment the first promising results were just emerging.
- The programme is open to international cooperation: the central laboratory, which is in fact a part of ETL (Electro-Technical Laboratory), located in Tsukuba, will conduct only a part of the R&D activities. Domestic and foreign organisations (private or public) will play an important role in the programme. It is true that up to now, only a very few foreign organisations have accepted to join in the programme, or have declared their interest. ERCIM is one of them. Others come from Australia, South-Korea, USA (only for the Optical-computing domain) and Germany (GMD is already member of the RWC partnership). It is up to all research organisations interested in the domain to turn this programme into a truly international effort.

The Fifth Generation Computing Systems initiative was very similar to RWC in many aspects, even if the strategic objectives were quite different. FGCS was more centralised (most of the work was done in a single central laboratory, ICOT), and less open to international participation, although some European and American laboratories succeeded in partici-

pating in it during the last years. In spite of these limitations, several ERCIM members had a very positive experience of collaboration with our Japanese colleagues within this previous programme. We all consider that RWC is a new major opportunity to increase the scientific co-operation which was initiated by FGCS.

ERCIM is currently engaged in negotiation with the MITI to define precise terms of cooperation. The philosophy that will direct our requests in this negotiation is quite simple: we want to participate in a genuine basic research programme, and the conditions should reflect our concept of basic research, i.e. free publication and distribution of the results, possibility for any laboratory in the world to use the results as a background for its own research, fair access to the generic technologies generated by the programme for all participants, and publicity of the detailed work-plan ("who's doing what").

In a recently published report, ERCIM strongly advocated refocusing of the EC framework programme on strategic research. RWC presents several fundamental features that could usefully inspire a European IT programme. In the meantime, ERCIM considers that research is an international activity and is happy to have the opportunity to develop cooperation with Japanese colleagues.

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CNR Coordinates Project DERPI

by Nicoletta Celli

The DERPI project (Data Exchange on Research Projects and Institutions) has been approved within the context of the agreement for collaboration and aid to Eastern Europe promoted by the Italian Ministry for Foreign Affairs.

The project, which will be coordinated by CNR, aims at creating a common data bank containing information on research activities. The countries to be involved in this initiative together with Italy are Poland, Czechoslovakia, Bulgaria, Hungary, Rumania, Austria, and the ex-Yugoslavian states.

The objective is to make a large amount of information on scientific work and projects in Eastern Europe, which is currently impossible or very difficult to retrieve, generally available to the international scientific community. CNR will also supply the information retrieval system to be adopted. This system, called Domino, is already operational at SIAM (the information and computer service for the area of research of Milan).

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International Research Cooperation at ICSI

by Joachim Beer

The International Computer Science Institute (ICSI) and its role in promoting German-American cooperation in the field of computer science was presented at a status seminar, hosted at GMD, and featured in ERCIM-News (see No 10, page 25). While Germany was the initiator of ICSI the idea soon found friends and supporters in other countries as well. With the subsequent participation of Italy and Switzerland as sponsor nations the Institute is now well on its way to become truly "international".

Prof. Domenico Ferrari who was already instrumental in bringing ICSI to Berkeley in 1988 was also the major force in winning national Italian support for ICSI. In recognition of his many efforts to further Italian and international co-operations

in computer science he was recently awarded the honorary title of "Commander in the Order of Merit of the Italian Republic". After serving as ICSI Deputy Director from 1988 to 1990 Prof. Ferrari is currently leader of the Tenet group, a joint project between ICSI and the University of California at Berkeley conducting research in high-speed computer networking. Swiss support was mainly organized by Prof. Erwin Engeler of ETH Zurich.

Beyond establishing co-operations between European and U.S. researchers, ICSI has also become a natural starting place for intra-European research collaborations as well. Recent projects include the development of algebraic models of computational complexity for problems involving approximations. This project was started by Italian and Swiss researchers while at ICSI. Two postdocs from Italy and Germany developed network transmission protocols for multimedia applications. On a larger scale, the development of the object-oriented programming language Sather at ICSI involved researchers from several European countries and the U.S. This is especially remarkable given the fact that the majority of researchers at ICSI are one-year postdocs and short term senior visitors. Maintaining progress and continuity in large projects under these circumstances attests to the high calibre of the researchers visiting ICSI.

To further strengthen the Institute's international research ties ICSI's Realisation Group has recently entered a three-year collaborative effort with speech researchers at Cambridge University, Lernout&Hauspie Speechproducts in Belgium, and INESC in Portugal. This effort is a Basic Research Action sponsored by the European Community and is believed to be the first time an American institute has been accepted as part of such a project. ICSI will be subcontracted by Cambridge University but will, of course, collaborate with all of the partners.

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GMD Hosts the Fourth International Olympiad on Informatics

by G. Hartmut Altenmüller

Mapping a group of islands and drawing up a plan for climbing a mountain are two tasks of apparently very concrete form which may be reminiscent of summer holidays. The two tasks were not as simple as they might seem, however, since the islands were only available as coded information in a matrix and the mountaineers had the task of finding the optimum way of reaching at least one of the peaks bearing in mind the limited abilities of each individual climber to carry sufficient supplies. Resolving these problems with the aid of computers was the task facing participants of the Fourth International Olympiad on Informatics (IOI'92) which was held in Bonn from 12 - 21 July 1992.

Shortly before the Summer Olympic Games in Barcelona, 166 schoolchildren from all continents tested out their mental skills at IOI'92. On July 15 and 17, they were given the assignment of precisely analysing the two tasks to arrive at the most elegant solutions and to program these solutions using PCs. From 13-19 July, the Gustav Stresemann Institute in Bad Godesberg (Bonn) became the world centre for young scientists in the growing field of informatics. On 20 July, the outstanding success of this competition was underlined at the closing festivities held at Schloss Birlinghoven near Bonn, the headquarters of GMD.

The Federal Minister of Education and Science, Professor of Informatics Dr. Rainer Ortleb, together with Hans Schwier, the Minister of Culture for North Rhine-Westphalia, and other leading personalities from the field of science and research presented the most successful participants with 13 gold, 31 silver and 41 bronze medals. Numerous

other prizes - including a number of valuable computers such as three laptops from Apple and Siemens Nixdorf - were awarded by private-sector companies. The Federal Minister of Education and Science funded the IOI'92 in Germany. Leading computer manufacturers also helped promote the competition. IBM and Siemens Nixdorf, for example, made around 200 PCs available free of charge for the duration of the Olympiad.

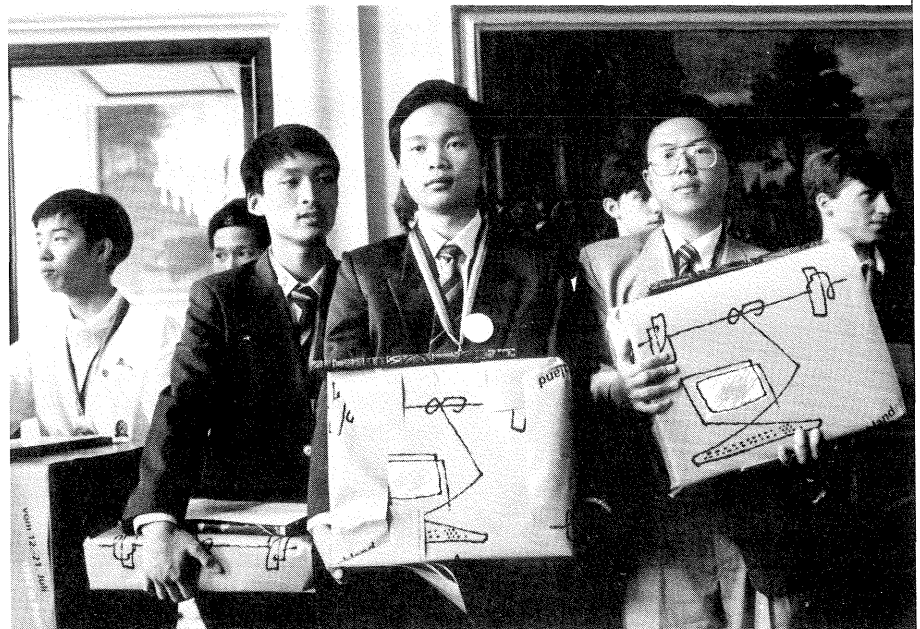
46 countries had sent delegations of up to four schoolchildren to IOI'92. The conference was open to both boys and girls still attending school in the 1991/92 school year who were born after 1 July 1972. Each delegation was accompanied by two leaders. Four countries also sent official observers. One aspect which was disappointing, however, was the fact that only four girls took part in the competition. In line with the principle of equal opportunity which applied for this Olympiad, two of the four Dutch participants were girls.

The programming languages allowed for the competition were Turbo Pascal V.5.5 and V.6.0, Turbo C++, Microsoft C V.5, Quick C, QuickBasic V.4.5, GWBasic and LCN Logo V.2.

GMD represented by its chairman Prof. Dennis Tsichritzis, and the Gesellschaft für Informatik e.V. in Bonn, represented by its chairman Prof. Roland Vollmar, provided their support to the event which was headed by Prof. Fritz Krückeberg, Chairman of the National Committee of the IOI, and Dr. Peter Heyderhoff, chairman of the International IOI Committee.

The IOI has been held annually since 1989. The number of participating countries in Bonn was more than twice that at the last Informatics Olympiad in Athens. Invitations have gone out for the next IOI to be held in Argentina in 1993.

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China was the most successful country at the International Olympiad on Informatics (IOI'92). Three of the four schoolchildren from the Far East received gold medals. Thailand and Sweden received two gold medals each and, in doing so, numbered among the three top nations. Two American participants also received gold medals, with one gold medal going to participants from Korea, Vietnam, Czechoslovakia and Hungary. The 13 gold medallists were: Yunhe Yang, Shanghai (China), Xing Wu, Fuzhou (China), Gao Chen, Wuhan (China), Shawn Smith, Oakton/Virginia (U.S.A.), Laszlo Peter (Hungary), Matej Ondrusek, Bratislava (Czechoslovakia), Viet Nguyen Tuan, Hanoi (Vietnam), Bom Jun Kim, Seoul (Korea), Fredrik Huss (Sweden), Jittat Fagcharoenphon, Nakorn Path (Thailand), Natha Bronson, Waxhow/North Carolina (U.S.A.), Pinit Asavanuchit (Thailand), each receiving 200 points, and Niklas Een (Sweden) who received 198 points. (Photo: Münch, GMD)

The History of ALGOL 68

Amsterdam, The Netherlands,
10-11 February 1993

In 1993 it will be 25 years ago that the programming language ALGOL 68 was established by WG 2.1 of IFIP. CWI will organise a conference to commemorate this fact, because the institute played a leading role in the development of the language. In a certain sense ALGOL 68 may be compared with Latin: although it is by now almost a dead language, its basic concepts have lost little of their actuality.

On 10 February a tutorial will be held in which Sietse van der Meulen (University of Utrecht) and Kees Koster (University of Nijmegen) will go into the actuality of programming concepts in ALGOL 68.

The conference on 11 February, chaired by W.L. van der Poel, includes the following speakers:

- Friedrich L. Bauer (Technical University Berlin)
- Charles Lindsey (University of Manchester)
- Kees Koster (University of Nijmegen)
- Sietse van der Meulen (University of Utrecht)
- A. Rar, M. Bulyonkov (Novosibirsk)
- A. Terekhov (St. Petersburg)
- Lambert Meertens (CWI)
- John Peck (University of British Columbia).

This conference is part of the ongoing activity History of Computing of the National Working Group on History and Social Function of Mathematics.

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Numerical Tools for Scientific Computation with Applications to Flow, Turbulence and Combustion

Antibes, France,
17-19 March 1993

The objective of this workshop is to bring together researchers and engineers working in the field of numerical simulation to exchange their experience on some basic tools common to many applications, for example, mesh generation, linear and non-linear solvers and graphic post-processing.

A full day will be devoted to each of these topics alternating with presentations of internationally known lecturers coming from both Industry and Academic Institutions.

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Third International Symposium on Integrated Network Management

San Francisco, USA,
18-23 April 1993

The symposium is sponsored by the International Federation for Information Processing (IFIP) Working Group 6.6 on Network Management for Communication Networks, with participation by the IEEE Communications Society Technical Committee on Network Operations and Management (CNOM) and support from the Institute for Educational Services (IES).

The Third International Symposium on Integrated Network Management will build on the success of ISINM '89 and ISINM '91 in forming a central technical forum for the research, standards, development, systems integrator, vendor and user communities of network management. The second symposium demonstrated an increasing interest in overall management solutions across all types of networks, enterprise communication systems, telecommunications, distributed computing systems and applications. Such comprehensive management is thus the focus of the third symposium. This focus includes all aspects of the network, integrating data and telecommunications – from narrowband to broadband, terrestrial to satellite, and stationary to mobile used for ordinary as well as advanced multi-media communications.

ISINM '93 spans an entire week. The combination of in-depth Tutorials, state-of-the-art Technical Sessions and Panel Discussions, Technology Center demonstrations and exhibits, ad hoc Birds-of-a-Feather Sessions and daily keynote presentations by industry leaders promise to provide you with the network management strategies you need to move forward in the nineties.

The program has undergone a stringent review process to present only the best and most important technical presentations. A total of 21 sessions will include 55 papers and 8 panels involving the foremost leaders of the field. The symposium will begin and end with a series of in-depth tutorial sessions presented by experts in fields of current importance.

For the first time, the 1993 symposium offers Technology Centers where multiple vendors will participate in live interoperability demonstrations of RMON, SMP, OSI, OmniPoint and Applications technologies over the symposium network. Symposium attendees will see first-hand how leading vendors work together to deliver cutting edge technologies and network management products.

ISINM '93 is a unique way to delve into every aspect of network management. More comprehensive than any other conference or show, ISINM '93 delivers the essential information you need to be pre-

pared for the nineties. In one week, you will hear, see, touch and talk more management than at any other event.

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RARE: European Research Networking in a Global Context

Trondheim, Norway,
10-13 May 1993

The theme of the 4th Joint European Networking Conference acknowledges the fact that networks covering a specific geographical area, or networks for a specific user group, will only be successful if they are connected to the rest of the world. This conference is THE forum on networking for research in Europe and presents a unique opportunity to meet key people active in the field today.

The conference addresses all staff from networking service providers of all sizes, as well as application developers, policy makers, and representatives of funding bodies, advanced user groups and standards organisations.

Topics:

Topics to be addressed are:

- Lower Layer Technology
- Security
- Mail and Messaging
- Policy
- Funding and Strategies
- Status Reports on Projects and Initiatives
- Network Management
- Network Applications
- Users

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CALL FOR PAPERS

Fourth Eurographics Workshop on Rendering

Paris, France, 14-16 June 1993

The series of the EG workshops on rendering has been met with growing success with the result that these workshops are being adopted as the forum of choice by the emerging "rendering community" in Europe and in the rest of the world.

We now announce the fourth workshop on rendering, to be held at the Ecole Normale Supérieure, in Paris, France. As in previous years, the workshop will aim at improving the exchange of experiences and knowledge between people interested in the different aspects of rendering techniques.

Topics:

The main topics of this workshop are: radiosity, ray tracing, illumination models, volume rendering, human perception issues, colour, texture mapping, sampling, filtering and anti-aliasing.

For additional information please contact the organising chairman:

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Deadlines:

26 March 1993: Extended abstracts
30 April 1993: Notification of acceptance
19 May 1993: Deadline of final paper

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CALL FOR PAPERS

AQuIS'93: Second International Conference on Achieving Quality In Software

Venice, Italy, October 18-20, 1993

Recent advances in Software Engineering suggest that sound technical solutions for achieving quality in software are available and all that software developers need to do is to use them to achieve the quality they desire. However, the take-up of these quality techniques from the research community by the software developer has not been very rapid and, where it has happened, the techniques chosen have been rather slow in producing their anticipated effects, if any effect at all is observed (apart from an increase in development costs!).

The conference aims at furthering the efforts of AQuIS'91 in emphasizing this issue of technology transfer. In addition, means to ascertain the quality of software under development will be investigated and pragmatic approaches towards attaining quality will be proposed.

Topics:

Submissions are welcomed in the following areas:

- Technology transfer techniques aimed at reducing the resistance to quality practice.
- Models of development processes and environments.
- Quantitative evaluation of quality attributes.
- The management, inspection, testing, maintenance and reuse of quality software processes and products.
- Software development tools: formal methods, tools/environments.
- Prediction techniques (quality, cost, resource requirements etc.).

- Quality standards/legislation.

Significant, real case study reports showing that quality is being achieved and why, as well as studies showing the opposite, would be among our ideal contributions.

For any additional information please contact the AQUIS'93 Secretariat:

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Deadlines:

1 May 1993: Papers
15 July 1993: Acceptance notification
1 September 1993: Camera-ready papers

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CALL FOR PAPERS

Category Theory and Computer Science

Amsterdam, The Netherlands,
7-10 September 1993

This is the fifth of a series of biennial conferences aiming at the advancement of the foundations of computing using the tools of category theory, algebra, geometry and logic.

Topics:

Central topics include:

- the semantics of computation
- program logics and specification
- type theory and its semantics
- domain theory
- linear logic and its semantics
- categorical programming.

Submissions purely on category theory are also acceptable as long as the appli-

cability to computing is evident. There will be a preliminary selection procedure.

Deadlines:

25 May 1993: Submission of abstracts of talks
1 July 1993: Notification of acceptance

Abstracts should be sent to:

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or: Fer-Jan de Vries - CWI (local arrangements)
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email: F.J.de.Vries@cwi.nl

PACTA '92: Parallel Computing and Transputer Applications

by Brian Henderson

Barcelona, the newest Olympic city, was the venue of the PACTA'92 conference, which took place on September 20-24, 1992. This event brought together many of the leading researchers and companies representing the state of the art in parallel processing.

183 papers were presented. Parallel sessions included: Algorithms, Robotics/Control, Scientific Computing, Linear Algebra, Signal Processing, System Tuning, Neural Nets, Simulations, Image Processing, Finite Elements, CFD, Transputer Applications, OS and Databases. The papers showed the emergence of parallel processing as a fundamental tool in many fields of computing.

As well as the technical presentations, six keynote lecturers were presented by invited speakers. These talks provided a wider perspective of the current developments taking place to promote and engender the exploitation of parallel processing. A review of the High Perform-

mance Computing Initiatives being set-up in both Europe and the USA was presented. The remaining talks featured Finite Elements, Weather Simulation, Oil Production and Automatic Parallelisation.

The general focus of the technical presentations was the "Teraflop Grand Challenge" – construction of a parallel supercomputer capable of achieving teraflop rates of calculation. INTEL, IBM, CRAY, Thinking Machines, Fujitsu and Convex each presented their view of what a Teraflop machine would be. It was interesting to note that based on current technologies a Teraflop computer would cost hundreds of millions of pounds; need to be housed in a small warehouse; and require an extensive cooling system. To operate the machine would require upwards of three Megawatts, requiring its own electricity sub-station to down-load off the national grid. It was noted that switching such a machine on or off would require the approval of the local Electricity authority on each occasion! There was much debate on who could afford to run a "teraflop" machine and what this would mean to the engineer.

Running in parallel with the conference sessions was a large exhibition of the latest products in the parallel field. The products displayed ranged from large scale supercomputers (Cray and Fujitsu) to workstation clusters (IBM) down to the current generations of chips from Texas Instruments (C40), Intel (i860) and INMOS (T800 and T9000). It was fairly obvious that the existing transputer range is no longer reigning supreme amongst the stands and that the C40 is currently leading the way, with the i860 close behind.

A panel session on the final day considered how to move applications to Teraflop Architectures. The panel expressed the need for conformity across the developing architectures to enable easy migration between systems, in addition to the training of engineers to learn the mechanisms required to build and generate code to operate on large-scale multi-processing systems.

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2nd ERCIM Database Research Group Workshop: Solutions to Problems of Scientific Databases

by John Kalmus

The second in the series of ERCIM Database Research Group Workshops was held near RAL at the Cosener's House, Abingdon, Oxfordshire, UK, between 13-15 July 1992, with a theme of "Solutions to Problems of Scientific Databases".

In order to stimulate discussion and encourage real interactive problem solving among the participants, an unusual approach was taken in the announcement of the Workshop, as follows. The Call for Papers included the statement of two typical problems (devised by Dr Brian Read of RAL) in the area of Scientific Databases: the first based on the idea of using the spreadsheet as a user paradigm for databases whose objects are very large grids; the second concerning the indexing structures and query algorithms which are appropriate to data clustering in Scientific Databases. Participants were invited to submit short, original papers which either proposed solutions to these or other scientific database problems, or else introduced an aspect of database technology that may be applied to such problems.

The Workshop attracted participants from a wide variety of backgrounds: from data engineering specialists, on one hand, to scientists engaged in the problems of handling large quantities of astronomical data on a day to day basis, on the other. There was very welcome representation from the Universitat Politècnica de Catalunya (part of the Spanish organisation, AEDIMA, which is expected to soon become a new Member of ERCIM). The contributions were techni-

cally varied and innovative: ranging from efficient techniques for performing fuzzy joins on astronomical data, through the use of Knowledge Based techniques to support Scientific Databases, to highly theoretical work on the use of spreadsheets as a datamodel.

The consensus of the participants was that the Workshop had provided a rare opportunity for a stimulating exchange of ideas and collaborative solution of problems among experts from different countries and various scientific / database backgrounds. The proceedings will be appearing as one of the new series of ERCIM Reports.

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3rd ERCIM Database Research Group Workshop: Updates and Constraint Handling in Advanced Database Systems

by Patrizia Asirelli, Fosca Giannotti and Michele Missikoff

More than twenty participants, from nearly all the ERCIM sites: CNR, CWI, GMD, INESC, INRIA, RAL, attended the Third Workshop of EDRG, the ERCIM Database Research Group. The workshop was hosted in Pisa, at the end of September, by CNUCE-CNR. There were also attendees from other scientific and academic institutions, demonstrating the growing interest in the work of this group.

This workshop was the third in a series that started in Amsterdam, at CWI, and

was then followed by a second, held by RAL, in Abingdon. The latest event was organised jointly by three CNR Institutes: CNUCE, IASI, and IEI. Continuing the tradition of these workshops, it was a three-day meeting, with active participation by the attendees who not only gave presentations, but freely interacted in the discussions, and informally exchanged their results and work experiences.

The topics covered important issues which included the active database approach to integrity maintenance, constraints modelling, logical foundations of database updates and constraints, object-oriented database systems and models, advanced database applications, and concurrent transaction execution. In addition to the scheduled presentations, there was also an invited talk by Francois Bry (ECRC, Munich) on the Theory and Implementation of an Integrity Checker.

The workshop was concluded by a lively session on organisational issues. It was common opinion that the EDRG Workshops are becoming mature, both in terms of the scientific quality of the presentations and the structure of the meeting. A particularly important point was the great interest in the organisation of future meetings in order to increase the opportunities for scientific exchanges and joint work by researchers from different ERCIM institutions. It was also decided that news and articles concerning EDRG should be coordinated before submission to ERCIM News. Michele Missikoff agreed to take on this task, so all EDRG material for possible inclusion in ERCIM News will go first to him, and he will liaise with the various ERCIM News Editors.

The preprints of the proceedings were distributed to the participants and the final version should appear as an ERCIM Report.

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SINTEF – The SINTEF Group, the mother company of SINTEF DELAB is currently negotiating plans to merge with SI, Center for Industrial Research. SI is located in Oslo and focuses among other things on research within information technology. At present, the SINTEF Group has about 1800 employees and SI has 350. Working groups with participants from the two companies are now coordinating the research, and the legal merger is scheduled for 1 January 93. This will make SINTEF by far the largest independent research institution in Norway, and among the top 3-4 in Europe.

CWI/GMD/INRIA/RAL – At its annual meeting in Cambridge in September 1992, Eurographics Association has appointed **Dr. Klaus Kansy** (GMD) Vice-Chair of the Association. **Prof. Bob Hopgood** (RAL) and **Sabine Coquillart** (INRIA) have been elected to the Executive Committee of EUROGRAPHICS for a term of three years commencing at September 1992. With **Prof. David Duce** (RAL) and **Dr. Ivan Herman** and **Paul ten Hagen** (CWI) already represented in this committee, ERCIM-members influence significantly the Association which comprises some 700 professionals working in computer graphics.

CWI – CWI presented recent research results to a public of about fifty representatives from industries, companies and government bodies on 9 October last year. The day consisted of lectures and an ongoing programme of demonstrations. It formed a part of CWI's increased activities in knowledge transfer and is likely to become an annual event.

GMD – Dr. Joachim Hertzberg, GMD Institute for Applied Information Technology, and **Dr. Wolfgang Schröder-Preikschat**, GMD Institute for Computer and Software Technology, are the first two winners of the GMD "ICSI Award" for special scientific achievement, a new prize awarded by GMD's Board of Directors. Both prize winners receive a six months' period of research work at the International Computer Science Institute (ICSI) in Berkeley, California. Dr. Hertzberg is currently researching into artificial intelligence,

while Dr. Schröder-Preikschat is active in the field of system software.

RAL – Mike Russell of RAL's Informatics Department has been awarded a professorship at Beijing University, partly because of his research on the interpretation of defects to be found in natural crystals. Prof Russell started work on this phenomenon some 30 years ago and was able to show that lines occurring in quasi 2-dimensional crystals such as moscovite mica were caused by charged leptons. The theory has since been developed further to include the possible explanation of very large tracks as being caused by solitons (which propagate energy like an atomic-scale shock-wave).

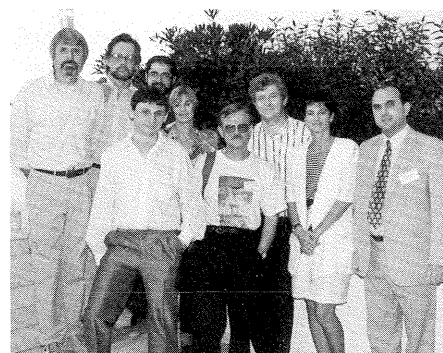
The research on the propagation of solitons in mica needs large-scale computational simulation of non-linear effects in order to artificially recreate pressure and temperature conditions that would be impossible to achieve experimentally at present.

Prof Russell is now working with groups in China, Italy, England, and France, both on the theory, and on applications of his findings - for example to nuclear safety. The work also has relevance to the production of high quality filter products created by a technique called "chemical etching".

Prof Russell's work is a classic example of cross-disciplinary research, as well as basic research leading to often unexpected applications. It is also an excellent example of applied computing, of course.

GMD – Prof. Dr. Igor Mel'cuk, University of Montreal, paid a two week visit to GMD-Institute for Integrated Publication and Information Systems (IPSI) in connection with the Humboldt Research Award he has been conferred with this year for outstanding scientific work. Professor Mel'cuk is one of the original movers of the Meaning Text Theory (MTT), a linguistic theory which was developed in the late sixties in Moscow and which is still attracting an increasing attention in Natural Language Processing. Even more than with the whole theory, the name Mel'cuk is associated with the

history of MTT-specific Explanatory Combinatorial Dictionaries (ECD). These dictionaries provide the most sophisticated and elaborated notion of what should constitute a lexical entry for both human and computational use. During Professor Mel'cuk's stay in Darmstadt a new phase of joint research was initiated in the area of ECDs: In traditional ECDs a full specification of the information for each lexical entry is required. This leads to a tedious repetition of information in entries with common semantic features. The goal of our common work is the development of a hierarchically structured lexicon of the ECD type with an organisation that makes extensive use of generalisation and inheritance techniques well-known in knowledge representation.

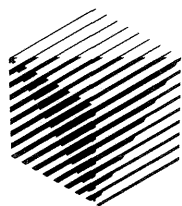


FORTH – The ERCIM News Editorial Board met on October 29 in Crete during the bi-annual ERCIM Workshop meeting. We had the pleasure of welcoming Lars Bergman, from SISU in Sweden, as the latest member to join the Board.

CNR – The new agreement for collaboration between CNR and KOSEF (Korea Science and Engineering Foundation) will be prolonged for three years, to be automatically renewed for a further three-year period if no objections are raised by either party. The text includes revisions to the original agreement, signed in January 1989, with respect to the organization of joint research projects, the exchange of scientists both on a short and long term basis between the two institutes, and the organization of bilateral seminars to discuss topics of common interest. One of the four seminars planned for 1993 is on "Information Science and Technology" and will be coordinated by Stefano Trumpy, CNUCE-CNR.

European Research Consortium for Informatics and Mathematics

ERCIM



The European Research Consortium for Informatics and Mathematics (ERCIM) is an organisation dedicated to the advancement of European research and development, in the areas of information technology and applied mathematics. Through the definition of common scientific goals and strategies, its national member institutions aim to foster collaborative work within the European research community and to increase co-operation with European industry. To further these objectives, ERCIM organises joint technical Workshops and Advanced Courses, sponsors a Fellowship Programme for talented young researchers, undertakes joint strategic projects, and publishes a newsletter.

ERCIM News is the in-house magazine of ERCIM. Published quarterly, the newsletter reports on joint actions of the ERCIM partners, and aims to reflect the contribution made by ERCIM to the European Community in Information Technology. Through short articles and news items, it provides a forum for the exchange of information between the institutes and also with the wider scientific community.

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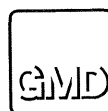


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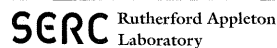
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