ERCIM NEWS

EDITORIAL

Promotion of Information Technology: ERCIM'S Role in Europe

The European Community has launched successful programmes in our field of science. ERCIM members are participating in quite a number of ESPRIT, RACE and other projects. The major areas of research promotion through the Commission of the European Communities are well in line with the long term research goals of ERCIM members. Other parts of the action programmes of ERCIM are running smoothly, like the fellowship programme, the series of scientific workshops, the training programme or the ERCIM News. We have succeeded in creating a kind of corporate identity, and contacts between our scientists have become routine. New members joining ERCIM add a new flavor, new energy and additional expertise to our consortium. It is important that we do not lose this momentum in our effort to promote our field of science on a European level. However, in the concert of European players we are not alone and not without competition. We have to carefully define our strengths and analyse our weaknesses.

We have to look out for answers to crucial questions like:

• what is our specific contribution to the European Science Community which no other organization can provide?

• are we prepared to deal with research topics which should dominate European Communities research and development in 5-10 years from now?

• what are the key issues we should concentrate on which really make a remarkable difference to the scientific and industrial community of today?

• how much money can we afford to invest in joint operations and which ones should be selected?

• do we need a concept by which we harmonize our research strategy, objectives and policy as a basis for our actions which do not have to be necessarily visible joint actions?

It would certainly not correspond to our scientific approach if we would end up merely as a lobbying organization for more European Communities money or as a European umbrella for pushing individual member interests. Instead, we should always be at least one step ahead of the Commission of European Communities in defining research needs of the future, in incorporating partners and researchers from other European (non-European Communities) countries. We should draw public attention to barriers which still prevent efficient research cooperation in Europe and globally.

We need to develop a vision of a Europe leading in specific fields of science, competing in others successfully and cooperating – where appropriate – as a reliable partner.

We need to reach out and build alliances in our field and then take the leadership where the specific

strengths and qualities of the joint and powerful capacity of our national research centres are required.

For that reason, we should activate our task force on scientific issues and have leading scientists of our organizations sit together and draw up an "information technology research map" of Europe, think about a valid European research strategy and explore the possibility of attractive services for the European science community. Only through such value added services we will prove that our consortium can be considered as an added value to our community.

And one more thing. Let us keep on involving our scientists and the management of our member organizations as much as possible in day-to-day ERCIM actitivites and centralize activities only where absolutely necessary even if it turns out to be sometimes more time consuming and complicated. The more our staff is actively participating in ERCIM related joint activities the more we can get our message across our own organizations and beyond to the scientific community, to politicians and industry.

Gerhard Seegmüller

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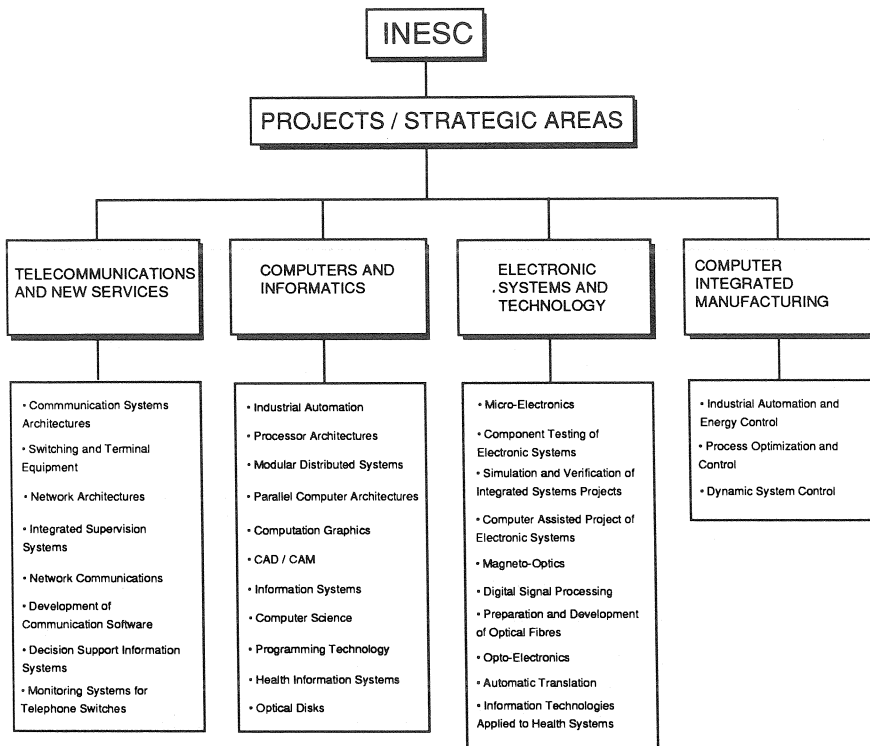## ERCIM's Fifth Partner: Instituto de Engenharia de Sistemas e Computadores

INESC — The Instituto de Engenharia de Sistemas e Computadores (INESC), the Institute for Systems and Computer Engineering, is a private, non-profit distributing and public utility association, dedicated to research, technological development and advanced training in information technology and telecommunication. INESC was created in 1980, and was able to win its place as a centre of excellence in Portugal and in Europe. The institution is an interface between the telecommunication and information technology sectors and the Portuguese academic world.

INESC's mission is:

• to increase the number of qualified people from the research to the technical level;

• to reinforce the national R&D capacity by strengthening the fundamental areas and by promoting cooperation between research groups and institutions;

• to make good use of the research results in order to stimulate and support industrial modernization;

• to stimulate the development of technology-intensive industries to increase self-sufficiency in high-tech products, exploring local and international markets;

• to create comparative advantages in terms of R&D resources in order to attract joint-ventures with international corporations.

INESC developed a project "Vencer o Adamastor," which involves cooperation between four kinds of institutions:

• non-profit company associations (e.g. FUNDETEC) which direct financial resources to educational and training activities;

• universities that have the duty to produce the human resources for national development;

The Instituto de Engenharia de Sistemas e Computadores at Lisbon
Photo: INESC

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                │ PROJECTS / STRATEGIC AREAS  │
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TELECOMMUNICATIONS AND NEW SERVICES	COMPUTERS AND INFORMATICS	ELECTRONIC SYSTEMS AND TECHNOLOGY	COMPUTER INTEGRATED MANUFACTURING
• Commmunication Systems Architectures	• Industrial Automation	• Micro-Electronics	• Industrial Automation and Energy Control
• Switching and Terminal Equipment	• Processor Architectures	• Component Testing of Electronic Systems	• Process Optimization and Control
• Network Architectures	• Modular Distributed Systems	• Simulation and Verification of Integrated Systems Projects	• Dynamic System Control
• Integrated Supervision Systems	• Parallel Computer Architectures	• Computer Assisted Project of Electronic Systems	
• Network Communications	• Computation Graphics	• Magneto-Optics	
• Development of Communication Software	• CAD / CAM	• Digital Signal Processing	
• Decision Support Information Systems	• Information Systems	• Preparation and Development of Optical Fibres	
• Monitoring Systems for Telephone Switches	• Computer Science	• Opto-Electronics	
	• Programming Technology	• Automatic Translation	
	• Health Information Systems	• Information Technologies Applied to Health Systems	
	• Optical Disks		

Projects and Strategic Areas of the "Instituto de Engenharia de Sistemas e Computadores"

• institutions like INESC, where the adequate human and technological resources are concentrated for pursuing R&D activities on behalf of industry and the academic world;

• institutions for professional training in advanced technologies.

INESC pays attention to the business world by guiding youngsters and technologies in order to create new enterprises. In this context the role played by AITEC (business incubator), very much linked with the university structures of professional training and research, is highly relevant for the success of this project.

INESC gives special attention to the needs of its non-academic associates, viz. the telecommunication operating companies CTT, TLP and CPRM, and has played a prominent role in the modernization of Portugal's telecommunications network.

Having as associates the principal Portuguese universities, INESC is in a privileged position by its relation with the formal education system. The cooperation developed by this relationship allows the promotion and growth of large-scale regional and national R&D projects in advanced scientific areas in a quite natural way.

Nowadays, the INESC model is a paradigm of the university's interaction with the outside world, linking enterprise management's rigour with academic scientific creativity in a flexible institutional way.

INESC's activities have led to the provision of services to its associates and to society in general, in strategic areas and advanced training.

INESC's research activities are divided into four strategic areas:

• telecommunications and new services

• computers and informatics

• electronic systems and technology

• computer integrated manufacturing.

The increase in opportunities for scientific and technological cooperation significantly influenced Portuguese science and technology. Since Portugal's entry in the EEC in 1986, INESC boosted its international R&D activities through intensive participation in European Programmes which contributed considerably to the growth of INESC as a research institution.

The expansion of INESC in terms of external relations is reflected in its recent participation in European projects and initiatives — ESPRIT, RACE, EUREKA, BRITE/EURAM, DELTA, SFS/NATO, AIM, COMETT, COMAC/BME, SCIENCE, COST, CTS, Y-NET, JESSI, OMI and ESSI. This has led to many international institutional connections: 50 partners in the United Kingdom, 50 in France, 35 in Italy, 28 in Germany, and 16 in Denmark.

INESC now finds itself integrated in an international institutional network of extreme relevance, with supported links in a strong field of personal relationships between its researchers and their project colleagues from other institutes in other countries.

INESC represents with its staff of almost 1000 about half of the Portuguese scientific community in this sector. There are 400 students in engineering, a teaching staff of 300, and over 200 scientists in M. Sc. and Ph. D. programmes.

ERCIM-Members Active in Networking

Networking is an extremely important issue for any society aiming at integration, as is the case with Europe. ERCIM is of course very much aware of this fact and organized a workshop on high-speed networking during the ERCIM meeting in Amsterdam last fall. The following articles cover work carried out in this field at ERCIM institutions.

Computer Networking in Portugal

INESC — Computer networking in Portugal is not so advanced as in some other European countries. However, a reasonably large number of activities already exists, and this can lead, in the near future, to an increase in the number of users and services. The need for efficient computer communications was felt for a long time, but it was mainly around 1983 that this need reached the level that forced the start of real activities. With the start of the operation of the Portuguese public packet switching network, by 1983, INESC helped some computer manufactors in establishing some pilot connections to X.25. Shortly after this, some electronic mail and file transfer service was initiated running proprietary protocols, namely DECNET. Around 1985 the necessity to reach a greater community forced us to look to the networking activities more popular inside Europe, and that could give us, in addition, a worldwide connectivity. INESC became the first Portuguese institution connected to EUnet and the RD-MHS Service and, as a consequence, started to route all the international traffic to/from Portugal. By 1987 the EARN network started real operation in Portugal, with the international node located at the University of Lisbon, one of the three universities of Lisbon.

At present three networks exist in Portugal: EUnet, RD-MHS and EARN. INESC is running an e-mail gateway between these networks. By far the most popular services are electronic mail and the UNIX News. Along the years the services have been extended. At present all major universities in the country have access to the network. A large number of users already exists. One limitation on the increase in the number of users is related to the lack of good interconnection facilities inside several campuses; in some cases the university computer centre has e-mail facilities, but not the users located in the other buildings. This situation, hopefully, will change in the near future, since most universities and research centres are in the process of installing local area networks.

The routing of traffic to/from the country is made using public X.25 (for EUnet and RD-MHS) and by means of a leased line for EARN. The routing of e-mail traffic to the US is made using the EUnet link located at CWI. One major limitation to a greater penetration of the network is related to the high costs of X.25 traffic. At the same time renting a leased line to central Europe (e.g., CWI or INRIA) is difficult due to the high cost of these lines (remember the cost of leased lines is proportional to distance). Additionally the quality of leased lines is low. At present it is not possible to have a 64 Kbps line, for example.

Some user groups, such as the high energy physics community, have special requirements. They need to import massive amounts of data from CERN. As high-speed lines do not exist, we try to look to alternative solutions. At present we are starting a cooperation with CERN, ESA, Finland and Greece that will lead, by the third quarter of 1991, to the use of the Olympus satellite, during night hours, for the batch transmission of huge files at a rate of 8 Mbps. This is a limited solution, because it only provides access at limited hours during the day, but helps to solve some specific problems.

As in other countries several local area networks are in operation, running mainly the TCP/IP stack of protocols. Of course there is a large demand to connect these networks to the Internet. At present several alternatives are being studied, to see how (and if) the service can be provided.

Inside the country, and with the support of FCCN (Fundação para os Meios de Cálculo Cinetíficos Nacionais) a X.25 private network is being installed to interconnect the main universities. This network will carry on top of it:

• the OSI stack of protocols, in particular X.400, FTAM;

• the TCP/IP stack of protocols, interconnecting LANs inside the country.

The existence of medium to high-speed lines (2 Mbps) could improve significantly our international connectivity that, at present, is still quite limited. Anyway they are not yet available from the telecommunication operators. However if they existed it is quite likely that the tariffs would be prohibitive, if these tariffs follow the rules used at present for low speed lines, and this is a major limitation to the evolution of international computer networking in Portugal.

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ISDN - Broadband System in Portugal

INESC — The project SIFO (Integrated Services Optical Fibre Network), which started in May 1985, is the first Portuguese R&D effort in the area of broadband systems, aiming at a tight connection with future developments for the public tele-communications network and focussing on the advancement of communication technologies in Portugal. SIFO has now been completed with the demonstration of a laboratory prototype.

As a consequence of the project activities, good laboratory facilities have been established, as well as a team with know-how in fast electronics, optical communi-cations and broadband integrated services networks, and experienced in the production and integration of complex communi-cation systems.

The laboratorial network allows access both to public networks (phone, data) as well as broadcast of digital video and audio signals. Transmission is based on monomode optical fibre technology. A star topology is used. Each subscriber is linked to a local broadband switch by a single mode optical fibre carrying the digital information.

The transmission rate in the subscriber direction is 153.6 Mbps and the frame adopted to carry the clowstream information supports the following combination of channels: H4+4*H12+2B+D0. In the opposite direction the transmission rate is only 8.4 Mbps, therefore the H4 channel is not included.

The laboratorial demonstra-tion, aiming at the technical dem-onstration of the results obtained with the prototypes developed, consists of a small-scale network.

The output of the digital video coder switched through the broadband switch (that allows the user to select a specific channel), together with the output of the audio coder and the signals coming out of a ISDN exchange emulator (to implement a minimum set of functions not yet available in the public network at the time of the demonstration) are time multiplex, scrambled and 5B6B encoded before transmission in the monomode fibre towards the subcriber.

The terminal equipment on the subscriber side is supplied with all modules required for the reverse operations and individual analogue and digital signals. Subscriber equipment handles signalling required by the switching of the broadband channels. This signalling information is processed by the ISDN exchange emulator which sends the corresponding commands to the switching unit.

This configuration allows the demonstration of broadband and narrowband service integration. ISDN calls are possible between two units located in the subscriber S-bus or one unit in this bus and another attached to the ISDN exchange emulator.

The first demonstration of this configuration, early in 1989, has shown that the technical solutions adopted were correct. All systems worked as intended.

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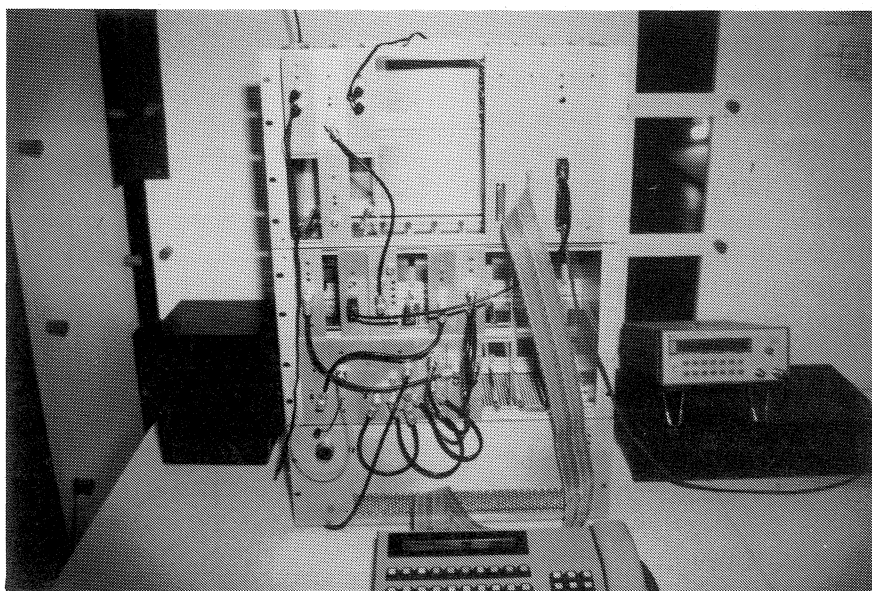
Integrated Services Optical Fibre Network Subscriber Terminal Equipment
Photo: INESC

RODEO — High-Speed and Open Networks

INRIA — The RODEO project, carried out at INRIA in Sophia-Antipolis aims at developing new protocols for high-speed networks (one Gigabits or more). These new protocols can be classified into three main categories: transport, presentation and application.

At the transport level, efforts have been undertaken to extend the classical transport protocols (e.g. TP4) to provide correction-less services for real-time

applications. These efforts have led to the definition of a so-called TP. S protocol, which has been thoroughly analysed. This will be followed by the definition of new synchronisation services for these real-time applications like digital video.

At the presentation level, the project has studied alternatives to the costly ASN-1 encodings standardized by ISO and CCITT. This has led to the specification of the "Flat Tree Light Weight Transfer Syntax," which is now being standardized. This new transfer syntax can be generated by the ASN-1 compiler MAVROS which was developed in the project.

At the application level, work is focusing on the definition of standard "stub generators," based on MAVROS. Much experience has been gained in the development of X.400 and X.500 mail servers (M. PLUS) and directory servers (PIZARRO). The project begins now to experiment with digital multimedia conferences, using a FDDI network as support.

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High-Speed LAN Initiative

RAL — In April 1989, the UK Computer Board approved a new local area networking initiative with the aim of supporting the installation of an initial high performance backbone LAN in each UK university over a four year period (starting in financial year 1990-91). The Computer Board's contribution to this initiative is sufficient to provide "starter kits" or "pump priming". It is intended that every UK university will receive a share of this funding.

The RAL Joint Network Team (JNT) has identified the following as objectives of the high-speed (or Fibre) LAN Initiative:

• to enable an order of magnitude increase in perceived performance in data transmission for existing users over the LAN (workstations to servers) at all University sites and to upgrade the infrastructure to allow access to data applications if required to users on a campus;

• facilitating introduction of "new" data applications impossible or impractical at present;

• to provide infrastructure on campuses in anticipation of SuperJANET's data transmission facilities;

• to prepare to accommodate very high performance hosts, servers and workstations;

• (physical) security will also be a consideration.

Having surveyed the current standards activity in this area, it is clear that the only contender at the present time is FDDI (Fibre Distributed Data Interface). Bearing in mind the large costs involved, a prudent strategy is being adopted, of supporting a limited number of FDDI pilot projects in financial year 1990-91 in order to assist in the preparation of the installation of a high-speed LAN backbone on each campus which will commence in financial year 1991-92. Each UK University site was invited to bid to be an FDDI pilot site.

Five University sites were selected as potential FDDI pilot sites: Birmingham, Edinburgh, Glasgow, Manchester and Queen Mary and Westfield College (QMW). Birmingham and Manchester are evaluating FDDI bridges, Edinburgh and Glasgow are evaluating FDDI routers and QMW are evaluating end systems running novel applications.

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Wide-band Communications on Integrated Services Digital Networks (ISDN)

RAL — Networking research is particularly active these days. All the talk is of broadband networks, employing ATM, SDH, SMDS and other technologies, which will operate at tens of Megabits/sec up to Gigabits/sec transmission speeds. These technologies, however are for the future in Europe: at the moment the carriers are busy introducing Integrated Services Digital Network (ISDN) services to their customers. ISDN (now often called narrowband-ISDN) networks are essentially digital
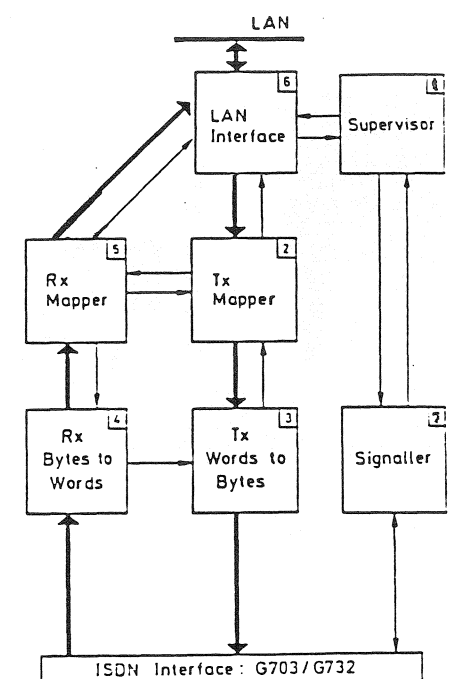
A mash of seven transputers used in the construction of a ramp

telephony networks which provide 64 Kbps calls between subscribers on channels called B-channels. Customers are also provided with a digital signalling channel (for dialling) which is called a D-channel. While 64 Kbps is adequate for many types of application, it is not sufficient bandwidth for carrying digital images or large files of computer data. It is also not appropriate for carrying packet multiplexed data, as in the case of circuits joining widely separated Local Area Networks (LANS).

The problem of constructing equipment functioning outside the network that can aggregate B-channels to form channels of larger bandwidth is non-trivial, and data can easily become scrambled, as data travelling over a group of B-channels will normally be scrambled by the network. As part of an IT research project, RAL has designed and constructed a piece of equipment, called a Ramp, which can perform an unscrambling operation at the receiving end. The ramp allows B-channels to be aggregated together to form a number of wideband channels. These channels may be up to 30 times 64 Kbps wide and the widths may be varied dynamically by adding or subtracting B-channels without disturbing the flow of data. The computational task required to carry out the unscrambling is quite large and the ramp is constructed using a mesh of 7 transputers arranged as shown in the figure.

Ramps are in operation at a number of research laboratories in the UK connected to British Telecom's ISDN service. Ramps are also being manufactured commercially under licence. They provide for the first time the possibility of obtaining quite large bandwidths on a dial-up basis.

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BERMAN — BERKOM Management for Distributed Applications

GMD — The concepts of the BERKOM Administration Infrastructure have been developed within the BERMAN Project, a subproject of the BERKOM Project (Berliner Kommunikationssystem) which was started in 1986 in order to provide experience in using the high-speed 140 Mbps broadband ISDN network that the German PTT, the Deutsche Bundespost, was installing in Berlin. Various projects have been initiated within the framework of BERKOM in order to evaluate its potential, with particular attention being paid to new protocols for high-speed bulk transfer over reliable links, group communication, interorganisational networking, and cooperation in an open services environment. Within the BERKOM framework new areas of application are being developed which are based on work investigating the design of a multi-media document model. Various projects are concerned with the possibilities offered by the high-speed network for transmitting video pictures, text and speech and with the innovative applications that can result from this.

All these projects need to be concerned with the management of their particular application and it was recognized that a unified management concept should be developed for the BERKOM integrated. In order to prevent each project developing its own management solutions that would then be incompatible with the other BERKOM projects, the BERMAN project was started in the autumn of 1988. The aim of the project is to develop a model for managing distributed applications in an open broadband ISDN environment and to provide basic management components that can be used by other BERKOM projects. Individual mangement solutions developed by each BERKOM project can thus be prevented and a "BERKOM-wide" management system supported.

The BERMAN project is currently developing the BERKOM Administration Infrastructure (BAI) which is a management platform providing generic management functions to all BERKOM services. The services it provides are part of the BERKOM infrastructure which provides a service pool of generally useful services intended to support distributed applications in the BERKOM environment. The advantage of such an infrastructure is that it provides
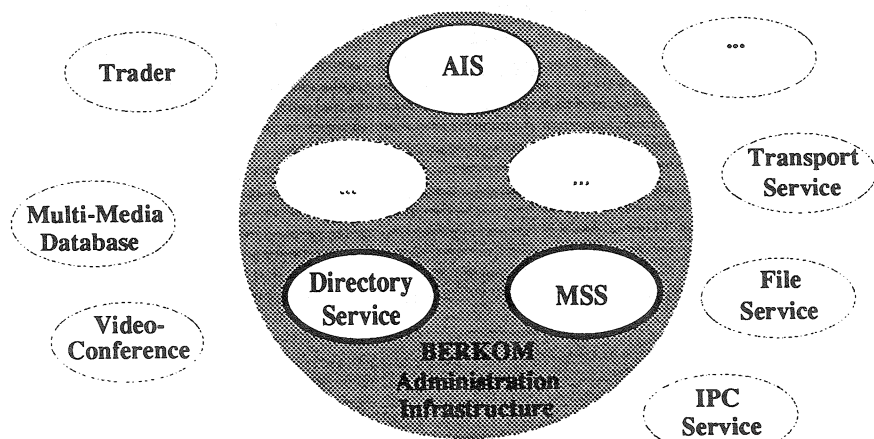
AIS Administration Information Service   MSS Management Support Service

The BERKOM Administration Infrastructure in the BERKOM Service Pool

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basic services that can be used generally and which do not have to be designed anew by each service designer. In the case of the BAI, the services provided are related to administrative support, and they can be selcted and configured according to a distributed appication's requirements. The BAI consists of two services at present, the Mangement Support Service (MSS) and the Directory Service (DS) (see Figure). A third service, the Administration Information Service (AIS) is still being designed and is intended to provide functions that extend beyond the MSS and DS. Further services will be specified and incorporated into the BERKOM Administration Infrastructure as and when required.

The Management Support Service is provided by the Basic Management Support System. It is based on OSI systems management concepts that have been extended to supported distributed applications in the BERKOM environment and it uses the OSI management object-oriented modelling approach. The MSS is particularly concerned with administering management data that is liable to change rapidly and so cannot be stored using more permanent information storage tools.

The Directory Service is based on an implementation conforming to the X.500/ISO-9594 Standard. The BERKOM Directory can store semi-permanent information and can be used to administer such information on behalf of integrated services. This can obviate the need to provide separate information storage for the services and it also enables locally administered information to be available globally, thus contributing to the interoperability and cooperation between autonomous services in a heterogeneous environment.

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BERGATE: LAN/Broadband ISDN Internetworking

GMD — The development of a modular and flexible network interconnection system - in official ISO terminology it is an Interworking Unit - was the aim of the BERGATE project, when it started three years ago. An Interworking Unit is a real piece of equipment interconnecting two or more subnetworks and behaving as an Intermediate System. An Intermediate System is the abstraction of the functions performed by an Interworking Unit.

The result is a VMEbus system based on a Sun-3/E which consists of a CPU board (M68020), an 802.3 Ethernet/SCSI interface board and a video controller board. The Sun operating system SunOS 4.1 running on the Sun-3/E includes the TCP/IP protocols as well as ISO/OSI protocol stacks with the MAP (Manufacturing and Automation Protocol) and TOP (Technical and Offical Protocols) network and transport layer protocols.

The system was enhanced by a 802.4 Motorola Token Bus controller and modem board providing access to MAP networks and by a 140 Mbps Broadband ISDN network interface to the fibre optical BERKOM test network. The BISDN interface consists of two parts:

• a network adaptor providing the physical access (layer 1 functions) to the BERKOM network and implementing an enhanced D-channel narrowband ISDN signalling protocol;

• a protocol adaptor realizing a high-speed layer 2 protocol on the 140 Mbps H4-channel of the BERKOM network.

While the network adaptor was realized by a company in close cooperation with GMD-FOKUS, the protocol adaptor was designed and realized by GMD-FOKUS itself. Because of the speed requirements the protocol adaptor is completely realized by means of programmable logic devices (PLD's). For doing error detection on the 140 Mbps channel, GMD developed an 8-bit parallel high-speed CRC32-Chip.

The communication between the layer 1 network adaptor and the layer 2 protocol adaptor took place via VME subsystem bus VSB with a gross bitrate of 160Mbit/s in duplex operation. The functionality of the complete BERGATE system includes the interconnection of MAP and TOP networks via the 140Mbit/s H4-channel of BERKOM as well as the interconnection of TCP/IP networks via the H4-channel. The BERGATE system itself may also act as a TCP/IP or OSI endsystem.

Future work is directed towards a modified system architecture based on SPARC technology an the development and integration of additional networks interfaces as DQDB and ATM.

The BERGATE project was supported by the Detecon, a subsidiary of the DBP Telekom.

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The Transport System in BERCIM

GMD — The BERCIM project deals with the design and development of distributed fault-tolerant CIM applications based on interconnected LANs and broadband WANs. It is founded by Detecon, a subsidiary of the German Telekom. Besides advanced CIM applications and its supporting environment, a new

transport system is one of the main parts, which was designed and will be implemented before the end of 1991.

The main areas in which new approaches are introduced are transport services, transport and network protocols.

Transport Services: the Transport System supports three types of services: the connectionless, the request/-response and the connection-oriented transport service. Normally these service types only provide the transmission of data between two communication partners (point-to-point), which will be identified by individual transport addresses. Furthermore group communication (point-to-multipoint) is provided in order to transmit data between more than two partners. To support the addressing of transport user groups, new group transport addresses have to be introduced, which are aliases of a list of individual addresses. The additional possibility of group communication can be used in conjunction with each of the three transport service types.

Compared to the unreliable point-to-point connectionless transport service, the group communication associations differ only in that an attempt is made to transmit a datagram to several users. Thereby, it is possible that the datagram will be received by none or only by part of the group members. A reliable transmission is terminated if all members of the group have received the datagram correctly, or it is aborted after a predefined time period. Within this time period, it is possible that part of the group members has received the datagram properly.

A request/response group communication association is characterized by the sending of a request message from a client to several servers, who in turn each send a response message to the client. The transmission is reliable, e.g. an attempt is made to recover from detected errors. In case of the occurrence of unrecoverable errors, an abnormal termination is dependent upon the fulfillment of a success condition. This condition can distinguish between mandatory and optional servers to be reached or can specify a number of servers, which, at a minimum, must be reached and send a response.

The connection-oriented transport service, expanded to include point-to-multipoint transport connections, supports a transmission of messages between one sender, which initiates the connection (initiator), and several receivers. Furthermore the independent reverse direction can be used from one or more of the receivers to transmit messages to the initiator. The establishment of a connection is always reliable and dependents upon the fulfillment of success conditions which are specified by the initiator. This, for example, could be defined to specify users for whom receipt should be mandatory or optional. A connection is then only successfully established if all the mandatory members of the group have been reached. Another criterion could also be the specification of a minimal number of members, which must be reached. In case of the occurrence of unrecoverable errors the connection is not aborted, but only the corresponding path is released. An abortion depends on the occurrence of conditions which are identical to the specified conditions for success of a connection establishment and differentiate between mandatory and optional group members, or a specific number of group members could be specified, which must be reached at a minimum in order for the connection to continue in existence.

Transport and Network Protocols: The new generation of local and wide area networks, based on optical fibre technology, changes the substrata for transport protocols. High data rates beyond 100 Mbps and low error rates below 10^{-14} are the new properties to deal with.

The BERCIM transport protocol provides the three service types mentioned above including group communication and is designed for the new network generation. To adapt the performance increase, a lightweight protocol functionality is used, which also opens up the possibility of hardware implementation.

The transport protocol uses a timer-based connection management mechanism, to minimize connection management packet exchanges. Due to low error rates it is also possible to minimize acknowledgement and flow control packets, by using error and flow control mechanisms based on packet bursts instead of single packets.

The BERCIM network protocol offers a connectionless unreliable network service based on a connectionless data link service. It enables the transmission of datagrams from one sender to one or more receiver transport entities identified by group network addresses. These group network addresses are part of the group transport addresses, which are aliases of a list of individual transport addresses and have been introduced in order to support group communication at the transport layer.

To provide routing in an interconnected network environment every node has a group address and a routing table. The routing table will be used to find the next hop on the communication path to the destination and the group address table will be used to map a group address to its associated list of individual

addresses. These lists are used to duplicate and forward the datagrams with group addresses.

Under consideration of optimised routing algorithms the duplication of group datagrams does not take place directly at the sender-node but at the (intermediate) nodes, where the route to the receivers splits.

A management entity located on every node is responsible for the maintenance of group address and routing tables. Management messages containing routing and group address information, will be transmitted between the management entities due to every change in the network environment, e.g. nodes failure, transport group creation, update or release, etc. The network domain management protocol supports the distribution of management information using individual and group communication associations provided by the transport system.

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Multimedia Documents in ISDN-B

GMD — The BERKOM project has been launched to promote the development of future services and end systems for broadband ISDN, so that various kinds of applications may profit from this new technology. Within this framework GMD-FOKUS is carrying out a project entitled "Multimedia Documents in ISDN-B (BERMMD)".

In order to provide services, which allow communication between arbitrary communication partners in an open systems environment, future developments have to be based on international standards. As integrated services, which are provided by distributed applications, have a lot of common functionality, the application developer should be supported in the selection of suitable combinations of standards and application profiles. Additionally similar services should use the same profiles to provide interoperability. An analysis of relevant standards in the fields of communication, application environment, and data structures has shown that these developments have not been adequately coordinated.

The main aim of BERMMD is to develop a Reference Model which supports the application designer by providing a framework for existing standards as well as by identifying functional areas where no standards are available ("white spots"). The Reference Model is structured into two parts, one part for the transport-oriented layers (lower layers), called Reference Model I, and the second part for the application-oriented layers (upper layers), called Reference Model II.

The presently available Reference Model II contains short-term and medium-term profile recommendations, which should serve as a basis for the development of applications within this framework. The profile recommendations are based on the OSI Basic Reference Model, existing CCITT telematic services, distributed applications already standardized within OSI, and other international standards and profiles in the areas of communication and data structures for information interchange. In addition to these profile recommendations, areas are identified for which the available standards do not yet offer any solutions. For some of these identified areas, solutions are offered, such as combinations of profiles for isochronous and anisochronous communication.

The disadvantage of standards which do not complement each other in most cases, but which are of overlapping functionality, is not solved by the current approach of the RM II. The current approach can be regarded as a first step to an architecture providing generic or common functions which can be combined according to general rules. In order to eliminate, in the long term, the inadequacies of the presently available standards, an architecture for distributed processing (including homogeneous concepts, generic functions and common data and informations facilities) has to be developed in addition to the current Reference Model II approach. This work is part of the international standardization activities on Open Distributed Processing (ODP) within JTC1/SC21/WG7.

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Lotosphere — an ESPRIT2 Project

GMD — The aim of the ESPRIT2 Project Lotosphere is to prepare mathematically-founded formal description techniques (FDT) for use in industry. This is to be demonstrated through the development of adaptable, tool-assisted methodology based on the Lotos standardised formal description technique. As for the methodology, the following areas will be developed:

• a theory based on Lotos for the gradual design of distributed systems. Semantic aids are to be developed for checking transformation steps;

• linguistic elements in Lotos for appropriate representation of modules, data structures, generic data types and abbreviated notations;

• tools to support the entire development process, from the design

stage to testing of an implementation derived from a Lotos representation;

• validation of the methods by means of appropriate examples from the field of telecommunications.

The role of the GMD Research Centre for Open Communications Systems within this ESPRIT2 project concentrates on linguistic extensions of the data type section of Lotos, the development of a theoretical framework for conformance tests between the formal specification and actual implementation, as well as the development of tools for verifying and simulating Lotos specifications. With the second year of the project almost complete, the consolidated reports of the "Design Methods," "Tool Developments" and "Applications" working groups are now available.

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RACE Project "IBCN Testing Architecture for Conformance Assessment"

GMD — The aim of the RACE Project "IBCN Testing Architecture for Conformance Assessment" is to make available and apply methods and technologies for the definition of a test environment for performing conformance tests for integrated broadband communications networks (IBCN). The project takes special account of the specific requirements of broadband communication networks, e.g. high data rates.

The ITACA project is to be carried out in conjunction with other RACE projects concerning the definition of an architecture for IBCNs, in particular the RACE "Consensus Management" project.

The scope of work to be performed comprises definition of the following aspects:

• IBCN conformance test services or suitable IBCN test scenarios and a uniform description of these;

• the functional architecture of IBCN test tools;

• IBCN test aims at different levels of abstraction and the structure of test suites, and grouping of these with respect to test aims;

• a suitable IBCN test description language;

• methods for automatic test generation and test runs.

The role of the GMD Research Centre for Open Communications Systems within this RACE project is concentrated on the design of IBCN test tools and of IBCN test description languages.

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RACE Project "RACE Open Services Architecture II"

GMD — The rapid technological development of integrated broadband communications systems (IBCS) creates the need for open architecture in order to satisfy new requirements such as changes in the configuration of such systems or the introduction of new hardware and software technologies.

A system, or the architecture of a system, can be described as "open" if it satisfies at least the following requirements:

• expandable for new, initially unplanned services;

• adaptability of existing services to new, initially unplanned requirements;

• openness with respect to new technological developments.

The GMD Research Centre for Open Communications Systems is involved in the definition of formal terms for the description of open, distributed IBC systems within the RACE "Open Services Architecture II" project. The Research Centre continues to contribute to the description of a concrete RACE Open Services Architecture.

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Distributed Systems and Knowledge-based Systems

GMD — The "Distributed Systems and Knowledge-based Systems" project (COST11ter DISK) is directed towards the development of a methodology that can be used for epistemological specification of services and protocols of distributed systems. The methodology is based on a conceptual approach that incorporates the following three models or views:

• a knowledge-based model that formally represents the knowledge required for communication between intelligent, cooperating processes;

• a behaviouristic model in which communication can be represented;

• an architectural model for representing the objects of a system under consideration together with its relationships and attributes.

A report has been prepared containing the results of small case studies applying the epistemological approach to protocols and distributed systems.

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101-digit Number Factorized on CRAY Y-MP4

CWI — For the first time a supercomputer has succeeded in factorizing a special number of 101 digits. The program was

$$(2^{463} + 1)/(3*2356759188941953*7683496620985804 9526107)=$$
$$8811930792526904110741840483 3666787*$$
$$49753260455140380065971880516533368559591310618679 2454026995210139$$

written by CWI troika Herman te Riele, Walter Lioen and Dik Winter. The factorized number belongs to a list of thirty 'most wanted' numbers, whose factorization with other methods

failed until now. Numbers of 116 digits have already been factorized with this method by world-wide cooperation of several hundreds of computers.

The factorization was carried out on the new national Dutch supercomputer, a CRAY Y-MP4/464, installed at SARA, the common computing centre of the two Amsterdam Universities and

CWI. It took one of its four processors about 475 hours of computing time. With the CRAY completely dedicated to this task the result could have been obtained in only five days.
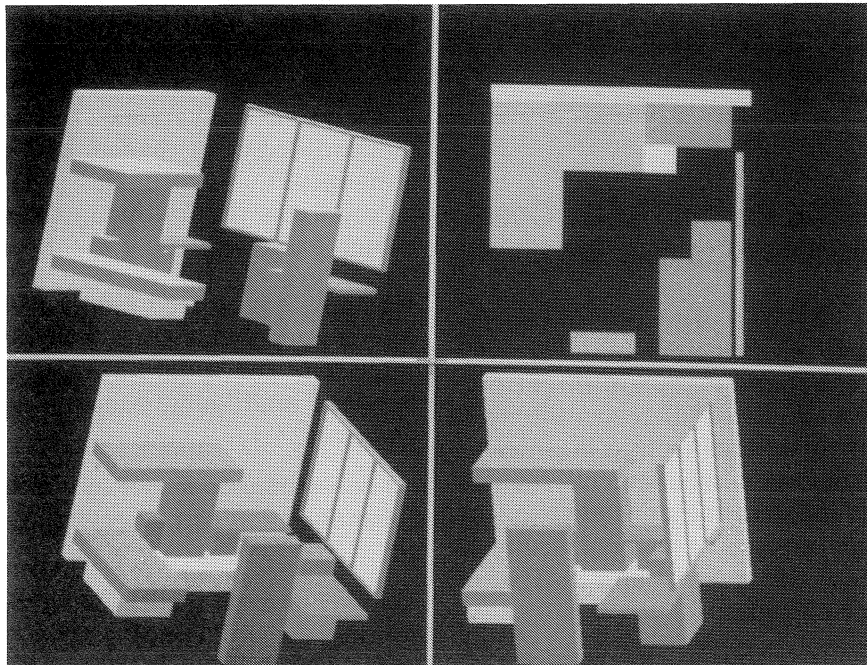
During the last six years the CWI group held a few times the world record of factorizing on a supercomputer. The present result shows that the art of factorizing develops much faster than was anticipated. For example, the well-known American number theorist Carl Pomerance estimated only a few years ago the required computing time for factorizing the 101-digit number to be approximately nine months.

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The configuration of a bedroom. CWI developed a prototype IIICAD (III = Intelligent Integrated Interactive) system as an aid to the actual design of such objects. The system employs a library of standard components for the selection of the parts of the room, and parts of these parts. The designer can freely choose and adjust components from the library. The 3-D viewing and illumination is accomplished by a proprietary visualization tool using Silicon Graphics' GL library. (Courtesy J. Rogier and F. Kuijk, CWI.)

CWI Quarterly Special on Computer Graphics

CWI — CWI Quarterly is a scientific journal covering a wide variety of subjects in mathematics and computer science, basically related to CWI's research programme. Articles are intended for a wide readership of researchers in the field. Authors come from inside and outside CWI. Editorial policy now emphasizes topical issues. As a consequence, the most recent issue (Vol.3 nr.3) concentrates on Computer Graphics, covering work done in CWI's department of Interactive Systems. It contains an introduction by the department's head Paul ten Hagen, followed by articles on Architectures for Interactive Raster Graphics (Fons Kuijk & Robert van Liere), User Interfaces (Henk Schouten), the Development of an Artifact and Design Description Language (Paul Veerkamp) and Computer Graphics Standards (Miente Bakker).

Coming issues will focus on the History of Computing, Databases, Statistics and Semantics. CWI Quarterly started in the fall of 1983 under the name CWI Newsletter, as a consequence of the wish to communicate with the scientific community about

CWI's activities in addition to the usual way of publications in journals, conference proceedings, etc. It changed to its present name after sixteen issues in January 1988. The present scientific editors are Arjeh Cohen, Evangelos Kranakis and Nico Temme.

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SION — Dutch Computer Science Research Organization

CWI — SION (Foundation for Computer Science in the Netherlands) is a government-funded organization, coming under the Netherlands organization for scientific research NWO. It promotes and subsidizes computer science research in the broadest sense. SION's involvement in CWI's research policy is twofold: SION nominates three members of CWI's Board of Trustees and advises NWO about CWI's research programme in computer science (CWI's subsidy largely comes from NWO).

Within SION four scientific working communities have developed (main topics in brackets):

• Theory of Computation (algorithms and complexity; type theory, rewriting systems and constructive algorithms; language, logics, and logical foundations of artificial intelligence; concurrency).

• Software Engineering and Computer Architecture (high performance computing; programming technology; distributed systems and parallel processing; software engineering).

• Computing Methodologies (image processing and pattern recognition, particularly model based image processing and dynamic intelligent systems; computer graphics and interactive systems, in particular interactive graphic systems and geometric modelling; artificial intelligence and autonomous systems, in particular 2nd generation expert systems and neural networks).

• Information Systems (system and information theory; databases). Recently the last working community defined "Communication and Information Systems" as an important research topic.

At this moment some 45 projects involving about 60 PhD students are in progress at virtually all Dutch universities and at CWI. Notable among these projects are:

• "Typed Lambda Calculi," which proposes to extend the lambda-cube taxonomy by taking into account additional parameters like recursion, other type constructors and subtyping. This taxonomy will be used to investigate and structure the syntactic, semantic and pragmatic aspects of systems to study programming languages.

• "Design, Implementation, and Application of a Transparent Distributed Computing System," which proposes to build a transparent distributed operating system that can be used on multiprocessors, local area networks and wide area networks. To users of this system, the entire collection of machines is invisible and the whole thing looks like a single conventional time-sharing system.

• "Model Controlled Image Processing," consisting of five subprojects that aim at developing a new paradigm of image processing, using new structures, new algorithmic organizations and new architectures, organizing process elements in structures concentrating on global or local aspects of the image.

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Multi-Modal Interface for Man Machine Interaction with Knowledge Based Systems (MMI2)

RAL/INRIA — MMI2 is a research project partly funded under the CEC ESPRIT initiative involving BIM (Belgium) as lead partner, with Intelligent Software Solutions (Spain), University of Leeds (UK), Ecole des Mines de Saint-Etienne (France), SERC/RAL (UK), ADR/CRISS (France), and INRIA (France). The objective of the research is to develop a computer software demonstrator of an advanced human-computer interface which will allow users to interact with knowledge based systems (KBS) through co-operative dialogues. In the demonstrator the KBS guides users through the design of computer networks, making suggestions and criticisms as though it were a well informed consultant. The five year project started in 1989 and an initial prototype was sucessfully demonstrated to the CEC and reviewers in October 1990.

At present KBS normally ask users questions about a problem and reason towards a solution on the basis of users' answers. The questions are normally written into the program and a very limited range of possible answers is permitted. If users do not understand the questions or the conclusions reached, they can ask for a record of the reasoning which leads the system to ask a question or reach a conclusion.

The MMI2 interface not only allows users to interact with the system in this way through command languages, but both the user and the system can also ask questions and make replies in free ranging natural language (in English, French or Spanish). Users are able to interrupt the system by

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asking questions of the system instead of merely replying to questions. The system will be able to justify its reasoning and elaborate on those justifications if required. Moreover, users are able to describe the building where they wish to place a computer network and any design suggestions by drawing them as diagrams that the KBS will understand and which both users and the system can refer to throughout the dialogue.
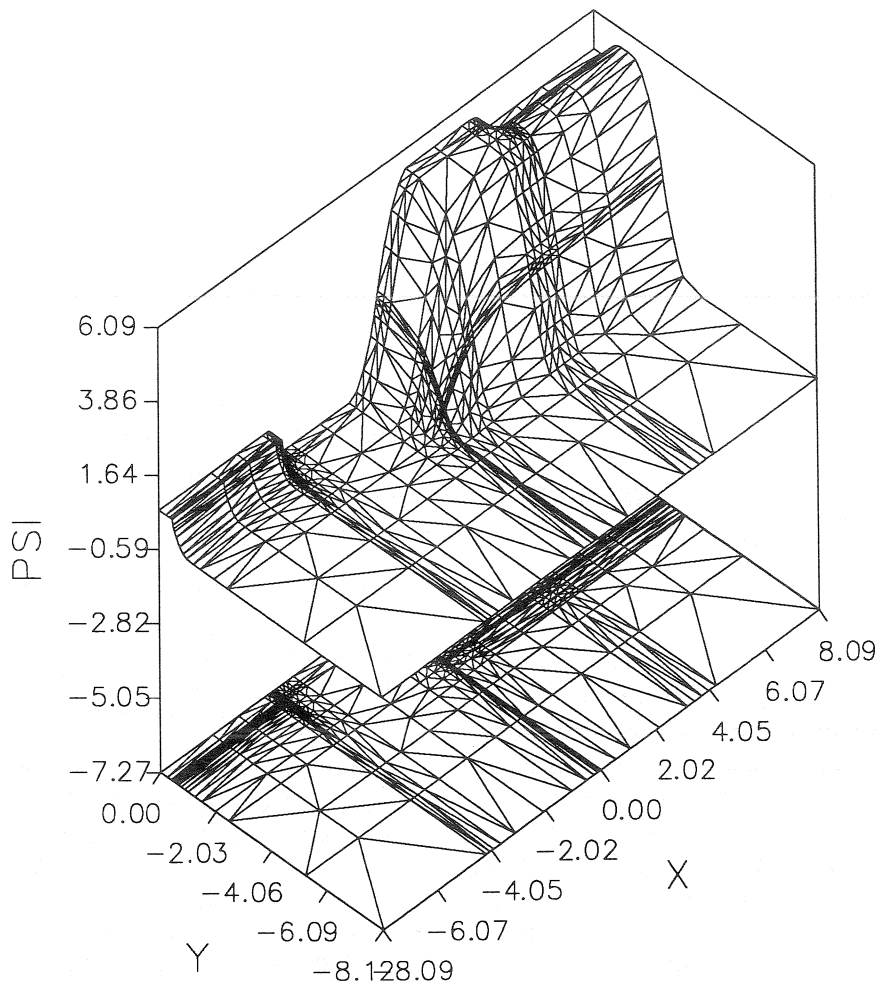
Reference for further reading: Binot, J-L., Falzon, P., Perez, R., Peroche, B., Sheehy, N., Rouault, J. and Wilson, M. D. (1990). 'Architecture of a multimodal dialogue interface for knowledge-based systems,' in Esprit '90, 412-433. Kluwer Academic Publishers, Dordrecht.

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Three-Dimensional Semiconductor Device Simulation

Plot of electrostatic potential at t = 8 ns with a 5.5 V forward bias on the parasitic function

RAL — January marked the successful completion of the EC funded EVEREST Project (ESPRIT 962E) of which RAL was the leading contractor. EVEREST was a four year project investigating improved physical models and computational algorithms for the solution of the drift/diffusion representation of the electrical properties of silicon based semiconductor devices. The main thrust of the project was towards the creation and analysis of three-dimensional models of both MOS and bipolar technologies, and the extraction of performance parameters for use in circuit design analysis.

The partners were: Analog Devices (Ireland), Philips (The Netherlands), SGS-Thompson (Italy), STC Technology Ltd (UK), NMRC (Ireland), IMEC (Belgium), University College Swansea (UK), University of Bologna (Italy) and Trinity College Dublin (Ireland).

The project addressed five main areas: physical models and validation, discrete formulations, mesh generation and refinement, linear and non-linear algebra and software development. The project has produced over 100 reports and papers in these areas and many algorithmic and software developments.

For example, the Project developed a new mathematical model for carrier mobility in MOS structures which was validated against measurements on fabricated test devices. Theoretical advances in the application of mixed and hybrid finite element methods to the semiconductor device problem were made. The Project also formulated a number of new time discretisation schemes including a modified GEAR method for imposing the algebraic constraint relations introduced by Poisson's equation on the continuity equations in the time dependent problem. For three-dimensional mesh generation, the Project developed a robust Delaunay algorithm for non-convex domains and a methodology for applying refinement to semiconductor device problems. Progress made in linear and non-linear algebra includes robust pre-conditioners for ICCG and CGS, and the "correction transformation" technique.

As well as being leading contractor, RAL led the software development team in the project. A major output of the project is one

of the world's most advanced three-dimensional device simulators, EVEREST. The EVEREST Suite includes a geometric modeller, mesh generator, impurity profile generator, simulator and post-processor. These modules are integrated through a common, RAL-developed command parser and data interface software. The simulator performs both the steady-state and transient analysis of devices and provides automatic mesh generation and mesh refinement based on the impurity profile and the electric field.

The photo shows a mesh and the electric potential distribution generated by EVEREST in the simulation of the latch-up problem in CMOS technologies. This analysis required the transient simulation of a complex four-contact structure.

Although the EVEREST Project has now ended, EVEREST is being used at Philips and STC and development of the simulator is continuing at RAL. Work is in hand to include more advanced physical models and to produced implementations of the suite on vector and concurrent architectures. We intend to form a new consortium to continue this type of work in a bid to the EC under ESPRIT III.

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GMD Research Unit for the Economics of Information Involved in New EC Project

GMD — A study is to be published giving details of electronic information services available in the member states of the European Community. This project is being led by the GMD Research Unit for the Economics of Information in Cologne. The agreements covering this second coordinated survey of electronic information services in the 12 EC member countries were signed in Luxemburg on 30 November, 1990.

This survey will cover both hosts, i.e. computer centres which offer online databases to external users, and database producers, including manufacturers of CD-ROM products. The survey covers the years 1989 and 1990 and will be conducted in all EC member countries in spring 1991. Publication of the results is planned for the end of 1991. For the territory of the Federal Republic of Germany, the project is being conducted by the GMD Research Unit for the Economics of Information in Cologne on behalf of the Commission of the European Communities and in cooperation with the Specialised Information Consortium (Arbeitsgemeinschaft Fachinformation e.V.) in Frankfurt/Main.

It is planned to extend these coordinated surveys to other types of electronic information services at a later date, e.g. to include value-added network services (VANS). The Commission of the European Communities intends to use these projects to obtain meaningful statistics - based on standard definitions and deliminations - on the information services industry in the member countries of the European Community.

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GMD Information Centre Extends Range of Online Databases

GMD — Since February 1991, the INFODATA and ADDAT specialised information banks of the GMD Information Centre - a division of the Institute for Integrated Publication and Information Systems - have been available online to users worldwide. INFODATA, a bibliographic database on information science and applied information science comprising over sixty-thousand literature references, has been provided online by the Specialised Information Centre for Technology (FIZ Technik) via the host of Radio Schweiz AG in Berne since 1987. Under an agreement concluded between GMD and the Specialised Information Centre in Karlsruhe (FIZ Karlsruhe), the database is now also available via STN International, the international scientific-technical information network.

In addition to Karlsruhe, STN nodes also exist in Tokyo and Columbus, Ohio. The ADDAT database, an electronic directory of specialised information databases offered by German manufacturers and available online, on optical discs (CD-ROM) or indirectly via search services, is now itself available online for the first time through the Specialised Information Centre for Technology (FIZ Technik).

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Start-ups and Subsidiaries of INRIA

INRIA — The club of INRIA's start-ups and subsidiaries met at Rocquencourt early in January. These companies, created at the initiative of INRIA researchers, specialize in the transfer of research prototypes developed at INRIA. In 1990,

there were 11 companies of this type. The club welcomed three new companies in 1991:

• ERGOMATIC (Ergonomic Consultants), founded by Bernard Sénach at Sophia-Antipolis;

• EUROCLID, created in its new form by Antoine Rizk, which will commercialize SYNTAX in various forms;

• O2Technology, originating from GIP ALTAïR, which will exploit, commercialize and distribute O2, an object-oriented database management system and its programming environment. This company will be a subsidiary of INRIA (60 % of the capital will belong to INRIA).

A document which summarizes INRIA policy concerning the creation of start-ups is now available in French. This document also contains some synthetic information on these companies. The English version will be available in May 1991.

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Chorus Systèmes Signed Agreement with INMOS

INRIA—INMOS, a member of the SGS-Thomson Microelectronics Group, Chorus Systèmes of Paris, Archipel of Annecy and Telmat Informatique of Soultz, near Strasbourg, announce a joint development to port the CHORUS operating system to the transputer. The implementation of CHORUS on the H1 transputer in the first quarter of 1992 provides UNIX capability on scalable transputer systems, thus further strengthening the transputer's established position as a front runner in the embedded microprocessor market.

CHORUS is a distributed multiprocessing operating system based on a small, efficient microkernel around which communications, memory management and real-time event processing modules are added to provide the user with UNIX System V version 3.2. These modules communicate through a message-passing protocol. The multiprocessing capability of the H1 transputer with its virtual communication channels and dynamic message routing provides an ideal architecture for the efficient implementation of the CHORUS system model. CHORUS was initially developed by INRIA and Chorus Systèmes is one of INRIA's start-ups.

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SYNDEX distributed by INRIA

INRIA — In the framework of the project PTTS (signal processing workstation), led by INRIA and CNET (national centre for telecommunication studies), a team conducted by M. Sorine at INRIA developed a programming environment for multiprocessors devoted to signal processing called SYNDEX (SYNchronous Distributed EXecutive). This environment allows a high level description for a specific machine and its application program. It can then automatically generate the system program to run the application program on the machine in real-time.

The diffusion to universities and research centres is now efficient. Six users licences have already been signed with universities and the company Thomson in France.

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Grouping for Human Genome Sequences

INRIA — Mr. Hubert Curien, Minister for Research and Technology, has announced the creation of a Public Interest Grouping to coordinate research on human genome sequences in France. Some French teams at INSERM (Centre for Medical Studies), at CEPH (Research Centre for Human Polymorphism) and at the University of Montpellier, already work on this subject. INRIA will be in charge of all problems related to computer science in this project. The following researchers at INRIA are already involved:

• François Rechenmann at IMAG on artificial intelligence;

• Michel Scholl and François Bancilhon on data management systems;

• Mireille Régnier for algorithmics;

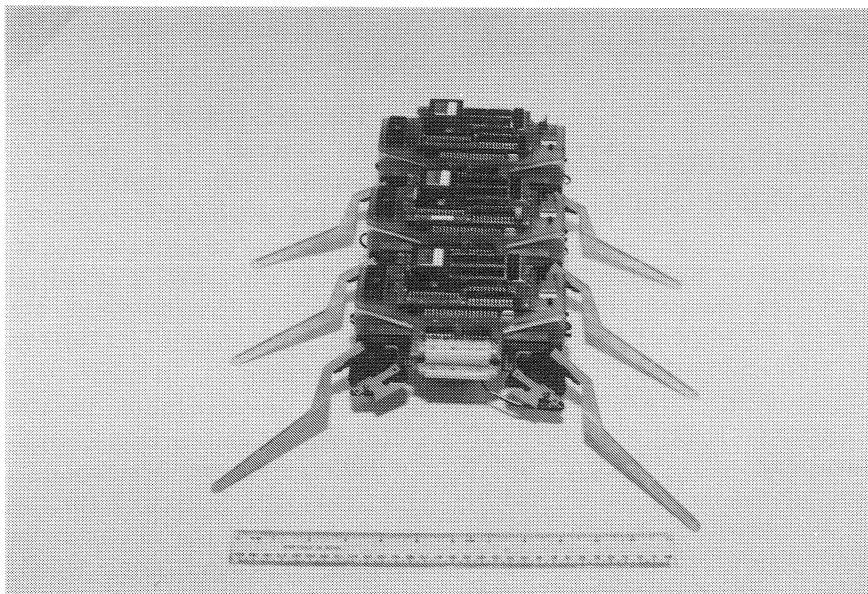• Joël Quinqueton on the classification of symbolic objects at CRIM (Montpellier).

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Mural — An Interactive Proof Assistant

RAL — One reason often given for the slow take-up of formal methods by industry is the

```
                          Proof for N-ind
 rule:                         N-ind                          attempts
 theory:                  Natural Numbers                     main proof
 marked items:                                      clear
        consistent          complete          not assumed
             tactic tool              justif tool

                           main proof
 s1 [ n ] { ( P [ n ] ) , ( n : N ) } ⊢ ( P [ ( succ [ n ] ) ] )

 h1 ( P [ 0 ] )
 h2 ( m : N )
 1 ( 0 : Z )                                   by 0-form on []; []
 2 ( m : < n : Z . ( 0 < n ) > )               unfolding from h2
 3 ( m : Z )                                    by supertype on [2]; []
 4 ( 0 < m )                                    by subtype-E on [2]; []
 5 ( ( 0 < 0 ) ⇒ ( P [ 0 ] ) )                  by vac⇒-I-left on [h1]; []

   6 [ z1 ]
   6.h1 ( z1 : Z )
   6.h2 ( 0 < z1 )
   6.h3 ( ( 0 < z1 ) ⇒ ( P [ z1 ] ) )
   6.1 ( P [ z1 ] )                             by ⇒-E-left on [6.h3, 6.h2]; []
   6.2 ( z1 : N )                               by Z and >0 ⇒ N on [6.h2, 6.h1]; []
   6.3 ( P [ ( succ [ z1 ] ) ] )                by s1 on [6.1, 6.2]
   6.c ( ( 0 < ( succ [ z1 ] ) ) ⇒ ( P [ ( succ [ z1 ] ) ] ) )   by vac⇒-I-left on [6.3]; []

   7 [ z2 ]
   7.h1 ( z2 < 0 )
   7.h2 ( ( 0 < z2 ) ⇒ ( P [ z2 ] ) )
   7.h3 ( z2 : Z )
   7.1 ( ( pred [ z2 ] ) < z2 )                 by pred(z)<z on [7.h3]; []
   7.2 ( ( pred [ z2 ] ) : Z )                  by pred-form on [7.h3]; []
   7.3 ( ( pred [ z2 ] ) < 0 )                  by <-<-trans on [7.2, 7.h3, 1, 7.1, 7.h1]; []
   7.4 ( ¬ ( 0 < ( pred [ z2 ] ) ) )            by x<y ⊢ ¬(y<x) on [7.2, 1, 7.3]; []
   7.c ( ( 0 < ( pred [ z2 ] ) ) ⇒ ( P [ ( pred [ z2 ] ) ] ) )   by vac⇒-I-right on [7.4]; []

 8 ( ( 0 < m ) ⇒ ( P [ m ] ) )                  by Z-induction on [5, 3]; [6, 7]
 c ( P [ m ] )                                  by ⇒-E-left on [8, 4]; []
```

The Mural Proof Tool showing a proof of an induction rule for natural numbers

The Mural Proof Tool showing a proof of an induction rule for natural numbers

Three body segments of the hexapodal robot await the addition of the head. The robot is 40 cm long with a leg span of 25 cm and weighs 1.5 kg.
Photo: University of Salford

lack of tools supporting the processes involved. MURAL, developed by Manchester University and RAL, is designed to assist with the theorem proving tasks arising in software engineering applications.

Considerable emphasis has been placed upon the design of the user interface, enabling users to maintain their intuition of the problem domain and guide the proof in the right direction, whilst the faultless symbolic manipulation of the machine maintains the integrity of the proof.

An exploratory style of working is encouraged with the intention of assisting the proof discovery process rather than merely serving to check proofs previously worked out on paper. Proofs can be constructed by working forwards from the hypotheses, backwards from the conclusion, or from new lines added directly to the middle of the proof. Lines of reasoning can be temporarily abandoned whilst alternative approaches are attempted or lemmas conjectured and proved on the fly.

The Mural proof assistant is generic: founded on a logical frame, theories are constructed in a hierarchical store where each theory inherits from and extends its parents.

An instantiation of the proof assistant has been developed for the Vienna Development Method (VDM) providing support for the creation of specifications and reifications between them, and also for the construction of the theories that provide the context in which proof obligations can be meaningfully discharged.

Mural is currently undergoing further development. Enhancements are being made to the VDM support facilities and the generic

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proof assistant. An instantiation for the Z notation is also being considered.

We believe that interactive proof facilities such as those provided by Mural can form the basis of integrated formal development environments of industrial relevance.

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Transputers in Real Time Control

RAL — A project to illustrate the use of transputers in real time control has been funded through one of the community clubs run by RAL as part of the SERC / DTI Transputer Initiative. The work is being undertaken at the University of Salford on behalf of the Real Time Control Transputer Applications Community Club (CTACC). Its purpose is to demonstrate to industrial engineers that transputers are ideally suited to control complex engineering processes more quickly and more cost-effectively than conventional processors.

The demonstrator is a six legged mobile robot which will track and follow in real time the motion of an object such as a person while avoiding or negotiating obstacles in its path. The key feature of the demonstrator is that it is a segmented device in which each segment has its own power supply, sensors and processor. It mirrors industrial applications where many separate machines working in parallel have to be controlled in a way that enables them to cooperate.

Three body segments of the robot have been completed already. Each segment possesses two legs with servo drivers and torque sensors. A head segment with an infrared sensor will be added shortly. A transputer on each segment controls movement, processes sensor information and communicates with other segments. The transputer's hardware support for communication and for multi-tasking makes it the ideal processor for the project. Its small size, weight and cost together with its self-containment are further important considerations.

The project demonstrates well the incremental properties of transputer networks. An individual body segment operating in isolation can maintain a stance but cannot walk. The progressive addition of further segments increases the capabilities of the system until the full functionality of the complete robot is attained.

The robot is available for demonstration from April 1991.

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INTERNATIONAL RELATIONS

Annual Forum of GMD's Washington Office

GMD — Research promotion activities, as practised in the Federal Republic of Germany via the state-supported GMD, other government measures and programmes and also through European Community programmes, were the subject of the Annual Forum held by GMD's Washington office in the Carl-Schulz Auditorium of the German Embassy in Washington DC on 24 January, 1991. This was the third presentation in a series of events usually held anually by GMD's Washington office.

The purpose of such events is to inform the American specialist public from universities, research centres, the administration and industry in the Washington area about GMD's work. At the same time, the aim is also to show which trends and pioneering activities are taking place in the relevant specialist environment. This demonstrates the various cooperative relationships at the national and international level in which GMD is involved and the way in which it meets the challenges facing it. This year's Forum was particularly well attended with over 90 participants. Roughly equal numbers of participants came from the three groups industry, administration and universities/specialist associations.

In his welcoming speech, Dr. Jürgen Ruhfus, the German Ambassador to the United States, stressed the role of information technology as a key element in international competition. At the same time, he drew attention to the great potential for cooperation presented by the creation of a single European market and to the willingness to further intensify the already numerous contacts with the USA.

The next speaker, Dr. Hans G. Klaus, Head of GMD's Department of International Affairs, presented GMD's research programmes, concentrating in particular on GMD's level of international involvement. He stressed participation by GMD in EC programmes, in particular ESPRIT, involvement in the European Research Consortium for Informatics and Mathematics (ERCIM), the initiative for the establishment of the International Computer Science Institute (ICSI) in Berkeley and the work of the GMD offices in Washington, Berkeley and Tokyo.

Dr. Klaus Schroeter, Scientific Officer at the Germany Embassy

in Washington, reported on initiatives taken by the Federal Government to promote information technology. He drew international comparisons in terms of the volume of funding provided and areas covered and gave information on links between national and European initiatives.

Dr. Willy van Puymbroeck from the EC Commission, General Directorate XIII, provided an overview of the complex structure of the EC funding programmes. Naturally, he devoted particular attention to ESPRIT, the European Strategic Programme for Research in Information Technology.

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German-Chinese Electronics Congress Planned

GMD — A German-Chinese Electronics Congress planned for autumn 1991 is intended to give experts from the two countries the opportunity of assessing the results of cooperation in recent years and discussing joint projects for the future. The first details of these joint plans for this year were discussed at a meeting between Dr. Tong Zhipeng from the Chinese Ministry of Mechanical Engineering and the Electronics Industry and Prof. Dr. Eckart Raubold, Manager of the GMD Institute for Systems Engineering in Darmstadt.

While the Congress will mainly deal with computer science topics, consideration was also given to the possibility of including microelectronics in the workshop. This will depend on whether the research institutes participating in the German-Chinese Congress are joined by industry. It was agreed that reports would be given at the Congress on ongoing German-Chinese cooperation and on future prospects in this field. Shanghai was chosen as venue.

Cooperation between GMD and experts from the People's Republic of China is currently concentrated on the establishment of an X.400 electronic mail network between Chinese institutes and universities with access to international networks. Four Chinese guest scientists from institutes of the Ministry of Mechanical Engineering and the Electronics Industry and three from institutes of the Chinese Academy of Science are currently working at GMD.

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Cooperation with Bulgaria

GMD — The "Information Centre for Technology Transfer - Informa" in Sofia, Bulgaria, and the GMD Research Unit for the Economics of Information in Cologne are now cooperating in a first joint project. Dr. Stoyan G. Denchev, Deputy R&D Director General, and Dr. Dimitar G. Christozov, Head of the Informa "System Analysis and Control" Scientific Laboratory will cooperate with Dr. Karl A. Stroetmann of the information management group at the Cologne research unit on the subject of "Information Management for Information Services". Two scientific papers are prepared, i.e. an invited keynote address by Dr. Stroetmann on "Strategic Information Management" and a companion paper by Dr. Denchev/Christozov for the 6th General Conference of the "European Cooperation in Social Science Information and Documentation," an East-West project set up following the CSCE.

The ECSSID Conference was held at the University of Kent in Canterbury, England, from 22 to 26 March, 1991.

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SIGGRAPH Tutorial on Object and Constraint Paradigms for Graphics

GMD/CWI — Together with Edwin Blake (CWI), Chris Laffra (Software Engineering Research Center) and Bjorn Freeman-Benson (Washington University), Peter Wißkirchen of the GMD Institute for Applied Computer Science will hold a tutorial on "Object and Constraint Paradigms for Graphics" at the 1991 SIGGRAPH Conference. The tutorial is a development of earlier cooperation between scientists from GMD and CWI on Object-Oriented Graphics. The SIGGRAH Conference is one of the largest scientific conferences covering computer science. The 1991 Conference will be held from 26 July to 3 August in Las Vegas.

Suggestions for SIGGRAPH tutorials are carefully reviewed and fewer than fifty percent of the proposals received are actually accepted. Peter Wißkirchen and his colleague Erich Rome already held a tutorial on object-oriented graphics at the 1988 SIGGRAPH Conference in Atlanta.

Object-oriented techniques are appropriate for structuring complex designs in computer graphics, and graphics requirements have prompted further development of this approach. The tutorial covers the concepts and extensions needed for the implementation of these ideas in graphics applications.

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The tutorial also compares object-oriented and classical computer graphics approaches. General techniques and solutions are demonstrated by tackling specific problems in graphics, interaction, and animation. Constraint-based techniques are explored as a useful extension of object-oriented methods, with recent progress presented.

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EVENTS

Transputer Applications 91 (TA91)

RAL — The 3rd International Conference and Exhibition on the Applications of Transputers, sponsored by the RAL based SERC/DTI Initiative in the Engineering Applications of Transputers, will take place in Glasgow UK, August 28–30th 1991.

The emphasis of these conferences is on real world applications, particularly those that are now in use; last year 75 papers were presented covering topics ranging from the reading of car number plates from roadside cameras, to the modelling of River Systems for flood control. The presence at TA90 of speakers from Bosch and Volkswagen showed that the potential of the Transputer has already been recognised by some world-class manufacturing companies; several more are expected to be present at TA91. In addition to industrial applications, topics will also include Real Time Control, Signal Processing, Image Processing, Robotics, Molecular Modelling, Software Tools, Communications plus several others.

The accompanying Exhibition provides a unique opportunity to meet the leading suppliers; at TA90 over 40 companies from both the UK and overseas were present.

The venue is the centrally located Moat House International Hotel which gives delegates an opportunity to see the City that was European City of Culture in 1990. Glasgow is also a good base for getting to see the rest of Scotland which is at its best in early Autumn.

Details may be obtained from: TA91, Scottish Transputer Centre, Exchange House, 229 George St., GLASGOW, G1 1RX, Scotland, UK or by e-mail from: T. S. Durrani@vaxa.strath.ac.uk

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Computational Fluid Dynamics Community Club Meeting on Mesh Generation

RAL — The Seminar on Mesh Generation Applied to Computational Fluid Dynamics (CFD) organised by RAL took place at the Laboratory, February 7, 1991, at which over 70 delegates attended. This seminar is one of a continuing series organised by the CFD Community Club within the UK.

Dr N. P. Weatherill (Swansea) chaired the meeting. In the first session there were presentations on established techniques such as the advancing front method, Delaunay tetrahedralisation, transfinite interpolation and multiblock. The second session, on newer methods, included talks on adaptive refinement in multigrids applied to CFD, feature-aligned mesh

embedding, irregular quadrilateral adaption and mesh generation by medial axes subdivision.

Finally, there was a presentation on methods for assessing the quality of meshes in CFD. The quality of the meeting. was reflected in the lively discussion sessions after each presentation. A report on the meeting is available from the contacts below.

The next meeting in this series will be on parallel processing for CFD at the Daresbury Laboratory, on May 22, 1991.

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NAG/SERC Finite Element Library User Course

RAL — Release 3 of the NAG/SERC Finite Element Library is now available from the Numerical Algorithms Group Ltd (NAG). To complement this release a 4 day User Course is to be run at RAL by the authors early in the summer 1991. Anyone interested in attending this course or requiring more information please contact the authors.

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Workshop on the Accuracy of Numerical Techniques in Computational Fluid Dynamics

RAL — The Workshop on the Accuracy of Numerical Techniques organised by RAL in cooperation with the Institute of

Computational Fluid Dynamics took place in Abingdon (UK), November 15-16, 1990. Prof K. W. Morton (Oxford) chaired the meeting which was attended by over 80 delegates. There were presentations on current practice, the choice of physical models, discretisation procedures, the solution of nonlinear and linear systems of equations, and validation. Three discussion sessions on numerical formulation, problem solution and validation identified problem areas. A report on the meeting is available from the author. The next meeting in this series on mesh generation for CFD, was held at RAL, on February 7, 1991.

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Advanced Database Technology

RAL — The Database workshop (ERCIM Meeting at RAL, May 1991) will concentrate on advanced database technology; the areas are those where research is active and where there are alternative views. This should ensure not only timely and relevant presentations, but also vigorous discussion. The topics discussed below are those approved by the ERCIM Standing Committee. The aim is to find areas of common research interest between the ERCIM partners leading to possible cooperation in research and in attempts to secure further research funding.

The 'hot topics' are:

• Object-Oriented Database Systems: do we need a theory? This was discussed at a panel session at the Very Large Database (VLDB) conference in Brisbane, August 1990, and generated some interesting insights and viewpoints. Would relational systems have been successful without Codd's theoretical work? Does theory restrict and retard systems development and experimentation to find solutions?

• Have Logic-based Database Systems come of age? This asks the question whether all the research in logic-based databases has been worthwhile; where are the products? In the same timescale relational products were in the market, as were earlier network and hierarchic systems.

• Performance Issues in Database Systems (or expressiveness versus efficiency). This questions whether the greater expressiveness of the object-oriented, logic-programming and functional programming paradigms is too costly in terms of database system performance. Where is the trade-off between development effort and production efficiency? 4GLs are becoming more acceptable despite poorer runtime performance compared with 2- and 3-GLs; will the reducing cost of hardware resources and increasing parallelism allow us the luxury of these more expressive programming methods?

• Systems Development Methods for Database Systems. This raises the issue of the classical 'waterfall model' and the progressive movement away (via the 'spiral model') towards repeated refinement by prototyping and more sophisticated user requirement elicitation and formal specification.

Behind these 'hot topics' are the basic concerns of advanced database research, the use of parallel hardware, the representability of models, the techniques for end-user involvement in system development and the need to handle ever increasing volumes and types of information.

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SmartCard Workshop at GMD Darmstadt

GMD — The plastic cards with integrated computer chip known as chipcards or smartcards are set to find many applications and enter the lives of virtually
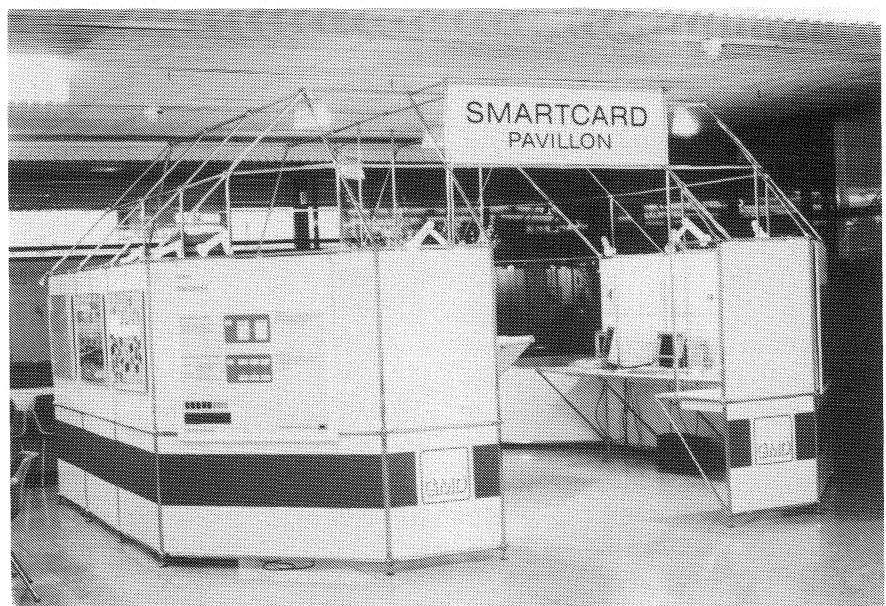
**The SmartCard Pavillon at GMD-Darmstadt
Photo: Münch**

every citizen in the future. Judging by the current state of research work, a number of interesting developments are likely to emerge. For example, the next generation of identity cards will be entered as documents on smartcards, voting will be further automated with smartcards, health insurance certificates will be replaced by smartcards and payphones will be operated with smartcards instead of small change. At the same time, cigarettes, car-park fees and travel tickets will be paid with electronic money, shopping paid for with smart credit cards, bank transfers secured with smartcards and faxes provided with electronic signatures by means of such cards.

GMD held a SmartCard Workshop in Darmstadt on 22 and 23 January, 1991, at which 120 visitors from industry and science heard talks by 23 experts on mathematical and technical principles, smartcard operating system developments and standardisation, legal and organisational aspects, as well as applications and development trends in smartcard technology. The Workshop was accompanied by an exhibition on smartcards in GMD Darmstadt's new SmartCard Pavilion. Ten companies also presented smartcard applications.

Jürgen Dethloff from Hamburg, one of the inventors of smartcard technology and holder of many patents in this field, some dating as far back as 1968, was guest of honour at the GMD Workshop. The event was organised by Dipl.-Ing. Bruno Struif, the research group leader at GMD Darmstadt with responsibility for smartcard applications, whose research group is currently cooperating with the Gesellschaft für Automation und Organisation, one of Germany's leading companies in the smartcard sector, in the

development of a new smartcard operating system. These developments are part of the work of GMD Darmstadt's communications technology research division on the GMD main theme "Information technology cooperation support."

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Colloquium in Honour of Computer Pioneer Konrad Zuse

GMD — In honour of Konrad Zuse, the German computer pioneer who celebrated his 80th birthday in June 1990, GMD held a Special Colloquium on Computer Architecture on 30 November, 1990, at its Schloß Birlinghoven headquarters near Bonn. The theme of this day-long series of lectures, which began with an introductory lecture by Prof. Dr. h.c. Konrad Zuse, was the further development of computer architectures starting with Zuse's Z1 in 1936 and progressing to the massive-parallel information processing systems of the year 2000. The Colloquium was addressed by leading computer architecture specialists including Prof. Dr.-Ing. Wolfgang K. Giloi from Berlin, Prof. Dr. Kai Hwang from Los Angeles, Prof. Dr. Arvind from Cambridge, USA, Prof. Dr. Philip Treleavan from London and Dr. Wilhelm Spruth from Böblingen.

On the occasion of his 80th birthday, Konrad Zuse was honoured in a ceremony held at his home in Hünfeld attended by the Federal Minister for Research, Heinz Riesenhuber, and numerous computer experts from science and industry.

As far back as the 1930s, Konrad Zuse was the first scientist to develop and build - quite separately from other developments - the prototype of all modern computers, the "Z1," the first binary digital computer in the world. A copy of this computer has been on display in the Berlin Museum of Transport and Technology since 1989. The first fully functional program-

The German Computer Pioneer Konrad Zuse at GMD-Birlinghoven
Photo: Münch

controlled electromechanical digital computer in the world, the Z3 with 2000 relays, was completed in 1941 but destroyed during the war in 1944. Because of its historical importance, a copy was made in 1960 and put on display in the German Museum in Munich. Konrad Zuse developed further computer generations up to Z22 which were equally important to the progress of computer engineering. In the forties, Zuse also developed the first ever higher-level programming language, "Plankalkül". In overall terms, the lines of development initiated by Konrad Zuse are now finding their culmination in massive-parallel, neuronal and optical computers.

GMD, which unveiled a bronze portrait in honour of the German computer pioneer at GMD Birlinghoven in August 1979, began a historical study of German computer developments in 1976. This study also included documentation of Konrad Zuse's own papers.

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Workshop on Intelligent Interfaces for Information Systems

GMD — An international workshop on the subject of "Intelligent Interfaces for Information Systems" was held on 1 and 2 November, 1990, by GMD's Darmstadt Institute for Integrated Publication and Information Systems in cooperation with the University of Darmstadt, the University of Colorado in Boulder and the Expert Committee on "Integrated Publication and Information Systems" of the Gesellschaft für Informatik (Computer Science Society). In addition to the seven

invited lecturers, Hans-Dieter Böcker (GMD), Jaime Carbonell (Carnegie Mellon University), Gerhard Fischer (University of Colorado), Walter Kintsch (University of Colorado), Gerhard Knorz (University of Darmstadt), Brian C. Vickery (University College, London) and Wolfgang Wahlster (German Research Centre for Artificial Intelligence), ten other speakers from five countries gave an overview of the international state of research and presented the results of individual projects and prototypes. The programme of lectures was complemented by system demonstrations.

The around 100 guests heard general lectures followed by more specialised talks on knowledge-based and epistemological approaches employed in the development of interfaces for such widely varying information collections as fact databases, the belles-lettres collection of a public library, or large object-oriented programs as sources for software reutilisation. Some lectures dealt with the particular problems of access to hypertext systems. Other subjects included, for example, psychological findings on human memory and possible consequences for the design of information retrieval systems, linguistic analyses of specialist dialogues and the generation of multimodal presentations of information contents.

The level of interest shown in the workshop by various disciplines was demonstrated by the attendance of researchers from fields as varied as information retrieval, artificial intelligence, computer linguistics, psychology and information science. On the occasion of the workshop, Prof. Gerhard Knorz also headed a preparatory meeting for the establishment by the Gesellschaft für Informatik of a special interest

group on "Information Retrieval" which is intended to take account of this wide range of interests.

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Comparison of Parallel Computers

GMD — GMD held a forum on concepts and applications of parallel systems, "KEpSY 91," in St Augustin from 8 to 10 April, 1991. The aim of this forum was to provide a comparative survey of parallel computers that are already suitable for use today, as well as their architectures, languages, development tools and experience gained through their practical application.

This aim was achieved with summary lectures and presentations of GMD's own parallel computer systems. Manufacturers and suppliers of parallel computers also presented their respective computers and demonstrated them in action. The forum was completed by reports on practical experience by users from industry and research.

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Workshop on Information Retrieval

GMD — A workshop on Information Retrieval jointly organized by the German "Gesellschaft für Informatik" and the GMD will be held at the GMD Integrated Publication and Information Systems Institute on June 24 to 25, 1991. For the first time in Germany, the workshop will bring together scientists from the various aspects of Information Retrieval thereby providing a

broad survey of the field. Evaluation aspects, user interfaces, implementation techniques, knowledge representation, and advanced applications will be the main topics of the workshop. One of the workshop activities will be the foundation of a special interest group on Information Retrieval within the Gesellschaft für Informatik.

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14th International Symposium on Mathematical Programming

CWI — Amsterdam will host the 14th International Symposium on Mathematical Programming from August 5 to 9, 1991. This triennial meeting of the Mathematical Programming Society is organized jointly by CWI, the Free University Amsterdam and the Universities of Amsterdam, Eindhoven, Rotterdam and Tilburg. The meeting offers invited and contributed talks on theoretical, computational and practical aspects of the field.

The plenary opening address will be delivered by W. R. Pulleyblank (IBM Thomas J. Watson Research Center, USA, and University of Waterloo, Canada). There will be a series of some fifteen invited lectures of one hour each. In addition, a large number of shorter presentations will cover a wide variety of subjects, as well of a fundamental nature as directed to applications and teaching.

The organizing committee is chaired by J. K. Lenstra (Eindhoven University of Technology and CWI), A. H. G. Rinnooy Kan (Erasmus University Rotterdam) and A. Schrijver (CWI and University of Amsterdam). More information can be obtained from the Symposium Secretariat, tel. +31 20 675 2120, fax +31 20 662 8136, email: ismp@swi.psy.uva.nl

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LIFE IN THE INSTITUTES

INRIA Research Teams Win CRAY Prizes

INRIA — CRAY France awards annual prizes to research teams using high-speed and parallel computers. Recently two prizes were awarded to research teams at INRIA: one for the work on CAPRAN (exploitation of fine grain parallelism) and the other for the work of André Gagalowicz and his team SYNTIM on image synthesis and analysis.

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INRIA's New Research Programme

INRIA — Research at INRIA is organized in research teams composed of 10 to 15 persons (permanent staff, Ph. D. students, guest researchers, postdoctoral fellows). Presently there are about 60 projects. For the sake of presentation and of evaluation these teams are grouped into programmes. INRIA now has reduced its number from eight to six programmes, as follows:

• Parallel Processing, Databases, Networks and Distributed Systems (ex-programmes 2, 3 and 4);

• Symbolic Computation, Programming and Software Engineering (ex-1);

• Artificial Intelligence, Cognitive Systems and Man-machine Communication (ex-8 + parts of ex-1, 4 and 5);

• Robotics, Images and Vision (ex-6);

• Signal Processing, Control, Automatic Manufacturing (ex-5);

• Scientific Computing, Numerical Software and Computer-aided Engineering (ex-7).

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PEOPLE

CWI — Dr. Jan van Eijck, researcher in CWI's research group on Logic and Language, has been appointed part-time professor at the University of Utrecht in the logical aspects of computational linguistics.

CWI — Prof. Jaco de Bakker, head of CWI's department of Software Technology, has been elected a member of the Academia Europaea.

CWI — Dr. Sape Mullender, leader of CWI's research project on Distributed Systems (Amoeba, a cooperative effort with the Free University of Amsterdam, and supported by the Open Software Foundation OSF), accepted a professorship at the University of Twente in Systems Programming and Architecture. As a consequence, Amoeba has been terminated at CWI. Mullender remains affiliated with CWI as an adviser.

GMD — Dr. Thomas Christaller, Head of the GMD Research Group on Expert Systems, was appointed as a university professor and awarded a chair in the Faculty of Linguistics and Literature Studies at the University of Bielefeld. With effect from 1 October, 1990, Dr. Christaller was appointed Head of the GMD Institute for Applied Information Technology where he is in charge of research work in the field of artificial intelligence.

GMD — Dr. Diether Craemer, lecturer in the Institute for Technology Transfer, has accepted a professorial chair in agricultural information science at Nürtingen Technical College. He took up the chair on 1 March, 1991, and will build up the department of "Applied Information Science, in particular Agricultural Information Science."

GMD — Prof. Dr. Raul Camposano will take over as Head of GMD's large project "Design of Integrated Circuits" (E. I. S) on 1 April, 1991. He will be appointed simultaneously as professor at the University of Paderborn. Dr. Camposano previously worked for IBM in the United States.

GMD — Dr. Michael Timm, Acting Head of the GMD Institute for Systems Engineering, will take up a post in the data processing and organisation division of the Gerling Group on 1 April, 1991. He will become Head of the "Software Engineering" department.

GMD — Dr. Dr. Norbert A. Streitz, Head of Publications and Hypertext Systems in the GMD Institute for Integrated Publication and Information Systems was appointed Associate Editor of ACM Transactions on Information Systems (TOIS) with effect from December 1990. In the summer of 1990, Dr. Streitz was appointed to the Editorial Board of the international journal Hypermedia.

GMD — Dr. Klaus Truöl, a scientist in the GMD Institute for Systems Engineering was appointed for two years as Chairman of the Technical Liaison Group by the EWOS Technical Assembly (European Workshop on Open Systems, Brussels).

GMD — Dipl.-Ing. Leo A. Nefiodow, Head of the Working Party on Efficiency and Program Studies, was appointed to the expert committee "The Infrastructure of the Communications Society" with effect from 1 January, 1991. The appointment was made by the Minister-President of the Land of Schleswig-Holstein.

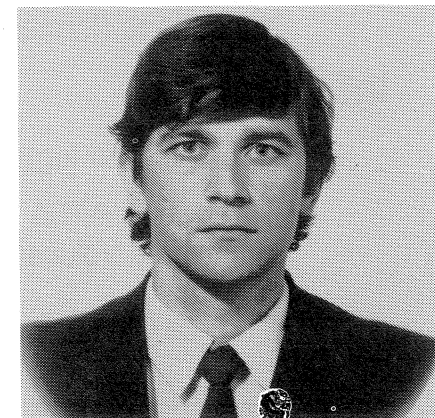**ERCIM — Michal Haindl** (Czechoslovakia), **Eric Rutten** (France) and **Alexander Malyshev** (Soviet Union) are spending three periods of half a year at three different ERCIM institutions (see ERCIM News No. 5). Haindl is a specialist in computer vision, Rutten wrote his Ph. D. thesis about the application of temporal logic in telerobotics, Malyshev's speciality is numerical linear algebra.
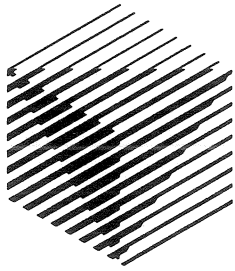

Michal Haindl
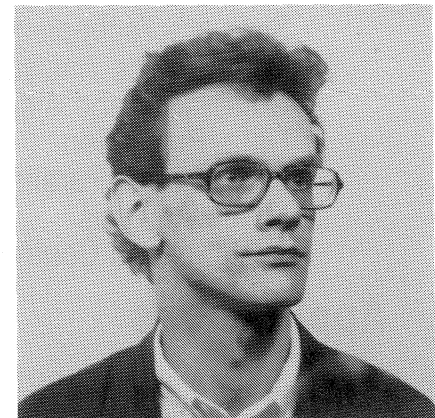
Eric Rutten

Alexander Malyshev

ERCIM

The European Research Consortium for Informatics and Mathematics

offers

4 FELLOWSHIPS

1991-1992

The fellowships will have a duration of 18 months, and are divided into 3 periods of six months, each to be spent in one of the four ERCIM Institutes (CWI, GMD, INRIA, RAL) The program will start on 1 July 1991

Research Themes

|	
Software Technology	Concurrency
Performance Analysis	Scientific Computation
Complexity and Algorithms	Human Computer Interaction
Data Protection	VLSI Design
Software for Parallel Systems	Symbolic Computation
Image Analysis	High Speed Networking
Systems and Control Theory	Databases

Applications

-Before 1 May 1991
-Maximum age: 35
-PhD's only
-Open to Residents of European Countries
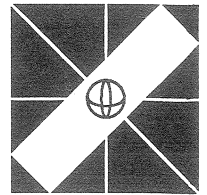-Not open to (former) employees of ERCIM members

Information

For application forms and detailed information, contact:

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CWI   GMD   INRIA   RAL
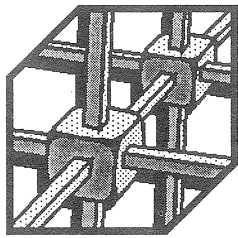
International IFIP Workshop on Open Distributed Processing

Berlin, October 8 - 11, 1991

Organized by:
GMD Research Center for Open
Communication Systems (FOKUS)
   and
Institute of Informatics and
Computing Technique (IIR)

Programme Chair:
J.de Meer, GMD-FOKUS, Berlin
V.Heymer, IIR, Berlin

Programme Committee:
S.Asano, NACSIS Tokyo, Japan
K.Chon, KAIST, Seoul, Korea
L.Csaba, MTA Sztaki Budapest, Hungary
A.Danthine, UoLiege, Belgium
J.v.Griethuysen, Casteren, Netherlands
A.Herbert, APM Cambridge, U.K.
P.Linington, UoKent Canterbury, U.K.
W.A.McCrum, Depart.of Com., Canada
E.Najm, INRIA Rocquencourt, France
A.Petkov, RCCS Sofia, Bulgaria
J.Kikuts, ESTI Riga, USSR
K.Raymond, UoQueensland, Australia
K.Rayner, British Telecom, U.K.
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C.Sattler, IIR, Berlin
G.Schürmann, GMD-FOKUS, Berlin
M.Sloman, Imperial College, U.K.
J.-B.Stefani, CNET Paris, France
A.Wolisz, IITiS PAN Gliwice, Poland

Local Organization Committee:
J.Kittan, IIR
A.Rennoch, GMD-FOKUS
R.Roth, GMD-FOKUS
P.Schoo (Chair), GMD-FOKUS

Announcement and Call for Papers

Scope of the Workshop: The workshop gives new insight into design and implementation aspects of Open Distributed Processing. Topics include Viewpoint Modelling of ODP, Lightweight Protocols, Distributed Application. Special attention is given to the development of tools. The Workshop will take place in Berlin in the year after its reunification On the road to European integration, Berlin will be one of the centers of scientific communication and technology exchange between East and West.

Topics:
- Modelling of ODP Viewpoints
- Formal Approaches to Modelling of Distributed Systems
- Time and Performance Aspects
- Conformance
- Object Oriented Architecture
- Enterprise Model
- Telecommunication
- Test Data Generation and Selection
- Tool Presentations

Workshop Organization: Invited talks will be given addressing major topics of the workshop: Basic ODP Reference Model, Object Oriented Specification, TINA, Enterprise Modelling, ANSA, Intelligent Networks. Accepted papers are presented in serial sessions. Additionally presentations of last minute mini-papers and position statements are welcome. A Panel Discussion on the East European perspective on the Telecommunication Market will be held. For the demonstration of tools technical support for SUN, IBM Workstations and PCs will be provided.

Workshop Participation: All papers will be refereed. Papers should not exceed 12 pages. Arrangements with North Holland are being made to publish the workshop proceedings. Effort is being made to provide financial support for a limited number of participants from Eastern Europe at reduced costs. The Workshop language is English. Please submit 5 copies of your contribution to one of the programme chairmen:

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Important Dates:
Submission of Papers: April 26, 1991
Notification of Acceptance: July 12, 1991

Name: ....
Organization: ....
Address: ....
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....
Phone: ....
Fax: ....
E-Mail: ....

I intend to:
❏ participate at the workshop
❏ submit a paper
❏ demonstrate a tool

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