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In this issue

Editorial

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This is the second issue of the CoLogNet Newsletter, the official newsletter of the Network of Excellence in Computational Logic (CoLogNet). As announced in the first issue the main purpose of the newsletter is to report on the activities of the network and more generally on the international developments in the scientific field of computational logic. The newsletter reports on the network's activities and other related events and present short popular−style reviews of specific sub−areas of computational logic and cases of industrial application.

This issue has concentrated, for the most part, on dealing with activities of the network in symposiums, conferences, and workshops. Of particular interest is the 13th International Workshop on Principles of Diagnosis dealing with model−based diagnosis that makes use of logical models for detecting failures and locating the faults in arbitrary systems. Also of special interest is a report appearing in the UK Grand Challenges Workshop on the development of a Mathematical Assistant aiming to cooperatively help users solve their mathematical problems.

The success of the newsletter depends on the continued interest of the CoLogNet members and other researchers outside the network to contribute with their own reports, articles, news items, reviews and any other appropriate information. In particular, letters or comments on the newsletter itself with suggestions and criticisms for the improvement and expansion of the newsletter will be most welcome and greatly appreciated. In the newsletter web site you have the opportunity to open or take part in a discussion on a topic of your choice.

We would like to thank all the contributors for helping us put together an interesting second issue of the newsletter. We hope that with the support of the network members and the community at large we will be able to continue improving the

newsletter in the future.

Executive Council Report

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Introduction

This report presents our work in the network since CoLogNet started in due time on 01/01/02 and it outlines the general progress of the networking activities and support measures. The particular achievements of area initiatives and work package tasks are summarized in their respective reports and are covered in more detail elsewhere in this newsletter.

Infrastructure Building

Efficient communication and its contribution to infrastructure building is an ambitious spectrum of activities and includes support for disseminating information about the network and its field of activity. The dissemination of information will be ensured via internal communication streams i.e. electronic mailings lists and externally via web site presentation.

In a first approach electronic mailing lists were set up for the different organisational units of CoLogNet such as areas, work packages and task forces. In the second step electronic mailing lists were set up to ensure the external communication flow with new members and nodes (i.e. e−eu−contacts@colognet.org, colognet−nodes@colognet.org). The main mailing lists for all nodes and members will also be open to individual subscribers outside of the net.

A subcontract was concluded to establish, maintain and update a project website for CoLogNet. Therefore a two−step approach to establish a community platform in the field of Computational Logic was approved by the Commission and the Consortium. First, a preparatory concept study was undertaken to provide the necessary information on how to implement a portal solution in the framework of CoLogNet. Based on this study and the necessary adjustments, the technical implementation of the final portal solution will be now realised in step two. The overall goal of a portal solution in Computational Logic is to support networking of the researchers in the various areas related to CL and to present the relevant European research and development expertise as a whole. CoLogNet groups and participants with relevant information will be able to present this information on the platform. The service envisaged is a continuously updated portal site which will help the CL community to survey and monitor the research areas. The main goal is to approach new partners from both industry and research institutions to promote cross−fertilisation.

Another support measure for the network's information is the CoLogNet newsletter, whose main purpose is to report on the activities of the network and more generally on the international developments in the field of Computational Logic. The newsletter presents short reviews of specific sub−areas of Computational Logic and case studies of industrial applications.

Relationship To IFCOLOG

An IFCoLog business meeting was held on 30 July at FloC'02 in Copenhagen. The prime outcome of the meeting is:

- Moshe Vardi accepted the offer to become the new President of IFCoLog
- Dana Scott resigned as a president but agreed to become the "Founding President" of IFCoLog
- With regard to officers and their respective positions within IFCoLog, the IFCoLog Manifesto has been rewritten and the revised version is now on the IFCoLog site at www.ifcolog.org
- Email distribution lists have been revised and are available on the web as well

At the time of writing there are some changes on their way: We are in the process of restructuring the IFCoLog web site and also finally establishing IFCoLog as a legal entity.

Task Force Initiatives

The Task Force Initiatives (TFI) to establish and strengthen links with industry witnessed a number of activities in the field of formal methods and constraint logic programming. Their reports are listed in this issue of newsletter below.

Task Force 1 organised a CoLogNet & FME Industry Day – a full day meeting at FloC'02 where several management−level industry people were invited. They represent leading−edge European industries that significantly rely on the research, development and use of formal methods.

Task Force 2 organised two industrial events. One event was co−located with the ECAI 2002 workshop on "Modelling and Solving Problems with Constraints" in Lyon. The industrial panel organised at ECAI 2002 focused on the relationship between CLP and industry. Another industrial event was co−located with LOPSTR 2002/SAS/AGP in Madrid. A CoLogNet stand was set up and displayed posters and distributed leaflets about CoLogNet. Furthermore, two invited industrial talks were submitted.

Task Force 3 used FloC'02 as a platform to initiate a CoLogNet and EU enlargement awareness launch in Copenhagen. In the run−up to the awareness launching of CoLogNet a number of institutions in Eastern European Countries have been addressed in form of an official invitation letter drawn up by Jörg Siekmann and Dov Gabbay to participate in the launching. A stand was prepared which displayed posters providing information on the structure and organisation of CoLogNet. Furthermore, leaflets about CoLogNet and its task forces were distributed. Though the participation of representatives from Eastern European Countries was considerably lower than expected, CoLogNet received quite an acceptable number of requests for membership application from institutions of Eastern European Countries and this is increasing now as CoLogNet becomes better known in the East.

Picture from the CoLogNET Awareness Launching (TF 3 Initiative)

Picture from the Reception organised by and held at Dines Bjorner's Place in Copenhagen, The Reception was organised within the framework of TF 3 initiative at FLoC'02 in Copenhagen where mainly participants from Eastern European Countries were invited

EC Meeting In Madrid

With the co−operation of UPM the Executive Council meeting and the general Task Force meeting was hosted by Dr. German Puebla at “La Residencia de Estudiantes” on 13th and 14th of October in Madrid. Dr. David Pearce form the European Commission and all partners – except for Dr. Antonios Kakas who was not able to attend the EC meeting − followed the invitation. The schedule for both days was quite tight. The overall objective of both meetings was to review work package activities as well as task force initiatives and discuss future plans. The minutes of the EC and TF meeting are on its way and will be sent out within the next couple of days. Although both meetings proved to be enjoyable and efficient working sessions the overall meeting was overshadowed by a dreadful and brutal incident. One of the participants was brutally attacked by a group of gangsters.

New Nodes

As a result of the Task Force 3 activities to promote the integration of Eastern European Countries (EEC) a set of core institutions that could act as an initial focal point for further institutions from that respective country were identified and promising applications for CoLogNet membership were submitted.

In the course of events launched by CoLogNet activists and based on already existing relationships and contacts a

large number of membership applications were submitted to the Executive Council for approval.

So far the following institutions have been approved by the Executive Council:

The Institute of Cybernetics in Estonia, the Charles University in Czech Republic, SRCIM – Slovak Research Consortium for Informatics and Mathematics in Slovak Republic, the Institute of Computer Science in Poland, the Institute of Mathematics and Informatics in Lithuania, USAM − University of Applied Sciences of Moldova, Tver State University in Russia, the Institute de Recherche en Informatique de Nantes – COCOA – Continous Constraints and Applications in France, RISC − Research Institute for Symbolic Computation in Graz / Austria, SICS – Swedish Institute of Computer Science in Sweden, the University of Milan, the Imperial College of Science, Technology and Medicine in the UK, Roskilde University in Denmark, INRIA France, EPFL – Swiss Federal Institute of Technology Lausanne / LIA – Artificial Intelligence Laboratory, Department of Information Technology of Uppsala University, DSI Bologna – Department of Computer Science of the University of Bologna, CLEF – Computation Logic in Ferrara of the University of Ferrara, APES – St Andrews University in Scotland, Theory and Logic Group – TU Wien, RISC – University of Linz, Carmen Systems – Sweden, LORIA & INRIA – Nancy, PLUME – ENS Lyon, Torino University in Italy, UNITN – Trento University, DEIS – University of Bologna, TCSLAB – Linköping University Sweden, APES – University of Glasgow, IASI – CNR in Rome, Mathematical Reasoning Group – School of Informatics – University of Edingburgh, Model Checking and Reasoning Group – School of Computer Science – University of Birmingham, APES – University of Huddersfield

In a next approach links to nodes of the previous Compulog Net will be re−established to integrate all former nodes into CoLogNet. So by the end CoLogNet will unite a vast number of nodes. Thus it will significantly contribute to efficient innovation transfer and close interdisciplinary co−operation between industry and research areas. Moreover, it will play an important role in promoting the field of Computational Logic as an academic subject of its own.

Workshop on Education and Training

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On September 19−20, 2002, a Workshop on Education and Training organized by Work Package 12 took place in Madrid. The general purpose was to discuss the goals of the Work Package with respect to what can realistically be accomplished till the end of 2004. The main discussion points were:

- evaluation of the CL Masters Programme at the TU Dresden,
- the distributed Masters Programme between Dresden and Lisbon,
- accessing the potentials of summer schools (SS),
- possibilities and potential of E−learning and Video teaching.

The results of the Workshop were presented and discussed 3 weeks later at the CoLogNET EC Meeting (Madrid, October 14, 2002), whose conclusions are integrated into this report.

Evaluation of the TU Dresden CL Masters Programme

The two−year study programme "International Masters Programme in Computational Logic" established at the Technische Universität Dresden (TUD) (http://www.cl.inf.tu−dresden.de/compulog/) was presented by Steffen Hölldobler with the purpose of a critical review. The discussions showed that the contents of the offered lectures, 6 years after their conception, is still considered up−to−date, exhaustive and well structured.

Distributed Masters Programme

A presentation of the Master of Science Course in Applied Artificial Intelligence (MIAA) at the Universidade Nova de Lisboa (UNL) (http://www.centria.fct.unl.pt/~lmp/miaa/miaa.html) opened the discussion of issues like councils for recognition of the lecture courses and examination procedures. Computational Logic courses at Lisbon from MIAA have been already formally accredited at Dresden, and vice−versa, as a starting basis for the distributed Masters. A further point was the desirability of establishing double degrees awarding from cooperating universities. Dresden and Lisbon are already actively pursuing this objective.

The idea to develop Distributed Masters Programme in the foreseen framework of the Erasmus World programme, which targets non−EU countries, (http://www.europa.eu.int/rapid/start/cgi/guesten.ksh) envisaged by the European Commission was met with great enthusiasm both at the Workshop and at the EC Meeting. For the purpose of putting in a CoLogNet proposal as soon as the call opens, apart from Dresden and Lisbon, a third university from a different EU country is required to join in, according to this EU programme's conditions. It should already have a strong

commitment to teaching Computational Logic, and an ongoing master's, so that there is no delay. Another prerequisite of the programme is that the universities involved are prepared to award double degrees.

Accessing the potential of Summer Schools

After presentations of the aims and scope of the summer schools ESSLLI (European Summer School in Logic, Language and Information) and ISCL (International Summer School on Computational Logic), there followed a profound discussion of the relations between such summer schools and CoLogNET with special emphasis to Work Package 12. At the EC meeting a decision was made for further financial supporting of ESSLLI. An open problem remains the requirements for supporting other summer schools. The problem of how courses of summer schools can be credited for Masters Programmes like the one in Dresden, and whether this is desirable, was left open as being too controversial. E−Learning and Video teaching The ambitious goal of these two subjects was to find a way for interactive teaching, which could be applied in the distributed masters programmes.

Ulrich Furbach from the University Koblenz−Landau presented his "Living Book" (http://www.in2math.de). This system offers possibilities for explorative learning: self−made examples, solving exercises, accessing theorem provers; re−use of existing documents, support of a wide range of examples and questions −− from elementary to realistic.

The first live broadcast colloquium between Dresden and Madrid was, at the workshop, executed with the tool VidConference (awarded with prize ``Best of Show"on CeBit 2002) developed at the TU Dresden and VidSoft GmbH, Dresden (www.vidsoft.de). We showed the features of the tool: simple user interface, integrated data conferencing, synchronous bidirectional transmission of audio and video, extremely low delay, etc. It is planned to evaluate another similar products (e.g. Quicktime) in view of their suitability for our purposes. Suggestions are welcome.

For further information please see at the web page of the workshop:
http://www.ki.inf.tu−dresden.de/Research/CologNet/CLN_Events/CLN_WS_EaT.html

ERCIM/CologNet 2002 workshop on constraints

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If you survived the long title and started to read this report then you know that this is a report on the ERCIM/CologNet 2002 workshop on constraints. To be more precise, it is about the seventh meeting of the ERCIM Working Group on Constraints organised together with the first annual workshop of the CologNet area on Constraint Logic Programming. This year, this joint event was hosted by newly established Cork Constraint Computation Centre in the city of Cork, Ireland in June 19−21, 2002.

Talks

The workshops in this series are known for their open character; they are open to everyone and to every topic related to constraint (logic) programming. This year we have 18 contributing talks and 2 invited talks spread over the three days. Let me first tell few words about the two invited talks.

Barbara Smith (University of Huddersfield, UK) "played" with queens in the first invited talk. To be more serious, she used the problem of peaceable armies of queens to demonstrate how the problem formulation can influence the speed of solving. Symmetry breaking, dual models, and search strategies were the main topic of her very interesting talk "Solve Your Problem Faster − by changing the model".

In the second invited talk Manuel Hermenegildo (UPM, Spain) almost convinced us that the debugging facilities of CIAO Prolog can solve the halting problem. Of course, the presented pre−processor cannot handle this problem but it can help programmers to identify where the problem in C(L)P program settles. Manuel's practically oriented talk "Abstract Verification and Debugging of Constraint Logic Programs" gave many examples of Ciao pre−processor's capabilities.

The topics of the contributed papers can be roughly classified into the following areas: modelling and solving CSPs; explanation generation; inference and consistency processing; SAT and 0/1 encodings; soft constraints and constraint

relaxation; real−world applications; and distributed and parallel constraint solving. Full versions of the papers are available on−line at the workshop web pages (http://www.cs.ucc.ie/~osullb/ercim2002/) so I will only briefly survey the topics of talks here.

The first session on modelling and solving CSPs showed how solving a relaxed problem can provide information to value ordering oracle (Reduced Costs for Generating Promising Subproblems). An automatic system for adding implied constraints and removing symmetries has also been introduced there (CGRASS: A System for Transforming Constraint Satisfaction Problems) together with a technique for removing redundant rules from rule−based constraint systems (A Note on Redundant Rules in Rule−based Constraint Programming).

The session on explanations included just one talk on explanations of preferences in configuration systems (Explanations and optimization in preference−based configurators).

The next session on inference and constraint satisfaction presented a method of minimising a number of consistency checks in arc consistency (Domain−Heuristics for Arc−Consistency Algorithms) and an idea of replacing rules by constraints in expert systems (Constraint Processing Offers Improved Expressiveness and Inference for Interactive Expert Systems).

In the session on SAT and 0/1 encodings of CSPs we have learned how to encode CSP using 0/1 variables (A Study of Encodings of Constraint Satisfaction Problems with 0/1 Variables) and how CSP technology can contribute to design of state−of−the−art SAT solvers (The Effect of Nogood Recording in MAC−CBJ SAT Algorithms). A new constrained local search algorithm useful when finding a feasible solution is hard was also presented there (A Local Search Algorithm for Balanced Incomplete Block Designs).

The session on soft constraints and relaxations showed how the notions of substitutability and interchangeability can be extended from flat CSP to soft constraints (A Definition of Interchangeability for Soft CSPs) and how to solve over−constrained problems via fine−graded relaxation of constraints (Experimental Results in Constraint Relaxation).

In the session on applications we have learned how to choose a digital camera (Constraint−Based Matchmaking: A Personal (Interim) Perspective) and how to produce tons of candies (Visopt ShopFloor: On the edge of planning and scheduling).

The session on distributed and parallel constraint solving introduced a new Java−based interface between the application side and the constraint solvers (POOC − A Platform for Object−Oriented Constraint Programming) and a new framework for configuration of parallel constraint solvers (A Coordination−Based Framework for Parallel Constraint Solving). We also saw the application of asynchronous constraint solving to distributed meeting scheduling (Dynamic Distributed Constraint Satisfaction with Asynchronous Solvers).

In the final session on numerical constraints we have learned how to reason about non−linear constraints over continuous domains (Reasoning on the Properties of Numerical Constraints) and how to cut and pack 2D angles (Comparing OR and CLP Approaches to 2D Angle Cutting and Packing Problem).

Conclusions

I really like to attend the events in this series of ERCIM/CologNet workshops with the broad scope of talks. Even if the topic of many papers is probably different from the area where you are working right now, the presentations quite often evoke new hidden connections and bring new ideas. This year's workshop was not exception and I really enjoyed the talks and the friendly and warm atmosphere (even if the disobedient air−conditioning tried to freeze us). At this place I should thank the organisers for putting together the interesting programme and the sponsors (the ERCIM Working Group on Constraints, the CLP area of CologNet, and the 4C research centre) for covering all the local expenses and for supporting my participation. If you missed the opportunity to be there (and to see Toby Walsh in long trousers, as Krzysztof Apt pointed our during the workshop dinner ;−) you can enjoy Ireland's stable weather − some rain and some sun every day − in 2003 when the CP conference will be organised by 4C close to Cork. See you at next ERCIM/CologNet events.

ECAI 2002 panel on the relation between Constraint Logic Programming and industry

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ECAI 2002 (http://ecai2002.univ−lyon1.fr/show_en.pl) has been held in Lyon on July 21−26, 2002. As part of the program of the ECAI 2002 workshop on "Modelling and Solving Problems with Constraints" (http://www−users.cs.york.ac.uk/~tw/ecai02/), a panel was focussed on the issue of the relation between CLP and industry. The invited panelists were Helmut Simonis (Parc Technologies, UK), Wim Nuijten (ILOG, France), and Laurent Zimmer (Dassault Aviation, France) and the title of the panel was "What the user really, really wants". The meaning of the title, apart from its similarity with the title of a famous song, was to concentrate on the issues that users find necessary in contraint−based tools. In particular, the aim was to point out the main features that are crucial when using such tools in real life.

Toby Walsh, the workshop organizer, was the moderator of the panel, and started it by laying a number of issues to discuss, like the debate between libraries and toolkits, the modelling and solving lyfe−cycle, the possibility of modelling uncertainty, the choice between optimization and soft constraints, explanations, CP inside (as in Intel inside), ...

Wim Nuijten started the discussion by stressing that usually the user does not care what technology is used to solve a problem, so constraints are in fact hidden from the user, who just desires to press a button and have a reasonable solution. He also said that the main features of a successful tool are: ease of use, reliability, and robustness. This is way CPLEX is so successful: because it has all these features. Explanations are useful, in his view, when there is no solution. Otherwise, it is more important that the user has confidence in the product. He also enphasized the need to teach constraint programming in schools, to create a generation of people knoledgeable in CP.

Laurent Zimmer pointed out that explanations are instead useful in some domains, for example in design. Moreover, he also mentioned that sometimes it is too expensive to use constraint technology, so industries move to other technologies.

Helmut Simonis said instead that a solving button is not enough, one needs also explanations and justifications in many planning and scheduling scenarios. This opinion, so different from Nuijten's, depends perhaps from the class of users that ILOG and Parc Technologies have. Since ILOG sells mainly tools while Parc Technologies sell solutions, it is possible that tool users are less computer science literate, so they don't desire many added features but just a reliable tool. He also mentioned that customization is often bad for scheduling packages, since it yields many

different variants that have to be maintained. At Parc Technologies, they develop hybrid solutions, which use both linear and constraint programming.

Some of the partecipants mentioned that constraint programming should be more widely available, and less costly. They has expressed the hope that the European Community could help in this respect, by funding projects which could develop free constraint−based sofware. Others wondered if there will ever be a constraint programming tool with a vast horizontal market, like Excel.

One precise question was then asked the panelists: how can we get interest from industry into constraint programming? Simonis proposed to consider one problem and to use it for confidence building. He also recommended not to talk about the technology itself. Nuijten enphasized reliability, in the sense of assuring that in a certain number of seconds one can get optimality within a certain tolerance.

Another question was about the main obstacle for the customers to adopt constraint−based technology. Nuijten stressed that education would be very important, and mentioned the ILOG academic licence program, which allows universities to use and teach constraint programming via ILOG
tools. Simonis mentioned the ECLIPSE summer school, and also suggested to consider the productivity of the people using the tools.

This panel has been a first attempt to listen to constraint−knowledgeable industry people and to discuss the relation between CLP and industry. In particular, it has been interesting to see that many of the features that researchers are working on at the theoretical or prototype level are not yet considered ascrucial in real life. This means that either we have to push them more and make the CP producers know about these features, or that
we should realize that our idea of what is important is not really a realistic one.

Many thanks to CologNet for the support given to the panelists.

8th International Conference on Principles and Practice of Constraint Programming (CP−2002)

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The Constraint Programming conference was held in Cornell University, from September 8 to September 12, 2002. The main organizers were Carla Gomez as Conference Chair and Pascal Van Hentenryck as Program Chair. This conference was a main event for the constraint programming community, where the most recent advances and technical contributions were presented. This year the Conference aimed at broadening its scope, bringing researchers from close fields who could give some new views about research issues certainly relevant for the constraint community.

The first day was devoted to a Symposium on Graph Coloring, which grouped contributions on generators and exact and heuristic solving methods. The same day 9 conference workshops (8 half−day plus 1 all day) ran in parallel on very different topics.

The next five days were devoted to the main conference, including invited talks, tutorials, technical sessions, doctoral program and posters. Regarding invited talks, we enjoyed a set of very well−known speakers coming from close fields, bringing recent advances and developments in areas as bioinformatics (J.L. Lassez), nonconvex optimization (G. Nemhauser), probabilistic networks (R. Dechter), model checking (E. Clarke) and heuristics for discrete optimization (D. Shmoys). In addition, we had a set of tutorials done by specialists on the following topics: constraint programming systems (M. Carlsson and C. Schulte), constraints and integer programming (J. Hooker), global constraints (N. Beldiceanu and J.C. Regin) and interval reasoning (F. Benhamou). Tutorials were very well−prepared and quite useful for both senior researchers and novice PhD students.

Technical contributions were grouped in 14 sessions, ranging many aspects of the constraint area. We have to mention a long session on symmetries, two sessions on innovative applications (a separate track in the call for papers), two sessions on SAT and two more sessions on hybrid approaches. Other sessions were devoted to programming & modeling, soft constraints, complexity, global constraints, CSP, learning and scheduling. In total, 44 contributions were presented as full papers. In addition, 16 posters were on display allowing authors to explain interested attenders their research. All are recorded in the conference proceedings (LNCS 2470).

This year the doctoral program was continued, funding 25 students who could present their work publicly, getting one

page in the proceedings. As a novelty, each student was assigned to a mentor, a senior researcher to discuss with the student work. The doctoral program was completed with two doctoral tutorials (T. Walsh and M. Veloso) and a doctoral program dinner.

On the social side, the conference was quite lively and everyone enjoyed meeting at the coffee breaks, during lunches served in the university, or at dinner time in Ithaca's restaurants. Three main events deserve special mention. First, the reception in the Herbert F. Johnson Museum of Art, where good food, drinks and desserts came with a free and lovely visit to the museum galleries. Art masterpieces and splendid views on the sunset on Cayuga lake made an unforgettable reception. Second, a nice walk inside Cascadilla Creek (one of the two creeks crossing Cornell campus) illustrated by a retired Cornell professor, where we learned some facts about the geology of the Finger Lakes region. And third, the banquet at Williard Straight Hall Memorial Room, where conference participants enjoyed a nice dinner in a relaxed atmosphere. Finally, we have to mention the announcement of the next conference, CP−2003, to be held in Kinsale, Country Cork, Ireland, in late September, and the next CP−AI−OR, to be held in Montreal, Canada, in May, both next year 2003.

In summary, CP−2002 has been a successful conference both on the technical and human sides. It provided a good forum to discuss and exchange ideas and research results, with a pleasant atmosphere were people could communicate easily. And according to experts, weather was excellent for Cornell standards!.

CDB 2002 / ITCLS 2002 − CoLogNet Workshop

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Madrid, 19−20 September 2002

Abstract

This report describes summarily some data about the First CoLogNET workshop on Component−based Software Development and Implementation Technology for Computational Logic Systems, held in Madrid during 19−20 September 2002, and collocated with SAS, LOPSTR, and AGP.

As part of the yearly activities of the Area 3 (Implementation Technology for Computational Logic Systems and Components−based Software Development) of the CoLogNET1 project, a joint workshop (CBD 2002 / ITCLS 2002) was held in Madrid, a liated with LOPSTR (the 11th International Workshop on Logic−based Program Development and Transformation) and collocated with SAS'02 (the 9th International Static Analysis Symposium) and AGP'02 (Joint Conference on Declarative Programming) . All of these conferences and workshops together made the week a really exciting week full of interesting events. More information on these events is available at the conference set web site2.

Focusing on the CoLogNET workshop, researchers and practitioners interested in the marriage between component based software development and computational logic, and in the implementation of computational logic systems (in a broad sense) were invited to submit papers and get together in a friendly and lively ambient on September 19th and 20th, 2002. More papers than initially expected were submitted, which forced the organized to discard some of them and to squeeze the rest in the time allotted for the workshops. Besides refereed papers, a few well known researchers were contacted by the workshop organizers, and gave very interesting talks in the workshop sessions, and also plenary invited talks which were shared (and, we think, much appreciated) with the rest of the collocated conferences.

Fifteen talks were scheduled as part of the workshop sessions, ve of which were delivered by invited speakers. All the papers accepted at the workshop are collected in the proceedings, a 195 page volume which was handed to the people who registered for the workshop. The proceedings were edited by Manuel Carro, Claudio Vaucheret, and Kung−Kiu Lau, and published by the Computer Science School3 of the Technical University of Madrid (UPM)4.

We will first detail the invited talks, and then comment on some of the topics discussed in the papers presented at the workshop.

Robert Hall (AT&T research Labs) was invited by CoLogNET to give a talk which was shared with SAS, AGP, and LOPSTR. His talk, entitled Open Modeling in Multi−stakeholder Distributed Systems: Research and Tool Challenges shown how traditional requirement engineering falls short when considering systems where different agents have conflicting intentions and goals (which, taken as a whole, can even be inconsistent), and partial knowledge of other agents' beliefs and aims. He then sketched a model which aims at addressing the design of such a system by expressing the behavior of each agent and then assembling them using a combination of high−level tools and mechanisms, such as automatic theorem proving, model checking, etc.

Antonio Brogi (University of Pisa) opened the component−based development track on Thursday with his talk Systematic Component Adaptation, in which he presented a methodology for adapting components whose behaviors do not match exactly. The core idea is the generation of intermediate entities, adaptors, which act as glue between components. The specification of these adaptors is generated from that of the (mismatched) component interfaces, and the adaptor itself is derived from its specification.

Kung−Kiu Lau (University of Manchester) gave a talk on A Priori Reasoning for Component−based Software Development. The core idea is to use component speci cations to reason about its compositions before the composition proper takes place, or is even considered at the level of implementation / library of components. This reasoning allows making sure about the correctness (and other properties) of the composition of components. His presentation addressed the very relevant topic of interface and behavior speci cation and the property of steadfastness, as the one which ensures that a component is correct in every instance and specializations of the context in which the component is defined.

Michael Fisher (University of Liverpool) opened the track on implementation technology for computational logic systems on Friday with a profound and enlightening presentation titled Implementing Temporal Logics: Tools for Execution and Proof. He reviewed the key concepts and applications behind temporal logic, highlighting the relationship with other, perhaps more widely known, logics (e.g., first order and higher−order logic). He gave interesting insights into the difficulties of solving problems with (e.g., proving theorems within) temporal logic, even when only the propositional case is considered.

Enrico Pontelli (New Mexico State University) managed to squeeze what could be considered as a tutorial on Answer Set Programming (ASP) and its parallel implementation in half an hour. ASP initially devised as a strategy for dealing with negation, and then evolved as a general approach to logic programming in which rules are seen as constraints on sets. He reviewed the basic concepts and application areas of ASP and then he moved on to show different strategies for the parallel implementation of Answer Set−based programs. He then reviewed and commented speedup results experimentally obtained, pointing out the difficulties found, unexpected results which showed up during implementation and evaluation, and paths for future research.

Michel Vanden Bossche (Mission Critical) delivered a speech entitled Logic Programming for Industrial Software Engineering. In this talk he reviewed the reasons which lead him to believe that Computational Logic in general and Logic Programming (LP) in particular can play an important role in Software Engineering, and he showed, with a practical case, the advantages obtained using a LP−based language (Mercury, in his case) in a real software implementation.

Other ten contributed papers focused on many interesting topics such as components and the B method, approaches to reuse open−source software, the definition of domain−specific languages for component definitions and their interaction, polyhedrons encoding for (analysis of) constraint−based languages, java−based deduction engines with academic purposes, and preliminary results on the compilation of Prolog to C.

Around seventy five people registered for the workshop. Attendance for the sessions was somewhat lower since the event run in parallel with SAS. The presentations were followed by discussions in which many interesting questions were raised. Unfortunately, time constraints did not allow longer discussions.

The call for papers and the workshop program can be found at the workshop site5, which is being restructured in order to store (pointers to) future editions of the workshop. The workshop was organized by the following people:

- Antonio Brogi (U. Pisa)
- Manuel Carro (T. U. Madrid)
- Shui Ming Ho (U. Manchester)
- Kung−Kiu Lau (U. Manchester)
- Mario Ornaghi (U. Milano)
- German Puebla (T. U. Madrid)
- Claudio Vaucheret (T. U. Madrid)

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- Computational Logic Network, CoLogNet
- Association for Logic Programming, ALP6
- Computer Science School of the T. U. Madrid
- Technical University of Madrid (UPM)

1 http://www.colognet.org/

2 http://clip.dia.fi.upm.es/SAS−LOPSTR−AGP/

3 http://www.fi.upm.es/

4 http://www.upm.es/

5 http://clip.dia.fi.upm.es/COLOGNET−WS/

6 http://www.cwi.nl/projects/alp/

The 13th International Workshop on Principles of Diagnosis (DX−02)

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Figure 1: Georg Gottlob holding his invited talk.

The 13th International Workshop on Principles of Diagnosis (DX−02) took place in Semmering, Austria from 2nd to 4th of May. 50 scientists from the U.S.A. and European countries participated in the event. The DX workshops are organized on an annual basis and are the main discussion forum for researchers both from industry and universities which are interested in basic diagnosis theory and its applications. Although the workshop is open for different techniques of diagnosis most of the papers always come from model−based diagnosis which is a sub−area of AI. In contrast to other diagnosis areas model−based diagnosis makes use of a model of the system for detecting failures and locating the faults in arbitrary systems. Usually, the underlying models are logical models, e.g., written in first−order logic, or are formulated as constraint satisfaction problems. Hence, there is a strong relationship between the DX community and the knowledge representation and reasoning field which makes it a very good choice for a CoLogNet funded event in order to attract people from AI to join CoLogNet. Therefore, the chair of Cologne's area 4 *Logic−based Data and Knowledge Systems* Georg Gottlob decided to co−organize the DX−02 workshop as part of the area 4 workpackage.

In 17 paper presentations and two poster sessions (with overall 9 presentations) current research, new directions in diagnosis, and applications of model−based diagnosis techniques were presented. Two presentations which were given as part of a separated industrial session dealt with the application of model−based diagnosis techniques in configuration and car manufacturing. The proposed diagnosis techniques varied from using Bayesian networks, genetic algorithms, process algebra models, constraint satisfaction to standard logical approaches and discrete event

systems. The application areas varied from space exploration, distributed and hybrid systems, the automotive industry, paper plants to even software debugging and information survivability. The latter dealt with self−diagnosis and recovery from failure of critical software systems.

In particular 3 main research directions in model−based diagnosis can be identified when looking at the DX−02 proceedings. One direction deals with hybrid systems, i.e., systems that exhibit discrete and continuous behavior. The papers *Particle Filters for Real−Time Fault Detection in Planetary Rovers* by Dearden and Clancy, *Hybrid Modeling and Diagnosis in the Real World: A Case Study* by Narasimhan and colleagues, *Hybrid Diagnosis with Unknown Behavioral Modes* by Hofbaur and Williams, *State Tracking of Uncertain Hybrid Concurrent Systems* by Benazera and colleagues, and *Model−based Monitoring of Piecewise Continuous Behaviors using Dynamic Uncertainty Space Partitioning* by Rinner and Weiss deal with modeling, diagnosis and monitoring of hybrid systems. Another active area of research in model−based diagnosis deals with algorithms and extensions of diagnosis. The papers *Consistency−based Fault Isolation for Uncertain Systems with Applications to Quantitative Dynamic Models* by Jones and colleagues, *Merging Indiscriminable Diagnoses: An Approach Based on Automatic Domains Abstractions* by Torasso and Torta, *Computing Minimal Conflicts for Rich Constraint Languages* by Mauss and Tatar, *Computing Minimal Hitting Sets with Genetic Algorithm* by Li and Yunfei, and *Possible Conflicts, ARRs, and Conflicts* by Junquera and González are examples for this research area. Finally, the number of papers dealing with new application areas is increasing. Papers that deal with new fields are: Model−based Tools for the Integration of Design and Diagnosis into a Common Process – A Project Report by Struss and colleagues, Suggestions from the Software Engineering Practice for Applying Consistency−based Diagnosis to Configuration Knowledge Bases by Fleischanderl, Model−based Diagnosis for Information Survivability by Shrobe, Observations and Results Gained from the Jade Project by Mayer and colleagues, and Fault Isolation using Process Algebra Models by Lawesson and colleagues. All papers can be obtained from the DX−02 homepage.

In addition to the technical program of the DX workshop three talks were given by the invited speakers: Georg Gottlob (Vienna University of Technology), Toby Walsh (Cork Constraint Computation Center), and Andreas Zeller (Saarland University).

- *Hypergraph Decomposition for solving finite−domain CSPs and related Problems*
  Georg Gottlob (Vienna University of Technology)
  Abstract. The structure of a CSP (and of related problems such as e.g. conjunctive database queries is best described by a hypergraph. It is well−known that in case this hypergraph is acyclic, the CSP can be solved efficiently. In this talk various methods of generalizing the notion of hypergraph acyclicity will be discussed. In particular, we will introduce the audience into the method of "Hypertree Decompositions" developed at TU Wien. Hypergraph decomposition methods can be used, in particular, to simplify diagnostic problems.

- *The Search for Satisfaction*
  Toby Walsh (Cork Constraint Computation Center)
  Abstract. In recent years, there has been an explosion of research in AI into propositional satisfiability (or SAT). There are many factors behind the increased interest in this area. One factor is the improvement in search procedures for SAT. New local search procedures are able to solve SAT problems with thousands of variables. At the same time, implementations of complete search algorithms like Davis−Putnam have been

able to solve open mathematical problems. Another factor is the identification of hard SAT problems at a phase transition in solubility. A third factor is the demonstration that we can often solve real world problems by encoding them into SAT. This talk reviews the state of the art for research into satisfiability , and discuss applications like model checking in which algorithms for satisfiability have proved successful.

- *Why does my program fail? Isolating failure causes automatically*
  Andreas Zeller (Saarland University)
  Abstract. Every programmer has seen this before: A program does not run as it is supposed to be. To fix the failure, one must narrow down the possible failure causes. This narrowing is typically a manual task, dependent on the skill and the endurance of the programmer. In this talk, we shall present some techniques that widely automate the quest for failure causes. Based on a simple trial−and−error process and an automated test, it is fairly simple to isolate external failure causes like input, code differences, or thread schedules. Advanced techniques can even isolate causes and effects within the program run: "First, variable x_1 had a value of x_1, thus v_2 became x_2, thus v_3 was set to x_3 ... and thus the program failed". Case studies on real programs with real bugs, from Mozilla to the GNU C compiler, demonstrate the practical feasibility of these experimental approaches.

The presentations of the invited talks and the proceedings are online and can be accessed via the DX−02 homepage (http://www.dbai.tuwien.ac.at/user/dx2002/). The next DX workshop will be held in Washington, DC in June, 2003. More information about the DX workshop series can be found at (http://www.ksl.stanford.edu/dx/).

Figure 2: Participants of the DX−02 Workshop

Expression of Interest for a Constraints Network of Excellence

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The Cork Constraint Computation Centre (4C) helped put together a proposal to the EU's Framework VI programme, proposing a Network of Excellence in Constraints. The aim of the Network is to build and extend Europe's lead in constraint programming. Constraint programming is the tool of choice for a wide range of problems in business and industry like configuration, resource allocation, transportation, and scheduling. However, uptake of these tools is limited by at least three factors. First, constraint programming tools need to be extended to deal with issues like problem uncertainty and solution robustness. Second, constraint programming tools currently require sophisticated users. And third, real world problems can be large and combinatorially challenging. The goal of this Network of Excellence is to support research to address these three issues. In addition, novel applications (like bioinformatics, peer−to−peer and grid computing, semantic web) will be used to drive new research directions.

Other partners in the proposal included Avaca Technologies (Greece), Bouygues Telecom (France), BTexact (UK), CERT (France), Charles University (Czech Republic), COSYTEC (France), CWI (Netherlands), Dassault−Aviation (France), EPFL (Switzerland), Glasgow University (UK), IC−Parc (UK), IIIA−CSIC (Spain), ILOG (France), INRA, Toulouse (France), INRIA, Rocquencourt (France), INRIA, Sophia−Antipolis (France), IRST, Trento (Italy), ISTC−CNR, Roma (Italy), Koalog (France), KTH, Stockholm (Sweden), Laboratoire d'Informatique de Marseille, (France), LIRMM CNRS (France), LORIA, Nancy (France), Oxford University (UK), Parc Technologies (UK), SICS (Sweden), SINTEF (Norway), Technical University of Crete (Greece), Thales Research and Technology (France), TU Wien (Austria), Universidad Politecnica de Madrid (Spain), Universität des Saarlandes (Germany), University of Bologna (Italy), University of Essex (UK), University of Genova (Italy), University of Huddersfield (UK), University of Klagenfurt (Austria), University of Munich (Germany), University of Nantes (France), University of Padova (Italy), University of Paris 6 (France), University of Pisa (Italy), University of St. Andrews (UK), University of Udine (Italy). It was the intention that the Network was inclusive not exclusive, and any other centres working in constraints would be invited to join the Network when it was up and running.

The proposal identified the following four tasks to be undertaken by the Network:

T1. Extensions to better meet real world needs.

Constraint programming tools currently fail to address certain issues important in real world problems. For example, to model many problems realistically, we must deal with uncertainty and preferences (other examples can be given: conditional constraints, multiple optimization criteria etc.). There are a number of sources of uncertainty. For example, parameters in a model may be subject to change and error. Also, constraints may change over time. For example, when scheduling power stations, the actual energy demand may be different to that predicted by forecasters.

For financial and other reasons, we usually do not want our problem solutions to be overly sensitive to such changes and errors. We do not want, for example, to fire up a new power station to deal with a small increase in energy demand. We therefore want solutions which are robust to change, as well as models which can capture this uncertainty. To determine if solutions are robust to change, we also need to develop a theory of sensitivity analysis for constraint programs. The importance and usefulness of sensitivity analysis is well recognized in many other domains but has not yet been addressed in constraint programming. Sensitivity analyses for constraint programs would have a large number of different uses. For example, they could identify critical values where (optimal) solutions change, constraints which are especially influential on the solution, (optimal) solutions which are robust to change or which are risky, and input parameters which are especially critical to the model. With such a theory in hand, we would then be in a position to develop algorithms which return solutions which are stable to change. To model uncertainty within constraint programs, there are a number of extensions of the traditional constraint satisfaction problem for describing constraints that are uncertain, probabilistic or not necessarily satisfied. However, none of these frameworks is by itself adequate to model the full range of uncertainty found in real problems. These different frameworks need to be merged and combined so that we can, for example, model many different types of uncertainty. Moreover, often constraints are not really mandatory, but express preferences which should be satisfied if possible, but could also be slightly violated if necessary. For example, in a car configuration setting, some color could be preferred over the other ones, but the less preferred colors should not be ruled out. To faithfully model real−life problems, and thus to find exact solutions and not just approximations, we must be able to represent preferences, or so−called soft constraints. Some formalisms already exist to model soft constraints, but there are very few intelligent solution algorithms for classes of soft constraints.

T2. Automation to make constraint technology more usable.

Solving a problem with constraint programming currently requires considerable expertise in modelling the problem, and in choosing and adapting the solution method. This has greatly limited the uptake of constraint programming tools, especially within SMEs. There are a number of areas in which we can provide automation to help the less experienced user. First, in modelling the problem, we need to help the user to extract the constraints and user preferences. Techniques from artificial intelligence like machine learning could be adapted to help construct an initial model and learn the user's preferences. Second, the initial model needs to be transformed to a more computationally effective one using techniques like the addition of implied constraints, redundant modelling, and symmetry breaking. Again, we can adapt techniques from artificial intelligence like automated deduction to automate such transformations. Third, the user needs to select an appropriate solution method and adapt it to the particular problem (for example, by developing a specialized branching heuristic). Again, we may be able to adapt techniques from artificial intelligence like case−based reasoning to automate such choices. Fourth, users do not just require solutions but also need explanations. Problems are often over−constrained and the user needs help in knowing how the problem can be relaxed. Again, we can adapt techniques from artificial intelligence like truth maintenance to automate such steps.

T3. Integration for more powerful solvers.

Real world problems are often very large and combinatorially challenging. Pure constraint solution methods are therefore often inadequate to solve them. However, such problems can often be solved by using hybrid methods that

combine together the best features of constraint solving and other search methods from operations research (OR) and artificial intelligence (AI). We therefore need to develop sophisticated hybrid methods that combine together the best aspects of OR techniques like linear programming, and the best aspects of AI techniques like genetic algorithms, and tabu search. We also need to develop hybrids that combine the best features of systematic methods and local search. In addition, very large real world problems pose new challenges that require issues like data structures, and memory management to be addressed. Again, we may be able to adapt techniques from other areas like formal methods and checking where large specifications and models are common. We must also deal with heterogeneous and distributed data. New constraint based algorithms are therefore needed for such problems.

T4. Novel Applications

The Network proposed addressing three important classes of applications that play a big role in the Priority Thematic Areas of FP6. The intention is to utilize the complete arsenal of constraint programming techniques, methodologies and systems for tackling new applications. The lessons learned are expected to feedback anew round of research and development in constraint programming. Additionally, participants of the network are expected to form consortia with users and industry to attack concrete instances of these applications with projects funded at national or European levels. There are three subtasks, each one corresponding to a class of applications:

T4.1 Bioinformatics

The solution of problems arising from biology using computer science methodologies has recently become a very exciting field with tremendous importance worldwide. Members of this EoI have shown that constraint programming is an important technology for bioinformatics and it is useful for the solution of problems such as sequence alignment, NMR structure prediction, alignment and threading, protein structure prediction, protein docking, metabolic pathway analysis etc. This Network of Excellence will reinforce the work of these members and will allow other members of the network to join this fruitful research area.

T4.2 Complex Problem Solving in Science and Engineering

The importance of computational GRIDs for the solution of complex problems in science and engineering has become apparent today and is an important priority in the European Research Area envisaged in FP6. We would like to explore the applicability of constraint programming techniques and tools in this new and exciting area. We are also interested in the use of constraint programming techniques for the solution of search and resource allocation problems as they arise in computational GRIDs and peer−to−peer computing systems. Some participants of this EoI have already worked in such problems and more are expected to join this effort.

T4.3 Agent Systems and the Semantic Web

The Network will explore the use of constraint−based techniques in multi−agent systems, and their application to information retrieval, information filtering, information dissemination, electronic negotiation and trading, and distributed computing. We would also like to apply constraint−based techniques to knowledge representation and reasoning problems arising in the Semantic Web area to facilitate the creation of the WWW of the future. Members

of this EoI have previously worked on constraint−based knowledge representation and reasoning as used in the Semantic Web area and more are expected to join this effort.

The Network also proposed a number of other activities:

Short−, medium− and long−term exchanges of personnel between the academic participants (according to the rules and regulations of individual institutions).

Extended visits of academic participants to industrial participant sites and vice versa.

- Development and use of joint research infrastructures. In particular, the joint development of source code for constraint satisfaction problems, the joint development of benchmarks for algorithm evaluation, the joint development of prototype constraint programming systems and applications.
- Joint management and exploitation of the knowledge generated by encouraging its joint exploitation by academic and industrial partners (i.e., by filing patents), or the creation of start−up companies by academic partners.
- The training of young researchers especially Ph.D. students and post−docs. The training of engineers coming from the industrial participants. This will be supported through fellowships at node institutions but also with intensive summer schools etc.
- The dissemination of knowledge generated through publications in conferences, scientific journals and books. The publication of selected applications work in popular magazines and newspapers so that we can raise public awareness of this exciting research area and its applications to society.
- The creation of services (e.g., specialized constraint programming courses aimed at industry) in support of technological innovation in SMEs achieved through the use of “best−practice” constraint programming technologies.

Panel Discussion at the Calculemus 2002 symposium on the Integration of Deduction and Computer Algebra

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Subject of the Panel Discussion: Challenging Mathematical Problems (for details see also http://www.ags.uni−sb.de/~calculemus2002/panel/)

Panel Members: James H. Davenport, Jörg Siekmann, Jacques Calmet, Thomas Sturm, Alain Colmerauer, Claude Kirchner

Chair: Jacques Calmet

Format: 5 minute opening remarks for each panel member, followed by an hour of general discussion, open to the floor.

Initial Statements

Jacques Calmet opened the panel session by arguing that algebraic topology is a field in which automated theorem proving could be successfully applied and that Jesus Aransay a PhD student currently in Karlsruhe is indeed working on this problem.

Jörg Siekmann objected that the real challenge is not to find the occasional problem we can solve and mathematicians cannot, but instead to find mathematicians who are actually interested in formal proofs and certified computer algebra. He argued that although the field of Theorem Proving is around for more than three decades it has not delivered what it promised. On the other hand Computer Algebra actually occupies a market niche, however, its users are generally content with the (buggy) way it currently works.

Claude Kirchner replied that it is in particular a problem of the techniques used in theorem proving that are already difficult to relate to anyone inside the field let alone to a user from outside. CASs usually work very intuitive, ATPs not. Moreover, CASs solve hard problems which are difficult even for trained mathematicians whereas theorem provers solve relatively trivial problems in a domain where mathematicians think they are better anyway.

Thomas Sturm presented his point calling himself "somewhat of an outsider to the Calculemus community". He claimed that their own work on RedLog is taken seriously by mathematicians and is very much related to automated reasoning aspects. In particular the challenging problem he is proposing (for more details at http://www.fmi.uni−passau.de/~sturm/activities/calculemus/challenge/) would benefit from combined techniques

from quantifier elimination, reasoning and computer algebra.

James Davenport argued that a combination of theorem proving and computer algebra could very well be attractive for mathematicians. Not only can it provide more reliability but it can in particular give more insights into the problems. Mathematicians (as well as many Engineers) are not only interested in solutions but also into details what the problem entails.

Alain Colmerauer commented that instead of trying to become attractive for mathematicians the field should rather try to offer its services to computer scientists and concentrate on verification and design of logical programming languages.

Open Floor Discussion

The discussion focused mainly on the point if mathematicians can be attracted by automated reasoning and if there is a user community for computer algebra systems that contain formal reasoning.

Some points of the discussion were:

James Davenport emphasized that the work by Wiedijk/Beeson and by Colton presented at Calculemus were the right way to bring both reasoning and notions of formality into CAS. Jörg Siekmann added that the recent work by Freek Wiedijk in comparing deduction system by applying them to the problem that SQRT(2) is irrational was very impressive and shows how far the field is. Thomas Sturm, however, pointed out that this result should not be overemphasized since if it were advertised as state of the art of the field it might rather turn off mathematicians instead of attract them.

Volker Sorge asked the panelists why many discussions at automated reasoning conferences recently become `soul searching' events. Jörg Siekmann replied that a field has to question its own assumptions occasionally otherwise it is doomed.

The emerging semantic web and the necessity for mathematical knowledge management was identified as one future challenge for the community. In this context Volker Sorge suggested whether it would not be wise to consult members from the database and semantic web community before creating large, possibly naively structured, mathematical knowledge base. Jörg Siekmann dismissed this as the `hackers argument' claiming that first the mathematical data has to be available. However, this was seen as a rather arrogant stance by several members of the audience, since in particular for databases special techniques, such as indexing, are often tailored to the particularities of the data before knowledge bases are created.

As other challenging problems for the community, the discussion identified formal classification problems that are either too large or too tedious for mathematicians, as well as formal verification problems in CAS such as definite integration, problems with branch cuts, etc.

UK Grand Challenges Workshop

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As part of the work package for the Automated Reasoning area of CoLogNet, a proposal was sent to the Workshop on Grand Challenges for Computing Research. This workshop is sponsored by the UK Computing Research Committee, with support from EPSRC. The goal of the workshop is to draft a report that describes a range of generally accepted long−term and large−scale challenges for computing research in the twenty first century. The challenges will be grouped and classified, and a preliminary assessment will be made of their maturity. See http://umbriel.dcs.gla.ac.uk/NeSC/general/esi/events/Grand_Challenges/index.html for more details.

The proposal was entitled "A Mathematical Assistant" . Scientists, engineers and students would all benefit greatly from the help of a mathematical assistant. Such an assistant should be rigorous and indefatigable, and have vast amounts of mathematical knowledge at her fingertips. Since these are precisely the qualities we appreciate most in computers, computers ought to make excellent mathematical assistants. Indeed, in specialized domains, computers already are useful mathematical assistants. For example, computer algebra systems can compute complex indefinite integrals and solve difficult algebraic equations, whilst matrix packages can perform large and tedious matrix computations.

However, we lack systems that have the breadth as well as the depth of knowledge of a working mathematician. Systems typically do not reason at the meta−level about how they solve problems. They are unable therefore to explain their answers, to apply their expertise to new domains, or to reason about the quality of their answers. In addition, systems are neither pro−active nor adaptive. They do not leap in and offer the user help. They require the user to know when and how to call them.

The challenge then is to develop an automated mathematical assistant with both breadth and depth of mathematical expertise. The assistant should cooperatively help users solve their mathematical problems, adapting and learning over time. Such an assistant would be able to:

- Prove that a complicated series diverges;
- Identify parameters for which an indefinite integration is "dangerous";
- Construct a counter−example to the security of the user's cryptographic scheme, and suggest how to modify it;
- Explain an integral over the real line by identifying a suitable contour in the complex plane and locating all the poles;
- Find a large combinatorial object like a projective plane of order 10;
- Prove the uniqueness of a solution to Laplace's equation by appealing to a general purpose uniqueness proof

method.

A mathematical assistant will have skills across a wide range of topics, from the very formal and axiomatic (e.g. constructing theories, identifying inconsistencies, proving meta−theoretic results) to the very applied (e.g. numerically solving a set of partial differential equations).

Is this research?

Such an assistant will require research in a wide number of areas. These include:

- [Knowledge represent ation:] a mathematical assistant will need a large ontology of mathematical information at both the object and the meta level;
- [Automated reasoning:] a mathematical assistant will need rich and complex inference mechanisms;
- [Learning:] a mathematical assistant will need to learn new mathematics;
- [User modelling:] a mathematical assistant will need to infer the user's goals and intentions from their actions;
- [Databases:] a mathematical assistant will need to access vast mathematical databases in complex ways (e.g. search a database for a balanced incomplete block designs with some given properties)
- [Distributed computation:] a mathematical assistant will need to know how to break large computations down to tap into the GRID;

Is it a grand challenge?

It is certainly a challenge since we could fail. AI has had success in narrow domains (witness expert systems) but broad expertise , like that proposed here, is a much more challenging and uncertain goal. What about the other criteria identified in the call for submissions to the workshop? This challenge arises from curiosity about the limits of how much mathematics we can automate.
It aims to build something never seen before. It ought to be obvious when the challenge is met since we will stop asking our mathematical colleagues for help. It will be useful to the whole scientific community so should gain their support. It is of a scale that will require international participation. It will be comprehensible to the general public. It was formulated long ago (at least as far back as Leibnitz's desire to reduce all mathematics to calculation). It will take us way beyond the domain specific mathematical tools available today. It will require planned co−operation between many different research projects. Even partial success will improve the mathematical tools available. Finally, given the scale and ambition of the challenge, it is unlikely to happen through the evolution of existing commercial products.

TF2 Industrial Event at LOPSTR 2002, Madrid

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The Event

Since LOPSTR was co−located with SAS and AGP, the industrial event took place over 16−21 September 2002. It consisted of the following:

1. A CoLogNET stand at SAS/LOPSTR/AGP (total number of registered participants: 135) from 16 to 21 September. The stand displayed posters about CoLogNET and distributed leaflets about CoLogNet and its taskforces.
2. An invited industrial talk by Robert Hall, AT&T, USA, at SAS/LOPSTR (total number of registered participants: 120) The talk was on research challenges for multi−stakeholder distributed systems. Such systems consist of open networks of components whose behaviour or even participation is not predictable. The talk was very much an industrial view of next−generation open distributed systems, and offered valuable insight into the pertinent research issues, which is invaluable to academic researchers in component−based software and system development.
3. The First CoLogNet workshop on Component−based Software Development (CBD) and Implementation Technology for Computational Logic Systems (ITCLS), which was affiliated to LOPSTR (total number of registered participants: 72). The workshop consisted of (the invited talk by Robert Hall and) 4 invited talks (2 CBD, 2ITCLS) and contributed papers from European academic researchers on their views and recent work on CBD and ITCLS, as well an invited industrial talk by Michel Vanden Bossche, Mission Critical, Belgium, on Computational Logic for Industrial Software Engineering. Michel's talk was about how Computational Logic can make a significant contribution to Industrial Software Engineering, given the new opportunities created by component technology such as Microsoft's .NET.

Impact

The impact of the industrial event can roughly be measured by the total number of participants of AGP/SAS/LOPSTR (135) and the LOPSTR/CoLogNet workshop(72). More specifically, Robert Hall's talk showed CoLogNET members the industrial challenges, whilst Michel Vanden Bossche's talk showed CologNet members the industrial opportunities, for Computational Logic. The other talks showed the current work of CoLogNET members and other European researchers, thus providing a cross−fertilisation of knowledge and ideas for future work.

Upcoming Events

1. Symposium on LOGIC in GAMES and MULTIAGENT SYSTEMS University of Liverpool, UK

The symposium aims at bringing together researchers working at the intersection of logic, game theory and multiagent systems, in order to identify the key issues, problems, and techniques in the application of logic to games and multiagent systems.
Call for papers deadline: 25 Oct 2002
Home page: http://www.csc.liv.ac.uk/~pauly/logamas

From **December 16 2002** to **December 17 2002** at The University of Liverpool

2. Fourth Panhellenic Logic Symposium

The Panhellenic Logic Symposium is a biannual scientific event established in 1997. It is open to researchers from all countries who work on Logic broadly conceived. The language of the Symposium is English. The Fourth Panhellenic Logic Symposium will be hosted at the Conference Center of the International Fair of Thessalonica, located downtown in close proximity to the University campus. The scientific program of the symposium will consist of hour−long invited talks, tutorials and presentations of accepted papers. Original papers on all aspects of Logic are solicited. Authors are invited to submit an extended abstract of at most five pages. In addition, the contact author of each paper should send a cover page with his/her addresses (postal and email) and a statement classifying the paper in one of the following areas: Mathematical Logic, Set Theory, Logic in Computer Science, History of Logic, Philosophy of Logic, other Logic related area (specified).
Home page: http://www2.cs.ucy.ac.cy/pls4

From **July 07 2003** to **July 10 2003** at Conference Center of Thessalonica International Fair (HELEXPO), Pavillion 8