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SCIENCE AND ENGINEERING RESEARCH COUNCIL
RUTHERFORD APPLETON LABORATORY

COMPUTING DIVISION

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Science and Engineering Council

Computing and Communications Subcommittee

PANEL VISIT TO PROFESSOR HOARE, OXFORD UNIVERSITY, 24 NOVEMBER 1982

BACKGROUND

Currently Professor Hoare holds SERC grants as follows:

Information Engineering

A. GR/B/55435 "Software Engineering" special grant for £125,064 over 36 months with a review after 15 months period 1/9/81-31/8/84.

B. GR/B/62976 "Distributed Computing Software" special grant for £180,985 over 36 months with a review after 15 months period 1/9/81-31/8/84.

GR/C/11350 "High-level simulation and implementation of distributed systems", £10,700, period 1/10/82-30/9/83.

GR/C/14719 Visiting Fellowship, Mr Schuman, £11,145, period 1/9/82-31/8/83.

GR/C/29171 Visiting Fellowship, Dr Sokolowski (jointly with Edinburgh University), £13,898, period 1/11/82-31/10/83.

Robotics Programme

GR/B/51550 "Sensory Control of fixed arm robots for continuous path fusion welding of vehicle bodies"
(grant is held by Professor Hoare but investigator is actually Mr P G Davey), £159,600, period 1/2/81-31/1/84.

GR/C/09500 Ditto
£191,476, period 1/2/82-31/1/85.

Grants A and B arose from a programme which was supported by a DCS rolling grant. In 1980 the DCS Panel recommended that support for Professor Hoare's programme should be split because a major part of his proposals for further work lay outside the remit of DCS. Subsequently Professor Hoare submitted two applications for continued support of his programme. "Software Engineering" comes under the Software Technology Panel whilst "Distributed Computing Software" remains with the DCS Panel. The two awards were each intended to run for 39 months but because termination of Professor Hoare's then existing grant was delayed, they were announced for 36 month periods. In September 1982 Professor Hoare sumbitted an application to extend his software engineering programme up to 31 August 1987 (GR/C/34700). With Professor Hoare's agreement, this application was not put to the recent Computing and Communications Subcommittee meeting, in order to allow a visiting Panel to discuss the application in the context of Professor Hoare's other research.

PANEL TERMS OF REFERENCE

On the behalf of the Computing and Communications Subcommittee:

(i) review progress in the "Software Engineering" programme;

(ii) review progress in the "Distributed Computing Software" programme;

(iii) discuss with the applicants (Professor Hoare and Mr Stoy) their proposal to extend the "Software Engineering" programme and make appropriate recommendations to the Subcommitte;

(iv) discuss with the investigators their plans for the "Distributed Computing Software" programme.

MEMBERSHIP OF THE PANEL

Professor J Welsh Chairman
Mr A J R G Milner
Dr I C Wand
Dr R W Witty
Dr D A Duce
Mr F Chambers
Mr M J Hotchkiss Secretary

VENUE

Professor Hoare's office, G2, 45 Banbury Road, Oxford 24 November 1982.

SOFTWARE ENGINEERING GRANT

Staff

Bernard Sufrin has been in post since 1978. He originally worked with Jean-Raymond Abrial who came on an SVF and then spent a further year on the grant. Abrial left last year but is continuing the work in Paris and is a regular visitor to Oxford.

Tim Clement began as a PhD Student in Oxford under Frank Harris in the Nuclear Physics Department working on Pattern Recognition. He then became an IBM Research Fellow working on the IBM CICS system. This work has now finished and he has been working on the grant since October 1982.

The third RA on the grant is Martine Raskovsky who joined the project in October 1982 having given up a tenured lectureship at Essex University. The current grant is now therefore fully up to complement with Sufrin, Clement and Raskovsky.

Progress to Date

Hoare's original 1977 proposal was the "Publication of High Quality Software," Bernard Sufrin and Abrial originally set to work on this task and rapidly graduated to formal methods because they realised that to produce high quality software for publication meant they had to have good formal specifications. This was the background to Abrial's work on the Z notation which was the

application of conventional mathematical set theory to the area of program specification. For the last few years considerable pencil and paper work was done on improving the Z notation by attempting formal specifications of various realistic systems including the CAVIAR small database system in conjunction with STL. This system was actually implemented and delivered to STL by Tim Clement.

This combination of formal work and practical experience has developed the Z notation considerably to the stage where the Oxford Group now feel they have a stable and usable meta language for formal specification; this is now called MPL. Hoare made the point that the group has deliberately not yet attempted to mechanise any of their work because they have been concentrating on the human readable rather than machine readable specifications. The group has placed much emphasis on getting the style of the "English" correct. They have spent a lot of time re-writing specifications to improve their understandability. The group feel that they have been able to maintain this freedom to re-write because they have not yet mechanised things. To summarise Hoare felt that the group had

a. made considerable progress with conceptual tools and techniques for formal specification arriving at the now stable meta language MPL

b. they had actually tested their specification technique with realistic industrial style problems

c, on publication and implementation, they had actually produced the CAVIAR database system, Sufrin - editor, Ian Cottam - student project on project support database, another student did some pattern matching work for genetics application, another student had produced a library system which had actually won a BCS prize.

d. on mechanisation they had not as yet done anything for the reasons given above.

FUTURE WORK

1. Mechanisation

In the short term the group intends to use the LCF specification system produced at Edinburgh to help them mechanise the theory of Z. This would primarily help them to remove some of the tedium from proof checking. The Oxford group are cooperating with several other groups in the country to save duplication of effort in the exploitation of LCF. Hoare felt that they would continue to work on the mechanisation in the sense of "wordprocessing" tools for handling specifications. The ability to do computer based text processing for specifications has been a significant advantage to them already. Hoare saw the need for mechanisation to ensure commercial acceptability of formal specification methods.

2. Prototyping

They are now less enthusiastic about possibilities of producing a mechanised rapid prototyping system, although a computable subset of MPL exists for MPL is an imperative language. Hoare made the comment "never build a prototype unless you have a question to ask of it".

3. Technology Transfer

The group has already been teaching formal specification to industrial people with some success and they see that this work will continue into the future.

DCS GRANT

Staff

Two RAs are currently employed on the DCS project, Dr Carroll Morgan and Dr Roger Gimson.

Progress to Date

The emphasis in the DCS project to date has been in specification. Some implementation work has been done, e.g. a UCSD filing service is now operational, and protocols for a filing service and printing service are being investigated. The emphasis has been on taking advantage of the modularity offered by Distributed Computing hence there is more interest in self contained services than in programs distributed across processors. The system being constructed at Oxford is similar to the Cambridge distributed system except that the ring is not envisaged as a connection to a remote server but rather Oxford envisage local workstations using batch services remotely.

UCSD Pascal was chosen as the basis for this project because at the time it was a part of the DCS common base and exists and works. It is likely that free standing servers will be programmed in Modula.

The filing service is based on a formal specification. A specification for a batch service (dry cleaners) was presented at the Strathclyde DCS Conference.

The emphasis of the project is much more on specification than was evident in the proposal. Oxford feel it is no longer worth investing vast effort in extending the UCSD system. Instead programming is being made easier by providing the right services underneath the system rather than by extending the language etc. The filing service owes much to the work at Cambridge and Xerox PARC.

Specification is seen as a prerequisite to builing ones own tools, but also as a means of understanding what other groups have done; for example Carroll Morgan has produced a specification of the Cambridge name server.

Equipment

Equipment money has been used for the purchase of Logica Ring interfaces. A 300 megabyte Winchester disc is soon to be purchased. Dr Duce was asked to investigate the availability of time servers.

Oxford are also looking for a laser printer. The common base view of laser printers was outlined.

LSI11/02 processors are being used for stand alone servers. At some stage LSI 11/23s may replace the 11/02s; but at present there is nothing in the DCS project requiring a PERQ. However when the software basis of the PERQ is reasonably stabilised it is likely that one will be required.

There was discussion of the provision of an SERCnet connection. Programming research group are soon to move to Keeble Road, which is close to the Nuclear Physics building in which an SERCnet connection already exists. It seemed that the sensible way to provide an SERCnet connection for PRG was to run a link to the Nuclear Physics connection. Dr Duce was asked to discuss this with the appropriate people at RAL.

PANEL SUMMARY

The new RG2 application to extend the software engineering project had already been seen by the Software Technology Panel and had received a very favourable view. The Panel recommended the grant be supported at alpha plus.

The visiting panel added the further positive comment that in the case of Bernard Sufrin he should continue to be supported. He is a very senior experienced and now very valuable researcher, one of the few people in the country who is really up to speed in formal specification. There is considerable danger of individuals like this and Sufrin himself going down the brain drain. Sufrin has been approached by one or two people already and the panel felt it was important that he was supported. This is made even more important with the Alvey programme beginning which requires such experienced people as Sufrin to get going.

The visiting panel made similar a comment on the case of Raskovsky who is also a very experienced person and should be supported on this grant. The depth of experience in the Oxford group is considerable and it is important that this experienced team be kept together.

The visiting panel formally recommended that the expenditure bars on the Software Engineering project and the DCS project be removed.

The visiting panel recommended in the feedback session that Professor Hoare might like to change one or two of the details in the actual RG2 application itself. It was recommended that the case be altered to include details of the previous project application which is only referred to indirectly by the current application ie the case should be made a consistent document.

The visiting panel made the comment that the application was probably under resourced and recommended to Professor Hoare that he revise his estimates of the equipment needed to perform the work, particularly in light of the reasonably long timescales involved.

The third recommendation of the visiting panel was that the case be improved to include more detailed long term planning and the identification of some milestones.

During the panel discussion Professor Hoare identified the need for help with documentation and the visiting panel said that a revised RG2 application could well include such a case.

The visiting panel supported the directions being persued in the DCS project.