SCIENCE AND ENGINEERING RESEARCH COUNCIL
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Academic Coordinator's Progress Report   Dr D A Duce
July-September 1981

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SCIENCE & ENGINEERING RESEARCH COUNCIL   DCS/81/82/3
ENGINEERING BOARD
INFORMATION ENGINEERING COMMITTEE

COMPUTING AND COMMUNICATIONS SUB-COMMITTEE
DISTRIBUTED COMPUTING SYSTEMS PANEL   13 October 1981

Academic Coordinator's Progress Report
July-September 1981

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1. SOFTWARE TECHNOLOGY INITIATIVE

The Computing and Communications Sub-Committee and Engineering Board have
approved, in principle, the launch of a Software Technology Initiative
and associated Common Base Policy centred around the ICL Perq single user
system.

Mr R W Witty, formerly DCS Coordinator, has been appointed Coordinator of
the Initiative. Details of the initiative were to be considered at the
September Policy Meeting of CCSC and the outcome of these discussions
will be reported orally at the Panel Meeting. For the information of
Panel Members, the discussion paper presented at the CCSC Meeting is
included as an Appendix to this paper.

The Common Base Policy which is in line with the policy of the DCS Panel,
is described in 2.1 below.

2. PERQ

ICL signed a Marketing Agreement with the Three Rivers Computer Corporation
covering marketing of the PERQ computer in the UK on 28 August 1981 and
ICL expect to begin UK manufacture in Spring 1982.

Six PERQ computers have been ordered from ICL for the DCS equipment pool
in accordance with the decision made by the DCS Panel in January 1980.
Delivery is imminent.

Three PERQ systems have already been allocated:

Professor Coulouris	2	awarded with grant in 1980
Mrs Brown	1	awarded with grant in 1981

2.1 SERC's Common Base Policy

The following paragraphs are taken from a paper presented at the September
1981 Policy Meeting of the Computing and Communications Sub-Committee on
CCSC's Software Technology Initiative. The paper in included as an
Appendix to this paper, certain sections are included here as they are
directly relevant to the DCS Programme. It is expected that the Chairman's
Report will cover the discussion of the paper at CCSC.

The whole academic community, not just Computer Science, is a major user
and developer of software and so the degree of ease with which software
can be developed affects the scientific productivity of many researchers.

Currently the academic software technology base is very non-uniform in that the knowledge, experience, tools, techniques and equipment vary considerably between projects. The motivation to create a common Hardware and Software Base is to bring together all of the best existing tools and techniques into a uniform framework so that the 'whole' is more effective than the 'sum of diverse parts'. This will be achieved via EMR contracts to move existing tools into the common base, specific purchases, the direct results of SERC research projects using the common base equipment and the 'free' effort that will be generated as a natural consequence of providing a state of the art hardware base. To this set will be added the products of current and future research. A good example of the common base 'snowball' effect is the widespread use of the Unix operating system which has enabled a large number of software tools to be made available throughout the UK academic community.

The CCSC wish the common software base to be Pascal/Unix and the common hardware base to be the Perq. The Perqs should be networked together via Cambridge Rings, SRCnet and PSS to allow widespread cooperation between tool users and developers. This combination of software and hardware is widely accepted as being the best combination for developing software tools in the coming years. (A common base does not imply rigid standardisation however). The equipment forming the common hardware base will be organised as an 'equipment pool' to be allocated and reallocated as the CCSC decides, in the same way that the DCS programme currently organises its resources.

The development programme would thus proceed as follows:

(a) Loan PERQs (common hardware base) running Pascal/Unix (common software base) to participating institutions, on their undertaking to develop and/or move useful tools to common base and distribute these tools to community (via RAL).

(b) Get RAL to act as central clearing house for software tools on common software and hardware bases (receive, test, copy, send out). CCSC may identify need for further development of promising tools and RAL would place appropriate EMR contracts for these to be brought into the common bases.

(c) Arrange for those tools which cannot be brought into common bases (eg big theorem prover) to be made available as <u>service</u> to community via network facilities. This might again involve EMR development work to bring tool up to standard and funds to run the service.

(d) Invite participation by non-SERC funded projects to contribute to common base tool kits (see Appendix Technology Transfer section 6). They would not be supplied with equipment by SERC, but would join the community by contributing tools of their own to the common base tool kits.

2.1.1. Support for British Industry

The Perq computers will be purchased from a British company, ICL, who should be shortly announcing their collaborative venture with the Three Rivers Computer Corporation for the marketing and manufacture of Perqs. Network equipment will be entirely British, in line with the DCS programme. Thus, implementing the common base policy will mean that the academic community will directly contribute to improving and promoting state of the art British industrial initiatives rather than helping the USA companies to dominate the UK market.

The mutually beneficial effect of practically linking academic research to British companies will help build up technology transfer.

2.1.2. Council Support for the Common Base Policy

To date the Distributed Computing Systems Programme, the Software Technology Initiative and the Interactive Computing Facility have had funds approved to purchase Perqs. The Council has become aware that powerful single user systems are going to change the way SERC provides computing resources to all scientists, not just Computer Scientists. The Council has therefore approved a recommendation that all Single User System purchases and developments are handled centrally through the CCC with development activity coordinated by the RAL, who will be collaborating with ICL to promote technology transfer and cooperation between industry and academia.

Thus the CCSC's idea of a common base policy has been endorsed and expanded by the Council. If all goes according to plan, this Council decision should add significantly to the scale of activity contributing to the common software base, thereby increasing the likelihood of success for the CCSC's Software Technology Initiative.

2.1.3. Status of Common Base

Funds have been made available for the Software Technology Initiative to purchase 10 Perqs this financial year. Approval has been given for 10 more Perqs to be purchased next year.

The RAL is developing a Cambridge Ring interface for the Perq which should be available 1Q82. The RAL also expects to make Unix available on the Perq in 1Q82. With the DCS Programme having over 20 Cambridge Ring installations by 1982 in the same departrments as are likely to be engaged in Software Engineering projects, the common base policy should be a concrete reality by Easter 82.

3. MAIL SERVICES

A meeting was held on 4 September under the auspices of the Joint Network Team to discuss Mail Services at which the DCS Community were represented by UCL, QMC, York and Newcastle. There were two aims of the meeting:

   (a) adoption and implementation of an interim system for electronic mail

   (b) discussion of issues and proposals for an eventual standard

A proposal from UCL for an interim standard was agreed and the use of FTP as a basis for implementation was accepted.

A number of sites wish to participate in an experiment using the interim standard and there is to be a further meeting in 16 October to discuss implementation.

This move is directly in accord with the DCS Panel's discussion at the July Policy meeting on Network Services and it is proposed that the DCS Panel should support an implementation of the interim standard for Unix.

4. GRANTS

The Academic Coordinator has had discussions with Professors Aspinall, Grimsdale, Welsh, Jones, Hoare and Fitch and also with Drs Edmonds, Garrett and Wilkinson concerning forthcoming grant applications.

The Academic Coordinator was involved in discussions with Dr Weston of Loughborough University and Redfearn National Glass Limited concerning a Cooperative Research Grant Application on which the DCS Panel will be invited to comment.

5. ANNUAL REPORT

Good progress is being made on the 80/81 Annual Report, but unfortunately a draft will not be completed before the October Panel Meeting.

The Panel are invited to authorise the Chairman to approve the format and content of the Report. The Panel's views on the Annual Report were the subject of a thorough discussion at the July Policy Meeting.

6. COORDINATOR'S DIARY

16 July	Prof C Jones, Manchester
17 July	PDP11 Network User Group Meeting
20 July	Logica VTS Ltd
28 July	Dr Edmonds, Leicester Polytechnic
30 July	Dr W Newman, Logica VTS Ltd
3 August	Prof Needham, Mr Shepherd, Cambridge
19 August	Redfearn Glass Limted, Barnsley
20 August	Dr Gurd, Prof Aspinall, Prof Welsh, Manchester
27 August	Prof Grimsdale, Sussex
18 September	Prof Fitch, Bath
23 September	Dr Sleep, East Anglia
28 September	CCSC Meeting, London

ENGINEERING BOARD

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SOFTWARE TECHNOLOGY INITIATIVE
Policy Discussion Paper

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1. THE ROBERTS PANEL AND SOFTWARE TECHNOLOGY

In March 1979 an SRC Panel, chaired by Derek Roberts, proposed that SRC
mount major new initiatives in computing and computer applications.
Roberts selected Education and Training, New Computing Applications and
New Technology as the three areas to be stimulated. One of the new
technologies was Software Technology.

The Roberts Panel reported that:

"Already the cost of software is frequently greater than that of the
associated hardware, and this trend will be accentuated by the continued
reduction in (silicon) hardware costs. Software production must be one
of the few industries where no adequate tools exist for specification,
design, production updating and re-engineering. Despite the high cost,
and long development cycle of most large systems, no serious attempt is
being made to develop new software methods and standards which could
reduce both cost and timescale. Add to that the need for improved hardware
independence and more user-orientated approaches to high level language
development and it is clear that this should be a major area for SRC
support. The Panel is aware that the Computing Science Committee has
devoted significant funding to this area but considers that more should
be done, particularly in exploiting existing research and applying this
in industry. As with Silicon Chip Design, there may be a need for a
mechanism to bring Universities, Software Houses and Industry together
and maximise the benefit of academic research, taking full account of the
major contribution industry is able to make in this area."

2. OVERALL OBJECTIVES

The CCSC has identified three major objectives for the Software Technology
Initiative.

(1) Stimulate more high quality software engineering research

(2) Improve the academic Software Technology base

(3) Facilitate two-way technology transfer between industry and academia

3. SUMMARY OF ISSUES

The CCSC and the EB have already apporoved, in principle, the launch of a
Software Technology Initiative and the associated Common Base Policy
centred around the ICL Perq single user system. The CCSC is invited to
discuss further details of the initiative including:

(1) Which aspects of Software Engineering research should be given
    priority?   (see section 9).

(2) How long should the Initiative exist and how should it be organised?
    (see section 10).

(3) How should grants be financed?   (see section 11).

(4) Should CCSC bid for more Perqs for the Common Base? (see section 11).

(5) What tools should be obtained for the Common Base? (see section 8.4).

4. SOFTWARE ENGINEERING RESEARCH

Stimulating Software Engineering research means awarding more grants.
This can be achieved by:

(1) Soliciting more grant applications.

(2) Giving Software Engineering grant applications high priority during
    the competition for funding.

(3) Formulating a programme of desirable research areas and publicising
    it widely.

(4) Cooperating with other funding bodies such as MOD and DOI to ensure
    that best use is made of all available funds so that the overall
    research programme is carried out through cooperative funding
    policies via formal or informal agreements.

5. ACADEMIC SOFTWARE TECHNOLOGY BASE

The whole academic community, not just Computer Science, is a major user
and developer of software and so the degree of ease with which software
can be developed affects the scientific productivity of many researchers.
The academic software technology base is that nebulous entity which
encompasses the overall level of skill, experience and knowledge contained
in the staff, tools and techniques which are used by the academic community
to develop software.

Currently the academic software technology base is very non-uniform in
that the knowledge, experience, tools and techniques vary considerably
between individual projects. It is always heart-breaking to meet, say, a
research assistant who spends 75% of his time programming but who has
never heard of cross-reference generators, pretty-printers or screen
editors let alone symbolic debugging packages or predicate transformers.
Conversely, one sometimes finds non computer science projects which invest
considerable time and effort in developing sophisticated programming
tools and techniques to solve their own special problems but which, if
disseminated, would be valuable to a wider community.

A task facing programmers is finding out what tools and techniques already exist to help them with their jobs. There is currently no efficient way in which the benefits of existing work can be disseminated to potential users, except in some special areas of which the NAG library is a fine example.

The CCSC has approved a plan containing the following major threads:

(1) Identify the software tool/technique producing people and projects.

(2) Form them into a working community by:

    (a) person to person links (fostered by Software Technology Coordinator);

    (b) computer to computer links.

    (c) common software and hardware base policy.

(3) Set in motion a coherent plan to exploit their software tool production by making such tools/techniqes widely known and available in forms which can be readily used by the whole user community.

6. TECHNOLOGY TRANSFER

The Roberts Panel were "aware that the Computing Science Committee has devoted significant funding to this area (ie software engineering) but considers that more should be done, particularly in exploiting existing research and applying this in industry ... there may be a need for a mechanism to bring Universities, Software Houses and Industry together and maximise the benefit of academic research, taking full account of the major contribution industry is able to make in this area."

Technology transfer consists of the exchange of:

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( ideas      )     ( people   )        ( industry )  -
( techniques ) via ( paper    ) between ( GRE      )
( experience )     ( software )        ( academia )
( tools      )     ( hardware )
                   ( meetings )
                   ( training )
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The Roberts Panel recognised that:

(a) technology transfer needs to be stimulated by the funding bodies;

(b) technology transfer is a symmetrical two-way process between the industrial and academic worlds.

To achieve these two sub-objectives the CCSC considers it desirable to:

(1) Set up Software Technology Centres to act as foci for certain areas of work.

(2) Appoint an SERC Software Technology coordinator whose job would be to oversee the implementation of CCSC Software Technology plans, stimulate research proposals and act as SERC liaison man with other funding bodies and industry.

It is envisaged that by setting up software technology centres, coordination, collaboration between funding bodies, an increased level of research activity and the creation of software engineering development and user communities, the British academic community will be drawn into close and profitable association with British industry.

7. DEVELOPMENT OF THE ACADEMIC SOFTWARE TECHNOLOGY BASE

The CCSC is invited to consider implementing the following steps to improve the academic community's software development capability.

(1) Carry out the following:

(a) collect information on the range of current SERC projects making software tools,
(b) identify the whole community concerned with making tools,
(c) list the actual tools currently in use and found worthwhile,
(d) identify software tools which are foreseen as needed,
(e) identify potential tools (open ended list, but start it).
(f) update this paper on a regular basis.

(2) Form working community:

(a) Circulate the identified community by mailshot (a la DCS) to solicit improvements of the paper described above. This will help to form person-person links and inform people of available technology.

(b) Link the software engineering community through computer networking.

(3) Implement the Software Technology development programme to raise the academic software technology base by creating a common base for development activities and, ultimately, 'production' programming.

Tool users may access tools via:

(a) common software base, eg create portable tool kit written in Pascal under Unix operating system.

(b) common hardware base, all tool developers have PERQs, Cambridge Rings, PSS and SRC-net X25 connections.

(c) common access to special tool, eg network access to single site running service for special tool, eg big machine dependent theorem proving system.

8. COMMON BASE POLICY

The whole academic community, not just Computer Science, is a major user and developer of software and so the degree of ease with which software can be developed affects the scientific productivity of many researchers.

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8.4 Acquisition of Software for the Common Base

The CCSC has previously approved the idea of acquiring useful tools for the Common Base via the placement of EMR contracts. The CCSC is invited to suggest likely candidates for the Coordinator to try to obtain.

9.   RESEARCH PRIORITIES

9.1   Short & Medium Term Objectives

The common base policy is likely to have an effect on both the short and medium term aspects of programming efficiency by reducing duplicate production of tools for different machines, reduce training needs and increase the quality and capability of tools available to scientists.

The CCSC is invited to give guidance to the Coordinator as to which types of tools the CCSC considers most important to bring into the common base in the short term.

9.2   Long Term Objectives

Whilst the common base policy should make life better for practicing programmers by rationalising the availability of current technology, it is vital that the CCSC funds projects which are likely to lead to significant new techniques to solve the Software Crisis.

The Coordinator has had a limited number of discussions with academic and industrial software engineering experts and a letter soliciting views has been circulated. As a result of this activity the following list of priorities has been identified.

(1) SPECIFICATION

     This was top of everyone's list.

(2) VERIFICATION (semi-automatic)

     Most people felt that the CCSC should give priority to proposals
     in this area as this was where a major breakthrough could occur.
     The USA has a significant lead on the UK in this field.

(3) VERIFICATION (manual)

     Most people felt that significant benefits will accrue if improved
     techniques are developed.

(4) 'PURE THEORY' (formal logic and semantics)

     It was felt that there is insufficient work in these fundamental
     areas. It was also felt that inadequate training was given in
     formal techniques to students.

(5) FUNCTIONAL PROGRAMMING

     Perhaps this avenue implictly embodies some of the above items.

(6) FORMAL TREATMENT OF APPLICATIONS

Is there a reputable theory on which to base the applications program, eg theory of databases, payroll, process control, akin to the theory of mathematics which underpins computational programs, eg numerical differential equation solving?

(7) PROGRAMMING 'WORKBENCH'

Plenty of support for practical developments relating to conventional programming methods, eg Ada's APSE. This is a more coherent version of the common base policy.

(8) HIGH SECURITY & RELIABILITY

Specific topics which could help to drive the developments of the more abstract techniques. Significant military and commercial benefit if advances in these areas were achieved.

The CCSC is invited to give the Coordinator guidance on what areas of Software Engineering research the CCSC feels should be given priority so that this can be relayed to grant applicants.

10. ORGANISATION OF THE INITIATIVE

The CCSC is invited to consider how the Initiative should be run. The following suggestions are offered:

(1) The Initiative is 'launched' on 1 November 1981 by a letter to all relevant academics and industrialists, outlining the CCSC's ideas, priorities and the common base policy, and an appropriate press release. This will enable applications to be generated for the 15 December 1981 closing date.

(2) The Initiative should last for 5 years, ie from January 1982 to March 1987.

(3) The Initiative should produce an annual report running Oct-Sept. This will be presented to the CCSC at its September meeting.

(4) The Initiative should produce a bi-monthly mailshot which goes to both academic and industrial parties.

(5) The CCSC should review its policy on Software Engineering annually so as to remain flexible in the light of future events and developments.

11. FINANCE & FACILITIES

It is suggested that grants are funded from the normal grant line in competition with other applications but weighted by their closeness to the Initiative's priorities.

The Engineering Board has already approved the provision of 10 Perqs in 1981 and 10 more in 1982 to start up the common base policy. The CCSC is invited to consider whether it would like to bid for further Perqs specifically for the programme to ensure timely supply as there is likely to be competition for Perqs from other Boards and Committees.

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