

SCIENCE AND ENGINEERING RESEARCH COUNCIL

RUTHERFORD APPLETON LABORATORY  
COMPUTING DIVISION

D I S T R I B U T E D   C O M P U T I N G   N O T E 495

VISITS

Notes on a Visit to Dr J Kerridge et al Sheffield  
Polytechnic - 27 October 1981

Issued by  
Dr D A Duce

28 October 1981

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IN CONFIDENCE

SCIENCE AND ENGINEERING RESEARCH COUNCIL  
COMPUTING AND COMMUNICATIONS SUB COMMITTEE  
DISTRIBUTED COMPUTING SYSTEMS PANEL

Notes of a Visit to Dr D Bell et al Sheffield Polytechnic on 27 October 1981

PRESENT:     Dr D Bell                 (Sheffield City Polytechnic)  
              Mr N Willis            (Sheffield City Polytechnic)  
              Dr J Kerridge         (Sheffield City Polytechnic)  
              Dr I C Wand            (University of York)  
              Dr D A Duce            (Academic Coordinator)

OBJECTIVES

At the 13 October 1981 meeting the DCS Panel considered a resubmission of a grant application from Dr Bell et al for a research project entitled "An Education of Alternative Implementations of Multiprocessor Communication Mechanisms".

The Panel were generally well-disposed towards the application, but were concerned at

1. the apparent scale of the proposed programme (requiring investigation of five different communications technologies) and
2. the proposed choice of hardware (Ithaca micro computers), requiring the investment of considerable software effort to implement the languages Pascal Plus and Edison.

The Panel asked Dr Wand and the Coordinator to visit the applicants to investigate these concerns and make a recommendation to the Chairman of the 13 October Panel Meeting (Mr B Brinkman).

FIRST PRIVATE MEETING

A number of questions arose during discussion, including:

1. Language availability - what is Edison implemented on?
2. Why investigate five different communications networks?
3. Why use Z80 based processors?

4. Are Pascal Plus and Edison to be compiled to Z80 code or interpreted code?
5. Classification of usage of terms process and processor.

The approach to be followed was to clarify the technical understanding of the project first and then consider any modifications to the programme felt necessary.

#### DISCUSSION

Dr Wand opened the discussion with an outline of the purpose of the visit and the proposed modus operandi.

Dr Wand asked the applicants to clarify the main theme of the proposed project. Dr Kerridge and Dr Bell explained that the main purpose of the project is to discover when it is worthwhile to distribute a computation (set of processes) over a set of processors and when interprocess communication costs are so high that the processes must reside in the same processor. The intention in each case is that the same program text (unmodified) would be used under different environments.

Dr Wand asked how shared variables would be treated in this scheme, for example if x is global to processes X and Y where does x reside. Dr Kerridge replied that in Pascal Plus a shared variable must be inside a module and hence there must be a monitor in which the variable exists. A similar model can be applied to Edison.

Dr Wand enquired about problems of object addressability - are objects passed as messages? Dr Kerridge said that if the Edison virtual machine is of similar structure to the concurrent Pascal virtual machine then procedure parameters can be extracted from the stack when a procedure is invoked and hence passed as a message.

Dr Wand enquired why so many communications techniques were being considered. Dr Kerridge explained that the intention was to perform a cost-benefit analysis of the applicability of particular communications technologies to particular problems.

Dr Wand pointed out that at least one group in the DCS program had discovered that implementing a reliable communications system over inherently error prone serial links is no trivial matter and can consume much effort in protocol design and implementation. Dr Kerridge stated that the intention is to build run-time systems in which the i/o package interface is uniform regardless of the communications technology used. The aim is to consider communications requirement (bytes/sec) as a function of process type and enumerate points at which it becomes necessary to move to a higher performance technology.

Static process to processor mapping is to be used. The run time system will support interprocessor interprocess communications.

Software development work is restricted to rewriting the Pascal Plus (and Edison) interpreter, loader, common memory code, i/o code and process control code. This software will be written in Pascal which explains the significance

of the reference to CP/M and Pascal in the application. The applicants also have access to the Pascal environment on the Polytechnic's IBM 4341.

The applicants have no intention of touching either compiler or embarking on the construction of Z80 code generators.

The Pascal Plus interpreter is written in Pascal Plus and so it should be a relatively straight forward task to convert this to sequential Pascal. This work is already in hand. The Edison system may require more effort, but Dr Kerridge is experienced in moving software from PDP11's to other machines, having recently ported Brinch Hansen's concurrent Pascal system.

Dr Wand enquired if the fact that the implementations are to be interpretive would invalidate the conclusions. The view of the applicants was that it would not as the implementations would be equally slow.

Dr Bell commented that there is much published material on the run-time overheads of uni-processor run-time systems, but nothing on distributed systems. Dr Kerridge added that it is the communications aspects and the way that interprocess swapping is organised that are interesting.

Dr Wand asked the applicants to expand on the proposed applications studies.

The control of the paint mixer blender machine is a genuine problem faced by Daniel Doncaster Ltd. They want to implement a five-processor solution to the problem. Good working relationships exist between the company and the department.

The chicken farm application involves the control of fans, cooler doors, food supply, etc to minimise costs. The buildings involved are distributed over a closed distance of 4-5Km.

Both applications studies will be simulations in the sense that pre-gathered data rather than real input devices will be used, thus avoiding some potentially difficult interfacing problems.

Dr Duce asked the investigators for details of existing communications software for the Ithica machines. File Transfer Protocol has been implemented running over asynchronous lines, which is already in heavy use. Econet software is written and interface hardware (a joint project with Acorn) to the Ithica system should be operational by Christmas. This will essentially provide a byte stream service between hosts.

The investigators hope to purchase CP/M Cambridge Ring software from SEEL. The SEEL product supports Cromenco hardware which differs from Ithica hardware in the support of interrupts, but the investigators are well aware of the necessary changes and envisage no major difficulties.

Dr Wand asked about the survey of local industry and the types of problem they expected to discover. Dr Kerridge felt the paint mixer blender was a good example that could be decomposed into a set of problems that could be tackled by students. Dr Duce asked who would be doing the survey. Dr Bell is principally interested in this work and will be aided by the research assistant.

Dr Wand enquired about the facet of the work concerned with shared memory. Dr Kerridge explained that the Ithica machine has a memory management option that can be used to swap memory banks and hence provide a shared memory capability. The unit has the necessary logic to support locks, etc.

Dr Wand asked why the applicants were requesting funds to purchase Cambridge Ring equipment rather than requesting a loan from the DCS Pool. Dr Duce explained that the DCS Pool did not include S100 bus interfaces which are essential for this project.

The communications boards requested support serial and parallel interfaces. Funds are being requested for maintenance of Ithica software and possible purchase of Cambridge Ring software (SEEL have given the impression their software is free!)

In further discussion it became clear that the applicants were aware of the problems of debugging parallel programs.

The product of the research valuable to industry should be a set of evaluated techniques.

#### SECOND PRIVATE DISCUSSION

The Visitors felt that the discussion had allayed the fears expressed at the Panel meeting regarding language implementation, but had confirmed the feeling that to tackle five different communications systems was too ambitious. It was agreed to recommend to the Chairman that:

1. the DCS Panel should recommend to the Council that an award be made to the applicants;
2. that the applicants be asked to remove the parallel lines and shared memory communications techniques from their programme, to concentrate on the Cambridge Ring, Econet and serial lines techniques as representing a sensible spread of bandwidth and technology.

The Visitors were of the view that the survey of industrial applications could lead to a very valuable set of example problems which the applicants should be encouraged to publish.

#### FEEDBACK

The applicants were informed of the recommendation to be made to the Chairman.

The applicants accepted the request to limit their programme to Cambridge Ring, Econet and serial lines technologies.

The Visitors advised the applicants that in their view the survey of industrial applications could lead to a very valuable set of example problems which the applicants should be encouraged to publish.