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SCIENCE AND ENGINEERING RESEARCH COUNCIL
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COMMON BASE POLICY
Technical Specification
(draft 1 for discussion)

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1. INTRODUCTION

In outline the Common Base Policy comprises

- a. Pascal (ISO Standard)
- b. Fortran (Ansi Standard)
- c. GKS (draft ISO Standard)
- d. UNIX (32 bit virtual memory - de facto standard)
- e. PERQ (High performance single user system)
- f. Cambridge Ring (Local Area Network)
- g. X25 (Wide Area Network)

The following gives a more detailed exposition of the technical components and philosophy of the policy.

2. LANGUAGES - PASCAL AND FORTRAN

Pascal and Fortran 77 have been chosen as they are the two most popular scientific languages. They possess the properties of portability and official standard definitions. There is a large amount of software already written in them which allows people to make use of existing investment.

There will be considerable SERC support for Fortran and Pascal. This will take the form of software tools and techniques developed by the Software Technology Initiative and the activities of the SERC Computing Service team. Thus the CBP will act as a focus for many different activities.

The technical definition of Pascal is given in (ref 1).

The technical definition of Fortran 77 is given in (ref 2).

3. LANGUAGES - OTHER

Other languages will be available with the set of software tools in the CBP. For instance the Unix 'C' language is already available and Ada is under development by York. LISP and Prolog are likely to be implemented.

These other languages will not receive the same degree of support and tool development as Pascal and Fortran. They are not 'blessed'. This situation must be reviewed regularly. Specific minority groups eg LISP community will no doubt receive minority support through individual committees eg EBCC.

4. MIXED LANGUAGE WORKING

It is a requirement of the CBP that 'blessed' languages should be inter-workable at the procedure call level ie a Pascal program can call a Fortran subroutine which can call a Pascal procedure etc. This is a vital capability to ensure maximum use of standard components. It is ridiculous to have to, say, reimplement a Fortran graphics package in Pascal because Pascal cannot call Fortran.

Interworking has implications for compiler construction and operating system development. It has its limitations and difficulties, eg the difficulties in enforcing type checking across procedure interfaces, but its benefits outweigh its drawbacks.

5. PORTABILITY

Fortran and Pascal will allow PERQ CBP software to be moved to and from other non PERQ computers. However it is recognised that even when programs are written in Fortran and Pascal much work often has to be done to move them because of the inbuilt operating system dependencies. By using Unix as a de facto standard execution environment it should be much easier to move programs in Pascal and Fortran from on Unix system to another.

Portability is also one of the reasons for backing national and international standards generally, hence the use of the GKS graphics package. GKS will be available on all SERC supported machines.

Portability of software is also one of the aims of the networking side of the CBP. Good communications are needed if software is to be easily shared by geographically dispersed research groups.

6. GRAPHICS

In line with the policy of supporting international standards and portability aids the CBP has 'blessed' GKS as its basic graphics package. GKS will be available on all SERC machines, not just PERQ, to help the transfer of graphics software and, via metafile standards, pictures themselves.

There will have to be a significant amount of software developed on top of GKS to give the scientist the graphics facilities he requires. Much of this graphics library work will be led by RAL Graphics Section.

It is an open question whether GKS on the PERQ will be able to handle all graphics requirements.

The technical definition of GKS is given in (ref 3).

7. UNIX

Unix is already a de facto standard in many academic institutions in both USA and UK. It has enabled a great deal of software to be shared amongst research groups and has built up a large quantity of widely applicable software.

Unix is being used increasingly by industry again both in the USA and UK. The CBP philosophy is based on the following properties of Unix.

- a. It is popular ie a de facto standard.
- b. It is implemented on a wide variety of makes and sizes of computer (IBM 370 - M 68000).
- c. It is manufacturer independent.
- d. It is cheap (\$150 per PERQ).
- e. It has a large body of user level software.
- f. It is used by both industry and academia.

For the scientific community Unix is likely to become the standard small machine operating system because 'small' machines seem to get bigger everyday!

It is likely that 'Berkelly' Unix will become the de facto VAX/Unix operating system. Therefore we must look at implementing Berkelly Unix as well as V7. This should be easy as only the 'suspend' and 'resume' process Unix system calls need to be added. They are already Accent primitives.

The CBP Unix has the following properties

- a. It is full '32 bit'.

Arithmetic is 32 bits by default to overcome the annoying limitations of microprocessors. 8,16,32,64 bit quantities are available.

- b. It is virtual memory.

Full 32 bit addressed linear address space (via paging) removes the size restriction which is often so frustrating.

The technical specification of Unix is given in (ref 4).

8. PERQ

The PERQ was and is the first machine which satisfies the requirement for a high performance single user system. Other machines are likely to follow (some are already here). The expected proliferation of machines will tend to fragment the software development activities because some things will always be machine specific. The Council therefore wishes to balance the benefits of standardisation (which acts against change) with the need to give state of the art facilities to scientists (which requires change). The future CBP is therefore expected to include more than just today's PERQ but such changes must be taken infrequently and given very careful consideration before hand.

It should be borne in mind that the criteria for choosing a single user system must be that it runs the common software base rather than has some new hardware feature. The investment in software is already so large that computers must be designed to run the Council's software rather than the Council's money be wasted on reimplementing existing software on some new hardware. Manufacturers will have to understand the changing balance of power between them and their customers. The manufacturer independence of Unix is a key factor in this equation.

The technical specification ^{of Perq} is given in (ref 5, ref 6).

9. CAMBRIDGE RING

The CBP requires a fast local area network to link its machines together. The ring has been chosen because it is

- a. British
- b. DCS Programme's common equipment
- c. has protocols implemented for Unix which are a de facto UK academic standard.
- d. much greater installed base in the UK than 10 MHz Ethernet as UK universities through their own efforts, together with DCS and JNT have installed >20 Rings already.
- e. it is an easily purchased and maintained commodity from a variety of UK suppliers.
- f. UK standardisation is well in hand (see Bill Sharpe's work for technical definition of Ring hardware).

The current PERQ-Ring interface uses the IEEE 48 (GPIB) interface to give a cheap but reasonable speed connection. Discussions are in hand about high speed interfaces with in board microprocessors running TSBSB etc. They are likely to cost £2-4000 (comparable to Ethernet prices) whereas the GPIB is likely only to cost approximately £250.

The technical specification of the Cambridge Ring is given in (ref 7).

10. ETHERNET

The PERQ can be supplied with an Ethernet interface. The protocol strategy (see below) has been deliberately made conservative so that the Ethernet/Ring issue is irrelevant if both provide Transport Service. Ethernet is not cheap and is not dominant in the UK academic market. What happens in the next 3-5 years cannot be predicted. It is (in my opinion) unlikely that either the Ring or Ethernet will win the industrial market in the 5-10 year period as neither has the bandwidth or capability to handle sophisticated office automation mixed media communications (eg integrated voice/vision/data).

11. X25

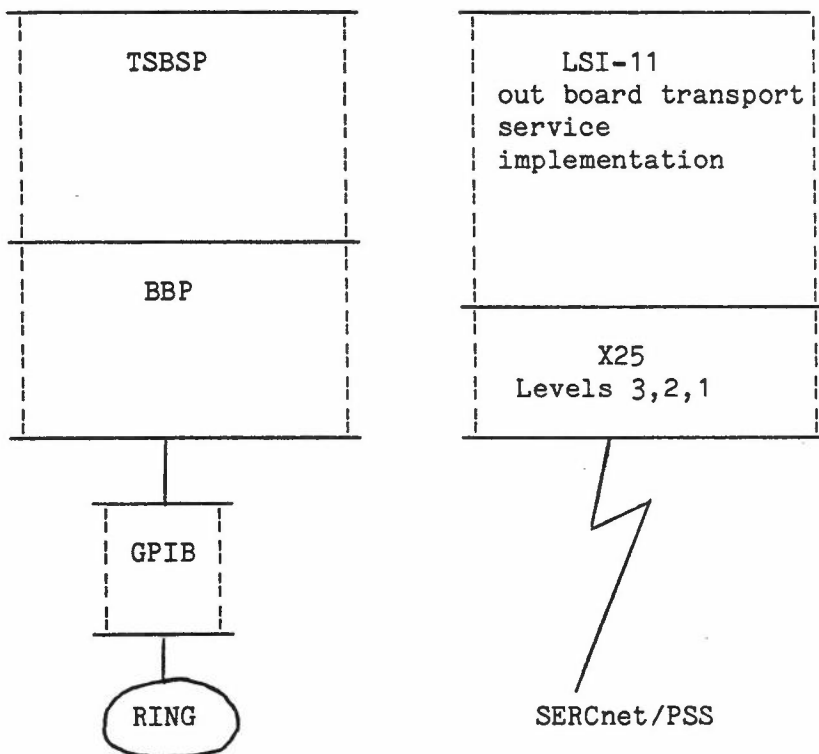
The PERQ-X25 connection, in the short term, will be via the York LSI-11 transport service front end originally designed for the PDP-11. This will cost approximately £5000.

Studies are in hand for cheaper 'in-board' solutions.

The technical specification of SERCnet X25 network is given in (ref 8).

12. PROTOCOL STRATEGY

JTMP (Red Book) Job Submission	MAIL (Grey Book) Electronic Mail
FTP 80 (Blue Book) File Transfer	TS 29 (Green Book) Remote Terminal Login
TRANSPORT SERVICE (Yellow Book)	



The protocol strategy is based on the de facto UK academic standards approved by the SERC/CB JNT in their 'coloured books'. The adoption of the Wide Area Network protocols of transport service and above for the local area network use gives a useful unification of LAN/WAN facilities. The average user sees only one and the same mechanism to move files, mail etc between machines independent of distance (ie local or wide area net). The adoption of transport service also gives a degree of hardware independence for local area networks.

The use of wide area protocols for local area networks is 'conservative' in that it does not allow various advantages of LANs to be exploited eg speed, reliability. More LAN specific (light weight) protocols could be employed for high speed intermachine interaction (eg remote process execution). Such protocols should only be 'blessed' if they attain a measure of widespread acceptability. Specific research projects are likely to require lightweight protocols. They should not be discouraged in appropriate circumstances.

Transport Service around the Ring is implemented by TSBSP (Transport Service Byte Stream Protocol) running above BBP (Basic Block Protocol). These are the de facto UK academic Ring standard protocols based on Cambridge's work. Currently the JNT is having the Mace box built by Orbis which will be a high speed intelligent interface having TSBSP, BBP in it so providing a DMA transport service to its host. Mace boxes are being built for a number of mainframe and multi user minis. They will cost around £2-4000. A PERQ Mace box is under discussion.

The JNT coloured books are not formal standards nor are they likely to become ISO standards. It will be necessary eventually to change the protocols on SERCnet to whatever emerges as ISO standards. This will be a major change for the entire network community and will not come quickly.

ICL are pushing for their ECMA initiatives to be ISO standards. The ECMA initiative might well affect Yellow Book Transport Service within the next 2 years but ECMA are not likely to have a full set of protocols comparable the coloured books for quite some time.

The protocols specifications are given in (refs 9-15).

13. GENERAL POINTS

- a. Great stress should be laid on the fact that the CBP does not see single user systems as standalone systems. Networking is the key to file backup, mail, software update and interchange.
- b. CBP links people just as much as computers.
- c. CBP aims to back all international standards if possible.

- d. Software sharing and portability only really comes when both the programming language and execution environment (ie operating system) are defined. Hence the beauty of Unix running in a IBM virtual machine - users who only want to do something simple on the IBM do not have learn another editor, JCL etc etc. If they need IBM features or performance then they must put in the effort. The corollary is "it's OK to change the machine - just don't change the operating system".

14. REFERENCES

1. ISO Standard Pascal
2. Ansi Standard Fortran 77
3. GKS draft ISO standard
4. UNIX Manual
5. PERQ glossy
6. PERQ hardware manual
7. Bill Sharpe's UK Ring hardware specification
8. SERCnet X25 specification
9. TS29: Green Book
10. FTP80: Blue Book
11. JTMP: Red Book
12. MAIL: Grey Book
13. Transport Service: Yellow Book
14. TSBSP: Bill Sharpe
15. BBP: Bill Sharpe