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ATLAS COMPUTER LABORATORIES FUTURE

The effect of the Flowers Report on the Laboratory over the next five years will be twofold :-

1) Atlas will no longer be an order of magnitude faster than the computers available in the Universities
2) More machine time should become available for our own needs.

§1 The first point should have a serious effect on our future. In general the policy of the Laboratory so far has been based, quite rightly, ~~that~~ Atlas on the assumption that our machine, being much more powerful than the University machines, provides a service for Universities to run programs too big for their own machine and to ease general overloading problems. This has meant that a large number of compilers have had to be available on the machine and that these compilers have been flexible to allow for the difference in dialects in the Major languages. Fortran, Algol and EMA all exhibit this aim of providing maximum compatability with other dialects.

When the Universities start feeling the effects of the Flowers Report this will not be the case. The updated KDF9's should provide facilities, as far as Algol, Fortran and EMA is concerned, of the same order as the ones obtained on Atlas at present. The same should apply to the large 1900's.

I feel that we are moving into an era where the Laboratory will have periods (i.e. just after a new machine has arrived) when there will be a definite increase in speed to be had by coming here but that in general this will not be the case. Therefore I think it is more reasonable that if we are supplying a service to the Universities that it should be more on the line of quality rather than quantity. At present a large number of the users come to Atlas because of facilities available rather than machine speed and I think that this is the direction we should go. Work on these lines could be in the following areas :-

1) Providing special purpose Compiler facilities. This can be divided into three subsections :-
   a) New Languages of International Acceptance
   b) Compiler Compilers for aiding Compiler writing
   c) Special purpose Compilers.

a) The obvious languages at the moment are PL/I and Algol X. I feel it would be desirable for Compilers for both these languages to be written at the Laboratory. This would enable users to view these languages and try them out before making decisions on their usefulness. Universities that ~~would~~ expecting machines with Compilers for these languages could do a certain amount of program rewriting using our machine before their own arrived. Information concerning implementation

techniques could be made available to other Establishments hoping to write Compilers for their own machine. I would hope that the implementation could be by using some Compiler Compiler system that would allow large amounts of the Compiler to be available to other Establishments

b) The Compiler Compiler of Brooker and Morris is not perfect by any means but the ideas are good and some serious work should be done on producing a general purpose Compiler Compiler for Atlas that is not Atlas oriented. It will be of benefit to ourselves when a new machine arrives and additionally it is necessary for sections a and c.

The extensions to the CC are many but a few important points are as follows :-

1) Good documentation so that anyone can use it.
2) More flexibility in definition of Syntax
3) Optimisation added
4) Simulator to allow simulations of compilers generated for other machines
5) ~~Machine definition of~~ The ability to define the machine code of the machine for which the Compiler is being produced
6) Flexible floating point and fixed point instructions in the Compiler's Routines so that it can be used as a Data Processing Tool

c) With a general purpose Compiler Compiler of the type suggested it is quite reasonable for special purpose Compilers to be produced by users for their own ends. This could be done by building facilities onto existing compilers or starting from scratch. ~~The reasons that~~ Some areas where I feel that this would be useful are algebraic manipulation, data processing, information retrieval and general large scale scientific programs which require a lot of bookkeeping. By this method we could attract users, for example, who wanted to do a special work in say algebraic manipulation.

2) Providing hardware facilities not available elsewhere. There are two or three obvious candidates here although I am sure a lot of others are possible I am thinking in terms of hardware which is too expensive for local Universities but which should be available at a Regional Centre.

a) ON-LINE CONSOLES

Research into these is desirable in any case but there are users who require this sort of facility to run their programs. Programs requiring human intervention can only be run satisfactorily using such a system. Fast debugging of programs can only be achieved by using

such a system. The on-line side could be built up until University users eventually came here to have an office with a console which they could use for a day.

b. GRAPHICAL OUTPUT

The SRC has not, at present, any decent facilities for producing Graphical Output. Some Universities have Benson-Lehner Graph Plotters or inferior models but that is all. There is obviously a need for an SC 4020 at least. It is something that the Universities need and the Atlas Laboratory is obviously the place where it should be situated (We have IBM decks and experience in using Graph Plotters and an SC 4020). Once installed a large amount of software is required to make maximum use of this and it is important that this work is not duplicated for every language available on the machine. It should be the responsibility of one section of the programming group to produce compatible software for all languages. Apart from obvious routines like straightforward plotting there should be available 3-dimensional drawing, rotation of graphical output so as to get different projections, film and slide making, data document production and in particular the ability to get a normal lineprinter output from the SC 4020.

This I am sure is a ~~vote~~ worthwhile project that has, at present, no competition from other SRC or University departments.

c. OSCILLOSCOPE OUTPUT

By this I mean on-line consoles which provide some form of visual display other than a printed sheet produced by some kind of lineprinter. Little work has been done in this country so far and the research possibilities are enormous. A pilot scheme consisting of only one or two such devices would, I think, provide much stimulating work for ourselves and University users.

3. The provision of a high-class Computer Program Library

The Laboratory already has a fairly large Library of Algol and Fortran routines which could be extended. The new regional centres will require such a library and if a joint structure for such a library could be set up it would be very advantageous. The present library suffers from being rather poorly vetted especially in the case of Algol and a large amount of work could be put into producing a decent library of well-tested and documented routines. This should be machine-based possibly with the aid of the SC 4020 and consoles.

4 The provision of a good Book and Periodical Library

It is essential that somewhere in the British Isles a good Library of Computing Periodicals and Books exists. It is also essential that coupled to this is a good method of Information Retrieval. The Laboratory could be a good place for such a Library as we have the basis of one already and we have the computer facilities for doing the Information Retrieval. The main drawback at present is the lack of staff to run such a Library and the present incompetent method of obtaining books and periodicals. The 'assistance' of the Rutherford and other Harwell Libraries would have to be removed and all ordering cataloguing etc done ourselves. This will require staff and room to accomodate such a Library. In addition a proper Xerox instead of the one we have at the moment would have to be hired for reproduction from books and periodicals.

§2 The second main effect of the Flowers Report will be more machine-time available for the Laboratories own use. The service projects outlined in §1 should take up a certain amount of this time but, even so, there should be sufficient time available for research projects to be initiated in the Laboratory independent of our service ~~work~~ work. The difference between service work and research work is rather academic as ~~the two should be done with~~ the service work in a large number of cases may be treated as research. For example I have already mentioned under the heading of service such items as :-

1. Construction of an efficient and flexible Compiles Compiler
2. Production of PL/I and Algol X compilers
3. Production of Special Purpose Compilers
4. Time-Sharing Systems
5. Computer Graphics
6. Information Retrieval (preferably à la Kessler)

Additional topics will depend to a large extent on the Fellows we have and the programming staff available. If any additional Fellows are made, it would be desirable that they should be associated with Computer Theory rather than branches of Mathematics or Physics which incidentally use Computers. Partly I feel because we have sufficient non-Computer Fellows and also for fertilizing the programming group.

The amount of work suggested above could easily take up the complete time of 20 - 30 programmers. These need not all be of the S.O grade and above and it is possible an advantage to have some

lower grade staff in the programming group. A fair proportion of the work being done by the programming group is very menial in its nature and ought not to be done by programmers of SO grade and above. The present set up is rather a waste of highly paid manpower. In this connection I feel that the Mike Claringbold position in the Operations Group should be expanded to two or three people to provide a buffer between the users and programming group. Too much of the Programming Group's time is wasted by elementary questions from users. The answers are usually available in the literature which has not been read. It is the job of the Programming Group to document their work. It is not their job to teach people to read. The problem is one of educating the user and, to a large extent, I feel it is the job of the Operations Group.

The only research project that I would like to see started in the Laboratory (apart from ones already described) is some work on Automatic Learning or Game Playing. Little work has been done in this field over the last few years and I am sure worthwhile results would be achieved given sufficient machine time and people interested in the subject. There is a fair amount of interest in the subject in the Laboratory and, with the aid of a reputable Fellow (not a crackpot), I am sure the effort would be worthwhile. The field is fairly wide open and we have a powerful machine available with possibly some surplus machine time.

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