Organization of a Computing Service for Industry and Commerce

By A. R. Bagshaw

Following experience using the Mark I computer at Manchester University, Ferranti opened their own Computer Centre in London in 1955 and have continued to extend their facilities each subsequent year. This paper, which was given at the Harrogate conference of the British Computer Society in July 1960, reviews the first five years of operation and considers some of the problems to be met in the near future.

Introduction

It has always been recognized by computer manufacturers that Computer Centres play an important, if not essential, part in both sales promotion and after-order services. Potential customers require facilities for their own staffs to investigate the capabilities and suitability of available equipments. Such experience provides the background needed to assess not only existing machines but also projected designs. At a later stage, when a decision has been reached and an order placed, computer centres provide facilities for program testing and for experimental production runs in parallel with the traditional system. This development work and practical experience enable customers to take the fullest possible advantage of their capital investments as soon as possible after delivery.

Apart from these special interests, all the manufacturers are anxious to stimulate the efficient use of digital computers for as many applications as possible, and one of the most effective ways to promote this policy is to offer a computing service to industry, commerce, and research, regardless of any particular user's potential value as a machine customer. In our case the Service is not an isolated activity. It is very closely related to other types of work and provides a down-to-earth link with the problems which the world requires computers to handle.

The Installations

Up to the end of 1955, Computing Service work undertaken by Ferranti Ltd. was run on the Mark 1 machine installed at Manchester University, but early in 1956 the engineers completed the commissioning of the prototype Pegasus 1 at 21 Portland Place, W.1, and handed it over for normal use.

The aims of the Centre were to provide facilities for:

1. training our own and our customers' staffs;
2. development and expansion of the library of programs available with Pegasus;
3. investigation and development of new applications and techniques;
4. computer customers to do pre-delivery program development and experimental work;
5. demonstrations and other selling-aid activities;
6. use as an engineering test bed (e.g. development of magnetic tape on Pegasus);
7. a computing service to research, industry, and commerce.

The original Pegasus has been extended by the attachment of a larger drum store, four magnetic-tape units and a 150 c.p.s. Soroban paper-tape punch, enabling us to undertake a much wider range of applications. Early in 1960, The London Computer Centre at 68 Newman Street, W.1, was opened and, so far, it is equipped with a 4,000-word Sirius Computer, and a Pegasus 2 System including five magnetic-tape units, a Creed 300 c.p.s. checked paper-tape output punch, and 80-column punched-card input/output. Extensions to the system are still being made and shortly will include an on-line printer and a special Pegasus 2 modification known as "pseudo off-line working." This enables the computer to perform conversions (e.g. magnetic tape to either card punch or line printer) at the same time as it is engaged on other work. A complete Orion System is being manufactured for installation at Newman Street and the organizational changes this will entail are discussed in a later section of this paper.

The Nature of the Service

The Computing Service is integrated into the Computer Sales Department and therefore, although we have programming and data-handling sections specifically engaged on service work, we can call for technical support from a large team representing a wide range of specialized knowledge and experience.

Broadly, we offer two types of service.

1. Hire of computer time by organizations programming their own work.
2. Complete service, in which we take the problem and produce results.

In the first case the customer pays a fixed rate for good computer time used—calculated to the nearest minute on Pegasus and Sirius. This charge covers such additional facilities as technical advice from our staff, a reasonable amount of use of our tape editing and card facilities, and the use of working magnetic tapes (i.e. tapes not required beyond the duration of a run). Paper tape and teleprinter paper are provided, but customers must either provide or pay for punched cards and must buy magnetic tapes required exclusively for their work.

Advice on programming and operating is available whenever the Centres are open. On a rota, our experienced staff are present as duty programmers to give technical assistance to customers either using or waiting to use the equipments. Normally new customers are attached to particular members of the staff who

give guidance and personal tuition during the initial training period, but most people quickly come to rely upon the duty programmer and only call for other assistance when they need advice from a specialist member of the staff. Of course, certain cases do arise in which the continued collaboration of a particular member of the staff is desirable. In such circumstances, suitable arrangements are made.

There are two booking lists which operate in parallel. One is a fixed time-schedule which, usually, is reserved for work being done by or on behalf of customers. The other is a queue of people—mainly staff—who require time and are available on the premises to fill gaps which occur during the operation of the fixed schedule. The queue is subdivided into two sections, for requirements up to 10 minutes and for longer periods, respectively. Normally the short runs take priority so that the maximum number of people can benefit from available development time. Low priority long runs usually end by being fitted into the fixed bookings either at week-ends or during a night shift. Fixed booking sheets are divided into five-minute intervals during the working day and ten-minute intervals outside normal hours. In general, customers hiring time are allocated bookings between 1100 and 2130 hours when the standard duty-programmer rota operates, but it is not uncommon for customers to book all-night sessions, in which case special arrangements are made to have a Ferranti programmer present.

Although the bookings determine the basic pattern of work, we appreciate that in many cases it is extremely difficult to assess requirements accurately in advance. From time to time customers who, in good faith, have made reservations, find themselves either unable to complete the work in the time booked or unable to use the time effectively. The second case presents little difficulty. We simply limit our charge to the time used and we accept responsibility for filling any gap in the schedule. Over-runs are a little more difficult, but we appreciate that enforced termination of a run usually means that some, if not all, of the value of the work is lost. If a few extra minutes are required, our system is flexible enough to permit such extensions. For longer periods we cannot disorganize the work planned by other users, but we aim to avoid serious waste of effort and machine time. The system generally adopted is to arrange for the process to be stopped at the earliest convenient point, the relevant contents of the store to be "dumped" on magnetic tape and full records made of the restart details. Then, when time becomes available, the appropriate conditions can be restored quickly and the job restarted with very little trouble or loss. This procedure is made easier because the majority of users act on our advice and write into their programs reasonable restarts for jobs which involve long production runs.

Wasted time is classified as being due to:

(*a*) Equipment fault.
(*b*) Operator error.
(*c*) Unacceptable paper tapes or cards.
(*d*) Defective magnetic tape.

If the waste can be identified with any equipment under our control, on or off line, or with any action by a member of our staff, it is not deemed to be "good" time for charging purposes. Disputes are normally settled by the duty programmer, but can be referred to the Head of the Computing Service if necessary. If there is any shadow of doubt, the charge is cancelled.

Turning to the complete Computing Service which we offer, work is undertaken either on fixed prices for standard jobs or on terms specified in formal quotations. For these types of work, details of effort involved are required only for internal costing purposes and the customer's concern is simply with the price quoted for a particular job. Naturally there are some problems in which the customer recognizes that the very nature of the process makes it impossible to assess accurately the time required to complete certain sections of the work. In such cases fixed charges are quoted for as much of the work as possible, and a reasonable indication is given of the rate at which the charges will accrue for those sections which cannot be determined in advance (e.g. cost quoted per iteration). Some problems are well defined and can be dealt with quite satisfactorily by mail, but more usually discussions are necessary before a formal quotation can be prepared. The preliminary investigations and advisory sessions carry no financial obligations for the prospective customer.

As indicated earlier, apart from the staff directly engaged on Computing Service work, we can call upon the specialist experience of a large team of Sales and Research staff who work in the Computer Centres. However, in the main we handle work in which the customer provides the expertise on his own subject and we contribute our experience of computer techniques. Recognizing the importance of the customer's expert knowledge of his own problems, we encourage a policy of "do-it-yourself" programming, using either machine orders or autocodes according to the nature of the work. Regular courses are run throughout the year and, excluding our own staff, we have trained over 1,050 Pegasus programmers and more than 60 on Sirius to date. In addition, the universities and technical colleges have trained large numbers of people in the use of Ferranti machines, and these courses bring a demand for Service facilities when the students enter, or return to, industry or commerce. The results of this "do-it-yourself" policy can be judged from the fact that, of all service work undertaken over the past year, 65% has been programmed and run by customers.

Considering all forms of service work, more than 260 organizations have used the Centres up to date, and new contacts are continually being developed. Many customers have regular bookings and, apart from extending the facilities which we offer in our Centres in London and Manchester, we purchase time which can be made available to us on customer-owned Ferranti computers in the London area and put it to work solving other peoples' problems. In the early days the work being done was almost exclusively scientific, but with the

introduction of magnetic tapes and high-speed output there was a pronounced swing towards commercial data-processing. The Pegasus 2 System has been installed to absorb some of this work and to extend the range of applications. Fortunately, the rapid expansion of our commercial Computing Service coincided with a lull in the pressure of scientific work, following the installation of a number of Pegasus computers in technical organizations. Although subsequently there has been no fall in the demand for commercial service, there has been a steady increase in the flow of technical and scientific problems being submitted for our attention, and an even balance is being achieved as we extend our facilities.

The Future

With the introduction of our Orion system numerous organizational changes will become necessary. I do not suggest that, as yet, I can offer satisfactory solutions to all the scheduling, operating, and accounting problems which a time-sharing machine presents, but perhaps I can give some indication of my provisional ideas on these subjects.

Provided that users make reasonably accurate assessments of the duration of their runs, scheduling work on Pegasus and Sirius is a simple matter of allocating bookings on clock time; but, apart from those users who wish to hire the complete installation for a fixed period, the conventional clock will have less significance in time-shared work. The period of time which will elapse between the start and the finish of a job will depend upon the priorities of the programs which are run in parallel with it, and as this interaction cannot be predetermined accurately, fixed bookings, in the present sense, will not be possible.

It is reasonable to expect that, at some future date, the computer will accept details of all jobs queueing for attention, and their priorities, and will optimize the sequencing of the work, but for the present we expect to rely upon human decisions made by the duty controller. In time the controller may be a senior operator, but, in the initial stages, when we will be gaining, and learning by, experience, we expect to employ programmers on this work. In fact, the duty programmer will become the duty controller.

It is anticipated that the large jobs will fix the basic pattern of a day's work and that small jobs will be integrated into the schedule by the duty controller, as spare capacity becomes available. To enable the controller to make sensible decisions, the built-in programs will print out, on demand, full details of uncommitted storage and peripheral equipment. In any case, the computer will reject any program which requires more facilities than are available at the time when it is read into the machine.

It will be appreciated that this system of work scheduling points to an operator-run "closed shop" method of working. One could not accept a situation in which a number of independent users were competing for access to the controls and equipments. Ideally a time-sharing machine would be run by a controller, supported by a number of assistants attending to the various input and output devices, but in our case the organization will be influenced by the special requirements and responsibilities of a computer manufacturer. For example, customers who have placed orders for machines will require us to provide training and experience for the staffs who will be concerned with the operation of their own installations.

A relaxation which I consider likely to be found desirable at a Service Centre dealing with many different customers is connected with jobs involving punched-card input/output. In such cases I feel that the customers should be permitted—even encouraged—to provide staff familiar with their cards to man the peripheral equipments and do the card handling.

So far, as with bookings, accounting has been related to conventional clock time but, as indicated earlier, this is variable on a time-sharing machine and therefore is not in itself an acceptable measure for charging purposes. Within reasonable limits a user expects to pay the same amounts for identical jobs run at different times. On Orion, one of the built-in programs will keep a record of both the overall clock time and the time when the machine is operating under the control of each program, and at the end of a run will print out the total chargeable times used. When the charging formula has been agreed the program can be extended to convert the times into cost per run.

There is some value in having a charging system which encourages use of the machine so that the fullest possible advantage can be taken of the time-sharing facilities. It would appear that in such a system the machine's record of operational times must be related to the peripheral devices used and to the amount of drum and core store reserved for the program. Naturally there are some factors which completely override all other considerations. The obvious example is the program which, by using the whole of the core store, prevents other jobs being run in parallel, even though peripheral equipments are standing idle.

Our preliminary investigations into this problem indicate that even if an accurate and completely equitable formula could be found it would be very complex. Again, if it were simply a matter of leaving the computer to evaluate a complex formula at the end of each job, there would be no problem, but customers using a service centre expect to be provided with either a fixed quotation or a scale of charges which they can use to assess the cost of an operation in advance, without their having to do complicated arithmetic. Although on this point we cannot see our way to working on a flat machine-time rate, it is our intention to aim at a simple scale of charges even though this will mean sacrificing some of the possible refinements.

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