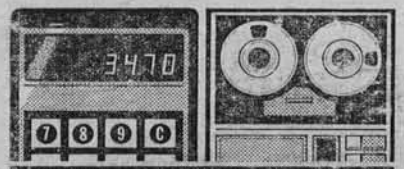

CALCULATORS AND COMPUTERS

A spectrum from pounds to fortunes

Brian Gaines

A continuous spectrum of computers is now available ranging from the microprocessor (computer-on-a-chip) for a few pounds, through minicomputers (computer-on-a-board) for a few hundred pounds, midi-computers (computer-in-a-box) for a few thousand pounds, small office systems (computer-in-a-cabinet) for some tens of thousands, to central computer services (computer-in-a room) for some hundreds of thousands, and giant machines (computer-in-a-building) for those with millions to spend on weather forecasting and military modelling.

I shall take the minicomputer system to be one consisting of a *disk store*, an *interactive terminal* (visual display unit or VDU), and *medium-speed printer*, with sufficient overall storage to run an *operating system* and *language compilers*. The cost of such a system is currently between £6,000 - £12,000.

The key features of such a system are: It is a complete tool for developing and running computer programs without any other facilities. It is sufficiently inexpensive for it to be cost-effective for an individual to use it alone and gain the benefit of direct interactive communication with the computer.

By way of contrast, a microprocessor is far less expensive but requires a separate developmental system to provide tools for effective programming. On the other side, a central service machine is more powerful, but very much more expensive so that it either needs a batch of jobs waiting to be processed, or a time-sharing operating system enabling many users to interact with it at the same time, or preferably, both.

In essence, a minicomputer is the most powerful computer system that can reasonably be dedicated to a single individual user. In the past such dedicated systems were generally not powerful enough to provide as good computing facilities as a central service machine. They were used mainly for instrumentation, data-logging, control of experiments and other specific applications. The economies of scale possible with a large central service were necessary to make the provision of adequate facilities, particularly storage, cost-effective.

However, in recent years advances in electronic and electromechanical technologies have made it feasible for dedicated machines to compete with the previous generation of larger machines in the facilities they offer. Computer scientists and manufacturers have been quick to take advantage of the new hardware and provide operating systems and languages that are no longer toys but compete seriously with the best available.

Why are economies of scale not still prevailing? It is certainly true that unit storage costs decrease on larger systems as do those of many other facilities. However, there is a cost to be borne in sharing a machine among many users and providing them each with comparable performance to a dedicated minicomputer. Added to this overhead of timesharing is the communication cost of gaining access to a remote central machine, the personnel cost of running a service, and perhaps the cost of not having a machine under your direct personal control.

Overall the balance is veering to the dedicated system and, more importantly, will continue to do so as technology costs fall but communication and staff costs rise. The day of the central service machine is by no means yet over, but its value will eventually lie only in direct requirements for centralization, for example, shared data-bases, interchange of messages, or shared access to massive compufing facilities beyond the means of an individual user.

The illustration shows a typical mini-computer system aimed at the educational market. The computer itself is invisible (no flashing lights or banks of keys) within the 19-inch cube cabinet that is also a desk for the user.

In the same cabinet are two floppy disc drives each taking a removable magnetic disc very much like the old 45 rpm gramophone records. Each disc can hold about a quarter of a million characters (alphanumeric within a 256 character set) of data. This is small in computer terms (sufficient only to store the text or 12 pages of this supplement), but substantial for an individual user and will increase (already discs with four times as much storage capacity for a similar cost are coming onto the market).

On top of the cabinet is a visual display unit showing some 20 lines each 80 characters long, with a keyboard similar to that of a typewriter. This is the user's main channel of communication with the computer. Through it he can type in and edit programs and data, control the computer in running his programs, and receive the results. To the right is a typewriter terminal giving similar facilities but also providing typed output.

Gone are the days when computer output was distinguished by being of poor quality, capitals only text on wide music paper! Both display and typewriter use the full normal alphabet and the printed output can be on normal paper — many people now use such systems for preparing papers and correspondence.

The picture shows two other visual display units in the background since this system was designed for four students to use simultaneously. Like other similar systems on the market, it offers full access to high-level programming languages such as BASIC and FORTRAN. In particular the FORTRAN available on mini-computers is now comparable in its facilities to that on much larger machines and can be used for major applications.

Looking into the future, in the United States the next generation of such systems, the "personal computers", are already being developed. They offer full graphic output on the visual display, storage capacity and processing power that exceeds that of many of the central service machines of some five years ago, as well as facilities for communicating with giant central computer utilities through the telephone network when there are data-processing requirements that exceed that of the local machine.

It is difficult to predict where it will all end because there is none in sight, and our wild speculations of yesterday are already becoming the realities of today.

Digital's compact microcomputer timesharing system, the Multi-User/11VO3.

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