Past Memories

The development of more compact means of storing information has been the aim of designers since the computer was invented

Every computer needs some capacity to store information because even in the simplest processes, such as addition, a digit may have to be stored or 'carried' until it is needed in the next step of the computation. Since the birth of the computer, memory sizes have steadily increased, and this has allowed not only larger problems to be attempted but also types of problems that were insoluble before.

Ever since electricity was first investigated scientists have been looking for ways of using it for storing information. Electricity can be thought of either as a flow of electrons or as a moving wave, but in both descriptions the implicit characteristic is movement. The impossibility of retaining something that by its very nature must always be moving has led to the adoption of indirect storage methods. A battery, for example, stores energy in a chemical form and a hydroelectric power station releases the potential energy in water when it is driven through the turbines. We will see that many solutions have been found to the problem of handling data in the form of electrical signals.

In the Second World War a great deal of work was done with radar to separate the signal reflected from a moving aeroplane from pulses echoing off fixed objects such as trees. A device called a 'mercury delay line' was invented that could temporarily store the pulses of radio waves and thus compare reflected waves at successive 'sweeps' of the radar so that permanent patterns could be eliminated.

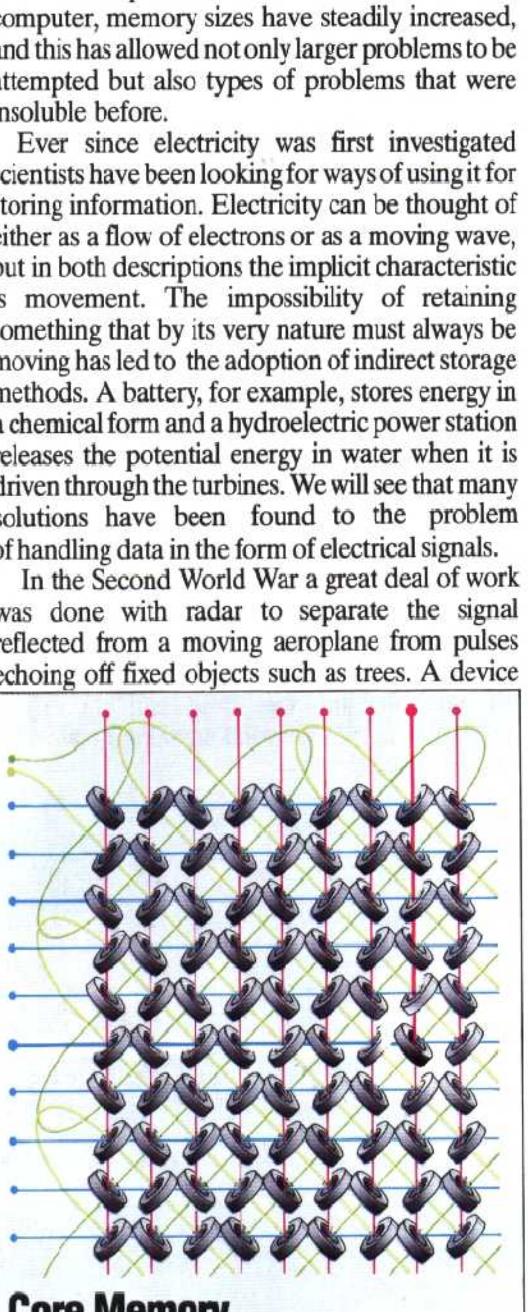
A mercury delay line consists of a glass tube, one metre (39 inches) long, filled with mercury and with a quartz crystal at each end. When an electrical signal is applied at one end, the quartz crystal vibrates and creates a physical wave that travels to the other end of the tube, where it is detected by the other crystal and converted back to an electrical signal. It takes the wave about 660 microseconds to travel down the tube, but by feeding the signal in a loop back through the mercury, pulses can be stored for several minutes before the signal becomes too distorted.

With a clock regulating the train of pulses at 500,000 cycles a second, 330 bits could be stored in a metre tube. The memory size could be increased by lengthening the tube, but only at the expense of increasing the access time, since a pulse could be read only when it was in the electrical circuit outside the tube. These systems were bulky and expensive, requiring skilled engineering to construct sets of tubes to an accuracy of 100th of a millimetre (1/2500th inch).

In Britain another method of storing data was invented by F C Williams at Manchester University, who investigated the use of static electricity generated on the inside surface of a cathode ray tube (a television screen) as the storage medium. An electron gun set up a pattern of static charges on the screen, and this pattern could be detected by a wire grid close to the outer surface of the glass screen. By 1947, it was possible to store 2,048 bits of information on a single screen for a number of hours. Although the speed of access was fast, the static charges had to be refreshed every 30 microseconds, otherwise they would fade and be lost.

The use of magnetic tape was first tried out with LEO in Britain (see page 320) and in the United States on UNIVAC (Universal Automatic Computer) in the late 1940's. This was the first technique by which large amounts of information could be stored cheaply and reliably. Eight bits were stored in a 'frame' across the tape at a density of 6,000 frames per inch (2,360 frames per cm). With a total length of tape of 200 feet (61 metres) or more, permanent memories of at least a megabyte were possible. However, even with the fastest of drive motors, the access time for data in the middle of the tape was some seconds. Consequently, this sort of storage found its natural use in files where the data is required sequentially, as in the calculation of a company's payroll. The tape could be speeded up by floating the 'head' that detects the magnetic signals on a cushion of air, which also relieves frictional wear and tear.

A memory with a large capacity, high access



Core Memory

Iron rings (tori) are threaded onto a lattice of intersecting wires. Any particular ring can be addressed by sending a current through the appropriate horizontal and vertical wires. The reading wire, which threads its way through all the rings, picks up changes in the magnetic flux in the ring, indicating whether a 1 or 0 is stored

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