

Total Recall

How the computer keeps careful track of all the information stored in its memory — and makes sure that it never forgets

RAM Memory

The RAM chip (below) is one of the major recent advances in computer technology. RAM (Random Access Memory) is one of the varieties of completely electronic memory, a category that also includes ROM (Read Only Memory). Cassette tapes and magnetic floppy disks are examples of the other main kind, electro-magnetic memory.

RAM memory is fabricated from silicon using a photographic process and chemical etching to create thousands of tiny transistors. Each 'bit' of memory requires at least one transistor in a storage cell circuit.

The time taken to 'write' a single bit into any one of the 16,384 storage cells is about 200 nanoseconds — a five-millionth of a second

In human terms, memory is the storehouse of the mind, the place where details of experience are stored for later use. And in computer terms 'memory' means pretty much the same thing, only a computer's memory is more limited in what it can do.

For a human being, poor memory is an inconvenience or an embarrassment. For a computer, it is disastrous. Without memory, the computer would have nothing to work on and nothing to tell it what to do, since it also uses its memory to store the programs that drive it.

In both cases, the word 'memory' implies two things; storage and recall. Storing information without being able to get it out again is not very useful, and trying to recall information that hasn't been stored is obviously futile.

The two kinds of memory are similar in another way too. Human memory appears to be of two general types, short-term and long-term. A man crossing the road, for example, will remember to wait until the approaching car has passed by. But when he is safely on the other side of the road, the vehicle is forgotten. His memory of the car was short-term.

However, had the same car contained two masked men in the back seat, and the man's wife in the driver's seat, he may well have remembered the whole incident, including the type and colour of the car, and possibly its registration number! This was a long-term memory.

Stretching a point a bit, computers have short-

term and long-term memories as well. The long-term or 'non-volatile' type contains programs and information that the user wants to keep; these are stored as magnetic recordings on the surface of cassette tape, floppy disks, or ROM packs.

The short-term or 'volatile' type is the RAM chip inside the computer itself, and is only used temporarily while the computer is working. The moment the power supply is removed, even for a fraction of a second, all the contents in the memory disappear instantly.

The analogy with human memory is not exact, however. For the computer to work, the right programs and data need to be transferred from long-term storage into short-term storage so that the computer can have instant access to them. And the way data are stored and recalled to and from a computer memory is completely different too from the methods human beings use.

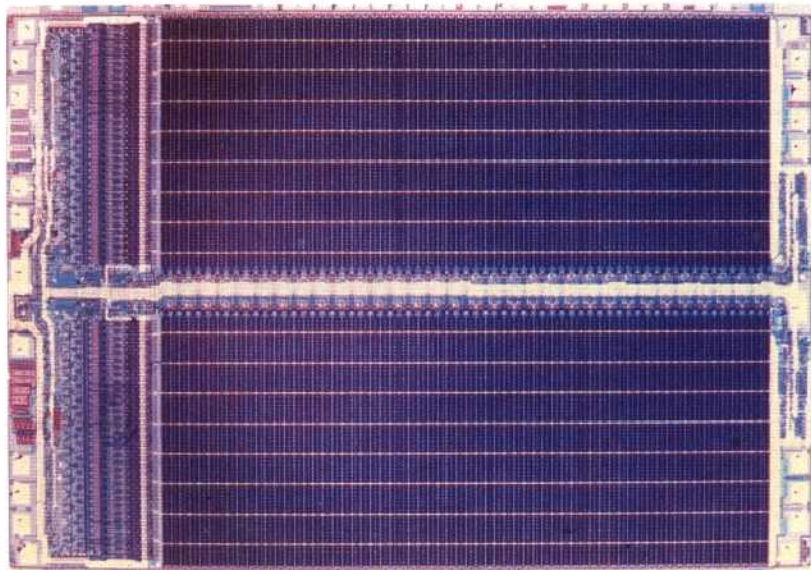
The way human memory works is still a mystery, since memories of a particular incident do not seem to be stored in any identifiable tiny segment of the brain. We do not have to figure out where a particular item of memory is to recall it to the foreground of the mind. And when we have finished with a memory, we do not have to worry about putting it back in its particular slot in the brain.

Organised Chaos

In computer memory, it is the *location* of each item that is vital. The computer has to be able to find a particular byte of information, whether it is part of a program or part of the program's data. The computer also needs to keep a 'note' of where it puts the information.

Human memory seems more like a box crammed full of information, but not organised. The pieces of information are just stuffed in, apparently at random, tangling up with each other and being shoved around inside the brain as more and more images and experience are crowded in. Somehow or other, the brain can make sense of this and pull out what it needs, when it needs it.

Computer memory is more like a giant rack of pigeonholes, each hole completely separate from the rest. Everything is very orderly; each pigeonhole has a number (called its 'address') and contains just one byte, no more and no less. The computer finds information by pigeonhole number, not by what is stored in that pigeonhole.



COURTESY OF MOSTEK LTD