

WORRYING ABOUT MEMORY

More and more computer users are worrying about memory these days - the memory in their computers. However, they often confuse working memory with long term storage. On more than one recent occasion I have heard comments like "I need to buy more memory for my hard drive", or "I need to expand my computer's memory, so I think I'll buy a larger drive." Clearly, these folks were mixing metaphors!

I really like to use analogies, because analogies allow people to move easily from what we understand (the "known") to what we do not yet understand (the "unknown"). Therefore, let's consider an analogy of hard drives and memory.

It is really quite simple. A sheet of paper and a pencil are to human memory as a hard drive is to computer memory. We devise our shopping list in our human memory, and write it on paper. At the store, we read the paper to refresh our human working memory, so that we don't forget to purchase any items. A computer **MUST** store data concerning what it is supposed to do (like watching the keyboard, in case a human types something) on a hard drive or floppy because when it is turned off, all memory is lost. However, it can, next time it is turned on, read the data written on the hard drive and put that data back in its memory so it knows what to do again. The analogy is a good one, except that we (thank goodness!) don't lose everything from our memory each time we go to sleep like a computer does each time it is powered down (my wife, Shari, reminds me that certain individuals in our household come pretty close)!

So the hard drive is really a long-term storage device rather than main computer memory (some authors hedge by calling a hard drive "secondary memory"). Well then, what the heck is this main memory stuff? You have probably heard it called RAM, though it has nothing to do with goats or trucks.

RAM stands for Random Access Memory, and random access simply means that you don't have to examine the contents of the first 326 files in a filing cabinet if you know the data is in the 327th file. Another analogy (stolen by me from someone else): if you want to play the 4th song on a record, just lift the phonograph arm and lower it on the correct track. You don't have to listen to songs 1 through 3 first. However, you can't do that with a tape. In that case, you must fast forward the tape, passing songs 1 through 3, until you reach the 4th. That is **SEQUENTIAL** access, as opposed to **RANDOM** access.

RAM is good stuff. Not only can it be quickly accessed because it can be randomly accessed, it is also high speed. Your computer RAM can be written to or read from in less than a millionth of a second. While data on a hard drive can also be accessed randomly, the process is much slower - by at least a thousand times.

Like all good stuff, RAM costs a lot. A megabyte of RAM (roughly enough to hold the text of your favorite novel) costs about \$40 these days. The equivalent space on a hard drive runs about 50 cents.

On the other hand, RAM is **VOLATILE**. That means that the data in RAM goes bye-bye when you turn off the power. Type a 10-page memo on your computer, and as you type, it gets stored in RAM. Turn off the power, and poof, your hard work is gone! The RAM chips need power to store data, and in the absence of power, they get Alzheimer's. That is why you save your work to disk, **BEFORE** you turn off the power. Your memo then gets written to a floppy or hard drive - a long-term storage device with non-volatile memory - which can be read again next time you power up.

It should be evident now that RAM is memory that is used constantly (and nearly instantly) as we humans work at the computer. If we are typing a memo and press the letter A, a number that represents the letter A is immediately stored in RAM. RAM is therefore working memory, rather than just storage space. The hard drive, on the other hand, is storage space. We only access it occasionally, as when saving a file to the disk or reading a file from the disk.

How much RAM does your computer have? How much does it need? We'll explore that story the next time around. Happy computing!