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A CONVERSATION IN A COMPUTER

Time before last we considered memory. Remember? (Pun intended!) I pointed out that a hard or floppy disk is non-volatile memory, since anything written to these devices remains there after the power is turned off, providing everything goes as it should. Your computer's RAM (Random Access Memory) is different, however. Anything stored in it goes away to never-never land when that power switch is turned off. However, RAM is very necessary, because it is really the "scratch pad" for all your work, as well as the programs that allow you to work. Let me illustrate this with an everyday example.

Suppose your computer has a hard drive, and last week, you started a letter to the ARRL. Today, you intend to finish it. You sit down at the keyboard, turn on the power, and wait for a few moments while your machine boots up. Then you change to your LETTERS subdirectory and use the DIR command to confirm that the letter you started, named ARRL.195, is still there. Next, you start your word processor and open the letter, which promptly appears on your screen.

What significant steps have occurred? When you started your word processor, most of the instructions in the word processing program were read from the hard drive and moved into RAM, where they take over most of the interpretation of your keystrokes. Then, when you opened ARRL.195, the letter was read from the hard drive and an exact copy was made in RAM, but in an area of RAM different from the word processor. What you see on the screen is an exact copy of your letter as found on the disk, and another exact copy is now in memory.

Let us suppose that, after reading what you wrote last week, you decide it is fine and no changes are necessary. All you need to do is to add the closing, so you type the following 16 characters: Sincerely yours, and you save the letter.

Your keystrokes were sensed and acted on by your word processing program, acting in concert with your computer's operating system (the latter also resides in RAM, in another, remote spot). These two are like Siamese twins, joined at the brain, so we will nickname the pair WP-OS. As you typed the character S in Sincerely, WP-OS did two things. First, they were "watching" the keyboard in case you typed something, which you did. When they saw the S typed, they moved the S (actually, it's numeric representation) into RAM. Second, they echoed the S to your screen. They accomplished those two steps pretty quickly; both steps were finished when the S appeared on your screen. (Note carefully, however, that WP-OS did absolutely nothing to the hard drive, which you can prove to yourself by watching the LED while typing - it will not light up.) The same thing was repeated for the i, then the n, and each of the characters. In each case, the character was added to the copy of the letter in RAM and also echoed to your screen.

Then, you saved the letter. For the first time, WP-OS "talked" to the hard drive. What did they say? Assuming your word processing program works like most do, here is the conversation, with WP-OS = the word processor working in concert with the operating system, and HD = Mr. Hard Drive:

WP-OS: Mr. Hard Drive, take the copy of ARRL.195 you have written on your platters, and rename it ARRL.BAK.

[The hard drive complies, and it also lights it's LED while doing so, indicating it is active.]

HD: OK, Boss, I did it!

WP-OS: Good guy. Now, take this data I am about to send you, write it to your platters, and name it ARRL.195.

HD: Right, Boss, send it down. Got it! There, I'm all done.

That is the way it works. Now you can understand that those .BAK files your word processor keeps creating represent a copy of your work **before** your last edit. You can also see why, if you turn off the computer before saving your work on hard disk or floppy, you are out of luck. Until you give the command

to save your work to disk, that data resides only in one place - in RAM, and RAM is terribly volatile. How volatile?

A RAM chip, so long as it is fed power, acts like a bank of capacitors. Some capacitors are charged (representing ones) and some are not (representing zeroes). However, these chips are really forgetful. Even if they have plenty of power, **they will loose their memory** (zeroes stay zeroes, but the ones also become zeroes) **within about 4 milliseconds!** So the engineers have designed circuitry within the computer to refresh the charges (or lack of them) about every 3.8 milliseconds. Think about that next time you are editing a critical file, and don't have a backup!

See you next time. By the way, I am writing this on 27 December, so my best wishes to you and your family for a happy, healthy and prosperous 1995!