

Memory 1: ROM and RAM

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Back in December 1994, number 16 in this series titled "Worrying About Memory" covered the basic differences between storage space (hard drives) and main computer memory (RAM). But today there are so many different kinds of RAM, including different physical kinds, that I thought it might be appropriate to revisit the subject and go into a little more depth. So, here we go.

At the outset, let me state that all computer memory resides in chips, so let us begin by considering just one chip. The BIOS (Basic Input/Output System) chip(s) in your computer contains information about the hardware in your machine and how to "talk" to it to make it do stuff or save information, and how to listen to it when the hardware wants something or wants to transmit information. BIOS chips need to keep their information both when the computer is turned on and even when it is turned off. Therefore, they are designed to keep their information more or less permanently. Hence they are often referred to as non-volatile memory. In the really old days, the information was hard-wired in the chip during manufacture. A little later, some engineers devised a way to electrically "burn" the information in, sort of like blowing a bunch of predetermined fuses in order to create a desired circuit pattern. This device was called the PROM (Programmable Read Only Memory), and was typically "burned" using a 12-volt signal, though the chip was designed to run thereafter at 5 volts, a voltage level which would not destroy the programming. Still later, the process was made reversible. A quartz window in the chip's top made it possible to expose the circuit to ultraviolet light for a few minutes from a special lamp, which erased the memory by photochemically restoring the "blown" fuses that had been programmed in before. Then new instructions could be reprogrammed into the chip again using electrical signals. That process could be repeated many times using the same chip, whenever it was desirable to put new information in the chip. The window was then covered with opaque tape to prevent stray light from erasing the data. You can still find this type of EPROM (Erasable Programmable Read Only Memory) chip around – just look for a long chip with a slightly raised round platform in the top of the chip, often covered with tape or a printed label. You can sometimes feel the round area right through the label. Your TNC probably has one. The quartz window is underneath the tape, and it is kind of neat to use a magnifying glass to look directly at the circuit of the chip. That exercise will give you a good feel for what the micro means in microelectronics! Get one to examine at a swapfest. Don't pull the one in your TNC!

More recently, a newer type of chip, the Electrically Erasable Programmable Read Only Memory (EEPROM) has gained very wide use (even your car has one). Also called "Flash Memory", this chip also keeps its information permanently, even when it is running normally in an electrically live circuit. However, special programs can be used to erase and reprogram the chip, again by raising the voltage higher than that normally found in the live circuit. The other day, I upgraded the data in my computer's video card by downloading a special program from the manufacturer over the web, then "flashing" the EEPROM on the card. That updated the card's capabilities and fixed a couple of minor bugs, and I didn't even have to open the case of my computer to do it. All I had to do was run the program, which took less than 10 seconds! That video card is currently showing me these words as I type. Today I flashed the main computer BIOS in exactly the same way.

ROM chips hold information that is more or less permanent – changeable only when you want to periodically upgrade the information as I did with my video card and computer BIOS. The main

RAM memory in your computer, however, is another story. The information that is stored there is constantly changing as you use your computer. Indeed, in a Windows machine, the information seems to be constantly changing even when you are not using the computer, so long as the power is on. Win95/98 seems to be constantly doing stuff in the background, without human intervention!

At any rate, this main memory can be thought of as many, many toggle switches being turned on or off constantly in varying patterns as you work. Main memory needs to be changeable, or volatile, because that is its purpose. Furthermore, it needs to be accessed randomly. Non-random access is akin to having to listen to the first four songs on a record or CD-ROM, even when the one you want is the fifth one. Random access permits you to skip directly to song number 5, which you can do on a phonograph record by lifting the arm and putting the needle in the right track. Therefore the main memory in your computer is called RAM (Random Access Memory), or DRAM (Dynamic RAM). It is volatile, indeed, for any information stored there goes "poof" when you turn off the power.

RAM is really important, especially so in newer machines and VERY ESPECIALLY so if you use Windows 95 or 98(both are memory hogs, and can hardly function without lots of it). How much do you need? What kind do you need? What does the kind you need look like? What do the terms SIMM, DIMM, Fast Page Mode DRAM, EDO RAM, Burst EDO, SDRAM and even RDRAM mean? Next time. Happy computing!