Diabologic: Next Year's Computer

by Frank Dolinar

Some time ago, in the deep past of pre-history, our ancestors began the journey away from innumeracy by counting on their fingers. It took ages to move from that fundamental innovation to the invention of the abacus, the first known computational device.

Much later, written numbers came along, in a myriad of base systems (the Sumerians and Mayans used a base-60 arithmetic, for example). The invention of the zero, in India, enhanced the development of what today are known as Arabic numbers. Without the zero, much of modern mathematics would be difficult, if not impossible.

The slide rule, essentially unknown to the current generation of high school and college students, had its halcyon days in the midst of the 20th century, a reign cut suddenly short by the invention of the electronic calculator.

The 19th century saw the invention of Babbage's Difference Engine and the Jaquard Loom, both precursors to the modern computer.

Innovations came quickly throughout the 20th century: The invention of the electronic computer at the Moore School of Engineering at the University of Pennsylvania in 1943; commercial computers used by banks and insurance companies in the 1950s; scientific computers in the 1960s; computers serving many users in the 1970s; personal computers and the proliferation of networks for resource sharing in the 1980s; and the internet in the 1990s.

It's 2006 and we've become accustomed to the rapidly changing face of computing.

These days, with computer chips showing up everywhere, our day-to-day devices are all computing devices. Cell phones are data communication devices (converting our voices to and from digital transmission signals), databases (storage for our phone numbers and email addresses), and optical processors (cameras). Pagers, PDAs, and the ubiquitous Apple iPod all continue to acquire more computational horsepower, and progressive ease of use. Even our computers are more than they seem, becoming more capable and powerful as they become smaller. Today, many of us have multi-processor systems powered by the AMD Athlon 64 Dual Core or the Intel Core Duo chips – even though many of us barely tap the capabilities of computers with a fraction of the current horsepower.

In June, IBM and Georga Tech demonstrated a chip, cooled to 4.5 degrees Kelvin, running at 500 gigahertz, almost 200 times faster the typical home or office computer available today. It will be a while before anything this blindingly fast makes its way into our home computer systems, and by the time it does, what we currently think of as a 'computer' will have disappeared or morphed into forms that we cannot imagine today.

In July, engineers at the University of Wisconsin-Madison created a single-crystal semiconductor film (200 nanometers thick) that can be transferred to glass, flexible plastic, etc. opening possiblities for flexible electronics. Both sides of the film can host active components and several layers can be stacked, opening the way to very powerful 3-D flexible computer chips. Besides computer chips, this technique could be used for solar cells, smart cards, RFID tags or active-matrix flat panel displays."

Worries about power consumption and the associated heat dissipation are headline news these days. It is becoming more expensive to cool rooms full of high-density servers than it is to run them in the first place. These costs combine for a double-whammy that doesn't have an easy solution.

There are a number of options on the horizon. Taken individually, the difference they might make is small. Collectively, the difference is much bigger, and as new technologies come to the fore, this will accelerate.

The hard drives in our computers eat power for breakfast, lunch, and dinner. In August, Samsung announced that it had developed a high capacity flash drive (like the one on your keychain) that will hold 32 gigabytes, that's 32 billion characters, of data. These flash drives are a win-win for any individual or organization that uses computers in any form. They are light weight, use a tenth the power of a hard drive of equivalent capacity, and are approximately ten times faster. In November, Samsung began marketing a computer that contains a number of these flash drives, and no hard disk. At the moment it's available only in South Korea. Wait a couple of months.

If you travel with your laptop, you have discovered that carrying that weight gets old in a big hurry. The single most massive component of the laptop computer is the battery. Researchers at MIT are about to relegate all of the batteries in our personal electronic devices to the scrap heap of history. They have found a way to increase the electrical potential stored in a capacitor (which is directly and irrevocably related to the capacitor's surface area) by growing a dense forest of conducting nanotubes on the electrode surfaces of the capacitor, thereby dramatically increasing the capacitor's surface area. These have the advantage of being light weight, completely and repeatedly rechargeable, and less expensive than batteries.

Combining these components gets a result that looks like a computer you can fold up an put in your pocket.

Fasten your seat belts now, because this ride is just beginning and is going to get progressively faster.

As Jeff Harrow says, "Don't blink."

