Carbon Nanotube Chips Could Power Your Computer in the 2020s

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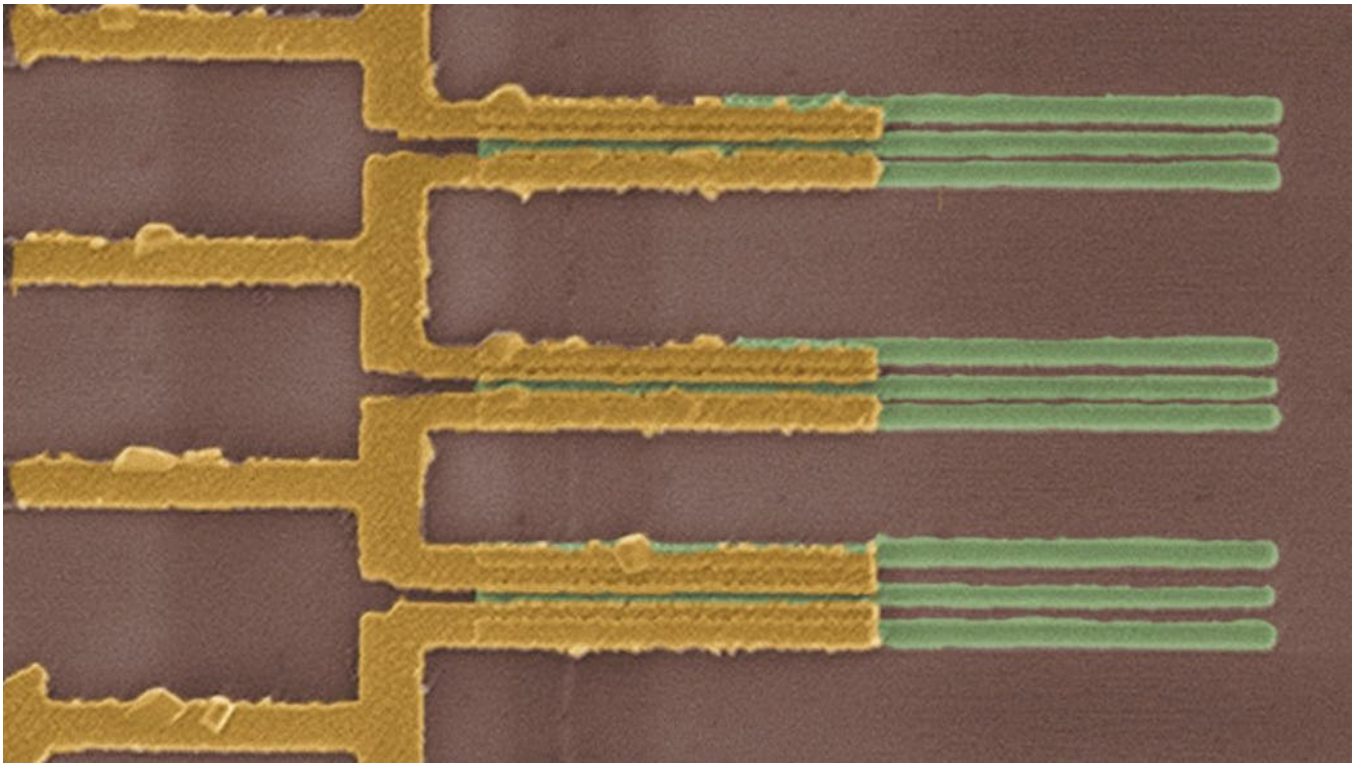
Posted by Tim De Chant on Fri, 02 Oct 2015

The bleeding-edge of computer processors seems to have dulled over the past decade.

Huge leaps in processing power used to be the norm, but as electrical engineers have struggled with barriers imposed by chemistry and physics, new chips now offer something closer to cautious steps.

That may change in the early 2020s, though. Scientists from IBM report that they have been able to feed electricity to regularly spaced, parallel carbon nanotubes via more traditional metal contacts.



Carbon nanotube transistors (seen here in green) are fed electricity by metal contacts (yellow).

The structure allows the nanotubes and to function as semiconductors (and thus be switched on and off) while also providing an efficient way to deliver electricity to them. Chips made of such carbon nanotube switches, or transistors, would operate in much the same way as computers today, but they would likely be significantly faster.

Scientists have long been attracted to carbon nanotubes for their small diameter and tunable electrical properties, both of which make the material an ideal replacement for today's semiconductor technology. Various teams have successfully crafted chips that employ carbon nanotubes, but they don't have enough transistors to be very powerful. That's because it's difficult to shrink the metal contacts that carry electricity to the nanotube switches without introducing undesirable properties.

Mike Orcutt, reporting for Technology Review, explains the solution:

> *The researchers addressed the issue by changing the interface between a nanotube and the two metal contacts. Instead of depositing them on top of the tube, as in the conventional scheme for building nanotube transistors, they placed them at the ends of the tube and made them react with the carbon to form a different chemical compound. Using this technique, the group demonstrated that contacts less than 10 nanometers long didn't compromise performance. (Today's top-of-the-line silicon chips have 14-nanometer features.)*

Of course, challenges still remain. Engineers need to get better at isolating semiconducting carbon nanotubes and then cramming them onto tiny wafers with expert precision. Orcutt reports that we've gotten better at the former, but we still have a long way to go when it comes to assembling the chip itself.