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By Pam Baker
March 2, 2005 4:28PM

Intel currently produces the world's smallest transistor -- half the size of a flu virus. The Pentium 4 processor contains 291 million transistors. "Think of a processor as a brain. The more brain cells you have, the smarter the brain," says Intel's Manny Vara.

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Hewlett Packard researchers created a computer-world frenzy with the recent announcement of a new invention designed to replace transistors on chips -- the fundamental building block of computers for the last half century -- the buzz just bluff or the stuff of real scientific advancement?

"HP is a long way off, not in the science, but in terms of the limits of the current environment. It will take at least ten years for the industry to retool," Yank Andy Efstathiou told NewsFactor.

Re-inventing at Molecular Scale

In a paper published in the Journal of Applied Physics, three members of H Quantum Science Research (QSR) group described their invention as a "crossbar" which provides the signal restoration and inversion required for general computing without the need for transistors.

The technology could result in computers that are thousands of times more powerful than those that exist today. "We are re-inventing the computer at the molecular level," Stan Williams, HP senior fellow and QSR director, and one of the authors of the paper said.

"The crossbar latch provides a key element needed for building a computer using nanometer-sized devices that are relatively inexpensive and easy to build," he added.

QSR works on nanoscale electronic devices that will first supplement, and eventually replace, transistors.

perhaps replace, silicon technology, which is expected to reach its physical a decade. But, such a replacement could devastate chipmakers and turn the industry on its ear.

"Any truly new technology requires an entire industry to support it -- an entire infrastructure -- and retooling takes years. Plus, products have to be adapted compatible to a radical change," Manny Vara, manufacturing side spokesman for Intel, told NewsFactor.

The Race Is On

"Everyone's looking for an answer. No one can make transistors too much smaller, still keep them operable," says Vara.

Certainly, Intel is there for the count. The giant chipmaker currently produces the smallest transistor -- about 50 nanometers -- half the size of a flu virus. The Pentium 4 has 150 million transistors.

"Think of a processor as a brain and transistors as brain cells. The more transistors you have, the smarter the brain," says Vara.

Intel researchers also are experimenting with ways to advance transistor design by using new materials to build better transistors; transforming the common planar transistor into a Tri-gate 3-D transistor; and, exploring whether transistors can be built from nano devices like carbon nanotubes and nano wires, says Vara.

"What can be enhanced or added to a silicon chip to increase performance per watt?" Vara muses.

But HP researchers are taking a different tack.

The crossbar latches use a sequence of voltage impulses to the control line to switch in opposite polarities. As a result, they can perform the three basic logic functions that comprise the primary logic of a circuit and are essential for basic computer functions.

The new latch technology could restore a circuit to its ideal voltage. That way, designers can chain many simple gates together, allowing them to perform complex functions.

"These types of advancement are mission-critical to the long-term survival of the industry," says Efstathiou.

Beyond the Finish Line

In addition to exploring the fundamental scientific principles of computing at the molecular level, QSR also is looking at architectural issues and determining how many devices -- thousands of which could fit across the diameter of a human hair -- can be fabricated economically and in mass quantities.

Meanwhile, Intel Israel has spent the last two to three years developing the new chip at the company's Jerusalem facility to replace the standard electronic communications between computer components, allowing this communication to be conducted at the speed of light -- 10 times the current speed.

"Today, the fast processors operate at speeds over three gigahertz, but the surroundings still work at speeds of hundreds of megahertz and, therefore, in exploiting their speeds," Amir Elstein, the co-CEO of Intel Israel and director of the Jerusalem facility told reporters. "When the chips, the processor and the peripheral computer speak at the same speed, which will be about 10 gigahertz, the computing capability will be totally different," he added.

"None of these advancements will happen tomorrow -- but when they do, it will be far more progress than we have yet experienced, and it will be highly disruptive technology," says [Frost & Sullivan](#) senior strategic analyst Ronald Gruia.

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