Researchers Work on Transistor Successor

A team of Hewlett-Packard scientists has developed a technique that, they say, could potentially replace the transistor. With their *crossbar-latch* technology, the researchers have built very small junctions of platinum wires that can perform switching and Boolean logic functions now handled by transistors.

HP, like other companies, is working on the challenges chip makers face in trying to improve processor performance by reducing the size of transistors and circuitry. Advanced chip manufacturers, which currently make processors with feature sizes of 90 nanometers, say they could probably reduce feature sizes to 32 nanometers, after which they may need new materials and techniques.

As feature sizes decrease, very small gate lengths can cause transistors to leak electricity, devices to consume large amounts of power, data to corrupt, and device performance to vary, said Philip Kuekes, senior computer architect and one of HP's crossbar-latch researchers.

Crossbar latches aren't transistors and don't experience these problems, Kuekes explained. Thus, chip makers could use large numbers of small latches, rather than transistors, to make chips more powerful.

Crossbar latches are devices created between the two junctions where one tiny wire—currently 30 nanometers across but that could be as small as 2 to 3 nanometers—crosses two other parallel wires at right angles. Each junction functions as a switch.

To transmit and identify data, the system applies a sequence of electrical charges to a junction. The resulting voltage level determines whether the switch is open or closed and thus whether the binary data is a one or zero. This determines the data's value.

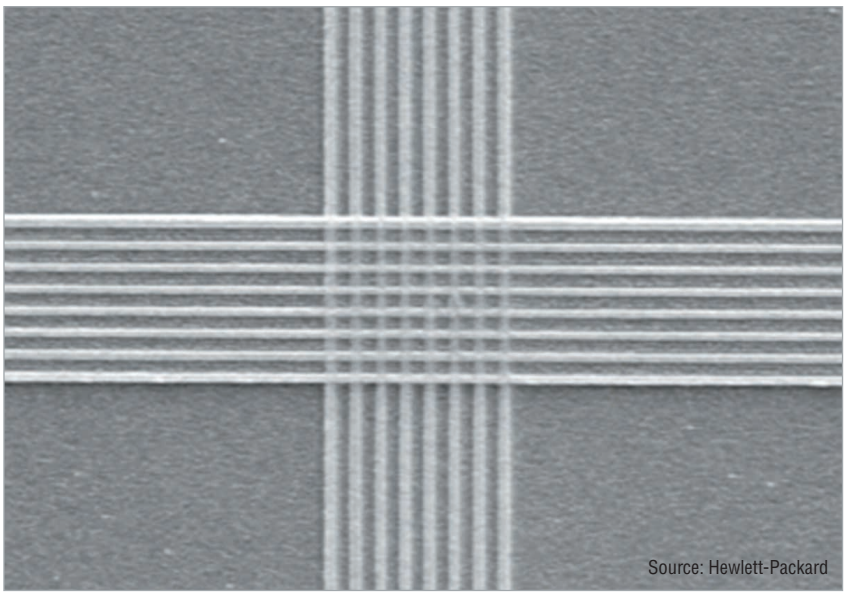
A crossbar latch, consisting of two switches, can handle three functions a transistor must perform to do calculations using Boolean logic: signal restoration, which keeps a signal functioning and thereby avoids data corruption; signal inversion, which enables the "not" Boolean logic function; and logical latch functionality, which lets a system store results of one operation for use in another.

HP makes crossbar latches via nanoimprint-lithography, a common approach that will let companies employ existing manufacturing techniques but that has not been used previously on such a small scale.

"The current CMOS technology is running up against some barriers so people are concerned," explained Nathan Brookwood, an analyst at Insight 64, a market research firm. "There is a constant search for a new technology. This looks like it might work." However, he said, it's premature to hail crossbar technology as CMOS's successor.

HP will face the challenge of convincing an industry built on silicon to try new techniques. In addition, researchers are still trying to link multiple crossbar latches so that they can work in parallel to create a nanoscale computer.

According to Kuekes, crossbar-latch technology probably won't be commercially viable until 2012. Manufacturers probably will first use it in memory devices, which would be simpler to build. ■



This electron microscopy image of a 64-bit memory device shows the architecture used by Hewlett-Packard's crossbar-latch technique, which HP says could replace the transistor some day. Crossbar latches are created by the two junctions where one tiny wire crosses two other parallel wires. To transmit and identify data, the system applies a sequence of electrical charges to a junction. The resulting voltage level determines whether the junction, functioning as a switch, is open or closed and thus whether the binary data is a one or zero. A crossbar latch consists of two switches and can handle functions a transistor must perform to do calculations using Boolean logic.

Using Topic Maps to Improve Searches

A key problem with database queries and Internet searches is that they frequently return large numbers of irrelevant responses. To ease this problem, a variety of organizations have begun using *topic maps* to index their data.

Topic maps are essentially smart indices that improve search capabilities by categorizing subjects, such as a concept or name, based on their relationships with one another.

This addresses a key issue that for many queries and searches, different terms could be used to describe the same thing or the same word could be used to describe two subjects. For example, "jaguar" could refer either to a vehicle or a cat.

In response, a topic map organizes topics by subject so that databases or search engines can find data more easily. Thus, "Jaguar" when referring to the vehicle could be mapped to "car," "racing," and "Ford" (the company that owns Jaguar); while the topic "jaguar" when referring to the animal could be mapped to "cat," "carnivore," and "South America."

Topic maps provide a different organizational system for data than that used in databases or search engines, explained Patrick Durusau, director of research and development at the Society of Biblical Literature and chair of the Published Subjects Technical Committee at the Organization for the Advancement of Structured Information Standards.

OASIS—a nonprofit, international consortium that promotes the development, convergence, and adoption of e-business standards—is exploring ways to standardize various aspects of topic maps and is acting as a clearinghouse for the development of topic-map approaches.

To build topic maps, computers use metadata, text, or text-mining technologies to automatically extract and classify information from documents or files. Humans can refine the map-creation model and the topic map itself by, for example, specifying an extraction schema, handling exceptions, or adding information.

Users could also create topic maps manually by having Google conduct a search and then going through documents to find and then organize those that are relevant, or via a combination of processes, explained Michel Biezunski, president of InfoLoom, which sells services for semantically integrating information sets.

According to Biezunski, topic maps are part of the Semantic Web, an approach to making the Web more intelligent by adding computer-understandable meaning to content. The maps provide a rich, predefined set of semantic layers to Web-accessible content, he explained.

Durusau said topic maps can do more than just index data. For example, they could be used to organize disparate data about a topic—such as material about a family with branches that spell the last name differently—into one subject, which could then be searched as a unit for genealogical information.

The US Internal Revenue Service has begun developing topic maps to organize its tax forms and publications and make it easier for IRS employees to find information and answer callers' questions.

Topic maps are more widely used in Europe. According to Durusau, proponents have not marketed the concept and its advantages effectively in the US. ■

Companies Agree on Mobile Intellectual Property Protection

The mobile phone industry has agreed on a single set of standards designed to prevent the unauthorized sharing, recording, and distribution of digital video and audio produced for use on mobile phones.

Intellectual property protection vendors ContentGuard and Intertrust Technologies—as well as electronics vendors Matsushita Electric Industrial, Philips Electronics, and Sony—have pooled their essential patents into the Digital Rights Management (DRM) 1.0 standard set by the Open Mobile Alliance (OMA), an organization of phone makers and mobile telecommunications providers whose sponsors include Cingular Wireless, IBM, Motorola, Nokia, NTT DoCoMo, and Texas Instruments.

The DRM standard lets a content-distribution system deliver the product provider's software for controlling and enforcing its usage rights either with or separately from the content.

This creates a situation vastly different than that for PC-based multimedia, which works with multiple proprietary, incompatible DRM technologies—such as those used in Apple's iTunes Music Store, Microsoft's MSN Music Club, and Sony's Connect—to provide intellectual property protection.

As is the case with PC-based DRM technologies, the mobile industry wants the OMA standard to encourage music, film, and software providers to feel that they can sell their material for use on cell phones without buyers reselling, giving away, or otherwise sharing the content in unauthorized ways.

Apart from OMA's activities, MPEG LA—which licenses numerous technology platforms, including those related to the MPEG-2 digital video-compression standard—arranged the pooling of the DRM patents and issued the licensing terms, said organization

spokesperson Larry Horn. MPEG LA will also provide centralized services for collecting royalties from users and distributing them to patent holders.

Manufacturers will pay royalties of 65 cents per hardware or software device to include DRM 1.0 in their products. Buyers of DRM 1.0-protected material will pay 25 cents per year.

Proponents say DRM 1.0 will promote content distribution. However, for recipients to work with the content, they must use the same file format as the sender. Thus, DRM could encourage more companies to use a common format, said Josh Bernoff, principal analyst at Forrester Research.

DRM 1.0 patent holders have already specified the next versions of their intellectual-property-protection technologies. MPEG LA plans to pool the patents into DRM 2.0 by later this year, according to Horn. He said DRM 2.0 will offer more transmission security, such as sender authentication and encryption. ■

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Dousing Flaming E-Mail

Software maker InBoxer has developed a corporate e-mail filter that could keep people from sending confidential, obscene, racy, or other e-mail messages that they or their employers might regret later.

Like the company's InBoxer antispam product, OutBoxer scans written messages based on concepts used in speech recognition and on complex linguistic approaches such as language modeling.

According to InBoxer CEO Roger Matus, his company used 1.5 million e-mail messages and other Microsoft Outlook records stored on the servers of the failed, scandal-ridden energy company Enron to build statistical models of e-mail messages that should be blocked. InBoxer obtained the public records from the US Federal Energy Regulatory Commission's Enron investigation.

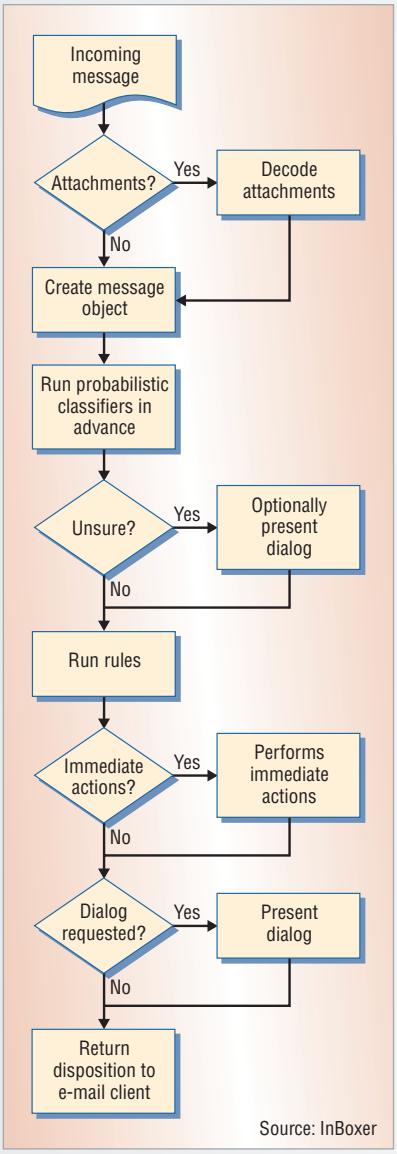
Researchers analyzed the messages for problematic content, such as trade secrets; sexual, racial, or other inappropriate messages; and even attachments containing potentially offensive images. They then built statistical models of questionable content, let the system "learn" how to use the models, and refined them until satisfied with the results.

Upon encountering an outgoing message, the OutBoxer system, which currently works only with English-language messages and Microsoft Outlook, breaks it into pieces of text, also called tokens. The system then analyzes the collection of tokens in a document, compares the result against its language models, and calculates the probability that the e-mail is offensive.

If the probability is higher than the threshold set by the e-mail administrator, OutBoxer holds the message in the client machine—before it reaches a server and becomes an official document legally subject to US government regulation and inspection—and alerts the sender with a pop-up warning.

Each company can determine how OutBoxer should deal with problematic messages, such as by treating content from different types of employees differently and by responding in various ways—for example, blocking notes, sending them, or removing questionable content—when a user tries to ignore a warning. ■

The OutBoxer filter lets companies block transmission of outbound e-mail messages because of potentially confidential, obscene, or otherwise problematic content. The filter initially runs messages through probabilistic classifiers to determine whether they could be troublesome. The system then runs rules using the results of the probabilistic classifiers along with other analyses and produces a list of ways the message should be handled. OutBoxer performs corrective actions it deems immediately necessary. If other potential actions require user dialog, this takes place. The system then decides what steps must be taken and notifies the e-mail client.



Source: InBoxer