They could save you from surgery, transform your telephone, and provide all the handheld computing wizardry you’ll ever want. After scouring corporate and university labs around the world, *Technology Review* found five patents issued in 2003 poised to change computing, medicine, communications, and security.

*ILLUSTRATIONS BY GREG MABLY*
A GOOD CALL FOR THE INTERNET
Lucent Technologies

INVENTION: Method for ensuring that voice data packets get high priority on the Internet

BENEFIT: Could give Internet telephony the same reliability and high quality as landline phone calls

In theory, using the Internet to make phone calls could revolutionize telecommunications by enabling cheap links to anywhere in the world, the convenient bundling of voice messages and e-mails, and services that integrate voice and video. But in practice, service quality is still a major stumbling block to widespread implementation. An Internet call—like all other data on the Internet—is broken into packets that travel along myriad pathways where they must compete for bandwidth. The result: Internet calls can become riddled with clicks and short delays.

A patent issued to Lucent Technologies—the company’s 30,000th to date—describes technology that could improve Internet telephone service, finally unlocking its full potential. Lucent’s innovation is software that behaves like a traffic cop for data packets—but a traffic cop that has some clear preferences. The software receives information about bandwidth capacity and determines whether to allow packets for Internet calls onto a given network path or to direct them to a different, less congested path. The software then ensures that real-time data packets, such as voice data from conversations, are given priority.

While many other approaches to solving the Internet telephony problem simply add more routers or increase bandwidth on local networks, Lucent’s method works with existing equipment, says Yun-Terng Wang, one of the inventors. Indeed, “Lucent’s proposal seems to be simple enough and does the job,” says Steven Low, a computer scientist at Caltech, whose group works on Internet congestion control.

The company will incorporate the technology into systems it sells to telecom companies like Qwest of Denver, CO, and Phonon of Richmond, VA. Of course, Lucent isn’t the only player looking to improve Internet telephony. But given its technical background and expertise, a lot of people are listening clearly to what the company has to say. TRACY STAEDTER

A VOICE OF APPROVAL
IBM

INVENTION: A way to verify identity using both voice authentication and personal queries

BENEFIT: Reduces the chance of fraudulent telephone transactions

Dial up your bank, and chances are a recorded message will request your personal identification number, and an operator will ask for your mother’s maiden name or other personal information. It’s hardly an infallible way to verify identity. An alternate method—automatic voice recognition—can have trouble with background noise or even the natural variability in people’s voices. But by combining the two methods, IBM believes it has created a way to provide far better fraud protection than either affords alone—without sacrificing convenience.

The invention—by Dimitri Kanevsky and Stephane Maes at IBM’s Watson Research Center in Yorktown Heights, NY—records a “voiceprint,” or sample of a user’s speech, for later comparisons. It also records the user’s answers to a series of personal questions. Then, during a transaction, if both the voice and the answers match its records, it grants access. But it’s not quite that simple: the technology also generates additional questions based on account information, such as, “What was the amount of your last withdrawal?” It asks questions in random order, so recordings of previous sessions can’t be used to commit fraud. And it can be calibrated to ask more questions, or require a closer voice match, for a customer requesting a large transaction.

Several IBM customers are now testing early prototypes, which build on IBM’s expertise in voice recognition technology. The challenge lies in getting all the variables aligned for the tightest security with the fewest delays or errors. Though there’s no official date for a product launch, the system could be on the market in a few years. IBM hopes the technique will eventually become as mainstream—and secure—as today’s fingerprinting, iris-scanning, and facial recognition systems, which are projected to form a combined $1.2 billion market this year, as places like airports and banks begin using them as security measures. PATRIC HADENIUS

MEMORY BOOSTER
Motorola

INVENTION: A technique for more accurately writing data on magnetic memory chips

BENEFIT: Makes a new kind of nonvolatile semiconductor memory commercially viable

Magnetic random-access memory, or MRAM, has long been held out as a potential next-generation, universal memory technology. It is faster and more durable than the flash memory used in handheld devices, and unlike the dynamic random-access memory used in PCs, it doesn’t lose data when its power is turned off. These attributes make MRAM attractive for everything from digital cameras to instant-on laptops.

But scientists have struggled for years to make it work. MRAM stores data in an array of small magnetic devices, or cells; electrical pulses write data by flipping the cells’ magnetic orientation. The problem: flipping one cell often flips neighboring ones, too. These errors become more and more an issue as the cells become smaller and their shapes less precise. Leonid Savtchenko, a scientist with Motorola in Chandler, AZ, devised a solution—a two-step method of applying the elec-
practice, many times we can see the problem, but we can’t get the instrument into smaller airways. “With today’s 3-D image of the lung, allowing the surgeon to more easily superimpose the position of the bronchoscope on the virtual board beneath the patient. As a result, software is able to scope’s tip wirelessly reports its location to an antenna on a formation of the bronchoscope in the lung and correlating this information with the 3-D image. A sensor at the bronchoscope’s tip wirelessly reports its location to an antenna on a board beneath the patient. As a result, software is able to superimpose the position of the bronchoscope on the virtual 3-D image of the lung, allowing the surgeon to more easily guide the instrument into smaller airways. “With today’s practice, many times we can see the problem, but we can’t get to it. With this new technique, we can actually go there and see where we are, where we need to be, and which path to take to get us to our target,” says David Feller-Kopman, a pulmonary specialist at Beth Israel Deaconess Medical Center in Boston. “It is the future of bronchoscopy.”

The system is already approved for use in Europe, where SuperDimension launched it last fall, and it is now used in Germany and other countries. Approval by the U.S. Food and Drug Administration is expected this summer. SuperDimension says it will market the software and hardware system on its own. The company says that if all goes well, the technology could allow bronchoscope-based procedures in 80 percent of lung biopsies, up from about 50 percent today. If that prediction holds true, and the technology becomes universally available, nearly one million people would be spared major lung surgery every year.

RUSS ARENSMAN

INVENTION: A method for separating and chemically modifying carbon nanotubes
BENEFIT: Could make it easier to use nanotubes in superstrong materials, bright, low-power displays, or ultrasensitive biosensors

RICE UNIVERSITY

The technique involves some straightforward chemistry. Led by Robert Hauge and the late John Margrave, the Rice chemists first exposed carbon nanotubes to fluorine gas. The fluorine binds to the sides of the tubes, making them less sticky and allowing them to be separated from each other. This makes it easier to incorporate the nanotubes into materials, whose strength or electrical conductivity can improve as a result; it is also a key step in using single nanotubes as parts of nanoelectronic devices. “If you want to use nanotubes one by one, you’re going to have to do something to the sides, and this allows you to do that,” says Richard E. Smalley, a Nobel laureate Rice chemist who collaborated on the work.

Houston-based Rice spinoff CNI, which was cofounded by Smalley, is using the patented technique to modify manufactured batches of the nanotubes that it sells to academic and corporate researchers. While the company is mum on the details of its collaborative efforts to exploit nanotubes, the new separation technique could help the molecules fulfill their revolutionary promise.

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